

# Massachusetts Statewide Airport Economic Impact Study Update

TECHNICAL REPORT  
JANUARY 2019



MASSACHUSETTS





# MASSACHUSETTS STATEWIDE AIRPORT ECONOMIC IMPACT STUDY UPDATE

JANUARY 2019

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## Introduction

Airports and aviation are essential elements of today's national economy and transportation system. They provide a quick, efficient, and safe method to move people and goods, and they improve the quality of life of every citizen. As important as the network of airports is to the nation's well-being, so too are airports essential to the economy of the Commonwealth of Massachusetts. Massachusetts' system of public-use airports provides an integral link to the rest of the country and the world, as well as serving as a critical source of economic stimulus within the Commonwealth.



*Control Tower at Lawrence Municipal Airport*

Massachusetts airports are important generators of revenues, wages, and jobs. Not only do the airports themselves generate economic benefits, but many non-aviation employers rely on the Massachusetts airport system to support their daily business activities. These business activities also contribute to building the Commonwealth's economy. While most people of Massachusetts are quite familiar with Boston Logan International Airport, many are less familiar with the Commonwealth's other public-use airports. The Massachusetts Department of Transportation's (MassDOT) Aeronautics Division conducted an economic impact analysis to help the citizens of the Commonwealth more fully understand the relationship between Massachusetts' public-use airports and the statewide economy.

industrial employers whose shipments arrive or depart via the airports; employees of businesses and corporations who base corporate aircraft at Massachusetts airports; and the travel industry including hotels, restaurants and tourism-related activities, whose patrons use the airport system to visit the Commonwealth's premier travel destinations such as the Cape and Islands and the Berkshires. Non-aviation businesses in Massachusetts and their clients and suppliers rely on aviation in a wide variety of ways to support their daily operations and to grow their overall business activity.

This study shows that many people, even beyond the immediate environs of each airport, derive significant economic benefits from the daily operation of the airport system. These groups include the commercial and

industrial employers whose shipments arrive or depart via the airports; employees of businesses and corporations who base corporate aircraft at Massachusetts airports; and the travel industry including hotels, restaurants and tourism-related activities, whose patrons use the airport system to visit the Commonwealth's premier travel destinations such as the Cape and Islands and the Berkshires. Non-aviation businesses in Massachusetts and their clients and suppliers rely on aviation in a wide variety of ways to support their daily operations and to grow their overall business activity.



*State Police Helicopter at Plymouth Municipal Airport*

The 2019 *Massachusetts Statewide Airport Economic Impact Study Update* summarizes the significant economic benefit that the Commonwealth of Massachusetts derives each year from its public-use airports. Sponsored by the MassDOT Aeronautics Division, this study is a continuation of an overall

planning effort initiated by the Aeronautics Division in 2009 with the *Massachusetts Statewide Airport System Plan* and is specifically an update to prior economic impact studies published in 2011 and 2014. While the system plan examined the structure and long-term development of the statewide airport system as a whole, the goal of the 2019 *Massachusetts Statewide Airport Economic Impact Study Update* is to show how aviation serves as an economic engine for the Commonwealth as well as to highlight some of the many other benefits that the Massachusetts system of airports brings to its host communities.

Both of these planning efforts, the *Massachusetts Statewide Airport System Plan* and 2019 *Massachusetts Statewide Airport Economic Impact Study Update*, are key initiatives that directly support MassDOT Aeronautics' defined mission statement:

**MassDOT Aeronautics Mission Statement:**

“To promote aviation throughout the Commonwealth, while providing an efficient, integrated airport system that will enhance airport safety, customer service, economic development, and environmental stewardship.”

## Study Background

Massachusetts is home to a system of 39 public-use airports that support the air travel needs of the Commonwealth's businesses, residents, and visitors (**Figure 1-1**). MassDOT Aeronautics Division supports the operation and development of 36 of these airports through grant funding, inspections, technical guidance, statewide system planning, education outreach, and communication with local, state, and federal officials. Boston Logan International Airport, Laurence G. Hanscom Field, and Worcester Regional Airport are overseen by the Massachusetts Port Authority (Massport), which owns and operates these facilities.



*Jets at Beverly Regional Airport*



**Figure 1-1**  
**Massachusetts Airports Included in Economic Impact Analysis**



Source: CDM Smith

This report shows how these airports are vital economic engines for the Commonwealth and their host communities by quantifying their employment, payroll, and economic output. The economic impact analysis considers the annual economic impacts associated with on-airport businesses and government organizations, capital improvement projects, military aviation, the spending of visitors that arrive via scheduled commercial service airlines, and the spending of visitors that arrive on privately-owned general aviation aircraft. Economic impacts are presented for each individual airport and the Commonwealth as a whole. It is important to note that an economic impact study provides a "snapshot in time" with respect to airport operations and economic conditions. The data collection process, economic modeling, and the state of the economy for this study update are all specifically related to 2017.

## ELEMENTS OF ECONOMIC IMPACT

**EMPLOYMENT**



**PAYROLL**



**ECONOMIC OUTPUT**



The employment, payroll, and economic output impacts generated by Massachusetts' public-use airports do not tell the whole story of aviation's benefits for the Commonwealth's citizens. This study summarizes other qualitative benefits attributed to aviation activity in Massachusetts that include the following:

**Tax Impacts:** While public airports do not generally pay taxes, airports and aviation-related services still help to contribute to state and local tax bases. For example, airport employees pay income tax, itinerant aircraft pay tax on aviation fuel, and visitors arriving by commercial airlines or general aviation aircraft pay tax on their meals, lodging, retail purchases, and rental cars. This analysis identifies these and other sources of aviation-related and aviation-driven tax benefits in the Commonwealth and provides an estimate of those benefits for each of the study airports.

**Case Studies:** This report highlights unique aviation activities that take place in Massachusetts through case study analysis. These more detailed analyses provide examples of how aviation enhances the economic, business, and educational aspects of Massachusetts beyond the calculated economic impacts. This study presents the following two case studies:

- **Unmanned Aircraft Systems (UAS)/Drones:** Use of UAS for commercial and recreational use has grown significantly in recent years due to the increasing affordability of drones and the FAA's ratification of Part 107 rules for small unmanned aircraft systems. This chapter discusses the uses and benefits of drones from precision agriculture and border security to search and rescue and the ability to take human workers out of a variety of hazardous working situations. Also included is a discussion on the scope of the drone economy both nationally and in Massachusetts, and a discussion of drone activities specific to the Commonwealth. These activities include a comprehensive Drone Pilot Program being undertaken by MassDOT, UAS testing operations at Joint Base Cape Cod, and drone programs at UMass and Northeastern University.
- **Business/Airport Synergies:** Businesses located both on- and off-airport have a symbiotic relationship with their airports. Businesses rely on aviation for everyday operations while airports rely on businesses for fuel sales and other revenue. The companies themselves also often invest in airfield improvements. This chapter analyzes the various synergies and relationships Massachusetts businesses have with their local and regional airports, offering specific examples such as capital improvement investments, educational programs, volunteer work, and equipment loans.



*Drone in use at Fenway Park*

**Airport Stories:** Massachusetts' airports have stories to tell, and each is unique. From the bustling Boston Logan International Airport where travelers jet off to faraway lands, to the tranquil turf field



of Myricks Airport, where taildraggers and antique aircraft demonstrate their grace by gently touching down on the grass runway. This study captures the key aspects of each of these airports and what makes them so special to their communities. Several of these stories are highlighted in the ensuing chapters of this report. A complete airport-by-airport list of these stories is provided in **Appendix D**.

## Study Findings

Results from the 2019 *Massachusetts Statewide Airport Economic Impact Study Update* show that the Commonwealth's system of 39 public-use airports has a tremendous economic impact:

### MASSACHUSETTS ECONOMIC IMPACT

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#### EMPLOYMENT



**199,237 JOBS**

#### PAYROLL



**\$7.2 BILLION**

#### ECONOMIC OUTPUT



**\$24.7 BILLION**

Included in these economic impacts are direct impacts from hundreds of on-airport businesses and government organizations, military air facilities co-located with study airports, capital improvement projects at airports, and the in-state spending by millions of visitors that arrive via commercial or general aviation. Multiplier impacts created as the money produced by the direct impacts is recirculated through the Massachusetts economy are also included. **Table 1-1** details the total employment, payroll, and economic output for each of the 39 public-use airports in the Commonwealth.

**Table 1-1**  
**Total Economic Impacts for Massachusetts Airports**

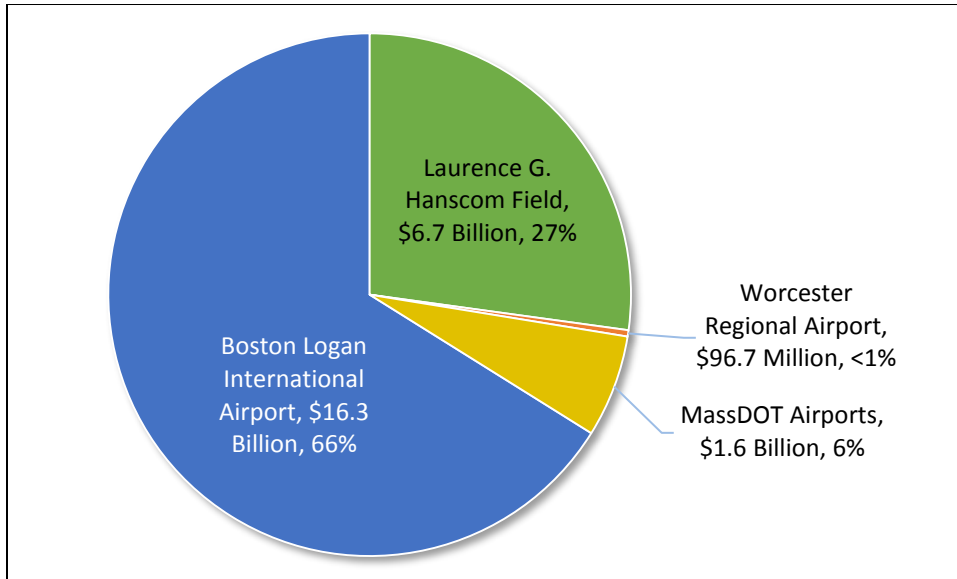
Associated City	Airport Name	Total Employment	Total Payroll	Total Output
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field*	19,587	\$527,823,000	\$6,709,016,000
Boston	Boston Logan International Airport	162,266	\$5,974,587,000	\$16,325,472,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport*	4,571	\$172,687,000	\$245,257,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	1,724	\$73,761,000	\$157,240,000
Nantucket	Nantucket Memorial Airport	3,268	\$118,249,000	\$323,044,000
New Bedford	New Bedford Regional Airport	277	\$11,025,000	\$29,598,000
Provincetown	Provincetown Municipal Airport	390	\$13,958,000	\$34,856,000
Vineyard Haven	Martha's Vineyard Airport	1,401	\$50,939,000	\$140,551,000
Worcester	Worcester Regional Airport	587	\$29,617,000	\$96,746,000
<b>Commercial Service Airports Total</b>		<b>194,071</b>	<b>\$6,972,646,000</b>	<b>\$24,061,780,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	18	\$294,000	\$702,000
Berkley	Myricks Airport	0	\$0	\$58,000
Beverly	Beverly Regional Airport	269	\$11,638,000	\$34,302,000
Chatham	Chatham Municipal Airport	156	\$4,777,000	\$13,919,000
Edgartown	Katama Airpark	19	\$636,000	\$2,087,000
Falmouth	Falmouth Airpark	7	\$294,000	\$641,000
Fitchburg	Fitchburg Municipal Airport	162	\$6,573,000	\$17,619,000
Gardner	Gardner Municipal Airport	8	\$279,000	\$1,028,000
Great Barrington	Walter J. Koladza Airport	56	\$1,827,000	\$5,213,000
Hanson	Cranland Airport	11	\$351,000	\$990,000
Hopedale	Hopedale Industrial Park Airport	13	\$719,000	\$1,010,000
Lawrence	Lawrence Municipal Airport	403	\$18,363,000	\$49,885,000
Mansfield	Mansfield Municipal Airport	112	\$4,490,000	\$12,455,000
Marlborough	Marlboro Airport	1	\$34,000	\$189,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	82	\$5,177,000	\$15,897,000
Marstons Mills	Cape Cod Airport	8	\$303,000	\$937,000
Montague	Turners Falls Airport	30	\$1,420,000	\$3,924,000
Newburyport	Plum Island Airport	6	\$167,000	\$295,000
North Adams	Harriman-and-West Airport	122	\$5,427,000	\$18,398,000
Northampton	Northampton Airport	32	\$806,000	\$3,202,000
Norwood	Norwood Memorial Airport	467	\$19,854,000	\$59,266,000
Orange	Orange Municipal Airport	110	\$4,297,000	\$11,067,000
Pittsfield	Pittsfield Municipal Airport	219	\$13,421,000	\$40,262,000
Plymouth	Plymouth Municipal Airport	368	\$19,273,000	\$62,910,000
Southbridge	Southbridge Municipal Airport	57	\$2,280,000	\$6,185,000
Spencer	Spencer Airport	3	\$100,000	\$356,000
Sterling	Sterling Airport	18	\$601,000	\$1,871,000
Stow	Minute Man Air Field	210	\$7,576,000	\$25,844,000
Taunton	Taunton Municipal Airport - King Field	25	\$1,060,000	\$3,543,000
Westfield/Springfield	Westfield-Barnes Regional Airport*	2,174	\$138,486,000	\$236,750,000
<b>General Aviation Airports Total</b>		<b>5,166</b>	<b>\$270,523,000</b>	<b>\$630,805,000</b>
<b>All Airports Total</b>		<b>199,237</b>	<b>\$7,243,169,000</b>	<b>\$24,692,585,000</b>

Source: CDM Smith and IMPLAN

\* Includes economic impacts associated with military aviation activities based on the airport. See **Appendix C** for specific military economic impact totals associated with each airport.

The contributions of total economic output generated by Massachusetts’ 39 public-use airports are presented in **Figure 1-2**. With 66 percent of the total, Boston Logan International Airport generates the majority of the Commonwealth’s airport economic output, while MassDOT-supported airports contribute approximately 6 percent of the total.

**Figure 1-2**  
**\$24.7 Billion in Total Economic Output**



Source: CDM Smith and IMPLAN

This study details the many ways in which Massachusetts’ system of public-use airports serves as a critical economic engine for the Commonwealth. Some of the most significant findings include the following:

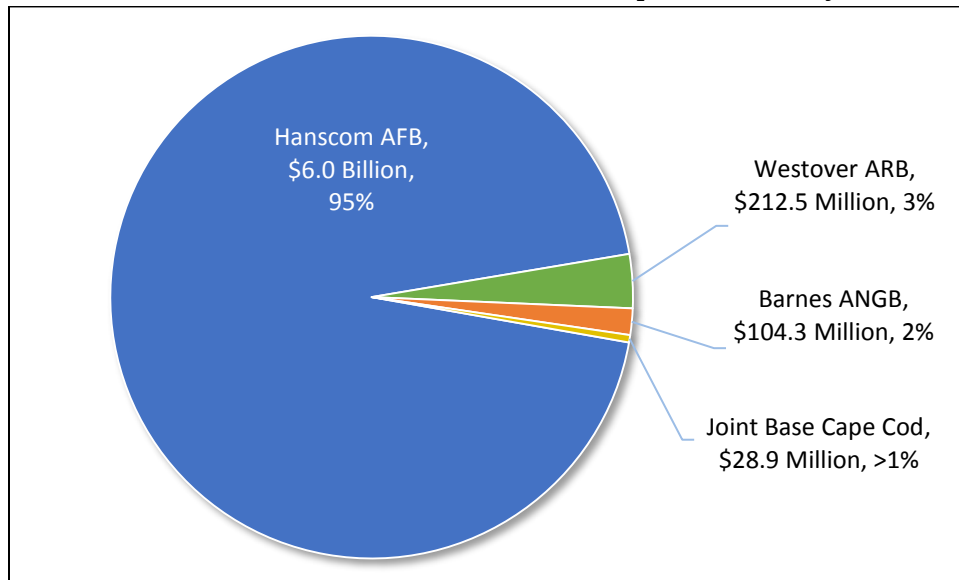
- Since the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*, total jobs supported by the 39 public-use airports have increased by 23 percent, total payroll has grown 19 percent, and total output has risen by 49 percent.
- The Commonwealth’s general aviation airports produce total economic impacts of nearly 5,200 jobs, \$270.5 million in payroll, and \$630.8 million in output.
- Over \$1 billion in total airport-related taxes were collected in Massachusetts in 2017.



*Jets at Southbridge Municipal Airport*

- Of the total statewide economic impacts, military aviation at co-located military facilities (Hanscom Air Force Base (AFB), Westover Air Reserve Base (ARB), and Barnes Air National Guard Base) account for 23,247 jobs, \$640.8 million in payroll, and \$6.3 billion in total annual output. Joint Base Cape Cod, which unlike the other military air facilities is not co-located with any of the study airports, adds approximately 299 jobs, \$10.8 million in payroll, and \$28.9 million in total annual output. **Figure 1-3** illustrates the distribution of aviation economic impacts across the Commonwealth’s military air facilities.

**Figure 1-3**  
**Distribution of \$6.3 Billion in Annual Economic Impact at Military Air Facilities**



Source: CDM Smith and IMPLAN

## Summary

Massachusetts' system of 39 public-use airports is an essential and critical element of the Commonwealth's economy. The 2019 *Massachusetts Statewide Airport Economic Impact Study Update* is the latest in a series of economic impact studies illustrating the huge value and economic contribution of these airports. This study found that the 2017 economic impact of Massachusetts' airports supported approximately 199,237 jobs with a payroll of over \$7.2 billion. In total, the economic output of the system is estimated at over \$24.7 billion.

Because these studies are performed regularly, it is possible to track the growth of the Massachusetts airport system over time. Just since the 2014 study, the economic impact of these 39 public-use airports has increased dramatically. Total employment has grown by 23 percent with total payroll nearly matching at 19 percent. The most dramatic growth over this period has been in total economic output, which increased by 49 percent.

Beyond their importance as massive engines of economic activities, Massachusetts' public airports are essential to the quality of life of the Commonwealth's residents. Airports and aircraft enable rapid emergency response and medical transport, are used for law enforcement operations, wildlife inspections, and news reporting, and aid in the inspection and upkeep of public infrastructure and utilities. Airports are also centers of education. In Massachusetts, this goes beyond flight training, as institutions such as MIT conduct innovative UAS tests in the Commonwealth. Airports provide numerous benefits both quantifiable and intangible for Massachusetts' residents and businesses.



Runway 23 at Laurence G. Hanscom Field



The remainder of this technical report will detail these various benefits, which are presented in the following chapters:

- **Chapter 2: Socioeconomic Overview** – Provides an overview of population and employment trends in Massachusetts while also discussing economic indicators such as per capita personal income and gross domestic product.
- **Chapter 3: The Economic Modeling Process** – Describes the methodology employed to estimate the economic impacts stemming from Massachusetts’ 39 public-use airports. Beginning with a definition of economic terms, the chapter also describes the economic model used, provides details on the data gathering process, and discusses the subsequent data analysis.
- **Chapter 4: Airport Economic Impacts** – Details the estimated economic impacts of the Commonwealth’s system of 39 public-use airports, including on-airport impacts such as those created by on-airport businesses and government organizations; capital improvements; military aviation at Hanscom AFB, Westover ARB, and Barnes ANGB; commercial service and general aviation visitor impacts, and multiplier impacts.
- **Chapter 5: Tax Impacts** – Details the methodology for estimating tax impacts related to airports in Massachusetts. Tax impacts include those related to aviation fuel and sales and income taxes generated by on-airport businesses and commercial service and general aviation visitor spending.
- **Chapter 6: Unmanned Aircraft Systems Case Study** – Provides an overview of recent trends in the UAS industry and details several drone programs both at Massachusetts government agencies and higher education institutions.
- **Chapter 7: Business-Airport Synergies Case Study** – Details several examples of airport-business synergies existing at airports throughout the system. Synergies include capital investments, volunteering, and equipment loaning, among others.
- **Appendix A: Economic Impact Tables** – Includes full economic impact tables for the study.
- **Appendix B: Economic Impacts of Boston Logan International Airport** – Details the specific methodology used to estimate the tremendous economic impacts generated by Boston Logan International Airport, the Commonwealth’s largest and busiest airport.
- **Appendix C: Economic Impacts of Military Aviation** – Provides overviews of activities and histories of Massachusetts’ four military air facilities and identifies the estimated economic impacts generated by each installation.
- **Appendix D: Airport Stories** – Presents each airport’s unique story that highlights how they help drive Massachusetts’ economy and what makes them special to the communities they serve.

# 2 Socioeconomic Overview



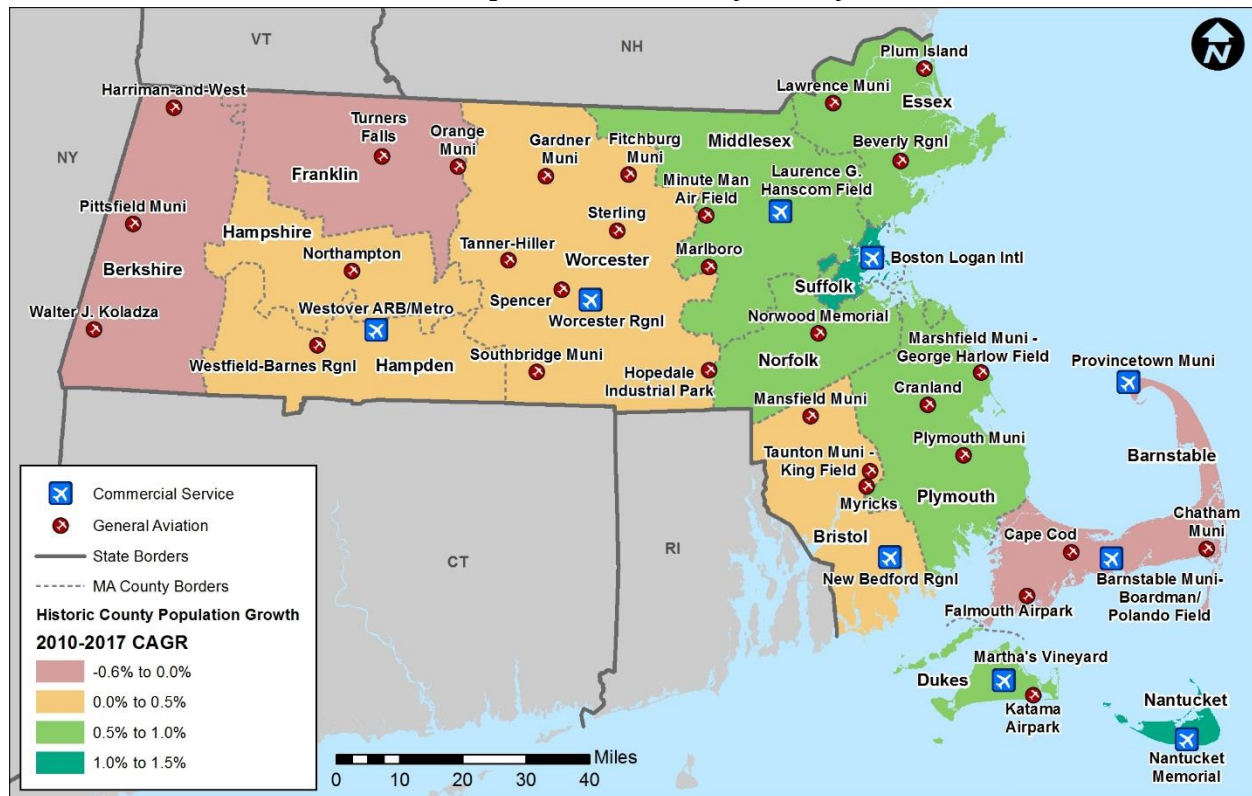
## Introduction

Socioeconomic data can indicate important trends that directly affect the aviation industry in Massachusetts. Using data from the U.S. Census Bureau, U.S. Bureau of Economic Analysis (BEA), and the UMass Donahue Institute, changes over time and projections for the future are compiled and analyzed to find important areas of note that may influence how residents, businesses, and visitors interact with aviation. Throughout this chapter, various socioeconomic categories such as population, per capita income, and gross state product will be examined and presented to illustrate how they're interrelated in supporting a strong aviation presence throughout the Commonwealth.

## Population

Massachusetts' population experienced steady growth from 2010 to 2017, climbing from 6.5 million to nearly 6.9 million. The eastern portion of the Commonwealth, which includes more urban areas with increased density, saw continued improvement while western communities and Cape Cod continued to observe a slight decrease. Suffolk County, with Boston as an anchor, as well as Nantucket County, led all counties in terms of compound annual growth rate (CAGR) at 1.4 percent. **Figure 2-1** illustrates population growth in Massachusetts by county from 2010 to 2017.

**Figure 2-1**  
Massachusetts Population Growth by County: 2010-2017

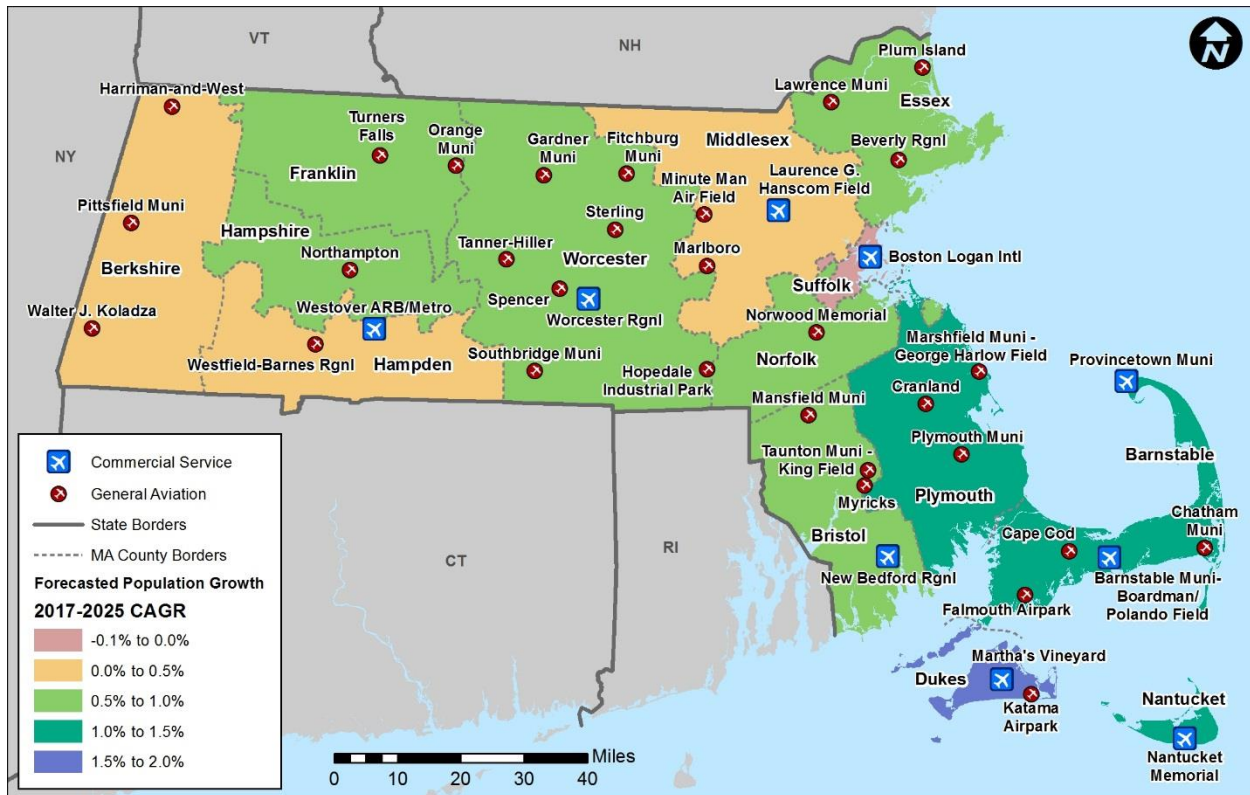


Source: U.S. Census Bureau

During the 2010 to 2017 time period, Massachusetts experienced an almost 5 percent change in population, gaining more than 300,000 residents. When comparing Massachusetts to the rest of the United States, growth occurred at similar rates with CAGRs of 0.7 percent and 0.8 percent, respectively.

Looking to the future, Massachusetts is projected to continue its growth, albeit at a slightly reduced rate, growing from 6.9 million in 2017 to 7.1 million in 2025. This amounts to a projected CAGR of 0.4 percent from 2017 to 2025. Norfolk County, located southeast of Boston and Suffolk County, is projected to become the fastest growing county in terms of CAGR at 0.9 percent, followed by Suffolk County at 0.9 percent. **Figure 2-2** shows projected population growth in Massachusetts counties from 2017 to 2025.

**Figure 2-2**  
**Massachusetts Projected Population Growth by County: 2017-2025**



Source: U.S. Census Bureau and UMass Donahue Institute

## Employment

Across the entire Commonwealth of Massachusetts, 4.7 million people are employed and contributing to the economy. From 2010 to 2016, employment has grown by more than 600,000 from 4.1 million to 4.7 million, resulting in a 2.3 percent CAGR.

Many industries have direct and indirect ties to aviation. Certain industries, such as construction, transportation and warehousing, and accommodation and food services, maintain employees that are a direct result of aviation-related investment in Massachusetts. **Figure 2-3** shows examples of these industries and the percentage of total employment in Massachusetts for which they are responsible. Other large industry contributors to the Massachusetts economy include health care, professional and scientific services, and retail, which make up a combined 34 percent of jobs.

**Figure 2-3**  
**Percentage of Total Employment in Massachusetts**



Transportation - 3%



Food Service and Accommodations - 7%



Construction - 5%

Source: Bureau of Economic Analysis

## Per Capita Personal Income

Massachusetts employees earn considerably more compared to the United States, with per capita personal income in the Commonwealth listed at \$67,630 in 2017 compared to \$51,640 for the United States. While there is a significant gap, both Massachusetts and the United States experienced similar growth in per capita personal income with CAGRs of 3.5 percent since 2010.



**EDUCATION IN MASSACHUSETTS SETS THE COMMONWEALTH APART FROM THE REST OF THE UNITED STATES, WITH A HIGH PERCENTAGE OF THE POPULATION, 58 PERCENT COMPARED TO 41 PERCENT, POSSESSING A BACHELOR'S DEGREE OR HIGHER.**

## Gross Domestic Product

Massachusetts industries are responsible for \$527.5 billion in gross domestic product (GDP).<sup>1</sup> According to the BEA, Massachusetts ranks 11<sup>th</sup> among states in GDP, up from 12<sup>th</sup> in 2010 when its GDP was \$402.7 billion. The change between 2010 and 2017 resulted in a strong growth rate of 3.9 percent, just outpacing the United States' rate of 3.8 percent.



**GOVERNMENT CONTRIBUTED \$54.3 BILLION (10.3 PERCENT) TO THE GDP, A PORTION OF WHICH COMES FROM ENTITIES SUCH AS THE FAA AND AIRPORT SPONSORS.**

Real estate is the largest industry, contributing \$77.5 billion in GDP (14.7 percent) and holds the highest year-to-year increase, growing by

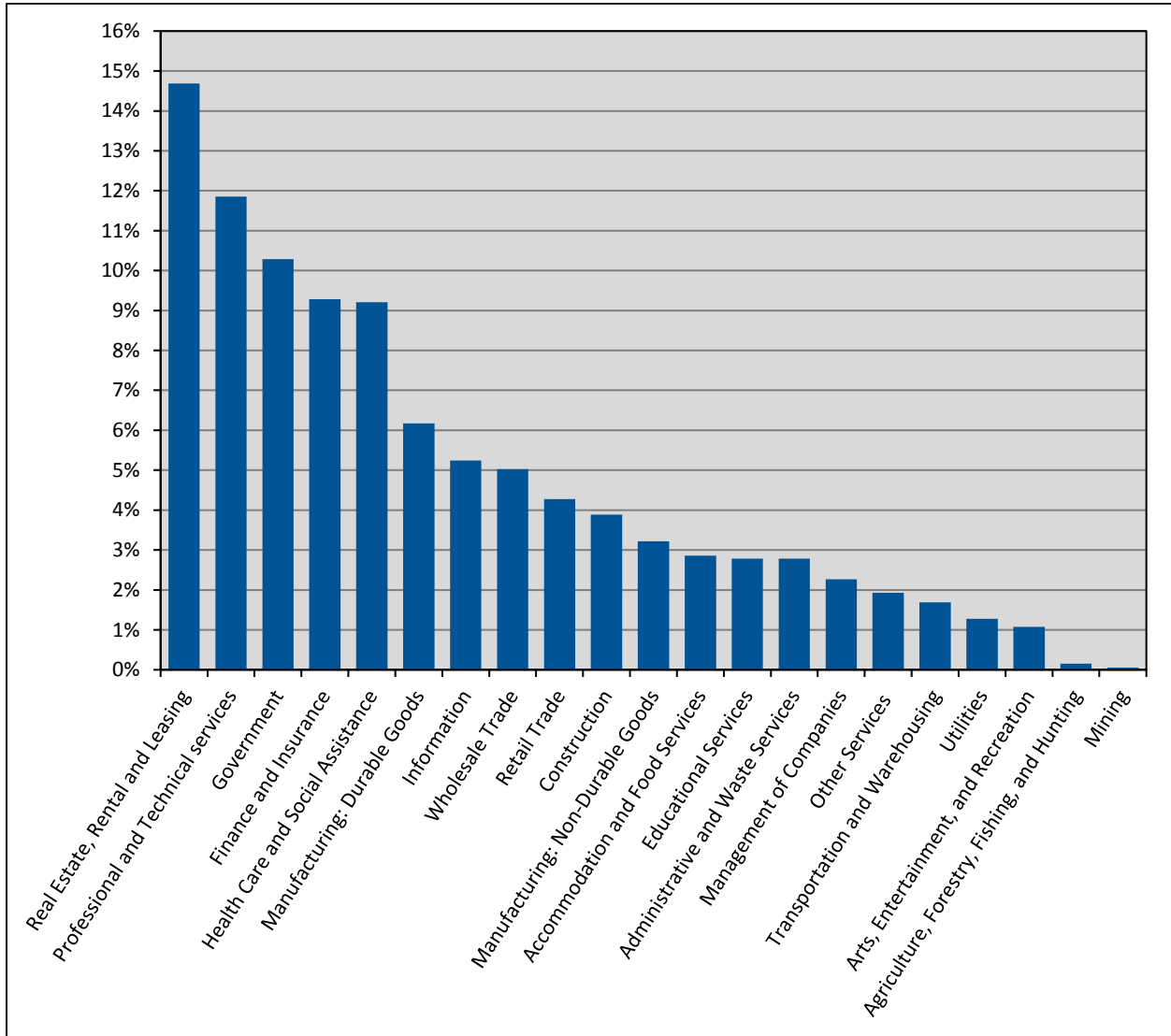
\$20.2 billion from 2010 to 2017. BEA industry categories with major ties to aviation include construction, transportation and warehousing, and accommodation and food services, which combine to represent \$44.5 billion dollars, or 8.4 percent of the GDP. Aviation's complete

<sup>1</sup> Data sourced from the Bureau of Economic Analysis was downloaded in August 2018, containing data current as of May 2018.



contribution to the Massachusetts economy is made up of percentages from various industries. Massachusetts' GDP by industry is displayed in **Figure 2-4**.

**Figure 2-4**  
**Massachusetts GDP by Industry**



Source: Bureau of Economic Analysis

## Summary

The socioeconomic makeup of Massachusetts illustrates significant areas of strength and continued growth. Massachusetts has a history of strong growth in population and employment, with growth in both categories projected to continue into the future. Per capita personal income has also seen significant growth and is well above per capita personal income in the United States. GDP in Massachusetts helps support the high employment and per capita personal income figures, with significant contributions from industries that help support or rely on aviation. Significant data points related to Massachusetts that directly affect spending on aviation are summarized below:



**Population** increased from 6.5 million in 2010 to 6.9 million in 2017 and is projected to grow to 7.1 million in 2025.



**Employment** grew from 4.1 million jobs in 2010 to 4.7 million in 2016.



**Per Capita Personal Income** was \$53,073 in 2010 with growth to \$67,630 in 2017.



**Gross Domestic Product** was \$402.7 billion in 2010 and rose to \$527.5 billion in 2017.

Socioeconomic data provides a link to aviation data gathered in this study, with airports maintaining staff and tenants that earn payroll and produce output and in turn, create their own ripple effect in the economy with their spending. Understanding the context of the economy in which aviation operates provides an explanation for its successes and downturns. Growth in all facets of the Massachusetts economy parallels the improvements in employment, payroll, and output impacts found in this study update.



This chapter describes the methodology used to estimate the economic impacts stemming from Massachusetts' 39 public-use airports. Beginning with a definition of economic terms, the remainder of the chapter describes the economic model used, provides details on the data gathering process, and discusses the subsequent data analysis.<sup>1</sup>

## Study Approach

All economic impacts from the 39 airports considered in this analysis were either estimated using data gathered from the airports or calculated using an input-output model. This input-output model, described in more detail below, provides three **measures** of economic impact, broken down into several **categories** of economic impact, and expressed as three related **types** of economic impact.

### Measures of Economic Impact

This economic impact study expresses the results using three measures – employment, payroll, and output.

- **Employment** – Employment is based on the total of full-time jobs plus part-time jobs. In this analysis, two part-time positions are the equivalent of a single full-time position. In the case of seasonal employment, two seasonal full-time positions are the equivalent of a single year-round full-time position, and four seasonal part-time positions are the equivalent of a single year-round full-time position.
- **Payroll** – Payroll represents the costs associated with the annual salary, wages, and benefits earned by all employees, or business owners.
- **Output** – Output is the quantity of goods and services generated annually by an airport, and its associated activities and businesses, expressed in dollars. Output is estimated using an organization's annual sales, or its annual operating costs, which assumes that its output is approximately equivalent to what it expends.



*Refueling at Falmouth Airpark*

It is important to note that payroll and output cannot be combined because elements of economic benefit related to payroll are also contained, to some extent, in the output estimate. Each of the three impact measures (employment, payroll, and output) stand alone as part of the quantification of an airport's total economic impact.

### Categories of Economic Impact

The three measures described above are used to evaluate several categories of economic impact. These categories are based on the source of economic activity and require various forms of inputs that are described in detail as follows:

<sup>1</sup> It should be noted that the economic impacts for Boston Logan International Airport were estimated using a methodology that varied from the one used for the other airports included in this analysis. As such, the methodology used for Boston Logan International is explained in **Appendix B**.

- **On-Airport Tenants** – This category includes airport tenants that are businesses with employees, such as fixed base operators (FBOs), flight schools, airlines, charter operators, corporate flight departments, and concessionaires. Also included are governmental agencies, such as public airport sponsors, the Federal Aviation Administration (FAA), the Transportation Security Administration (TSA), as well as other state and federal agencies that serve or use aviation. Output for on-airport tenants is typically assumed to be the sum of annual gross sales. While this assumption works well for profit-oriented tenants, it must be modified for organizations that do not generate sales, such as governmental agencies or corporate flight departments. To estimate the impact of these tenants, output is assumed to be the sum of all annual operating expenditures. While airlines do generate sales, ticket revenue is usually transferred outside the area being modeled. This makes it difficult to assign that revenue to specific airports, so airlines are treated like organizations that do not generate sales.



*Gulfstream hangar at Westfield-Barnes Regional Airport*

- **Capital Improvement Impacts** – Airport sponsors undertake capital improvement projects (CIPs) such as pavement rehabilitation, security enhancements, and terminal improvements on an annual basis. In addition, on-airport businesses and governmental agencies undertake capital improvements. These projects employ people in jobs such as construction, architecture, engineering, and consulting. Output related to CIP is equal to the expenditures on those projects. Ratios of employment to capital expense, and per capita income were used to estimate the number of jobs and associated payroll tied to these capital expenditures.

- **Commercial Service Visitors** – This group includes estimated non-local passengers (visitors) arriving via commercial airlines. The annual spending by these visitors, which supports the employment of local workers predominantly in the hospitality industry, is treated as output. Data provided by the Massachusetts Office of Travel and Tourism and updated commercial service visitor expenditure patterns from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update* were used to estimate average visitor spending at the Massachusetts commercial service airports. Jobs associated with this visitor spending were estimated using ratios from the input-output model. Payroll was estimated using average wage information from the Bureau of Labor Statistics.



*Cape Air aircraft parked at Provincetown Municipal*

- **General Aviation Visitors** – Impacts from general aviation visitors are produced by non-local passengers arriving via private or business aircraft. Similar to commercial service visitors, the annual spending of this category promotes the local economy, particularly the hospitality industry, and is treated as output. General aviation visitors were estimated using survey data from airports across the Commonwealth and various in-house databases to convert FAA general aviation operations data into visitor numbers. Survey and in-house data



were also used to estimate average spending per visitor. Jobs associated with this visitor spending were estimated using ratios from the input-output model. Payroll was estimated using average wage information from the Bureau of Labor Statistics.

## Types of Economic Impact

Data gathered from the categories described above were used as inputs for a linear input-output economic impact model. That model estimates three types of economic impact associated with Massachusetts airports using each of the three economic impact measures described previously.



*Aircraft maintenance at Westfield-Barnes Regional Airport*

- **Direct Impacts** – Direct impacts account for the initial point where the money from aviation-related activity enters the economy. This includes impacts that result from on-airport activity and visitor spending. On-airport activity includes the benefits associated with businesses and government organizations located at the airport, which are directly related to the provision of aviation services.<sup>2</sup> On-airport impacts include the employment, payroll, and spending of businesses such as FBOs, flight schools, aircraft repair facilities, and airport management and operations staff. Capital expenditures of these businesses and government organizations are also part of the

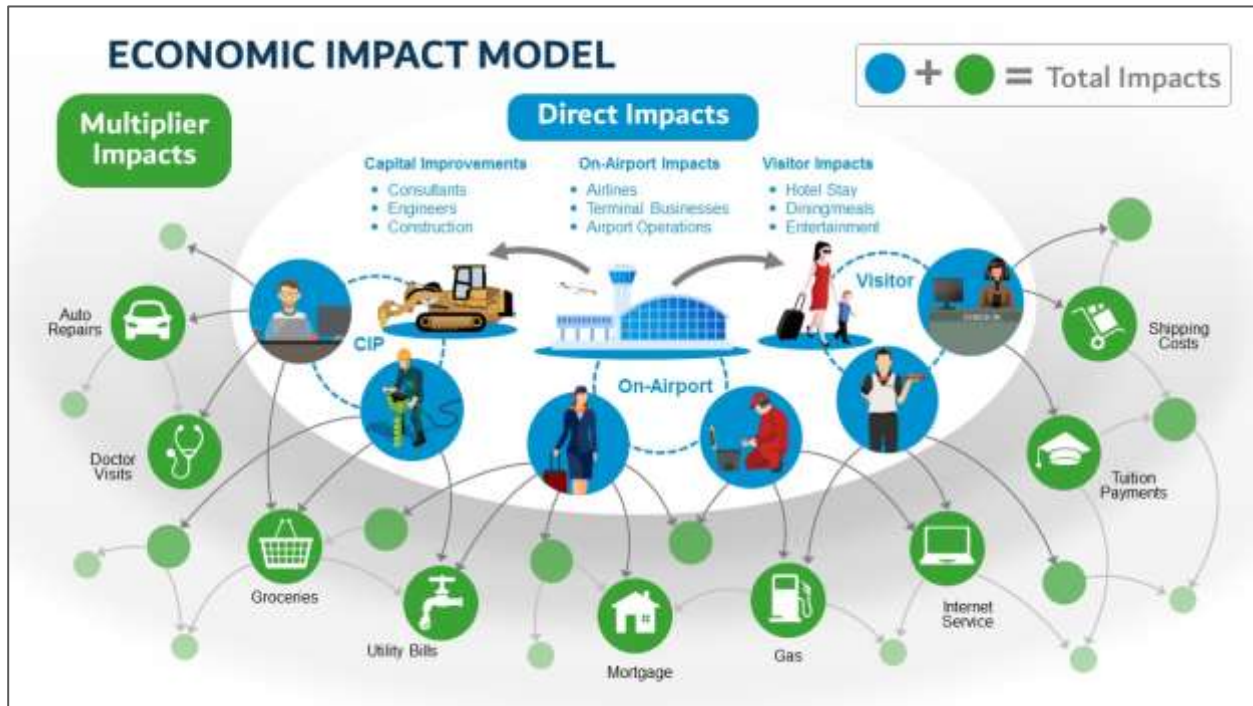
direct impacts. Visitors contribute to direct impacts through their off-airport spending (any on-airport spending by visitors is included in the on-airport impacts), such as might take place at restaurants or hotels. Direct impacts serve as the inputs for the economic model.

- **Multiplier Impacts** – Multiplier impacts result from the re-circulation and re-spending of direct impacts within the economy. This re-spending of money can occur multiple times and takes two forms – indirect and induced. Indirect impacts occur when businesses spend their revenue on business expenses, whereas induced impacts occur when employees spend their earnings on goods and services. For example, as airport employees spend their salary for housing, food, and services, those expenditures circulate through the economy resulting in increased spending, payroll, and employment throughout Massachusetts. As this money is spent over and over again, some of it leaks beyond the boundaries of Massachusetts, and thus no longer benefits the Commonwealth's citizens. The economic model uses parameters specific to Massachusetts to estimate the leakage effect associated with these multiplier impacts, thereby tabulating only those impacts that benefit the people and businesses of the Commonwealth. Multiplier impacts are the output of the economic model.
- **Total Impacts** – Total impacts are the sum of all direct and multiplier economic impacts attributable to an airport or the system of airports.

**Figure 3-1** shows how the categories of impacts flow through the types of impacts. It can be seen that the direct on-airport impacts are generally measured in terms such as the number of jobs that are located on the airport, while the direct visitor impacts are measured in jobs that are found off the airport. Furthermore, the direct impacts help drive the multiplier impacts and contribute to the total impacts.

<sup>2</sup> Consistent with previous economic impact studies of Massachusetts' public-use airports, this study includes military aviation with on-airport activity. The methodology for estimating the economic impacts for Massachusetts' military air facilities is provided in **Appendix C**.

**Figure 3-1**  
**Illustration of Economic Impacts**



Source: CDM Smith

Direct impacts are measured through surveys of businesses, governmental agencies, and visitors. Because multiplier impacts are not as easy to measure as direct impacts, they are estimated instead. It is important to employ a reliable method of estimating multiplier impacts, and one leading method used to estimate these impacts is the input-output model.

The Impact Analysis for Planning (IMPLAN) input-output model was used to quantify multiplier impacts in this study. IMPLAN is a linear model that estimates purchases and sales between hundreds of sectors of the economy. The U.S. Forest Service, in cooperation with several other government agencies, initially developed the IMPLAN system to generate regional non-survey input-output models for regions as small as a single county. This modeling process is considered one of the leading methods currently available for estimating the total economic impact of an industry and has been used to estimate economic impacts for individual airports and systems of airports throughout the country.

The IMPLAN model contains a large economic database used to generate input-output tables. It includes data from sources such as Dun and Bradstreet, the U.S. Department of Commerce, and the U.S. Census Bureau. IMPLAN multipliers and data tables specific to Massachusetts' industrial sectors were used in this analysis.

Proper use of this model involves inputting the best economic data available for the industry analyzed. Therefore, the information gathered during the early part of the study is critical.

## Data Collection Methods

Data collection for the analysis was a major undertaking and a critical component to making this a successful study. Each category of economic impact needed significant data inputs from various sources. The method used depended upon the category for which the data was gathered.

### *On-Airport Activity*

A variety of economic data was needed from airport management and each business and government tenant operating on the airport. This information was obtained through a two-step process. The first step involved surveying the airport sponsor or manager to obtain basic data relating to the operation and management of the airport. This involved a survey that asked the airport to provide:

- Number of full-time, part-time, and seasonal employees working for the airport sponsor in 2017
- Estimated total operating expenses in 2017
- Estimated total annual wages and benefits paid to airport employees in 2017
- Estimated total capital improvement expenditures for each year, 2015 through 2017

In addition, the airport sponsor was asked to provide a list of all business and government tenants located on the airport, an email contact, and an estimate of the number of employees working for each tenant.

The second step involved contacting each business and government tenant and requesting that they complete a survey. Contact was attempted either through face-to-face communication for those airports visited by the study team, or by an emailed survey. The survey asked for:

- Type of aviation activity or business conducted by the tenant
- Number of full-time, part-time, and seasonal employees working for the tenant in 2017
- Estimated total operating expenses in 2017
- Estimated total annual wages and benefits paid to employees of the tenant in 2017
- Estimated total capital improvement expenditures for each year, 2015 through 2017
- Estimated total gross sales (where applicable) by the tenant on the airport in 2017

A key component of this surveying effort was determining the type of aviation activity each tenant undertook. This served a two-fold purpose. The first was to screen out tenants that were not aviation-related and should not be included in the impact totals of the airport. For example, the impacts of an insurance business located on an airport would not be included since an insurance business does not need an airport to operate. If it were determined that the insurance business operated an aircraft that required a pilot or dispatcher at the airport, then it would be treated as an aviation-related business and the impacts of its flight operations included.

## Barnstable Municipal Airport is Preparing for the Future

Over the last ten years, the FAA, MassDOT, and the airport have made significant strategic investments into airport infrastructure, which has helped position the airport for future economic growth while enhancing airfield safety. Specifically, with the new airport terminal building, HYA has been able to attract JetBlue to provide seasonal service from New York to Cape Cod. Additional successes at the airport include the airport solar farm, which provides non-aviation related revenues and addresses sustainability concerns for the airport and the Cape. HYA is a vital transportation hub for Cape Cod and the region.

The second was to classify the tenant for purposes of evaluating the reasonableness of their data. By comparing per capita payroll and output to other similar businesses or government units, any outliers could be identified and investigated for soundness.

Some companies engaged in more than one line of business, so a determination of their primary focus was made and each tenant assigned to one of the following categories:

- Air ambulance operators
- Air cargo
- Air traffic control
- Aircraft maintenance
- Airlines
- Airport management
- Charter operators
- Concessions
- Corporate flight departments
- FBOs
- Federal government (not including air traffic control or TSA)
- Flight instruction
- Hangar rental and development
- Nonprofit
- Parking
- Rental car
- State and local government
- TSA

For airport tenants who did not supply complete information on payroll, expenses, output, and CIP, estimates were developed using ratios of payroll, expenses, output, and CIP per employee. These ratios were developed from survey data obtained from similar tenant and business categories who did respond to the survey. For those categories of tenants that did not have sufficient Massachusetts data to provide reliable averages, additional data was used from economic studies conducted by CDM Smith around the country, which is a standard practice for economic impact studies such as this.

This blend of survey data and estimated economic impact data was used to determine the direct on-airport impacts and served as inputs for the IMPLAN model.

### ***Capital Improvement Impacts***

As previously explained, capital projects, both by airports and the businesses and organizations operating on the airport, employ people in jobs such as construction, architecture, engineering, and consulting. For this analysis, information was gathered on capital expenditures from airports and their tenants as described above and combined with IMPLAN data to estimate direct capital impacts. This survey data was checked against grant history data provided by MassDOT Aeronautics Division to ensure that all impacts were captured.

The following steps were used to estimate direct capital project impacts:



*Construction work at New Bedford Regional Airport*



- The CIP data provided by airports, businesses, and government organizations for the period 2015 to 2017 was averaged to avoid showing peaks or troughs in capital project activity. This average CIP expenditure was used as the CIP direct output for the airport.
- Direct employment related to this capital impact was determined through the use of the IMPLAN model. The IMPLAN model indicates that every \$1 million in CIP-related expenditures supports approximately 7.7 jobs in Massachusetts.
- Data from the U.S. Bureau of Labor Statistics was used to calculate the average annual pay and benefits for these jobs at approximately \$54,900.

The estimated direct jobs, payroll, and CIP expenditures (output) provided inputs for the IMPLAN model.

### **Commercial Service Visitors**

The Massachusetts system of 39 public-use airports features seven commercial service airports with scheduled airline service.<sup>3</sup> These airports enplaned more than 19 million passengers in 2017. A significant portion of these passengers were business and leisure visitors who spent money throughout the Commonwealth during their trip, predominantly on hospitality services, such as hotels and restaurants. Taking into account multiplier impacts, numerous other industries benefit from the effects of visitor spending as well.

For each commercial service airport with scheduled airline service, the methodology explained below was used to estimate commercial service visitor impacts.

Airport sponsors provided 2017 enplanement data for their respective airport. The percentage of visiting passengers was estimated for each airport using data from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*. The number of enplanements and estimated visitors for the commercial service airports are presented in **Table 3-1**. It can be seen that nearly 7.6 million (39 percent) of the 19.4 million enplanements were visitors to the Commonwealth, with Boston Logan International Airport serving most of the commercial service visitors in Massachusetts.



## **Worcester Regional Airport Invests in the Future**

Since Massport took ownership of Worcester Regional Airport (ORH) in 2010, numerous airlines have successfully started commercial service including JetBlue, American, Delta, and Rectrix, which has resulted in over 600,000 passengers using the airport. With the growth of passenger service at ORH, Massport has invested over \$100 million since taking ownership, including the strategic investment in a Category III Instrument Landing System in 2018.

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<sup>3</sup> The commercial service airports with scheduled airline service include Barnstable Municipal Airport-Boardman/Polando Field, Boston Logan International Airport, Martha's Vineyard Airport, Nantucket Memorial Airport, New Bedford Regional Airport, Provincetown Municipal Airport, and Worcester Regional Airport. Laurence G. Hanscom Field and Westover Air Reserve Base/Metropolitan Airport are also commercial service airports, but they serve passengers carried by non-scheduled operators.

**Table 3-1**  
**Enplanements and Visitors at Massachusetts Commercial Service Airports**

Associated City	Airport Name	2017 Enplanements	Percent Visitors	Visitors
<b>Commercial Service Airports</b>				
Boston	Boston Logan International Airport*	19,145,096	42%	7,429,446
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	31,422	51%	16,030
Nantucket	Nantucket Memorial Airport	120,937	70%	84,660
New Bedford	New Bedford Regional Airport	7,003	10%	700
Provincetown	Provincetown Municipal Airport	8,760	90%	7,880
Vineyard Haven	Martha's Vineyard Airport	49,767	70%	34,840
Worcester	Worcester Regional Airport	55,034	23%	12,660
<b>Commercial Service Airports Total</b>		<b>19,418,019</b>	<b>39%</b>	<b>7,586,216</b>

Sources: Airport sponsors and 2014 *Massachusetts Statewide Airport Economic Impact Study Update*

\*Visitors do not include connecting passengers.

Average expenditures per visitor per trip from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update* were adjusted based on data provided by the Massachusetts Office of Travel and Tourism to estimate 2017 expenditure patterns. These estimates were applied to the respective number of annual visitors for each airport to determine total economic output generated by spending from commercial service visitors. The IMPLAN model indicates that every \$1 million in visitor expenditures supports approximately 12.6 jobs, which are largely found in the hospitality industry (e.g., hotels, restaurants, retail stores, and entertainment venues). Data from the U.S. Bureau of Labor Statistics was used to calculate the average annual pay and benefits for these jobs at approximately \$27,500. This average annual pay and benefits was applied to each visitor-related employee to determine direct payroll associated with visitor spending.

The following example using Martha's Vineyard Airport demonstrates the calculations used to estimate commercial service visitor impacts. For this example, rounded numbers are used and any variation in calculations is the result of rounding.



*Terminal building at Martha's Vineyard Airport*

Martha's Vineyard Airport reported 49,767 enplanements in 2017. An estimated 70 percent of these enplanements were visitors to the area, or approximately 34,840 visitors traveled through Martha's Vineyard Airport.

$$49,767 \text{ enplanements} \times 70 \text{ percent visitors} = 34,840 \text{ visitors}$$

Martha's Vineyard Airport visitors spend an estimated average of \$1,240 per visitor during their stay. This average was used to calculate visitors' annual spending (or output) of approximately \$43.2 million.

$$34,840 \text{ visitors} \times \$1,240 \text{ per visitor per stay} = \$43.2 \text{ million}$$

This spending supported jobs and businesses around Martha's Vineyard Airport, primarily in the hospitality industry. The IMPLAN model was used to estimate employment associated with commercial service visitor expenditures. As previously explained, the IMPLAN model indicates that every \$1 million spent by commercial service visitors supports approximately 12.6 jobs. For Martha's Vineyard Airport, this means approximately 545 employees are supported by visitor spending attributed to the airport.

$$\$43.2 \text{ million} \times 12.6 \div \$1,000,000 = 545 \text{ jobs}$$

Using information from the U.S. Bureau of Labor Statistics, it was estimated that these types of jobs earned an average annual payroll and benefits of \$27,500, which generated a total of approximately \$15.0 million in 2017.

$$545 \text{ jobs} \times \$27,500 = \$15.0 \text{ million annual payroll}$$

The same calculation was used for each commercial service airport, using the estimated number of visitors and average expenditure per visitor per trip as appropriate. The direct impacts calculated using this methodology were used as inputs for the IMPLAN input-output model. Detailed tables showing the commercial service visitor impacts at each commercial service airport can be found in **Table A-7**, **Table A-11**, and **Table A-15** in **Appendix A**.

## Falmouth Airpark Fulfills Multiple Roles

Falmouth Airpark is a gateway to the beaches, trails, and lakes surrounding the area. Boston MedFlight and the Massachusetts State Police Air Wing frequently use the airpark for training and missions. Numerous business clients fly into Falmouth Airpark to conduct work at Joint Base Cape Cod and Woods Hole Oceanographic Laboratory. The airpark recently partnered with a fuel company to use an FAA-approved, environmentally-friendly, lead-free, 94-octane aviation gasoline.

## General Aviation Visitors

It is estimated that nearly half a million visitors in Massachusetts make use of general aviation aircraft to conduct business and enjoy the leisure opportunities available throughout the Commonwealth. There are numerous examples of airports that facilitate business operations. In the Boston region, Laurence G. Hanscom Field, Norwood Memorial Airport, and Beverly Regional Airport host corporate aircraft operations daily, providing company owners, business executives, managers, and key staff with convenient access to Eastern Massachusetts. Airports beyond the Boston region, such as Westfield-Barnes Regional Airport, Harriman-and-West Airport, Fitchburg Municipal Airport, and Hopedale Industrial Park Airport, also support business flight operations and accommodate their passengers daily.

Massachusetts airports also serve as gateways to local attractions for tourists. For example, Pittsfield Municipal Airport and Walter J. Koladza Airport serve thousands of visitors annually who use the airports to access resorts such as Canyon Ranch, cultural events at venues such as Tanglewood Music Center, and the many natural recreation activities available in the Berkshires. Visitors use Falmouth Airpark, Katama Airpark, and Chatham Municipal Airport as gateways to the beautiful beaches and trails found in the Cape and Islands region of Massachusetts. General aviation airports such as Sterling Airport and Spencer Airport are also important in allowing recreational enthusiasts to access attractions such as Sturbridge Village, the Appalachian Trail, Lake Quinsigamond, and Mount Wachusett.



*Jets parked on the apron at Beverly Regional Airport*

The direct economic activity produced by general aviation visitors in Massachusetts was determined through a combination of survey data, the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*, and economic model outputs. Surveys were used to gather expenditure data from visiting pilots and passengers and distributed through the help of FBO managers at airports across the Commonwealth. The survey requested the following information:

- The airport where the survey was received
- Where the aircraft is based (verifying the respondent was not based at the airport surveyed)
- The number of travelers in the aircraft
- The purpose of the trip
- The length of stay in the airport area
- The estimated expenditures during the trip
- The number of people responsible for the expenditures
- Additional comments regarding the value of the Massachusetts aviation system to pilots, passengers, and their businesses

## Pittsfield Municipal Airport Connects Western Massachusetts to the World

Pittsfield Municipal Airport (PSF) is strategically located in central Berkshire County and is home to a large-scale aircraft charter company, Lyon Aviation. Lyon Aviation provides aircraft charter operations across the world and bases 12 business jets at PSF with over 70 full-time employees.



The consultant team used this survey data, along with data from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*, to derive an estimate of direct general aviation visitor expenditures. Similar to the 2014 study, the airports were grouped into categories based on their activity level and location. Survey data within each airport category was used to estimate the average number of visitors per arriving aircraft and the average expenditure per visitor per trip, with data from the 2014 study serving as a benchmark. For airport categories lacking a sufficient number of survey responses, data from the 2014 study was used to estimate average visitors per aircraft and the average expenditure per visitor.

To estimate general aviation visitor expenditures (the direct output impact), data from FAA 5010 forms and air traffic control tower records were used to develop estimates of each airport's itinerant general aviation operations.<sup>4</sup> These are general aviation aircraft arrivals and departures that arrive from outside, or depart, the local airport area. Not all itinerant arrivals, as defined by the FAA, carry visitors. A majority of the itinerant arrivals are local aircraft returning from outside the immediate airspace, transient fuel stops, or other activities that are not consistent with the definition of a visitor. Estimates of true transient arrivals (itinerant operations carrying visitors) were made for each airport based on data from the 2014 *MassDOT Statewide Airport Economic Impact Study Update* and survey data provided by airport sponsors.

New Bedford Regional Airport is used in the following example to demonstrate the calculations for estimating general aviation visitor impacts. Like the commercial service visitor impacts example above, rounded numbers are used and any variation in calculations is the result of rounding.

New Bedford Regional Airport was estimated to have 23,570 itinerant operations in 2017, or 11,785 itinerant arrivals, since every arrival is assumed to have a corresponding departure. Of those, 33 percent were assumed to be visiting aircraft.

$$11,785 \text{ itinerant arrivals} \times 33 \text{ percent} = 3,889 \text{ visiting aircraft}$$

New Bedford Regional Airport's category of airports average 2.5 visitors per visiting aircraft and each of those visitors spent, on average, \$330 on goods and services away from the airport during their stay. Any on-airport expenditures are taken into account in the on-airport impacts and are not included in the general aviation visitor impacts. Using this data, an estimated 9,723 visitors passed through New Bedford Regional Airport in 2017 and spent approximately \$3.2 million during their stay.

$$3,889 \text{ visiting aircraft} \times 2.5 \text{ visitors per aircraft} = 9,723 \text{ visitors}$$

$$9,723 \text{ visitors} \times \$330 \text{ per visitor per trip} = \$3.2 \text{ million}$$

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<sup>4</sup> It is important to note that aircraft operations at airports without air traffic control towers were estimated by airport sponsors on FAA 5010 forms in the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*. For this current study, the aircraft operations at these airports were more accurately estimated through the Massachusetts Department of Transportation Aeronautics Division's investments in the G.A.R.D. (General Audio Recording Device) System that automates aircraft operations counts.



*Airport administration building at New Bedford Regional Airport*

These expenditures supported jobs and businesses in the region around New Bedford Regional Airport, predominantly in the hospitality industry. The IMPLAN model estimates that every \$1 million spent by general aviation visitors supports approximately 15.2 jobs. Based on this ratio from the IMPLAN model, visitors arriving on general aviation aircraft at New Bedford Regional Airport support approximately 49 employees in the region through their spending.

$$\begin{aligned} & \$3.2 \text{ million} \times 15.2 \text{ jobs} \div \$1,000,000 \\ & \text{per job} = 49.0 \text{ jobs} \end{aligned}$$

Information from the U.S. Bureau of Labor Statistics shows these types of jobs earn an average annual salary of

\$27,500 in Massachusetts. This average was applied to the estimate of employment to calculate the payroll impacts associated with general aviation visitors. In this example, visitor-related payroll created by the 49 jobs is estimated to total approximately \$1.3 million.

$$49.0 \text{ jobs} \times \$27,500 = \$1.3 \text{ million annual payroll}$$

These direct impacts from general aviation visitor spending were used as inputs for the IMPLAN input-output model. The aircraft operations and general aviation visitor impact data for each airport can be found in **Table A-8**, **Table A-12**, and **Table A-16** in **Appendix A**.

### **Multiplier Impacts**

The direct economic impacts from financial transactions are not the only effects that take place within an economy. As explained earlier, initial transactions result in a cascade of follow-on impacts. For example, some of the money a flight school takes in for giving flight lessons (its direct output) goes to the local bank to pay off part of the loan on the flight school’s training aircraft, which creates economic output for the bank. The bank then uses some of its revenues to pay for local contracted security services, adding to the output. Eventually, these transactions result in the money leaking beyond the defined boundaries of the study – in this case, Massachusetts. The number of times that a dollar of output, or a dollar of pay, or a job recirculates through the economy before it leaks, is a multiple of the initial input from the airport; hence it is referred to as a “multiplier” impact. Figure 3-1 (on page 3-4) shows the complex interactions typically occurring in an economy that the IMPLAN model takes into account.

## Spencer Airport Connects Users to Recreation Opportunities

Spencer Airport is a privately-owned, public-use airport located in central Massachusetts. The airport is a gateway for recreational enthusiasts visiting Sturbridge Village, hiking on the Appalachian Trail, crewing on Lake Quinsigamond, and skiing on Mount Wachusett.

Multiplier impacts are estimated by entering the direct impacts into the IMPLAN input-output model and accounting for the different interactions that various categories of impact have within the area of study. The model determines how many times an impact is multiplied within the boundaries of the study.

The multipliers used in this analysis were developed specifically to measure the economic impacts that occur within different sectors of the Massachusetts economy. **Table 3-2** summarizes the multipliers used for modeling the multiplier impacts of on-airport activities, capital improvement, and visitor spending. Note that on-airport activities were classified into one of three areas – aviation, concession, or government – based upon the nature of their operation. This was done to more accurately assess the degree to which each organization recirculated its economic influence within the Commonwealth.

**Table 3-2**  
**Massachusetts IMPLAN Multipliers by Economic Sector**

Economy Sector	Employment Multiplier	Payroll Multiplier	Output Multiplier
On-Airport: Aviation <sup>1</sup>	1.85	1.77	1.56
On-Airport: Concessions <sup>2</sup>	1.33	1.63	1.85
On-Airport: Government <sup>3</sup>	1.63	1.36	1.82
Capital Improvement <sup>4</sup>	1.83	1.75	1.95
Commercial Service Visitor Expenditures <sup>5</sup>	1.58	1.91	1.83
General Aviation Visitor Expenditures <sup>5</sup>	1.48	1.83	1.82

Sources: CDM Smith and IMPLAN multipliers

<sup>1</sup> Aviation multipliers are the weighted average of the Air Transportation, Aircraft Manufacturing, Aircraft Engine and Engine Parts Manufacturing, and Other Aircraft Parts and Auxiliary Equipment Manufacturing multipliers.

<sup>2</sup> Concessions multipliers are the weighted average of the Food Services and Drinking Places, Business Support Services, and Miscellaneous Retail Store multipliers.

<sup>3</sup> Government multipliers are the weighted average of the State and Local Government and Federal Government multipliers.

<sup>4</sup> Capital Improvement multipliers are the weighted average of the Construct Other New Nonresidential Structures, Maintenance and Repair of Nonresidential Structures, and Architectural, Engineering, and Related Services multipliers.

<sup>5</sup> Commercial Service and General Aviation Visitor Expenditures multipliers are the weighted average of the Food Services and Drinking Places, Automotive Equipment Rental and Leasing, Hotels and Motels, and Miscellaneous Retail Store multipliers. Weightings were different for commercial service and general aviation visitor multipliers to reflect the difference in their spending habits.

The multipliers presented in Table 3-2 were used to estimate multiplier impacts in this analysis. For example, \$100 in direct revenues (output) in the commercial service visitor expenditures sector supports a total output of \$183 (\$100 times the commercial service visitor expenditures output multiplier of 1.83). The total output breaks down into \$100 of direct output and \$83 of multiplier impact.

### **Total Impacts**

Total impacts consist of the sum of the direct and multiplier impacts. When referring to each Massachusetts airport's (or the airport system's) economic impacts, this generally means the total employment, total payroll, and total output of the airport (or the airport system).

# 4 Airport Economic Impacts



Airports serve as an economic driver in Massachusetts' diverse economy. Massachusetts' airports function as gateways for residents and visitors through commercial service and general aviation flights, as well as hubs for on- and off-airport commerce. The economic impact these airports generate translates into jobs, payroll, and economic output that can be directly and indirectly attributed to the aviation industry.

Airports in Massachusetts accommodate over 19 million enplanements, resulting in approximately 7.6 million visitors to the Commonwealth. While Boston Logan International Airport accounts for most of Massachusetts' visitors traveling by air, there are still significant numbers arriving via private and business aircraft at general aviation airports. It is estimated that 450,000 visitors arrived via general aviation aircraft at all airports in Massachusetts in 2017. These visitors impact more than just the aviation industry - they create jobs and add payroll through their expenditures throughout the Commonwealth.

The transportation network created by airports in Massachusetts supports a significant number of jobs in well-paying industries. For example, according to the Federal Aviation Administration, there were 7,820 certificated pilots in the Commonwealth in 2017. More than a third of these pilots have a certificate that allows them to fly for compensation or hire in fields such as corporate flight, charter, and commercial airlines. Also, data from the U.S. Bureau of Labor Statistics shows there were 1,390 aircraft mechanics and service technicians in the Commonwealth in 2017.



*Cape Air ground crew at Martha's Vineyard Airport*

Many notable aviation-related businesses call Massachusetts airports home, generating economic impact in their communities and throughout the Commonwealth. Gulfstream Aerospace Services Corporation has a Service Center at Westfield-Barnes Regional Airport that covers the Northeastern United States and performs maintenance on the Gulfstream fleet. Pittsfield Municipal Airport is home to Lyon Aviation, one of the top five largest private jet charter operators in the Northeastern United States with a fleet consisting of Gulfstream, Hawker, and Falcon jets. In addition, Cape Air, one of the largest regional airlines in the United States, is headquartered at Barnstable Municipal

Airport-Boardman/Polando Field and operates a hub at Boston Logan International Airport. Lastly, Raytheon and Liberty Mutual Insurance, both Fortune 500 corporations, are headquartered in Massachusetts and operate corporate flight departments.

Besides the aviation-related businesses found at the study airports, the United States Armed Forces maintain a significant military aviation presence in Massachusetts. For example, Westover Air Reserve Base (ARB), home to the Air Force Reserve Command's 439<sup>th</sup> Airlift Wing and the Air Force's largest cargo aircraft, the C-5 Galaxy, is the nation's largest Air Force Reserve base. Other military air facilities include Hanscom Air Force Base (AFB), a joint-use military-civilian facility with Laurence G.



Hanscom Field; Westfield-Barnes Regional Airport, which hosts Air and Army National Guard units; and Joint Base Cape Cod, which is not associated with any of the study airports.

This chapter identifies the economic impacts associated with employment, annual payroll, and total economic output that stems from each of the study airports. The combined impact of all 39 public-use airports is also presented. Detailed tables showing the impacts of each individual airport can be found in **Appendix A**. Note that in the case of military aviation, the economic impacts of Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport’s Air and Army National Guard units are included in the tables in this chapter to provide a complete picture of aviation’s economic impacts in the Commonwealth.<sup>1</sup>



*New administration building at Southbridge Municipal Airport*

## Employment Impacts

Airports are a significant source of employment across the entire Commonwealth of Massachusetts. Employment impacts are calculated for on-airport activity and visitors arriving via commercial service and general aviation flights. On-airport activity includes aviation-related businesses and government agencies, military aviation, and spending for capital improvement projects (CIPs), which generate jobs for architects, engineers, consultants, and construction workers.

### On-Airport Activity Employment

**Table 4-1** identifies the total number of jobs supported by the day-to-day activities of on-airport, aviation-related businesses and government agencies at the 39 Massachusetts study airports. These jobs include aircraft maintenance, flight instruction, pilot services, and fuel sales, to name just a few. Employment associated with military aviation at Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport and the average annual expenditure for airport CIPs undertaken between 2015 and 2017, such as the construction of new airport administration buildings at Beverly Municipal Airport, Southbridge Municipal Airport, and Fitchburg Municipal Airport, are also included.

**Table 4-1**  
**On-Airport Activity Employment**

Airports	Direct Employment	Multiplier Employment	Total Employment
Commercial Service Airports	31,642	20,564	52,206
General Aviation Airports	2,388	1,670	4,048
<b>TOTAL</b>	<b>34,030</b>	<b>22,234</b>	<b>56,264</b>

Source: CDM Smith and IMPLAN

<sup>1</sup> Joint Base Cape Cod’s economic impacts are not included in the tables in this chapter, since it is not co-located with one of the study airports, as are Hanscom AFB, Westover ARB, and the Air and Army National Guard units at Westfield-Barnes Regional Airport. Joint Base Cape Cod’s economic impacts are presented in Appendix C along with the economic impacts of Hanscom AFB, Westover ARB, and the Air and Army National Guard units at Westfield-Barnes Regional Airport.



*Stick 'N Rudder Aero Maintenance at Chatham Municipal Airport*

In total, there are 34,030 direct jobs supported by the on-airport activities of Massachusetts' airports, with 31,642 attributed to commercial service airports and 2,388 stemming from general aviation airports. Boston Logan International Airport, the primary airport serving New England and one of the nation's busiest airports, is one source of strong employment numbers at commercial service airports in Massachusetts. Military aviation activity at Hanscom AFB and Westover ARB is an additional generator of employment at the commercial service airports. It is important to note that this employment estimate does not include jobs associated with non-aviation businesses

which, for various reasons, are located on an airport. In instances where airports include nearby industrial and business parks, the tenants may technically be on airport property but are not involved with aviation. Employment related to non-aviation businesses is not included in the employment estimate shown in Table 4-1.

Jobs created by multiplier impacts are a result of activity by business and government agencies at Massachusetts airports. The magnitude of on-airport tenant activity relates to the number of additional multiplier jobs created at each airport. Multiplier impacts from the Commonwealth's airports add 22,234 positions to the economy. Combined, direct and multiplier employment from on-airport activity leads to 56,264 additional jobs within the Massachusetts economy. On-airport activity employment impacts for each airport are listed in **Table A-6** in **Appendix A**.

### **Commercial Service Visitor-Related Employment**

Massachusetts' commercial service airports accommodate nearly 7.6 million visitors annually to the Commonwealth, where they spend money on lodging, restaurants, transportation, entertainment, and other activities. This visitor spending supports jobs in a multitude of employment sectors outside aviation. **Table 4-2** identifies the number of employees in Massachusetts whose jobs are supported by the spending of visitors arriving at the Commonwealth's seven commercial service airports with scheduled airline service. Boston Logan International Airport accounts for the vast majority of all commercial service visitor-related employment in Massachusetts. It is important to note, however, that the commercial service airports in the Cape and Islands region of Massachusetts play a critical role in providing access to this popular tourist destination and account for more than 2,000 direct jobs

## Commercial Service Takes Off at Nantucket Memorial Airport

Nantucket Memorial Airport is a major transportation asset on the island and has several airlines providing seasonal and year-round service, including JetBlue, American, United, Delta, Cape Air, Rectrix Shuttle, and Tradewinds Aviation.

related to commercial service visitor spending. Air carrier visitor-related employment impacts for each airport are listed in **Table A-7** in **Appendix A**.

**Table 4-2**  
**Commercial Service Visitor-Related Employment**

Airports	Direct Employment	Multiplier Employment	Total Employment
Commercial Service Airports	87,924	50,953	138,877

Source: CDM Smith and IMPLAN

Massachusetts commercial service airports supported 87,924 direct jobs related to visitor employment in 2017 with an additional 50,953 jobs attributed to multiplier impacts. When combined, commercial service visitor-related employment totals 138,877 jobs.

### **General Aviation Visitor-Related Employment**

Visitors using general aviation travel also make purchases in the local economy, leading to jobs in different industries throughout Massachusetts. **Table 4-3** shows the number of jobs in Massachusetts supported by spending from approximately 450,000 visitors using general aviation aircraft to travel to and within the Commonwealth.

**Table 4-3**  
**General Aviation Visitor-Related Employment**

Airports	Direct Employment	Multiplier Employment	Total Employment
Commercial Service Airports	2,021	967	2,988
General Aviation Airports	750	358	1,108
<b>TOTAL</b>	<b>2,771</b>	<b>1,325</b>	<b>4,096</b>

Source: CDM Smith and IMPLAN

General aviation visitor expenditures occur off-airport property and directly support jobs at businesses operating in the cities and towns close to airports. Visitors arriving at Massachusetts airports via general aviation aircraft come for a variety of reasons, all of which in some way generate employment in varying industries and locations. Many airports in Massachusetts are regularly used by visitors conducting business-related activities. For example, Fitchburg Municipal Airport and Orange Municipal Airport serve as gateways for businesspersons to the numerous companies based at the nearby Devens Industrial Center in Fitchburg and Orange Innovation Center in Orange. In the Greater Boston area and its southern suburbs, airports like Norwood Memorial Airport and Mansfield Municipal Airport host visitors attending sporting events and concerts at Gillette Stadium and Xfinity Center. Many leisure visitors arrive via general aviation aircraft to enjoy the wide variety of attractions and outdoor recreational activities available in western and central Massachusetts and the beaches in the Cape and Islands region. These visitors spend money at hotels, bed and breakfasts, restaurants, and retail establishments. Overall, spending by general aviation visitors in Massachusetts supported 2,771 direct jobs.

As the money general aviation visitors spend at businesses continues to change hands in the local and state economy, a multiplier effect occurs creating additional jobs. In this case, multiplier impacts resulted in 1,325 additional jobs. When combined, direct and multiplier general aviation visitor-related impacts result in 4,096 jobs supported by visitors using general aviation aircraft. General aviation visitor-related employment impacts for each airport are listed in **Table A-8** in **Appendix A**.

## Total Employment

Massachusetts' public-use airports help augment employment across the Commonwealth through a variety of jobs, both on the airports themselves, as well as in nearby cities and towns. **Table 4-4** displays the total employment that is a result of all activity at the 39 public-use airports in Massachusetts. On-airport business and government tenants, military aviation, CIP expenditures, and spending by visitors at the study airports results in 124,725 direct jobs with the multiplier effect adding 74,512 additional jobs. Combined, 199,237 jobs are supported in the Commonwealth by aviation-related operations, businesses, military aviation, and visitors to the study airports. Total employment impacts for each airport are listed in **Table A-9** in **Appendix A**.

**Table 4-4**  
**Total Employment**

Airports	Total Direct Employment	Total Multiplier Employment	Total Employment
Commercial Service Airports	121,587	72,484	194,071
General Aviation Airports	3,138	2,028	5,166
<b>TOTAL</b>	<b>124,725</b>	<b>74,512</b>	<b>199,237</b>

Source: CDM Smith and IMPLAN

## Payroll Impacts

The salaries, wages, and benefits paid to the employees described in the previous section enter the Massachusetts economy and are analyzed as payroll impacts. Estimates of these payroll impacts associated with on-airport activity and commercial service and general aviation visitors are detailed below. As explained in the previous section, on-airport activity includes business and government tenants, military aviation, and spending for CIPs.

### On-Airport Activity Payroll

**Table 4-5** shows the annual payroll impacts associated with on-airport activity at the study airports.

**Table 4-5**  
**On-Airport Activity Payroll**

Airports	Direct Payroll	Multiplier Payroll	Total Payroll
Commercial Service Airports	\$1,468,095,000	\$796,511,000	\$2,264,606,000
General Aviation Airports	\$148,739,000	\$84,054,000	\$232,793,000
<b>TOTAL</b>	<b>\$1,616,834,000</b>	<b>\$880,565,000</b>	<b>\$2,497,399,000</b>

Source: CDM Smith and IMPLAN



## Norwood Memorial Airport Supports Helicopter Use

Norwood Memorial Airport (OWD) is strategically located 23 miles outside the City of Boston and is an important transportation gateway for general aviation activity in the region. The airport is a facility uniquely qualified to support helicopter operations and is frequently used for medical evacuations coordinated through the Norwood Fire Department and Boston MedFlight. In addition, helicopters operated by three Boston news stations are based at OWD along with a company that provides aerial videography for the motion picture industry.

Massachusetts airports contributed more than \$1.6 billion in direct on-airport payroll impacts. Commercial service airports make up more than 90 percent of payroll in the group of study airports. Boston Logan International Airport is a major contributor to the system, contributing nearly \$902.6 million in direct annual payroll to the economy. Military aviation at Hanscom AFB and Westover ARB contributed an additional \$418.7 million in payroll among the commercial service airports. General aviation airports in Massachusetts combine to contribute more than \$148.7 million in direct annual payroll impacts, distributed across a wide range of airports differing in size and function. Some airports only have one tenant that generates all of the airport's direct payroll while other airports may rely on a diverse tenant base working in aircraft maintenance, medical evacuation, flight training, or other areas. Expenditures for CIPs such as the extension of Runway 15/33 at Plymouth Municipal Airport in 2015 and 2016 and the rehabilitation of Runway 15/33 at Barnstable Municipal Airport-Boardman/Polando Field in 2017 also contribute to the direct payroll impacts in Table 4-5, because those projects generate jobs for construction laborers, engineers, and consultants.

As payroll is spent in industries outside aviation but within the Massachusetts economy, multiplier impacts are created. These multiplier impacts are estimated through the IMPLAN model. The multiplier impact stemming from the payroll of on-airport business and

government tenants, military aviation, and airport CIPs is estimated at \$880.6 million. Total payroll impacts produced by on-airport activity, which includes direct and multiplier payroll, are nearly \$2.5 billion annually. On-airport activity payroll impacts for each airport are listed in **Table A-10** in **Appendix A**.

### Commercial Service Visitor-Related Payroll

**Table 4-6** identifies the annual payroll impact attributed to employees whose jobs are supported by the spending of commercial service visitors using the study airports.

**Table 4-6**  
**Commercial Service Visitor-Related Payroll**

Airports	Direct Payroll	Multiplier Payroll	Total Payroll
Commercial Service Airports	\$2,417,913,000	\$2,188,495,000	\$4,606,408,000

Source: CDM Smith and IMPLAN

Direct payroll impacts related to commercial service visitors adds to the salary, wages, and benefits of workers in industries such as hospitality, entertainment, and recreation, that are most frequented by such visitors. Direct annual payroll attributable to spending by commercial service visitors is estimated at over \$2.4 billion, with more than \$2.3 billion contributed by Boston Logan International

Airport. Commercial service airports such as Nantucket Memorial Airport and Martha’s Vineyard Airport in the Cape and Islands region, however, also serve as important generators of visitor-related payroll in this premier travel destination.

As direct payroll impacts from commercial service visitors re-circulate in the Massachusetts economy, multiplier impacts are produced. This re-circulation of money generates employment and additional payroll in other industries outside of aviation that can be attributed to the initial spending by visitors arriving through commercial service airports. Payroll associated with multiplier impacts is estimated at almost \$2.2 billion. More than \$4.6 billion in total annual payroll impact from commercial service visitors is produced when combining direct and multiplier impacts. Air carrier visitor-related payroll impacts for each airport are listed in **Table A-11** in **Appendix A**.



*JetBlue aircraft at Worcester Regional Airport*

### **General Aviation Visitor-Related Payroll**

**Table 4-7** identifies the payroll impacts generated by visitors when traveling to Massachusetts airports using general aviation.

**Table 4-7  
General Aviation Visitor-Related Payroll**

<b>Airports</b>	<b>Direct Payroll</b>	<b>Multiplier Payroll</b>	<b>Total Payroll</b>
Commercial Service Airports	\$55,579,000	\$46,053,000	\$101,632,000
General Aviation Airports	\$20,632,000	\$17,098,000	\$37,730,000
<b>TOTAL</b>	<b>\$76,211,000</b>	<b>\$63,151,000</b>	<b>\$139,362,000</b>

Source: CDM Smith and IMPLAN

Payroll produced from general aviation visitors relates to the salaries, wages, and benefits at jobs serving those passengers traveling by general aviation aircraft, no matter if the airport hosts commercial service. Several Massachusetts airports serve as transportation portals for parents and students visiting local colleges and private secondary schools. For example, visitors use Walter J. Koladza Airport in western Massachusetts to access Berkshire School, Hotchkiss School, Salisbury School, Indian Mountain School, Rudolph Steiner School, and Bard College. These visitors spend money for lodging, meals, and transportation during their stay, supporting jobs in the local economy.



*Jet at Pittsfield Municipal Airport*

General aviation visitors generate \$76.2 million in direct annual payroll. Commercial service airports contribute nearly \$55.6 million in payroll, while the general aviation airports contribute more than \$20.6 million.

## Orange Municipal Airport Embraces Business Opportunities

Jumptown, a New England skydiving operation based at Orange Municipal Airport, attracts thousands of visitors from all over the Northeast to experience a unique and exhilarating aviation activity. Additionally, the airport is located two miles from the Orange Innovation Center, which is home to 51 technology-focused businesses. Clients for businesses located at the Orange Innovation Center periodically use the airport to attend meetings and events.

As employees in the visitor-related industries spend their payroll, this spending continues to circulate, generating additional employment and subsequent payroll. With these multiplier impacts, another \$63.2 million is added in payroll impact due to the spending of general aviation visitor dollars. General aviation visitor impacts combine to produce \$139.4 million in annual payroll impact. General aviation visitor-related payroll impacts for each airport are listed in **Table A-12** in **Appendix A**.

### **Total Payroll**

Continued investment in Massachusetts airports, whether in metropolitan, rural, or destination locations, adds significant payroll benefits to the Commonwealth's economy. The combined impacts of airport business and government tenants, military aviation, CIP, commercial service visitor, and general aviation visitor-related payroll in Massachusetts are identified in **Table 4-8**. Direct annual payroll impacts generated by commercial service and general aviation airports equate to more than \$4.1 billion. When considering multiplier impacts, another \$3.1 billion in annual payroll impacts are added to produce a total payroll impact exceeding \$7.2 billion. Total payroll impacts for each airport are listed in **Table A-13** in **Appendix A**.

**Table 4-8**  
**Total Payroll**

Airports	Total Direct Payroll	Total Multiplier Payroll	Total Payroll
Commercial Service Airports	\$3,941,587,000	\$3,031,059,000	\$6,972,646,000
General Aviation Airports	\$169,371,000	\$101,152,000	\$270,523,000
<b>TOTAL</b>	<b>\$4,110,958,000</b>	<b>\$3,132,211,000</b>	<b>\$7,243,169,000</b>

Source: CDM Smith and IMPLAN

## Output Impacts

Economic output generated by aviation-related businesses, government agencies, military aviation, airport CIPs, and visitors relates to the money spent and circulated due to Massachusetts airports. For this study, on-airport output is defined as annual gross sales for on-airport businesses and activities. In instances where businesses or organizations do not generate revenue, annual operating expenses are used as a gauge of output. Examples of these instances would be government agencies like the Federal Aviation Administration and Transportation Security Administration, corporate flight departments, and airlines which generate revenue from ticket sales, but are difficult to assign to specific airports. When looking at CIP, output is equivalent to the amount spent to complete the projects. Commercial service and general aviation visitor output is defined as the money spent by visitors outside the airport and airport-related activities. Annual economic output generated annually from Massachusetts' airports is discussed in this section.

### On-Airport Activity Output

**Table 4-9** identifies annual output for all on-airport activities, including aviation-related businesses and government agencies, military aviation, and airport CIPs. Massachusetts airports produce over \$7.5 billion in direct economic output, with nearly \$7.2 billion stemming from activity at the commercial service airports. Boston Logan International Airport and military aviation activity at Hanscom AFB are the primary generators of the economic output at the commercial service airports. General aviation airports also make important contributions to the Commonwealth's economy, producing \$340.7 million in direct output. At Harriman-and-West Airport near North Adams, Col-East International and Turboprop East use the airport daily for their aerial photography business and aircraft maintenance activities, respectively. Nancy's Airfield Café at Minute Man Air Field near Stow is a popular destination for locals and visitors seeking breakfast, lunch, and dinner along with panoramic views of airfield activity. These are just some of the types of on-airport businesses operating in Massachusetts that keep general aviation airports thriving in Massachusetts and encourage spending and investment by the community and other airport users.



*Fixed-based operator, Rectrix, at Westfield-Barnes Regional Airport*

Capital improvements and related construction work also add to on-airport activity output. For example, Martha's Vineyard Airport built a new Airport Rescue and Firefighting/Snow Removal Equipment building in 2016 and 2017 at a total cost of \$10.5 million. Projects such as these benefit the Commonwealth's economy through expenditures for labor, supplies, and materials.



**Table 4-9**  
**On-Airport Activity Output**

Airports	Direct Output	Multiplier Output	Total Output
Commercial Service Airports	\$7,188,171,000	\$3,848,907,000	\$11,037,078,000
General Aviation Airports	\$340,727,000	\$199,902,000	\$540,629,000
<b>TOTAL</b>	<b>\$7,528,898,000</b>	<b>\$4,048,809,000</b>	<b>\$11,577,707,000</b>

Source: CDM Smith and IMPLAN

As aviation-related tenants located on each study airport spend money keeping their businesses operating, these expenditures enter the Massachusetts economy and spread to different sectors and industries, leading to additional output impacts that can be derived from aviation-related spending. Multiplier output impacts are estimated using the IMPLAN model, with an estimate of more than \$4.0 billion in multiplier output from on-airport activity. When direct and multiplier impacts are combined, the total annual output for Massachusetts' 39 public-use airports from on-airport activity approaches \$11.6 billion. On-airport activity output impacts for each airport are listed in **Table A-14** in **Appendix A**.

### **Commercial Service Visitor-Related Output**

**Table 4-10** identifies the output attributed to commercial visitor spending. Of the nearly \$7.0 billion in direct spending by visitors arriving at the Commonwealth's commercial service airports, Boston Logan International Airport, which serves as a gateway to the City of Boston and New England, contributes \$6.8 billion in direct output. As previously explained, however, airports such as Barnstable Municipal Airport-Boardman/Polando Field, Nantucket Memorial Airport, and Provincetown Municipal Airport play an integral role in supporting the tourism industry and overall economic vitality of the Cape and Islands region. For example, Cape Air provides year-round airline service between Boston Logan International and Provincetown Municipal, allowing tourists to access Provincetown, surrounding communities, and the Cape Cod National Seashore. The recirculation of all direct spending from commercial visitors creates another \$5.8 billion in multiplier impacts. In total, the combined annual output from commercial service visitor spending is nearly \$12.8 billion. Air carrier visitor output impacts for each airport are listed in **Table A-15** in **Appendix A**.



*Shoreline on Nantucket Island*

**Table 4-10**  
**Commercial Service Visitor-Related Output**

Airports	Direct Output	Multiplier Output	Total Output
<b>Commercial Service Airports</b>	<b>\$6,974,920,000</b>	<b>\$5,807,871,000</b>	<b>\$12,782,791,000</b>

Source: CDM Smith and IMPLAN

### **General Aviation Visitor-Related Output**

**Table 4-11** displays the output generated by all general aviation visitors in Massachusetts. Direct annual output is estimated at nearly \$183.0 million, with commercial service airports supporting \$133.3 million and general aviation airports contributing \$49.7 million. Nantucket Memorial Airport has become a notable destination for weddings. Many of the wedding parties access Nantucket Memorial via charter aircraft operated by companies such as NetJets, Wheels Up, and PlaneSense. Sterling Airport draws general aviation visitors who use the airport as a gateway to Mount Wachusett Ski Resort and equestrian facilities in the area. These visitors contribute to the Commonwealth's economy through their purchases for food and beverage, lodging, transportation, entertainment, and retail items during their stay in the cities and towns near the airports.

When adding in the multiplier effect, as the money makes its way through the economy, over \$149.1 million is created in additional output. When direct and multiplier impacts are combined, general aviation visitor output approaches \$332.1 million. General aviation visitor-related output impacts for each airport are listed in **Table A-16** in **Appendix A**.

**Table 4-11**  
**General Aviation Visitor-Related Output**

Airports	Direct Output	Multiplier Output	Total Output
Commercial Service Airports	\$133,277,000	\$108,634,000	\$241,911,000
General Aviation Airports	\$49,682,000	\$40,494,000	\$90,176,000
<b>TOTAL</b>	<b>\$182,959,000</b>	<b>\$149,128,000</b>	<b>\$332,087,000</b>

Source: CDM Smith and IMPLAN

### **Total Output**

The total combined annual output related to on-airport businesses and government agencies, military aviation, airport CIPs, and commercial service and general aviation visitor spending is presented in **Table 4-12**. Direct annual output measures nearly \$14.7 billion while multiplier output impacts are estimated at approximately \$10.0 billion annually. Combined direct and multiplier output from on-airport activities and all aviation visitors produce a total annual output of \$24.7 billion for Massachusetts' economy. Output impacts for each airport are listed in **Table A-17** in **Appendix A**.

**Table 4-12**  
**Total Output**

Airports	Total Direct Output	Total Multiplier Output	Total Output
Commercial Service Airports	\$14,296,368,000	\$9,765,412,000	\$24,061,780,000
General Aviation Airports	\$390,409,000	\$240,396,000	\$630,805,000
<b>TOTAL</b>	<b>\$14,686,777,000</b>	<b>\$10,005,808,000</b>	<b>\$24,692,585,000</b>

Source: CDM Smith and IMPLAN

## Summary

Massachusetts' airports are significant contributors to the Commonwealth's economy. As presented in **Table 4-13**, the aviation-related activity at Massachusetts airports supports 199,237 jobs with an associated payroll of \$7.2 billion. This economic impact is the result of on-airport businesses and government organizations carrying out their duties and services as part of the aviation industry. It also includes impacts from military aviation activities at Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport; airport-related capital projects; and the effects from expenditures by visitors arriving via airline and private aircraft. Using an economic input-output model, the follow-on effects of multiplier impacts were estimated. Together, all of this activity results in \$24.7 billion of economic output for Massachusetts. These impacts have increased since they were last measured in the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*, which followed the same methodology. Since that study, employment has grown 23 percent, payroll has risen 19 percent, and output has increased 49 percent.

**Table 4-14** identifies the distribution of the economic impacts in Table 4-13 between the 36 public-use airports supported by the Massachusetts Department of Transportation's (MassDOT) Aeronautics Division and the three airports owned and operated by the Massachusetts Port Authority (Massport), which include Boston Logan International Airport, Laurence G. Hanscom Field, and Worcester Regional Airport. In 2017, when direct and multiplier impacts are included, the MassDOT-supported airports:

- supported 16,797 jobs,
- generated more than \$711.0 million in annual payroll, and
- produced nearly \$1.6 billion in economic output.

## Plymouth Municipal Airport Educates Future Aircraft Mechanics

Plymouth Municipal Airport is a large general aviation airport with numerous tenants. In the summer of 2016, Cape Cod Community College started their FAA Certified Aviation Maintenance Technology Program at the airport. To date the program has graduated two classes for a total of approximately 40 FAA Certified Aircraft and Powerplant Technicians. These students are being hired by local maintenance shops as well as airlines around the country. The airport is proud to be the home for such an amazing program that is creating jobs for students in a field that currently has a worldwide shortage.

The Massport airports:

- supported 182,440 jobs,
- generated more than \$6.5 billion in annual payroll, and
- produced over \$23.1 billion in economic output.

**Table 4-13**  
**Economic Impact Summary**

	Direct On-Airport Activity Impacts	Direct Visitor-Related Impacts	Multiplier Impacts	Total Impacts
<b>Employment</b>				
Commercial Service Airports	31,642	89,945	72,484	194,071
General Aviation Airports	2,388	750	2,028	5,166
<b>Total</b>	<b>34,030</b>	<b>90,695</b>	<b>74,512</b>	<b>199,237</b>
<b>Payroll</b>				
Commercial Service Airports	\$1,468,095,000	\$2,473,492,000	\$3,031,059,000	\$6,972,646,000
General Aviation Airports	\$148,739,000	\$20,632,000	\$101,152,000	\$270,523,000
<b>Total</b>	<b>\$1,616,834,000</b>	<b>\$2,494,124,000</b>	<b>\$3,132,211,000</b>	<b>\$7,243,169,000</b>
<b>Output</b>				
Commercial Service Airports	\$7,188,171,000	\$7,108,197,000	\$9,765,412,000	\$24,061,780,000
General Aviation Airports	\$340,727,000	\$49,682,000	\$240,396,000	\$630,805,000
<b>Total</b>	<b>\$7,528,898,000</b>	<b>\$7,157,879,000</b>	<b>\$10,005,808,000</b>	<b>\$24,692,585,000</b>

Source: CDM Smith and IMPLAN

**Table 4-14**  
**Economic Impacts of MassDOT-Supported Airports and Massport Airports**

	Direct On-Airport Activity Impacts	Direct Visitor-Related Impacts	Multiplier Impacts	Total Impacts
<b>Employment</b>				
MassDOT-Supported Airports	6,901	4,037	5,859	16,797
Massport Airports	27,129	86,658	68,653	182,440
<b>Total</b>	<b>34,030</b>	<b>90,695</b>	<b>74,512</b>	<b>199,237</b>
<b>Payroll</b>				
MassDOT-Supported Airports	\$336,097,000	\$111,028,000	\$264,017,000	\$711,142,000
Massport Airports	\$1,280,737,000	\$2,383,096,000	\$2,868,194,000	\$6,532,027,000
<b>Total</b>	<b>\$1,616,834,000</b>	<b>\$2,494,124,000</b>	<b>\$3,132,211,000</b>	<b>\$7,243,169,000</b>
<b>Output</b>				
MassDOT-Supported Airports	\$662,042,000	\$293,816,000	\$605,493,000	\$1,561,351,000
Massport Airports	\$6,866,856,000	\$6,864,063,000	\$9,400,315,000	\$23,131,234,000
<b>Total</b>	<b>\$7,528,898,000</b>	<b>\$7,157,879,000</b>	<b>\$10,005,808,000</b>	<b>\$24,692,585,000</b>

Source: CDM Smith and IMPLAN



# 5 Tax Impacts



Massachusetts airports not only generate employment, payroll, and output impacts, they also account for significant tax revenues for the Commonwealth and its local municipalities. This section explains the methodology for estimating tax revenues generated by airport activities as well as the revenue impacts associated with those activities. This analysis only examines the tax impacts from direct on-airport businesses and the direct spending by those commercial service and general aviation visitors that use the 39 study airports.

The far-reaching effects of airports is, in part, illustrated in this tax analysis. It takes into account revenues generated through the state sales tax, local lodging and restaurant taxes, rental car taxes, state income taxes, and aviation fuel taxes. These taxes are paid by on-airport businesses, visitors arriving by both commercial airlines and general aviation aircraft, and all of the employees supported by airport-related activity, which consist of those working on the airport for businesses and government organizations, and those found off-airport that are supported by visitor spending. The taxes examined in this analysis are explained below in their individual sections.

## State Sales Tax Rate

A sales tax of 6.25 percent is imposed on the sales price or rental charge of tangible personal property, with the proceeds going to the Commonwealth's general fund. This tax applies to gas, electricity, steam, and certain telecommunications services. It is also applicable to meals sold by or bought from restaurants or any part of a store.

## Room Occupancy Excise Tax and Local Room Occupancy Excise Tax

Massachusetts imposes a lodging tax of 5.7 percent on guests staying in hotels, motels, lodging houses, or bed and breakfasts if rates are \$15 or more per stays of 90 days or less. Additionally, Massachusetts state law permits cities and towns to levy a local room occupancy excise tax of up to 6 percent (Boston may impose a rate of up to 6.5 percent, but currently only charges 6 percent). More than half of Massachusetts municipalities take advantage of this tax, imposing anywhere from 2 percent to 6 percent additional tax. These taxes are typically used in areas that are destinations for tourist or business travel with the intention that the tax helps to offset the cost of services provided to visitors versus residents, thus balancing the tax burden more evenly across users.

## Convention Center Financing Surcharges

To assist in the funding of convention center construction, certain fees, surcharges, and taxes are permitted in the Boston region. Two of these are relevant for this analysis. The cities of Boston, Cambridge, Chicopee, Springfield, West Springfield, and Worcester impose a 2.75 percent room occupancy tax in addition to the room occupancy excise tax and local room occupancy tax. Vehicles rented in Boston are subject to a \$10 convention center financing surcharge.

## Local Option Meals Tax

Massachusetts municipalities are also permitted to levy a local option restaurant/prepared meals sales tax in the amount of 0.75 percent. In 2017, approximately 66 percent of all municipalities in Massachusetts exercised this sales tax. Coupled with the 6.25 percent sales tax levied by the

Commonwealth on prepared meals (as part of the state sales tax described previously), the total restaurant tax may amount to 7.0 percent in those municipalities that have opted to levy this tax.

## Rental Car Tax Rates

Visitors using rental cars in Massachusetts pay the 6.25 percent general sales tax on the cost of a rented vehicle. The City of Boston also imposes a \$10 vehicle surcharge for rental cars for the purpose of convention center financing in Boston, as described previously. Rental car companies often impose additional fees, but these are typically cost recovery mechanisms for facilities, or airport concession fees and do not result in direct revenue to Massachusetts or its municipalities and therefore were not included in this analysis.

## State Income Taxes

For 2017, the income tax rate in Massachusetts, which includes wages, pensions, business income, rents, etc., as well as interest and dividend income, is 5.1 percent. This is the only tax bracket Massachusetts has for income taxes.

## Aviation Fuel Taxes

The tax rates for aviation fuels are based on a percentage of the average fuel price and are set quarterly. The rate for aviation gasoline, which is predominately used by piston-powered aircraft, is 7.5 percent of the average price, as determined by the Commissioner of the Massachusetts Department of Revenue (DOR) for each calendar quarter, computed to the nearest 10<sup>th</sup> of a cent per gallon but no less than 10 cents per gallon. In 2017, the average tax rate on aviation gasoline for all four quarters was \$0.242 per gallon. The proceeds of this tax help to fund the MassDOT Aeronautics Division.

The Commonwealth has a local option tax for jet fuel. The jet fuel tax is enacted by a municipality and collected by the DOR. The money is not part of the general fund, but is remitted by the DOR directly to the municipality. Municipalities that have enacted the jet fuel tax are Bedford, Boston, Concord, Lexington, Lincoln, Mansfield, Marshfield, Norwood, and Worcester. The tax rate is 5.0 percent of the average wholesale price per gallon, as determined by the Commissioner of the DOR for each calendar quarter, computed to the nearest 10<sup>th</sup> of a cent per gallon but no less than five cents per gallon. In 2017, the average tax rate on jet fuel across all four quarters was \$0.074 per gallon.

## Sales Tax Estimation Methodology

This tax estimation methodology began by compiling the tax rates applicable to various purchases at each system airport. It was assumed that any taxes in the municipality in which the airport was found applied to purchases tied to that airport.

## Provincetown Municipal Airport Allows for Easy Access to Remote Parts of Cape Cod

Provincetown Municipal Airport (PVC) is located on Cape Cod and provides year-round airline service to Boston and seasonal airline service to White Plains, New York, by Cape Air. During the summer and shoulder months, numerous aircraft charter and fractional ownership companies such as Wheels Up, PlaneSense, and NetJets use the airport. With PVC situated within the Cape Cod National Seashore, it is a key gateway for tourism in the area. The airport is also used for business, personal travel, and by various whale watching aircraft that track migration routes and whale counts.

Certain taxes applied to all airports. Massachusetts' 6.25 state sales tax and 5.7 percent room occupancy excise tax were in effect in 2017 for all 39 airports. Other taxes, such as the local hotel room occupancy tax, are only applied in municipalities that have opted to enact such a tax. Using data from the Massachusetts DOR, sales and excise tax rates for retail sales, restaurants/prepared meals, lodging, and rental cars was obtained as shown in **Table 5-1**. For local option taxes that were enacted during 2017, an effective tax rate was applied based upon what time of year the tax went into effect.



*Downtown Nantucket*

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## Laurence G. Hanscom Field Supports General Aviation and the Military in the Boston Area

Owned and operated by the Massachusetts Port Authority, Laurence G. Hanscom Field (BED) is strategically located 15 miles outside of Boston and adjacent to Interstate 95/128. It is the busiest general aviation airport in New England, supporting business aviation and the military. BED is a gateway for numerous sports team charters for all major professional and college sporting events in the Boston area. The tenants of BED support various non-profit charities such as Angel Flight Northeast and Pilots N Paws. Boston MedFlight has their air ambulance operation headquarters based at the airport.

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**Table 5-1**  
**Tax Rates for Massachusetts Airports, 2017**

Associated City	Airport Name	Retail Tax	Lodging Tax	Restaurant Tax	Car Rental Tax
<b>Commercial Service Airports</b>					
Bedford	Laurence G. Hanscom Field	6.25%	11.70%	7.00%	6.25%
Boston	Boston Logan International Airport	6.25%	14.45%	7.00%	6.25%
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	6.25%	12.45%	7.00%	6.25%
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	6.25%	11.70%	7.00%	6.25%
Nantucket	Nantucket Memorial Airport	6.25%	11.70%	7.00%	6.25%
New Bedford	New Bedford Regional Airport	6.25%	11.70%	7.00%	6.25%
Provincetown	Provincetown Municipal Airport	6.25%	11.70%	7.00%	6.25%
Vineyard Haven	Martha's Vineyard Airport	6.25%	9.70%	7.00%	6.25%
Worcester	Worcester Regional Airport	6.25%	14.45%	7.00%	6.25%
<b>General Aviation Airports</b>					
Barre/Barre Plains	Tanner-Hiller Airport	6.25%	5.70%	6.25%	6.25%
Berkley	Myricks Airport	6.25%	5.70%	7.00%	6.25%
Beverly	Beverly Regional Airport	6.25%	11.70%	7.00%	6.25%
Chatham	Chatham Municipal Airport	6.25%	9.70%	7.00%	6.25%
Edgartown	Katama Airpark	6.25%	9.70%	6.25%	6.25%
Falmouth	Falmouth Airpark	6.25%	9.70%	7.00%	6.25%
Fitchburg	Fitchburg Municipal Airport	6.25%	9.70%	6.25%	6.25%
Gardner	Gardner Municipal Airport	6.25%	9.70%	6.25%	6.25%
Great Barrington	Walter J. Koladza Airport	6.25%	11.70%	7.00%	6.25%
Hanson	Cranland Airport	6.25%	5.70%	6.25%	6.25%
Hopedale	Hopedale Industrial Park Airport	6.25%	5.70%	6.25%	6.25%
Lawrence	Lawrence Municipal Airport	6.25%	11.70%	7.00%	6.25%
Mansfield	Mansfield Municipal Airport	6.25%	9.70%	7.00%	6.25%
Marlborough	Marlboro Airport	6.25%	11.70%	7.00%	6.25%
Marshfield	Marshfield Municipal Airport - George Harlow Field	6.25%	9.70%	7.00%	6.25%
Marstons Mills	Cape Cod Airport	6.25%	11.70%	7.00%	6.25%
Montague	Turners Falls Airport	6.25%	5.70%	6.25%	6.25%
Newburyport	Plum Island Airport	6.25%	11.70%	7.00%	6.25%
North Adams	Harriman-and-West Airport	6.25%	11.70%	7.00%	6.25%
Northampton	Northampton Airport	6.25%	11.70%	7.00%	6.25%
Norwood	Norwood Memorial Airport	6.25%	11.70%	7.00%	6.25%
Orange	Orange Municipal Airport	6.25%	11.70%	7.00%	6.25%
Pittsfield	Pittsfield Municipal Airport	6.25%	11.70%	7.00%	6.25%
Plymouth	Plymouth Municipal Airport	6.25%	11.70%	7.00%	6.25%
Southbridge	Southbridge Municipal Airport	6.25%	11.70%	7.00%	6.25%
Spencer	Spencer Airport	6.25%	5.70%	7.00%	6.25%
Sterling	Sterling Airport	6.25%	9.70%	6.25%	6.25%
Stow	Minute Man Air Field	6.25%	5.70%	6.25%	6.25%
Taunton	Taunton Municipal Airport - King Field	6.25%	11.70%	7.00%	6.25%
Westfield/Springfield	Westfield-Barnes Regional Airport	6.25%	11.70%	7.00%	6.25%

Source: Massachusetts Department of Revenue and CDM Smith



Using these tax rates, estimates of taxes paid by on-airport businesses, by visitors arriving by airport, by employees of the on-airport businesses, and by employees supported by visitor spending were determined.

## Sales Taxes Generated by On-Airport Businesses

On-airport businesses pay sales taxes on goods and services purchased. To estimate these taxes, each airport's direct payroll was subtracted from its direct output to obtain the taxable expenditures attributable to that airport. The applicable sales tax rate was then applied to obtain the sales taxes paid by the airport's on-airport businesses, using a generalized assumption that all of these expenditures occurred within the local tax district of the airport. It was also assumed that the taxable expenditures included the taxes paid and the calculation reflects that. To illustrate, assume a \$100 purchase is made on an item with a 10 percent tax. The total expenditure is \$110. If the analysis were to assume that 10 percent of this expenditure, or \$11, is the tax amount, it would overstate the taxes. Instead, the analysis uses the following formula to accurately estimate the tax portion of the \$110 expenditure:

$$\$110 \times [10\% \div (1 + 10\%)] = \$10 \text{ of taxes}$$

The following example using Plymouth Municipal Airport demonstrates the calculations used to estimate commercial service visitor impacts. For this and subsequent examples, numbers are rounded for ease of presentation and any variation in calculations is the result of this rounding.

- Plymouth Municipal Airport had \$34.4 million in direct on-airport output and \$10.1 million in direct on-airport payroll.<sup>1</sup> The state sales tax rate applicable for Plymouth Municipal Airport is 6.25 percent. This yields approximately \$1.4 million in sales taxes from Plymouth Municipal Airport's on-airport businesses for 2017.
- \$34.4 million output - \$10.1 million payroll = \$24.3 million in taxable expenditures
- \$24.3 million in taxable expenditures x 6.25 percent ÷ (1 + 6.25 percent) = \$1.4 million in sales taxes

For 2017, sales taxes paid by the on-airport businesses on Massachusetts' 39 airports are estimated at \$109.3 million.

## Sales Taxes Generated by Commercial Service Visitors

To estimate the sales taxes paid by visitors arriving by commercial airlines, it was necessary to estimate how visitor expenditures were allocated among lodging, restaurants, rental cars, and other purchases. Based on data from the Massachusetts Office of Travel & Tourism (MOTT), each airport's visitor expenditures were split between these four categories and the appropriate tax rates were applied. It was assumed that all of these expenditures occurred within the tax district of the airport. It was also assumed that the taxable expenditures included the taxes paid and the calculation reflects that. For example:

Worcester Regional Airport had \$7.5 million in commercial service visitor expenditures in 2017. Based on MOTT data, an estimated 21 percent of these expenditures were on retail, 35 percent on lodging, 28 percent on restaurants, and the remaining 16 percent on rental car. The tax rates for Worcester Regional Airport for retail sales, lodging, restaurants, and rental car are 6.25 percent, 14.5 percent, 7.0 percent, and 6.25 percent, respectively. From this data, it was estimated that Worcester Regional Airport's commercial service visitors paid approximately \$634,000 in taxes in 2017.

<sup>1</sup> Payroll and output associated with capital improvement activity are included in these figures.

- \$7.5 million visitor expenditures x 21 percent = \$1.5 million in retail sales
- \$1.5 million in retail sales x 6.25 percent ÷ (1 + 6.25 percent) = \$91,000 in retail sales taxes
- \$7.5 million visitor expenditures x 35 percent = \$2.6 million in lodging expenditures
- \$2.6 million in lodging expenditures x 14.50 percent ÷ (1 + 14.50 percent) = \$331,000 in lodging taxes
- \$7.5 million visitor expenditures x 28 percent = \$2.1 million in restaurant expenditures
- \$2.1 million in restaurant expenditures x 7.0 percent ÷ (1 + 7.0 percent) = \$139,000 in restaurant taxes
- \$7.5 million visitor expenditures x 16 percent = \$1.2 million in rental car expenditures
- \$1.2 million in rental car expenditures x 6.25 percent ÷ (1 + 6.25 percent) = \$69,000 in rental car taxes
- \$91,000 in retail sales taxes + \$331,000 in lodging taxes + \$139,000 in restaurant taxes + \$69,000 in rental car taxes = \$630,000 in commercial service visitor paid taxes

Taxes paid by commercial service visitors traveling through Massachusetts' seven commercial service airports with scheduled airline service are estimated at \$600.2 million in 2017. Boston Logan International Airport contributed nearly 98 percent of that amount, with its commercial service visitors paying \$587.3 million in sales, lodging, and restaurant taxes in 2017.



*Takeoff at Worcester Regional Airport*

## Sales Taxes Generated by General Aviation Visitors

The estimate for sales taxes paid by general aviation visitors used the same methodology as that used to estimate the sales taxes paid by commercial service visitors described previously. General aviation visitor expenditures were allocated among retail sales, restaurants, lodging, and rental cars using MOTT data and the appropriate tax rates were applied. It was assumed that all of these expenditures occurred within the tax district of the airport. It was also assumed that the taxable expenditures included the taxes paid and the calculation reflects that. For example:

Fitchburg Municipal Airport had \$3.0 million in general aviation visitor expenditures. Based on MOTT data, an estimated 21 percent of these expenditures were on retail, 35 percent on lodging, 28 percent on restaurants, and the remaining 16 percent on rental car. The tax rates for Fitchburg Municipal Airport for retail sales, lodging, restaurants, and rental car are 6.25 percent, 9.7 percent, 6.25 percent, and 6.25 percent, respectively. From this data, it was estimated that Fitchburg Municipal Airport's general aviation visitors paid approximately \$209,000 in taxes in 2017.

- \$3.0 million visitor expenditures x 21 percent = \$623,000 in retail sales
- \$623,000 in retail sales x 6.25 percent ÷ (1 + 6.25 percent) = \$37,000 in retail sales taxes
- \$3.0 million visitor expenditures x 32 percent = \$1.1 million in lodging expenditures
- \$1.1 million in lodging expenditures x 9.7 percent ÷ (1 + 9.7 percent) = \$94,000 in lodging taxes
- \$3.0 million visitor expenditures x 28 percent = \$861,000 in restaurant expenditures
- \$861,000 in restaurant expenditures x 6.25 percent ÷ (1 + 6.25 percent) = \$51,000 in restaurant taxes
- \$3.0 million visitor expenditures x 19 percent = \$477,000 in rental car expenditures

- \$477,000 in rental car expenditures x 6.25 percent ÷ (1 + 6.25 percent) = \$28,000 in rental car taxes
- \$37,000 in retail sales taxes + \$94,000 in lodging taxes + \$51,000 in restaurant taxes +
- \$28,000 in rental car taxes = \$209,000 in general aviation visitor paid taxes

After accounting for general aviation visitor expenditures at all 39 Massachusetts airports, it is estimated that total sales taxes paid amounted to \$14.2 million in 2017.

## Fitchburg Municipal Airport Serves as a Vital Part of the Community

Fitchburg Municipal Airport (FIT) recently opened its new airport administration building, which was part of MassDOT Aeronautics Division's Statewide Airport Administration Building Program. FIT is strategically located near Devens Industrial Center, which attracts users to the airport conducting business-related activities at the numerous companies based at the Center. Unitel, the regional power company for various communities in central Massachusetts, uses FIT for staging emergency equipment in the event of natural disasters. FIT was a primary launching point several years ago for local and state leaders during a major ice storm that crippled the region for two weeks.



*Construction worker at Beverly Regional Airport*

## Sales Taxes Paid by Employees of On-Airport Businesses

Just as visitors pay sales taxes when they make purchases, so do the people employed at the airport. The estimate of these taxes used U.S. Internal Revenue Service (IRS) tax tables that provide estimates of annual sales taxes paid based on annual income in each state. An average annual payroll was calculated for each airport. This average payroll was used to estimate the average annual sales tax paid by each on-airport employee, which was multiplied by the number of on-airport employees. In 2017, on-airport workers paid an estimated \$19.0 million in sales taxes through their purchases of goods and services in the region. This estimate includes workers affiliated with airport capital projects and military aviation found at Hanscom Air Force Base (AFB), Westover Air Reserve Base (ARB), and Westfield-Barnes Regional Airport.

## Sales Taxes Paid by Employees Supported by Visitor Spending

In addition to the on-airport workers that pay sales taxes, there are also employees supported by off-airport visitor spending that pay sales taxes. As described previously, the sales taxes paid by these people, predominately employed in the hospitality industry, is estimated using data from the IRS, which provides annual sales taxes paid in Massachusetts based on annual salary and wages. Applying these averages to each airport's number of visitor-supported employees, it was estimated that these workers paid \$36.9 million in sales taxes in 2017.



*Cape Air and Rectrix at Barnstable Municipal Airport*

## State Income Taxes Paid by Employees of On-Airport Businesses

On top of the sales taxes paid by employees tied to airports in Massachusetts, these workers also pay income tax to the state. As previously described, Massachusetts has a single tax bracket for all income, which was 5.1 percent in 2017. Applying this rate to each airport's direct payroll yielded estimates of state income taxes paid by the on-airport employees. For 2017, these workers paid an estimated \$82.5 million in Massachusetts income taxes. This included employment associated with on-airport capital improvements as well as military employment at Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport.

## State Income Taxes Paid by Employees Supported by Visitor Spending

The workers that owe their jobs to off-airport visitor expenditures also pay income tax. As with the estimate of state income taxes paid by on-airport employees, these income taxes were estimated by applying the 2017 income tax rate of 5.1 percent to the payroll of workers supported by visitor spending. This came to an estimated \$127.2 million of state income taxes.

## Lawrence Municipal Airport Utilized as Economic Development Tool by Communities

Besides being a key gateway for aviation activities in northeastern Massachusetts, Lawrence Municipal Airport (LWM) has been the site for various movie sets and music videos. LWM is used by the Department of Defense and Department of Homeland Security as a test site for various new technologies. The airport management team has established a strong partnership with the economic development teams of Lawrence, Haverhill, and North Andover, which market the airport as a key transportation infrastructure asset to support economic growth in the region.



## Aviation Fuel Taxes Paid by Aircraft Operators

Data on aviation fuel taxes was obtained from the *Annual Report FY2017* published by the Massachusetts DOR. The data available was reported for all of Massachusetts, so individual airport data was not available. In 2017, aviation gasoline taxes amounted to \$475,000 and jet fuel taxes amounted to \$19.0 million. Total aviation fuel taxes in 2017 amounted to approximately \$19.5 million. The 2014 *Massachusetts Statewide Airport Economic Impact Study Update* reported jet fuel tax revenue at more than \$38 million. The significant drop in jet fuel taxes over the past several years is attributed to the fluctuation in wholesale jet fuel price, which determines the tax rate as explained earlier. In 2013, the average jet fuel tax rate was \$0.15 per gallon, while in 2017, the average was less than half of that, at \$0.074 per gallon.

## Total Airport-Related Taxes

Airport-related activity in Massachusetts in 2017 generated an estimated \$989.2 million in sales and income taxes. **Table 5-2** shows how much of these taxes are generated by commercial service airports, and general aviation airports, in each category described previously. Each individual airport's tax generation is found in **Table A-19** in **Appendix A**.

**Table 5-2**  
**Airport-Related Taxes from Massachusetts Airports, 2017**

	Airport Tenant Sales Taxes	CS Visitor Sales Taxes	GA Visitor Sales Taxes	Employee Sales Taxes from Airport Tenants	Employee Sales Taxes from Visitors	Employee Income Taxes from Airport Tenants	Employee Income Taxes from Visitors	Total Taxes
Commercial Service Airports	\$98,675,000	\$600,193,000	\$10,454,000	\$17,438,000	\$36,562,000	\$74,873,000	\$126,148,000	\$964,343,000
General Aviation Airports	\$10,616,000	\$0	\$3,697,000	\$1,556,000	\$303,000	\$7,587,000	\$1,052,000	\$24,811,000
<b>Total Taxes</b>	<b>\$109,291,000</b>	<b>\$600,193,000</b>	<b>\$14,151,000</b>	<b>\$18,994,000</b>	<b>\$36,865,000</b>	<b>\$82,460,000</b>	<b>\$127,200,000</b>	<b>\$989,154,000</b>

Source: CDM Smith and Massachusetts Department of Revenue

Aviation fuel taxes, not shown in Table 5-2, added another \$19.5 million, bringing total airport-generated taxes to more than \$1 billion. The majority of these taxes were generated by commercial service visitors (primarily at Boston Logan International Airport), providing nearly \$600.2 million related to retail sales, lodging, restaurant, and rental car taxes.

## Examples of Aviation Fuel Taxes Supporting Aviation in Other States

States vary in how aviation fuel is taxed. Some states include jet fuel in their sales tax base. Others assess an excise tax separately, and for some states such as Colorado, both apply. Delaware, Ohio and Texas are the only states without a tax on commercial jet fuel. California has the highest jet fuel tax rate (7.5 percent), with an \$0.115 prepayment tax per gallon and a \$0.02 excise tax per gallon. California also levies an \$0.18 excise tax per gallon on aviation gasoline.

## Minute Man Air Field is Educating the Future of Aviation

Minute Man Air Field is a privately-owned, public-use airport with 70 based aircraft located in central Massachusetts. 6B6 is an essential part of the region, boosting the economy, serving the community, and nurturing the environment since 1969. With strategic MassDOT investment into the airside infrastructure, the private sector has invested significant monies into new hangars at the airport. The airport management team at 6B6 understands the importance of workforce development for the aviation industry. National Aviation Academy recently relocated to the airport and is training over 100 students to become aircraft maintenance technicians. The local Experimental Aircraft Association Chapter hosts the Young Eagles Program, flying several hundred students for free each year and introducing them to aviation.

activity and found that nearly \$30 million in general fund revenue was attributable to general aviation activity. More than half of that, \$15.9 million, was the result of taxes on avgas and jet fuel. As a result of this study, and lobbying efforts by the Ohio Aviation Association, the Ohio legislature increased its annual funding of Ohio airports from \$800,000 per year to \$6 million per year.

Louisiana is an example of a state with a dedicated aviation funding source. With a 4 percent aviation fuel tax, Louisiana generates approximately \$30 million annually that it uses to fund its aviation division and airport capital projects around the state.



*News helicopters at Norwood Memorial Airport*

Colorado supports and maintains their aviation system by using tax revenue from the sale of aviation fuel and excise tax collected. The Colorado Department of Revenue provides monthly reports on the amount of aviation gas and jet fuel sold at public-use airports. The division uses this information to reimburse airports each month based on fuel tax collections. Reimbursements are equal to revenue from the first \$0.04 per gallon tax collected on aviation gas and jet fuel, and 65 percent of the amount collected from the 2.9 percent jet fuel sales tax. The remaining revenues are used to fund the Division of Aeronautics and a grant program administered by the Colorado Aeronautical Board. In FY 2015-16, about \$10.2 million was reimbursed to Colorado airports and \$2.7 million was allocated in discretionary grants.

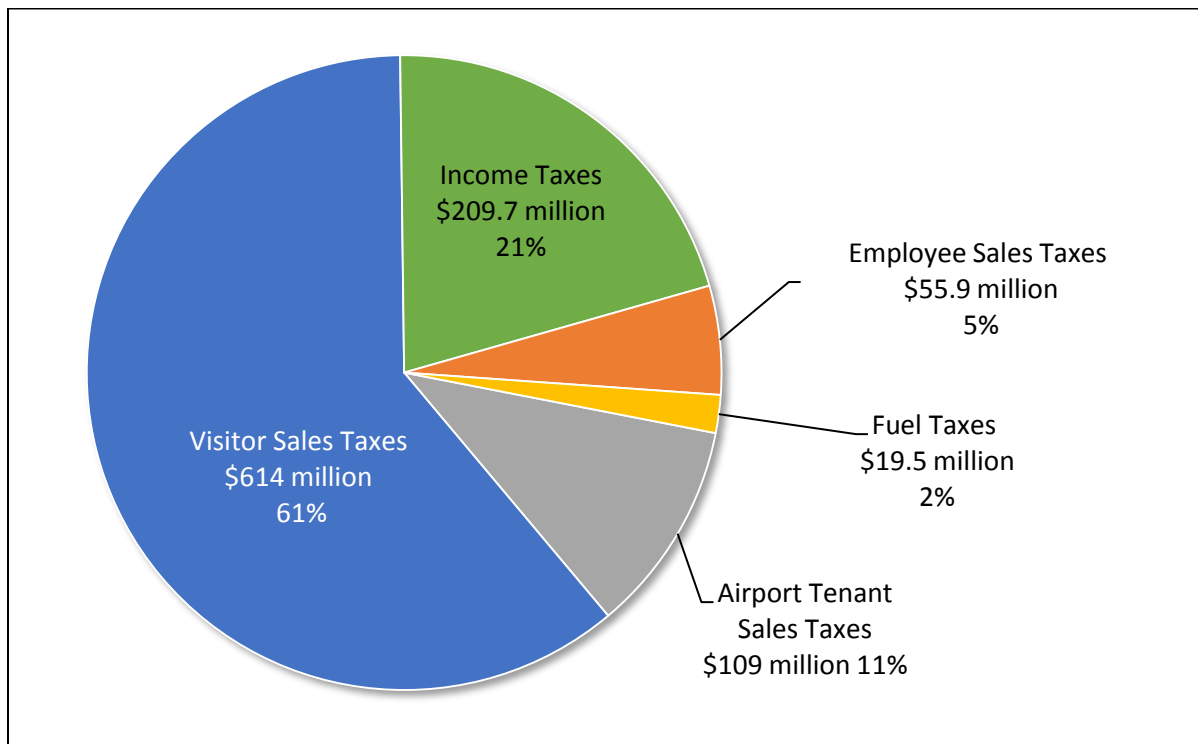
In Ohio, aviation efforts are funded by an aircraft registration fee and an appropriation from the state general fund. Prior to 2016, the general fund appropriation was between \$0.5 million and \$0.8 million annually, and, when combined with aircraft registration fees, provided Ohio with approximately \$1 million of aviation funding. The Ohio Focus Study analyzed the taxes supported by general aviation

## Tax Summary

Massachusetts' airports create economic activity that results in significant tax revenues for the Commonwealth. These taxes are generated from visitor and business expenditures, airport-related employee purchases, fuel sales, and income earned by airport-related employees. In 2017, all of these taxes amounted to more than \$1 billion.

**Figure 5-1** consolidates and summarizes the sources of these taxes into five categories. The largest of these is the result of visitor-related spending and contributes 61 percent to the overall taxes. The next largest portion comes from income taxes paid by aviation-related employees, which generates 21 percent of the total. Airport tenant sales taxes contribute 11 percent of all taxes, with employee sales taxes and aviation fuel taxes adding in 5 percent and 2 percent, respectively. It should be noted that taxes from multiplier impacts were not included in this analysis, which would make the total tax impacts larger.

**Figure 5-1**  
**Massachusetts Airport-Related Tax Impacts**



Source: CDM Smith and Massachusetts Department of Revenue



Unmanned aircraft systems (UAS) have seen a dramatic rise in activity for both recreation and commercial uses in recent years. A UAS consists of an unmanned aircraft – or drone – that can be operated without a human on board in addition to all ground-based control equipment necessary for its operation. Technological advancements such as miniaturization of components, materials improvements, and increased battery efficiency have helped to spur the rise in the UAS industry, as has the Federal Aviation Administration (FAA)’s recent ratification of drone use laws pertaining to commercial use.

As a result of these improving conditions, a wide variety of industries are taking advantage of the various benefits drones can provide; drones are used for a multitude of unique tasks: utility inspections, agricultural spraying, event and border security, and scientific research. Drones provide a wide variety of potential benefits for commercial use, including increased worker safety, improved speed and adaptability for data collection, and ultimately, cost and profit benefits. Precision agriculture, transportation, research, and public safety are all fields that are taking particular advantage of UAS technology.

UAS are used extensively throughout Massachusetts. The Commonwealth is home to UAS research at Joint Base Cape Cod, while industries throughout Massachusetts utilize drones for everyday operations with support by MassDOT through an official program focused on how best to implement drone use. The following sections provide an overview of the regulatory environment currently surrounding commercial and recreational UAS uses, the types of drones in use, a discussion of the various uses and benefits UAS offer to many industries, a discussion of the immense growth in the UAS industry in recent years, and specific examples of how drones are used in Massachusetts.



*Drone documenting the Commonwealth Avenue BU Bridge replacement*



## UAS Regulatory Environment

The FAA has worked extensively in recent years to develop a regulatory framework regarding UAS use. Through the FAA, the Federal Government has regulation and oversight over all U.S. airspace and air operations. In August 2016, the Small UAS Rule (Part 107 to Title 14 Code of Federal Regulations; FAA Advisory Circular 107-2) went into effect. This essentially expanded the FAA's governing of the National Airspace System (NAS) to include UAS activity for drones that weigh less than 55 pounds and more than 0.55 pounds, while also creating a regulatory environment in which small UAS could be used for a wide variety of commercial uses. Key provisions of Part 107 include:

- Any drone over 0.55 pounds must be registered with the FAA.
- Operators must maintain visual line-of-sight (VLOS) with drones.
- Small UAS may not be operated over any persons not involved in the operation of the drone, unless that person is under a covered structure or within a covered stationary vehicle.
- Small UAS may not be operated from another moving aircraft, or from a moving ground vehicle unless in a sparsely populated area.
- Operations limited to daylight or civil twilight (30 minutes before sunrise or 30 minutes after sunset).
- Drones must yield right-of-way to manned aircraft.
- Maximum groundspeed of 100 miles per hour.
- Maximum altitude of 400 feet unless the drone is flying within 400 feet of a structure, in which case it must fly no higher than 400 feet above the structure.
- Must notify airports and air traffic control (ATC) if drone is to be operated within five miles of an airport. Only operations in Class G Airspace allowed without ATC permission.<sup>1</sup>
- Transportation of hazardous materials is prohibited.
- Obtain a remote pilot certificate by passing the aeronautical knowledge test.



Some businesses and entities may wish to conduct drone operations that do not strictly adhere to Part 107 regulations. In these cases, the businesses or entities must apply for a Section 333 Certificate of Waiver or Authorization (COA). Such activities may include a news station that wishes to fly its drone over a crowd of people to film a scene or government agency hoping to fly search and rescue operations. Obtaining a COA is also necessary for flying UAS over 55 pounds.



*DJI Matrice 210*

The FAA requires registration of all small UAS that weigh more than 0.55 pounds regardless of their intended use. Those registering their drone must pay a \$5 registration fee and submit their personal information along with the make, model, and serial number for each small UAS they intend to fly and display the registration number on the UAS. Regardless of the drone use, the operator must keep proof of registration on their person when operating the UAS, either on paper or electronically.<sup>2</sup>

<sup>1</sup> Class G Airspace is uncontrolled airspace per FAA regulations.

<sup>2</sup> Federal Aviation Administration Advisory Circular 107-2: Small Unmanned Aircraft Systems (sUAS).

## **FAA Reauthorization Act**

In October 2018, the FAA Reauthorization Act of 2018 was signed, funding the FAA for an additional five years while establishing or updating a number of regulations and guidelines for the continued integration of UAS in the NAS.

Most notably, the Reauthorization Act repealed the Special Rule for Model Aircraft, previously the primary legislation governing recreational use of drones. Recreational drone users are now required to pass an aeronautical knowledge and safety test. Beyond this, the FAA acknowledges that not all changes can be implemented immediately and is currently evaluating the impacts of the repeal of the Special Rule. In the interim, the FAA recommends that operators follow current Special Rule policies for recreational use of small UAS in addition to now needing to pass an online aeronautical knowledge and safety test.<sup>3</sup> The Special Rule applied to hobby drone operators that registered their drone and adhered to the following rules:

- Fly hobby or recreational operations only.
- Operators must maintain VLOS with drones.
- Follow community-based safety guidelines.
- Never fly near other aircraft.
- Must notify airports and ATC if drone is to be operated within five miles of an airport.
- Never fly near emergency response efforts.

These guidelines apply to small UAS under 55 pounds, but operators may fly a UAS over 55 pounds if certified through a design, construction, inspection, flight test, and operational program administered by a community-based organization.<sup>4</sup> If an operator does not meet the above requirements, the drone must be flown under Part 107 rules.

Other notable actions of the Reauthorization Act include the following:

- Authorizes use of UAS at higher education institutions to fall under the definition of recreational use as long as the drones are used for educational or research purposes.
- Requires the FAA, U.S. Department of Transportation (USDOT), and Department of Defense (DoD) to cooperate on the development and deployment of counter-UAS (C-UAS) technologies in the NAS. Also requires these agencies and the Department of Homeland Security (DHS) to ensure that C-UAS technologies to not interfere with safe airport operations and navigation.
- Directs the FAA to update and improve the Special Governmental Interest process so that drone operators such as first responders can quickly and efficiently employ drones in response to emergencies.
- Requires the FAA to disseminate information to the public on government and commercial operators of UAS via a site on the USDOT website.
- Prohibits operating a UAS equipped with a harmful weapon.
- Makes it a crime to knowingly or recklessly operate a UAS too close to a runway or in a manner that interferes with operation of manned aircraft.
- Calls for additional research and policy related to several UAS issues including safety, regulations for aerial application, and responses to drone uses that danger public safety, among others.

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<sup>3</sup> “FAA Reauthorization Bill Establishes New Conditions for Recreational Use of Drones,” Federal Aviation Administration, 2018.

<sup>4</sup> Federal Aviation Administration Advisory Circular 91-57A: Model Aircraft Operating Standards.

## Where and When to Fly

The FAA's focus on drone safety includes multiple programs to educate both public and commercial users of UAS on where and when drones can be flown beyond the basic restrictions listed above. In addition to the restrictions based on flight near airports, all UAS flights are prohibited in security sensitive, restricted, or special use airspace such as that over military operating areas, controlled firing areas, and other prohibited flight areas. Drone flight is also prohibited where Temporary Flight Restrictions (TFRs) have been put in place for conditions such as a hazardous chemical spill or special event, or around a wildfire firefighting effort.

The FAA Reauthorization Act appropriated \$1 million annually from 2019 through 2023 for the Know Before You Fly campaign, a public-private effort operated by the FAA in conjunction with the Association for Unmanned Vehicle Systems International (AUVSI) and the Academy of Model Aeronautics (AMA). The goal of Know Before You Fly is to educate prospective drone pilots on safe operations and the regulatory framework.

The FAA also prohibits flying over or within the stadiums of major sporting events. The FAA has initiated a No Drone Zone public outreach program to educate governmental bodies about UAS restrictions. Finally, the FAA developed the B4UFLY mobile phone application for drone operators as a quick-reference guide on where they can fly and where temporary restrictions may be in place.<sup>5</sup>



## Types of UAS

Like manned aircraft, drones are made in both fixed-wing and rotary-wing varieties. Fixed-wing drones are utilized for long distance aerial photography or mapping, whereas rotary-wing drones are best for jobs where maneuverability is necessary, such as inspecting the undersides of a bridge or within a subway tunnel. AUVSI estimates that approximately 90 percent of all drones in use are rotary-wing drones, with the other 10 percent being fixed wing.<sup>6</sup>

**Table 6-1** provides basic specifications of several highly-rated UAS models. Fixed-wing drones typically have a higher maximum speed than several of the rotary-wing models; however, the DJI Inspire 2 had the highest speed at 58 miles per hour. The fixed-wing models also typically have a longer flight time, as none of the rotary-wing drones can fly longer than 30 minutes. As stated above, however, fixed-wing drones are typically used to photograph or map large areas of land with little or no maneuverability, whereas rotary-wing drones, like their manned helicopter counterparts, are designed to fit in otherwise inaccessible areas. The one hybrid drone on the list, the xCraft X Plus One, includes elements of both fixed-wing and rotary-wing drones. It takes off like a rotary-wing drone, but once airborne can be turned forwards so that it flies like a fixed-wing drone, enabling far greater speed.

<sup>5</sup> "No Drone Zone," Federal Aviation Administration, 2018.

<sup>6</sup> "Overview of the Unmanned Aircraft Systems Industry," The Association for Unmanned Vehicle Systems International, 2015.

**Table 6-1**  
**Basic Specifications of Highly-Rated UAS Models**

Drone Model	Flight Time	Maximum Speed	Camera/Sensors
<b>Fixed-Wing Drones</b>			
SenseFly eBee	50 minutes	56 mph	S.O.D.A. RGB Sensor
Hubsan H301S Spy Hawk	30 minutes	50 mph	HD camera
Parrot Disco	45 minutes	50 mph	HD camera
Delair UX11	59 minutes	34 mph	HD camera
<b>Rotary-Wing Drones</b>			
DJI Phantom Series	23-30 minutes	38.5-45 mph	HD camera
DJI Inspire Series	15-27 minutes	40-58 mph	HD camera
DJI Mavic Series	21-27 minutes	40-42 mph	HD camera
Parrot Bebop 2 Power	30 minutes	40 mph	HD camera
<b>Hybrid Drones</b>			
xCraft X Plus One	20 minutes	60 mph	HD camera

Source: 3D Insider, Drone Riot, MassDOT, CDM Smith

The high definition cameras installed on most of these devices vary by model. All three of DJI's Phantom series included in Table 6-1 can film in ultra-high definition 4K, with the Phantom 4 Advanced and Phantom 4 Pro both having 20-megapixel cameras that capture 4K at 60 frames per second (fps).<sup>7</sup> The SenseFly eBee is an example of a drone equipped with something other than a camera. The Sensor Optimized for Drone Applications (S.O.D.A.) includes a 20-megapixel true color (RGB) sensor that allows for both incredibly detailed photography and accurate 3D modeling of terrain.

## Uses and Benefits of UAS

The existing uses and future potential of commercial exploitation of UAS is almost limitless. A small drone can perform many human jobs with greater safety and efficiency and can go many places a human cannot. For example, a lightweight drone can be used to inspect the insides of large pipes, taking live video of its survey for analyzing in real time at a different location or at a later date. Drones can also be used to rapidly take pictures of disaster areas so that relief efforts can be prioritized or to deliver relief supplies as part of search and rescue missions. UAS are also used to investigate the conditions of a range of transportation infrastructure such as roads, airport pavement, and subway tunnels. **Figure 6-1** summarizes some of the many possible commercial uses of UAS. Specific uses of UAS within Massachusetts are discussed later in this chapter.

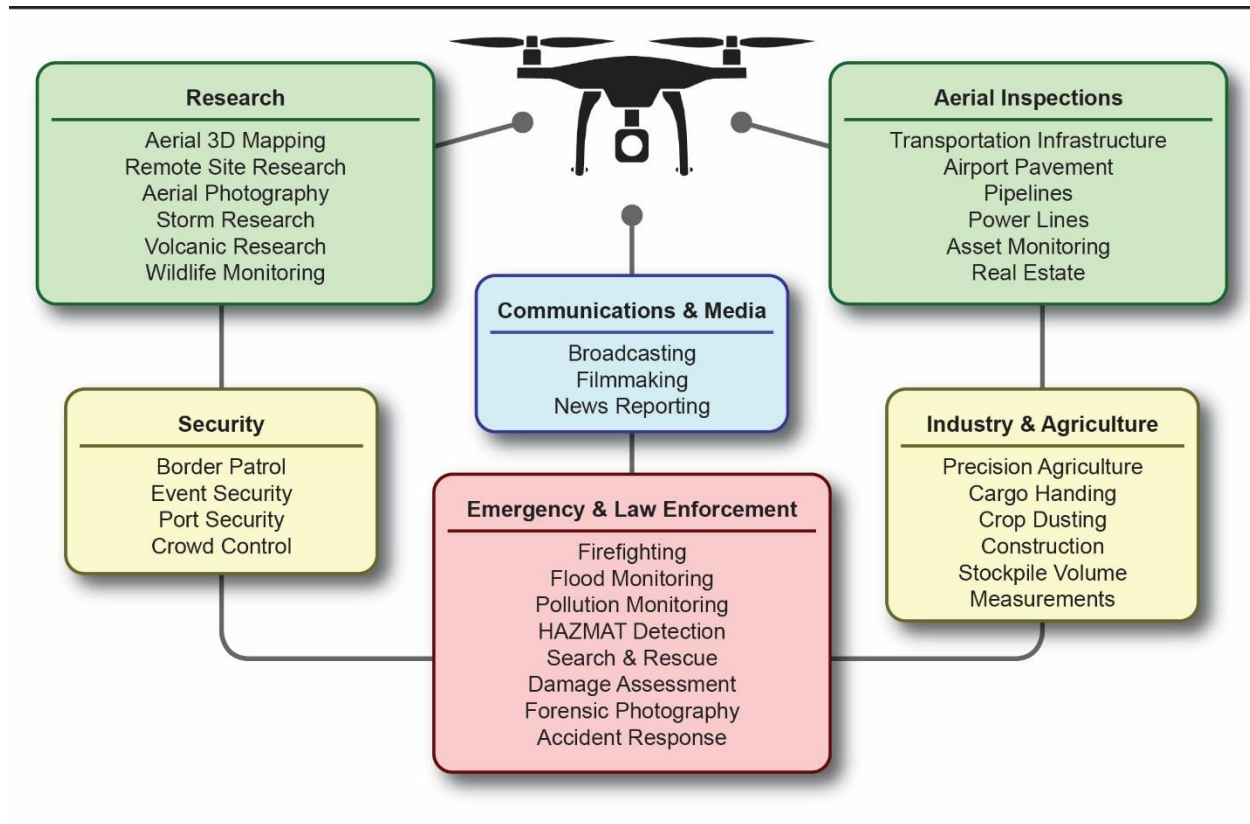


*MassDOT workers in the field with Delair UX11*

<sup>7</sup> 4K is a display with at least 8 million pixels, or approximately four times that of 1080p HD.



**Figure 6-1**  
**Common Uses for UAS**

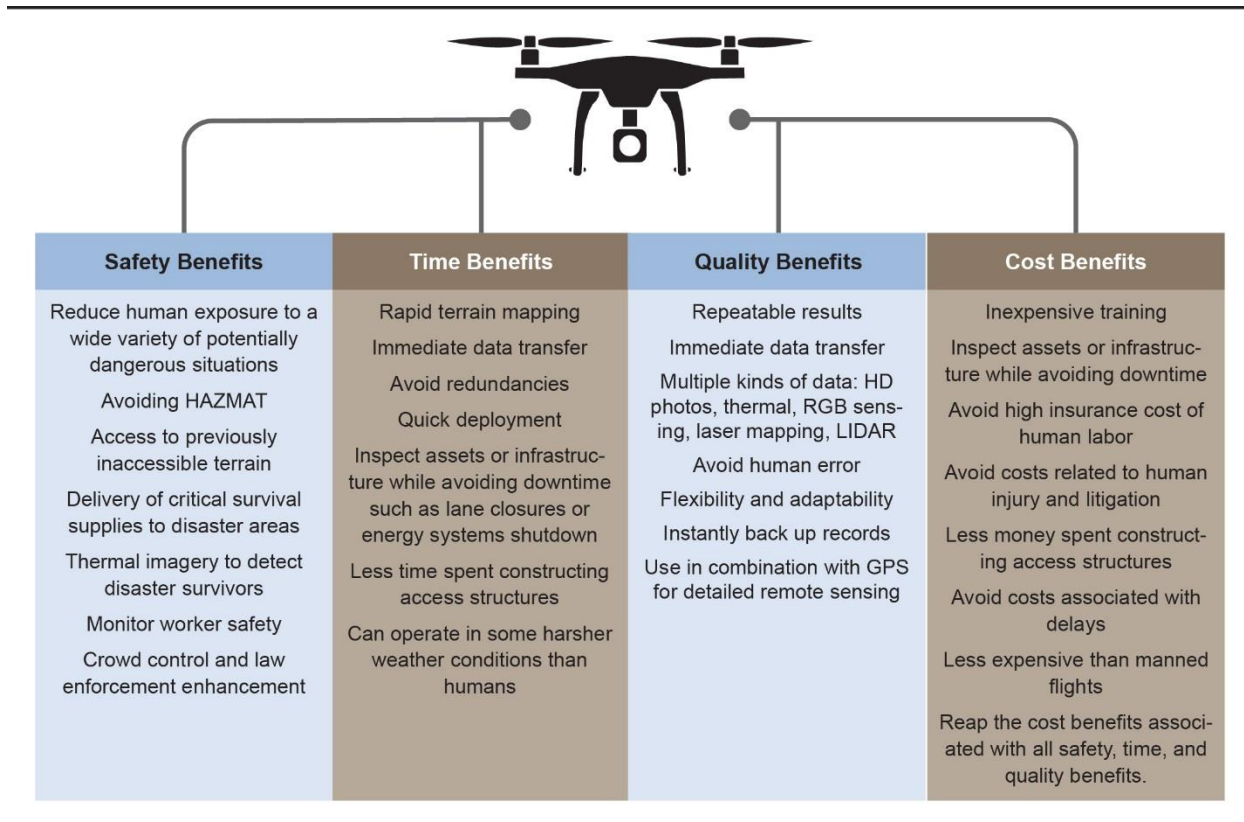


Source: Association for Unmanned Vehicle Systems International, CDM Smith, MassDOT.

One of the largest expected industry uses for UAS is precision agriculture, a modernization of farming that uses remote sensing, GPS technology, and drones to detect and preserve crop health while maximizing yields. Drones such as the relatively inexpensive DJI Phantom take high resolution imagery, which can be compiled and analyzed by farmers to detect where there are inefficiencies in growth or infestation. Other UAS are specially customized for aerial application of fertilizer and pesticide and capable of flying directly to the areas in need, an operation made possible by using UAS in concert with GPS technology.

An increased use of drones in precision agriculture will streamline many aspects of the industry, improving efficiencies in time, worker safety, product quality, and profitability. The benefits drones can provide to agriculture are mirrored in many of the industries mentioned above. **Figure 6-2** summarizes many of the safety, time, quality, and cost benefits drones can and will provide to agriculture, construction, transportation, security, research, and many other fields.

**Figure 6-2**  
**Benefits of UAS**



Source: Association for Unmanned Vehicle Systems International, CDM Smith, MassDOT.

The safety benefits of UAS center around how they limit human exposure to tasks with increased risks of danger. A drone allows for inspections in areas where it may either be hazardous for a human – such as around hazardous materials or at extreme heights – or where humans may have limited potential for access. The latter may include terrain such as cliffs or inside caves and tunnels. Drones can provide safety enhancements outside of operation, such as for survivors of disasters in need of critical supplies or in monitoring the public during large events. Drones are also being used in disaster recovery efforts not just to assess damage, but to search for survivors using thermal imaging.

The use of UAS cuts down on time not just because drones can perform many activities faster than a human, but because they can be deployed much faster than a human worker. A drone inspection of a cellular tower, for example, requires far less safety equipment and physical labor on the part of humans, while drones take away the need to build access structures for certain inspections. Drones also reduce downtime during inspections in cases where a road lane or energy infrastructure would need to be shut down during human inspections. UAS may be used to transfer remote sensing data to analysts immediately so that inspections or other work can be optimized in real time, as opposed to having to return to the field at a later date.

From a quality stand point, the most immediate and obvious benefit of drones is that they remove much of the possibility for human error in data collection. A UAS utilized for inspecting infrastructure is capable of not only accessing areas a human worker cannot but can capture much more data in a shorter amount of time, decreasing the possibility that crucial data is missed. This information can then be instantly backed up remotely, insuring against the loss of data. The adaptability of drones is another major benefit to users. Drones can be equipped with high definition cameras, LIDAR, RGB sensors, thermal imaging, aerial applicators, and laser mapping systems, among other tools. These

capabilities, combined with drones' ability to go places humans cannot and at much greater speed, allows for an unforeseen efficiency in activities such as construction site mapping and agriculture.

Most importantly, the benefits provided by drones are all linked. The ability to use a drone to inspect a bridge, as opposed to building a complex access structure needed for human inspection, not just enhances worker safety and reduces insurance costs, but greatly cuts down on the time necessary to perform the inspection, while also rapidly delivering high quality imagery. All of this provides cost and profitability benefits to the company or agency operating the UAS.

## Economic Impact of UAS

The rapid growth in UAS use has seen the industry expand exponentially throughout the world, with growth in the U.S. since the passing of Part 107 mirroring that in other countries where drone usage has become widespread. AUVSI conducted a thorough analysis and forecast of UAS' expected impact on the U.S. economy as UAS use integrates into the NAS and becomes more prevalent. The AUVSI study, *The Economic Impact of Unmanned Aircraft Systems Integration in the United States*, specifically related U.S. forecasts on the growth of the UAS industry in Japan, predicting that the UAS economy would grow rapidly immediately following integration into the NAS before decreasing to a lower, albeit steady and consistent rate of growth.



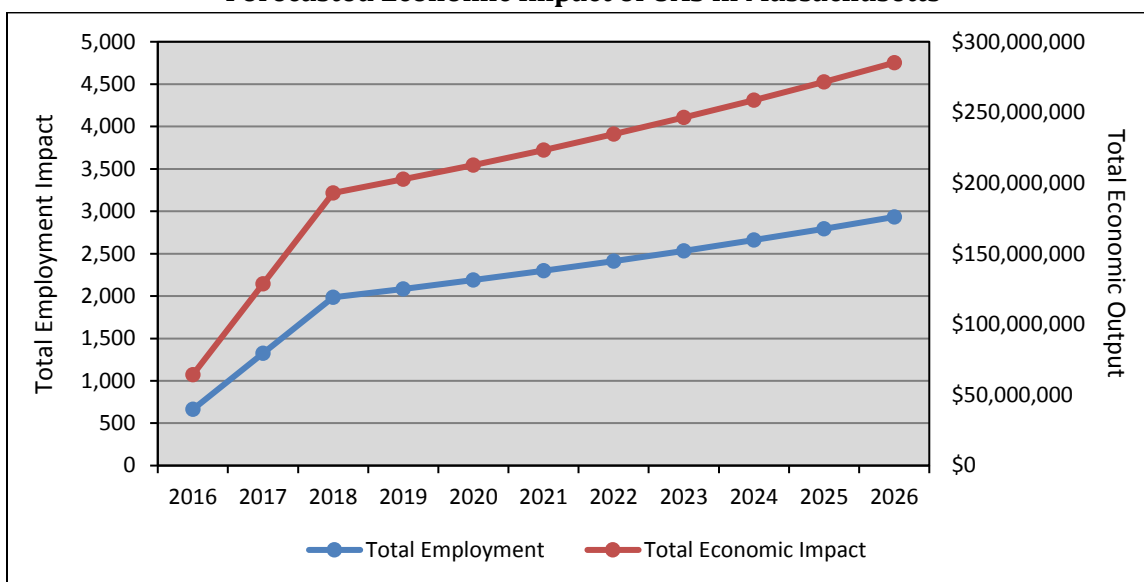
DJI Matrice 210

AUVSI estimated that by 2016, the global UAS industry was worth approximately \$11.3 billion but would increase to \$140 billion by 2026. Using Japan as a model, AUVSI estimated that airspace integration in the U.S. would have the most impact in the first three to six years, with the total economic impact in the first three years being over \$13.6 billion and the first 10-year impact to the U.S. being over \$82 billion.

In Massachusetts specifically, AUVSI forecasted that total employment related to UAS would increase from approximately 660 in 2016 to nearly 3,000 by 2026 (**Figure 6-3**). The same forecast projected total economic output – including direct and multiplier impacts – would grow from approximately \$63 million in 2016 to over \$285 million by 2026.<sup>8</sup> The expectation is that UAS integration into the NAS will result in rapid growth followed by more steady, conservative growth. In Massachusetts, this growth is expected to be 5 percent annually after the initial integration period.

<sup>8</sup> The original AUVSI report stated that the 10-year period would be from 2015 to 2025 based on expectations that Part 107 would go into effect in 2015. Because the legislation did not go into effect until 2016, the years were changed for this document.

**Figure 6-3**  
**Forecasted Economic Impact of UAS in Massachusetts**



Source: Association for Unmanned Vehicle Systems International

UAS integration is also expected to provide significant tax revenue to the Commonwealth. At the time of Part 107 implementation, it is estimated by AUVSI that the UAS industry contributed approximately \$560,000 in state taxes annually to Massachusetts. By 2026, AUVSI estimates that this state tax revenue will have increased to nearly \$2.5 million annually.

The manufacturing of drones will be a significant economic engine in the future, particularly during the boon years directly following NAS integration. AUVSI estimated that in the first 10 years following NAS integration, agricultural industries in the U.S. alone could demand between 150,000 to 165,000 UAS units per year. The same forecasts estimated that the agricultural demand will be at least 10 times the demand in public safety. To attempt to predict where manufacturing would occur, the study analyzed existing aerospace and defense jobs throughout the U.S. At the time of the study's publishing in 2013, Massachusetts accounted for 2.9 percent of all aerospace and defense industry employees in the nation, ranking 11th among all states.

## UAS Use in Massachusetts

Massachusetts is at the forefront of UAS use in industry and the government. The Massachusetts Department of Transportation (MassDOT)'s comprehensive Drone Pilot Program is a statewide effort to modernize operations through the use of drones for a wide variety of operations including inspections, maintenance, and emergency response. The Northeast UAS Airspace Integration Research Alliance is an interstate coalition that together with Plymouth-based company Avwatch, manages drone testing and research at Joint Base Cape Cod. Multiple Massachusetts higher education institutions, chief among them the University of Massachusetts and Northeastern University, conduct drone training and research programs. The following sections provide an overview of drone activity within the Commonwealth.

### *MassDOT Drone Pilot Program*

MassDOT has initiated a Drone Pilot Program to explore widespread use of UAS in the agency's operations. The program's statement of purpose is to "Facilitate the adoption of drones across MassDOT in a manner that is safe, cost effective, and secure; and incentivize applied research to solve



applied MassDOT drone challenges.” The program, which is being executed over several phases, includes the following objectives:

- Demonstrate drone capabilities to support MassDOT and Massachusetts Bay Transportation Authority (MBTA) missions and document best practices and lessons learned.
- Develop MassDOT and MBTA policies and processes for acquiring and using drone assets and for analyzing the data acquired from drones.
- Conduct cost-benefit analyses to include:
  - Compare drone methods versus traditional non-drone methods for each use-case.
  - Determine the optimum drone-use businesses model: employee versus vendor (or blend).
  - Identify new capabilities enabled by drones that support MassDOT/MBTA operations.
- Develop MassDOT Aeronautics’ knowledge base to support MassDOT and MBTA divisions in solving problems using drones.
- Develop a process to advise and assist other Commonwealth agencies with their drone programs.
- Using pilot programs to systematically implement and evaluate drone applications, MassDOT and the MBTA will develop safer, optimized solutions for those areas where drones may offer a cost-effective alternative.
- Communication and collaboration with other Commonwealth agencies will allow both agencies to take advantage of best practices and lessons learned.

MassDOT’s Drone Pilot Program is a multi-agency, cross-disciplinary effort that involves state and federal government agencies, laboratories, and higher learning institutions (**Table 6-2**). In total, 17 entities and partners are supporting the program’s efforts through research and coordination.

**Table 6-2  
MassDOT Drone Pilot Program Partners and Team Members**

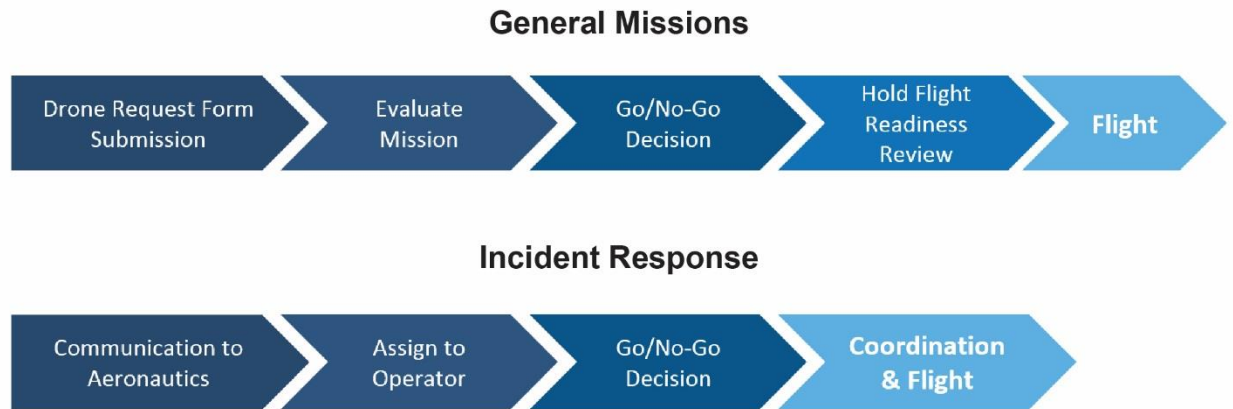
Group	Agencies
MassDOT & MBTA	MassDOT Highway Division MassDOT Rail & Transit Division MassDOT Aeronautics Division MassDOT Security & Emergency Management MassDOT IT Services Massachusetts GeoDOT Massachusetts Bay Transportation Authority
Massachusetts State Government	Massport Massachusetts State Police Massachusetts Water Resources Authority Massachusetts Emergency Management Agency
Federal Government	Federal Aviation Administration
Laboratories & Academia	MIT Libraries UMASS Amherst Massachusetts Green High Performance Computing Center (MGHPCC) Harvard Humanitarian Initiative The University of Vermont

Source: MassDOT

Together, these agencies and research institutions are developing a comprehensive drone program with consistent data analysis methods, standard operating procedures including defined requisition and go/no-go pre-mission decision-making (**Figure 6-4**), specific processes for staffing UAS flight

missions, and standards for training and qualification. Policies include several checklists including a certification requirements checklist, mission planning checklist, pre- and post-flight checklists, and an emergency checklist. The program also holds the safety and privacy of workers and the public and the security of data as paramount to the success of the program.

**Figure 6-4**  
**MassDOT Procedures for Requesting and Receiving Drone Resources**



Source: MassDOT

MassDOT currently uses a combination of rotary-wing and fixed-wing drones in their UAS operations. MassDOT has eight rotary-wing drones: four DJI Phantom 4s, two DJI Inspire 2s, one DJI Matrice 210, and one Yuneec H520. MassDOT also has two fixed-wing drones: one SenseFly eBee and one Delair UX11.

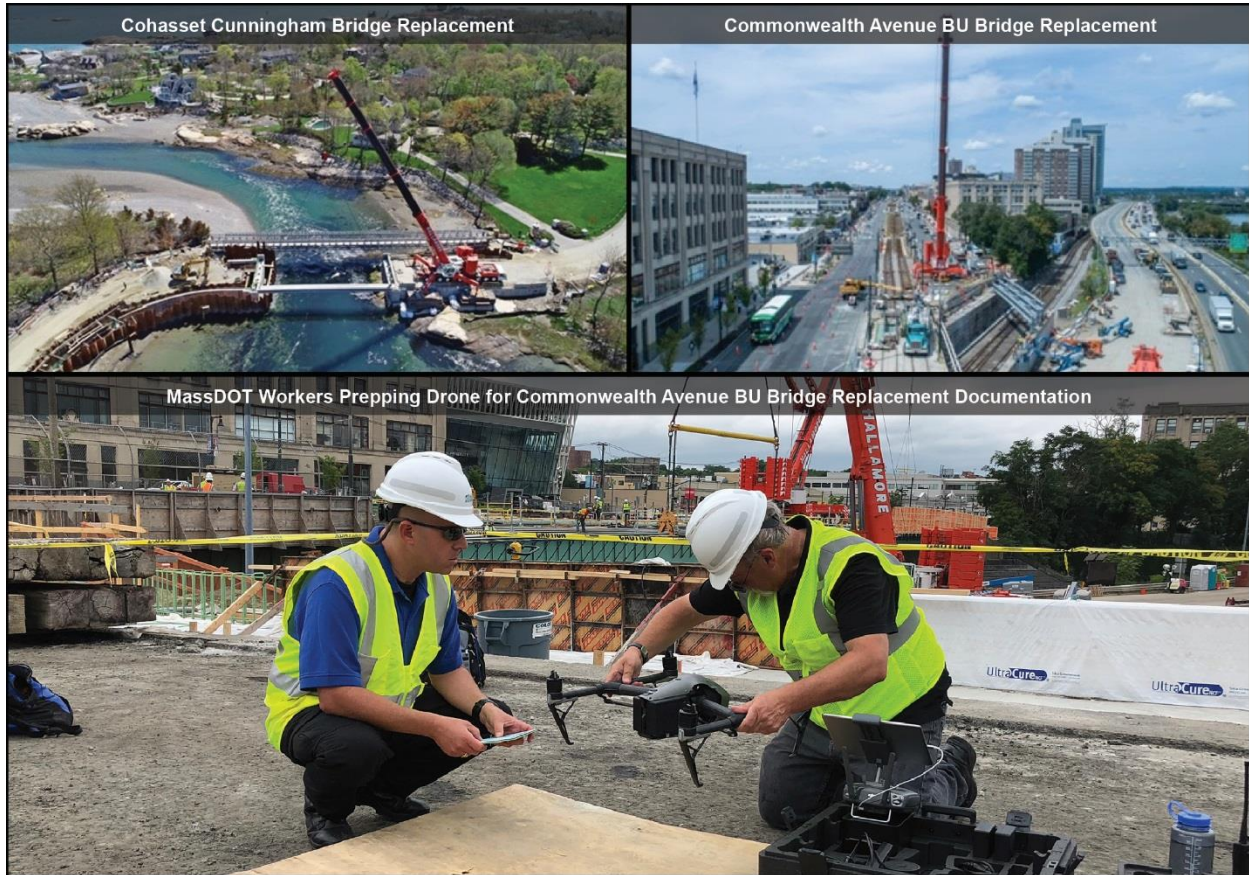
The Drone Pilot Program aims to implement UAS use in all MassDOT divisions for operations such as inspections, asset management, and incident response. The Highway Division has already used UAS for bridge replacements and asset monitoring. **Figure 6-5** shows two examples of MassDOT documenting bridge construction techniques using drone photography: the Cohasset Cunningham Bridge construction and the Commonwealth Avenue BU Bridge replacement.



*Disassembled SenseFly eBee*



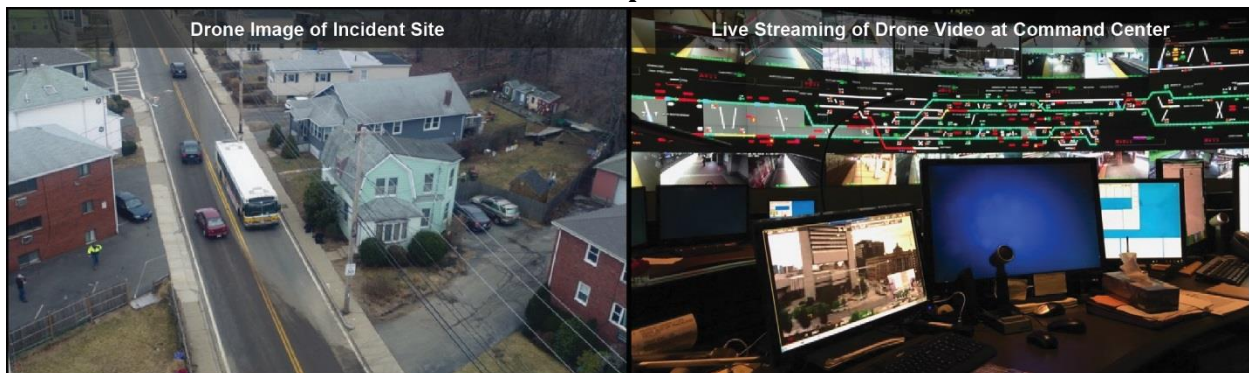
**Figure 6-5**  
**Examples of MassDOT Construction Documentation by Drones**



Source: MassDOT

One example of MassDOT utilizing drones for incident response happened in Quincy, Massachusetts when an MBTA bus became stranded due to flooding. MBTA requested drone support to assess and manage the situation (**Figure 6-6**). The response team was able to quickly gather video of the incident and live stream it to the command center, where management formulated an appropriate response. This type of real-time incident response reveals the value of UAS to be applied to a variety of situations, both planned and emergency, an aspect of the technology that MassDOT highly values.

**Figure 6-6**  
**Drone Use for Incident Response: Stranded MBTA Bus**



Source: MassDOT

MassDOT Aeronautics Division laid out specific ways in which UAS can be beneficial to regular operations such as inspections and surveying (**Table 6-3**). Chief among the benefits cited by MassDOT is the time saved by utilizing drones as opposed to manual labor. MassDOT claims that a runway inspection using UAS may only take tens of minutes as opposed to several hours. This greatly reduces the closure time of the runway and may also significantly lower the monetary cost of the inspection. MassDOT also touted the ability to use thermal imaging drones to operate wildlife surveys in airport environs.

**Table 6-3**  
**Benefits of UAS Touted by MassDOT Aeronautics Division**

Mission	Benefits of Drone Use
Runway inspection	Greatly reduce time of runway closures to tens of minutes as opposed to hours
Obstruction survey	Significant improvement to safety and cost
Fencing inspection	Greatly reduce time needed to inspect full perimeter fencing
Building inspections	Greatly reduce time needed while removing the risks of manual inspections
Wildlife survey	Thermal imaging to detect wildlife near airfield
Accident investigation	Provides additional data, photographs, and perspectives for FAA investigation

Source: MassDOT

Part of the program involves MassDOT and its partners developing an extensive list of lessons learned. This includes lessons learned on isolated projects and incidents, and the types of lessons that can be applied to all types of UAS missions. In highway UAS missions, lessons learned included best times of day for suitable lighting and traffic conditions, ideal altitude for pixel density, flight frequency depending on the type of information being gathered, and the best takeoff and landing locations. With the construction and inspection of structures such as bridges or agency buildings, lessons learned included appropriate standoff distance, shot angles necessary to capture the needed information, and how best to utilize 3D modeling. For incident responses, lessons learned included how to immediately and most efficiently share on-site data with the command center and how to deal with weather factors such as wind and rain. The Drone Pilot Program's system of lessons learned will lead to an ever-evolving system of best management practices.

### **Commonwealth UAS Integration Program**

The MassDOT Drone Pilot Program is not the only official UAS program of the Massachusetts state government. MassDOT Aeronautics is also the Commonwealth's lead on the Commonwealth UAS Integration Program (CUIP). CUIP is a cross-organizational and multi-disciplinary coalition of government agencies, aviation and autonomous technology industry companies, academic institutions, community development organizations, and funders focused on making Massachusetts a center of leadership and innovation in the future of UAS. CUIP's statement of purpose is as follows:

*"To create a world-class ecosystem across government, industry, and academia in which innovative unmanned and autonomous technologies are incubated and brought to operational use, in order to facilitate practical integration of UAS into the Massachusetts economy."*

A diverse and wide group of stakeholders is a specific part of CUIP's strategy, as is aligning efforts with the Commonwealth's transportation goals. The latter is aided by many of the same organizations that take part in the Drone Pilot Program also being part of CUIP. CUIP, however, includes an even wider collection of organizations than the Drone Pilot Program (**Table 6-4**), with industry companies and federal government agencies making up a large number of its participants.



**Table 6-4**  
**MassDOT Drone Pilot Program Partners and Team Members**

Group	Agencies
Commonwealth of Massachusetts	MassDOT Massport Massachusetts Bay Transportation Authority Massachusetts Emergency Management Agency Massachusetts National Guard Executive Office of Public Safety and Security
Federal Government	Federal Aviation Administration United States Department of Transportation United States Air National Guard NASA MITRE
Laboratories & Academia	MIT MIT Lincoln Laboratory UMASS Amherst Harvard Humanitarian Initiative Woods Hole Oceanographic Institution Massachusetts Green High Performance Computing Center (MGHPCC)
Industry	AirXOS Draper CyPhy Hangar Harris American Robotics Raytheon Aurora
Innovation Economy	AUVSI Mass Robotics Mass Technology Leadership Council

Source: MassDOT

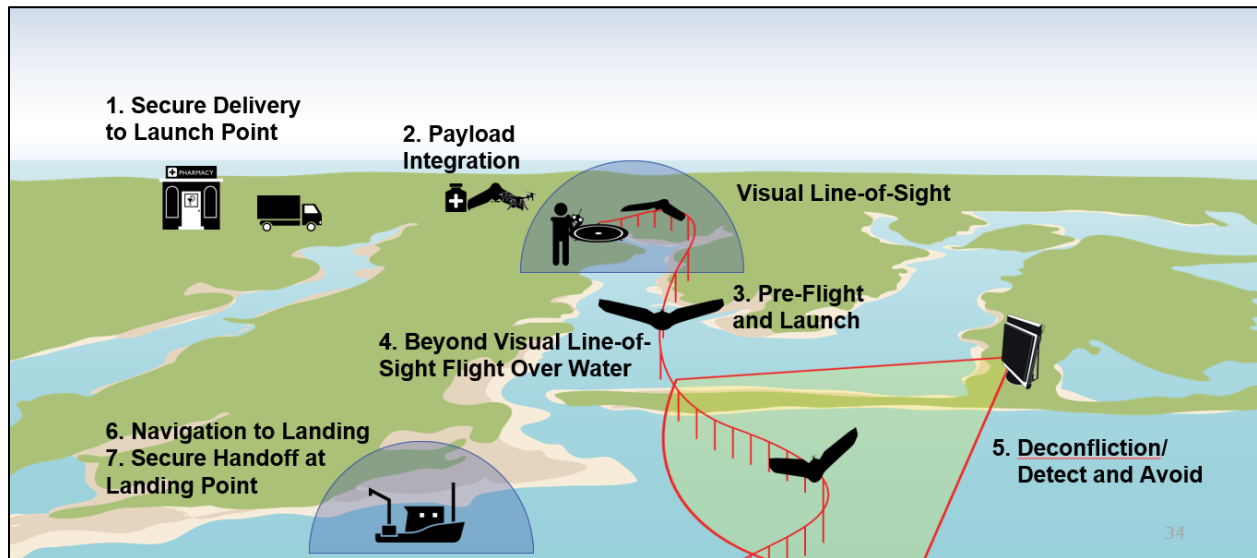
CUIP's participants are tasked with identifying and carrying out UAS-related missions that can provide advancements in government services, aid cross-industry commerce and economic development, advance autonomous technology itself, and help in the integration of UAS into the NAS. CUIP also focuses on C-UAS systems as well as broadening UAS education in STEM programs and workforce development.

Another element of CUIP's strategic approach is to build facilities or develop traffic corridors in which to test, demonstrate, and deploy autonomous technology in all transportation modes including UAS. Defense contractor and manufacturer Raytheon is currently working with UMass Amherst on a CUIP project testing multi-modal autonomous vehicles along a corridor in Massachusetts and New York. Raytheon's planned radar traffic corridor will help to test for safe beyond-visual-line-of-site (BVLOS) drone operators and the development and testing of C-UAS technologies.

In the Cape and Islands Region, CUIP is overseeing the Cape and Islands Coastal Connection, Clean Energy, and Marine Research Test Area. The initial goal of the program is to test delivering prescription medications or other small parcels (one kilogram or less) from a takeoff point near Falmouth on Cape Cod to Aquinnah, a community on the western edge of Martha's Vineyard. This approximately 18-mile journey, which is illustrated in **Figure 6-7**, would require BVLOS operation

of the drone. While the initial focus on the test program is on emergency delivery of medications, the results of the research could be applied to a wide variety of unmanned deliveries in remote locations.

**Figure 6-7**  
**Diagram of CUIP Package Delivery Tests to Martha's Vineyard**



Source: MassDOT

## Drone Research and Training in Massachusetts

In addition to, and often in cooperation with MassDOT's comprehensive Drone Pilot Program and CUIP, the Commonwealth is at the forefront of UAS training and research thanks to the work of several private companies, higher education institutions, and coalitions. The following sections provide an overview of these efforts and activities.

### Northeast UAS Airspace Integration Research Alliance

The Northeast UAS Airspace Integration Research Alliance (NUAIR) is an interstate, not-for-profit coalition of over 200 private and public entities, and academic and research institutions. The NUAIR coalition works together to test UAS in New York, Massachusetts, and Michigan. NUAIR is headquartered in Syracuse, NY, and the New York UAS Test Site at Griffiss International Airport in Rome, New York was one of the original six FAA-approved UAS test sites. NUAIR has logged over 700 UAS test flights using drones of all sizes.<sup>9</sup>



Drone research at JBCC

Massachusetts partners of NUAIR include MassDOT, Boston University, the Massachusetts Institute of Technology, the University of Massachusetts, the Massachusetts Development Finance Agency (MassDevelopment), Bridgewater State University, Cape Cod Community College, and Worcester Polytechnic Institute, among other corporate and research partners.

In Massachusetts, NUAIR conducts research at the Massachusetts Unmanned Aircraft Systems Test Center (MA UASTC) at Joint Base Cape Cod (JBCC) as part of CUIP. Within JBCC, MA UASTC utilizes sites at Otis Air National Guard Base (ANGB) and Camp Edwards Training Site. UAS testing at JBCC is

<sup>9</sup> NUAIR, 2018.

conducted in Class D controlled airspace,<sup>10</sup> with some testing conducted in restricted airspace (R-4101).<sup>11</sup> NUAIR and CUIP research at JBCC includes C-UAS testing.

### *Avwatch*

Plymouth Municipal Airport-based company Avwatch was chosen by MassDevelopment to operate and manage UAS test ranges at JBCC in cooperation with NUAIR. Avwatch supports and trains government agencies in support of homeland security and disaster recovery. The company provides mobile ad hoc network (MANET) services



customizable for operations such as combat readiness and emergency response, while also offering a wide range of UAS-related training both at their classroom at Plymouth Municipal Airport and in the field. Classes include specific training courses on oil spill responses, wildfire response, and various data services. At JBCC, Avwatch's ongoing responsibilities include research and testing for UAS integration into the NAS, while also managing and supervising the UAS research efforts of other commercial companies.

### *UMassAir*

UMassAir is the University of Massachusetts' team of faculty, students, and professionals focused on research and education related to UAS. UMassAir has locations at UMass campuses in Amherst, Dartmouth, and Lowell, as well as research stations such as the UMass Transportation Center – Aviation Center at Westover Air Force Base, among others. UMassAir has three main research focuses:

- UAS operational safety, security, and reliability
- National resources, agriculture, and infrastructure management
- Public policy and social impacts

UMassAir has conducted a wide range of UAS-related research projects. Environmental-related projects include using UAS to validate satellite imagery of surface water quality and using drones' multi-spectral and thermal sensors to assess vegetation health in salt marshes and soil moisture in wetlands. Similar to how UAS can be utilized for precision agriculture, UMassAir researchers are investigating how well UAS imagery can be used for assessing the health and growth of cranberry bogs. UMassAir researchers are also investigating potential cybersecurity threats to UAS data and programs and developing countermeasures to such threats.

A large team of UMassAir researchers has received a grant from MassDOT to investigate the utility of drones for investigating transportation needs in Massachusetts. Project tasks include assessing roadway pavement condition, evaluating speed on roadways, investigating the development of an emergency service drone network, assessing situational awareness technology to support surface transportation, and evaluating cybersecurity threats and countermeasures to surface transportation. Another UMassAir research project is using drone imagery to analyze traffic behavior in roundabouts and general traffic speeds.

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<sup>10</sup> Class D Airspace is airspace established around an airport with a control tower that does not have the volume of instrument flight rules (IFR) operations to necessitate Class B or C Airspace. This often applies to towered airports that do not have scheduled commercial service operations. Pilots flying into Class D airspace must have Air Traffic Control (ATC) permission, maintain at least three miles visibility, remain at least 500 feet below clouds, and stay 2,000 feet away from horizontal clouds. UAS pilots, however, cannot fly above 400 feet AGL (or more than 400 feet above an obstacle) without a waiver or COA.

<sup>11</sup> MassDevelopment, 2018.

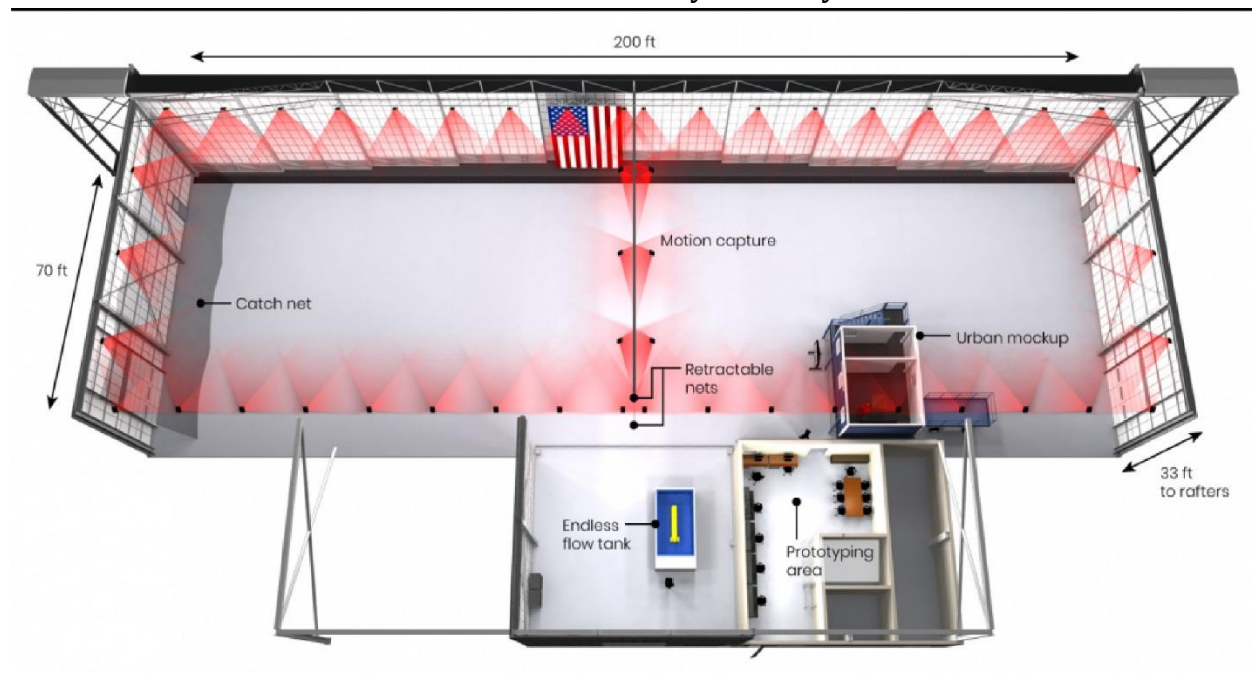
UMassAir also offers several UAS-related courses both on-campus and at remote research sites. These classes include detailed drone education and related fields such as geographic information systems (GIS) and remote sensing. UMassAir's overarching educational goals include teaching students the following:

- The safe and appropriate use of UAS operation
- The public policy issues surrounding UAS operation
- Data analysis of various UAS-produced data products including true color (RGB), multi-spectral, and thermal sensing of the environment
- Emergency developments in UAS in fields such as engineering, environmental management, and public policy, often through UMassAir-affiliated research

### **MIT Lincoln Laboratory**

The MIT Lincoln Laboratory is an advanced research and development (R&D) center located at Hanscom Air Force Base and a participant in CUIP. MIT's Autonomous Systems Development Facility (ASDF) is the Lincoln Laboratory's center for R&D related to autonomous systems including UAS in addition to ground- and water-based autonomous vehicles. The ASDF, shown in **Figure 6-8**, is a 17,000-square foot facility is used for the testing of prototype autonomous systems, and is equipped with perimeter motion-capture devices that provide highly accurate information on tests. Research at the ASDF includes, but is not limited to, developing advanced algorithms for the operation and interaction of a group of drones, the development of drone propellers with low acoustic signatures, and C-UAS activities in urban environments.

**Figure 6-8**  
**MIT Lincoln Laboratory ASDF Layout**



Source: MIT Lincoln Laboratory

### **Northeastern University**

In May 2018, Northeastern University became the latest higher education institution in Massachusetts to become involved in drone research. Northeastern has constructed a 150-foot by 200-foot, five-story-tall netted drone cage at the George J. Kostas Research Institute for Homeland



Security in Burlington, Massachusetts. Because the cage is netted, it is analogous to an indoor testing facility according to FAA regulations.

Still under construction is the facility's fully indoor space, which will include an anechoic chamber—a room that can completely absorb electromagnetic waves. This special chamber will assist in Northeastern's main research mission at the site: testing drones against wireless interference such as jamming and spoofing. The custom anechoic test room will allow researchers to simulate hostile interference so that countermeasures can be developed. Other Northeastern labs are also eager to conduct drone research on such topics as building and structure inspection and emergency response.

## Summary

The use of UAS for both recreation and commercial benefit has increased dramatically in recent years thanks to factors such as affordability and the FAA's recent enactment of Part 107. Drones come in both fixed-wing and rotary-wing models, with fixed-wing drones ideal for surveying large areas of land and rotary-wing drones best for scenarios that require maneuverability. Drones are often equipped with imagers such as HD cameras, RGB sensors, and thermal imagers, among others.

Part 107 authorized and regulates commercial drone use, and fields such as precision agriculture, public safety, transportation, border security, and scientific research are already making great use of the potential of UAS to improve worker safety, improve efficiency, and save money. Some of the greatest benefits of drones include: the reduction of human exposure to hazardous situations, the ease of deployment in emergency situations, the reduction in facility downtime such as bridge closures, the ability to offer highly repeatable data, and their customization to a wide variety of needs. Nearly all safety, time, and quality benefits of drones relate to cost and profitability benefits.

The UAS industry is large but forecasted to grow exponentially in the coming years. The global UAS industry in 2016 was approximately \$11.3 billion and is expected to increase to over \$140 billion by as early as 2026. In Massachusetts alone, employment related to UAS is expected to grow from 660 in 2016 to nearly 3,000 by 2026, while the Commonwealth's total economic output related to drones will grow from \$63 million to \$285 million.

Massachusetts is at the forefront of UAS innovation due to the efforts of its government agencies, higher education institutions, and private companies. MassDOT has initiated its Drone Pilot Program, a large-scale program designed to test and constantly improve the use of drones for MassDOT operations such as bridge and tunnel inspections, airport pavement inspections, traffic studies, and emergency response. The program includes best management practices and lessons learned so that policies are constantly improving with the intent that MassDOT's knowledge can be shared with other state agencies. MassDOT and several other Commonwealth government agencies are also members of the Commonwealth UAS Integration Program (CUIP), a comprehensive combination of government groups, industry leaders, and higher education institutions focused on making Massachusetts a leader and innovator in UAS and other autonomous technologies.



*MassDOT drone testing anti-drone technology at Boston's Fenway Park*

Several Massachusetts agencies and higher learning institutions are part of NUAIR, an interstate coalition focused on researching UAS integration into the NAS. Avwatch, under the umbrella of NUAIR, oversees UAS research projects at JBCC. The University of Massachusetts UMassAir program and Northeastern University's research center at the at the George J. Kostas Research Institute for Homeland Security are examples of Massachusetts higher education centers leading the charge in UAS research and education.

Such efforts of companies, lawmakers, and educators mean that the Commonwealth will continue to be a center of innovation and expertise in the field of UAS.



## Introduction

Airports have long provided a fertile environment for business development, and businesses situated on airports have provided a consistent revenue stream to support airport operations and the surrounding community. This synergy can be nurtured by local governments to the advantage of the community, the airport, and aviation-dependent businesses located both on-airport and off-airport.

Commercial service and general aviation airports are themselves centers of employment and generators of significant economic activity. Airports purchase goods and services, undertake capital improvement projects, and support visitors arriving on commercial airlines and privately-owned aircraft who spend money in the area, all activities that broaden the impact they have on both statewide and local economies. While commercial service airports are most often the focus of major multimodal considerations, general aviation airports offer businesses the opportunity to either connect to commercial service hubs and the scheduled airline services they provide or fly directly to any one of approximately 5,000 general aviation airports across the country.

Airports have attracted many businesses that are engaged in the development, production, and manufacturing of aircraft, aviation support systems, aircraft components, and other aviation-related products. Other businesses repair or perform different types of maintenance on commercial or general aviation aircraft. In some instances, these aviation-related businesses are located on-airport, and in other instances they are located off-airport. Aviation-related businesses throughout the Commonwealth of Massachusetts account for notable employment, payroll, and annual economic activity. Highlighted below are several noteworthy examples of the benefits of a close relationship between airports and their surrounding communities.



“Airports have evolved as drivers of business location and urban development in the 21<sup>st</sup> Century in the same way as highways did in the 20<sup>th</sup> Century, railroads in the 19<sup>th</sup> Century, and seaports in the 18<sup>th</sup> Century.”

- John Kasarda, *Gateway Airports: Commercial Magnets and Critical Business Infrastructure*



*Aircraft maintenance at Westfield-Barnes Regional Airport*

## Westfield-Barnes Regional Airport

The Westfield-Barnes Regional Airport is a public-use airport located three miles north of the central business district of the City of Westfield in Hampden County, Massachusetts. The airport is owned by the City of Westfield. It covers 1,200 acres, has two runways, averages 113 flights per day, and has approximately 129 aircraft based on its field. The regional airport in Westfield is increasingly playing a larger and more important role in the Commonwealth's local transportation infrastructure. It also is helping to create good jobs and economic development in western Massachusetts.



*Apron and hangar at Westfield-Barnes Regional Airport*

Westfield-Barnes Regional Airport is the home of the Massachusetts Air National Guard's 104<sup>th</sup> Fighter Wing. The 104<sup>th</sup> sits 24/7 Aerospace Control Alert with armed F-15 fighters ready to scramble at a moment's notice to protect the Northeast from any airborne threat. The 104<sup>th</sup> protects one-quarter of the nation's population and over one-third of the gross domestic product (GDP).

Westfield-Barnes Regional Airport is also a base for civilian aviation, corporate and charter flights and a Gulfstream service center, which has 232 employees who can perform maintenance on up to 22 aircraft at a time in the hangars.

### ***Gulfstream Aerospace***

Gulfstream Aerospace has been a long-time tenant at the Westfield-Barnes Regional Airport, and in 2012 the firm expanded their Northeast Aircraft Maintenance Repair Facility at the airport. Massachusetts was competing with other states and communities for this project. This was a classic example of a private-public partnership that provided economic development far beyond state and local officials anticipated. The Commonwealth invested \$5 million for airside and landside transportation infrastructure improvements that leveraged \$23 million of private funding (Gulfstream) for a 100,000-square-foot hangar facility. Additionally, Massachusetts' sales-tax exemption on aircraft parts and maintenance gives the Westfield location a distinct competitive advantage. Over 100 new jobs have been added to the location in Westfield, bringing the total to over 230 employees. These jobs pay between \$60,000 and 70,000 per year, on average.

In keeping with their strategic outlook, Gulfstream has recognized the need for new aviation technicians, and in response they have made a long-term commitment to assist the aviation technology program at the Westfield Technical Academy.

### ***Westfield Technical Academy***

The Westfield Technical Academy is a selective secondary vocational four-year public high school enrolling over 500 students in grades 9 to 12 across 12 career majors. Their program in Aviation Technology has been extremely successful in preparing students for rewarding careers in aviation, military service, and higher education.



With the growth of Gulfstream at Westfield-Barnes Regional Airport, the demand for qualified employees became a significant workforce development challenge. Recognizing the opportunities to partner with Westfield Technical Academy, the City of Westfield, Westfield-Barnes Regional Airport, and industry stakeholders such as Gulfstream, Embraer, Bombardier, and Rectrix worked together to establish an FAA approved Part 147 high school program. It took several years to accomplish, but the program is established, and the first class is graduating this Spring. Graduating seniors with their FAA licenses have starting salaries in the \$60,000 range.

## Southbridge Municipal Airport

The Southbridge Municipal Airport is a public-use airport located two miles north of the central business district of the Town of Southbridge, in Worcester County, Massachusetts. The airport is owned by the Town of Southbridge. It covers 229 acres, has one active runway, averages 86 flights per day, and has approximately 18 aircraft based on its field. A major tenant on the airport is the family owned business Hyde Tools.



*Runway 20 at Southbridge Municipal Airport*

### Hyde Tools

Established in Southbridge, Massachusetts as the Hyde Manufacturing Company well over a century ago, Hyde Tools has grown from its early start as a cutlery manufacturer into the leading provider of hand tools for jobs of many kinds. Today, HYDE® brand tools are used by painters, drywall professionals, and remodelers throughout the world. Rick Clemence, an Airport Commissioner and CEO of Hyde Tools, Inc., has a long history with the airport and is committed to the Southbridge community. Plans for the company's future are focused on continued growth in their Southbridge facility, and the development of an extensive and innovative product line.

The family bases a Robinson R-44 helicopter at the airport and regularly uses it for business purposes. The Clemence family has supported the airport over many years by purchasing airfield maintenance equipment such as a front-end loader and has loaned a bulldozer for airport staff to use throughout the year to level areas on the airport. In addition, the family has volunteered their time to assist airport staff with regular cleanup and airfield maintenance activities at the airport.

## Beverly Regional Airport

The Beverly Regional Airport is a public-use airport located three miles north of the central business district of the City of Beverly, in Essex County, Massachusetts approximately 20 miles from the City of Boston. The airport is owned by the City of Beverly. It covers 470 acres, has one active runway, averages 140 flights per day, and has approximately 106 aircraft based on its field. The airport offers many conveniences of being relatively close to the amenities of Boston while maintaining the availability of a wide range of services and space to grow. Corporate users of the Beverly Regional Airport range from very small companies to Fortune 500 companies.

The airport attracts industry that in turn provides the community with jobs. The Cherry Hill Industrial Park located adjacent to the airport offers tenants easy access to air transportation. Those businesses (and employees) also pay taxes and inject payroll and business dollars into the community.

The management of the airport is committed to providing the enhanced corporate access needed by the businesses operating in and around the City of Beverly while being a good neighbor to all airport stakeholders. Based tenants including North Atlantic Aviation, Sabrina Fisheries, and American Renal Aviation are strong supporters of the continuous improvements of the facility and constant focus on the safety of operations.

North Atlantic Aviation has short term plans to build new hangars at the airport to house large cabin business aircraft, which could catapult the airport into a National Airport General Aviation role category as defined by the FAA ASSET Study.<sup>1</sup> The growth of Cherry Hill Industrial Park and other regional business developments highlight the importance of the Beverly Regional Airport as a key transportation gateway in the region. The positive energy and spirit of cooperation at the airport between tenants, users, and the community is impressive.

## Minute Man Air Field



*Cafe at Minute Man Air Field*

Minute Man Air Field is a privately-owned, public-use airport strategically located off Route 495 in central Massachusetts. Since 2011, the Massachusetts Department of Transportation (MassDOT) Aeronautics Division has invested over \$4 million of targeted MassDOT Airport Safety and Maintenance Program funding for the Runway 03/21 and taxiway/apron projects. The airport has seen an increase in airport activity and based tenants. The investment by MassDOT has stimulated private investment at the airport with new t-hangars and tenants. These tenants are both aviation and non-aviation related.

Minute Man Air Field is an active part of the local community and provides important community services. The missions of Federal Emergency Management Agency (FEMA), Angel Flight, Civil Air Patrol, Medivac, Mosquito Control, law enforcement, aviation technology training and other important community initiatives are all supported at the airport. The airport works closely with local farmers and grows organic products on airport property. The airport hosts various fundraisers including Run the Runway, which generates funds for two local open space preservation groups. They host events throughout the year to introduce youth to aviation through the Experimental Aircraft Association's Young Eagles Program.

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<sup>1</sup> *General Aviation Airports: A National Asset* classified the nearly 3,000 general aviation airports, heliports, and seaplane bases identified in the FAA's National Plan of Integrated Airport Systems into one of four categories – national, regional, local, and basic – based on activity levels.

The management team of Minute Man Air Field has held a strong commitment to their pledge of “Economy, Community, Environment.” That commitment extends past their obligations to provide superior aviation services to the public to their belief that they serve as a “portal” to the world, allowing airport users to conduct business throughout many geographies and enabling a gateway into their community for tourism, recreation, and emergency/rescue operations. Management is equally proud of their support of the community’s focus on educational needs, community gathering spaces, and providing a natural habitat for hundreds of species of birds, reptiles, mammals, and insects.

Minute Man Air Field is home to more than 75 based aircraft stored in aircraft hangars and on tie-downs along the airfield’s taxiways and aprons. The airport features a 2,800-foot paved and lighted instrument runway as well as a 1,600-foot visual runway. In addition, the airport is home to several local businesses and helps support economic growth and development in the region.

“We are proud to support Minute Man Air Field and continue strengthening our transportation systems in ways that promote growth and development. Through aviation infrastructure investments we can ensure the Commonwealth supports air travel and upholds its commitment to a world-class transportation system that empowers its citizens.”

- Massachusetts Governor Charlie Baker, announcing an award to the airport of \$850,000 from MassDOT.

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### **National Aviation Academy**

National Aviation Academy (NAA) has been training aviation maintenance professionals since 1932. NAA’s Aviation Maintenance and Advanced Aircraft Systems courses are designed to provide the experience and education required to become a federally-licensed airframe and powerplant (A&P) technician and embark on an in-demand career with great earning potential. Individuals from across the globe attend the campus located in Concord, Massachusetts, which includes a new facility providing hands-on training that opened at Minute Man Air Field in 2016. NAA offers a comprehensive curriculum composed of coursework and hands-on training. Using industry standards and a forward-thinking sensibility, NAA delivers candidates who are educated, skilled and well versed in aviation culture. Industry leaders seek out NAA graduates for their reputation, knowledge, professionalism and success.

### **Marshfield Municipal Airport-George Harlow Field**

Marshfield Municipal Airport-George Harlow Field is located two miles east of the central business district of Marshfield in Plymouth County, Massachusetts. The airport is owned by the Town of Marshfield and is under contract with Shoreline Aviation to manage the airport. Shoreline Aviation is the lone fixed-base operator (FBO), providing traditional FBO services including fuel, flight instruction, aircraft maintenance and charter. In 2015, a major airport infrastructure project was completed that enhanced the safety of the airport, improved the environment surrounding the airport, and stimulated additional economic development. Runway 6-24 and an associated parallel taxiway were reconstructed to meet FAA design criteria. The waterways surrounding the airport were dredged as a wetland mitigation measure, which has reduced the flooding of nearby communities.

Since the completion of the project, the airport has added three new based business jets, bringing the total to five. Shoreline Aviation charters these aircraft out of the airport for both domestic and international flights. The size of the staff at the airport has nearly doubled since the completion of the runway project.

In addition, the team at Marshfield Municipal Airport is proactive in working with the local, state, and federal public safety agencies. Examples include assisting the Marshfield Police Department with providing aircraft and pilots to fly officers searching for lost children or other emergency responses, routine coordination with the Marshfield Harbormaster Boat for aircraft water rescues, providing fuel and training platforms for the Massachusetts State Police Air Wing, and providing fuel and training platforms for the U.S. Coast Guard and Massachusetts Army National Guard.

Once a year, the airport hosts the Marshfield Regional Safety Day which showcases the work of all public safety agencies and first responders. Residents can interact firsthand with the officials and equipment used in emergency response. Management is proactive in participating in training for emergency response with tabletop and full-scale response exercises at the airport.

## Summary

In economic terms, airports and businesses often have a symbiotic relationship. This synergy is particularly true for businesses located on airport property but can include a wide variety of regional companies that both utilize and show interest in the improvement of their local airports. Airports attract businesses involved in the advancement of aviation in addition to non-aviation companies that rely on airports for everyday operations. In turn, these businesses invest in airport facilities and improvements, continuing the mutually beneficial relationship.

This chapter summarized several examples of this airport-business synergy in Massachusetts, including the following:

- **Westfield-Barnes Regional Airport:** Gulfstream Aerospace has a longstanding tenancy at the airport and specifically benefits from Massachusetts' sales tax exemption on aircraft parts and maintenance. Gulfstream has benefited over the years from improvements at the airport, and in turn has invested heavily in hangar facilities. Westfield is also home to the Westfield Technical Academy, who opened an FAA Part 147 high school program to help create a funnel of employment for area companies such as Gulfstream.
- **Southbridge Municipal Airport:** Hyde Tools has been an established manufacturer in Southbridge for more than a century and relies greatly on its airport. The company bases a Robinson R-44 helicopter at the airport and has supported the airport by purchasing airfield equipment, loaning a bulldozer, and volunteering time for cleanup and maintenance.
- **Beverly Regional Airport:** The airport is adjacent to the Cherry Hill Industrial Park, providing businesses with easy aviation access, while on-airport businesses such as North Atlantic Aviation invest in facility improvements at the airport.
- **Minute Man Air Field:** Minute Man Air Field is closely involved with area agriculture, including growing organic products on airport property. The National Aviation Academy, an airframe and powerplant (A&P) school which has been training aviation maintenance professionals since 1932, opened a new training facility at the airport in 2016.
- **Marshfield Municipal Airport-George Harlow Field:** Airport improvements such as runway and taxiway reconstructions have led to an increased based jet fleet and charter operations. Marshfield Municipal Airport hosts the Marshfield Regional Safety Day, showcasing the work of public safety agencies and first responders.

Such airport-business synergies are crucial parts of the Massachusetts economy and the economies of their local communities. Fostering such relationships at each airport proves beneficial to airports and businesses alike.



# Economic Impact Tables



This section of the 2019 *Massachusetts Statewide Airport Economic Impact Study Update* contains tables providing details of the 2017 economic impact for each study airport. The tables present information on the number of jobs, payroll, and economic output associated with each airport's tenants, general aviation visitors, and, where appropriate, commercial service visitors and military aviation. Summary tables provide a combined total for jobs, payroll, and economic output. Additional details are provided for the estimates of visitor expenditures.

**Table A-1: Estimates of General Aviation Itinerant Arrivals at Massachusetts Airports**

Associated City	Airport Name	Itinerant GA Operations	GA True Transient Arrivals
<b>Commercial Service Airports</b>			
Bedford	Laurence G. Hanscom Field	82,289	17,155
Boston	Boston Logan International Airport	31,120	15,560
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	6,104	1,007
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	38,372	14,390
Nantucket	Nantucket Memorial Airport	55,872	22,349
New Bedford	New Bedford Regional Airport	23,570	3,889
Provincetown	Provincetown Municipal Airport	42,515	7,015
Vineyard Haven	Martha's Vineyard Airport	22,460	8,422
Worcester	Worcester Regional Airport	17,814	2,939
<b>Commercial Service Airports Total</b>		<b>320,115</b>	<b>92,726</b>
<b>General Aviation Airports</b>			
Barre/Barre Plains	Tanner-Hiller Airport	65	11
Berkley	Myricks Airport	410	68
Beverly	Beverly Regional Airport	25,799	4,257
Chatham	Chatham Municipal Airport	8,600	3,440
Edgartown	Katama Airpark	3,000	1,125
Falmouth	Falmouth Airpark	790	130
Fitchburg	Fitchburg Municipal Airport	21,760	4,380
Gardner	Gardner Municipal Airport	3,915	646
Great Barrington	Walter J. Koladza Airport	6,500	2,438
Hanson	Cranland Airport	2,550	421
Hopedale	Hopedale Industrial Park Airport	3,310	546
Lawrence	Lawrence Municipal Airport	21,911	3,615
Mansfield	Mansfield Municipal Airport	17,850	2,945
Marlborough	Marlboro Airport	675	111
Marshfield	Marshfield Municipal Airport - George Harlow Field	8,600	1,419
Marstons Mills	Cape Cod Airport	205	34
Montague	Turners Falls Airport	4,620	1,460
Newburyport	Plum Island Airport	970	160
North Adams	Harriman-and-West Airport	13,900	2,294
Northampton	Northampton Airport	1,700	281
Norwood	Norwood Memorial Airport	42,934	7,084
Orange	Orange Municipal Airport	26,050	4,298
Pittsfield	Pittsfield Municipal Airport	13,700	2,261
Plymouth	Plymouth Municipal Airport	20,950	3,457
Southbridge	Southbridge Municipal Airport	15,550	3,650
Spencer	Spencer Airport	550	91
Sterling	Sterling Airport	14,055	2,319
Stow	Minute Man Air Field	13,250	2,186
Taunton	Taunton Municipal Airport - King Field	3,750	619
Westfield/Springfield	Westfield-Barnes Regional Airport	23,003	3,795
<b>General Aviation Airports Total</b>		<b>320,922</b>	<b>59,540</b>
<b>All Airports Total</b>		<b>641,037</b>	<b>152,266</b>

Source: CDM Smith, FAA 5010 Forms, airport management estimates, air traffic control tower data

**Table A-2: Estimates of General Aviation Visitors at Massachusetts Airports**

Associated City	Airport Name	GA True Transient Arrivals	Visitors per Arrival	Estimated GA Visitors
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	17,155	3.3	58,112
Boston	Boston Logan International Airport	15,560	3.3	51,348
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	1,007	2.5	2,747
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	14,390	3.3	47,485
Nantucket	Nantucket Memorial Airport	22,349	3.3	73,750
New Bedford	New Bedford Regional Airport	3,889	2.5	9,723
Provincetown	Provincetown Municipal Airport	7,015	3.3	23,149
Vineyard Haven	Martha's Vineyard Airport	8,422	3.3	27,794
Worcester	Worcester Regional Airport	2,939	2.5	7,348
<b>Commercial Service Airports Total</b>		<b>92,726</b>		<b>301,457</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	11	1.8	19
Berkley	Myricks Airport	68	1.8	122
Beverly	Beverly Regional Airport	4,257	3.3	14,048
Chatham	Chatham Municipal Airport	3,440	3.3	11,352
Edgartown	Katama Airpark	1,125	1.8	2,025
Falmouth	Falmouth Airpark	130	2.5	326
Fitchburg	Fitchburg Municipal Airport	4,380	2.3	10,074
Gardner	Gardner Municipal Airport	646	1.8	1,163
Great Barrington	Walter J. Koladza Airport	2,438	2.3	5,606
Hanson	Cranland Airport	421	1.8	757
Hopedale	Hopedale Industrial Park Airport	546	1.8	983
Lawrence	Lawrence Municipal Airport	3,615	2.5	9,038
Mansfield	Mansfield Municipal Airport	2,945	2.3	6,774
Marlborough	Marlboro Airport	111	1.8	200
Marshfield	Marshfield Municipal Airport - George Harlow Field	1,419	2.5	3,548
Marstons Mills	Cape Cod Airport	34	1.8	61
Montague	Turners Falls Airport	1,460	1.8	2,628
Newburyport	Plum Island Airport	160	1.8	288
North Adams	Harriman-and-West Airport	2,294	2.3	5,275
Northampton	Northampton Airport	281	2.3	645
Norwood	Norwood Memorial Airport	7,084	3.3	23,378
Orange	Orange Municipal Airport	4,298	2.3	9,886
Pittsfield	Pittsfield Municipal Airport	2,261	2.5	5,651
Plymouth	Plymouth Municipal Airport	3,457	2.5	8,642
Southbridge	Southbridge Municipal Airport	3,650	1.8	6,570
Spencer	Spencer Airport	91	1.8	163
Sterling	Sterling Airport	2,319	1.8	4,174
Stow	Minute Man Air Field	2,186	2.3	5,028
Taunton	Taunton Municipal Airport - King Field	619	1.8	1,114
Westfield/Springfield	Westfield-Barnes Regional Airport	3,795	2.5	9,489
<b>General Aviation Airports Total</b>		<b>59,540</b>		<b>149,028</b>
<b>All Airports Total</b>		<b>152,266</b>		<b>450,484</b>

Source: CDM Smith

**Table A-3: Estimates of General Aviation Visitor Expenditures at Massachusetts Airports**

Associated City	Airport Name	Estimated GA Visitors	Avg. Visitor Spending per Trip	Annual GA Visitor Expenditures
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	58,112	\$450	\$26,150,000
Boston	Boston Logan International Airport	51,348	\$450	\$23,107,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	2,747	\$330	\$907,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	47,485	\$450	\$21,368,000
Nantucket	Nantucket Memorial Airport	73,750	\$450	\$33,188,000
New Bedford	New Bedford Regional Airport	9,723	\$330	\$3,208,000
Provincetown	Provincetown Municipal Airport	23,149	\$450	\$10,417,000
Vineyard Haven	Martha's Vineyard Airport	27,794	\$450	\$12,507,000
Worcester	Worcester Regional Airport	7,348	\$330	\$2,425,000
<b>Commercial Service Airports Total</b>		<b>301,457</b>	<b>\$442</b>	<b>\$133,277,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	19	\$130	\$3,000
Berkley	Myricks Airport	122	\$130	\$16,000
Beverly	Beverly Regional Airport	14,048	\$450	\$6,321,000
Chatham	Chatham Municipal Airport	11,352	\$450	\$5,108,000
Edgartown	Katama Airpark	2,025	\$130	\$263,000
Falmouth	Falmouth Airpark	326	\$330	\$108,000
Fitchburg	Fitchburg Municipal Airport	10,074	\$300	\$3,022,000
Gardner	Gardner Municipal Airport	1,163	\$130	\$151,000
Great Barrington	Walter J. Koladza Airport	5,606	\$300	\$1,682,000
Hanson	Cranland Airport	757	\$130	\$98,000
Hopedale	Hopedale Industrial Park Airport	983	\$130	\$128,000
Lawrence	Lawrence Municipal Airport	9,038	\$330	\$2,983,000
Mansfield	Mansfield Municipal Airport	6,774	\$300	\$2,032,000
Marlborough	Marlboro Airport	200	\$130	\$26,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	3,548	\$330	\$1,171,000
Marstons Mills	Cape Cod Airport	61	\$130	\$8,000
Montague	Turners Falls Airport	2,628	\$130	\$342,000
Newburyport	Plum Island Airport	288	\$130	\$37,000
North Adams	Harriman-and-West Airport	5,275	\$300	\$1,583,000
Northampton	Northampton Airport	645	\$300	\$194,000
Norwood	Norwood Memorial Airport	23,378	\$450	\$10,520,000
Orange	Orange Municipal Airport	9,886	\$300	\$2,966,000
Pittsfield	Pittsfield Municipal Airport	5,651	\$330	\$1,865,000
Plymouth	Plymouth Municipal Airport	8,642	\$330	\$2,852,000
Southbridge	Southbridge Municipal Airport	6,570	\$130	\$854,000
Spencer	Spencer Airport	163	\$130	\$21,000
Sterling	Sterling Airport	4,174	\$130	\$543,000
Stow	Minute Man Air Field	5,028	\$300	\$1,509,000
Taunton	Taunton Municipal Airport - King Field	1,114	\$130	\$145,000
Westfield/Springfield	Westfield-Barnes Regional Airport	9,489	\$330	\$3,131,000
<b>General Aviation Airports Total</b>		<b>149,028</b>	<b>\$333</b>	<b>\$49,682,000</b>
<b>All Airports Total</b>		<b>450,484</b>	<b>\$406</b>	<b>\$182,959,000</b>

Source: CDM Smith



**Table A-4: Estimates of Commercial Service Visitors at Massachusetts Airports**

Associated City	Airport Name	2017 Enplanements	Percent Visitors	Visitors
<b>Commercial Service Airports</b>				
Boston	Boston Logan International Airport	19,145,096	42%	7,429,446
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	31,422	51%	16,030
Nantucket	Nantucket Memorial Airport	120,937	70%	84,660
New Bedford	New Bedford Regional Airport	7,003	10%	700
Provincetown	Provincetown Municipal Airport	8,760	90%	7,880
Vineyard Haven	Martha's Vineyard Airport	49,767	70%	34,840
Worcester	Worcester Regional Airport	55,034	23%	12,660
<b>Commercial Service Airports Total</b>		<b>19,418,019</b>	<b>39%</b>	<b>7,586,216</b>

Source: Airport management and 2014 *Massachusetts Statewide Airport Economic Impact Study Update***Table A-5: Estimates of Commercial Service Visitor Expenditures at Massachusetts Airports**

Associated City	Airport Name	Annual Visitors	Avg. Expenditure per Visitor	Annual Visitor Expenditures
<b>Commercial Service Airports</b>				
Boston	Boston Logan International Airport	7,429,446	\$916	\$6,804,912,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	16,030	\$590	\$9,458,000
Nantucket	Nantucket Memorial Airport	84,660	\$1,240	\$104,978,000
New Bedford	New Bedford Regional Airport	700	\$360	\$252,000
Provincetown	Provincetown Municipal Airport	7,880	\$590	\$4,649,000
Vineyard Haven	Martha's Vineyard Airport	34,840	\$1,240	\$43,202,000
Worcester	Worcester Regional Airport	12,660	\$590	\$7,469,000
<b>Commercial Service Airports Total</b>		<b>7,586,216</b>	<b>\$919</b>	<b>\$6,974,920,000</b>

Source: CDM Smith, 2014 *Massachusetts Statewide Airport Economic Impact Study Update*, and Massachusetts Office of Travel & Tourism

**Table A-6: Massachusetts On-Airport Activity Employment**

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	10,924	8,078	19,002
Boston	Boston Logan International Airport	15,987	10,270	26,257
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	3,376	1,174	4,550
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	583	474	1,057
Nantucket	Nantucket Memorial Airport	252	182	434
New Bedford	New Bedford Regional Airport	115	85	200
Provincetown	Provincetown Municipal Airport	36	27	63
Vineyard Haven	Martha's Vineyard Airport	151	108	259
Worcester	Worcester Regional Airport	218	166	384
<b>Commercial Service Airports Total</b>		<b>31,642</b>	<b>20,564</b>	<b>52,206</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	10	8	18
Berkley	Myricks Airport	0	0	0
Beverly	Beverly Regional Airport	70	57	127
Chatham	Chatham Municipal Airport	26	16	42
Edgartown	Katama Airpark	9	4	13
Falmouth	Falmouth Airpark	2	2	4
Fitchburg	Fitchburg Municipal Airport	52	42	94
Gardner	Gardner Municipal Airport	3	2	5
Great Barrington	Walter J. Koladza Airport	11	8	19
Hanson	Cranland Airport	6	4	10
Hopedale	Hopedale Industrial Park Airport	6	4	10
Lawrence	Lawrence Municipal Airport	186	150	336
Mansfield	Mansfield Municipal Airport	38	28	66
Marlborough	Marlboro Airport	1	0	1
Marshfield	Marshfield Municipal Airport - George Harlow Field	30	25	55
Marstons Mills	Cape Cod Airport	5	3	8
Montague	Turners Falls Airport	13	10	23
Newburyport	Plum Island Airport	3	2	5
North Adams	Harriman-and-West Airport	47	40	87
Northampton	Northampton Airport	15	13	28
Norwood	Norwood Memorial Airport	128	104	232
Orange	Orange Municipal Airport	24	19	43
Pittsfield	Pittsfield Municipal Airport	97	81	178
Plymouth	Plymouth Municipal Airport	170	134	304
Southbridge	Southbridge Municipal Airport	23	15	38
Spencer	Spencer Airport	2	1	3
Sterling	Sterling Airport	4	2	6
Stow	Minute Man Air Field	100	76	176
Taunton	Taunton Municipal Airport - King Field	13	9	22
Westfield/Springfield	Westfield-Barnes Regional Airport	1,294	811	2,105
<b>General Aviation Airports Total</b>		<b>2,388</b>	<b>1,670</b>	<b>4,058</b>
<b>All Airports Total</b>		<b>34,030</b>	<b>22,234</b>	<b>56,264</b>

Source: CDM Smith and IMPLAN

**Table A-7: Massachusetts Commercial Service Visitor-Related Employment**

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
<b>Commercial Service Airports</b>				
Boston	Boston Logan International Airport	85,781	49,711	135,492
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	119	69	188
Nantucket	Nantucket Memorial Airport	1,323	767	2,090
New Bedford	New Bedford Regional Airport	3	2	5
Provincetown	Provincetown Municipal Airport	59	34	93
Vineyard Haven	Martha's Vineyard Airport	545	316	861
Worcester	Worcester Regional Airport	94	54	148
<b>Commercial Service Airports Total</b>		<b>87,924</b>	<b>50,953</b>	<b>138,877</b>

Source: CDM Smith and IMPLAN

**Table A-8: Massachusetts General Aviation Visitor-Related Employment**

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	396	189	585
Boston	Boston Logan International Airport	350	167	517
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	14	7	21
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	324	155	479
Nantucket	Nantucket Memorial Airport	503	241	744
New Bedford	New Bedford Regional Airport	49	23	72
Provincetown	Provincetown Municipal Airport	158	76	234
Vineyard Haven	Martha's Vineyard Airport	190	91	281
Worcester	Worcester Regional Airport	37	18	55
<b>Commercial Service Airports Total</b>		<b>2,021</b>	<b>967</b>	<b>2,988</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	0	0	0
Berkley	Myricks Airport	0	0	0
Beverly	Beverly Regional Airport	96	46	142
Chatham	Chatham Municipal Airport	77	37	114
Edgartown	Katama Airpark	4	2	6
Falmouth	Falmouth Airpark	2	1	3
Fitchburg	Fitchburg Municipal Airport	46	22	68
Gardner	Gardner Municipal Airport	2	1	3
Great Barrington	Walter J. Koladza Airport	25	12	37
Hanson	Cranland Airport	1	0	1
Hopedale	Hopedale Industrial Park Airport	2	1	3
Lawrence	Lawrence Municipal Airport	45	22	67
Mansfield	Mansfield Municipal Airport	31	15	46
Marlborough	Marlboro Airport	0	0	0
Marshfield	Marshfield Municipal Airport - George Harlow Field	18	9	27
Marstons Mills	Cape Cod Airport	0	0	0
Montague	Turners Falls Airport	5	2	7
Newburyport	Plum Island Airport	1	0	1
North Adams	Harriman-and-West Airport	24	11	35
Northampton	Northampton Airport	3	1	4
Norwood	Norwood Memorial Airport	159	76	235
Orange	Orange Municipal Airport	45	22	67
Pittsfield	Pittsfield Municipal Airport	28	13	41
Plymouth	Plymouth Municipal Airport	43	21	64
Southbridge	Southbridge Municipal Airport	13	6	19
Spencer	Spencer Airport	0	0	0
Sterling	Sterling Airport	8	4	12
Stow	Minute Man Air Field	23	11	34
Taunton	Taunton Municipal Airport - King Field	2	1	3
Westfield/Springfield	Westfield-Barnes Regional Airport	47	22	69
<b>General Aviation Airports Total</b>		<b>750</b>	<b>358</b>	<b>1,108</b>
<b>All Airports Total</b>		<b>2,771</b>	<b>1,325</b>	<b>4,096</b>

Source: CDM Smith and IMPLAN



**Table A-9: Massachusetts Airports Total Employment**

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	11,320	8,267	19,587
Boston	Boston Logan International Airport	102,118	60,148	162,266
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	3,390	1,181	4,571
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	1,026	698	1,724
Nantucket	Nantucket Memorial Airport	2,078	1,190	3,268
New Bedford	New Bedford Regional Airport	167	110	277
Provincetown	Provincetown Municipal Airport	253	137	390
Vineyard Haven	Martha's Vineyard Airport	886	515	1,401
Worcester	Worcester Regional Airport	349	238	587
<b>Commercial Service Airports Total</b>		<b>121,587</b>	<b>72,484</b>	<b>194,071</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	10	8	18
Berkley	Myricks Airport	0	0	0
Beverly	Beverly Regional Airport	166	103	269
Chatham	Chatham Municipal Airport	103	53	156
Edgartown	Katama Airpark	13	6	19
Falmouth	Falmouth Airpark	4	3	7
Fitchburg	Fitchburg Municipal Airport	98	64	162
Gardner	Gardner Municipal Airport	5	3	8
Great Barrington	Walter J. Koladza Airport	36	20	56
Hanson	Cranland Airport	7	4	11
Hopedale	Hopedale Industrial Park Airport	8	5	13
Lawrence	Lawrence Municipal Airport	231	172	403
Mansfield	Mansfield Municipal Airport	69	43	112
Marlborough	Marlboro Airport	1	0	1
Marshfield	Marshfield Municipal Airport - George Harlow Field	48	34	82
Marstons Mills	Cape Cod Airport	5	3	8
Montague	Turners Falls Airport	18	12	30
Newburyport	Plum Island Airport	4	2	6
North Adams	Harriman-and-West Airport	71	51	122
Northampton	Northampton Airport	18	14	32
Norwood	Norwood Memorial Airport	287	180	467
Orange	Orange Municipal Airport	69	41	110
Pittsfield	Pittsfield Municipal Airport	125	94	219
Plymouth	Plymouth Municipal Airport	213	155	368
Southbridge	Southbridge Municipal Airport	36	21	57
Spencer	Spencer Airport	2	1	3
Sterling	Sterling Airport	12	6	18
Stow	Minute Man Air Field	123	87	210
Taunton	Taunton Municipal Airport - King Field	15	10	25
Westfield/Springfield	Westfield-Barnes Regional Airport	1,341	833	2,174
<b>General Aviation Airports Total</b>		<b>3,138</b>	<b>2,028</b>	<b>5,166</b>
<b>All Airports Total</b>		<b>124,725</b>	<b>74,512</b>	<b>199,237</b>

Source: CDM Smith and IMPLAN

**Table A-10: Massachusetts On-Airport Activity Payroll**

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	\$363,808,000	\$144,101,000	\$507,909,000
Boston	Boston Logan International Airport	\$902,556,000	\$560,301,000	\$1,462,857,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$127,170,000	\$44,813,000	\$171,983,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$30,215,000	\$21,018,000	\$51,233,000
Nantucket	Nantucket Memorial Airport	\$15,123,000	\$8,517,000	\$23,640,000
New Bedford	New Bedford Regional Airport	\$4,971,000	\$3,431,000	\$8,402,000
Provincetown	Provincetown Municipal Airport	\$1,855,000	\$1,066,000	\$2,921,000
Vineyard Haven	Martha's Vineyard Airport	\$8,024,000	\$4,807,000	\$12,831,000
Worcester	Worcester Regional Airport	\$14,373,000	\$8,457,000	\$22,830,000
<b>Commercial Service Airports Total</b>		<b>\$1,468,095,000</b>	<b>\$796,511,000</b>	<b>\$2,264,606,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	\$167,000	\$127,000	\$294,000
Berkley	Myricks Airport	\$0	\$0	\$0
Beverly	Beverly Regional Airport	\$4,031,000	\$2,779,000	\$6,810,000
Chatham	Chatham Municipal Airport	\$550,000	\$354,000	\$904,000
Edgartown	Katama Airpark	\$267,000	\$168,000	\$435,000
Falmouth	Falmouth Airpark	\$110,000	\$83,000	\$193,000
Fitchburg	Fitchburg Municipal Airport	\$2,473,000	\$1,787,000	\$4,260,000
Gardner	Gardner Municipal Airport	\$101,000	\$77,000	\$178,000
Great Barrington	Walter J. Koladza Airport	\$322,000	\$247,000	\$569,000
Hanson	Cranland Airport	\$171,000	\$129,000	\$300,000
Hopedale	Hopedale Industrial Park Airport	\$350,000	\$268,000	\$618,000
Lawrence	Lawrence Municipal Airport	\$9,449,000	\$6,650,000	\$16,099,000
Mansfield	Mansfield Municipal Airport	\$1,680,000	\$1,250,000	\$2,930,000
Marlborough	Marlboro Airport	\$19,000	\$15,000	\$34,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$2,420,000	\$1,852,000	\$4,272,000
Marstons Mills	Cape Cod Airport	\$195,000	\$108,000	\$303,000
Montague	Turners Falls Airport	\$670,000	\$498,000	\$1,168,000
Newburyport	Plum Island Airport	\$66,000	\$50,000	\$116,000
North Adams	Harriman-and-West Airport	\$2,399,000	\$1,821,000	\$4,220,000
Northampton	Northampton Airport	\$371,000	\$283,000	\$654,000
Norwood	Norwood Memorial Airport	\$6,888,000	\$4,969,000	\$11,857,000
Orange	Orange Municipal Airport	\$1,176,000	\$857,000	\$2,033,000
Pittsfield	Pittsfield Municipal Airport	\$6,834,000	\$5,179,000	\$12,013,000
Plymouth	Plymouth Municipal Airport	\$10,090,000	\$7,020,000	\$17,110,000
Southbridge	Southbridge Municipal Airport	\$949,000	\$676,000	\$1,625,000
Spencer	Spencer Airport	\$57,000	\$43,000	\$100,000
Sterling	Sterling Airport	\$112,000	\$87,000	\$199,000
Stow	Minute Man Air Field	\$3,669,000	\$2,749,000	\$6,418,000
Taunton	Taunton Municipal Airport - King Field	\$570,000	\$389,000	\$959,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$92,583,000	\$43,539,000	\$136,122,000
<b>General Aviation Airports Total</b>		<b>\$148,739,000</b>	<b>\$84,054,000</b>	<b>\$232,793,000</b>
<b>All Airports Total</b>		<b>\$1,616,834,000</b>	<b>\$880,565,000</b>	<b>\$2,497,399,000</b>

Source: CDM Smith and IMPLAN

**Table A-11: Massachusetts Commercial Service Visitor-Related Payroll**

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
<b>Commercial Service Airports</b>				
Boston	Boston Logan International Airport	\$2,358,978,000	\$2,135,152,000	\$4,494,130,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$3,273,000	\$2,962,000	\$6,235,000
Nantucket	Nantucket Memorial Airport	\$36,383,000	\$32,931,000	\$69,314,000
New Bedford	New Bedford Regional Airport	\$83,000	\$75,000	\$158,000
Provincetown	Provincetown Municipal Airport	\$1,623,000	\$1,469,000	\$3,092,000
Vineyard Haven	Martha's Vineyard Airport	\$14,988,000	\$13,566,000	\$28,554,000
Worcester	Worcester Regional Airport	\$2,585,000	\$2,340,000	\$4,925,000
<b>Commercial Service Airports Total</b>		<b>\$2,417,913,000</b>	<b>\$2,188,495,000</b>	<b>\$4,606,408,000</b>

Source: CDM Smith and IMPLAN

**Table A-12: Massachusetts General Aviation Visitor-Related Payroll**

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	\$10,890,000	\$9,024,000	\$19,914,000
Boston	Boston Logan International Airport	\$9,625,000	\$7,975,000	\$17,600,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$385,000	\$319,000	\$704,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$8,910,000	\$7,383,000	\$16,293,000
Nantucket	Nantucket Memorial Airport	\$13,833,000	\$11,462,000	\$25,295,000
New Bedford	New Bedford Regional Airport	\$1,348,000	\$1,117,000	\$2,465,000
Provincetown	Provincetown Municipal Airport	\$4,345,000	\$3,600,000	\$7,945,000
Vineyard Haven	Martha's Vineyard Airport	\$5,225,000	\$4,329,000	\$9,554,000
Worcester	Worcester Regional Airport	\$1,018,000	\$844,000	\$1,862,000
<b>Commercial Service Airports Total</b>		<b>\$55,579,000</b>	<b>\$46,053,000</b>	<b>\$101,632,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	\$0	\$0	\$0
Berkley	Myricks Airport	\$0	\$0	\$0
Beverly	Beverly Regional Airport	\$2,640,000	\$2,188,000	\$4,828,000
Chatham	Chatham Municipal Airport	\$2,118,000	\$1,755,000	\$3,873,000
Edgartown	Katama Airpark	\$110,000	\$91,000	\$201,000
Falmouth	Falmouth Airpark	\$55,000	\$46,000	\$101,000
Fitchburg	Fitchburg Municipal Airport	\$1,265,000	\$1,048,000	\$2,313,000
Gardner	Gardner Municipal Airport	\$55,000	\$46,000	\$101,000
Great Barrington	Walter J. Koladza Airport	\$688,000	\$570,000	\$1,258,000
Hanson	Cranland Airport	\$28,000	\$23,000	\$51,000
Hopedale	Hopedale Industrial Park Airport	\$55,000	\$46,000	\$101,000
Lawrence	Lawrence Municipal Airport	\$1,238,000	\$1,026,000	\$2,264,000
Mansfield	Mansfield Municipal Airport	\$853,000	\$707,000	\$1,560,000
Marlborough	Marlboro Airport	\$0	\$0	\$0
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$495,000	\$410,000	\$905,000
Marstons Mills	Cape Cod Airport	\$0	\$0	\$0
Montague	Turners Falls Airport	\$138,000	\$114,000	\$252,000
Newburyport	Plum Island Airport	\$28,000	\$23,000	\$51,000
North Adams	Harriman-and-West Airport	\$660,000	\$547,000	\$1,207,000
Northampton	Northampton Airport	\$83,000	\$69,000	\$152,000
Norwood	Norwood Memorial Airport	\$4,373,000	\$3,624,000	\$7,997,000
Orange	Orange Municipal Airport	\$1,238,000	\$1,026,000	\$2,264,000
Pittsfield	Pittsfield Municipal Airport	\$770,000	\$638,000	\$1,408,000
Plymouth	Plymouth Municipal Airport	\$1,183,000	\$980,000	\$2,163,000
Southbridge	Southbridge Municipal Airport	\$358,000	\$297,000	\$655,000
Spencer	Spencer Airport	\$0	\$0	\$0
Sterling	Sterling Airport	\$220,000	\$182,000	\$402,000
Stow	Minute Man Air Field	\$633,000	\$525,000	\$1,158,000
Taunton	Taunton Municipal Airport - King Field	\$55,000	\$46,000	\$101,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$1,293,000	\$1,071,000	\$2,364,000
<b>General Aviation Airports Total</b>		<b>\$20,632,000</b>	<b>\$17,098,000</b>	<b>\$37,730,000</b>
<b>All Airports Total</b>		<b>\$76,211,000</b>	<b>\$63,151,000</b>	<b>\$139,362,000</b>

Source: CDM Smith and IMPLAN



**Table A-13: Massachusetts Airports Total Payroll**

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	\$374,698,000	\$153,125,000	\$527,823,000
Boston	Boston Logan International Airport	\$3,271,159,000	\$2,703,428,000	\$5,974,587,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$127,555,000	\$45,132,000	\$172,687,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$42,398,000	\$31,363,000	\$73,761,000
Nantucket	Nantucket Memorial Airport	\$65,339,000	\$52,910,000	\$118,249,000
New Bedford	New Bedford Regional Airport	\$6,402,000	\$4,623,000	\$11,025,000
Provincetown	Provincetown Municipal Airport	\$7,823,000	\$6,135,000	\$13,958,000
Vineyard Haven	Martha's Vineyard Airport	\$28,237,000	\$22,702,000	\$50,939,000
Worcester	Worcester Regional Airport	\$17,976,000	\$11,641,000	\$29,617,000
<b>Commercial Service Airports Total</b>		<b>\$3,941,587,000</b>	<b>\$3,031,059,000</b>	<b>\$6,972,646,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	\$167,000	\$127,000	\$294,000
Berkley	Myricks Airport	\$0	\$0	\$0
Beverly	Beverly Regional Airport	\$6,671,000	\$4,967,000	\$11,638,000
Chatham	Chatham Municipal Airport	\$2,668,000	\$2,109,000	\$4,777,000
Edgartown	Katama Airpark	\$377,000	\$259,000	\$636,000
Falmouth	Falmouth Airpark	\$165,000	\$129,000	\$294,000
Fitchburg	Fitchburg Municipal Airport	\$3,738,000	\$2,835,000	\$6,573,000
Gardner	Gardner Municipal Airport	\$156,000	\$123,000	\$279,000
Great Barrington	Walter J. Koladza Airport	\$1,010,000	\$817,000	\$1,827,000
Hanson	Cranland Airport	\$199,000	\$152,000	\$351,000
Hopedale	Hopedale Industrial Park Airport	\$405,000	\$314,000	\$719,000
Lawrence	Lawrence Municipal Airport	\$10,687,000	\$7,676,000	\$18,363,000
Mansfield	Mansfield Municipal Airport	\$2,533,000	\$1,957,000	\$4,490,000
Marlborough	Marlboro Airport	\$19,000	\$15,000	\$34,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$2,915,000	\$2,262,000	\$5,177,000
Marstons Mills	Cape Cod Airport	\$195,000	\$108,000	\$303,000
Montague	Turners Falls Airport	\$808,000	\$612,000	\$1,420,000
Newburyport	Plum Island Airport	\$94,000	\$73,000	\$167,000
North Adams	Harriman-and-West Airport	\$3,059,000	\$2,368,000	\$5,427,000
Northampton	Northampton Airport	\$454,000	\$352,000	\$806,000
Norwood	Norwood Memorial Airport	\$11,261,000	\$8,593,000	\$19,854,000
Orange	Orange Municipal Airport	\$2,414,000	\$1,883,000	\$4,297,000
Pittsfield	Pittsfield Municipal Airport	\$7,604,000	\$5,817,000	\$13,421,000
Plymouth	Plymouth Municipal Airport	\$11,273,000	\$8,000,000	\$19,273,000
Southbridge	Southbridge Municipal Airport	\$1,307,000	\$973,000	\$2,280,000
Spencer	Spencer Airport	\$57,000	\$43,000	\$100,000
Sterling	Sterling Airport	\$332,000	\$269,000	\$601,000
Stow	Minute Man Air Field	\$4,302,000	\$3,274,000	\$7,576,000
Taunton	Taunton Municipal Airport - King Field	\$625,000	\$435,000	\$1,060,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$93,876,000	\$44,610,000	\$138,486,000
<b>General Aviation Airports Total</b>		<b>\$169,371,000</b>	<b>\$101,152,000</b>	<b>\$270,523,000</b>
<b>All Airports Total</b>		<b>\$4,110,958,000</b>	<b>\$3,132,211,000</b>	<b>\$7,243,169,000</b>

Source: CDM Smith and IMPLAN

**Table A-14: Massachusetts On-Airport Activity Output**

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	\$4,690,701,000	\$1,970,850,000	\$6,661,551,000
Boston	Boston Logan International Airport	\$2,131,634,000	\$1,680,675,000	\$3,812,309,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$181,440,000	\$62,171,000	\$243,611,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$60,507,000	\$40,615,000	\$101,122,000
Nantucket	Nantucket Memorial Airport	\$40,518,000	\$29,895,000	\$70,413,000
New Bedford	New Bedford Regional Airport	\$13,161,000	\$10,152,000	\$23,313,000
Provincetown	Provincetown Municipal Airport	\$4,178,000	\$3,250,000	\$7,428,000
Vineyard Haven	Martha's Vineyard Airport	\$21,511,000	\$17,164,000	\$38,675,000
Worcester	Worcester Regional Airport	\$44,521,000	\$34,135,000	\$78,656,000
<b>Commercial Service Airports Total</b>		<b>\$7,188,171,000</b>	<b>\$3,848,907,000</b>	<b>\$11,037,078,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	\$441,000	\$256,000	\$697,000
Berkley	Myricks Airport	\$18,000	\$11,000	\$29,000
Beverly	Beverly Regional Airport	\$13,639,000	\$9,190,000	\$22,829,000
Chatham	Chatham Municipal Airport	\$2,715,000	\$1,932,000	\$4,647,000
Edgartown	Katama Airpark	\$904,000	\$706,000	\$1,610,000
Falmouth	Falmouth Airpark	\$267,000	\$178,000	\$445,000
Fitchburg	Fitchburg Municipal Airport	\$6,882,000	\$5,252,000	\$12,134,000
Gardner	Gardner Municipal Airport	\$439,000	\$315,000	\$754,000
Great Barrington	Walter J. Koladza Airport	\$1,375,000	\$785,000	\$2,160,000
Hanson	Cranland Airport	\$491,000	\$321,000	\$812,000
Hopedale	Hopedale Industrial Park Airport	\$488,000	\$290,000	\$778,000
Lawrence	Lawrence Municipal Airport	\$26,297,000	\$18,174,000	\$44,471,000
Mansfield	Mansfield Municipal Airport	\$4,928,000	\$3,839,000	\$8,767,000
Marlborough	Marlboro Airport	\$86,000	\$56,000	\$142,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$8,687,000	\$5,085,000	\$13,772,000
Marstons Mills	Cape Cod Airport	\$542,000	\$380,000	\$922,000
Montague	Turners Falls Airport	\$1,828,000	\$1,475,000	\$3,303,000
Newburyport	Plum Island Airport	\$144,000	\$84,000	\$228,000
North Adams	Harriman-and-West Airport	\$9,322,000	\$6,203,000	\$15,525,000
Northampton	Northampton Airport	\$1,805,000	\$1,045,000	\$2,850,000
Norwood	Norwood Memorial Airport	\$24,668,000	\$15,503,000	\$40,171,000
Orange	Orange Municipal Airport	\$3,292,000	\$2,391,000	\$5,683,000
Pittsfield	Pittsfield Municipal Airport	\$22,922,000	\$13,955,000	\$36,877,000
Plymouth	Plymouth Municipal Airport	\$34,422,000	\$23,311,000	\$57,733,000
Southbridge	Southbridge Municipal Airport	\$2,488,000	\$2,147,000	\$4,635,000
Spencer	Spencer Airport	\$199,000	\$119,000	\$318,000
Sterling	Sterling Airport	\$554,000	\$331,000	\$885,000
Stow	Minute Man Air Field	\$14,093,000	\$9,012,000	\$23,105,000
Taunton	Taunton Municipal Airport - King Field	\$1,926,000	\$1,354,000	\$3,280,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$154,865,000	\$76,202,000	\$231,067,000
<b>General Aviation Airports Total</b>		<b>\$340,727,000</b>	<b>\$199,902,000</b>	<b>\$540,629,000</b>
<b>All Airports Total</b>		<b>\$7,528,898,000</b>	<b>\$4,048,809,000</b>	<b>\$11,577,707,000</b>

Source: CDM Smith and IMPLAN

**Table A-15: Massachusetts Commercial Service Visitor-Related Output**

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
<b>Commercial Service Airports</b>				
Boston	Boston Logan International Airport	\$6,804,912,000	\$5,666,310,000	\$12,471,222,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$9,458,000	\$7,875,000	\$17,333,000
Nantucket	Nantucket Memorial Airport	\$104,978,000	\$87,413,000	\$192,391,000
New Bedford	New Bedford Regional Airport	\$252,000	\$210,000	\$462,000
Provincetown	Provincetown Municipal Airport	\$4,649,000	\$3,871,000	\$8,520,000
Vineyard Haven	Martha's Vineyard Airport	\$43,202,000	\$35,973,000	\$79,175,000
Worcester	Worcester Regional Airport	\$7,469,000	\$6,219,000	\$13,688,000
<b>Commercial Service Airports Total</b>		<b>\$6,974,920,000</b>	<b>\$5,807,871,000</b>	<b>\$12,782,791,000</b>

Source: CDM Smith and IMPLAN

**Table A-16: Massachusetts General Aviation Visitor-Related Output**

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	\$26,150,000	\$21,315,000	\$47,465,000
Boston	Boston Logan International Airport	\$23,107,000	\$18,834,000	\$41,941,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$907,000	\$739,000	\$1,646,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$21,368,000	\$17,417,000	\$38,785,000
Nantucket	Nantucket Memorial Airport	\$33,188,000	\$27,052,000	\$60,240,000
New Bedford	New Bedford Regional Airport	\$3,208,000	\$2,615,000	\$5,823,000
Provincetown	Provincetown Municipal Airport	\$10,417,000	\$8,491,000	\$18,908,000
Vineyard Haven	Martha's Vineyard Airport	\$12,507,000	\$10,194,000	\$22,701,000
Worcester	Worcester Regional Airport	\$2,425,000	\$1,977,000	\$4,402,000
<b>Commercial Service Airports Total</b>		<b>\$133,277,000</b>	<b>\$108,634,000</b>	<b>\$241,911,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	\$3,000	\$2,000	\$5,000
Berkley	Myricks Airport	\$16,000	\$13,000	\$29,000
Beverly	Beverly Regional Airport	\$6,321,000	\$5,152,000	\$11,473,000
Chatham	Chatham Municipal Airport	\$5,108,000	\$4,164,000	\$9,272,000
Edgartown	Katama Airpark	\$263,000	\$214,000	\$477,000
Falmouth	Falmouth Airpark	\$108,000	\$88,000	\$196,000
Fitchburg	Fitchburg Municipal Airport	\$3,022,000	\$2,463,000	\$5,485,000
Gardner	Gardner Municipal Airport	\$151,000	\$123,000	\$274,000
Great Barrington	Walter J. Koladza Airport	\$1,682,000	\$1,371,000	\$3,053,000
Hanson	Cranland Airport	\$98,000	\$80,000	\$178,000
Hopedale	Hopedale Industrial Park Airport	\$128,000	\$104,000	\$232,000
Lawrence	Lawrence Municipal Airport	\$2,983,000	\$2,431,000	\$5,414,000
Mansfield	Mansfield Municipal Airport	\$2,032,000	\$1,656,000	\$3,688,000
Marlborough	Marlboro Airport	\$26,000	\$21,000	\$47,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$1,171,000	\$954,000	\$2,125,000
Marstons Mills	Cape Cod Airport	\$8,000	\$7,000	\$15,000
Montague	Turners Falls Airport	\$342,000	\$279,000	\$621,000
Newburyport	Plum Island Airport	\$37,000	\$30,000	\$67,000
North Adams	Harriman-and-West Airport	\$1,583,000	\$1,290,000	\$2,873,000
Northampton	Northampton Airport	\$194,000	\$158,000	\$352,000
Norwood	Norwood Memorial Airport	\$10,520,000	\$8,575,000	\$19,095,000
Orange	Orange Municipal Airport	\$2,966,000	\$2,418,000	\$5,384,000
Pittsfield	Pittsfield Municipal Airport	\$1,865,000	\$1,520,000	\$3,385,000
Plymouth	Plymouth Municipal Airport	\$2,852,000	\$2,325,000	\$5,177,000
Southbridge	Southbridge Municipal Airport	\$854,000	\$696,000	\$1,550,000
Spencer	Spencer Airport	\$21,000	\$17,000	\$38,000
Sterling	Sterling Airport	\$543,000	\$443,000	\$986,000
Stow	Minute Man Air Field	\$1,509,000	\$1,230,000	\$2,739,000
Taunton	Taunton Municipal Airport - King Field	\$145,000	\$118,000	\$263,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$3,131,000	\$2,552,000	\$5,683,000
<b>General Aviation Airports Total</b>		<b>\$49,682,000</b>	<b>\$40,494,000</b>	<b>\$90,176,000</b>
<b>All Airports Total</b>		<b>\$182,959,000</b>	<b>\$149,128,000</b>	<b>\$332,087,000</b>

Source: CDM Smith and IMPLAN

**Table A-17: Massachusetts Airports Total Output**

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	\$4,716,851,000	\$1,992,165,000	\$6,709,016,000
Boston	Boston Logan International Airport	\$8,959,653,000	\$7,365,819,000	\$16,325,472,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$182,347,000	\$62,910,000	\$245,257,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$91,333,000	\$65,907,000	\$157,240,000
Nantucket	Nantucket Memorial Airport	\$178,684,000	\$144,360,000	\$323,044,000
New Bedford	New Bedford Regional Airport	\$16,621,000	\$12,977,000	\$29,598,000
Provincetown	Provincetown Municipal Airport	\$19,244,000	\$15,612,000	\$34,856,000
Vineyard Haven	Martha's Vineyard Airport	\$77,220,000	\$63,331,000	\$140,551,000
Worcester	Worcester Regional Airport	\$54,415,000	\$42,331,000	\$96,746,000
<b>Commercial Service Airports Total</b>		<b>\$14,296,368,000</b>	<b>\$9,765,412,000</b>	<b>\$24,061,780,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	\$444,000	\$258,000	\$702,000
Berkley	Myricks Airport	\$34,000	\$24,000	\$58,000
Beverly	Beverly Regional Airport	\$19,960,000	\$14,342,000	\$34,302,000
Chatham	Chatham Municipal Airport	\$7,823,000	\$6,096,000	\$13,919,000
Edgartown	Katama Airpark	\$1,167,000	\$920,000	\$2,087,000
Falmouth	Falmouth Airpark	\$375,000	\$266,000	\$641,000
Fitchburg	Fitchburg Municipal Airport	\$9,904,000	\$7,715,000	\$17,619,000
Gardner	Gardner Municipal Airport	\$590,000	\$438,000	\$1,028,000
Great Barrington	Walter J. Koladza Airport	\$3,057,000	\$2,156,000	\$5,213,000
Hanson	Cranland Airport	\$589,000	\$401,000	\$990,000
Hopedale	Hopedale Industrial Park Airport	\$616,000	\$394,000	\$1,010,000
Lawrence	Lawrence Municipal Airport	\$29,280,000	\$20,605,000	\$49,885,000
Mansfield	Mansfield Municipal Airport	\$6,960,000	\$5,495,000	\$12,455,000
Marlborough	Marlboro Airport	\$112,000	\$77,000	\$189,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$9,858,000	\$6,039,000	\$15,897,000
Marstons Mills	Cape Cod Airport	\$550,000	\$387,000	\$937,000
Montague	Turners Falls Airport	\$2,170,000	\$1,754,000	\$3,924,000
Newburyport	Plum Island Airport	\$181,000	\$114,000	\$295,000
North Adams	Harriman-and-West Airport	\$10,905,000	\$7,493,000	\$18,398,000
Northampton	Northampton Airport	\$1,999,000	\$1,203,000	\$3,202,000
Norwood	Norwood Memorial Airport	\$35,188,000	\$24,078,000	\$59,266,000
Orange	Orange Municipal Airport	\$6,258,000	\$4,809,000	\$11,067,000
Pittsfield	Pittsfield Municipal Airport	\$24,787,000	\$15,475,000	\$40,262,000
Plymouth	Plymouth Municipal Airport	\$37,274,000	\$25,636,000	\$62,910,000
Southbridge	Southbridge Municipal Airport	\$3,342,000	\$2,843,000	\$6,185,000
Spencer	Spencer Airport	\$220,000	\$136,000	\$356,000
Sterling	Sterling Airport	\$1,097,000	\$774,000	\$1,871,000
Stow	Minute Man Air Field	\$15,602,000	\$10,242,000	\$25,844,000
Taunton	Taunton Municipal Airport - King Field	\$2,071,000	\$1,472,000	\$3,543,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$157,996,000	\$78,754,000	\$236,750,000
<b>General Aviation Airports Total</b>		<b>\$390,409,000</b>	<b>\$240,396,000</b>	<b>\$630,805,000</b>
<b>All Airports Total</b>		<b>\$14,686,777,000</b>	<b>\$10,005,808,000</b>	<b>\$24,692,585,000</b>

Source: CDM Smith and IMPLAN



**Table A-18: Massachusetts Airports Total Economic Impacts**

Associated City	Airport Name	Total Employment	Total Payroll	Total Output
<b>Commercial Service Airports</b>				
Bedford	Laurence G. Hanscom Field	19,587	\$527,823,000	\$6,709,016,000
Boston	Boston Logan International Airport	162,266	\$5,974,587,000	\$16,325,472,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	4,571	\$172,687,000	\$245,257,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	1,724	\$73,761,000	\$157,240,000
Nantucket	Nantucket Memorial Airport	3,268	\$118,249,000	\$323,044,000
New Bedford	New Bedford Regional Airport	277	\$11,025,000	\$29,598,000
Provincetown	Provincetown Municipal Airport	390	\$13,958,000	\$34,856,000
Vineyard Haven	Martha's Vineyard Airport	1,401	\$50,939,000	\$140,551,000
Worcester	Worcester Regional Airport	587	\$29,617,000	\$96,746,000
<b>Commercial Service Airports Total</b>		<b>194,071</b>	<b>\$6,972,646,000</b>	<b>\$24,061,780,000</b>
<b>General Aviation Airports</b>				
Barre/Barre Plains	Tanner-Hiller Airport	18	\$294,000	\$702,000
Berkley	Myricks Airport	0	\$0	\$58,000
Beverly	Beverly Regional Airport	269	\$11,638,000	\$34,302,000
Chatham	Chatham Municipal Airport	156	\$4,777,000	\$13,919,000
Edgartown	Katama Airpark	19	\$636,000	\$2,087,000
Falmouth	Falmouth Airpark	7	\$294,000	\$641,000
Fitchburg	Fitchburg Municipal Airport	162	\$6,573,000	\$17,619,000
Gardner	Gardner Municipal Airport	8	\$279,000	\$1,028,000
Great Barrington	Walter J. Koladza Airport	56	\$1,827,000	\$5,213,000
Hanson	Cranland Airport	11	\$351,000	\$990,000
Hopedale	Hopedale Industrial Park Airport	13	\$719,000	\$1,010,000
Lawrence	Lawrence Municipal Airport	403	\$18,363,000	\$49,885,000
Mansfield	Mansfield Municipal Airport	112	\$4,490,000	\$12,455,000
Marlborough	Marlboro Airport	1	\$34,000	\$189,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	82	\$5,177,000	\$15,897,000
Marstons Mills	Cape Cod Airport	8	\$303,000	\$937,000
Montague	Turners Falls Airport	30	\$1,420,000	\$3,924,000
Newburyport	Plum Island Airport	6	\$167,000	\$295,000
North Adams	Harriman-and-West Airport	122	\$5,427,000	\$18,398,000
Northampton	Northampton Airport	32	\$806,000	\$3,202,000
Norwood	Norwood Memorial Airport	467	\$19,854,000	\$59,266,000
Orange	Orange Municipal Airport	110	\$4,297,000	\$11,067,000
Pittsfield	Pittsfield Municipal Airport	219	\$13,421,000	\$40,262,000
Plymouth	Plymouth Municipal Airport	368	\$19,273,000	\$62,910,000
Southbridge	Southbridge Municipal Airport	57	\$2,280,000	\$6,185,000
Spencer	Spencer Airport	3	\$100,000	\$356,000
Sterling	Sterling Airport	18	\$601,000	\$1,871,000
Stow	Minute Man Air Field	210	\$7,576,000	\$25,844,000
Taunton	Taunton Municipal Airport - King Field	25	\$1,060,000	\$3,543,000
Westfield/Springfield	Westfield-Barnes Regional Airport	2,174	\$138,486,000	\$236,750,000
<b>General Aviation Airports Total</b>		<b>5,166</b>	<b>\$270,523,000</b>	<b>\$630,805,000</b>
<b>All Airports Total</b>		<b>199,237</b>	<b>\$7,243,169,000</b>	<b>\$24,692,585,000</b>

Source: CDM Smith and IMPLAN

**Table A-19: Sales and Income Tax Contributions of Massachusetts Airports**

Associated City	Airport Name	Airport Tenant Sales Taxes	Visitor Sales Taxes	Employee Sales Taxes from Airport Tenants	Employee Sales Taxes from Visitors	Employee Income Taxes from Airport Tenants	Employee Income Taxes from Visitors	Total Taxes
<b>Commercial Service Airports</b>								
Bedford	Laurence G. Hanscom Field*	\$19,229,000	\$2,009,000	\$5,265,000	\$161,000	\$18,554,000	\$555,000	\$45,773,000
Boston	Boston Logan International Airport	\$72,299,000	\$589,365,000	\$9,704,000	\$35,012,000	\$46,030,000	\$120,799,000	\$873,209,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport*	\$686,000	\$72,000	\$1,627,000	\$6,000	\$6,486,000	\$20,000	\$8,897,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$1,782,000	\$2,369,000	\$354,000	\$180,000	\$1,541,000	\$621,000	\$6,847,000
Nantucket	Nantucket Memorial Airport	\$1,494,000	\$10,615,000	\$167,000	\$742,000	\$771,000	\$2,561,000	\$16,350,000
New Bedford	New Bedford Regional Airport	\$482,000	\$265,000	\$63,000	\$21,000	\$254,000	\$73,000	\$1,158,000
Provincetown	Provincetown Municipal Airport	\$137,000	\$1,157,000	\$22,000	\$88,000	\$95,000	\$305,000	\$1,804,000
Vineyard Haven	Martha's Vineyard Airport	\$793,000	\$3,960,000	\$92,000	\$299,000	\$409,000	\$1,030,000	\$6,583,000
Worcester	Worcester Regional Airport	\$1,773,000	\$835,000	\$144,000	\$53,000	\$733,000	\$184,000	\$3,722,000
<b>Commercial Service Airports Total</b>		<b>\$98,675,000</b>	<b>\$610,647,000</b>	<b>\$17,438,000</b>	<b>\$36,562,000</b>	<b>\$74,873,000</b>	<b>\$126,148,000</b>	<b>\$964,343,000</b>
<b>General Aviation Airports</b>								
Barre/Barre Plains	Tanner-Hiller Airport	\$16,000	\$0	\$3,000	\$0	\$9,000	\$0	\$28,000
Berkley	Myricks Airport	\$1,000	\$1,000	\$0	\$0	\$0	\$0	\$2,000
Beverly	Beverly Regional Airport	\$565,000	\$486,000	\$42,000	\$39,000	\$206,000	\$135,000	\$1,473,000
Chatham	Chatham Municipal Airport	\$127,000	\$363,000	\$11,000	\$31,000	\$28,000	\$108,000	\$668,000
Edgartown	Katama Airpark	\$37,000	\$18,000	\$4,000	\$2,000	\$14,000	\$6,000	\$81,000
Falmouth	Falmouth Airpark	\$9,000	\$8,000	\$1,000	\$1,000	\$6,000	\$3,000	\$28,000
Fitchburg	Fitchburg Municipal Airport	\$259,000	\$209,000	\$28,000	\$19,000	\$126,000	\$65,000	\$706,000
Gardner	Gardner Municipal Airport	\$20,000	\$10,000	\$1,000	\$1,000	\$5,000	\$3,000	\$40,000
Great Barrington	Walter J. Koladza Airport	\$62,000	\$129,000	\$4,000	\$10,000	\$16,000	\$35,000	\$256,000
Hanson	Cranland Airport	\$19,000	\$6,000	\$2,000	\$0	\$9,000	\$1,000	\$37,000
Hopedale	Hopedale Industrial Park Airport	\$8,000	\$7,000	\$4,000	\$1,000	\$18,000	\$3,000	\$41,000
Lawrence	Lawrence Municipal Airport	\$991,000	\$229,000	\$113,000	\$18,000	\$482,000	\$63,000	\$1,896,000
Mansfield	Mansfield Municipal Airport	\$191,000	\$144,000	\$21,000	\$13,000	\$86,000	\$44,000	\$499,000
Marlborough	Marlboro Airport	\$4,000	\$2,000	\$0	\$0	\$1,000	\$0	\$7,000

**Table A-19: Sales and Income Tax Contributions of Massachusetts Airports (cont.)**

Associated City	Airport Name	Airport Tenant Sales Taxes	Visitor Sales Taxes	Employee Sales Taxes from Airport Tenants	Employee Sales Taxes from Visitors	Employee Income Taxes from Airport Tenants	Employee Income Taxes from Visitors	Total Taxes
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$369,000	\$83,000	\$23,000	\$7,000	\$123,000	\$25,000	\$630,000
Marstons Mills	Cape Cod Airport	\$20,000	\$1,000	\$2,000	\$0	\$10,000	\$0	\$33,000
Montague	Turners Falls Airport	\$68,000	\$20,000	\$8,000	\$2,000	\$34,000	\$7,000	\$139,000
Newburyport	Plum Island Airport	\$5,000	\$3,000	\$1,000	\$0	\$3,000	\$1,000	\$13,000
North Adams	Harriman-and-West Airport	\$407,000	\$122,000	\$29,000	\$10,000	\$122,000	\$34,000	\$724,000
Northampton	Northampton Airport	\$84,000	\$15,000	\$6,000	\$1,000	\$19,000	\$4,000	\$129,000
Norwood	Norwood Memorial Airport	\$1,046,000	\$808,000	\$78,000	\$65,000	\$351,000	\$223,000	\$2,571,000
Orange	Orange Municipal Airport	\$124,000	\$228,000	\$13,000	\$18,000	\$60,000	\$63,000	\$506,000
Pittsfield	Pittsfield Municipal Airport	\$946,000	\$143,000	\$69,000	\$11,000	\$349,000	\$39,000	\$1,557,000
Plymouth	Plymouth Municipal Airport	\$1,431,000	\$219,000	\$103,000	\$17,000	\$515,000	\$60,000	\$2,345,000
Southbridge	Southbridge Municipal Airport	\$91,000	\$66,000	\$13,000	\$5,000	\$48,000	\$18,000	\$241,000
Spencer	Spencer Airport	\$8,000	\$1,000	\$1,000	\$0	\$3,000	\$0	\$13,000
Sterling	Sterling Airport	\$26,000	\$38,000	\$2,000	\$3,000	\$6,000	\$11,000	\$86,000
Stow	Minute Man Air Field	\$613,000	\$86,000	\$48,000	\$9,000	\$187,000	\$32,000	\$975,000
Taunton	Taunton Municipal Airport - King Field	\$80,000	\$11,000	\$7,000	\$1,000	\$29,000	\$3,000	\$131,000
Westfield/Springfield	Westfield-Barnes Regional Airport*	\$2,989,000	\$241,000	\$919,000	\$19,000	\$4,722,000	\$66,000	\$8,956,000
<b>General Aviation Airports Total</b>		<b>\$10,616,000</b>	<b>\$3,697,000</b>	<b>\$1,556,000</b>	<b>\$303,000</b>	<b>\$7,587,000</b>	<b>\$1,052,000</b>	<b>\$24,811,000</b>
<b>All Airports Total</b>		<b>\$109,291,000</b>	<b>\$614,344,000</b>	<b>\$18,994,000</b>	<b>\$36,865,000</b>	<b>\$82,460,000</b>	<b>\$127,200,000</b>	<b>\$989,154,000</b>

Source: CDM Smith

\*Includes sales and income taxes paid by employees of military air facilities co-located with the airport.

# Economic Impacts of Boston Logan International Airport



## Introduction

Boston Logan International Airport, owned and operated by the Massachusetts Port Authority (Massport), serves as the primary travel gateway to New England. As explained in Chapter 3, a separate methodology was used to update Boston Logan’s economic impacts from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*. Updated impacts for the airport generated by on-airport tenants, capital improvement projects, and visitor spending and the methodology used to estimate them are presented in this appendix.

## Boston Logan International Airport Background

Since the 2014 study update, Boston Logan International Airport has continued to experience growth in passengers and aircraft operations. Passenger levels grew to 38.4 million in 2017 compared to 30.2 million in 2013, while total aircraft operations rose to 401,000 in 2017 compared to 361,000 in 2013. This growth resulted in the airport ranking as the 16<sup>th</sup> busiest in the United States in terms of passengers and total aircraft movements in 2017.<sup>1</sup> Boston Logan is a critical transportation asset connecting the city of Boston, the Commonwealth of Massachusetts, and the entire New England region to destinations across the United States and throughout the world.

The airport is conveniently located five minutes east of downtown Boston with vehicle access on Interstate 90 and Massachusetts 1A and public transportation access via the Blue Line rapid transit route and Silver Line bus rapid transit route. More than 40 airlines utilize four different terminals and six runways to facilitate the movement of passengers to over 130 domestic and international destinations. Additionally, the airport is served by express package and all-freight cargo carriers



*International carriers at Terminal E*

that help deliver packages and cargo to destinations around the world. Massport has continued upgrading the airport’s infrastructure, investing \$828 million in capital improvements from 2015 to 2017.

Travelers within the United States and from around the world use Boston Logan to access the numerous attractions found in Massachusetts and throughout New England such as the Cape and Islands and the Berkshires as well as the world-class higher education institutions and medical facilities. Connections to so many domestic and international destinations allow the region to continually identify as a top location for businesses, tourism, and new residents.

<sup>1</sup> 2017 North American Airport Traffic Summary, Airports Council International – North America

## Economic Impact Update Approach

As explained in Chapter 3, all economic impacts generated by the 39 airports in this study were either estimated using data gathered from the airports or calculated using the Impact Analysis for Planning (IMPLAN) input-output model. The IMPLAN model provides three **measures** of economic impact, broken down into several **categories** of economic impact, and expressed as three related **types** of economic impact. The measures used to assess Boston Logan International's economic impacts are as follows:

- Employment
- Payroll
- Output

These measures were used to evaluate the following categories of economic impact:

- On-airport tenants
- Capital improvement impacts
- Commercial service visitors
- General aviation visitors

Data gathered from these categories were used as inputs for the IMPLAN model, which estimates three types of economic impact associated with Boston Logan using each of the three economic impact measures. The types of economic impact include the following:

- Direct impacts
- Multiplier impacts
- Total impacts

For a detailed discussion of the measures, categories, and types of economic impact, as well as the IMPLAN model, please refer to Chapter 3.



*Passenger waiting area in Terminal E*

## Data Collection

Boston Logan's economic impacts from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update* served as the starting point for updating the airport's economic impacts. Massport provided updated information for the airport that was used to estimate economic impacts for 2017. This information included the following:

- Number of full-time and part-time airport management employees in 2017
- Estimated total annual salary, wages, and benefits paid to these employees in 2017
- Estimated total capital improvement expenditures by airport management for each year, 2015 through 2017



- Estimated total operating expenses (excluding payroll and capital improvements) for airport management in 2017
- Enplanements (domestic and international) and aircraft operations in 2017
- Percentage of domestic and international enplanements who were visitors to the airport in 2017
- Percentage of enplanements who were connecting passengers in 2017
- Gross sales data for airport concessions for 2017

In addition to these data sources, the Massachusetts Office of Travel & Tourism (MOTT) provided information on expenditure patterns of visitors using Boston Logan as a gateway to Massachusetts. This information was used to develop estimates of spending per person for domestic and international visitors.

## Process for Estimating Direct Impacts

The process used to estimate direct employment, payroll, and output impacts for Boston Logan is described in the following sections. The direct impacts served as inputs to the IMPLAN model, which was used to estimate multiplier impacts.

### Direct Impacts of On-Airport Tenants

Direct employment impacts for on-airport tenants were updated using a combination of Massport data, the percentage increase in enplanements at the airport since 2013, and on-airport tenant employment data from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*.<sup>2</sup>



*Terminal E at Boston Logan International Airport*

Direct payroll impacts were updated based on data provided by Massport and adjustment of the average salary per category of employee (i.e., aviation-, government-, or concessions-related employee) from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update* using the Consumer Price Index (CPI).

Direct output impacts for on-airport tenants were updated using a combination of Massport data, CPI-adjusted data from the 2014 *Massachusetts Statewide Airport Economic Impact Study Update*, gross sales data for airport concessions, and the percentage increase in enplanements since 2013.

### Direct Impacts of Capital Improvement Projects

Massport provided expenditure data for capital improvement projects (CIP) for the 2015-2017 period, which was used to estimate direct employment and output impacts generated by on-airport construction projects. Associated employment impacts were estimated using Massachusetts-specific employment ratios per \$1.0 million of CIP output from the IMPLAN model, which was explained in Chapter 3. Payroll impacts were estimated based on the average salary for construction-related workers in Massachusetts in 2017 (\$54,900), which was obtained from the Bureau of Labor Statistics.

<sup>2</sup> The base year of the 2014 *Massachusetts Statewide Airport Economic Impact Study Update* was 2013.

## Direct Impacts of Commercial Service Visitors

Commercial service visitor expenditures (direct output) for Boston Logan were estimated using a methodology similar to that used for Massachusetts’ other commercial service airports (see Chapter 3). Massport provided calendar year 2017 domestic and international passenger enplanements and visitor percentages, which are presented in **Table B-1**. Average visitor spending per person for domestic and international visitors was estimated from data provided by MOTT. Employment and payroll impacts associated with commercial service visitor expenditures were estimated using the methodology explained in Chapter 3.

**Table B-1**  
**Enplanements and Visitors at Boston Logan International Airport**

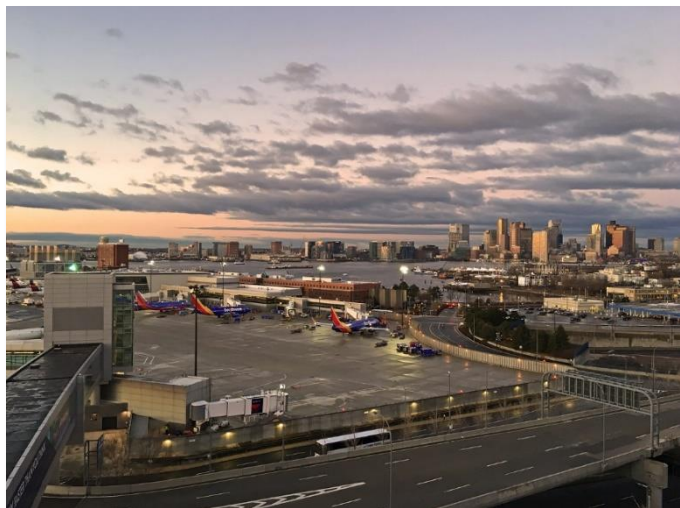
	2017 Enplanements	Percent Visitors	2017 Visitors
Domestic Passengers*	15,559,824	44%	6,447,182
International Passengers*	3,585,272	32%	982,264
<b>Total</b>	<b>19,145,096</b>	<b>42%</b>	<b>7,429,446</b>

Source: Massport

\* Visitor percentages and visitor numbers do not include connecting passengers.

## Direct Impacts of General Aviation Visitors

Direct impacts of visitors arriving at Boston Logan on general aviation aircraft were estimated using 2017 aircraft operations data provided by Massport and the methodology used for the other 38 study airports explained in Chapter 3.



*Terminal A with downtown Boston in the background*

## Multiplier Impacts

The Massachusetts-specific IMPLAN multipliers presented in Chapter 3 in Table 3-2 were applied to the direct impacts for on-airport tenants, CIPs, and commercial service and general aviation visitors to estimate multiplier impacts.

## Total Impacts

Total impacts were estimated by summing the direct impacts for on-airport tenants, CIPs, commercial service and general aviation visitors, and multiplier impacts.

## 2017 Economic Impacts of Boston Logan International Airport

**Table B-2** displays the 2017 economic impacts for Boston Logan International Airport, which were estimated using the methodology described above. The airport’s total annual output, including direct and multiplier impacts, is estimated at more than \$16.3 billion. Total employment generated by the airport is estimated at 162,266 jobs with a total annual payroll of nearly \$6.0 billion.

**Table B-2**  
**Economic Impacts of Boston Logan International Airport**

	Direct Impacts	Multiplier Impacts	Total Impacts
<b>Employment</b>			
On-Airport Tenants	13,850	8,493	22,343
Capital Improvement Projects	2,137	1,777	3,914
Commercial Service Visitors	85,781	49,711	135,492
<i>Domestic Visitors</i>	67,455	39,091	106,546
<i>International Visitors</i>	18,326	10,620	28,946
General Aviation Visitors	350	167	517
<b>Total Employment</b>	<b>102,118</b>	<b>60,148</b>	<b>162,266</b>
<b>Payroll</b>			
On-Airport Tenants	\$785,235,000	\$471,999,000	\$1,257,234,000
Capital Improvement Projects	\$117,321,000	\$88,302,000	\$205,623,000
Commercial Service Visitors	\$2,358,978,000	\$2,135,152,000	\$4,494,130,000
<i>Domestic Visitors</i>	\$1,855,026,000	\$1,679,017,000	\$3,534,043,000
<i>International Visitors</i>	\$503,952,000	\$456,135,000	\$960,087,000
General Aviation Visitors	\$9,625,000	\$7,975,000	\$17,600,000
<b>Total Payroll</b>	<b>\$3,271,159,000</b>	<b>\$2,703,428,000</b>	<b>\$5,974,587,000</b>
<b>Output</b>			
On-Airport Tenants	\$1,855,564,000	\$1,418,966,000	\$3,274,530,000
Capital Improvement Projects	\$276,070,000	\$261,709,000	\$537,779,000
Commercial Service Visitors	\$6,804,912,000	\$5,666,310,000	\$12,471,222,000
<i>Domestic Visitors</i>	\$5,351,161,000	\$4,455,801,000	\$9,806,962,000
<i>International Visitors</i>	\$1,453,751,000	\$1,210,509,000	\$2,664,260,000
General Aviation Visitors	\$23,107,000	\$18,834,000	\$41,941,000
<b>Total Output</b>	<b>\$8,959,653,000</b>	<b>\$7,365,819,000</b>	<b>\$16,325,472,000</b>

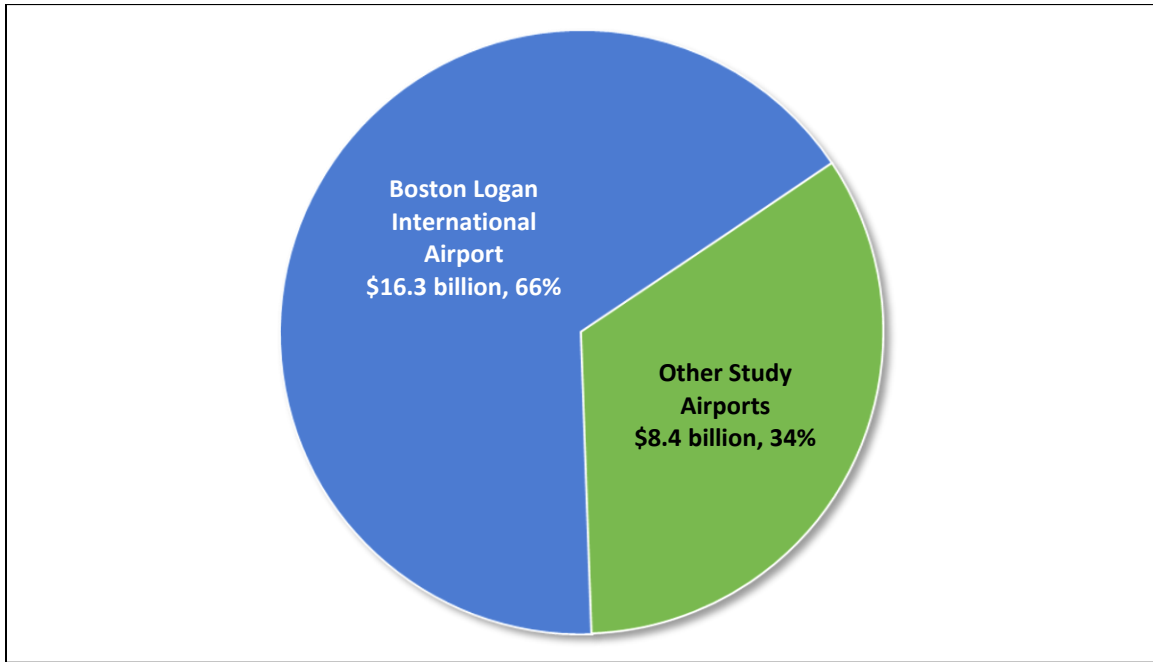
Source: CDM Smith and IMPLAN

## Summary

This study shows that Boston Logan International Airport continues to be a vital transportation hub and critical economic catalyst for Massachusetts. Total employment generated by the airport is estimated at 162,266 jobs earning a total annual payroll of almost \$6.0 billion. Total annual output exceeds \$16.3 billion. These impacts include direct and multiplier impacts.

**Figure B-1** illustrates Boston Logan International's economic contribution to the Massachusetts airport system. Of the \$24.7 billion in total annual output (including direct and multiplier impacts as well as military aviation at Hanscom Air Force Base, Westover Air Reserve Base, and Barnes Air National Guard Base) produced by the 39 public-use airports in the Commonwealth, Boston Logan contributes 66 percent.

**Figure B-1**  
**Contribution of Boston Logan International Airport to Total Statewide Annual Output**



Source: CDM Smith



*Terminal B at Boston Logan International*





## Introduction

The U.S. military has long enjoyed substantial support from Massachusetts, a tradition that dates back to the founding of the United States and continues to this day. The Commonwealth held a strategic location for the Revolutionary War in the 1700s, the World Wars of the 20<sup>th</sup> Century, and continues to be important for ongoing global conflicts. Massachusetts has historically been home to numerous military bases, camps, and forts, including those serving the U.S. Air Force, U.S. Army, U.S. Coast Guard, U.S. Marine Corps, and the U.S. Navy. Massachusetts has also historically been an important source of military personnel and has fulfilled a significant role in arms research, development, and production.

Today, military facilities in Massachusetts provide a substantial economic impact to the Commonwealth, including employment for residents, sales revenue for companies, and tax revenues for state and local governments. Many of these military facilities support aviation activities in addition to ground and maritime operations.

In fact, military aviation activities make one of the most significant contributions to the Massachusetts economy. Because the economic benefit of military aviation was included in the Massachusetts Department of Transportation Aeronautics Division's prior economic impact studies published in 2011 and 2014, it is important to include the same analysis in this study update. This facilitates a direct comparison between each study and allows for the tracking of impacts and growth over time. This appendix presents the economic impacts generated by the four major military air facilities in Massachusetts.



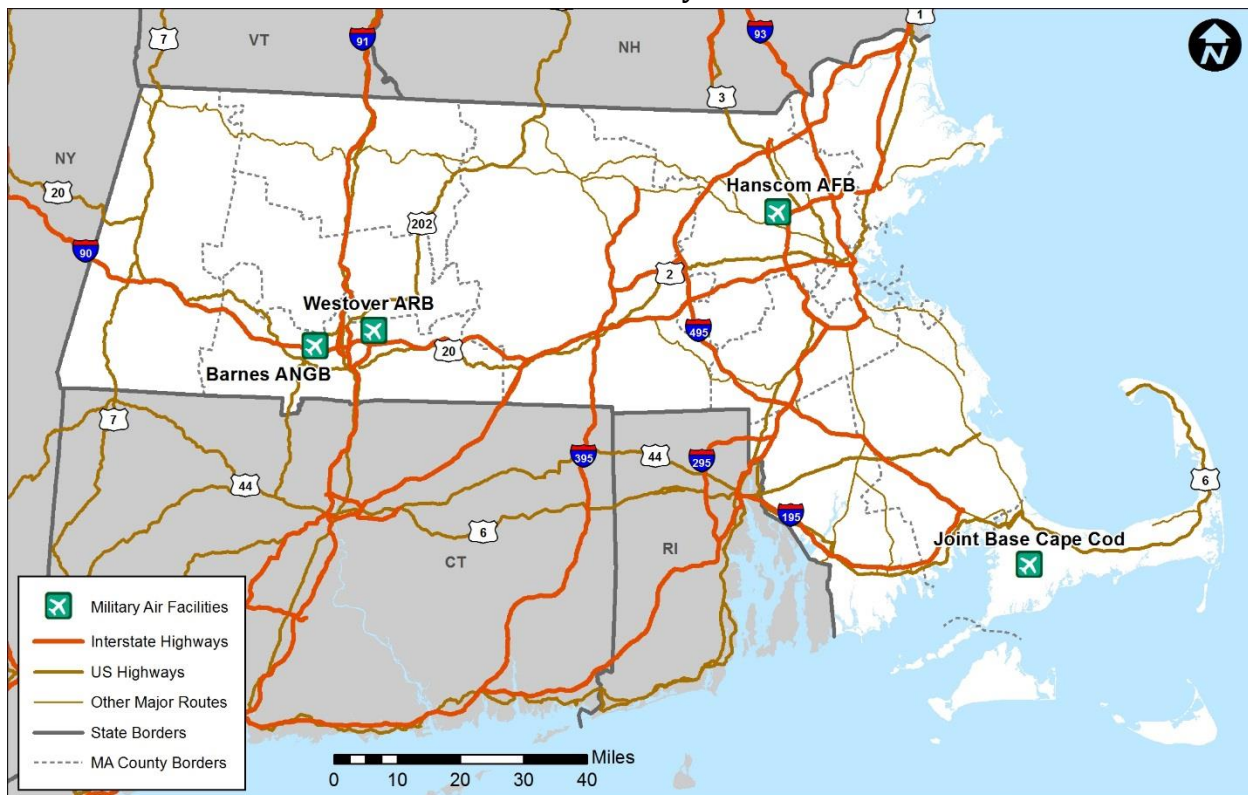
*Hanscom Air Force Base*

These facilities, shown in **Figure C-1**, include:

- Hanscom Air Force Base (AFB)
- Westover Air Reserve Base (ARB)
- Barnes Air National Guard Base (ANGB)
- Joint Base Cape Cod



**Figure C-1**  
**Massachusetts Military Air Facilities**



Source: CDM Smith

## Base Background Information

To provide context for the economic impacts presented later in this appendix, it is helpful to first provide profiles of the Commonwealth's four military air facilities. The following sections discuss background information about each of these facilities.

### *Hanscom Air Force Base*

Hanscom AFB is part of Laurence G. Hanscom Field, a joint-use facility that also accommodates general aviation activity. Located two miles outside of Bedford in Middlesex County, the airport has a total area footprint of 1,125 acres. The AFB has two runways: Runway 5/23 and Runway 11/29, which are 5,107 and 7,011 feet in length, respectively. Aircraft operations at Hanscom Field are supported by several advanced instrument approaches, including two instrument landing systems (ILSs).

### *Current Military Activities at Hanscom AFB*

Hanscom AFB is currently home to the 66<sup>th</sup> Air Base Group, part of the Air Force Life Cycle Management Center (AFLCMC), which is headquartered at Wright-Patterson AFB in Ohio. AFLCMC is itself part of the Air Force Materiel Command (AFMC).

Hanscom AFB is home to three Air Force Program Executive Offices (AFPEOs): Command, Control, Communications, Intelligence and Networks (C3I&N), Battle Management, and Nuclear Command, Control and Communications (NC3). C3I&N develops and deploys cyberspace, networks, cryptologic, and data links systems for combat operations. This AFPEO is responsible for more than 2,200 personnel and has a \$10.9 billion Future Years Defense Program (FYDP) portfolio. Battle

Management executes a \$19 billion FYDP acquisition portfolio of acquisitions, technology transition, and Foreign Military Sales programs, and employs over 3,500 airmen, government civilians, and support contractors. In 2018, Hanscom became the location of the NC3 AFPEO, which has a \$1.2 billion FYDP portfolio to provide survivable and endurable communications for the nation's nuclear enterprise. NC3 is also responsible for integrating over 60 nuclear command and control communications systems that support and enable nuclear deterrent operations.

In its current role, Hanscom AFB no longer accommodates conventional U.S. Air Force (USAF) flight activities. As a result, less than one percent of the more than 120,000 annual operations at Hanscom Field are by military aircraft.

Hanscom is also home to the Massachusetts Institute of Technology (MIT) Lincoln Laboratory, an advanced research and development (R&D) laboratory focused on developing and testing technologies for national security. The laboratory houses over 20 unique testing facilities and R&D centers, several of which are related to aviation. The Flight Test Facility at Lincoln Laboratory uses seven aircraft ranging in size from a Cessna 206 single-engine to a Boeing 707 to test the various airborne technologies developed at the laboratory. Such technologies include collision-avoidance tools, antennae prototypes, imagers for air surveillance, and long-range radio and laser communication systems. The

laboratory is home to the Autonomous Systems Development Facility (ASDF), a 17,000-square foot indoor testing space for ground-based, aerial, and underwater autonomous systems. The ASDF includes a complex system of motion-capture lasers to gain detailed information on tests. Drone and unmanned aircraft systems (UAS) tests at the ASDF are often done prior to large-scale outdoor



*MIT Lincoln Library at Hanscom AFB.*

testing. Staff at the Integrated Weather and Air Traffic Test Facility test prototype systems for air traffic control while also amassing weather data from over 150 next-generation radar (NEXRAD) systems. The latter is used to validate aviation weather algorithms so that hazardous weather conditions can be better detected by airports. Innovative air traffic control products developed at the laboratory include those related to collision avoidance, the Laser Aircraft Strike Suppression Optical System, a system that detects the source of laser beams to protect aircraft, and radar systems that help air traffic control in poor visibility conditions, among other innovations. In total, the Lincoln Laboratory employs approximately 3,950 persons.

### ***History of Hanscom AFB***

The history of Hanscom AFB began as the United States contemplated its entry into World War II. In May 1941, the Massachusetts Legislature authorized the purchase of a large tract of farmland bordering the towns of Bedford, Lincoln, Concord, and Lexington for a Boston Auxiliary Airport. Funds to build the new airport were contributed through the Development of Landing Areas for National Defense (DLAND) program. This federal program appropriated \$40 million for the purpose of building new airports across the United States to serve for future defense and post-war civil aviation.

Beginning in 1942, the Commonwealth of Massachusetts leased the Bedford airport to the War Department for use by the United States Army Air Forces. From 1942 to 1943, the 85<sup>th</sup> Fighter Squadron and the 318<sup>th</sup> Fighter Squadron trained at Bedford Army Air Field on the Curtiss P-40

Warhawk and eventually conducted combat missions against Axis forces in both North Africa and Europe. It was also during the war that the airport was renamed Laurence G. Hanscom Field in honor of a Massachusetts-born pilot and aviation enthusiast. Hanscom died in February 1941 from an aircraft accident in Saugus, Massachusetts while lobbying for the establishment of the airport at Bedford.

World War II unequivocally affirmed the essential military importance of radar, and the second major wartime activity at Bedford Army Air Field was the utilization of the base as a testing site for new radar sets developed by MIT's Radiation Laboratory. This served as a catalyst for the base's postwar role. In 1945, when the MIT and Harvard wartime laboratories were dissolved, the Army Air Forces aimed to continue some of their programs in radar, radio, and electronic research. It recruited scientists and engineers from the laboratories, and its new Air Force Cambridge Research Laboratories (AFCRL) took over MIT's test site at Hanscom Field. Hanscom emerged as the USAF's center for the development and acquisition of electronic systems. The base has also played a significant role in the development of a national high-technology area around Route 128.

By 1950, the USAF was working closely with MIT to develop a new air defense system for the continental United States. Expanding its facilities at Hanscom Field was a step towards accomplishing this massive project. The Commonwealth of Massachusetts agreed in 1952 to transfer land on the eastern side of the airport to the federal government and provide a renewable 25-year lease. The first buildings for the new MIT Lincoln Laboratory at Hanscom were completed approximately two years following the land acquisition. The airfield was revamped in 1953 with new hangars, headquarters, and facilities, and the USAF's electronic and geophysics laboratories began to occupy facilities in Bedford in 1954.

Several defense systems originated from Hanscom. In the early 1950s, the Lincoln Laboratory designed the "Cape Cod" experimental air defense system. In support of the fully operational system, Hanscom's 6520<sup>th</sup> Test Support Wing logged thousands of hours of flying time testing technological capability. The Semi-Automatic Ground Environment (SAGE) system, completed in the early 1960s, revolutionized air defense and accelerated advancements in air traffic control systems. As the SAGE system matured, the USAF pursued the development of a number of advanced command, control, and communications systems. In 1961, the Electronics System Division (ESD) began operations at Hanscom AFB, with the goal of consolidating the management of the USAF's electronic systems under one roof. In 1992, the ESD was renamed the Electronic Systems Center (ESC), by then part of the AFMC.

In June 2011, the Air Force Research Laboratory Sensors Directorate moved from Hanscom to Wright-Patterson AFB in Ohio and the Space Vehicles Directorate moved to Kirtland Air Force Base in New Mexico, closing more than 60 years of laboratory presence at Hanscom. The ESC was realigned in July 2012 and became a part of the newly-created AFLCMC at Wright-Patterson AFB. The mission program offices at Hanscom AFB remain an integral part of the evolving electronics technology community in the Boston area, consisting of educational institutions, private industry, and military research and development installations. Today, the base continues its leadership role in the development and acquisition of USAF command and control systems.

### ***Westover Air Reserve Base***

Westover ARB is the largest Air Force Reserve Base in the United States. The base is located in the communities of Chicopee and Ludlow approximately 10 miles northeast of Springfield, Massachusetts. Westover ARB is part of a joint-use military-civilian facility with Westover Metropolitan Airport. Aircraft operations at Westover ARB are supported by two runways: Runway 5/23 and Runway 15/33, which are 11,597 feet and 7,082 feet in length, respectively. Operations are



supported by several advanced instrument approaches including two ILSs. The total area of the facility, including military and civilian uses, is over 2,500 acres, making it the largest reserve base in the United States by land mass.

### ***Current Military Activities at Westover ARB***

Westover ARB is home to the 439<sup>th</sup> Airlift Wing of the Fourth Air Force, a numbered air force of the Air Force Reserve Command (AFRC). The mission of the 439<sup>th</sup> Airlift Wing is to provide worldwide air movement of troops, supplies, equipment, and medical patients. The 439<sup>th</sup> Airlift Wing operates 16 Lockheed Martin C-5B Galaxy airlifters. These aircraft provide the USAF with heavy airlift capabilities and intercontinental range. Westover ARB's long runways – particularly the 11,597-foot Runway 5/23, which is the third longest military runway on the east coast – allow for the C-5B Galaxy to operate out of the base. These runways were originally constructed to serve long-range nuclear bombers, while Runway 5/23 was also an alternative landing site for the NASA Space Shuttle.

The 439<sup>th</sup> Airlift Wing has been involved in every major military and humanitarian effort of the last 30 years. Its peacetime mission also includes recruiting, training, and supervision of personnel to ensure mission readiness. Military operations account for the majority of flights at Westover ARB. Out of the airport's more than 19,000 annual operations, approximately 10,000 are attributed to military activities.



*C-5 Galaxy Departs from Westover ARB*

### ***History of Westover ARB***

Westover Field was originally constructed with a \$750,000 Works Progress Administration project in 1939. The airport was designed to be the Northeast's premier Army Air Corps base in anticipation of the United States' potential entry into World War II. The groundbreaking and dedication ceremony occurred on April 6, 1940, when the new air base was named for Major General Oscar Westover, Chief of the Air Corps, US Army, who had died in September 1938 in an airplane accident. Major General Westover was a key advocate responsible for beginning the period of military aviation expansion that ultimately ended with the emergence of the USAF as a separate service branch.

During World War II, Westover Field served as a training base for fighters and bombers, a port of embarkation/debarkation, and an essential base for regional antisubmarine operations against German U-Boats. After the USAF became a unique entity in 1948, the base became Westover AFB and served as a staging point for the Berlin Airlift as well as a headquarters for the Military Airlift Command (MAC) system.

By 1955 and the advent of the Cold War, Westover became home to the Eighth Air Force and Strategic Air Command (SAC) units. For 19 years, these units flew B-52 nuclear bombers and KC-135 air refuelers. Westover was also a major USAF base of operations during the Korean War, Vietnam War, and throughout the Cold War, with bombers and tankers maintaining vigilance in anticipation of other "hot" wars. On May 19, 1974, the SAC turned the base over to the AFRC. Westover continues to operate as the world's largest Air Reserve Base and through its Tactical Wing is one of the country's two centers for C-5 Galaxy military transport aircraft.

BRAC recommendations in 2005 called for the creation of a new Armed Forces Reserve Center at Westover. Specifically, units displaced by other BRAC recommendations have been relocated to the new Reserve Center at Westover, including units from the MacArthur United States Army Reserve Center in Springfield, Massachusetts, the United States Army Reserve Area Maintenance Support Activity in Windsor Locks, Connecticut, and the Malony United States Army Reserve Center on Devens Reserve Forces Training Area. According to the DoD, this recommendation would support the Army Reserve's Command and Control restructuring initiative to reduce Regional Readiness Commands from 10 to four by closing one major peacetime administrative headquarters and creating a new deployable headquarters on Westover ARB.

### ***Barnes Air National Guard Base***

Westfield-Barnes Regional Airport is a joint-use, military-civilian facility located in Hampden Plains on the northern side of Westfield, Massachusetts. Westfield-Barnes Regional Airport hosts Barnes Air National Guard Base (ANGB). Aircraft operations at the airport and base are supported by two runways: Runway 2/20 and Runway 15/33, which are 9,000 and 5,000 feet in length, respectively. The airport is also equipped with several advanced instrument approaches, including multiple ILSs. The airport's total area, including both civilian and military operations, covers 1,200 acres.

### ***Current Military Activities at Barnes ANGB***

Barnes ANGB is the home of the 104<sup>th</sup> Fighter Wing of the Massachusetts Air National Guard, whose mission is to provide operational military forces, including combat-ready F-15 aircraft and support elements, for peacetime operations. The operational combat arm of the 104<sup>th</sup> Fighter Wing is the 131<sup>st</sup> Fighter Squadron, which provides combat ready pilots to perform air sovereignty and alert missions for air defense of the northeastern United States. Westfield-Barnes Regional Airport is also home to the Army National Guard 226<sup>th</sup> Division - Army Aviation Support Battalion.

### ***History of Barnes ANGB***

In 1923, a group of influential businessmen from Westfield and nearby Holyoke set out to build an airport in the region. With the assistance of both the Westfield and Holyoke Chambers of Commerce, this group led construction of Westfield Aviation Field on lands effectively donated by local businessman Vincent E. Barnes for that use. The 27-acre airport was officially dedicated on October 12, 1923. As the field gained activity, Mr. Barnes subsequently contributed additional parcels for aviation use that ultimately totaled approximately 351 acres. During the 1930s, the City of Westfield purchased the airfield from the chambers of commerce and voted to rename the airport Barnes Municipal Airport, in honor of the property owner who had originally provided the land.



*F-15 Eagle departing Barnes ANGB*



During World War II, the airport served as a fighter training base for regional enlistees. With the national establishment of the Air National Guard following the war in 1946, Barnes received its first Air National Guard unit flying P-47 Thunderbolt aircraft. Upon the extension of Runway 2/20 from 5,000 to 7,000 feet, the unit began using the P-51 Mustang, followed by its first jet aircraft, the F-94 Starfire. Advances in aircraft ultimately resulted in improvements to the airfield, including the extension of Runway



*F-15 fighter jet of the 104<sup>th</sup> Fighter Wing at Barnes ANGB.*

15/33 to 5,000 feet, the establishment of improved NAVAIDs (including a VORTAC and an ILS), as well as an air traffic control tower in 1974 that eased congestion at the airport.

The DoD's 2005 BRAC recommendations called for the re-assignment of the A-10s from the 103<sup>rd</sup> Fighter Wing at Bradley International Airport and ANGB in Windsor Locks, Connecticut to the 104<sup>th</sup> Fighter Wing at Barnes ANGB. The DoD also recommended the closure of Otis Air National Guard Base, which created the need to establish a new Air Sovereignty Alert site for the Air Force in the region. Due to its lower costs and higher military value, Barnes was selected over competitors such as Bradley International Airport, a joint use civilian-military facility in Connecticut.

### ***Joint Base Cape Cod***

Joint Base Cape Cod (JBCC) is a military training facility located on the upper western portion of Cape Cod, immediately south of the Cape Cod Canal in Barnstable County, Massachusetts. It includes parts of the towns of Bourne, Mashpee, Sandwich, and abuts the town of Falmouth. The installation covers about 22,000 acres, or approximately 30 square miles. The facility has two runways: Runway 5/23 at 8,000 feet in length and Runway 14/32 at 9,500 feet in length. Operations at the base are supported by several high-level instrument approaches including two ILSs.

#### ***Current Military Activities at Joint Base Cape Cod***

JBCC consists of several individual military bases and encampments: Otis ANGB, Camp Edwards, Cape Cod Air Force Station, and Coast Guard Air Station Cape Cod, among other smaller installations. Together, these bases are home to several military commands. Camp Edwards is home to the Massachusetts ANG and the Massachusetts National Guard Regional Training Institute. Otis ANGB also has a Massachusetts ANG command, in addition to the 102<sup>nd</sup> Intelligence Wing, ANG and the 253<sup>rd</sup> Combat Communications Group. Coast Guard Air Station Cape Cod (ASCC) is home to the 6<sup>th</sup> Space Warning Squadron and a maritime Coast Guard unit.

Commands at JBCC conduct a wide array of missions and training operations. The current mission of the 102<sup>nd</sup> Intelligence Wing, formerly an F-15 flying unit, is to provide worldwide precision intelligence and command and control, as well as training experienced airmen for expeditionary combat support and homeland security. ASCC is the only Coast Guard aviation facility in the northeast and operates both MH-60T Jayhawk helicopters and HC-144A Ocean Sentry fixed-wing aircraft to patrol the coasts of New England. The 6<sup>th</sup> Space Warning Squadron at Cape Cod Air Force Station uses the Precision Acquisition Vehicle Entry Phased Array Warning System radar to protect the eastern United States and Canada against sea-launched and intercontinental ballistic missiles, while also tracking low orbiting objects such as satellites and the International Space Station to watch for

deviating orbits. The mission of the Army Air National Guard 126<sup>th</sup> Aviation Regiment, the 3<sup>rd</sup> Battalion of which is located at Camp Edwards, is to perform both air assault and air movement operations and provide command and control support.

### *History of Joint Base Cape Cod*

The military use of the area that now houses JBCC dates back to 1911. During World War II, the installation was used as a National Guard training camp with a primary mission of providing training and housing to military units. It was federalized in 1940 in preparation for World War II. The US Army built and operated Camp Edwards on the installation between 1940 and 1946 for Army training and maneuvers, military aircraft operations, maintenance, and support. The war also produced the airfield on the facility that was designated as Naval Auxiliary Air Facility Otis, a subordinate field for Naval Air Station Quonset Point in Rhode Island.

The USAF operated the airfield as Otis Air Force Base from 1955 through 1972. The base functioned as a key Aerospace Defense Command center during the Cold War. In 1973, the USAF base was closed and later reopened as Otis ANGB and the Coast Guard Air Station Cape Cod, which share the facility. Until 2013, the joint base was known as the Massachusetts Military Reservation. Renaming it JBCC was done to place more emphasis on the base's joint partnership and training efforts.



*Cape Cod Air Force Station*

JBCC played a key role during the terrorist attacks of September 11, 2001. When American Airlines Flight 11 was hijacked, the Federal Aviation Administration contacted Otis ANGB. The base sent out F-15 fighters towards New York City in an attempt to intercept the plane.

As noted above, the DoD originally called for the closure of Otis ANGB in its 2005 BRAC recommendations, but the facility was spared in last minute decisions. However, the 102<sup>nd</sup> Fighter Wing lost its fleet of F-15 Eagles and transitioned to a non-flying mission, re-designated as the 102<sup>nd</sup> Intelligence Wing.

## **Methodology for Estimating Economic Impacts**

To estimate the economic impacts for the military air facilities, base public affairs offices were contacted to collect data. In some cases, a base had a recently completed economic impact study, which was used to the extent possible in this analysis.<sup>1</sup> For other bases, a survey similar to the surveys sent to airport sponsors and airport tenants as described in Chapter 3 was used to collect information.

In addition to these data sources, the economic impacts generated by the military air facilities were measured by using data from the Impact Analysis for Planning (IMPLAN) input-output model that

<sup>1</sup> Data from existing economic impact studies were used for Hanscom AFB and Westover ARB.

estimates purchases and sales between various sectors of the economy.<sup>2</sup> The model incorporates multipliers and data tables specific to Massachusetts and provides three measures of economic impact, which are expressed as three related types of economic impact. The measures of economic impact include the following:

- **Employment** – Employment is based on the total of full-time jobs plus part-time jobs. For example, two part-time employees were assumed to equal one full-time job, and three part-time reservists are equal to one full-time job.
- **Payroll** – Payroll represents the costs associated with the annual salary, wages, and benefits earned by all aviation-related employees at the military air facilities, both military and civilian.
- **Output** – Output includes expenditures associated with each military air facility, such as construction costs, service contracts, materials, equipment, supplies, and procurement.

It is important to note that payroll and output cannot be combined because elements of economic benefit related to payroll are also contained, to some extent, in the output estimate. Each of the three impact measures (employment, payroll, and output) stand alone as part of the quantification of a base's total economic impact.

The IMPLAN model expresses the three measures of economic impact as three types of economic impact, which are as follows:

- **Direct Impacts** – Direct impacts account for the initial point where the money from the day-to-day operation of each military air facility enters the economy. Direct impacts include the employment, payroll, and output of each military air facility.
- **Multiplier Impacts** – Multiplier impacts result from the re-circulation and re-spending of direct impacts within the economy. Multiplier impacts were estimated using the IMPLAN model.<sup>3</sup>
- **Total Impacts** – Total impacts are the sum of all direct and multiplier economic impacts attributable to the military air facilities.

Capital improvement impacts associated with capital improvement projects (CIPs) were estimated for the military air facilities without an existing economic impact study. The same methodology used to estimate CIP impacts at the study airports was followed (see Chapter 3). This methodology consisted of the following steps:

- The CIP data provided by bases for the period 2015 to 2017 was averaged to avoid showing peaks or troughs in capital project activity. This average CIP expenditure was used as the CIP direct output for the base.
- Direct employment related to this construction impact was determined through the use of the IMPLAN model. The IMPLAN model indicates that every \$1 million in CIP-related expenditures supports approximately 7.7 jobs in Massachusetts. These jobs include construction workers, equipment operators, foremen, engineers, architects, and managers.
- Data from the U.S. Bureau of Labor Statistics was used to calculate the average annual pay and benefits for these jobs at approximately \$54,900.

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<sup>2</sup> A more detailed discussion of the IMPLAN input-out model can be found in Chapter 3.

<sup>3</sup> See Chapter 3 for a more detailed discussion of multiplier impacts.

## Military Employment, Payroll, and Output Impacts

In addition to playing vital roles in national defense, the military air facilities in Massachusetts make substantial contributions to the Commonwealth's economy. **Table C-1** identifies the total economic impacts at these facilities, which include both direct and multiplier impacts. Military aviation supports 23,546 total jobs with an associated total annual payroll of more than \$651.6 million in Massachusetts. Total annual output approaches \$6.4 billion. Hanscom AFB is responsible for the majority of these impacts, contributing 17,344 total jobs and more than \$6.0 billion in total annual output to the Massachusetts economy.

**Table C-1**  
**Total Impacts of Massachusetts Military Air Facilities**

Military Air Facility	Total Employment	Total Payroll	Total Output
Hanscom AFB	17,344	\$393,836,000	\$6,030,000,000
Westover ARB	4,384	\$161,257,000	\$212,534,000
Barnes ANGB	1,519	\$85,742,000	\$104,359,000
Joint Base Cape Cod	299	\$10,800,000	\$28,969,000
Total	23,546	\$651,635,000	\$6,375,862,000

Source: CDM Smith, Base Public Affairs Offices, and IMPLAN

## Summary

Hanscom AFB, Westover ARB, Barnes ANGB, and the aviation-related activities at Joint Base Cape Cod are significant sources of jobs, payroll, and economic output in Massachusetts. The direct, multiplier, and total economic impacts generated by these military air facilities in 2017 are presented in **Table C-2**. As shown in Table C-2, when direct and multiplier impacts are summed, military aviation in the Commonwealth:

- supported 23,546 jobs,
- produced more than \$651.6 million in total annual payroll, and
- generated over \$6.3 billion in total annual output.

**Table C-2**  
**Economic Impact Summary for Massachusetts Military Air Facilities**

	Direct Impacts	Multiplier Impacts	Total Impacts
Employment	14,481	9,065	23,546
Payroll	\$490,403,000	\$161,232,000	\$651,635,000
Output	\$4,554,479,000	\$1,821,383,000	\$6,375,862,000

Source: CDM Smith, Base Public Affairs Offices, and IMPLAN



## **Barnstable Municipal Airport-Boardman/Polando Field (HYA)**

Over the last ten years, the FAA, MassDOT, and Barnstable Municipal Airport have made significant strategic investments into airport infrastructure, which has helped position the airport for future economic growth while enhancing airfield safety. Specifically, with the new airport terminal building, HYA has been able to attract JetBlue to provide seasonal service from New York to Cape Cod. Additional successes at the airport include the airport solar farm, which provides non-aviation related revenues and addresses sustainability concerns for the airport and the Cape. HYA is a vital transportation hub for Cape Cod and the region.

## **Beverly Regional Airport (BVY)**

Beverly Regional Airport is going through a substantial growth period since the construction of the new airport administration building and ownership change of the airport's fixed base operator. BVY has seen an increase of 22 percent in total aircraft operations to over 53,000 between 2014-2017 and an increase of 31 percent in total IFR operations to over 5,400 annually during that same period. Numerous large employers in the area, including those based at Cherry Hill Industrial Park, base their business jets or use air charter operators at the airport. BVY has a strong working relationship with its tenants in promoting the airport and educating community leaders.

## **Boston Logan International Airport (BOS)**

Boston Logan is the largest airport in New England and the 16<sup>th</sup> busiest airport in the United States. The airport is served (including new expected service in 2019) by 13 domestic and 31 international airlines that provide non-stop service to 76 destinations in the United States and 58 international destinations throughout the Americas, Asia, Europe, Africa and the Middle East. The airport is also served by express package and all-freight cargo carriers. This breadth of commercial and cargo service is essential to connecting New England with the nation and the world. Boston Logan also connects national and international travelers with the many premier attractions and amenities of Boston, Massachusetts and New England, including historic sites, museums, Cape Cod and the Islands, the Berkshires, the region's higher education institutions, and world-class health care facilities.

An example of Boston Logan's continuing contribution to the local economy is the recently completed \$200 million renovation to Terminal B. The Terminal B Optimization Project includes approximately 84,000 square feet of new terminal area and the renovation of approximately 81,000 square feet of the existing building. The new features of the Terminal include a consolidated security checkpoint, connection of Terminal B gates post security, enhanced passenger holdrooms, and new concessions options. Keeping with the culture of the surrounding neighborhoods and of the New England region as a whole, Boston Logan continues to promote unique dining and shopping options for the traveling public. The new concessions program at Terminal B includes local eateries such as Kelly's Roast Beef and Lucca Restaurant & Bar. Other new airport-wide concessions to open include: North End Deli and Italian Market; Monica's Mercato; OTTO Pizza; Shōjō Boston; Tasty Burger; Temazcal Tequila Cantina; Wow Bao; and MAC Cosmetics.



## **Cape Cod Airport (2B1)**

Cape Cod Airport is a historic airfield located in Marstons Mills. Given the location and ease to watch aircraft operations, many family members bring their young children to the airport to witness aviation first hand. This is a fantastic way to introduce young people to the world of aviation. Aviation activities at the airport include banner towing and bi-plane scenic rides.

## **Chatham Municipal Airport (CQX)**

Chatham Municipal Airport is a community transportation asset focused on supporting the region and tourism of Cape Cod. The CQX staff share their love for Chatham with all who use the airport. Cape Cod Flying Circus at CQX offers loaner bicycles free of charge to pilots that fly in so that they can enjoy the local bike path that winds around the runway and ends downtown at Chatham's town center. CQX has an intern program with Monomoy High School which enhances a partnership with the community and assists with workforce development.

## **Cranland Airport (28M)**

Cranland Airport is a privately-owned, public-use airport located in southeastern Massachusetts. The airport has an excellent relationship with their local Experimental Aircraft Association Chapter and regularly hosts pancake breakfasts on Sunday mornings. This family-friendly activity introduces young children to the world of aviation.

## **Falmouth Airpark (5B6)**

Falmouth Airpark is a gateway to the beaches, trails, and lakes surrounding the area. Boston MedFlight and the Massachusetts State Police Air Wing frequently use the airpark for training and missions. Numerous business clients fly into Falmouth Airpark to conduct work at Joint Base Cape Cod and Woods Hole Oceanographic Laboratory. The airpark recently partnered with a fuel company to use an FAA-approved, environmentally-friendly, lead-free, 94-octane aviation gasoline.

## **Fitchburg Municipal Airport (FIT)**

Fitchburg Municipal Airport recently opened its new airport administration building, which was part of MassDOT Aeronautics Division's Statewide Airport Administration Building Program. FIT is strategically located near Devens Industrial Center, which attracts users to the airport conducting business-related activities at the numerous companies based at the Center. Unitel, the regional power company for various communities in central Massachusetts, uses FIT for staging emergency equipment in the event of natural disasters. FIT was a primary launching point several years ago for local and state leaders during a major ice storm that crippled the region for two weeks.

## **Gardner Municipal Airport (GDM)**

Given fiscal constraints at Gardner Municipal Airport, the Gardner Airport Commission does not have a paid airport manager to run the facility. Because of their passion for aviation and the airport, volunteers at GDM maintain the airfield and keep the airport open. The volunteers cut grass and do snow plowing in the winter. GDM is used by various Massachusetts-based companies and organizations that conduct aeronautical research and development at the airport. In addition, the Massachusetts Army National Guard conducts various military training activities with Blackhawk helicopters.

## **Harriman-and-West Airport (AQW)**

Harriman-and-West Airport is home to several regional businesses that support aviation throughout the Northeast. Turboprop East and Col-East International use the airport daily for their aircraft maintenance activities and aerial photography business. "Movie Night" and "Pop Cares" events at the airport each summer are primary community outreach activities. Currently there are more than six major development projects in the area that are underway or proposed with a high degree of certainty of becoming a reality. Each developer stated the existence of an airport so close to their projects, and the obvious continued improvements of the airfield, were important considerations to select this area for development.

## **Hopedale Industrial Park Airport (1B6)**

The airport is located within Hopedale Industrial Park near Interstate 495. There are approximately 15 businesses in the industrial park, which attract customers to the airport for their transportation needs. National Grid, a major utility company in New England, operates helicopters from the airport to conduct utility infrastructure inspections four to five times a month.

## **Katama Airpark (1B2)**

Katama Airpark is a public-use, turf runway airport on the island of Martha's Vineyard. The airport is located adjacent to the beach, attracting visitors and beachgoers from throughout the Northeast. In addition, the airport has a locally recognized restaurant attracting residents and visitors for breakfast and lunch who are able to watch airplanes while they dine. The airport also offers scenic bi-plane tours of the island.

## **Laurence G. Hanscom Field (BED)**

Owned and operated by the Massachusetts Port Authority, Laurence G. Hanscom Field is strategically located 15 miles outside of Boston and adjacent to Interstate 95/128. It is the busiest general aviation airport in New England, supporting business aviation and the military. BED is a gateway for numerous sports team charters for all major professional and college sporting events in the Boston area. The tenants of BED support various non-profit charities such as Angel Flight Northeast and Pilots N Paws. Boston MedFlight has their air ambulance operation headquarters based at the airport.

## **Lawrence Municipal Airport (LWM)**

Besides being a key gateway for aviation activities in northeastern Massachusetts, Lawrence Municipal Airport has been the site for various movie sets and music videos. LWM is used by the Department of Defense and Department of Homeland Security as a test site for various new technologies. The airport management team has established a strong partnership with the economic development teams of Lawrence, Haverhill, and North Andover. The economic development arms of Lawrence, Haverhill, and North Andover market the airport as a key transportation infrastructure asset to support economic growth in the region.

## **Mansfield Municipal Airport (1B9)**

Mansfield Municipal Airport recently completed their new airport administration building as part of MassDOT's Statewide Airport Administration Building Program. This strategic investment at 1B9 has resulted in a new airport restaurant leasing space in the building and a new flight school. Airport management and the Mansfield Airport Commission are focused on educating the community that 1B9 is a transportation asset, economic engine, and recreational facility for all. 1B9 hosts their annual

Touch-a-Truck Program for area schools and works closely with special needs children visiting the airport. Boston MedFlight recently opened their fourth facility in Massachusetts at 1B9, providing air ambulance services to the region.

## **Marlboro Airport (9B1)**

Due to extenuating circumstances at Marlboro Airport, the privately-owned, public-use airport is for sale and expected to be redeveloped for residential use. However, the airport is still an important transportation facility providing access for visitors to the Massachusetts Emergency Management Agency (MEMA) Headquarters, New England Sports Center, and Best Western Conference Center. The airport hosts their Annual Open House, which brings in 2,000 attendees to experience aviation. The airport is also very active with the Marlborough High School Real World Design Challenge Team.

## **Marshfield Municipal Airport – George Harlow Field (GHG)**

Marshfield Municipal Airport-George Harlow Field and the community have significantly benefited from investments through public-private partnerships. The FAA, MassDOT, and Town of Marshfield invested monies into airside and landside infrastructure to enhance safety, the environment, and the local economy. GHG hosts their annual Marshfield Safety Day, which has resulted in a strong working relationship with Town Departments including Police, Fire, Harbormaster, Conservation Commission, and Town Planner. In fact, the Marshfield Police Department has used aircraft from the airport to assist with aerial support when the Massachusetts State Police Air Wing was unavailable. The airport management team at GHG reaches out regularly to area schools hosting airport tours and introducing students to various careers in aviation. Workforce development is an important priority at GHG.

## **Martha’s Vineyard Airport (MVY)**

Martha’s Vineyard Airport is an essential gateway for tourism, public safety, and economic development activities on the island. MVY has several airlines operating at the airport including Cape Air, Jet Blue, Delta and American, providing year-round and seasonal airline service. Major aircraft charter and fractional ownership companies use MVY for their clients and frequently use the entire apron for aircraft parking in the summer. Within the airport’s property, the MVY Business Park houses over 40 businesses and supports hundreds of jobs on the island.

## **Minute Man Air Field (6B6)**

Minute Man Air Field is a privately-owned, public-use airport with 70 based aircraft located in central Massachusetts. 6B6 is an essential part of the region, boosting the economy, serving the community, and nurturing the environment since 1969. With strategic MassDOT investment into the airside infrastructure, the private sector has invested significant monies into new hangars at the airport. The airport management team at 6B6 understands the importance of workforce development for the aviation industry. National Aviation Academy recently relocated to the airport and is training over 100 students to become aircraft maintenance technicians. The local Experimental Aircraft Association Chapter hosts the Young Eagles Program, flying several hundred students for free each year and introducing them to aviation.

## **Myricks Airport (1M8)**

Myricks Airport is a small general aviation airport with a single turf runway. The field provides short/soft/turf runway flight training opportunities, which are not available in the local area. The airport provides an aesthetically pleasing landscape, which is listed by the Town of Berkley as the most desirable conservation area to preserve. Many people in the community use the airport grounds for recreational activity. Tailwheel, experimental, and antique aircraft based at Myricks help generate interest in aviation. In addition, Myricks Airport is used as the staging area for police training and real-world search and rescue operations in southeastern Massachusetts.

## **Nantucket Memorial Airport (ACK)**

Nantucket Memorial Airport is a major transportation asset on the island and has several airlines providing seasonal and year-round service, including Cape Air, Rectrix Shuttle, JetBlue, American, United, Delta, and Tradewinds Aviation. ACK is served by numerous aircraft charter companies and fractional ownership companies such as NetJets, Wheels Up and PlaneSense. Since Nantucket is known as the "Grey Lady" for its preponderance of foggy days, ACK recently partnered with Elbit Systems to facilitate their testing of Enhanced Vision System equipment to improve aviation safety in hopes of aiding development of future deployable technologies.

## **New Bedford Regional Airport (EWB)**

New Bedford Regional Airport is a commercial service airport located on the Southeast Coast providing year-round airline service by Cape Air to Martha's Vineyard and Nantucket. Not only is Bridgewater State University's flight school located at EWB, the airport offers internships to help aviation management students acquire real world experience managing an airport.

## **Northampton Airport (7B2)**

At Northampton Airport, one of the flight school's priorities is introducing youth to the world of aviation. Northampton Aeronautics offers youth programs including Northampton Airport Wright Flight and weeklong summer aviation camps. These programs are designed to give children an opportunity to learn about aviation through education and flight. Volunteer instructors share their time and expertise educating middle schoolers in the area. In addition, Northampton Aeronautics hosts Movie Night Fridays which run from May to September.

## **Norwood Memorial Airport (OWD)**

Norwood Memorial Airport is strategically located 23 miles outside the City of Boston and is an important transportation gateway for general aviation activity in the region. The airport is a facility uniquely qualified to support helicopter operations and is frequently used by medical evacuations coordinated through the Norwood Fire Department and Boston MedFlight. In addition, helicopters operated by three Boston news stations are based at OWD along with a company that provides aerial videography for the motion picture industry.

## **Orange Municipal Airport (ORE)**

Jumptown, a New England skydiving operation based at Orange Municipal Airport, attracts thousands of visitors/skydivers from all over the Northeast to experience a unique and exhilarating aviation activity. In addition, the airport is located two miles from the Orange Innovation Center, which is home to 51 technology-focused businesses. Clients for businesses located at the Orange Innovation Center periodically use the airport to attend meetings and events.

## **Pittsfield Municipal Airport (PSF)**

Pittsfield Municipal Airport is strategically located in central Berkshire County and is home to a large-scale aircraft charter company, Lyon Aviation. Lyon Aviation provides aircraft charter operations across the world and bases twelve business jets at PSF with over 70 full time employees. PSF supports military and law enforcement aviation activities, as the Massachusetts and Connecticut Army National Guard Aviation Units and Massachusetts State Police Air Wing frequently use the airport for helicopter training and missions.

## **Plum Island Airport (2B2)**

Plum Island Airport is a small general aviation airport located on the North Shore of Massachusetts. The airport sits on conservation-protected property and is a natural resource for the community. Each year the airport holds a music festival/porch party called PlumFest. This is a community-based event used to show the natural beauty and artistic culture of the island. During this event, the airport opens itself to the public to serve as a parking venue for visitors wishing to partake in the festivities.

## **Plymouth Municipal Airport (PYM)**

Plymouth Municipal Airport is a large general aviation airport with numerous general aviation tenants. In the summer of 2016, Cape Cod Community College started their FAA Certified Aviation Maintenance Technology Program at the airport. To date the program has graduated two classes for a total of approximately 40 FAA Certified Aircraft and Powerplant Technicians. These students are being hired by local maintenance shops as well as airlines around the country. The airport is proud to be the home for such an amazing program that is creating jobs for students in a field that currently has a worldwide shortage.

## **Provincetown Municipal Airport (PVC)**

Provincetown Municipal Airport is located on Cape Cod and provides year-round airline service to Boston and seasonal airline service to White Plains, New York, by Cape Air. During the summer and shoulder months, numerous aircraft charter and fractional ownership companies such as Wheels Up, PlaneSense, and NetJets use the airport. With PVC situated within the Cape Cod National Seashore, it is a key gateway for tourism in the area. The airport is also used for business, personal travel, and by various whale watching aircraft that track migration routes and whale counts.

## **Southbridge Municipal Airport (3B0)**

With the recently completed airport administration building and renovated airport restaurant, aviation enthusiasts and the general public are frequently visiting Southbridge Municipal Airport. Several businesses and organizations use the airport including Hyde Industrial Blade Solutions, Southbridge Isle, Sturbridge Village, Brimfield Flea Market, and Southbridge Conference Center. The airport management team continues to engage the public and aviation enthusiasts by hosting events at the airport such as the AOPA Rusty Pilots Program. The Friends of Southbridge Airport organization, whose mission is to promote the airport, schedule events such as the annual Holiday Party, assist with airport-wide cleanup projects, and coordinate fundraising activities, has been resurrected after a ten year absence.

## **Spencer Airport (60M)**

Spencer Airport is a privately-owned, public-use airport located in central Massachusetts. The airport is a gateway for recreational enthusiasts visiting Sturbridge Village, hiking on the Appalachian Trail,



crewing on Lake Quinsigamond, and skiing on Mount Wachusett. In addition, the Massachusetts State Police and Civil Air Patrol periodically use the airport for training and rescue missions.

## **Sterling Airport (3B3)**

Sterling Airport is a privately-owned, public-use airport that is home to the Greater Boston Soaring Club. There are nearly 40 based gliders at the airport. The airport management team encourages a strong community partnership through hosting events such as the Sterling Fair and Orange Drag Race Reunion. Transient aircraft use Sterling Airport to visit Mount Wachusett Ski Resort and various equestrian facilities in the area.

## **Tanner-Hiller Airport (8B5)**

Tanner-Hiller Airport was recently purchased by G&C Group USA Inc., a company specialized in the field of general aviation industries, investment into flight school management and general aviation airports. The company will provide flight instruction on fixed-wing and rotary-wing aircraft at the airport after renovation. The new airport management team is focused on recreational opportunities at the airport and partnering with the region. Camping areas with river access for canoeing and kayaking are available adjacent to the airport.

## **Taunton Municipal Airport (TAN)**

Taunton Municipal Airport partners with various educational organizations and non-profit groups focused on workforce development. Examples include supporting the ROTC Program at Taunton High School, partnering with Taunton Technical Academy Graphics Department in developing brochures for the airport's upcoming 100<sup>th</sup> year anniversary, and coordinating internships with Bridgewater State University for airport management students at the airport.

## **Turners Falls Airport (0B5)**

Turners Falls Airport has a strong partnership with Franklin County Technical Academy, which is located adjacent to airport property. Students from the school conduct weekly airport inspections and complete electrical repairs to the windsock and runway lights. In addition, these students assist with the maintenance of airport grounds. This not only provides the students with real world experience in their career choice but also lowers the operating costs for the airport. In addition, the airport hosted an Egg Drop experiment with the science and physics classes at Turners Falls High School.

## **Walter J. Koladza Airport (GBR)**

Walter J. Koladza Airport is truly a community airport that supports and partners with various non-profit organizations in hosting fundraising events at the airport. This includes partnerships with Great Barrington Rotary Club, Berkshire South Community Center, and other local groups. GBR also works closely with the Berkshire School, establishing a STEM-based program that introduces students to aviation. Flight instructors from Berkshire Aviation teach weekly ground school classes at the Berkshire School, and students can complete 10 to 12 hours of flight time at the airport.

## **Westfield-Barnes Regional Airport (BAF)**

Westfield-Barnes Regional Airport provides an excellent example of a successful public-private partnership stimulating economic development. Gulfstream Aerospace invested over \$20 million in a new 100,000 square-foot hangar and added 100 new aircraft maintenance technician jobs to an

existing workforce of over 130 employees. MassDOT invested \$3 million in airside infrastructure improvements for the project. This successful partnership fostered the creation of the Westfield Technical Academy Aircraft Maintenance Program which includes nearly 70 high school students training to become FAA certified aircraft maintenance technicians.

## **Westover Air Reserve Base/Metropolitan Airport (CEF)**

Westover Metropolitan Airport is a military/civilian joint-use airport located at Westover Air Reserve Base. The airport is home to several corporate flight departments and offers scheduled charter flights to Atlantic City, New Jersey. The airport also supports the aircraft of United Nations members during the annual United Nations meeting in New York. The Massachusetts State Police Air Wing has their western Massachusetts base located at the airport.

## **Worcester Regional Airport (ORH)**

Since Massport took ownership of Worcester Regional Airport in 2010, numerous airlines have successfully started commercial service including JetBlue, American, Delta, and Rectrix, which has resulted in over 600,000 passengers using the airport. With the growth of passenger service at ORH, Massport has invested over \$100 million since taking ownership, including the strategic investment in a Category III Instrument Landing System in 2018.



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 Aircraft Owners and Pilots Association (AOPA)  
 Massachusetts Port Authority (Massport)  
 National Business Aviation Association (NBAA)

**Photo Credits:**

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