

Massachusetts

Massachusetts Statewide Airport Economic Impact Study Update **TECHNICAL REPORT**



MASSACHUSETTS STATEWIDE AIRPORT ECONOMIC IMPACT STUDY UPDATE

DECEMBER 2014

Prepared for:

**MASSACHUSETTS DEPARTMENT OF
TRANSPORTATION AERONAUTICS
DIVISION**

Prepared by:

CDM SMITH INC.

8805 Governor's Hill Drive, Suite 305
Cincinnati, Ohio 45249
513-583-9800

With assistance from:

**AIRPORT SOLUTIONS GROUP, LLC
SPOTLIGHT COMMUNICATIONS**

TABLE OF CONTENTS

CHAPTER 1: STUDY SUMMARY

INTRODUCTION	1-1
STUDY BACKGROUND	1-2
STUDY FINDINGS	1-5
SUMMARY	1-8

CHAPTER 2: SOCIOECONOMIC OVERVIEW OF MASSACHUSETTS

INTRODUCTION	2-1
POPULATION	2-1
GROSS STATE PRODUCT AND INDUSTRY MIX	2-5
EMPLOYMENT	2-7
PER CAPITA PERSONAL INCOME	2-8
SUMMARY	2-8

CHAPTER 3: STUDY APPROACH

INTRODUCTION	3-1
THE ECONOMIC MODELING PROCESS	3-1
SURVEYS, DATA COLLECTION METHODS, AND MODEL ASSUMPTIONS	3-4
On-Airport Tenants	3-5
Construction Impacts	3-6
Commercial Service Visitors	3-7
General Aviation Visitors	3-9
STUDY MULTIPLIERS	3-11
SUMMARY	3-12

CHAPTER 4: AIRPORT EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS

INTRODUCTION	4-1
EMPLOYMENT IMPACTS	4-2
Employment from On-Airport Activity	4-2
Employment from Commercial Service Visitor Spending	4-3
Employment from General Aviation Visitor Spending	4-4
Total Employment	4-4
PAYROLL IMPACTS	4-5
Payroll from On-Airport Activity	4-5
Payroll from Commercial Service Visitor Spending	4-5

Payroll from General Aviation Visitor Spending	4-6
Total Annual Payroll	4-6
OUTPUT IMPACTS	4-7
Output from On-Airport Activity	4-7
Output from Commercial Service Visitor Spending	4-8
Output from General Aviation Visitor Spending	4-8
Total Annual Output	4-9
SUMMARY	4-9

CHAPTER 5: ADDITIONAL AREAS OF ANALYSIS

INTRODUCTION	5-1
QUALITATIVE AIRPORT BENEFITS	5-1
TAX IMPACTS	5-5
State and Local Sales Tax Rates	5-5
Lodging and Restaurant/Prepared Meals Tax Rates	5-5
Rental Car Tax Rates	5-6
State Income Taxes	5-6
Aviation Fuel Taxes	5-6
Sales Tax Estimation Methodology	5-6
Taxes Generated by On-Airport Businesses	5-7
Taxes Generated by Commercial Service Visitors	5-9
Taxes Generated by General Aviation Visitors	5-10
Taxes Paid by Employees of On-Airport Businesses	5-10
Taxes Paid by Employees Supported by Visitor Spending	5-11
State Income Taxes Paid by Employees of On-Airport Businesses	5-11
State Income Taxes Paid by Employees Supported by Visitor Spending	5-11
Aviation Fuel Taxes	5-11
Total Airport-Related Taxes	5-12
Tax Summary	5-12
SUMMARY	5-13

CHAPTER 6: AVIATION EDUCATION CASE STUDY

INTRODUCTION	6-1
PREPARING FOR TAKEOFF – LEARNING ABOUT AVIATION	6-2
Visiting the Community Airport	6-2
EAA Young Eagles	6-3
Wright Flight Program	6-3
Real World Design Challenge	6-4
Civil Air Patrol	6-4
Other Educational Initiatives	6-5
LEAVING THE GROUND – BECOMING PART OF AVIATION	6-6

Secondary School Education	6-6
Dedicated Aviation Training.....	6-7
Flight Training Schools	6-7
Aviation Maintenance Training School	6-9
SOARING INTO THE ATMOSPHERE – A CAREER IN AVIATION	6-9
Flight Training & Aviation Management Degree Programs.....	6-10
Bridgewater State University	6-10
Westfield State University	6-11
North Shore Community College	6-12
Aircraft Maintenance Degree Programs	6-13
Cape Cod Community College	6-13
Aerospace Engineering Degree Programs	6-14
Massachusetts Institute of Technology	6-14
Westover Polytechnic Institute.....	6-16
Boston University.....	6-17
METHODOLOGY FOR ESTIMATING THE ECONOMIC IMPACTS OF AVIATION	
EDUCATION	6-17
The Economic Modeling Process	6-17
Data Requirements and Collection	6-18
AVIATION EDUCATION EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS	6-19
SUMMARY	6-20

CHAPTER 7: AIR CHARTER CASE STUDY

INTRODUCTION.....	7-1
HOW AIR CHARTER WORKS	7-2
WHY AIR CHARTER WORKS.....	7-5
HOW AIR CHARTER WORKS FOR MASSACHUSETTS	7-9
METHODOLOGY FOR ESTIMATING THE ECONOMIC IMPACTS OF AIR CHARTER	
ACTIVITY IN MASSACHUSETTS	7-18
EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS FOR AIR CHARTER OPERATORS	7-18
SUMMARY	7-19

APPENDIX A: ECONOMIC IMPACT TABLES

APPENDIX B: AVIATION EDUCATION CASE STUDY

INTRODUCTION.....	B-1
BOSTON LOGAN INTERNATIONAL AIRPORT BACKGROUND.....	B-1
ECONOMIC IMPACT UPDATE APPROACH.....	B-2
Data Collection.....	B-2
Study Multipliers.....	B-2
PROCESS FOR ESTIMATING DIRECT ECONOMIC IMPACTS	B-3

Direct On-Airport Tenant Impacts	B-3
Direct On-Airport Construction Impacts.....	B-3
Direct Commercial Service Visitor Impacts.....	B-3
Direct General Aviation Visitor Impacts.....	B-4
Multiplier Impacts.....	B-4
Total Impacts.....	B-4
UPDATED ECONOMIC IMPACTS OF BOSTON LOGAN INTERNATIONAL AIRPORT	B-4
SUMMARY	B-5

APPENDIX C: ECONOMIC IMPACTS OF MILITARY AVIATION

INTRODUCTION	C-1
BASE BACKGROUND INFORMATION.....	C-2
Hanscom Air Force Base	C-2
Westover Air Reserve Base.....	C-4
Barnes Air National Guard Base.....	C-6
Joint Base Cape Cod	C-7
ECONOMIC IMPACT METHODOLOGY	C-8
MILITARY EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS.....	C-9
SUMMARY	C-10

APPENDIX D: PROJECTED 2018 ECONOMIC IMPACTS FOR MASSACHUSETTS AIRPORTS

INTRODUCTION	D-1
METHODOLOGY FOR ESTIMATING 2018 ECONOMIC IMPACTS	D-1
MSASP Airports.....	D-1
Massport Airports	D-2
PROJECTED 2018 ECONOMIC IMPACTS.....	D-2
SUMMARY	D-3

FIGURES

CHAPTER 1: STUDY SUMMARY

Figure 1-1: Massachusetts Airports Included in Economic Impact Analysis 1-3

Figure 1-2: Distribution of \$16.6 Billion in Annual Economic Output 1-7

CHAPTER 2: SOCIOECONOMIC OVERVIEW OF MASSACHUSETTS

Figure 2-1: Massachusetts Population Growth, 2010 – 2013 2-1

Figure 2-2: Massachusetts Population Growth Forecast, 2013 – 2020..... 2-5

CHAPTER 3: STUDY APPROACH

Figure 3-1: Ripple Effect Associated with Induced Impacts 3-2

CHAPTER 5: ADDITIONAL AREAS OF ANALYSIS

Figure 5-1: Massachusetts Airport-Related Tax Impacts..... 5-13

APPENDIX B: AVIATION EDUCATION CASE STUDY

Figure B-1: Contribution of Boston Logan International Airport to Total Statewide
Annual Output..... B-6

APPENDIX C: ECONOMIC IMPACTS OF MILITARY AVIATION

Figure C-1: Massachusetts Military Air Facilities C-2

APPENDIX D: PROJECTED 2018 ECONOMIC IMPACTS FOR MASSACHUSETTS AIRPORTS

Figure D-1: Projected 2018 Total Employment for Massachusetts Airports..... D-2

Figure D-2: Projected 2018 Total Output for Massachusetts Airports..... D-3

TABLES

CHAPTER 1: STUDY SUMMARY

Table 1-1: Total Economic Impacts for Massachusetts Airports	1-6
--	-----

CHAPTER 2: SOCIOECONOMIC OVERVIEW OF MASSACHUSETTS

Table 2-1: Massachusetts Population Growth, 2010 – 2013.....	2-2
Table 2-2: Massachusetts Population Growth Forecast, 2013 – 2020	2-4
Table 2-3: Massachusetts Gross State Product by Industry, 2013	2-6
Table 2-4: Massachusetts Jobs by Industry for 2013.....	2-7

CHAPTER 3: STUDY APPROACH

Table 3-1: Enplanements & Percent Visitors at Massachusetts Commercial Service Airports	3-8
Table 3-2: Massachusetts IMPLAN Multipliers by Economic Sector	3-12

CHAPTER 4: AIRPORT EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS

Table 4-1: Massachusetts On-Airport Activity Employment	4-2
Table 4-2: Massachusetts Employment from Commercial Service Visitor Spending.....	4-3
Table 4-3: Massachusetts Employment from General Aviation Visitor Spending.....	4-4
Table 4-4: Massachusetts Airports Total Employment.....	4-4
Table 4-5: Massachusetts On-Airport Activity Payroll.....	4-5
Table 4-6: Massachusetts Annual Payroll from Commercial Service Visitor Spending...	4-5
Table 4-7: Massachusetts Annual Payroll from General Aviation Visitor Spending.....	4-6
Table 4-8: Massachusetts Airports Total Annual Payroll.....	4-7
Table 4-9: Massachusetts On-Airport Activity Output	4-8
Table 4-10: Massachusetts Output from Commercial Service Visitor Spending.....	4-8
Table 4-11: Massachusetts Output from General Aviation Visitor Spending.....	4-8
Table 4-12: Massachusetts Airports Total Annual Output	4-9
Table 4-13: Economic Impact Summary for Massachusetts Airports.....	4-10
Table 4-14: Distribution of Economic Impacts Between 2010 MSASP Airports and Massport Airports	4-10
Table 4-15: Projected 2018 Economic Impacts for Massachusetts Airports.....	4-11

CHAPTER 5: ADDITIONAL AREAS OF ANALYSIS

Table 5-1: Sales Tax Rates for Massachusetts Airports, 2013	5-8
Table 5-2: Airport-Related Taxes from Massachusetts Airports, 2013	5-12

CHAPTER 6: AVIATION EDUCATION CASE STUDY

Table 6-1: MIT Research Labs	6-15
Table 6-2: Economic Impacts of Aviation Education at Massachusetts Airports	6-19
Table 6-3: Off-Airport Schools Providing Aviation Education in Massachusetts	6-20

CHAPTER 7: AIR CHARTER CASE STUDY

Table 7-1: Massachusetts Air Charter Providers	7-9
Table 7-2: Massachusetts' Premier Educational Institutions	7-13
Table 7-3: Economic Impacts of Air Charter Activity at Massachusetts Airports	7-18

APPENDIX A: ECONOMIC IMPACT TABLES

Table A-1: Estimates of General Aviation Itinerant Arrivals at Massachusetts Airports.	A-2
Table A-2: Estimates of General Aviation Visitors at Massachusetts Airports	A-3
Table A-3: Estimates of General Aviation Visitor Expenditures at Massachusetts Airports	A-4
Table A-4: Estimates of Commercial Service Visitors at Massachusetts Airports	A-5
Table A-5: Estimates of Commercial Service Visitor Expenditures at Massachusetts Airports.....	A-5
Table A-6: Massachusetts On-Airport Employment	A-6
Table A-7: Massachusetts General Aviation Visitor-Related Employment	A-7
Table A-8: Massachusetts Commercial Service Visitor-Related Employment.....	A-8
Table A-9: Massachusetts Airports Total Employment	A-9
Table A-10: Massachusetts On-Airport Payroll.....	A-10
Table A-11: Massachusetts General Aviation Visitor-Related Payroll.....	A-11
Table A-12: Massachusetts Commercial Service Visitor-Related Payroll	A-12
Table A-13: Massachusetts Airports Total Payroll.....	A-13
Table A-14: Massachusetts On-Airport Output	A-14
Table A-15: Massachusetts General Aviation Visitor-Related Output	A-15
Table A-16: Massachusetts Commercial Service Visitor-Related Output.....	A-16
Table A-17: Massachusetts Airports Total Output	A-17
Table A-18: Massachusetts Airports Total Economic Impacts.....	A-18
Table A-19: Qualitative Benefits of Massachusetts Airports	A-19
Table A-20: Sales and Income Tax Contributions of Massachusetts Airports	A-21

APPENDIX B: AVIATION EDUCATION CASE STUDY

Table B-1: Enplanements & Percent Visitors at Boston Logan International Airport.	B-4
Table B-1: Economic Impacts of Boston Logan International Airport.	B-5

APPENDIX C: ECONOMIC IMPACTS OF MILITARY AVIATION

Table C-1: Total Impacts of Massachusetts Military Air Facilities.	C-9
Table C-2: Economic Impact Summary for Massachusetts Military Air Facilities.	C-10

APPENDIX D: PROJECTED 2018 ECONOMIC IMPACTS FOR MASSACHUSETTS AIRPORTS

Table D-1: Total Employment and Output Impacts for Massachusetts Airports, 2010-2018.....	D-4
--	-----

CHAPTER 1: STUDY SUMMARY

INTRODUCTION

Aviation has helped transform the way people and goods move around the world. It has brought distant markets together and made a global economy possible. Air travel brings benefits to countries with robust air transportation systems by providing access to markets that would otherwise be unavailable. The same is true in the U.S. at the state and regional level – airports and the linkages they provide help to drive the economies in those states. They do so by providing vital connections that enable businesses to function more capably, by allowing visitors to easily travel long distances, and by improving the quality of life for people, both directly and indirectly.

For the Commonwealth of Massachusetts, airports and aviation are a significant part of the economy. To begin with, quality air transportation is a key driver in attracting and retaining business. Companies rely on aviation to move people and goods in a timely manner, which enhances the products and services they bring to market.

To keep these valuable infrastructure assets operating efficiently, capital improvement projects are undertaken every year. These airport investments boost the local and regional economies where they take place, while ensuring that high quality facilities are available.



In addition to augmenting business operations, airports in Massachusetts promote the Commonwealth's tourism industry. Boston Logan International Airport gives millions of annual visitors the chance to enjoy the culture and offerings of the Greater Boston region, while airports such as Barnstable Municipal Airport-Boardman/Polando Field, Nantucket Memorial Airport, and Martha's Vineyard Airport support travel to and within the iconic Cape and Islands region, one of the world's premier travel destinations. Other airports in Massachusetts make it possible for visitors to experience many of the state's parks and historic sites. During these trips, visitors spend money locally on food, lodging, and other items in mutually beneficial transactions. Residents of Massachusetts use airports for travel, connecting them to family and friends and tourist destinations through the convenience of modern air travel.

Beyond business and tourism, aviation brings other benefits to Massachusetts' residents. Airports facilitate the movement of patients to and from medical centers. Aviation enhances public safety by facilitating law enforcement activities, military training, and search and rescue

operations from Massachusetts airports. Aircraft use Massachusetts airports to conduct aerial surveys, photography, and inspections. Airports help to support services which are vital to all citizens in the Commonwealth. Even if they never use an airport directly, citizens benefit from an improved quality of life that air transportation helps to support. Through simple things such as package delivery and the ability to visit family and friends, aviation in Massachusetts helps promote safer, healthier, and more productive lives.



As an update to the 2011 *Massachusetts Statewide Airport Economic Impact Study*, the *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 Massachusetts Department of Transportation (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* (MSASP). While the MSASP examined the structure and long-term development of the statewide airport system as a whole, the goal of the *Massachusetts Statewide Airport Economic Impact Study Update* is to show how aviation serves as an economic engine for the Commonwealth, document the changes that have taken place since the last study, and highlight some of the many other benefits that air transportation brings to its host communities. Note that both of these planning efforts, the MSASP and *Massachusetts Statewide Airport Economic Impact Study Update*, are key initiatives that directly support MassDOT Aeronautics' defined mission statement to:

Promote aviation throughout the Commonwealth, while establishing an efficient integrated airport system that will enhance airport safety, economic development, and environmental stewardship.

STUDY BACKGROUND

Massachusetts' 39 public-use airports support the air travel needs of the Commonwealth's residents, businesses, and visitors, acting as economic engines for regional economies. **Figure 1-1** shows the location of each of these airports. This report highlights the important economic contributions that the Commonwealth realizes from its airports by quantifying employment, payroll, and total economic activity. The analysis presented in this report considers the annual economic impacts associated with airport business operations, on-airport construction, military aviation, visitors who arrive via commercial airlines, and visitors who arrive on privately-owned general aviation aircraft. These impacts are reported for each individual airport. It is also 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 2013.

This map of Massachusetts displays the locations of various airports, categorized by color-coded icons: blue squares for Commercial Service Airports, green squares for Reliever Airports, and orange circles for General Aviation Airports. Major transportation infrastructure is shown, including Interstate Highways (thick red lines), US Highways (thin black lines), and Other Major Routes (yellow lines). Dashed lines delineate the boundaries of Massachusetts counties. The map also includes labels for neighboring states (NY, VT, NH, CT, RI) and a scale bar in miles (0 to 40). A legend in the bottom left corner provides the key for the symbols used.

Legend:

- Commercial Service Airports
- Reliever Airports
- General Aviation Airports
- Interstate Highways
- US Highways
- Other Major Routes
- Massachusetts Counties

In 2013, Massachusetts' system of public-use airports was comprised of nine commercial service and 30 general aviation airports. MassDOT Aeronautics Division supports the operation and development of 36 of these airports through grant funding, inspections, technical guidance, planning studies, education efforts, and communication with local, state, and federal officials. Boston Logan International Airport, Laurence G. Hanscom Field, and Worcester Regional Airport are the responsibility of the Massachusetts Port Authority (Massport), which owns and operates these facilities.

- Qualitative Airport Benefits:** Airports provide contributions in forms other than jobs, payroll and economic activity. This section highlights some of the airport benefits that are not easily assigned a dollar value.

- **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. This analysis identifies the 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 provides case studies of unique segments of aviation in Massachusetts. These more detailed analyses provide examples of how Massachusetts airports improve the quality of life for Commonwealth residents, over and above the jobs, payroll, and economic activity that they generate. The two areas that were analyzed include:
 - Aviation Education: Aviation education is a critical and growing element of the aviation industry in Massachusetts. Various schools and businesses throughout the Commonwealth train students to become pilots, air traffic controllers, airplane mechanics, flight attendants, airport managers and many other professions within the industry. These aviation-related curriculums range from major university programs to small training classes at general aviation airports. While most of these schools are located on-airport, many of the higher education programs also offer coursework off-airport. These entities are identified and their economic benefits estimated in this case study. Many of the Commonwealth's flight schools and higher education institutions go beyond merely providing certification and flight hours to trainees. Universities and colleges may offer a wide array of degree programs in the aviation industry, varying from training in aviation administration to becoming a commercial pilot. Many of these schools emphasize a hands-on learning experience at their associated airports, and help to ensure the continuation of the industry through cooperative learning programs and partnerships with airlines and other aviation companies. Profiles of select programs are highlighted to further illustrate the range of aviation education offerings in Massachusetts.
 - Charter Activity: Massachusetts realizes and benefits from significant air charter operations throughout its airport system. Air charter refers to a variety of services available that allow



individuals, corporations, or groups to charter aircraft for their personal and professional use. Charter flights provide point-to-point travel services that are fast, efficient, convenient, comfortable, reliable, and private. These are all traits that are critical to businesses, as well as to visitor destinations. This case study identifies where charter activity takes place in the Commonwealth, provides specific examples, and highlights the quantitative and qualitative benefits it provides.

STUDY FINDINGS

This study found that the system of 39 public-use airports in Massachusetts has a substantial economic impact on the Commonwealth. In brief, the 39 airports:

- Supported approximately 162,300 jobs
- Generated \$6.1 billion in annual payroll
- Produced \$16.6 billion in annual economic output

These numbers include expenditures by hundreds of on-airport businesses and government organizations, military air facilities co-located with the study airports, and millions of visitors, as well as the multiplier effect associated with this spending. In addition, residents of the Commonwealth increasingly depend on civil aviation to support their health, welfare, and safety needs.

Table 1-1 lists the total employment, payroll, and output for the 39 Massachusetts public-use airports. These economic impacts include direct impacts from on-airport businesses and government organizations, capital improvement projects, military aviation, spending by visitors using commercial airlines and general aviation, and the multiplier impacts resulting from the recirculation of money spent by all of the aforementioned activities. A more detailed breakout of this information can be found in **Appendix A**.



Table 1-1: Total Economic Impacts for Massachusetts Airports

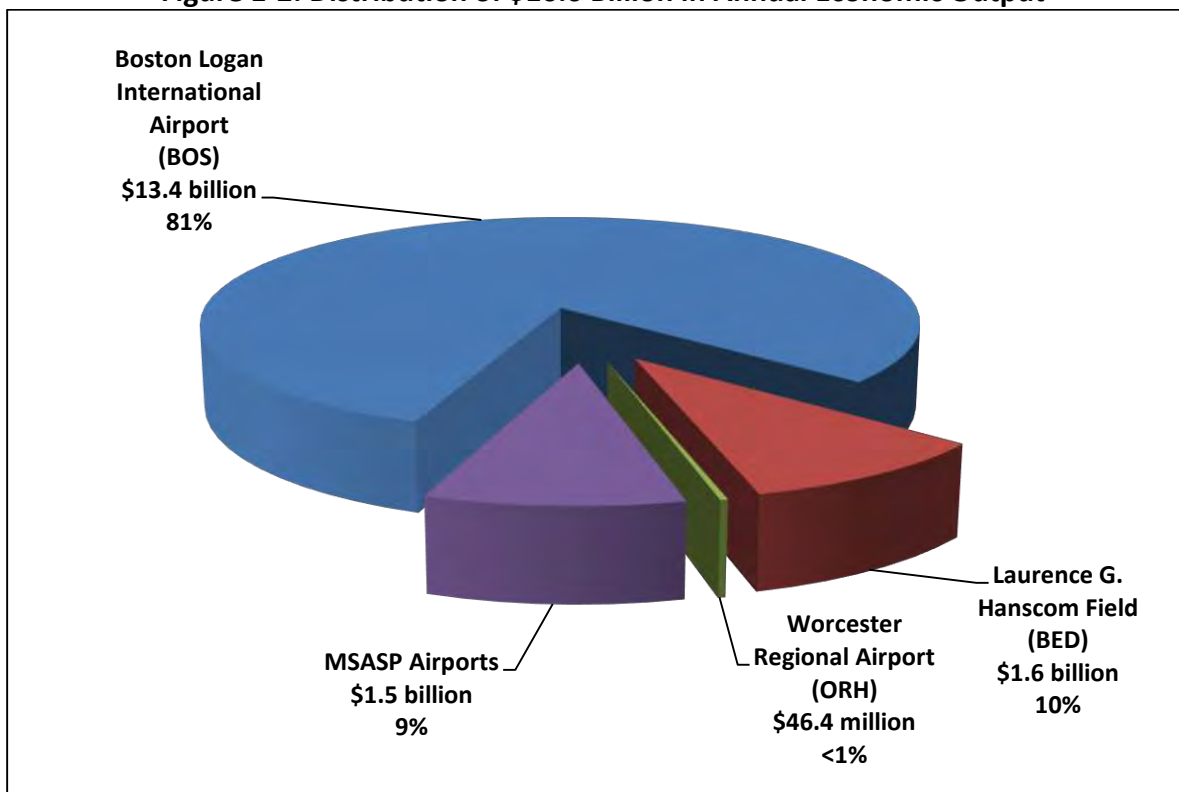
Associated City	Airport Name	Total Employment	Total Payroll	Total Output
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	12,355	\$1,162,158,000	\$1,604,078,000
Boston	Boston Logan International Airport	131,991	\$4,290,597,000	\$13,359,865,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	5,241	\$195,081,000	\$255,691,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	2,135	\$85,358,000	\$208,023,000
Nantucket	Nantucket Memorial Airport	3,802	\$116,648,000	\$378,531,000
New Bedford	New Bedford Regional Airport	297	\$10,625,000	\$32,434,000
Provincetown	Provincetown Municipal Airport	379	\$11,336,000	\$33,945,000
Vineyard Haven	Martha's Vineyard Airport	1,232	\$38,170,000	\$120,049,000
Worcester	Worcester Regional Airport	358	\$14,925,000	\$46,433,000
COMMERCIAL SERVICE AIRPORTS TOTAL		157,790	\$5,924,898,000	\$16,039,049,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	5	\$94,000	\$548,000
Berkley	Myricks Airport	3	\$34,000	\$74,000
Beverly	Beverly Municipal Airport	245	\$10,122,000	\$32,502,000
Chatham	Chatham Municipal Airport	149	\$4,347,000	\$12,518,000
Edgartown	Katama Airpark	17	\$520,000	\$1,895,000
Falmouth	Falmouth Airpark	7	\$271,000	\$621,000
Fitchburg	Fitchburg Municipal Airport	129	\$4,752,000	\$14,619,000
Gardner	Gardner Municipal Airport	8	\$237,000	\$800,000
Great Barrington	Walter J. Koladza Airport	43	\$1,164,000	\$3,321,000
Hanson	Cranland Airport	9	\$291,000	\$972,000
Hopedale	Hopedale Industrial Park Airport	14	\$408,000	\$899,000
Lawrence	Lawrence Municipal Airport	267	\$10,212,000	\$30,147,000
Mansfield	Mansfield Municipal Airport	54	\$1,804,000	\$9,392,000
Marlborough	Marlboro Airport	5	\$144,000	\$468,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	74	\$3,627,000	\$9,154,000
Marstons Mills	Cape Cod Airport	8	\$213,000	\$876,000
Montague	Turners Falls Airport	14	\$498,000	\$1,801,000
Newburyport	Plum Island Airport	2	\$35,000	\$121,000
North Adams	Harriman-and-West Airport	97	\$3,557,000	\$11,259,000
Northampton	Northampton Airport	25	\$480,000	\$2,000,000
Norwood	Norwood Memorial Airport	394	\$16,863,000	\$52,232,000
Orange	Orange Municipal Airport	147	\$4,849,000	\$13,992,000
Pittsfield	Pittsfield Municipal Airport	226	\$10,260,000	\$35,387,000
Plymouth	Plymouth Municipal Airport	319	\$13,669,000	\$47,867,000
Southbridge	Southbridge Municipal Airport	20	\$556,000	\$1,712,000
Spencer	Spencer Airport	3	\$63,000	\$141,000
Sterling	Sterling Airport	21	\$426,000	\$1,546,000
Stow	Minute Man Air Field	141	\$4,563,000	\$12,315,000
Taunton	Taunton Municipal Airport - King Field	31	\$978,000	\$3,261,000
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	1,989	\$74,067,000	\$213,628,000
GENERAL AVIATION AIRPORTS TOTAL		4,466	\$169,104,000	\$516,068,000
ALL AIRPORTS TOTAL		162,256	\$6,094,002,000	\$16,555,117,000

Source: CDM Smith and IMPLAN multipliers

Note 1: 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.

Figure 1-2 presents the distribution of annual economic activity between airports supported by the MassDOT Aeronautics Division and the Massport airports. Not unexpectedly, Boston Logan International Airport generates the majority of the airport system's economic activity.

Figure 1-2: Distribution of \$16.6 Billion in Annual Economic Output



Source: CDM Smith

Considering the growth in aircraft operations and enplanements forecast by the MSASP and Massport over the next five years, a supplemental analysis was conducted to estimate the economic impacts generated by this increase in activity.¹ The analysis found that by 2018, the total economic impacts generated by the 39 public-use airports are estimated to increase to approximately 181,000 total jobs and \$18.4 billion in total annual output.²

The findings of this study show that Massachusetts' system of public-use airports is a major catalyst to the continued growth of the Commonwealth's economy. Other significant findings included the following:

- The total economic impacts calculated in this analysis represent an increase of approximately 38,000 total jobs, \$1.2 billion in total annual payroll, and \$4.7 billion in total annual output since the 2011 *Massachusetts Statewide Airport Economic Impact Study*.

¹ Details of the supplemental analysis can be found in **Appendix D**.

² Projected 2018 total annual output is presented in constant dollars to allow for direct comparison to 2013 total annual output.

- Total economic impacts tied to Massachusetts' general aviation airports are estimated at nearly 4,500 jobs, approximately \$169.1 million in annual payroll, and approximately \$516.1 million in annual output.
- Massachusetts' airports serve as vital business links and support critical services such as medical care, search and rescue, military training, law enforcement, recreation, and environmental services.
- Total airport-related taxes collected in Massachusetts in 2013 amounted to approximately \$846.9 million, which represents additional economic benefits above and beyond the total jobs, payroll, and output estimated for the 39 public-use airports.
- Of the total statewide economic impacts, military aviation at Hanscom Air Force Base, Westover Air Reserve Base, and Barnes Air National Guard Base accounts for approximately 17,000 jobs, \$1.3 billion in annual payroll, and \$1.6 billion in annual output.³ Joint Base Cape Cod, which unlike the other military air facilities is not co-located with any of the study airports, adds approximately 1,200 jobs, \$93.0 million in annual payroll, and \$134.6 million in annual output.
- Total economic impacts tied to aviation education in the Commonwealth are estimated at 487 jobs, \$14.3 million in annual payroll, and \$45.2 million in annual output.
- Air charter activity in Massachusetts accounts for 408 total jobs, \$22.1 million in total annual payroll, and \$99.6 million in total annual output.
- The total economic output and associated expenditures from Massachusetts' 39 public-use airports (including associated military air facilities) and visitors who arrive by air comprised 3.7 percent of the Commonwealth's 2013 estimated Gross State Product.

SUMMARY

The *Massachusetts Statewide Airport Economic Impact Study Update* determined that the 39 public-use airports in the Massachusetts system are significant contributors to the continued growth of the Commonwealth's economy. Specifically, this study found that in 2013, the airports supported approximately 162,300 total jobs with a total annual payroll of \$6.1 billion. The airports produced an estimated \$16.6 billion in total annual economic output. Since the 2011 *Massachusetts Statewide Airport Economic Impact Study*, these impacts have increased by approximately 38,000 jobs, \$1.2 billion in annual payroll, and \$4.7 billion in annual output. Based on growth in aircraft operations and enplanements forecast by the MSASP and Massport, the 2013 economic impacts are projected to increase to approximately 181,000 total jobs by 2018. Total annual output is projected to reach \$18.4 billion by 2018.

In addition to these quantitative impacts, airports in Massachusetts provide a number of health, welfare, and safety benefits, the impacts of which are beyond conventional measurement. Services such as medical transport and evacuation, flight training, law enforcement flights, wildlife management, military exercises, and search and rescue operations, all contribute directly to the quality of life of those who live and work in the Commonwealth.

³ Hanscom Air Force Base, Westover Air Reserve Base, and Barnes Air National Guard Base are co-located with Laurence G. Hanscom Field, Westover Metropolitan Airport, and Westfield-Barnes Regional Airport, respectively.

CHAPTER 2: SOCIOECONOMIC OVERVIEW OF MASSACHUSETTS

INTRODUCTION

The magnitude of the economic impact of Massachusetts' airports is linked to the demand that is generated within the Commonwealth for aviation goods and services. As population, employment, and personal income levels rise in the Commonwealth, so too does demand for airline travel, business aviation, air cargo shipments, personal flying, and other aviation-related activities by Massachusetts residents, businesses, and visitors. This chapter provides an overview of the Commonwealth's general socioeconomic characteristics, focusing on trends since the 2011 *Massachusetts Statewide Airport Economic Impact Study*. Information presented in this chapter helps to highlight Massachusetts' strong demand for aviation and aviation-related services, which is what ultimately fuels the economic impacts measured in this study.

POPULATION

In 2000, Massachusetts' population was more than 6.3 million.¹ By 2010 (the base year of the 2011 *Massachusetts Statewide Airport Economic Impact Study*), the population had grown to more than 6.5 million, representing a compound annual growth rate (CAGR) of 0.3 percent.² From 2010 to 2013 (the base year of this study update), Massachusetts grew at a CAGR of 0.7 percent and reached a population estimate of nearly 6.7 million, making Massachusetts the 14th most populated state in the nation. By comparison, the U.S. population grew at 0.7 percent annually during this period. In terms of overall population, Massachusetts ranked 28th in the United States in total population growth between 2010 and 2013.

Between 2010 and 2013, only three of the 14 counties in Massachusetts experienced a loss in population. Seven counties experienced a CAGR greater than or equal to the national and statewide rate of 0.7 percent. With a CAGR of 1.52 percent annually, Suffolk County experienced the most rapid growth over this period. Other counties experiencing growth over the period at rates above the national and statewide rate were Dukes (1.43 percent), Middlesex (1.09 percent), Essex (0.86 percent), and Norfolk (0.84 percent) Counties. This data, along with the study airports located within each county, is outlined in **Table 2-1**.

¹ U.S. Census Bureau

² Ibid.

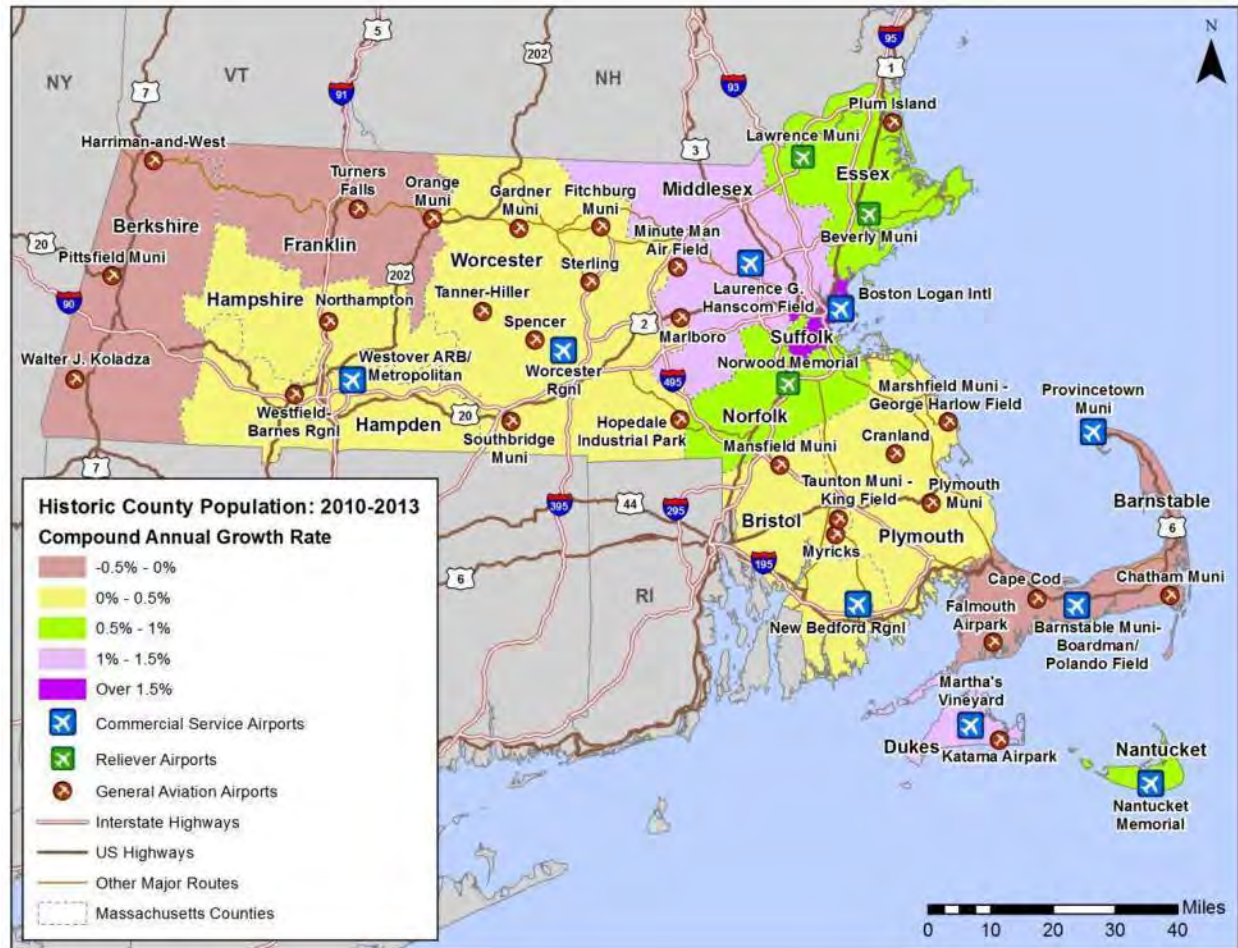
Table 2-1: Massachusetts Population Growth, 2010 – 2013

Area	Airports	2010	2013	2010 - 2013 Change	CAGR	Population Change
Massachusetts		6,547,629	6,692,824	145,195	0.73%	2.22%
Barnstable	Barnstable Municipal Airport- Boardman/Polando Field, Cape Cod Airport, Chatham Municipal Airport, Falmouth Airpark, Provincetown Municipal Airport	215,888	214,990	-898	-0.14%	-0.42%
Berkshire	Harriman-and-West Airport, Pittsfield Municipal Airport, Walter J. Koladza Airport	131,219	129,585	-1,634	-0.42%	-1.25%
Bristol	Mansfield Municipal Airport, Myricks Airport, New Bedford Regional Airport, Taunton Municipal Airport - King Field	548,285	552,780	4,495	0.27%	0.82%
Dukes	Katama Airpark, Martha's Vineyard Airport	16,535	17,256	721	1.43%	4.36%
Essex	Beverly Municipal Airport, Lawrence Municipal Airport, Plum Island Airport	743,167	762,550	19,383	0.86%	2.61%
Franklin	Orange Municipal Airport, Turners Falls Airport	71,372	71,221	-151	-0.07%	-0.21%
Hampden	Westfield-Barnes Regional Airport, Westover Air Reserve Base - Metropolitan Airport	463,490	467,319	3,829	0.27%	0.83%
Hampshire	Northampton Airport	158,080	159,596	1,516	0.32%	0.96%
Middlesex	Laurence G. Hanscom Field, Marlboro Airport, Minute Man Air Field	1,503,091	1,552,802	49,711	1.09%	3.31%
Nantucket	Nantucket Memorial Airport	10,172	10,399	227	0.74%	2.23%
Norfolk	Norwood Memorial Airport	670,726	687,802	17,076	0.84%	2.55%
Plymouth	Cranland Airport, Marshfield Municipal Airport - George Harlow Field, Plymouth Municipal Airport	494,921	501,915	6,994	0.47%	1.41%
Suffolk	Boston Logan International Airport	722,135	755,503	33,368	1.52%	4.62%
Worcester	Fitchburg Municipal Airport, Gardner Municipal Airport, Hopedale Industrial Park Airport, Southbridge Municipal Airport, Spencer Airport, Sterling Airport, Tanner-Hiller Airport, Worcester Regional Airport	798,548	809,106	10,558	0.44%	1.32%

Source: U.S. Census Bureau

Figure 2-1 graphically depicts the population CAGR for each Massachusetts county from 2010 to 2013. As illustrated in Figure 2-1, the fastest growing counties include the island county of Dukes, and Suffolk and Middlesex Counties, which are located within the Boston Metropolitan Statistical Area.

Figure 2-1: Massachusetts Population Growth, 2010 – 2013



Source: CDM Smith and U.S. Census Bureau

Future population projections based on the U.S. Census Bureau and the University of Massachusetts Donahue Institute Population Projections from December 2013 outlined in **Table 2-2** indicate that the population growth trends experienced from 2000 to 2013 will continue. Massachusetts' population as a whole is expected to grow to nearly 6.8 million by 2020. This represents a total increase of nearly 1.0 percent and a CAGR of 0.1 percent for the 2013 to 2020 projections.

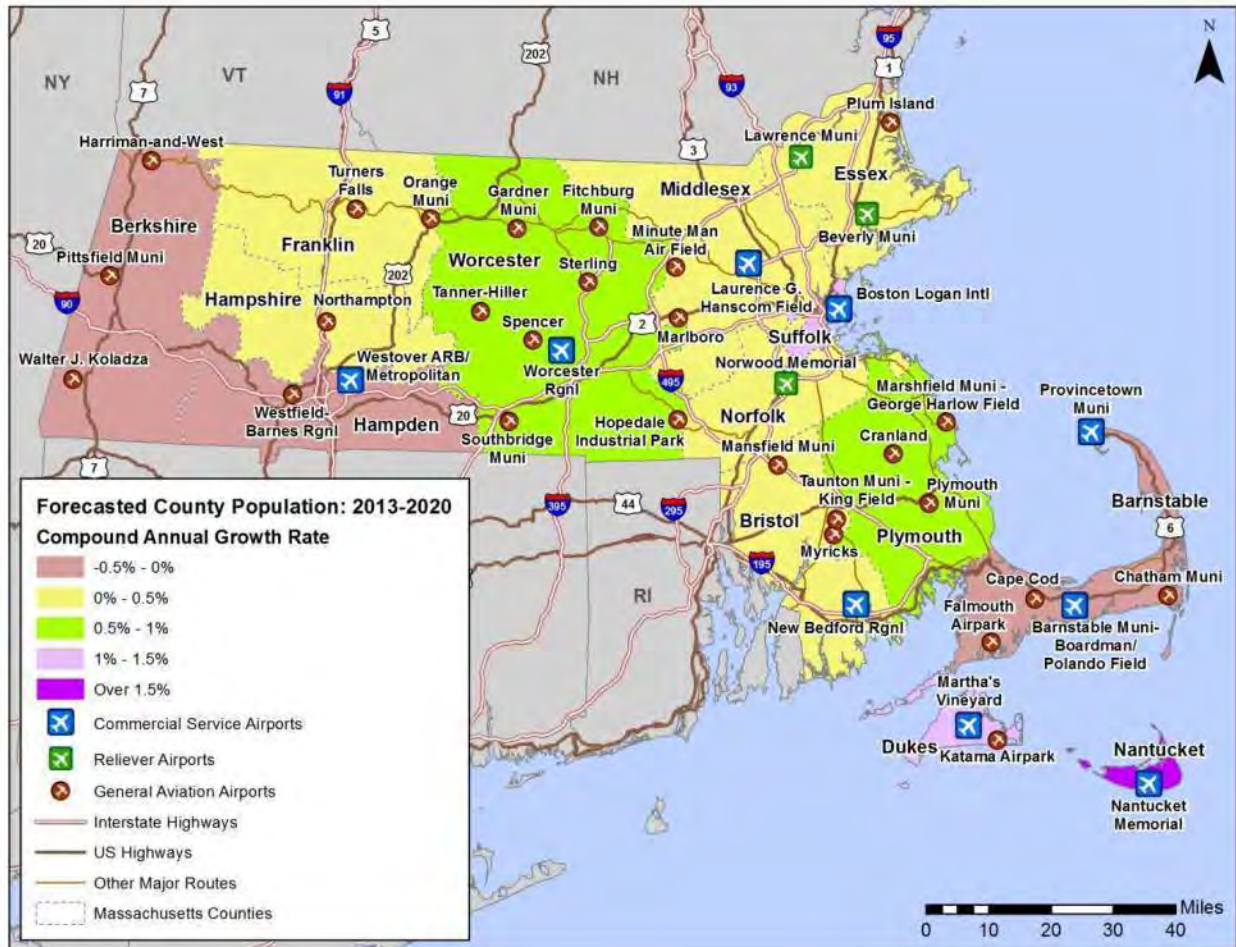
Table 2-2: Massachusetts Population Growth Forecast, 2013 – 2020

Area	Airports	2013	2020	2013 - 2020 Forecast	CAGR	Population Change
Massachusetts		6,692,824	6,757,574	64,750	0.14%	0.97%
Barnstable	Barnstable Municipal Airport- Boardman/Polando Field, Cape Cod Airport, Chatham Municipal Airport, Falmouth Airpark, Provincetown Municipal Airport	215,888	215,584	-304	-0.02%	-0.14%
Berkshire	Harriman-and-West Airport, Pittsfield Municipal Airport, Walter J. Koladza Airport	131,219	131,002	-217	-0.02%	-0.17%
Bristol	Mansfield Municipal Airport, Myricks Airport, New Bedford Regional Airport, Taunton Municipal Airport - King Field	548,285	554,946	6,661	0.17%	1.21%
Dukes	Katama Airpark, Martha's Vineyard Airport	16,535	18,216	1,681	1.39%	10.17%
Essex	Beverly Municipal Airport, Lawrence Municipal Airport, Plum Island Airport	743,167	759,959	16,792	0.32%	2.26%
Franklin	Orange Municipal Airport, Turners Falls Airport	71,372	71,459	87	0.02%	0.12%
Hampden	Westfield-Barnes Regional Airport, Westover Air Reserve Base - Metropolitan Airport	463,490	457,264	-6,226	-0.19%	-1.34%
Hampshire	Northampton Airport	158,080	158,211	131	0.01%	0.08%
Middlesex	Laurence G. Hanscom Field, Marlboro Airport, Minute Man Air Field	1,503,091	1,542,892	39,801	0.37%	2.65%
Nantucket	Nantucket Memorial Airport	10,172	11,477	1,305	1.74%	12.83%
Norfolk	Norwood Memorial Airport	670,726	694,383	23,657	0.50%	3.53%
Plymouth	Cranland Airport, Marshfield Municipal Airport - George Harlow Field, Plymouth Municipal Airport	494,921	514,819	19,898	0.56%	4.02%
Suffolk	Boston Logan International Airport	722,135	790,064	67,929	1.29%	9.41%
Worcester	Fitchburg Municipal Airport, Gardner Municipal Airport, Hopedale Industrial Park Airport, Southbridge Municipal Airport, Spencer Airport, Sterling Airport, Tanner-Hiller Airport, Worcester Regional Airport	798,548	837,298	38,750	0.68%	4.85%

Source: U.S. Census Bureau and UMass Donahue Institute Population Projections, December 2013

As shown in **Figure 2-2**, counties in Massachusetts' Cape and Islands region are expected to experience the highest growth rates. Nantucket County is projected to have the most rapid population growth, with a CAGR of 1.7 percent. Other counties forecasted to experience growth above the national and statewide rates are Dukes (1.4 percent) and Suffolk (1.3 percent) Counties.

Figure 2-2: Massachusetts Population Growth Forecast, 2013 – 2020



Source: CDM Smith, U.S. Census Bureau, and UMass Donahue Institute Population Projections, December 2013

GROSS STATE PRODUCT AND INDUSTRY MIX

In 2013, Massachusetts' Gross State Product (the state equivalent of Gross Domestic Product, or GDP) was \$446.3 billion, ranking 12th in the United States, an increase from its rank of 13th in 2010. The Gross State Product grew 3.8 percent annually from \$378.7 billion in 2010. By comparison, the national Gross Domestic Product grew 4.1 percent annually during the same period.

As shown in **Table 2-3**, the economy of Massachusetts is relatively diversified as real estate, professional and technical services, and government all represent greater than 10 percent of

the Gross State Product. Historically, real estate has been the largest sector of the Commonwealth's economy. In 2013, this sector comprised nearly 15 percent of Massachusetts' Gross State Product. Government is the second largest sector at 11.6 percent, while professional and technical services and health care are the next most productive industries at approximately 11.4 percent and 9.4 percent, respectively. Finance and insurance, wholesale trade, and durable goods manufacturing are other industries in Massachusetts that each represent greater than five percent of the Gross State Product. The industries experiencing the most substantial growth since 2010 include government, which grew a total of 51.3 percent, while management of companies and durable goods manufacturing increased by 41.9 and 33.4 percent, respectively.

Table 2-3: Massachusetts Gross State Product by Industry, 2013

Industry	2013 Gross State Product (In Millions)	Percent of Total
Agriculture, Forestry, Fishing, and Hunting	\$889	0.20%
Mining	\$187	0.04%
Utilities	\$5,582	1.25%
Construction	\$14,603	3.27%
Manufacturing: Durable Goods	\$30,118	6.75%
Manufacturing: Non-Durable Goods	\$14,941	3.35%
Wholesale Trade	\$22,628	5.07%
Retail Trade	\$18,773	4.21%
Transportation and Warehousing	\$7,149	1.60%
Information	\$21,440	4.80%
Finance and Insurance	\$39,205	8.78%
Real Estate, Rental, and Leasing	\$66,706	14.95%
Professional and Technical Services	\$50,956	11.42%
Management of Companies	\$10,596	2.37%
Administrative and Waste Services	\$12,057	2.70%
Educational Services	\$12,590	2.82%
Health Care and Social Assistance	\$41,889	9.39%
Arts, Entertainment, and Recreation	\$4,024	0.90%
Accommodation and Food Services	\$11,828	2.65%
Other Services	\$8,319	1.86%
Government	\$51,843	11.62%
TOTAL	\$446,323	100%

Source: U.S. Bureau of Economic Analysis

EMPLOYMENT

Data from the U.S. Bureau of Economic Analysis (BEA) indicate the nonfarm workforce in Massachusetts totaled more than 4.3 million workers in 2013. This reflects a total increase of approximately 208,100 jobs from the number identified in 2010, representing a CAGR of 1.7 percent during this period. **Table 2-4** presents employment statistics in Massachusetts categorized by industry for the year 2013. Of workers in 2013, 631,000, or 14.6 percent of the workforce, were employed in health care and social assistance. Another 458,800 workers, or 10.6 percent of the workforce, were employed in government. Professional, scientific, and technical services and retail trade also made up significant portions of the Massachusetts workforce, accounting for 9.5 percent and 9.3 percent of jobs, respectively.

Table 2-4: Massachusetts Jobs by Industry for 2013

Industry	Employment	Percent
Agriculture, Forestry, Fishing, and Hunting	9,706	0.23%
Mining	3,643	0.08%
Utilities	10,727	0.25%
Construction	210,346	4.88%
Manufacturing	263,132	6.10%
Wholesale Trade	134,229	3.11%
Retail Trade	399,972	9.28%
Transportation and Warehousing	100,359	2.33%
Information	98,773	2.29%
Finance and Insurance	270,634	6.28%
Real Estate and Rental and Leasing	172,275	4.00%
Professional, Scientific, and Technical Services	408,698	9.48%
Management Of Companies and Enterprises	65,990	1.53%
Administrative and Waste Services	224,128	5.20%
Educational Services	220,898	5.12%
Health Care And Social Assistance	631,072	14.64%
Arts, Entertainment, and Recreation	108,672	2.52%
Accommodation and Food Services	298,099	6.92%
Other Services, Except Public Administration	220,714	5.12%
Government and Government Enterprises	458,834	10.64%
TOTAL EMPLOYMENT	4,310,901	100.00%

Source: U.S. Bureau of Economic Analysis

Short-term labor projections by the Commonwealth of Massachusetts' Executive Office of Labor and Workforce Development indicate continued employment growth through 2015, primarily in the real estate, construction, information, and professional, scientific, and technical services

sectors.³ Long-term projections include an overall positive employment change of 11.3 percent by 2022.⁴

PER CAPITA PERSONAL INCOME

Per capita personal income can be used as an indication of how much money people will spend on the consumption of goods and services, including aviation, since the greater the amount of income, the greater the purchasing power one has. According to data from the BEA, per capita personal income for Massachusetts was approximately \$51,500 in 2010, and grew to approximately \$57,200 by 2013. The change in this figure represents a CAGR of 3.6 percent. By comparison, per capita personal income for the United States as a whole grew from approximately \$40,100 to approximately \$44,800 over the same period, for a slightly higher 3.7 percent CAGR. This ranks Massachusetts third in terms of per capita personal income in the United States in 2013 and 26th in terms of per capita personal income CAGR for the 2010 to 2013 period.

The Commonwealth's per capita personal income level is largely influenced by the high percentage of the workforce possessing a college degree. As of 2012, approximately 39 percent of those living in Massachusetts had earned a bachelor's degree or higher. By comparison, the national average of the same educational attainment is 28.5 percent.⁵

SUMMARY

As reported in this chapter, Massachusetts' population grew slowly but steadily at a CAGR of 0.3 percent from 2000 to 2010 and a CAGR of 0.7 percent between 2010 and 2013. Forecasts indicate population is projected to grow to nearly 6.8 million by 2020. Employment grew at a CAGR of 1.7 percent from 2010 to 2013 and is projected to experience total growth of 11.3 percent by 2022. Massachusetts also ranks among the highest in the U.S. in terms of personal per capita income due to its highly educated workforce. Further, according to a June 2014 study by the Information Technology and Innovation Foundation, Massachusetts is now listed as the best state in the U.S. for the new economy. Massachusetts scored in the 94.7 percentile, dramatically surpassing even the second-highest state, Delaware, by 9.6 points. The study cites Massachusetts' strong presence of professional and technological firms and a series of world-class universities bolstered by innovation, a significant capital of knowledge workers and workforce education, fast-growing businesses, and the inclusion of the digital and globalized economies to be the leading contributors to this rating.⁶ These statistics indicate an expanding economy for the Commonwealth and its citizens, which should result in increased demand for aviation services and aviation-related businesses.

³ http://lmi2.detma.org/Lmi/Industry_Projection_ST.asp

⁴ http://lmi2.detma.org/Lmi/Industry_Projection.asp?area=01000025long&cmd=Go

⁵ U.S. Census Bureau

⁶ Atkinson, R. D., & Nager, A. (2014). The 2014 State New Economy Index: Benchmarking Economic Transformation in the States. *Information Technology and Innovation Foundation*.

CHAPTER 3: STUDY APPROACH

INTRODUCTION

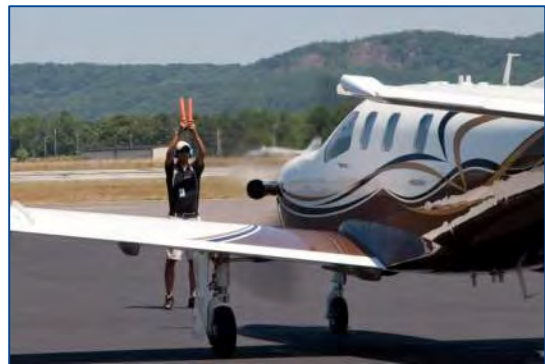
This study follows a proven Federal Aviation Administration (FAA) approved methodology of survey data and modeling estimates that has been used in numerous other airport economic impact studies. The total economic impact of the airports in this analysis is quantified in terms of employment, payroll, and output. Output represents total spending or economic activity and accounts for the total value of aviation-related activities supported by the airports included in this analysis. This chapter details the methodology used to estimate the economic impact of the airports in terms of the following three aviation-dependent groups:

- Businesses and government organizations engaged in on-airport activities, including on-airport construction projects;
- Visitors traveling to and within Massachusetts via commercial airlines; and
- Visitors traveling to and within Massachusetts via general aviation aircraft.

THE ECONOMIC MODELING PROCESS

All economic impacts from the 39 airports considered in this analysis were calculated using an input-output model. The input-output model describes the following three types of impacts:

- **Direct Impacts:** Direct impacts account for the initial point where the money from aviation-related activity first starts circulating in 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.¹

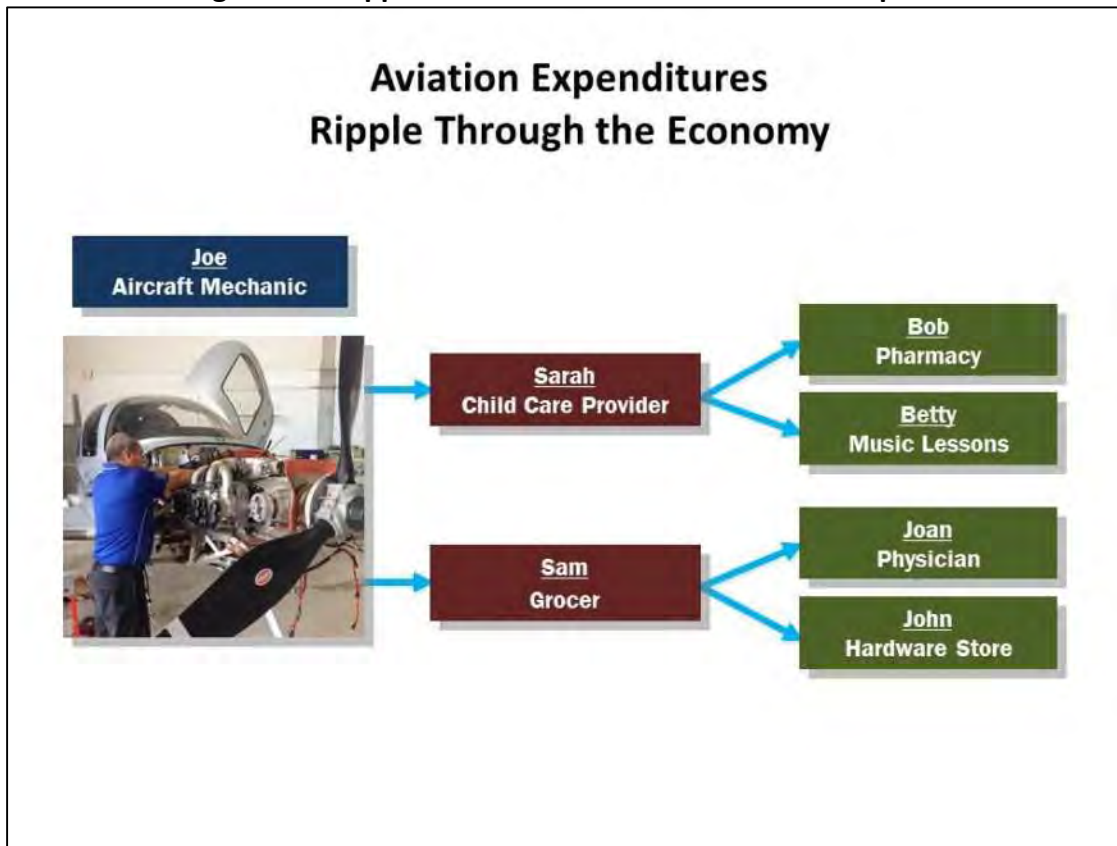


On-airport impacts include the employment, payroll, and spending of businesses such as fixed base operators (FBOs), flight schools, aircraft repair facilities, and airport management and operations staff. Capital expenditures of these businesses and government organizations are also included in direct 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 expenditures at restaurants or hotels. Direct impacts serve as the inputs for the economic model.

¹ Military aviation is included in on-airport activity in this study. Please refer to **Appendix C** for the methodology used to estimate the economic impacts for Massachusetts' military air facilities.

- **Multiplier Impacts:** Multiplier impacts result from the recirculation 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. For example, when an FBO purchases fuel from a supplier, this expenditure circulates through the local economy. Induced impacts are the impacts resulting from the recirculation of employee payroll within the economy. For example, as airport employees spend their salary for housing, food, and services, those expenditures also circulate through the economy resulting in increased spending, payroll, and employment throughout Massachusetts. This “ripple effect” of expenditures is graphically depicted in **Figure 3-1**. As this money is spent several times, it eventually 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. Multiplier impacts are the output of the economic model.

Figure 3-1: Ripple Effect Associated with Induced Impacts



Source: CDM Smith

- **Total Impacts:** Total impacts are the sum of all direct (on-airport and visitor spending) and multiplier (indirect and induced) economic activities attributable to an airport or the system of airports.

Direct impacts are measured through surveys of businesses, government organizations, and visitors. Because multiplier impacts are not as easy to measure as direct impacts, it is important to employ a reliable method of estimating multiplier impacts. A leading method used to estimate multiplier 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 obtained and used in this analysis. The IMPLAN input-output model used for this analysis requires direct impact estimates for three separate measures of the economy. These measures of economic impact are:

- **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 annual salary, wages, and benefits paid to all employees.
- **Output (Spending):** Output for on-airport activities 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 government tenants or corporate flight departments. In order to estimate the impact of these important tenant-related activities, output is assumed to be the sum of payroll and 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 in a manner similar to organizations that do not generate sales. Output related to capital improvement projects is equal to the expenditures on those projects. For visitors using an airport, output is assumed to equal visitor spending.

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 components (employment, payroll, and output) stands alone as a measure of an airport's total economic impact.

A number of data collection efforts were undertaken to gather information related to economic activity occurring at the Massachusetts airports considered in this analysis. These data were inputs to the modeling process to identify total economic impacts. The following groups were part of the data gathering effort to estimate direct impacts:

- **On-Airport Tenants:** This group includes airport tenants that are businesses with employees, such as airlines, FBOs, flight schools, corporate flight departments, concessionaires, and airport restaurants. Also included in this group are governmental agencies, such as public airport sponsors, air traffic controllers, other Federal Aviation Administration (FAA) units, as well as various other state and federal agencies.
- **Construction Impacts:** Each year, airports undertake capital improvement projects (CIP) such as runway rehabilitation or terminal improvements. In addition, businesses and other agencies undertake capital improvement projects. These projects employ people in jobs such as construction, architecture, engineering, and consulting.
- **Commercial Service Visitors:** This group consists of estimated visiting passengers (those deemed not local residents) arriving via commercial airlines. Average visitor spending for this group was estimated from updated commercial service visitor expenditure patterns from the 2011 *Massachusetts Statewide Airport Economic Impact Study* and comparison to the consultant's in-house database of visitor spending at commercial service airports throughout the United States.
- **General Aviation Visitors:** Impacts from general aviation visitors are produced by non-local passengers arriving via private or business aircraft. General aviation visitors make up the portion of each airport's general aviation operations that leave the airport's local airspace, termed itinerant operations. Some itinerant operations at an airport are conducted by residents of the airport's market area who fly their planes to distant locations and subsequently return to their home airport. The remaining itinerant operations are attributed to visitors. Itinerant operations performed by visitors are called true transient operations. Impacts for this group were estimated using survey data from pilots and passengers visiting airports across Massachusetts. IMPLAN multipliers specific to Massachusetts were then applied to direct impacts to estimate subsequent multiplier economic impacts.



SURVEYS, DATA COLLECTION METHODS, AND MODEL ASSUMPTIONS

The economic model requires an extensive data gathering effort in order to estimate the measures of direct impacts. The methods used to collect information from each category considered in the direct impacts are discussed in the ensuing sections, along with the assumptions needed to arrive at these direct impacts. An explanation of the multiplier impacts

resulting from the recirculation of the direct impacts follows the descriptions of the direct impacts.

It should be noted that most of the data collection methods described in the following sections do not apply to Boston Logan International Airport. Instead, the methodology used to update the economic impacts for this airport, based on the 2011 *Massachusetts Statewide Airport Economic Impact Study*, is detailed in **Appendix B**.

On-Airport Tenants

Airport sponsors and managers were directly interviewed or contacted to provide names, mailing addresses, telephone numbers, and e-mail addresses for each airport business or government tenant. All airport tenants having aviation-related employees on Massachusetts airports in 2013 were contacted to collect information regarding their economic activity. Since the purpose of this study was to measure the economic impacts of each Massachusetts airport and the activity that relied on the airport, a distinction was made between those on-airport tenants that depended on the airport (deemed aviation-related) and those that did not. For example, an insurance business located on an airport would not be designated as aviation-related since an insurance business typically does not need an airport to operate. A survey was provided to each aviation-related tenant and follow-up calls and e-mails were made to obtain responses and to verify information on returned surveys. Airport tenants at each airport were grouped into 19 categories to aid in analysis. These categories consisted of:



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

The survey sent to each airport tenant, including airport sponsors and managers, requested the following information:

- Type of aviation activity conducted by the tenant
- Number of full-time, part-time, and seasonal employees in 2013

- Estimated total annual wages and benefits paid to employees in 2013
- Estimated total capital improvement expenditures for each year, 2011 through 2013
- Estimated total operating expenses (excluding payroll and capital improvements previously identified) for 2013
- Estimated total gross sales (where applicable) by the business on the airport in 2013

A high response rate was desired for the airport management and tenant surveys. Several rounds of follow-up telephone calls and e-mails were therefore made to non-responding entities and airport managers to obtain the greatest response rate possible for on-airport employment. 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 those tenants and businesses that 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 the consultant's in-house database compiled from airport economic impact studies conducted throughout the United States.

To estimate multiplier impacts, airport tenants were classified into one of three categories (aviation, concession, and government), based upon the nature of their business. This was done to facilitate subsequent IMPLAN modeling of multipliers. Aviation multipliers were used for airlines, aircraft maintenance, FBOs, air cargo, flight schools, and corporate flight departments. Retail, food and beverage, car rental, and parking tenants had a set of concession multipliers applied to estimate multiplier impacts. Government related entities received their own set of multipliers for estimating multiplier impacts. Impacts stemming from construction projects were broken out from each tenant so a set of construction-related multipliers could be used for capital projects.

Construction Impacts

Each year, airports and their tenants undertake construction projects such as runway rehabilitation, terminal improvements, or business renovations. These projects employ construction workers, architects, engineers, and consultants. For this analysis, data was gathered on CIP expenditures and combined with IMPLAN data to estimate direct construction impacts. The following steps were used to estimate construction impacts:



- CIP data for the 2011-2013 time period was gathered from airport managers as well as from aviation-related businesses and government agencies located on each airport. Survey data was compared to MassDOT Aeronautics Division's Grants History database to insure consistency.

- CIP expenditures were averaged over the time period to avoid showing peaks or troughs in construction activity. This average CIP expenditure was used as the CIP direct output for the airport.
- The IMPLAN model indicates that every \$1 million spent annually on construction activity supports approximately 7.7 construction-related jobs in Massachusetts. These jobs include construction workers, equipment operators, foremen, engineers, architects, consultants, and managers.
- Data from the U.S. Bureau of Labor Statistics was used to determine average annual pay for Massachusetts employees involved in construction activity. This average payroll (\$49,200) was applied to each CIP-related employee to determine direct payroll associated with CIP activity.
- CIP multipliers from the IMPLAN model were applied to these direct impact numbers to estimate induced and indirect impacts.

Commercial Service Visitors

Massachusetts' commercial service airports serve as gateways to the Commonwealth for millions of business- and pleasure-related visitors each year. These visitors contribute to the economy through their expenditures for food, lodging, entertainment, transportation, retail sales, and other goods and services. Numerous service industries also benefit from the multiplier effects stemming from visitor spending.

Massachusetts is home to nine commercial service airports, with seven of these airports providing commercial airline service in 2013.² For each commercial service airport with commercial airline service, the following methodology was used to estimate commercial service visitor impacts.



Enplanement data for 2013 was obtained for each airport from airport sponsors and managers. The percentage of visiting passengers was estimated for each airport, using data from the 2011 *Massachusetts Statewide Airport Economic Impact Study* or a sampling of U.S. Department of Transportation origin and destination data for 2013. The number of enplanements and estimated visitors for each airport in 2013 is presented in **Table 3-1**. As shown in Table 3-1, there were nearly 15.5 million enplanements at Massachusetts' commercial service airports, with the large majority occurring at Boston Logan International Airport. Of these enplanements, an estimated 6.7 million (44 percent) were visitors to the Commonwealth.

² Laurence G. Hanscom Field and Westover Air Reserve Base/Metropolitan Airport were without commercial airline service in 2013. Both airports, however, served passengers carried by non-scheduled operators. In this study, the economic impacts supported by enplanements at these airports were included in each airport's general aviation visitor impacts.

Table 3-1: Enplanements & Percent Visitors at Massachusetts Commercial Service Airports

Associated City	Airport Name	2013 Enplanements	Percent Visitors	Visitors
COMMERCIAL SERVICE AIRPORTS				
Boston	Boston Logan International Airport (Note 1)	15,109,485	45%	6,527,734
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	90,332	51%	46,070
Nantucket	Nantucket Memorial Airport	175,328	70%	122,730
New Bedford	New Bedford Regional Airport	10,500	10%	1,050
Provincetown	Provincetown Municipal Airport	11,208	90%	10,090
Vineyard Haven	Martha's Vineyard Airport	50,957	70%	35,670
Worcester	Worcester Regional Airport	11,156	23%	2,570
COMMERCIAL SERVICE AIRPORTS TOTAL		15,458,966	44%	6,745,914

Source: Airport management, 2011 *Massachusetts Statewide Airport Economic Impact Study*, and US DOT O&D data

Note 1: Visitors do not include connecting passengers.

Average expenditures per visitor per trip from the 2011 *Massachusetts Statewide Airport Economic Impact Study* were compared to the consultant's in-house database of commercial service visitor expenditures at airports across the country and adjusted for inflation to estimate 2013 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 airline visitors using each airport. Ratios from the IMPLAN input-output model found that every \$1 million in visitor expenditures supported approximately 12.6 jobs, predominantly in the hotel and motel, food and beverage, entertainment, retail, and transportation sectors. Data from the U.S. Bureau of Labor Statistics were used to determine that the average pay for Massachusetts employees supported by visitor spending was approximately \$23,800. This average payroll was applied to each visitor-related employee to determine direct payroll associated with visitor spending.

The following example using Barnstable Municipal Airport-Boardman/Polando Field 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.



Barnstable Municipal Airport-Boardman/Polando Field reported 90,332 enplaned passengers in 2013. An estimated 51 percent of these enplanements were visitors to the area, or approximately 46,070 visitors traveled through Barnstable Municipal Airport-Boardman/Polando Airport.

$$90,332 \text{ enplanements} \times 51 \text{ percent visitors} = 46,070 \text{ visitors}$$

Barnstable Municipal Airport-Boardman/Polando Field visitors spend an estimated average of \$530 per visitor during their stay. This average was used to calculate visitors' annual spending (or output) of approximately \$24.4 million.

$$46,070 \text{ visitors} \times \$530 \text{ per visitor per stay} = \$24.4 \text{ million}$$

In order to estimate employment associated with commercial service visitor expenditures, Massachusetts specific employment ratios per \$1 million of visitor output were developed using the IMPLAN model. It was estimated that approximately 12.6 people were employed in Massachusetts as result of every \$1 million in commercial service visitor output. This results in an estimated 308 visitor-related jobs associated with the spending by visitors arriving via Barnstable Municipal Airport-Boardman/Polando Field on commercial airlines.

$$\$24.4 \text{ million} \times 12.6 \div \$1,000,000 = 308 \text{ jobs}$$

In order to estimate payroll impacts associated with employment supported by commercial service visitors, average state wages for appropriate industry sectors were applied to the estimated number of employees supported by commercial airline visitor spending. Most visitor expenditures take place in the hotel and motel, food and beverage, entertainment, retail, and transportation sectors. Based on data obtained from the U.S. Bureau of Labor Statistics, an average payroll of \$23,800 per employee in Massachusetts was assumed for these job categories.

$$308 \text{ jobs} \times \$23,800 = \$7.3 \text{ million annual payroll}$$

The same calculation was used for each commercial service airport, using the average expenditure per visitor per trip as appropriate. Detailed tables showing the commercial service visitor impacts at each commercial service airport can be found in **Appendix A**.

General Aviation Visitors

General aviation refers to all segments of aircraft activity that are not related to the commercial airlines (including scheduled air cargo) or the military. Visitors to Massachusetts use general aviation aircraft to enjoy both the leisure opportunities available in Massachusetts as well as to conduct business. For example, the airports in the Cape and Islands region support flight operations conducted by visitors to this premier travel destination. The visitors on these flights spend money in the local economy on food, lodging and other hospitality services.

The economic activity generated by general aviation visitors in Massachusetts was determined by surveying visiting pilots and passengers. Surveys were delivered to FBO managers throughout the state system of airports that requested the following information:

- The airport where the survey was received
- The number of travelers in the aircraft
- Where the aircraft was based

- Whether the respondent was a pilot or passenger
- 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
- Further comments regarding the value of the Massachusetts aviation system to the pilot and his or her business

This survey data was used to develop an estimate of visitor expenditures. These estimates included the average number of visitors per aircraft and the average expenditure per visitor per trip. It is recognized, however, that these averages vary at different types of airports. Because of this, the same approach used in the 2011 *Massachusetts Statewide Airport Economic Impact Study* was applied to Massachusetts' airports. Similar to that study, the airports were grouped into one of five categories based on their activity level and location. Survey data within each group of airports was used to estimate the average number of visitors per arriving aircraft and how much each spent during their stay.

Data from FAA 5010 forms, airport management estimates, and air traffic control towers were used to develop estimates at each airport of itinerant aircraft operations, which are operations by aircraft coming from another airport. Since many of these operations are aircraft that are returning to their home base, the same estimate of true transient aircraft (those bringing visitors to the airport) used for each airport in the 2011 *Massachusetts Statewide Airport Economic Impact Study* was applied.

Together, all of these estimates were used to assess the level of general aviation visitor spending at each airport as illustrated in the following example using Nantucket Memorial Airport. This example demonstrates the calculations used to estimate general aviation visitor impacts in this study. As with the commercial service visitor impact example above, rounded numbers are used and any variation in calculations is the result of rounding.



Nantucket Memorial Airport was estimated to have approximately 54,920 itinerant operations in 2013; or 27,460 annual itinerant arrivals (since it is assumed that all arrivals have a corresponding departure). Furthermore, it was estimated that 75 percent of these itinerant arrivals were true transient arrivals.

$$27,460 \text{ itinerant arrivals} \times 75 \text{ percent} = 20,595 \text{ true transient arrivals}$$

Transient pilot survey data for the group of airports including Nantucket Memorial Airport provided estimates of the average number of visitors per aircraft, including the pilot (3.3 visitors), and the average spending (\$430 per visitor per trip). These averages were used to calculate the total annual visitors (67,964 visitors) and the impacts of those visitors' spending in the region around Nantucket Memorial Airport, or approximately \$29.2 million per year. It should be noted that visitor spending does not include purchases on the airport. For example, FBO services or fuel purchases are removed from this calculation to avoid double-counting. These purchases are included in the direct impacts associated with each on-airport tenant.

$$20,595 \text{ true transient arrivals} \times 3.3 \text{ visitors per arrival} = 67,964 \text{ visitors}$$

$$67,964 \text{ visitors} \times \$430 \text{ per visitor per trip} = \$29.2 \text{ million annual spending by visitors}$$

To determine payroll and employment impacts resulting from this visitor spending (or output), multiplier ratios based on \$1.0 million of output were used. In other words, ratios developed by the IMPLAN model indicate that for every \$1.0 million of general aviation visitor output, approximately 15.2 full-time positions in other industries are created. Most of these jobs are in the service and retail sectors. Visitors using general aviation at Nantucket Memorial Airport would then support approximately 443.0 full-time positions.

$$\$29.2 \text{ million} \times 15.2 \text{ jobs} \div \$1,000,000 = 443.0 \text{ jobs}$$

The average annual statewide salary for service/retail industries (\$23,800) was then 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 443.0 full-time positions is estimated to total approximately \$10.5 million.

$$443.0 \text{ jobs} \times \$23,800 = \$10.5 \text{ million annual payroll}$$

The operational and visitor impact data for each study airport can be found in Appendix A.

STUDY MULTIPLIERS

Employment, payroll, and output impacts derived from airport businesses and government organizations, on-airport activities, spending on capital projects, and visitor expenditures, comprise each airport's direct economic impacts. As these impacts enter the economy, they circulate among other sectors, creating multiplier impacts of additional spending beyond the direct impacts.

Multiplier impacts arise from various interdependencies within an economic system. For example, the operation of an airport requires inputs in the form of supplies, equipment, and maintenance. These inputs generate a boost in sales for those businesses providing these services and products. Moreover, the goods and services themselves require inputs for their production. The process continues as a large number of impacts recirculate through the

economy. The total requirement for goods and services is the multiple of the initial needs of the airports considered in this analysis; hence it is referred to using the term “multiplier.”

Industry-specific multipliers were derived from the IMPLAN model. 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 and visitor spending. For example, \$100 in direct expenditures (output) in the aviation sector supports a total output of \$156. That total output breaks down into \$100 of direct output and \$56 of multiplier impact. This methodology was applied to each of the study airports and generated estimates of total employment, annual payroll, and economic output associated with each airport.

Table 3-2: Massachusetts IMPLAN Multipliers by Economic Sector

Economy Sector	Employment Multiplier	Payroll Multiplier	Output Multiplier
Government	1.63	1.36	1.82
Construction CIP (Note 1)	1.83	1.75	1.95
Concessions (Note 2)	1.33	1.63	1.85
Aviation (Note 3)	1.85	1.77	1.56
Commercial Service Visitor Expenditures (Note 4)	1.58	1.91	1.83
General Aviation Visitor Expenditures (Note 4)	1.48	1.83	1.82

Source: CDM Smith and IMPLAN multipliers

Notes

1. Construction 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.
2. Concessions multipliers are the weighted average of the Food Services and Drinking Places; Business Support Services; and Miscellaneous Retail Store multipliers.
3. Aviation multipliers are the weighted average of the Aircraft Manufacturing; Aircraft Engine and Engine Parts Manufacturing; Other Aircraft Parts and Auxiliary Equipment Manufacturing; and Transport by Air multipliers.
4. Visitor expenditures multipliers are the weighted average of the Food Services and Drinking Places; Automotive Equipment Rental and Leasing; Hotels and Motels – Including Casino Hotels; and Miscellaneous Retail Store multipliers. Weightings were different for commercial service and general aviation visitor multipliers to reflect the difference in their spending habits.

SUMMARY

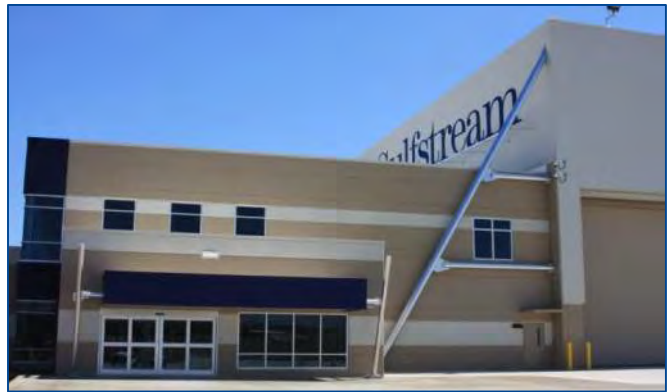
This chapter presented the methodology used to estimate the economic impacts of the Massachusetts airports in this airport economic impact analysis. The total economic impact of each study airport is quantified in terms of employment, payroll, and output for three aviation-dependent groups: on-airport activities and construction projects; visitors traveling to Massachusetts via commercial airlines; and visitors traveling to and within Massachusetts via general aviation aircraft. The impacts for each of these groups are discussed as direct impacts (both on-airport and visitor-related), multiplier impacts, and total impacts. By following this methodology, estimates of total employment, annual payroll, and economic output associated with each airport were developed.

CHAPTER 4: AIRPORT EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS

INTRODUCTION

Massachusetts' 39 public-use airports help to accommodate the travel needs of business and leisure visitors to the Commonwealth. The airports themselves are also significant generators of economic activity. Airports support jobs, payroll, and output for the Massachusetts economy.

A wide variety of businesses and employers are found at Massachusetts' airports, ranging from individual flight instructors to major airlines, such as Delta Air Lines, which operates a hub at Boston Logan International Airport, and corporate flight departments for Fortune 500 companies, such as Liberty Mutual Insurance at Laurence G. Hanscom Field. Cape Air, a regional airline, has more than 300 employees at its corporate



headquarters at Barnstable Municipal Airport-Boardman/Polando Field and a total of approximately 200 additional employees at several of the Commonwealth's other commercial service airports. Gulfstream Aerospace Corporation has more than 230 employees at its Falcon and Gulfstream aircraft service center located at Westfield-Barnes Regional Airport.

Military aviation has a significant presence in Massachusetts. For example, Westover Air Reserve Base (ARB), home to the Air Force Reserve Command's 439th Airlift Wing, is the nation's largest Air Force Reserve Base and has more than 3,800 military and civilian employees. 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 describes the economic impacts associated with employment, annual payroll, and total annual output for the 39 Massachusetts public-use airports. The combined impact of all the airports is shown in each section. Detailed tables showing the impacts of each individual airport can be found in **Appendix A**.

It should also be noted 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 in order to provide a complete picture of aviation's economic impacts in the Commonwealth.¹

EMPLOYMENT IMPACTS

This analysis found that airports in Massachusetts are an important source of jobs. Employment, as defined in this analysis, is based on estimates where 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. Employment impacts were calculated for on-airport activity and visitor-related spending. On-airport activity includes private businesses, government organizations, and military aviation. On-airport activity also includes spending for capital improvement projects (CIP) and other improvement and construction projects that make significant contributions to on-airport employment.



Employment from On-Airport Activity

The total number of jobs supported by on-airport activity at the airports included in this study is identified in **Table 4-1**. These jobs are comprised of those people who are engaged in the provision of aviation-related services on the airports, such as aircraft fuel sales, aircraft maintenance, flight training, corporate flight departments, concessions (e.g., restaurants and rental car agencies), and charter services. Employment associated with military aviation and airport CIPs are also included.

Table 4-1: Massachusetts On-Airport Activity Employment

	Direct Employment	Multiplier Employment	Total Employment
Commercial Service Airports	26,017	16,172	42,189
General Aviation Airports	2,038	1,402	3,440
TOTAL	28,055	17,574	45,629

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

There are 28,055 direct jobs supported by the on-airport activities of the Commonwealth's 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. For instance, some airports have industrial or business parks that include companies that are not related to

¹ Joint Base Cape Cod's economic impacts are not included, since it is not co-located with one of the system airports, as are Hanscom AFB, Westover ARB, and the Air and Army National Guard units at Westfield-Barnes Regional Airport.

the airport or aviation in any way. Employment related to these businesses is not included in the employment estimate shown in Table 4 1.

Multiplier impacts are those jobs that are created by ripple effects stemming from direct jobs associated with businesses, government agencies, military aviation, and CIP activity at Massachusetts' airports. For example, an employee of a landscaping company may owe a portion of his job to an airport since part of the employee's job is periodic cutting of the grass at the airport. As a result of on-airport activity, additional multiplier employment is created. Multiplier impacts associated with the day-to-day operation of Massachusetts' airports add 17,574 positions to the economy. When direct and multiplier employment are considered, on-airport activity at Massachusetts' airports contributed 45,629 jobs to the Commonwealth's employment base.

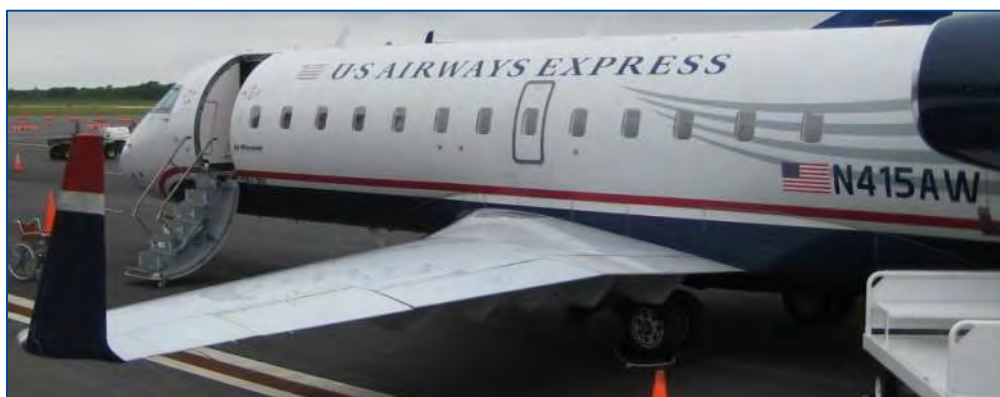
Employment from Commercial Service Visitor Spending

Visitors arriving at Massachusetts' airports on commercial airlines spend money during their stay in the Commonwealth, which supports jobs found off-airport, primarily in the hotel and motel, food and beverage, entertainment, retail, and transportation sectors. **Table 4-2** identifies the number of employees in Massachusetts whose jobs are supported by the spending of visitors arriving on commercial airlines via the Commonwealth's seven airports with commercial service in 2013.

**Table 4-2: Massachusetts Employment from
Commercial Service Visitor Spending**

	Direct Employment	Multiplier Employment	Total Employment
Commercial Service Airports	71,459	41,411	112,870

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A



As shown in Table 4-2, 71,459 direct jobs can be traced to visitors arriving in Massachusetts on commercial airlines. Multiplier impacts include those jobs that exist due to ripple effects. Multiplier impacts result in 41,411 additional positions supported by the spending of

commercial service visitors. When direct and multiplier visitor-related employment impacts are combined, an estimated 112,870 jobs are supported by spending from visitors to Massachusetts who arrive via commercial airlines.

Employment from General Aviation Visitor Spending

Visitors that use general aviation also contribute to the Commonwealth's economy through their purchases made while traveling. **Table 4-3** identifies the number of Massachusetts jobs supported by spending from visitors using general aviation aircraft to travel to and within the Commonwealth.

Table 4-3: Massachusetts Employment from General Aviation Visitor Spending

	Direct Employment	Multiplier Employment	Total Employment
Commercial Service Airports	1,847	884	2,731
General Aviation Airports	695	331	1,026
TOTAL	2,542	1,215	3,757

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

Direct jobs associated with general aviation visitor spending are usually found off-airport and are attributed to a variety of sectors; however, most of these jobs are concentrated in the hotel and motel, food and beverage, entertainment, retail, and transportation sectors. As a result of general aviation visitor expenditures in Massachusetts, there are 2,542 direct jobs supported in the Commonwealth.

Multiplier employment includes those jobs that exist due to continued circulation of general aviation visitor expenditures. Multiplier impacts result in 1,215 additional jobs. When direct and multiplier general aviation visitor-related employment impacts are combined, 3,757 jobs are supported by the spending of visitors using general aviation aircraft in Massachusetts.

Total Employment

Table 4-4 identifies the total number of jobs supported by all activities at Massachusetts' 39 public-use airports. As a result of on-airport activities and spending by visitors using the study airports, there are 102,056 direct jobs. Multiplier impacts add 60,200 jobs. In total, 162,256 jobs are supported in Massachusetts by on-airport activity and visitors to the study airports.

Table 4-4: Massachusetts Airports Total Employment

	Total Direct Employment	Total Multiplier Employment	Total Employment
Commercial Service Airports	99,323	58,467	157,790
General Aviation Airports	2,733	1,733	4,466
TOTAL	102,056	60,200	162,256

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

PAYROLL IMPACTS

Massachusetts' economy benefits from the salaries, wages, and benefits paid to the employees described in the previous section. Estimates of these payroll impacts associated with on-airport activity, commercial service visitors, and general aviation visitors are detailed below by economic impact category.

Payroll from On-Airport Activity

Table 4-5 shows the annual payroll impacts associated with on-airport activity at the study airports. It is important to note that payroll supported by airport construction projects and payroll associated with military aviation at Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport are also included.

Table 4-5: Massachusetts On-Airport Activity Payroll

	Direct Payroll	Multiplier Payroll	Total Payroll
Commercial Service Airports	\$1,777,073,000	\$827,361,000	\$2,604,434,000
General Aviation Airports	\$86,383,000	\$52,473,000	\$138,856,000
TOTAL	\$1,863,456,000	\$879,834,000	\$2,743,290,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

This study found that direct on-airport annual payroll impacts approach \$1.9 billion. The majority of this is attributed to Massachusetts' commercial service airports, which provide approximately \$1.8 billion in payroll. The general aviation airports add another \$86.4 million to direct payroll.

This payroll impact ripples throughout the Commonwealth's economy, creating multiplier payroll impacts that are estimated through the IMPLAN model. The multiplier annual payroll impact related to on-airport activity at the study airports is approximately \$879.8 million. Total payroll impacts produced by the airports, which include direct and multiplier payroll, exceed \$2.7 billion annually.

Payroll from Commercial Service Visitor Spending

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

Table 4-6: Massachusetts Annual Payroll from Commercial Service Visitor Spending

	Direct Payroll	Multiplier Payroll	Total Payroll
Commercial Service Airports	\$1,700,725,000	\$1,539,357,000	\$3,240,082,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

Direct payroll consists of salary, wages, and benefits paid to employees working at restaurants, hotels, motels, retail businesses, and other service industries that are used by commercial service visitors. Direct annual payroll attributable to spending by commercial service visitors is estimated at \$1.7 billion.

As employees in the service industries spend their payroll, the money continues to circulate in Massachusetts, generating additional employment and subsequent payroll. Annual multiplier payroll impacts associated with commercial service visitor-supported employment are estimated at \$1.5 billion. When direct and multiplier payroll impacts stemming from commercial service visitor spending in Massachusetts are combined, a total annual payroll impact of approximately \$3.2 billion is produced.

Payroll from General Aviation Visitor Spending

Table 4-7 identifies the payroll impacts attributed to spending by visitors using general aviation to travel to various parts of Massachusetts. Visitor-related payroll includes salaries paid to employees working in visitor-related businesses and other service industries that are utilized by general aviation visitors, such as hotels, motels, and restaurants. Direct annual payroll attributable to spending by general aviation visitors is estimated at \$60.5 million.



**Table 4-7: Massachusetts Annual Payroll
from General Aviation Visitor Spending**

	Direct Payroll	Multiplier Payroll	Total Payroll
Commercial Service Airports	\$43,958,000	\$36,424,000	\$80,382,000
General Aviation Airports	\$16,542,000	\$13,706,000	\$30,248,000
TOTAL	\$60,500,000	\$50,130,000	\$110,630,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

As employees in the visitor-related industries spend their payroll, this spending continues to circulate, generating additional employment and subsequent payroll. The multiplier payroll impact associated with general aviation visitor spending is estimated at approximately \$50.1 million. When direct and multiplier payroll impacts stemming from general aviation visitor spending are combined, a total payroll impact of \$110.6 million is produced annually.

Total Annual Payroll

Table 4-8 identifies the combined impacts of payroll tied to on-airport activity and visitors arriving at the study airports. The collective direct annual payroll impact supported by the study airports is approximately \$3.6 billion. Multiplier impacts add another \$2.5 billion in annual payroll impacts to produce a total payroll impact of \$6.1 billion.

Table 4-8: Massachusetts Airports Total Annual Payroll

	Total Direct Payroll	Total Multiplier Payroll	Total Payroll
Commercial Service Airports	\$3,521,756,000	\$2,403,142,000	\$5,924,898,000
General Aviation Airports	\$102,925,000	\$66,179,000	\$169,104,000
TOTAL	\$3,624,681,000	\$2,469,321,000	\$6,094,002,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

OUTPUT IMPACTS

Economic output is the result of money spent, invested, and generated by aviation-related businesses, government organizations, military aviation, and visitors in Massachusetts. For this study, on-airport output is defined as annual gross sales for on-airport businesses and activities. The exceptions are organizations such as corporate flight departments and government agencies that do not generate revenue. Airlines are also exceptions since it is difficult to attribute ticket revenues to specific airports. Output for these types of organizations is defined as the sum of payroll and operating expenses. Output for CIP is simply the expenditures related to those projects. Output related to commercial service and general aviation visitors is defined as spending by those people during their visits at locations that are not already captured by on-airport output, typically off-airport establishments. Annual economic output attributed to the system airports that benefits Massachusetts' economy is discussed in this section.



Output from On-Airport Activity

Table 4-9 identifies annual output for all on-airport activities, including airport construction projects and military aviation at Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport. Massachusetts' airports produce \$3.6 billion in direct economic output, with the bulk of that coming from the commercial service airports.

Table 4-9: Massachusetts On-Airport Activity Output

	Direct Output	Multiplier Output	Total Output
Commercial Service Airports	\$3,318,621,000	\$2,110,050,000	\$5,428,671,000
General Aviation Airports	\$269,930,000	\$163,148,000	\$433,078,000
TOTAL	\$3,588,551,000	\$2,273,198,000	\$5,861,749,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

As aviation-related businesses and government entities located on each study airport and military air facilities spend money, these expenditures ripple through the Commonwealth's economy, leading to additional output impacts. Multiplier output impacts are estimated using IMPLAN multipliers, with approximately \$2.3 billion in multiplier output from on-airport activity. When direct and multiplier impacts are combined, the total annual output for the study airports from on-airport activity is nearly \$5.9 billion.

Output from Commercial Service Visitor Spending

The output attributed to commercial service visitor spending is presented in **Table 4-10**. Direct output is comparable to total annual visitor expenditures. Direct output from commercial service visitor spending is estimated at approximately \$5.7 billion. The recirculation of those impacts creates another \$4.7 billion in multiplier impacts. In total, the combined annual output from commercial service visitor spending approaches \$10.4 billion.



Table 4-10: Massachusetts Output from Commercial Service Visitor Spending

	Direct Output	Multiplier Output	Total Output
Commercial Service Airports	\$5,668,828,000	\$4,720,317,000	\$10,389,145,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

Output from General Aviation Visitor Spending

Table 4-11 identifies the output attributed to general aviation visitors using airports in Massachusetts. Direct annual output is comparable to all general aviation visitor expenditures at these airports and is estimated at \$167.6 million. As the businesses that support visitor activities recirculate this money, multiplier impacts estimated at \$136.6 million are created. Combining the direct and multiplier impacts of general aviation visitor spending yields total general aviation visitor output of \$304.2 million.

Table 4-11: Massachusetts Output from General Aviation Visitor Spending

	Direct Output	Multiplier Output	Total Output
Commercial Service Airports	\$121,884,000	\$99,349,000	\$221,233,000
General Aviation Airports	\$45,722,000	\$37,268,000	\$82,990,000
TOTAL	\$167,606,000	\$136,617,000	\$304,223,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

Total Annual Output

The total combined annual output related to on-airport activities and commercial service and general aviation visitor spending is presented in **Table 4-12**. Direct annual output is estimated at \$9.4 billion. Multiplier output impacts are estimated at \$7.1 billion annually. Combined direct and multiplier output from on-airport activities, visitors, and ripple effects produce a total annual output estimate of approximately \$16.6 billion for the Commonwealth's economy, which comprises 3.7 percent of Massachusetts' 2013 estimated Gross State Product of \$446.3 billion.

Table 4-12: Massachusetts Airports Total Annual Output

	Total Direct Output	Total Multiplier Output	Total Output
Commercial Service Airports	\$9,109,333,000	\$6,929,716,000	\$16,039,049,000
General Aviation Airports	\$315,652,000	\$200,416,000	\$516,068,000
TOTAL	\$9,424,985,000	\$7,130,132,000	\$16,555,117,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

SUMMARY

Massachusetts' 39 public-use airports generate significant economic impacts and are critical components of the Commonwealth's economy. This study examined their economic contributions in terms of jobs, payroll and output from on-airport activity (including military aviation and airport CIPs), visitor expenditures, and the multiplier impacts resulting from the recirculation of these initial impacts.

Table 4-13 provides a summary of each category of economic impacts for Massachusetts' airports discussed in this chapter. As shown, Massachusetts' 39 public-use airports generated approximately \$16.6 billion in total annual output in 2013. These expenditures helped to support a total of 162,256 jobs that have an annual payroll of approximately \$6.1 billion. These impacts represent an increase of approximately 38,000 total jobs, \$1.2 billion in total payroll, and \$4.7 billion in total output since the 2011 *Massachusetts Statewide Airport Economic Impact Study*.

Table 4-13: Economic Impact Summary for Massachusetts Airports

	Direct On-Airport Activity Impacts	Direct Visitor-Related Impacts	Multiplier Impacts	Total Impacts
EMPLOYMENT				
Commercial Service Airports	26,017	73,306	58,467	157,790
General Aviation Airports	2,038	695	1,733	4,466
TOTAL	28,055	74,001	60,200	162,256
PAYROLL				
Commercial Service Airports	\$1,777,073,000	\$1,744,683,000	\$2,403,142,000	\$5,924,898,000
General Aviation Airports	\$86,383,000	\$16,542,000	\$66,179,000	\$169,104,000
TOTAL	\$1,863,456,000	\$1,761,225,000	\$2,469,321,000	\$6,094,002,000
OUTPUT				
Commercial Service Airports	\$3,318,621,000	\$5,790,712,000	\$6,929,716,000	\$16,039,049,000
General Aviation Airports	\$269,930,000	\$45,722,000	\$200,416,000	\$516,068,000
TOTAL	\$3,588,551,000	\$5,836,434,000	\$7,130,132,000	\$16,555,117,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

Table 4-14 provides an additional breakout of the economic impacts generated by Massachusetts' airports. As shown, the distribution of the total economic impacts in Table 4-13 between the airports included in the 2010 *Massachusetts Statewide Airport System Plan* (MSASP) and the airports owned and operated by the Massachusetts Port Authority (Massport), which include Boston Logan International Airport, Laurence G. Hanscom Field, and Worcester Regional Airport is identified.

Table 4-14: Distribution of Economic Impacts Between 2010 MSASP Airports and Massport Airports

	Direct On-Airport Activity Impacts	Direct Visitor-Related Impacts	Multiplier Impacts	Total Impacts
EMPLOYMENT				
MSASP Airports	7,181	4,456	5,915	17,552
Massport Airports	20,874	69,545	54,285	144,704
TOTAL	28,055	74,001	60,200	162,256
PAYROLL				
MSASP Airports	\$291,585,000	\$106,053,000	\$228,684,000	\$626,322,000
Massport Airports	\$1,571,871,000	\$1,655,172,000	\$2,240,637,000	\$5,467,680,000
TOTAL	\$1,863,456,000	\$1,761,225,000	\$2,469,321,000	\$6,094,002,000
OUTPUT				
MSASP Airports	\$612,301,000	\$328,623,000	\$603,817,000	\$1,544,741,000
Massport Airports	\$2,976,250,000	\$5,507,811,000	\$6,526,315,000	\$15,010,376,000
TOTAL	\$3,588,551,000	\$5,836,434,000	\$7,130,132,000	\$16,555,117,000

Source: CDM Smith and IMPLAN multipliers; Note: Individual airport data can be found in Appendix A

Total employment supported by the MSASP airports is estimated at 17,552 jobs; total annual payroll associated with these jobs is estimated at \$626.3 million. Total annual output from the MSASP airports exceeds \$1.5 billion. For the Massport airports, total employment is estimated

at 144,704 jobs, with total annual payroll estimated at nearly \$5.5 billion. Total annual output for the Massport airports is estimated at \$15.0 billion.

It should be noted that, based on a variety of factors including projected changes in passenger enplanements and aircraft operations, anticipated capital improvement project expenditures, and in the case of Boston Logan International Airport, forecasts of concessions gross sales, the economic impacts shown in Tables 4-13 and 4-14 can be expected to increase to approximately 181,000 total jobs and \$18.4 billion in total annual output by 2018. These impacts are presented in **Table 4-15**. A discussion of the methodology used to estimate the 2018 impacts can be found in **Appendix D**.

**Table 4-15: Projected 2018 Economic Impacts
for Massachusetts Airports**

	Total Employment	Total Output
MSASP Airports	19,690	\$1,859,937,000
Massport Airports	161,370	\$16,573,539,000
TOTAL	181,060	\$18,433,476,000

Source: CDM Smith and IMPLAN multipliers

CHAPTER 5: ADDITIONAL AREAS OF ANALYSIS

INTRODUCTION

Airports in Massachusetts provide benefits in addition to the economic impacts detailed in Chapter 4. These benefits, some of which are not easily quantified, are not typically captured by traditional economic impact studies of airport systems. It is important to identify these benefits, however, because the total value of an airport system is comprised of more than the employment, payroll, and output impacts. For instance, airports provide real value to those people who rely on them not just for their livelihoods, but also their safety and quality of life. Also, aviation in the Commonwealth plays an important role in generating tax revenues for Massachusetts and local municipalities for the provision of community services and protection of the public's health, safety, and welfare. As such, this chapter provides an overview of the following additional benefits:

- Qualitative Airport Benefits
- Tax Impacts

QUALITATIVE AIRPORT BENEFITS

Massachusetts' airports provide substantial quantitative benefits, as explained in the preceding chapter. Beyond the quantitative aspects of aviation benefits, there are also qualitative benefits that deserve consideration when the total value of an airport system is analyzed. Qualitative benefits are those activities which take place at an airport on a regular basis that add to the quality of life, but are difficult to assign a dollar value. Qualitative benefits typically enhance the health, welfare, or safety of individuals in the airport's market area. While it may be difficult to place a dollar value on such impacts, these benefits, which vary throughout the airport system, improve the quality of life of the Commonwealth's residents in a variety of ways. The following are examples of the qualitative benefits of aviation at Massachusetts' airports, with statistics on the prevalence of those benefits gleaned from the survey of airport sponsors and managers during the data collection process for this study:¹

- Facilitating emergency medical transport: Airports routinely operate as bases of operations for medical transport aircraft (including Angel Flights), allowing patients and doctors to be moved quickly and efficiently through smaller, less active airports. This service is particularly important to remote locations (such as an island) that do not have convenient or direct ground access to



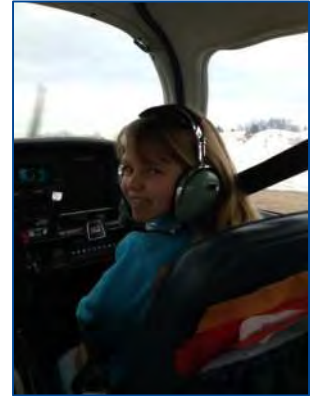
¹ Boston Logan International Airport was not included in this analysis.

appropriate medical facilities. Eighty-seven percent of general aviation airports and all commercial service airports accommodate some form of emergency medical evacuation and/or patient transfer. Transport of medical personnel occurs at forty-four percent of general aviation airports and 62 percent of commercial service airports.

- Providing police support: Airports are routinely utilized by local and state police units as bases of operations for helicopter units, as staging areas for emergency evacuation plans, as a resource for facilitating prisoner transports, among other services. Ninety-three percent of general aviation airports and all of the commercial service airports provide police support. Fourteen percent of general aviation airports and 75 percent of commercial service airports are used for prisoner transport.
- Supporting forest and wildlands firefighting operations: Some Massachusetts airports are occasionally used to provide forest and wildlands firefighting support. Twenty-eight percent of general aviation airports and 25 percent of commercial service airports are used for these operations.
- Serving as a staging area for community events: An airport should always be considered to be a community asset, and as part of a community at-large, airports are frequently used to host various events. Whether it is because of the open space and facilities available for community gatherings or for the activities directly related to airport operations, airports are a multifaceted resource for host communities. Eighty-six percent of general aviation airports and 62 percent of commercial service airports are used for these events. Air shows are one example of events held at airports. Forty-seven percent of general aviation airports and 50 percent of commercial service airports host some type of air show.
- Conducting search-and-rescue operations: During a search-and-rescue operation, minutes count. Airports typically are able to provide a quickly mobilized base of operations for such activities. Not only does the airfield provide the infrastructure required for aircraft operations, but airports also typically have the space and utilities required to quickly and efficiently establish a search and rescue base of operations. The Civil Air Patrol's Massachusetts Wing plays a critical role in search and rescue operations in Massachusetts with squadrons in 15 locations statewide in 2013. Seventy-six percent of general aviation airports and 87 percent of commercial service airports support search and rescue and Civil Air Patrol operations.
- Supporting aerial surveying, photography, and inspection operations: With the advent of geographic information systems (GIS) technologies, the importance of collecting aerial survey and photographic data continues to increase. Massachusetts airports play a key role in supporting these aircraft operations. Ninety-three percent of general aviation airports and 87 percent of commercial service airports accommodate aerial photography and surveying activities.



- Providing youth outreach activities (e.g., Boy Scouts, Young Eagles, Experimental Aircraft Association, Western Massachusetts Wright Flight Program): Airports have always been a draw for young people mesmerized by the allure of flying. Through various youth groups, airports routinely serve as an educational resource and inspiration for those that could choose to pursue a career in aviation. Eighty percent of general aviation airports and 50 percent of commercial service airports host youth outreach activities.
- Supporting the U.S. military and other government organizations: One of the principle benefits of the airport system is the number of airports available and the diversity of their locations. This is a primary consideration for supporting governmental organizations, including the military, where getting to where they need to go as quickly and as efficiently as possible is a major asset. Ninety-seven percent of general aviation airports and all of the commercial service airports are used for various military purposes.



Based on information provided by airport sponsors and managers that responded to this study's survey efforts, **Table A-19** in **Appendix A** attempts to tabulate the qualitative benefits each airport provides. The activities listed in Table A-19 are not all inclusive, but instead account for the most common types of aviation operations at these airports. Other aviation activities beyond what is shown in Table A-19 likely take place at these airports.

Results of a survey of visiting pilots and passengers during this study (see Chapter 3) further illustrate the qualitative benefits of aviation at the Commonwealth's airports. The survey requested general feedback regarding the benefits of the Massachusetts airport system to their business, community, and individual quality of life. Several common themes were evident in the survey responses. Examples of comments received categorized by these themes are provided below.

Accessibility of distant locations and the time savings afforded to airport visitors was a common theme noted in the feedback received from the survey of visiting pilots and passengers. Several examples of comments illustrating this benefit of aviation include the following:

"I have a vendor near the New Bedford Regional Airport area, a friend near Falmouth Airpark, and I have business near Minute Man and Beverly. Flying saves time."

"Barnstable Municipal is critical to easy access."

"The large number of general aviation airports provides easy access to many attractive destinations that would be impractical and thus not undertaken by car."

"[Provincetown Municipal] makes it easy to visit locations for the afternoon, locations we could not visit so easily, except that the airport makes it so convenient."

"I regularly travel for pleasure and work; airports keep me off the Massachusetts Turnpike and other crowded highways."

"Aviation provides a great way to travel around Massachusetts and New England."

Another common theme revealed by the survey effort included the critical role aviation and airports play for Massachusetts businesses. Examples of comments are as follows:

"Airports provide efficient access to medical and technical facilities so we can utilize them in our company's line of business."

"Airports have ease of location for our business and privacy that our clients desire."

"It's impossible to get business done without these airports."

"Small airports make day trips possible for our clients."

"Massachusetts airports have easy access to local small businesses."

"Airports make it possible and easy to spend time and money in Massachusetts."

Lastly, several surveys highlighted the recreational and educational benefits associated with aviation and Massachusetts' airports. The following are examples of comments received:

"We enjoy Massachusetts airports for a short flight for breakfast/dinner and sightseeing. We would not have come to Massachusetts if this airport [Minute Man Airfield] was not here."

"Aviation allows me to visit historical and scenic areas during my retirement."

"[Marshfield Municipal] provides access to recreational facilities and sights to share with others."

"[Norwood Municipal] is great for visiting friends and family! It makes it easy."

"Aviation allows more available access to activities, events, and vacation places all across New England and the northeast."

As explained above, these comments are only examples of the common themes noted in the feedback provided by visiting pilots and passengers. Comments regarding many other benefits

of aviation and Massachusetts airports were also provided. What is most important to recognize is that no matter how large or small their contributions, all airports (and aviation in general) contribute in some way to the quality of life of the Commonwealth's residents.

TAX IMPACTS

Airport activities in Massachusetts not only generate employment, payroll, and output impacts, they also produce 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 those activities. This analysis only examines the tax impacts from on-airport businesses and the spending by those commercial service and general aviation visitors that utilize the 39 study area airports. Note that this analysis does not take into account tax impacts from any off-airport aviation-related activities in Massachusetts.

This tax analysis estimated the revenues generated through the state sales tax, local sales taxes, lodging/restaurant taxes, rental car taxes, state income taxes, and aviation fuel taxes. This analysis also estimated the taxes paid by on-airport businesses, visitors arriving by both commercial airlines and general aviation aircraft, and employees supported by airport-related activity. These employees included 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 and Local Sales Tax Rates

Massachusetts has a state sales tax of 6.25 percent that is directed to the Commonwealth's general fund. In addition to the state sales tax, local governments also have the option of imposing local option sales taxes, but only specifically on lodging and prepared meals.

Lodging and Restaurant/Prepared Meals Tax Rates

Lodging taxes are collected by municipalities throughout Massachusetts and are charged as a percent of the cost of guest accommodations. Lodging taxes are often 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.

At the state level, a room occupancy excise tax is levied on any occupied room valued above \$15/night for periods less than or equal to ninety days at a rate of 5.7 percent. Additionally, municipalities may levy local occupancy excise taxes. Since 2009, the maximum legally allowable local occupancy excise tax rate is 6.0 percent (the exception being Boston, where the maximum rate permitted is 6.5 percent). Above these optional local occupancy excise rates, certain select cities also levy an additional 2.75 percent excise tax for the purposes of convention center financing (i.e., Boston, Worcester, Cambridge, Springfield, West Springfield, and Chicopee).

Since 2009, municipalities in Massachusetts have also been permitted to levy a local option restaurant/prepared meals sales tax in the amount of 0.75 percent. In 2013, approximately 73 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 general sales tax legislation), the total restaurant tax may total 7.0 percent in certain municipalities.

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. Rental car companies may impose additional fees (such as energy recovery fees or concession fees), but these are additional costs of the transaction, not taxes.

State Income Taxes

For 2013, the tax rate in Massachusetts on income, which includes income such as wages, pensions, business income, rents, etc., as well as interest and dividend income, is 5.25 percent.²

Aviation Fuel Taxes

The tax rate for aviation gasoline (AvGas) 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 10th of a cent per gallon but no less than 10 cents per gallon. In 2013, the average tax rate on aviation gasoline was 33 cents per gallon. The proceeds of this tax help to fund MassDOT Aeronautics Division.

The Commonwealth has a separate tax for jet fuel (Jet A). The jet fuel tax is a local option tax 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 include Bedford, Boston, Concord, Lexington, Lincoln, North Andover, Norwood, and Worcester. The tax rate is 5.0 percent of the average price per gallon, as determined by the Commissioner of the DOR for each calendar quarter, computed to the nearest 10th of a cent per gallon but no less than five cents per gallon. In 2013, the average tax rate on jet fuel was 15 cents per gallon.

Sales Tax Estimation Methodology

The first step in this analysis was to determine the sales tax rates applicable to each of the study airports. All airports are subject to Massachusetts' 6.25 percent state sales tax, 5.7 percent room occupancy excise tax, and 60-cent parking ticket surcharge per rental car. Airports are subject to additional sales taxes depending on the corresponding municipality. Sales tax rates were obtained from the DOR. The tax rates for retail sales, restaurants/prepared

² Starting in January 2014, the income tax rate was reduced to 5.2 percent.

meals, lodging, and rental cars shown in **Table 5-1** were then assigned to each airport based upon the airport's associated city.

It should be noted in the case of restaurant/prepared meals tax rates, the additional local option tax in the amount of 0.75 percent went into effect at various times throughout 2013 for some municipalities. For this analysis, the local option restaurant/prepared meals sales tax was only applied for municipalities where this tax was in effect for the entire 2013 calendar year.

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.

Taxes Generated by On-Airport Businesses

To estimate the sales taxes paid by on-airport businesses, 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. For example:

- Martha's Vineyard Airport had \$13.7 million in direct on-airport output and \$4.7 million in direct on-airport payroll.³ The tax rate for Martha's Vineyard Airport is 6.25 percent (state sales tax). This yields approximately \$530,000 in sales taxes from Martha's Vineyard Airport's on-airport businesses for 2013.
- \$13.7 million output - \$4.7 million payroll = \$9.0 million in taxable expenditures
- \$9.0 million in taxable expenditures x 6.25 percent ÷ (1 + 6.25 percent) = \$530,000 in sales taxes

All 39 of Massachusetts' airports in this study are estimated to have paid approximately \$89.4 million in on-airport business sales taxes in 2013.

³ Payroll and output associated with construction activity are included in these figures.

Table 5-1: Sales Tax Rates for Massachusetts Airports, 2013

Associated City	Airport Name	Retail Tax	Lodging Tax	Restaurant Tax	Rental Car Tax
COMMERCIAL SERVICE AIRPORTS					
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%	11.70%	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%	6.25%	6.25%
Worcester	Worcester Regional Airport	6.25%	14.45%	7.00%	6.25%
GENERAL AVIATION AIRPORTS					
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 Municipal 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%	6.25%	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%	9.70%	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%	6.25%	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%	9.70%	6.25%	6.25%

Source: Massachusetts Department of Revenue and CDM Smith

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:

- Nantucket Memorial Airport had \$136.2 million in commercial service visitor expenditures in 2013. Based on MOTT data, an estimated 21 percent of these expenditures were on retail, 32 percent on lodging, 28 percent on restaurants, and the remaining 19 percent on rental car. The tax rates for Nantucket Memorial Airport for retail sales, lodging, restaurants, and rental car are 6.25 percent, 11.7 percent, 7.0 percent, and 6.25 percent, respectively. From this data, it was estimated that Nantucket Memorial Airport's commercial service visitors paid approximately \$10.3 million in taxes in 2013.
- $\$136.2 \text{ million visitor expenditures} \times 21 \text{ percent} = \$28.6 \text{ million in retail sales}$
- $\$28.6 \text{ million in retail sales} \times 6.25 \text{ percent} \div (1 + 6.25 \text{ percent}) = \$1.7 \text{ million in retail sales taxes}$
- $\$136.2 \text{ million visitor expenditures} \times 32 \text{ percent} = \$43.6 \text{ million in lodging expenditures}$
- $\$43.6 \text{ million in lodging expenditures} \times 11.70 \text{ percent} \div (1 + 11.70 \text{ percent}) = \$4.6 \text{ million in lodging taxes}$
- $\$136.2 \text{ million visitor expenditures} \times 28 \text{ percent} = \$38.1 \text{ million in restaurant expenditures}$
- $\$38.1 \text{ million in restaurant expenditures} \times 7.0 \text{ percent} \div (1 + 7.0 \text{ percent}) = \$2.5 \text{ million in restaurant taxes}$
- $\$136.2 \text{ million visitor expenditures} \times 19 \text{ percent} = \$25.9 \text{ million in rental car expenditures}$
- $\$25.9 \text{ million in rental car expenditures} \times 6.25 \text{ percent} \div (1 + 6.25 \text{ percent}) = \$1.5 \text{ million in rental car taxes}$
- $\$1.7 \text{ million in retail sales taxes} + \$4.6 \text{ million in lodging taxes} + \$2.5 \text{ million in restaurant taxes} + \$1.5 \text{ million in rental car taxes} = \$10.3 \text{ million in commercial service visitor paid taxes}$

Commercial service visitors to Massachusetts' seven airports with commercial airline service are estimated to have paid \$477.5 million in taxes through their expenditures in 2013. Boston Logan International Airport contributed the greatest share of those taxes, with \$462.1 million (97 percent).

Taxes Generated by General Aviation Visitors

To estimate the sales taxes paid by visitors arriving by general aviation aircraft, it was necessary to estimate how visitor expenditures were allocated among retail sales, restaurants, lodging, and rental cars. Expenditures were estimated based on 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:

- Chatham Municipal Airport had \$5.4 million in general aviation visitor expenditures. Based on MOTT data, an estimated 21 percent of these expenditures were on retail, 32 percent on lodging, 28 percent on restaurants, and the remaining 19 percent on rental car. The tax rates for Chatham Municipal Airport for retail sales, lodging, restaurants, and rental car are 6.25 percent, 9.7 percent, 7.0 percent, and 6.25 percent, respectively. From this data, it was estimated that Chatham Municipal Airport's general aviation visitors paid approximately \$381,000 in taxes in 2013.
- \$5.4 million visitor expenditures x 21 percent = \$1.1 million in retail sales
- \$1.1 million in retail sales x 6.25 percent ÷ (1 + 6.25 percent) = \$66,900 in retail sales taxes
- \$5.4 million visitor expenditures x 32 percent = \$1.7 million in lodging expenditures
- \$1.7 million in lodging expenditures x 9.7 percent ÷ (1 + 9.7 percent) = \$153,100 in lodging taxes
- \$5.4 million visitor expenditures x 28 percent = \$1.5 million in restaurant expenditures
- \$1.5 million in restaurant expenditures x 7.0 percent ÷ (1 + 7.0 percent) = \$100,400 in restaurant taxes
- \$5.4 million visitor expenditures x 19 percent = \$1.0 million in rental car expenditures
- \$1.0 million in rental car expenditures x 6.25 percent ÷ (1 + 6.25 percent) = \$60,500 in rental car taxes
- \$66,900 in retail sales taxes + \$153,100 in lodging taxes + \$100,400 in restaurant taxes + \$60,500 in rental car taxes = \$381,000 in general aviation visitor paid taxes

General aviation visitors to Massachusetts' airports are estimated to have paid approximately \$12.6 million in taxes through their expenditures in 2013.

Taxes Paid by Employees of On-Airport Businesses

Employees that work at on-airport businesses pay sales taxes in their local community when they purchase items. The U.S. Internal Revenue Service (IRS) estimates how much in sales taxes are paid based on payroll for each state. Using this information, and the estimated average payroll for each airport, sales taxes paid by employees of on-airport businesses were estimated. These taxes were estimated at nearly \$15.4 million in 2013 and include taxes paid by employees associated with on-airport construction activity as well as military aviation at

Hanscom Air Force Base (AFB), Westover Air Reserve Base (ARB), and Westfield-Barnes Regional Airport.

Taxes Paid by Employees Supported by Visitor Spending

The employees related to visitor spending (both commercial service and general aviation visitors) also pay Massachusetts sales taxes when they spend their income. As with the taxes paid by employees of on-airport businesses, these taxes were estimated using data from the IRS specific to Massachusetts. Using the IRS data and an estimated average salary for employees supported by visitor spending, it was estimated that these employees paid more than \$22.4 million in taxes in 2013.

State Income Taxes Paid by Employees of On-Airport Businesses

Employees that work at on-airport businesses pay Massachusetts state income taxes on an annual basis. As explained above, the 2013 tax rate on income in Massachusetts was 5.25 percent. Using this information, and the estimated direct payroll for each airport, state income taxes paid by employees of on-airport businesses were estimated. In 2013, these taxes were estimated at \$97.8 million and include taxes paid by employees associated with on-airport construction activity as well as military aviation at Hanscom AFB, Westover ARB, and Westfield-Barnes Regional Airport.

State Income Taxes Paid by Employees Supported by Visitor Spending

The employees related to visitor spending (both commercial service and general aviation visitors) also pay Massachusetts state income taxes. Similar to the state income taxes paid by employees of on-airport businesses, these taxes were estimated using the 2013 tax rate on income in Massachusetts and the estimated average salary for employees supported by visitor spending. These taxes were estimated at \$92.5 million in 2013.

Aviation Fuel Taxes

Data on aviation fuel taxes was obtained from the DOR. For aviation gasoline and jet fuel sales, data was not available at the individual airport level, so aviation fuel taxes are reported as a whole at the Commonwealth level. In 2013, aviation gasoline taxes amounted to \$962,000 and jet fuel taxes amounted to \$38.5 million. Total aviation fuel taxes in 2013 amounted to approximately \$39.4 million.



Total Airport-Related Taxes

Total estimated taxes, by type, generated by commercial service and general aviation airports in 2013 are presented in **Table 5-2**. Taxes generated by individual airports can be found in **Table A-20** in **Appendix A**.

Table 5-2: Airport-Related Taxes from Massachusetts Airports, 2013

	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	\$81,675,000	\$477,462,000	\$9,334,000	\$14,503,000	\$22,139,000	\$93,297,000	\$91,595,000	\$790,005,000
General Aviation Airports	\$7,710,000	\$0	\$3,271,000	\$880,000	\$211,000	\$4,535,000	\$868,000	\$17,475,000
TOTAL TAXES	\$89,385,000	\$477,462,000	\$12,605,000	\$15,383,000	\$22,350,000	\$97,832,000	\$92,463,000	\$807,480,000

Source: CDM Smith and Massachusetts Department of Revenue

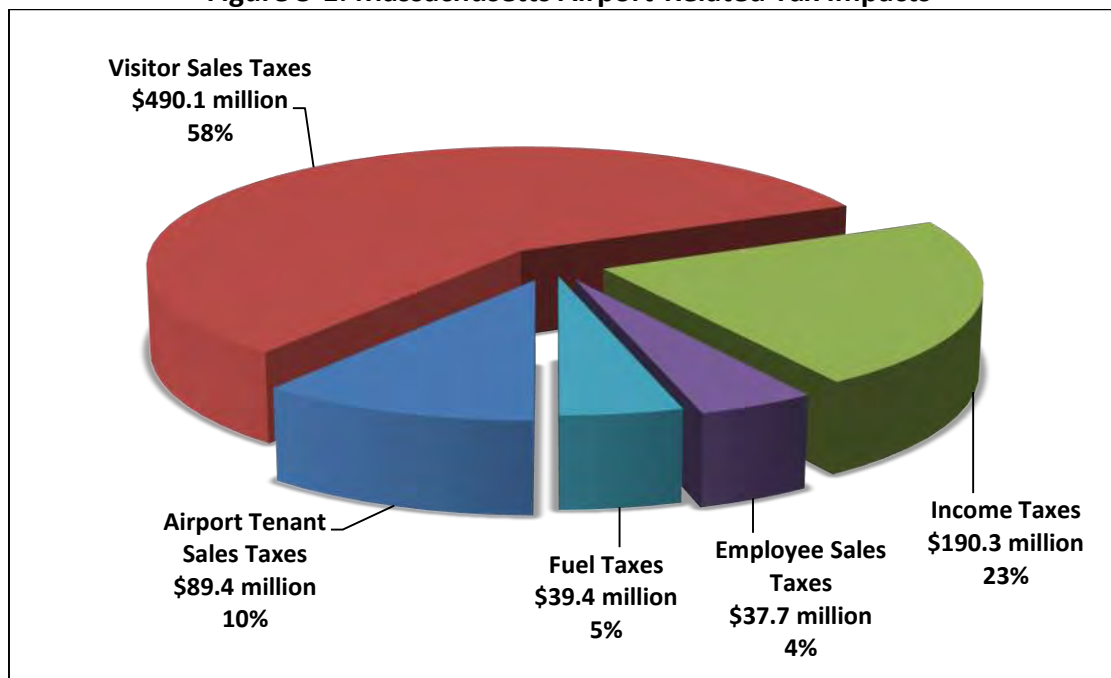
Aviation fuel taxes, not shown in Table 5-2, added another \$39.4 million, bringing total airport-generated taxes to an estimated \$846.9 million. The majority of these taxes were generated by commercial service visitors (primarily at Boston Logan International Airport), providing nearly \$477.5 million related to retail sales, lodging, restaurant, and rental car taxes.

Tax Summary

The Commonwealth of Massachusetts and its municipalities generate revenue from taxes levied on activities tied, either directly or indirectly, to Massachusetts' airports. These include taxes on visitor and tenant expenditures, fuel sales, and expenditures and state income taxes paid by employees that are supported by aviation. In 2013, these taxes totaled approximately \$846.9 million.

Figure 5-1 summarizes the sources of these taxes. The majority of the taxes (58 percent) are the result of visitor-related spending. Income taxes paid by aviation-related employees generate 23 percent of the total tax impacts, followed by airport tenant sales taxes (10 percent), fuel taxes (five percent), and employee sales taxes (four percent). It should be noted that tax benefits 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

SUMMARY

This chapter has described the benefits of Massachusetts' 39 public-use airports that go beyond the employment, payroll, and output impacts identified in Chapter 4. Some of these additional benefits defy conventional measurement, whereas others are more tangible. The additional areas of economic benefits summarized in this chapter included qualitative airport benefits and tax impacts.

Qualitative benefits are related to health, welfare, safety, and the environment and cannot be easily assigned dollar values. Airport-related qualitative benefits help to improve the overall quality of life in the Commonwealth, and all 39 public-use airports in Massachusetts contribute in this regard. As discussed in this chapter, airports in Massachusetts support emergency medical transport and evacuation flights, law enforcement and prisoner transport operations, forest and wildlands firefighting activities, search and rescue operations, aerial surveying and photography flights, youth outreach activities, community events, and a variety of other services. Airports in Massachusetts positively impact and improve everyone's quality of life, even those individuals who never directly use one of the commercial service or general aviation airports or the many services they provide.

Tax impacts are quantifiable and represent an important source of revenue for the Commonwealth and local municipalities. These impacts are tied to aviation-related activities at Massachusetts' airports and include taxes on tenant and visitor expenditures, fuel sales, and expenditures and state income taxes paid by tenant and visitor-related employees. These taxes totaled an estimated \$846.9 million in 2013.

CHAPTER 6: AVIATION EDUCATION CASE STUDY

INTRODUCTION

With aviation passenger traffic climbing globally and a record number of new aircraft on order, the time for training highly qualified aircraft operators, technicians, and engineers is now – and Massachusetts is positioning itself to fill that need today and into the future. The airline industry continues to flourish, serving 3.3 billion passengers in 2014, supporting an estimated \$2.4 trillion in economic activity, and 58 million jobs in aviation and related tourism.¹ By 2020, it is predicted that air traffic will double with a continuous annual increase of 4 percent through 2050.² Boeing anticipates a demand for 33,500 new airplanes over the next 20 years, valued at more than \$4 trillion, requiring nearly 500,000 new professional pilots and nearly 600,000 aircraft maintenance technicians. In short, the need for qualified aviation professionals to fill these high-income, quality jobs will continue to grow well into the future.

The Massachusetts airport system is currently home to over 40 airport-based flight schools that provide flight training certifications from private pilot to airline transport pilot, as well as specialty training for certification in helicopters, sport aircraft, and taildraggers. Beyond this, through a variety of independent but related initiatives - individuals, groups, schools, airports, and businesses are working together to create a “Flight Plan” for the citizens of the Commonwealth to future lucrative careers in the aviation industry.

Flight Plan to a Future in Aviation



This Flight Plan frequently starts for kids and young adults at their local airports, through public events, dedicated aviation education programs, and other efforts to educate and expose people to aviation in general. The plan then continues as individuals take those first steps toward the aviation industry through avenues such as flight training, aircraft maintenance training, or other fields of interest. While those steps could themselves result in a successful and rewarding career in aviation, others continue to pursue their future in aviation through opportunities in higher education.

This chapter provides an overview of aviation education in Massachusetts and presents the economic impacts associated with on-airport schools and businesses engaged in this activity.

¹ <http://www.iata.org/pressroom/pr/Pages/2014-10-16-01.aspx>

² Ibid.

PREPARING FOR TAKEOFF – LEARNING ABOUT AVIATION

The passion for aviation that often marks those that ultimately pursue careers in the industry typically is born at an early age and is frequently found at a local area general aviation airport. These airports are far more accessible than the commercial aviation airports most people are familiar with, and they are typically populated by enthusiasts that foster a visitor's interest in aviation. Through airport events like open houses, air shows, and airport tours, among others, kids are introduced to the world of aviation. Established airport programs like the EAA Young Eagles and the Civil Air Patrol provide youth with their first opportunity to fly in a small plane and to be part of the aviation community. Other outreach efforts such as the Wright Flight program establish working partnerships between airports and the local schools to extend aviation education into the school curriculums. Beyond those, there are a wide range of promotions and outreach efforts that aviation enthusiasts take upon themselves to share and promote their interest and passion for aviation. Following are just a few of the ways that Massachusetts airports help prepare people to takeoff in an aviation career.

Preparing for Takeoff **Learning about Aviation**

- Visiting the Community Airport
- EAA Young Eagles
- Wright Flight Program
- Real World Design Challenge (RWDC)
- Civil Air Patrol
- Other Educational Initiatives

Visiting the Community Airport

The first exposure to aviation for many people often occurs during a visit to the community general aviation airport for an open house, an air show, a fly-in, or some other sort of special event. These gatherings provide the general public with an opportunity to see and experience aviation firsthand. While visitors may simply appreciate participating in aviation activities, exploring exhibits and seminars, and enjoying a couple of meals, they are also in fact often building an interest in and a relationship with aviation.



Most Massachusetts airports not only sponsor some sort of aviation-related outreach event (e.g., fly-ins, open houses, free flight days, air shows, etc.), but nearly every one also provides

guided tours to interested local groups such as Boy Scouts, Girl Scouts, school classes of all ages, groups of “at-risk” kids, physically challenged adults, etc. Additionally, many airports serve as an important local resource by hosting other special community events, such as “touch-a-truck” events for kids, toys-for-tots events, car shows, town festivals and fairs, among many others. Airport facilities are often utilized by the local community for other unique purposes, such as to support firefighting training, to stage community meetings, or to serve as a natural resource for such groups as bird watchers. Through all of these, and many other outreach efforts, the local airport becomes intertwined in the fabric of the community, and through that, the community ultimately becomes integrated with aviation.

EAA Young Eagles

Created by the U.S. Experimental Aircraft Association (EAA), the Young Eagles program is a national initiative designed to give children between the ages of eight to 17 an opportunity to experience flight in a general aviation airplane while educating children about aviation. This program is offered free of charge with donations and volunteers. In Massachusetts, Young Eagles programs are available at many airports, with notable programs existing at Fitchburg Municipal Airport, Lawrence Municipal Airport, Orange Municipal Airport, Minuteman Air Field, and Northampton Airport.



Wright Flight Program

The mission of the Western Massachusetts Wright Flight Program is to educate students from grades seven to 12 in the history of aviation and its future, the significance of aviation in the development of technology and its global impact, and the many careers in the aviation industry. The program emphasizes the importance of setting goals, developing plans to attain those goals, and understanding the need to develop skills in Science, Technology, Engineering and Math (STEM). The program also seeks to recruit and integrate students of diversity into the aviation industry.



An educational unit of the Barnes Airport Support Group, the Wright Flight Program is supported by participants from both Westfield-Barnes Regional Airport and Northampton Airport. Volunteers from both airports lead outreach efforts to local middle and high schools.

Real World Design Challenge

The Real World Design Challenge (RWDC) is an annual high school competition run by a public-private partnership with the goal of sustainably increasing the Science, Technology, Engineering, and Mathematics (STEM) workforce. The partners are focused on working within the context of the American educational system to transform STEM education in the United States by providing professional science and engineering and learning resources to students and teachers. The RWDC provides the opportunity for students to work on real world engineering challenges in a team environment.



Each year, student teams are asked to address a challenge that confronts our nation's leading industries (to date, challenges have been all aerospace focused). Students utilize professional engineering software to develop their solutions and generate presentations that convincingly demonstrate the value of their solutions. The RWDC provides students with opportunities to apply the lessons of the classroom to the technical problems that are being faced in the workplace.

As one of the founding members of the RWDC program, Massachusetts, and MassDOT Aeronautics Division in particular, is actively involved in promoting and supporting the the annual Aviation Challenge. Annually, Massachusetts fields 10 to 20 high school teams that first compete in a state level Governor's Cup, with the best design in each state getting an all-expenses-paid trip to Washington, DC to compete in the national finals for scholarships. Projects are judged by industry leaders.



Civil Air Patrol

The Civil Air Patrol (CAP) is a congressionally chartered, federally supported non-profit corporation that serves as the official civilian auxiliary of the United States Air Force. It is a volunteer organization with an aviation-minded membership that performs three key missions: emergency services; aerospace education for youth and the general public; and cadet programs for teenage youth. There are 13 CAP squadrons at airports throughout Massachusetts.



Young people from ages 12 through 21 are introduced to aviation through CAP's cadet program, a unique youth oriented program that uses aviation as its cornerstone. The program

allows young people to progress at their own pace through a 16-step program including aerospace education, leadership training, physical fitness, and moral leadership. Cadets compete for academic scholarships to further their studies in fields such as engineering, science, aircraft mechanics, aerospace medicine, meteorology, as well as many others. Those cadets who earn cadet officer status may enter the Air Force as an E3 (airman first class) rather than an E1 (airman basic). Each year, cadets have the opportunity to participate in special activities at the local, state, regional or national level. Many cadets will have the opportunity to solo fly an airplane for the first time through a flight encampment or academy.

Other Educational Initiatives

As noted previously, people in aviation are often ardent about sharing their passion for aviation with others, particularly with the youth in their communities. They want young people to experience and embrace the joys of flight so that they will carry aviation into the future. In support of that, there are many airports and individuals that start their own outreach efforts apart from some of the more established programs listed above. Nearly every Massachusetts airport has its own stories and examples of aviation enthusiasts taking it upon themselves to promote aviation. The following are just two examples.

Northampton Airport, in addition to its participation in the Wright Flight program, hosts several aviation-themed day camps during the summer in which kids (ages 11 and over) get to learn about the principles of flying and experience a real flight. The airport also hosts a “wheels to wings” program for people with physical limitations to provide them with a unique way to challenge themselves and offer an opportunity to experience the freedom of aviation. Northampton also sponsors an annual “Women in Aviation” week that promotes aviation for women of all ages – affording them flight training and free flights.



The Nantucket Flying Association (NFA) is a good example of the active airport and pilot groups that are present at most Massachusetts airports. All of them share the goal of promoting all aspects of aviation to the surrounding community. Specifically, the NFA sponsors an annual Aviation Camp for kids that includes aviation education, flying and rocket launching, as well as guest speakers that are influential in the aviation industry. Typical of many airport groups, they are also active supporters of educational initiatives in the local schools and promote aviation events that occur within the region (e.g., fly-ins, art contests, etc.).



Greenfield Community College (GCC) is a two-year community college in Greenfield, Massachusetts that offers a non-credit “Pathway to Aviation” course as part of its non-degree, community education program. The course is designed to spur interest in aviation as a career or as a hobby, and participants range in age from high school to retired. Specifically, the class curriculum extends from the basics of aerodynamics, to the history of aviation, to the requirements for obtaining a pilot's license. The seminar has been offered at GCC since 2000 and is conducted by one instructor. No flying is involved in the six-class program. Approximately 50 to 60 students have attended the class to date with 10 to 12 attendees progressing on to obtain a pilot's license. Classes are held at both Turners Falls Airport and Orange Airport. Cost for the program is currently \$105. Note that Pathway to Aviation is also helping to sponsor a flying club at nearby Deerfield High School, again to spur interest in aviation.



LEAVING THE GROUND – BECOMING PART OF AVIATION

The initial phases of the Flight Plan are designed to foster an interest in aviation. In order to take that leap of faith by leaving the ground, an individual is ultimately required to become intentional in exploring the range of career potentials in the world of aviation. In addition to the programs listed above that are often designed to extend into the potential career exploration part of the plan, there are a wide range of opportunities in Massachusetts for people of all ages to take that next intentional leap. These opportunities include those found in the Commonwealth's secondary schools (i.e., high schools, vocational schools, etc.) and dedicated aviation training schools (i.e., flight training and mechanical training).

Leaving the Ground **Becoming Part of Aviation**

- Secondary School Education
- Dedicated Aviation Training
 - o Flight Training Schools (Part 61 & Part 141)
 - o Aviation Maintenance Training School



Secondary School Education

In recent years, a renewed emphasis is being placed on Science, Technology, Engineering, and Mathematics (STEM) education within Massachusetts as a means of preparing its youth for the career demands of today and tomorrow – and aviation is a primary beneficiary of that effort. As described previously, many airports and aviation enthusiasts are participating in integrating aviation education into local elementary school and high school curriculums through programs

like Wright Flight and Real World Design Challenge (RWDC). Others have focused on helping to establish flying or aviation clubs at high schools. The RWDC program is of particular value to STEM initiatives in that it provides real world experience to those interested in a STEM-based career.

The renewed emphasis on STEM, and in particular with a focus on aviation, has begun to net real world results for the Commonwealth. In 2014, Westfield Vocational High School announced the creation of a new aviation technology education program to give students a path to high-paying jobs in the aviation industry, while also helping to fill employment gaps for local area companies. Anticipated to start operation in Fall 2015, the new FAA Part 147 maintenance program will give students a path from middle school through college to pursue jobs in the aviation industry, either in aircraft maintenance and manufacturing, or through continued education. Graduates will earn their Airframe and Powerplant (A&P) license, helping enable them to fill current and projected employment gaps with local companies such as Gulfstream, AirFlyte, and B&E Precision Aircraft Components.



There are several other airports within Massachusetts that have joined with local community and governmental leaders to explore establishing similar programs within their schools. Although none of these have yet progressed beyond the conceptual stage, their development does reflect the increased understanding and appreciation of the future opportunities that lie within the aviation industry.

Dedicated Aviation Training

Beyond secondary school aviation programs, Massachusetts is also home to an educational infrastructure of schools dedicated to aviation training. Similar in application to a vocational technical school, these training programs provide students with opportunities to receive professional instruction in dedicated aviation fields that, if pursued to their conclusion, ultimately would result in an aviation career. These training schools are generally either focused on flight training, or on aircraft maintenance training, and are described in the following sections.

Flight Training Schools

The cornerstone and most recognizable aviation education program in any state or on any airport is the flight school. These typically are for-profit businesses located at local airports whose primary purpose is the teaching and honing of basic airmanship skills through an integrated program of ground school and in-flight



instruction. This method of learning to fly is invaluable for the student who wants to have some theoretical understanding of aerodynamics, navigation, and safe procedures before taking the controls. Depending on the qualifications of the school and the flight instructors, pilot licensing and certifications can include Private Pilot, Instrument rating, Commercial Pilot, Airline Transport Pilot, Multi-Engine rating, and Certified Flight Instructor.

Flight schools are classified into two types, Part 61 and Part 141, which refer to the parts of the Federal Aviation Regulations (FARs) under which they operate. While both methods of flight training require the student to meet the same standard of performance in order to obtain a pilot certificate, the methods differ in their rigidity and in some minimum requirements. Part 61 flight schools are those typically found at most airports that offer flight training. They have a relatively informal teaching environment; they have greater flexibility in scheduling and therefore are normally better for part-time students; they allow students to pick their own instructors; and they require a minimum flight time of 40 hours for a private pilot certificate, and 250 hours for a commercial pilot certificate. The teaching environment at Part 141 flight schools is more reflective of a college classroom in that they generally have a more structured and formal educational approach. Additionally, Part 141 schools are held to a higher federal regulatory standard in that these schools (1) must have detailed, FAA-approved course curriculums; (2) are subject to regular surveillance audits by the FAA; and (3) must meet minimum student pilot pass rates on the practical exams. Part 141 schools also have reduced minimum flight time requirements for some flight certifications: 35 hours for a private pilot certificate, and 190 hours for a commercial certificate.



In short, either type of school teaches to the same requirements. However, a Part 141 school is particularly focused and perhaps better for a full-time student whose goal is a professional pilot career, while a Part 61 school is more flexible and may be more appropriate for a student whose goal is training for private and/or recreational purposes.

The Massachusetts airport system is currently (2014) home to a total of 37 flight schools located on 22 different airports throughout the Commonwealth. These schools provide training for a full range of aircraft operations including standard fixed-wing piston aircraft, multi-engine piston aircraft, turbine aircraft, and helicopters. They also include dedicated flight simulator centers. Flight schools operate in a wide variety of manners, ranging from formal flight training academies, where students are expected to operate and learn in a professional teaching environment, to less formal individual flight instruction, where students have the flexibility to learn at their own pace. In short, the range of flight training opportunities that currently lie within Massachusetts are diverse enough to meet demand for all levels of standard aircraft operations, as well as all styles of learning and training.

Aviation Maintenance Training School

Located on Laurence G. Hanscom Field since 1932, the National Aviation Academy (formerly East Coast Aero Tech) is a long-standing fixture in Massachusetts' aviation education infrastructure. Its mission is to educate aviation students in a learning environment conducive to excellence in meeting the needs and challenges of the aviation global marketplace. They do this while providing a quality and innovative learning experience that upholds ethical standards and respect for one another. As a continuously evolving institution, the National Aviation Academy (NAA) constantly strives to ensure improvements in the quality of its faculty, staff, facilities, and other resources in order for its faculty, staff, and students to assume their roles as respected professionals within the aviation industry.



The primary mission of NAA is preparing students for employment in the aviation industry. The aviation maintenance education program is an FAA Part 147 accredited program for students seeking an Airframe & Powerplant (A&P) certification. Students receive qualified instruction from licensed A&P instructors who teach real world experience. With today's sophisticated aircraft, technicians with both mechanical and electrical education are in high demand, so NAA also provides avionics training through its Aviation Maintenance Professional program. This 21 month program has an estimated tuition and fees of \$47,250 (including living expenses).

SOARING INTO THE ATMOSPHERE – A CAREER IN AVIATION

While flight training and aircraft maintenance training could themselves result in a successful and rewarding career in aviation, others on the Flight Plan continue to pursue their future in aviation through opportunities in higher education. Massachusetts is home to a world-renowned college educational system – and this extends directly to the aviation industry. Students in the Commonwealth are afforded undergraduate educational opportunities through the state's public university and community college system, in addition to an expansive private college and university system. Bridgewater State University is the pre-eminent flight training and aviation management program in New England, offering degrees that enable graduates to pursue careers as pilots, airport managers, flight planners, systems engineers, flight instructors, and air traffic controllers. Cape Code Community College is initiating the development of a unique FAA-certified aircraft maintenance training program for meeting the critical need for highly skilled technicians in airframe and power plant repair and certification for airlines like Cape Air. Other schools like North Shore Community College and Westfield State partner with local flight schools to offer opportunities to integrate flight training with an aviation degree program. Beyond those and at the heart of the country's epicenter for technology education, Massachusetts educational institutions like Massachusetts Institute of Technology (MIT), Worcester Polytechnic Institute (WPI) and Boston University (BU) continue to develop the aerospace scientists and engineers that will shape the future of aviation.

Soaring into the Atmosphere

A Career in Aviation

- Flight Training & Aviation Management Degree Programs
- Aircraft Maintenance Degree Programs
- Aerospace Engineering Degree Programs



Flight Training & Aviation Management Degree Programs

Higher education degrees rooted directly in aviation are typically founded on flight training and on aviation management. The former provides the technical proficiency to function as a professional pilot, while the latter provides the practical skills to function in a professional aviation environment. Massachusetts is fortunate to have three such programs located within the Commonwealth, including Bridgewater State University, Westfield State University, and North Shore Community College.

Bridgewater State University

Founded in 1840 in Bridgewater by Horace Mann, Bridgewater State University (BSU) is Massachusetts' largest state college outside the University of Massachusetts system. Since 2000, BSU has aggressively expanded its curriculum and its faculty, including investing over \$400 million in upgraded and new facilities. This university-wide surge in growth and expansion of services included the expansion of its Department of Aviation Science, which offers a BS degree in Aviation Science with a concentration in aviation management or flight training.



The program is accredited by the Aviation Accreditation Board International (ABBI), which assures students and prospective employers that an educational degree program has met stringent industry quality standards. It ensures that graduates have received in-depth training and education and are capable of performing a broad range of professional responsibilities.

The aviation management concentration is designed to prepare graduates for managerial and supervisory positions throughout the air transportation industry. Primary flight training is included, along with broad exposure to aviation specific business and management courses. This program of study is interdisciplinary in nature and prepares the aviation career-oriented student for virtually any management career in aviation or aviation-related industries. Some of these positions include airport manager, air carrier manager and general aviation operations manager.

The flight training concentration combines academic studies and flight training, in order to prepare graduates for a wide variety of positions within the air transportation industry, including general, airline, and military aviation. The flight program allows the student to obtain private pilot, commercial pilot, instrument pilot and/or flight instructor certificates. BSU Aviation is the only four-year aviation training program in New England, maintaining its own in-house flight training center at the New Bedford Regional Airport. The Bridgewater Flight Academy is an FAA-approved Part 141 flight training provider with an aircraft fleet comprised of eight Cessna 172Rs, a Piper PA-28R Arrow, and a Piper Seneca. It also has multiple single-engine and multi-engine flight simulators.

The curriculum provides the flight training necessary to operate in the high-density environment of modern airspace. The program emphasizes critical thinking and analytical skills, as well as oral and written communication skills. Effective resource management, human factors and safety awareness are constantly emphasized throughout the curriculum. Complementing the intensive flight training is expert classroom instruction and use of flight simulators. The flight training concentration leads to the development, administration and enforcement of safety regulations, including airworthiness and operational standards in civil aviation. This program prepares the graduate for a career path that starts as a certified flight instructor, and leads to positions with airlines and corporate flight departments.

The BSU Aviation program is currently sustained by four full-time faculty members and five additional staff members. At any time, there is also an average of 17 full time flight instructors on staff, many of which are BSU Aviation graduates. In 2014, there were a total of 184 students in the BSU Aviation Program (121 in the flight program and 63 in the airport management program), with a basic BSU annual tuition of \$8,043. Flight training costs in addition to tuition are estimated to be approximately \$42,000 for a student to progress to a certified flight instructor rating.

Westfield State University

Founded in 1838 by noted educator and social reformer Horace Mann, Westfield State University (WSU) is a comprehensive, four-year public university located in Westfield, Massachusetts. For over 10 years, WSU has offered a Business Management Degree (B.S.) with a concentration in Aviation Management as part of the Economics and Management Department. The overall mission of that department is to provide a high quality program of undergraduate education in the areas of business management and economics to Massachusetts citizens at an affordable price. The program is designed to prepare students to be successful and productive members of any organization they join, enabling them to contribute to the greater good of society, and provide them a framework to continue expanding and learning throughout their personal and professional lives.



For the B.S. in Management with a concentration in Aviation Management, the program is designed to prepare students for a variety of aviation related careers by combining liberal arts, management pedagogy, and flight proficiency, qualifying them for careers in general management as well as aviation management. There is also a flight school option that enables students to obtain their private pilot license through Five Star Flight Academy, an FAA approved Part 141 flight training school located at Westfield-Barnes Regional Airport. Through its association with Five Star Flight Academy, WSU is also able to offer regular internships with the flight school through its program. In 2014, there were 18 students in the aviation management program, with an annual tuition of \$21,809. The aviation program currently functions with four part-time faculty members and two part-time staff members.

It should also be acknowledged that as a community outreach, WSU is also actively partnering with Westfield Vocational Technical High School to establish an aviation technology education program at Westfield-Barnes Regional Airport. This program will provide students a path from middle school through college to pursue jobs in the aviation industry, either in manufacturing or continued education. Of great value will be the FAA Aviation Maintenance Certificate (i.e., Airframe and/or Powerplant) that will facilitate employment at aircraft maintenance centers.

North Shore Community College

North Shore Community College (NSCC) is a comprehensive community college offering associate degree and certificate programs through four campuses in Danvers, Lynn, Beverly and Middleton, Massachusetts. The program is maintained by two full-time faculty members, who also promote the program through outreach efforts to local schools. Established in the late 1960s, NSCC's Aviation Science Department now offers two associate degree programs in the field of aviation.



The Professional Pilot Program at NSCC is designed to provide students with the necessary knowledge, skills, and training to become fixed-wing commercial pilots. Graduates are prepared for careers as professional pilots for regional airlines, corporate and general aviation, and government agencies such as the military and the FAA. The program maintains national accreditation status and emphasizes a strong culture of safety through effective resource management, human factors, and safety awareness training. NSCC also has articulation agreements with other 4-year institutions (e.g., Embry-Riddle Aeronautical University and Bridgewater State University) to provide students transferability to continue educational opportunities. NSCC maintains an FAR Part 141 ground school, while FAR Part 61 flight training is facilitated by the Beverly Flight Center at Beverly Airport. As of 2014, there were 21 students in the professional pilot program, which itself has a student cost of approximately \$41,890.

The Aviation Management Program at NCSS is designed to provide students with the general management skills needed for entry-level positions as supervisors, managers or sales trainees, assistant managers, administrators, or administrative assistants in the field of aviation. Coursework exposes students to the basic principles and applications of aviation management

within the aviation industry that can lead to job opportunities at major and regional airlines, fixed-base operators, aircraft and aircraft component manufacturers (including GE, and Pratt and Whitney), fractional operators, and corporate aviation flight departments, etc. Similar to the professional pilot program, NCSS helps facilitate students transferring to a four-year institution to pursue a bachelor's degree in Aviation Management or Business Management. In 2014, there were 18 students in the aviation management program, with an annual tuition of \$5,370.

Aircraft Maintenance Degree Programs

A new initiative within the Commonwealth's higher education system is a degree program based on aircraft maintenance. Similar to the flight training and aviation management degree structure, the objective of this new program is to provide students with the technical skills to function as a professional aircraft mechanic, while also training them to function effectively in a professional work environment. Although other schools are exploring expansion into this field, only Cape Cod Community College is currently actively initiating a program.

Cape Cod Community College

Cape Cod Community College (CCCC) is a two-year community college located in West Barnstable that offers associate's degrees in a wide variety of programs, as well as bachelors and master's degrees in partnership with various other Massachusetts schools. In 2014, CCCC announced that with the help of a \$2.0 million grant from the Commonwealth of Massachusetts and a \$2.5 million grant from the Federal Government, it will launch a new 12-month aviation technician training program starting in fall 2015. With the guidance of the FAA and other industry stakeholders including JetBlue, Cape Air, FedEx and the U.S. Coast Guard, this educational program will be designed to not only prepare students to receive an FAA Aviation Maintenance Certificate (i.e., Airframe and/or Powerplant), but also to facilitate their transition into careers at these and other companies. Additionally, students will have the option to pursue higher level degrees in other aviation fields through CCCC's existing educational partnerships, including a Bachelor's Degree in Aviation Science at Bridgewater State University.



CCCC is optimistic that its program will become a destination for students hoping to enter the industry as demand for specialized labor increases. Specifically, the program will start with three full time instructors in addition to several part-time technical specialists. CCCC is anticipating an initial class of 25 full-time students, in addition to a class of part-time students that are working but focusing on advancing their careers, changing their careers, and/or anticipating transitioning out of active military service at Joint Base Cape Cod (JBCC). CCCC is currently planning to accommodate the program in two hangars located at the Barnstable Municipal Airport in Hyannis. Undergraduate tuition at CCCC is \$5,070 per year for Massachusetts residents (not including living expenses). No projection has been made for additional fees associated with the aviation technician training program.

Aerospace Engineering Degree Programs

The field of Aerospace Engineering is where Massachusetts' higher educational system garners worldwide recognition. Aerospace Engineering focuses on the research, design, development, construction, testing, science and technology of aircraft (aeronautics) and spacecraft (astronautics). Degree programs within Massachusetts include the Massachusetts Institute of Technology (recognized as the preeminent aerospace program in the world), Worcester Polytechnic Institute, and Boston University.

Massachusetts Institute of Technology

The Massachusetts Institute of Technology (MIT) Department of Aeronautics and Astronautics (AeroAstro) is America's oldest and one of the most respected university aerospace programs. The study of aeronautics at MIT began six years prior to the Wright brothers' first flight when in 1896, mechanical engineering student Albert J. Wells built a 30-square-inch wind tunnel as part of his thesis. Its first undergraduate class and graduate degree in Aeronautical Engineering began in 1914. For more than a century, MIT AeroAstro faculty, students, and staff have been making major contributions to the development of aerospace in the fields of transportation, communications, exploration, and national security as well as in developing innovative educational programs. Over the years, numerous leaders—pioneering entrepreneurs and explorers as well as gifted men and women in industry, government and academia—have found key sources of inspiration and innovation and learned crucial skills at MIT. AeroAstro has established a tradition of strong scholarship and solving industrial-strength problems. Its community is comprised of people whose careers have included astronaut, Air Force secretary, NASA associate administrator and chief technologist, Air Force chief scientist, aerospace executive, and corporate founder. Alumni are entrepreneurs, policy-makers, educators, and researchers pushing technology's boundaries.



MIT's AeroAstro is one of the nation's premier aeronautical research institution with current teaching ranging from silent aircraft; to alternative jet fuels; to highly flexible space suits woven skin-tight on their inhabitants; to unmanned vehicles capable of complex maneuvers without human intervention; to constellations of tiny satellites that, in concert, far outperform the single, large satellites of the past; to the development of ultra-wide bandwidth communications. These projects will make the environment cleaner and quieter; improve health and safety; increase mobility; heighten efficiency; and enable the exploration of frontiers far beyond current limitations. Current research labs include those presented in **Table 6-1**.

Table 6-1: MIT Research Labs

Aerospace Computational Design Lab	Improving the design of aerospace systems through the advancement of computational methods and tools that incorporate multidisciplinary analysis and optimization, probabilistic and robust design techniques, and next-generation computational fluid dynamics.
Aerospace Controls Laboratory	Investigates estimation and control systems for modern aerospace systems, with particular attention to distributed, multivehicle architectures.
Aerospace Robotics and Embedded Systems	The development of theoretical foundations and practical algorithms for real-time control of large-scale systems of vehicles and mobile robots
Communications and Networking Research Group	The design of network architectures that are cost effective, scalable, and meet emerging needs for high data-rate and reliable communications.
(Dept. of Energy) DiaMonD Center	Addresses the challenges of end-to-end, data-to-decisions modeling and simulation for complex problems in computational science and engineering in a unified and integrated way.
Gas Turbine Laboratory	Advancing the state-of-the-art in fluid machinery for power and propulsion.
Institute for Soldier Nanotechnologies	Improving soldier survivability by extending the frontiers of nanotechnology via fundamental research and transitioning with Army and industrial partners.
Interactive Robotics Lab	Developing technology to ease the integration of robotics and autonomous systems into human-centered work environments.
International Center for Air Transportation	Discovering and disseminating the knowledge and tools underlying a global air transportation industry driven by new technologies.
Laboratory for Aviation and the Environment	Advances knowledge of how aviation impacts the environment and collaboratively develops mitigation strategies.
Laboratory for Information and Decision Systems	Advances the field of systems, communications and control.
Man Vehicle Laboratory	Optimizes human-vehicle system safety and effectiveness by improving understanding of human physiological and cognitive capabilities, and developing appropriate countermeasures and evidence-based engineering design criteria.
necslab	Explores new concepts in engineered materials and structures.
Space Propulsion Laboratory	Studies and develops systems for increasing performance and reducing costs of space propulsion.
Space Systems Laboratory	Engages in cutting-edge research projects with the goal of directly contributing to the current and future exploration and development of space.
Systems Engineering Advancement Research Initiative	Advances the theories, methods, and effective practice of systems engineering applied to complex socio-technical systems through collaborative research.
System Architecture Lab	Studies the early-stage technical decisions that will determine the majority of the system's performance.
Systems Engineering Research Lab	Engineer new tools and processes that will allow us to improve and create systems in enhance safety and productivity.
Technology Laboratory for Advanced Materials and Structures	Provides leadership in the advancement of the knowledge and capabilities of the composites and structures community through education of students, original research, and interaction with the community at large.
Wright Brothers Wind Tunnel	Plays a major role in the development of aerospace, civil engineering and architectural systems.

Source: Massachusetts Institute of Technology

As of 2014, AeroAstro had 168 students in its undergraduate degree program, as well as 241 students in its graduate program. Undergraduate tuition at MIT is \$43,210 per year (not including living expenses), while graduate tuition is \$44,720. The program's faculty count at the end of the 2013 (spring 2014) academic year was 36, which translated to 32.5 FTE after accounting for dual appointments. This number fluctuates as faculty members can take leaves of absence to fulfill temporary roles in other research programs and governmental agencies (e.g. NASA Chief Technologist). The AeroAstro program also currently employs an additional 81 other staff members, including administrative personnel, support staff, research staff, other academics, and postdoctoral fellows.

As a research institution, AeroAstro faculty and students are engaged in hundreds of research projects under the auspices of the department's laboratories and centers. The department's total research expenditures (adjusted for duals) for 2013 was \$32.3 million. Finally, with respect to major capital expenditures, AeroAstro will soon be undertaking facility improvements and laboratory upgrades as part of a \$10.0 million grant. This is planned to be followed by two more \$25.0 million grants for further improvements.

Worcester Polytechnic Institute

Founded in 1865, Worcester Polytechnic Institute (WPI) is a private research university noted as being one of the United States' first engineering and technology universities. The university is one among a small group of polytechnic universities in the country which tend to be primarily devoted to the instruction and research of technical arts and applied sciences. It is consistently ranked as being one of the country's top tier universities as well as being renowned for producing high earning graduates.



Established in 2005, WPI's Aerospace Engineering Program provides students with the skills needed to start an exciting and successful career in Aeronautics and Astronautics. The BS program is designed to educate and engage students in the analysis and design of aircraft, rotorcraft, and rocket and space systems. Expanding in 2015 to incorporate MS, PhD and BS/MS degrees, WPI's Aerospace Engineering Program is balanced with technical, mathematical, laboratory and science courses that culminate in a senior design project (Major Qualifying Project or "MQP"). The program is supported by several facilities including wind tunnels, vacuum chambers, controls instrumentation, and computational laboratories.

WPI's Project Program allows students to solve real-world problems in a team-oriented environment before they graduate. MQPs involve the design of micro-aerial vehicles, structural dynamics, fluid-structure interactions, aircraft guidance, Cubesat design, electric micropropulsion, micro/nanofluidics, mission design, spacecraft dynamics, renewable energy concepts, and flow control. MQPs are conducted in a dedicated lab, or in one of WPI's research laboratories or in collaboration with external organizations. Airplanes designed by WPI students have won numerous international competitions. In the past, students have completed their MQPs at various off-campus sites such as:

- The Natick Army Research Laboratory
- UTC, Pratt and Whitney Aircraft
- The MIT Lincoln Laboratory
- The NASA Goddard Space Flight Center
- The NASA Glenn Research Center
- The NASA Jet Propulsion Laboratory

As of 2014, WPI's Aerospace Engineering Program had 190 students in its BS degree program, graduating approximately 47 students annually. Its new MS and PhD degree programs are expected to graduate about 20 MS and about five PhD candidates annually. The overall program is currently sustained by almost nine full time employees, which is expected to expand as the program continues to grow. Undergraduate tuition at WPI is \$44,422 per year (not including living expenses).

Boston University

Established in 1839, Boston University (BU) is a private research university offering bachelor's degrees, master's degrees, and doctorates, and medical, dental, business, engineering, and law degrees through eighteen schools and colleges on two urban campuses. BU's College of Engineering offers specialized concentrations that allow students to



complement their undergraduate degrees. Designed for undergraduate mechanical engineering majors, an Aerospace Engineering concentration offers students a foundational mechanical engineering degree and specialized training in the aerospace discipline. This concentration covers the design, construction and science of aircraft and spacecraft, preparing students for leadership in the aerospace industry.

In 2014, there are 67 students in the BU Aerospace Engineering concentration program, with an annual tuition of \$45,686 (not including living expenses). The program is supported by a total of five part-time faculty members and approximately eight part-time staff members. Note that faculty members are full-time, but also teach other classes in the Mechanical Engineering Department.

METHODOLOGY FOR ESTIMATING THE ECONOMIC IMPACTS OF AVIATION EDUCATION

This section describes the methodology used to quantify the economic impacts associated with aviation education at the study airports.

The Economic Modeling Process

Economic impacts associated with aviation education were determined by using actual survey data and data from an input-output model with multipliers specific to Massachusetts. As with other economic impacts discussed in this report, impact estimates for three separate components of the economy were developed, as follows:

- **Employment** - Employment is based on full-time equivalent positions in which two part-time employees equal one full-time employee. 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 is the annual salary, wages, and benefits paid to employees.
- Output (Spending) - Output is equivalent to annual expenditures for goods and services, supplies, and other services needed to support aviation education activities.

It is important to note that payroll and output cannot be combined, because elements of the economic benefit related to payroll are also contained in the output estimate. Each of these three impact components (employment, payroll, and output) stands alone as a measure of the total economic impact of aviation education in Massachusetts.

Economic impacts of aviation education were calculated using an input-output model. The input-output model considers three impact categories to assess the economic impacts associated with aviation education. These categories are:

- Direct Impacts - Direct impacts include employment, payroll, and spending tied to schools and businesses that are engaged in aviation education activities at Massachusetts' airports.
- Multiplier Impacts - Multiplier impacts, or indirect and induced impacts, are the benefits resulting from the recirculation of direct impacts within the economy. See Chapter 3 for a more detailed discussion of multiplier impacts.
- Total Impacts - Total impacts are the sum of all direct and multiplier economic activities attributable to aviation education activities at Massachusetts' airports.

Because multiplier impacts are not as easily quantified as direct impacts, a reliable method of estimating the multiplier impacts must be applied. For this analysis, the Impact Analysis for Planning (IMPLAN) model was used to determine multiplier impacts. More information on the economic modeling process and multipliers used in this study can be found in Chapter 3.

Data Requirements and Collection

Data collection efforts were undertaken to gather information related to aviation education at Massachusetts' airports. This information served as an input to the modeling process to identify the total economic impacts associated with on-airport aviation education. Direct impacts regarding aviation education were identified primarily through survey efforts. Schools and businesses involved in aviation education were contacted to gather data related to their employment, payroll, and annual spending.

As explained in Chapter 3, all airport tenants having employees on Massachusetts' airports during 2013 were contacted via surveys, site visits, phone calls, or e-mails to collect information for this study. Since on-airport schools and businesses providing aviation education are airport tenants, they were surveyed as part of this effort. The following information was collected to estimate direct impacts for each on-airport aviation education school or business:

- Number of full-time and part-time employees
- Estimated total annual wages and benefits paid to employees in 2013
- Estimated total capital improvement expenditures for 2011 through 2013, to calculate average annual expenditures on capital improvement projects (CIPs)
- Estimated total operating expenses (excluding payroll and capital improvements previously identified) in 2013
- Estimated total gross sales (where applicable) in 2013

In addition, each school or business was asked to report the percentage of total employment, payroll, CIP expenditures, operating expenses, and gross sales that could be attributed to aviation education activity. This allowed aviation education activities to be separated from other activities at businesses such as FBOs.

Several rounds of follow-ups were made to non-responding schools and businesses to obtain the greatest response rate possible for employment. For schools and businesses who did not supply complete information on payroll, expenses, and gross sales, estimates were developed using ratios of payroll, expenses, and gross sales per employee. These ratios were developed from the consultant's in-house database compiled from airport economic impact studies conducted throughout the United States.

AVIATION EDUCATION EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS

Using the methodology detailed in this chapter, the economic impacts of aviation education activities at Massachusetts airports were estimated. **Table 6-2** presents these impacts. Direct employment at schools and businesses providing aviation education in Massachusetts is estimated at 264 jobs. Annual payroll for these jobs is estimated at \$8.1 million, and annual output is estimated at \$28.3 million.

**Table 6-2: Economic Impacts of Aviation Education
at Massachusetts Airports**

	Direct Impacts	Multiplier Impacts	Total Impacts
Employment	264	223	487
Payroll	\$8,088,000	\$6,187,000	\$14,275,000
Output	\$28,288,000	\$16,935,000	\$45,223,000

Source: CDM Smith and IMPLAN multipliers

Multiplier impacts are those economic benefits that exist due to the recirculation of direct impacts. Multiplier impacts associated with aviation education at Massachusetts airports result in 223 additional jobs, \$6.2 million in annual payroll, and \$16.9 million in annual output.

Total economic impacts are the sum of direct and multiplier impacts. At the study airports, total impacts associated with aviation education are estimated at 487 jobs, \$14.3 million in annual payroll, and \$45.2 million in annual output. These impacts are included in, and not additive to, the economic impacts presented in Chapter 4.

Although not measured in this study and not included in Table 6-2, it is important to realize that several of the schools discussed in this chapter are located off-airport and generate additional economic impacts throughout Massachusetts. **Table 6-3** lists these off-airport schools along with their direct employment and student enrollment in 2014. As shown in Table 6-3, off-airport schools have more than 140 direct employees and nearly 1,000 students enrolled in aviation education programs.

Table 6-3: Off-Airport Schools Providing Aviation Education in Massachusetts

School	Location	Program Type	Employment	Students
Greenfield Community College (GCC)	Greenfield, MA	Continuing Ed	1	50
Bridgewater State University (BSU)	Bridgewater & New Bedford, MA	Pro Pilot & Aviation Mgmt	26	184
Westfield State University (WSU)	Westfield, Ma	Pro Pilot & Aviation Mgmt	3	18
North Shore Community College (NSCC)	Beverly, MA	Pro Pilot & Aviation Mgmt	2	39
Massachusetts Institute of Technology (MIT)	Cambridge, MA	Engineering & Research	94	416
Worcester Polytechnic Institute (WPI)	Worcester, MA	Engineering & Research	10	190
Boston University (BU)	Boston, MA	Engineering & Research	7	67
TOTAL			143	964

Source: Airport Solutions Group



SUMMARY

Through its “Flight Plan to Aviation”, Massachusetts is positioning itself to meet the aviation industry’s demand for technically qualified personnel today and into the future. The Flight Plan that continues to develop within the Commonwealth is a multi-faceted collection of resources and programs that has evolved organically through a combination of private enterprise initiatives, state and federal programs, local airports and their host communities, and the passionate outreach of aviation enthusiasts. Today, that Flight Plan is generating notable

economic benefits for the Commonwealth of Massachusetts. This collection of on-airport aviation education entities generates more than \$45.2 million in total annual output for the state, including nearly 500 total jobs earning approximately \$14.3 million in total annual payroll. These figures do not include impacts generated by off-airport schools, which were not estimated in this study. Off-airport schools have more than 140 direct employees and enroll nearly 1,000 students in 2014. But beyond these numbers of today, Massachusetts must focus its efforts for those numbers to continue to grow into the future. Therefore, it is critical that Massachusetts continues to look forward on its own Flight Plan to Aviation by finding its place in the future of aviation for the long-term benefit of the Commonwealth and its citizens.

CHAPTER 7: AIR CHARTER CASE STUDY

INTRODUCTION

Time is a finite resource – and whether it is spent for professional or personal purposes, there is no getting around the fact that we cannot create more time. However, we can use it more wisely and more efficiently. For people and businesses seeking opportunities to better utilize their time, use of charter aircraft has become indispensable. “Air charter” refers to a variety of services available that allow individuals, corporations, or groups to move people and cargo in the fastest, most efficient manner available today. It can include the transporting of business people to open new markets, the transfer of patients during medical emergencies, the shipping of time-sensitive cargo to restart a production line that is down, as well as any other use where time and convenience are of the essence.

Air charter eliminates many travel inefficiencies by providing immediate point-to-point travel services that are fast and reliable. Moreover, flight time itself is much more productive as charter aircraft have the capability to allow their passengers to operate much as they would in a professional office. Air charter operators board passengers closer to their points of origin and deliver them closer to their final destination by effectively utilizing the country’s vast general aviation airport network of more than 5,000 airports. Bags and cargo are never separated from their owners and security screening is much quicker and more efficient.

In Massachusetts, air charter is an essential transportation means that provides critical linkages between the Commonwealth and other markets within the country and around the world. From a business perspective, it is the fastest and most reliable transportation mode available today for providing immediate access to Massachusetts’ corporate and industrial base. The speed and convenience provided by air charter are also key factors in allowing many companies to operate in, or develop markets outside of major metropolitan areas like Boston. Businesses in Central and Western Massachusetts, on the North and South Shores, and on the Cape and Islands rely on the accessibility that air charter provides.



Air charter operations are also critical to support Massachusetts’ world class educational system (from prep schools to universities), as students from around the world frequently travel via charter aircraft. Professional and collegiate sports teams regularly utilize air charter as they travel to and from the area for games and tournaments, as do thousands of fans in support of

their teams. As an internationally recognized vacation destination, charter aircraft operations have proven to be a critical asset in moving tourists in and out of often difficult to access destinations. For those who want to live in Massachusetts but have business interests elsewhere, air charter also allows those individuals the flexibility to be full-time or part-time citizens of our state. For many of Massachusetts' renowned festivals and events, air charter is one of the most important tools for allowing national and international access and participation. Additionally, an important component of air charter is that it can serve as a lifeline during emergency medical events where immediacy and accessibility save lives.

Similar to Chapter 6, this chapter provides a case study of air charter activity in Massachusetts and presents the associated economic impacts for the Commonwealth. Primary data sources for the discussion in this chapter included:

- *Business Aviation in Today's Economy: A Shareholder Value Perspective*. Tech. N.p.: n.p., 2001. Print. The White Paper Ser. - Number 4.
- *Business Aviation in Today's Economy: A Guide to the Analysis of Business Aircraft Use, Benefits and effects on Shareholder Value*. Tech. N.p.: n.p., 2001. Print. The White Paper Ser. - Number 9.
- "NBAA - National Business Aviation Association." *NBAA - National Business Aviation Association*. N.p., n.d. Web. 24 Nov. 2014.
- NBAA. *Air Charter Consumer Guide*. N.p.: NBAA, 2011. Print.
- "No Plane No Gain." *No Plane No Gain*. N.p., n.d. Web. 24 Nov. 2014.
- Simm, Carole. "Definition of a Charter Flight." *Travel Tips*. USA Today, n.d. Web. 24 Nov. 2014.

HOW AIR CHARTER WORKS

Safety, security, convenience, and productivity are key reasons why individuals and companies choose on-demand air travel for personal and business travel. Air charter flights operate on the passenger's schedule, allowing considerable flexibility. With the ability to fly in and out of more than 5,000 public use airports in the United



States (more than 100 times that of the airlines) air charter provides convenient access to nearly any destination - and air charter is among the safest modes of transportation.

Air charter is generally defined as the business of providing nonscheduled flights that carry passengers or cargo where the party receives the exclusive use of the aircraft. The aircraft can be large or small, and flights can be one-way or round-trip. The charter could be made on a flight-only basis, or could be part of a complete travel package. There are both private and public charter companies.

- Private Charters - Private charter companies offer a tailored service in which the client has complete use of a charter aircraft for a particular time or flight mission. Typical plane charters accommodate 5-10 people on smaller aircraft or as many as 50 on larger business jets. There are several avenues by which a customer can access a private charter company, including directly with the air charter company (sometimes through a pre-purchase membership card program), through an air charter broker, or through buying in to an air charter company through a fractional ownership program.

It should be noted that in recent years, fractional ownership programs have become particularly popular options for utilizing air charter capabilities. “Fractional ownership” is a program where customers purchase a permanent “share” of a particular aircraft or a fleet of aircraft that are then managed by a dedicated aircraft management or air charter company. Essentially, share owners are guaranteed a portion of that aircraft’s annual flight time - this results in net savings for owners in terms of time, effort and money. Essentially, share owners can avoid the hassles of finding and employing reliable air charter companies and/or brokers, thereby ensuring consistency of service (by using the same aircraft and professional service providers, including pilots), predictable costs (it is not required to negotiate a fee for each trip), and maximum flexibility (aircraft are on-call and flight hours can be transferred to other travelers, including customers). Additionally, since the aircraft shares are tangible assets, they are often eligible for tax and depreciation benefits.

Private charters can typically operate in two manners:

- o Single-Entity Charter Operation – This charter operation is one in which an individual or company charters a plane and bears the entire cost of the flight, so that the passengers do not pay their own airfare. There is no minimum passenger requirement, since the cost is per flight, not per person. Single-entity charters are most often used for business purposes and are likely the operation most commonly associated with air charter.
- o Affinity Charter Operation – This charter operation is slightly different in that, although all of the passengers are affiliated with a specific business, group or organization, each pays their own air fare. Passengers might be traveling as business commuters (e.g., from the Boston area to the New York area), as friends to some special event or a vacation destination, among many other applications. Since it is a private operation, none of the seats are sold to members of general public.
- Public Charters - A public charter is one in which a tour operator rents a charter aircraft and advertises and sells seats to members of the public, either directly or through a travel agent. A public charter may include only the flights, or it may be sold as a complete package, including hotels, guided tours, and ground transportation. These flights must be filed with the U.S. Department of Transportation (USDOT), and the tour

operator must supply a charter prospectus. The tour operator assumes a legal responsibility to provide the transportation service, and must abide by USDOT requirements for the protection of the clients' money. Public charters often only operate seasonally, and are often sold as part of a vacation package deal. Note that public charters also still require that passengers pass through standard security checks as they would for any commercial air service.

Nationwide, there are more than 2,100 air charter operators. These charter operators are required to hold an air carrier or commercial operating certificate issued by the Federal Aviation Administration (FAA) and operations specifications that contain company names, authorizations, and limitations. This certificate allows charter operators to conduct on-demand operations under FAR Part 135 for most business aircraft.

It is important to note that the types of charter operators available are as diverse as the number of aircraft that they utilize (and there are more than 300 business aircraft makes and models certificated by the FAA). Some air charter operators serve local markets, while others operate internationally. Some operate smaller single-engine aircraft; others operate large "flying office" turbojet aircraft. Some operate at world-class levels; others operate at the bare minimum FAA regulatory requirements.

In addition to the operators, there are air charter brokers who are individuals or companies that act as a service agent representing either the air charter customer or air charter operator. In addition to linking charter customers with charter operators, they may also provide many value-added services to assist the air charter consumer. In addition to due diligence research on air charter operators, aircraft and crew qualifications, brokers also can make arrangements for ground transportation, special catering, on-board passenger amenities, hotels, executive security, destination security briefings, etc.

Unlike FAA-certificated charter operators, charter brokers are not regulated by the FAA or DOT. However, the DOT has set the following requirements for air charter brokers: (1) air charter brokers must be clear with the consumers that they are not the FAA-certificated charter operator or the entity operating the flight; and (2) air charter brokers work either at the request of the consumer to find charter operators or at the request of the charter operator to find customers. Alternatively, brokers can act as a "middle-man" where the broker, at the request of a customer, finds an appropriate charter operator, with which the customer then contracts directly for the charter flights. In this middle-man scenario, the broker is not involved in any way with the provision of air transportation, and the customer pays the broker separately for its services.

WHY AIR CHARTER WORKS

Air charter is a highly effective tool for a multitude of applications, including personal travel, emergency transport, business transportation, etc. - all of which derive specific and tangible benefits from employing charter aircraft. Yet, it is in its most recognized application for business interests where air charter's wide range of benefits is most easily identified and quantified. In the past, the decision to use air charter for business has generally been intuitive — a common-sense feeling by corporate executives that the choice of greater mobility would be good for business because of strategic competitive urgency, accelerated transaction value, improved productivity, practical realities, or some other (typically not quantified) reason.



Today, based on extensive industry research, it can be definitively stated that business aircraft (and by extension, air charter aircraft) help improve performance in the areas of greatest importance in today's fast paced economy (e.g., identifying and executing strategic opportunities for new relationships and/or alliances; reaching critical meetings and closing transactions; expanding into new markets; and increasing contact with customers). Senior executives in operator organizations that utilize business and charter aircraft can visit hundreds of locations (their own facilities or those of customers/suppliers) in a year because of the flexibility inherent in being able to control the aircraft's schedules and routes. In some cases, executives have stated they visit four or five sites in one day, reviewing operations, efficiency, quality, and customer service. Also, the use of employee shuttles can help a company save time and reduce costs, while enabling cost-effective growth.

But outside of those quantifiable characteristics, the timeless motive that underlies business use of air charter is the recognition of the value of face-to-face communication. Although business travel undulates with the economy at some companies, many longstanding business aircraft operators have concluded that the amount and quality of information that can be gathered or delivered face-to-face exceeds that of any other communication method. While phone, video conferencing or email obviously are ideal under many circumstances, some critical information sources make "being there" imperative. To secure this communication advantage, a growing number of companies rely on the travel efficiencies that are unique to business aviation.

Business aircraft, whether owned or chartered, can make a substantial difference in how a company performs its mission. Increased mobility is at the core of this increased performance — satisfying management's need for greater organizational agility, knowledge integration, and transaction speed. Corporate executives have consistently confirmed that everyone — customers, suppliers, and key employees — observed the positive impact of using air charter

aircraft within their business model. Understanding those specific positive impacts is a key to grasping how aircraft usage impacts the performance of an organization. Generally, business utilization strategies of aircraft include the following six categories:

- Transportation of employees and executives - The most common use of air charter aircraft is transporting the company's own employees. Corporations can maximize the efficiency of scarce human resources by better allocating their knowledge assets (the collective knowledge of an organization, including its best practices, and the wisdom and experience of its employees and executives). Strategies include facilitating strategic opportunities, exploring new markets, extending management control, and improving relations with customers, investors, and the public. Moving specialist management or financial teams may be necessary to close transactions, or in the case of some companies, to move production, engineering, and operations teams on a regular basis between company facilities.
- Transportation of customers - With increasing frequency, companies use business air charter aircraft to transport their customers, differentiating themselves from competitors. Companies can create a sales environment enroute or simply bring customers to key facilities to accelerate their comprehension, build stronger personal relationships, and ultimately close more sales transactions.
- Transportation of suppliers - Companies can accelerate or improve supply chain integration by transporting suppliers more efficiently via air charter aircraft. This may involve improving a supplier's understanding of production facilities, bringing multiple suppliers to customer meetings, or simply concluding supplier negotiations.
- Transportation of cargo, parts, and mail - This entails moving company cargo, machine parts, and mail between internal facilities and externally between suppliers, customers, and potential customers. Depending on volume, this practice can substantially reduce alternative overnight transportation costs. Two examples of deployment strategies include the direct shipment of parts to remote locations, or the delivery of emergency components to keep production flowing.
- Transportation for charity - This pertains to the benevolent applications of business air charter aircraft. Aircraft can be very powerful tools to advance community service. Although there is no direct business impact from this practice, companies are community-based and often play an important role in serving their local area. For example, many companies permit the transport of non-employee patients to distant treatment centers for medical treatment when there are available seats on a business aircraft.
- Direct applications - This utilization strategy includes using air charter aircraft as an aerial platform to accomplish a given task or simply as an incremental profit center.

Aerial platform applications include site mapping, aerial photography, and many other direct uses.

Understanding the net financial benefits (incremental benefits offset by incremental costs) of utilizing air charter is key to isolating its asset efficiency and its overall value to corporate success. But, net benefits are only one possible justification - there are also other benefits that are very difficult to quantify and, even with the best available data, difficult to capture. But the most substantial net benefits are listed below:

- Employee time savings - An employee's time has intrinsic value. In the past, this value was thought to increase with expertise and decision-making responsibility. But now, the value of time savings can no longer be automatically associated with levels in an organizational hierarchy. It is the preservation of any scarce knowledge resource that often makes the most compelling case for air charter operation. In the final tally of costs and benefits, it is often quite difficult to justify air charter operational costs without placing value on the time saved door-to-door. Closely linked with this, increased productivity includes being able to complete essential business tasks more quickly, thereby reducing unit costs of sales and improving time to market. Considering the value of knowledge integration and the rapid deployment of specialist teams in improving an organization's efficiency, improved productivity emerges as a key benefit derived from operating business aircraft.
- Improved door-to-door and enroute productivity - Traveling in a business aircraft can significantly improve productivity and lessen fatigue by providing a more flexible travel schedule, decreasing the need for overnight "red eye" flights, enabling comfortable seating configurations conducive to team work, and including office amenities on board the aircraft. Also, avoiding the commercial air transportation system's stress-inducing processes (such as long lines at check in, baggage check, security screening, etc.) can make business travel less tiring and therefore, more effective.
- Strategic transaction efficiencies - Rapid deployment of transaction teams or improved responsiveness to opportunities for acquisitions or alliances are of increasing value today. On the revenue and market end of the business, being better able to respond to strategic opportunities, or being able to respond faster when a competitor courts a company's customers, may be of considerable benefit in a highly competitive environment.
- Privacy and protection of intellectual property - While it is nearly impossible to quantify the impact of the loss of intellectual property to a company, all businesses rate this loss as one of the costliest potential scenarios. The risks include competitor intelligence gathering in public places, lost laptops, and stolen property. Conducting discussions and reviewing documents in the total privacy afforded by an air charter aircraft is a benefit that should be fully considered.

- Improved customer retention or capture - Companies can increase customer satisfaction in many ways, including responding faster to customer needs, spending more time with customers, expanding relationships with existing customers, having a more focused attention to customer needs, and demonstrating new products and services to customers. Companies can differentiate their service from their competitors' in a safer, more secure, travel environment. Also, developing new products based on more customer input accelerates time-to-market.
- Supply chain improvement - Rapid deployment of supply chain transaction teams accelerates the business process. Being better able to conduct core meetings, reviews, etc., and having more frequent and targeted oversight of supplier operations, lead to better integrated supply chains.
- Product and production cycle improvement - By reducing cycle times, companies maximize revenue and reduce costs. Improving time to market entails shortening each segment in the product life cycle, including design and development, production, and after-market support. By carefully identifying components of the production cycle that could be improved by use of air charter aircraft (i.e. development team efficiencies, shipment of components and products that are part of the production cycle), companies can maximize these benefits.
- Employee safety and security - Absolute control over aircraft, crews and maintenance, can significantly reduce the risk of hijacking, cargo tampering, etc. In certain cases reduced travel visibility may be a crucial benefit in executing key transactions.
- Risk management - Because risk is an unavoidable characteristic of life and of business, companies that undertake a serious effort to understand potential threats or hazards can develop strategies to better manage and mitigate risks. Better oversight and control of critical processes and tasks through air charter aircraft use may become a key element of improved risk management.
- Direct travel expense savings - Rental cars, commercial air travel, additional hotel nights, meals, entertainment, per diems, and other costs can often be avoided.
- Increased personnel retention - By using air charter aircraft, companies can improve their personnel retention, thereby reducing the costs of turnover and retraining. Reduced attrition results from the controlled, more effective on-the-job experience for employees with access to business aircraft, as well as shorter travel schedules and greater family time. Attracting vital new hires, who are often courted extensively, is an associated benefit.
- Charitable missions - Using air charter aircraft for this purpose produces intangible benefits such as corporate image enhancement and brand name recognition. While these are "soft" benefits, they are nonetheless important to a company's success.

HOW AIR CHARTER WORKS FOR MASSACHUSETTS

Air charter operations provide fast, efficient and flexible transportation services for a wide variety of users and purposes. As detailed above, they provide value-added benefits that cannot be duplicated by other modes of transportation. In Massachusetts, air charter activities permeate the state's economy, as well as its life on a day-to-day basis. Following are examples of how air charter activities benefit various facets of the Commonwealth of Massachusetts today.

- **Business** – Business is what drives the Massachusetts economy - it generates the activity that makes the Commonwealth's economy vibrant and innovative; it enables its residents to enjoy the Massachusetts lifestyle; it underwrites its educational system; in short, it helps Massachusetts be the Massachusetts that is known throughout the world. And for all the reasons described in the sections above, air charter is a key contributor to ensure and promote the future vitality of business in Massachusetts.

Business charter operations can be seen at varying levels at nearly every airport within Massachusetts. From corporate jets to business turbine aircraft to single-engine piston aircraft to helicopters, business interests operating within the state utilize all forms of available air transportation. From the service provider perspective, the Commonwealth is also home to many dedicated air charter companies that provide those various forms of charter flight services to business clientele within New England and throughout the country. These companies provide the full range of aircraft and services demanded by businesses to enable them to be successful. Below is a listing of those air charter aircraft service providers currently operating within Massachusetts (see **Table 7-1**). Included in this table is the airport identifier that serves as each company's primary base of operation.

Table 7-1: Massachusetts Air Charter Providers

Company	Base(s) of Operation	Company	Base(s) of Operation
Boston Air Charter	OWD	Island Airlines	HYA
Boston Executive Helicopters	OWD	Kestral Aviation	OWD
Bullock Charter	FIT	Linear Air	BED
Cape Air	HYA	Nantucket Express	ACK
Commonwealth Air Charter	BVY	Professional Airways	PYM
Cornerstone Aviation LLC	FIT	Rectrix	HYA, BED, ORH, BAF
Harvard Air Taxi	FIT	Shoreline Aviation	GHG
Heliops LLC	PYM	Skyline Flight	FIT

Source: CDM Smith

An example of how one company successfully provides air charter services throughout the Commonwealth is PlaneSense. Although not based in Massachusetts, PlaneSense is a fractional aircraft ownership company that operates very similarly to a traditional air charter service. Based at Portsmouth International Airport at Pease, PlaneSense's fleet of PC-12



Pilatus turboprop aircraft can be seen throughout the Massachusetts airport system on a daily basis, fulfilling the business and personal needs of the citizens of the Commonwealth. Capable of operating equally well on turf and paved runways, it is just as common to see PlaneSense aircraft operating at Walter J. Koladza Airport bringing tourists to a local arts festival as it is to see them at Boston Logan International and Laurence G. Hanscom Field transporting people for business purposes.

- Tourism - Massachusetts is a vibrant international tourism destination that is based as much on its geographical and natural features as it is on its cultural and historical attractions. From the Berkshire Mountains to the rocky coast of Cape Ann, to the beaches of Cape Cod, and the vacation islands of Martha's Vineyard and Nantucket, Massachusetts' natural beauty fosters outdoor recreational activities of all choosing. Adding to that is the combination of Massachusetts' cultural diversity and historical attractions that cannot be matched anywhere in the United States. Anchored by the world class city of Boston (the self-identified "Hub of the Universe"), Massachusetts boasts premier cultural offerings, including hundreds of museums, festivals, art galleries, theaters and other attractions. And Massachusetts has history – lots of history. From the Pilgrims to the witch trials to the American Revolutionary to the industrial revolution to today, Massachusetts' history mirrors the history of the United States itself. There is little wonder why Massachusetts is a prime destination for tourists, domestic and international alike. Air charter is a key transportation resource in moving tourists in and out of the state's various (and sometimes remote) vacation destinations.

- o Western Massachusetts's Berkshires region offers skiing, whitewater rafting, sophisticated small towns and college towns, great performance art and fine museums (including the Tanglewood Music Center), many regional cultural festivals, and a vigorous antique-trading community. With commercial air service access to the region only available outside of the state (i.e. Hartford, CT; Albany, NY; etc.), air charter operations are frequently experienced at Harriman-and-West, Pittsfield Municipal,



Walter J. Koladza, Westfield-Barnes Regional, Westover Air Reserve Base/Metropolitan, and Turners Falls.

- o Cape Cod and the Islands is one of the world's preeminent vacation destinations featuring family-oriented attractions, miles of beaches, lighthouses, bluffs and dunes, freshwater ponds, walking and biking trails, glorious sunsets, and historic towns with good dining, baseball, summer theater, and scores of festivals. However, access to the area can be extremely challenging as thousands of visitors drive to the region every day on a constrained roadway network. Air charter allows visitors entrance into the area via one of eight airports that lie on the



Cape and Islands, enabling travelers to avoid the region's congested roadways during peak travel periods. Beyond the tourism industry's obvious dependence on air charter, multiple airports (such as Barnstable Municipal, Chatham Municipal, Provincetown Municipal, Nantucket Memorial, and Martha's Vineyard) also report that air charter is vital for many of the annual festivals and events that rely on people traveling from outside of Massachusetts for the execution and success of these occasions.

- o Boston has all the pleasures of a great city: theater, museums, excellent shopping and dining. The Freedom Trail, a walking circuit, passes many iconic settings of the American Revolution. The Boston Commons and Public Garden are superb urban parks. The Charles River with its picturesque bridges separates Boston from Cambridge, home to Harvard University. Nearby Lexington and Concord have



outdoor museums describing Revolutionary War events. While Boston is home to one of the country's large hub commercial service airports in Logan International Airport (more than 30 million passengers in 2013), air charter nevertheless plays an important role for Boston tourism for those who wish to avoid the inevitable congestion associated with such a large airport. Airports such as Laurence G. Hanscom Field, Beverly Municipal, Norwood Memorial, Lawrence Municipal, and Marshfield Municipal are utilized daily by air charter operators.

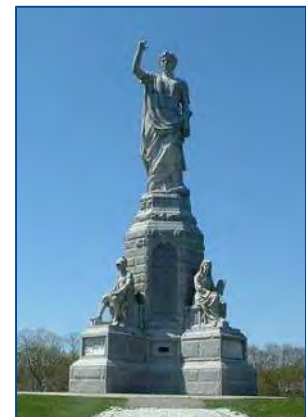
- o The Central Region of Massachusetts is a place of picturesque towns and farmlands that welcome visitors for its many agrarian attractions and fall harvest celebrations. Old Sturbridge Village, a living history re-creation with costumed interpreters that help visitors understand life in a 19th-century rural New England town. The second largest city in New England, Worcester draws visitors typical of any metropolitan area, including conventions, concerts, and several prestigious New England colleges. The town of Brimfield plays host to the giant Brimfield Antiques Show, and outdoor enthusiasts flock to the Quabbin Reservoir and Wachusett Mountain. Supporting these tourism destinations, regular air charter operations are experienced at airports such as Worcester Regional, Fitchburg Municipal and Orange Municipal.



- o The North Shore region, including the towns of Salem, Gloucester, Rockport, Newburyport, Marblehead, Lowell, and the greater Cape Ann area is known for its art galleries, seaside beauty, fine food, and its fleet of whale watch cruises. Salem, site of 17th-century witchcraft trials, attracts tens of thousands of visitors every October for its Halloween festival. The greater region that includes the Merrimack Valley and other points north of Boston likewise has a strong draw for tourism. The historic towns of Lexington and Concord boast nationally known museums detailing their Revolutionary War past. Lowell and its historic mills are showcases of early American industrial history. Airports such as Beverly Municipal, Lawrence Municipal, Minute Man Air Field, and Laurence G. Hanscom Field serve the region's daily air charter demands.



- o The South Shore region is where Pilgrims, Native Americans, and whaling fleets made their mark on the nation's history. The Town of Plymouth and its historic colonial sites draws tourists from around the country to visit Plymouth Rock, the National Monument to the Forefathers, and Plimoth Plantation. The region is also home to the City of New Bedford, famous for old seafaring history, and its whaling and maritime historical sites. Not far from the Stellwagan Bank, a former major



whaling ground, the region's seafaring towns now pursue whale watching tourists. Additionally, the region is one of the country's premier cranberry farm areas, in addition to many the quiet beach towns scattered along Buzzard's Bay. Air charter needs of the region are accommodated by New Bedford Regional, Plymouth Municipal, and Marshfield Municipal Airports.

- **Education** – Massachusetts is home to an incomparable educational system that attracts students from throughout the United States and around the world – and the schools and educational programs that comprise that system often rely on air charter operations (and the general aviation airports that lie nearby) to transport their students to and from their campuses. There are currently 115 colleges or universities within Massachusetts.



Additionally, there are 26 college preparatory schools located in the state, of which seven have been placed in the country's top 20 (see **Table 7-2**). Finally, it should be noted that Massachusetts has several of the country's most prestigious summer camp grounds. All of these speak to the prestige and international reputation that has attracted students to Massachusetts.

Table 7-2: Massachusetts' Premier Educational Institutions

Top 20 Prep Schools	Top 100 Colleges & Universities
Phillips Academy Andover (Andover)	Williams College (Williamstown)
Roxbury Latin (West Roxbury)	Massachusetts Institute of Technology (Cambridge)
The Winsor School (Boston)	Harvard University (Cambridge)
Groton School (Groton)	Amherst College (Amherst)
Milton Academy (Milton)	Tufts University (Medford)
Noble and Greenough School (Dedham)	Wellesley College (Wellesley)
Deerfield Academy (Deerfield)	Boston College (Chestnut Hill)
	Smith College (Northampton)
	College of the Holy Cross (Worcester)
	Brandeis University (Waltham)
	Boston University (Boston)
	Mount Holyoke College (South Hadley)

Source: Forbes Magazine 2014 rankings

These institutions are scattered throughout the Commonwealth and are not just located near commercial service airports where students and parents easily travel to the schools. Many are located in more remote corners of the state where access is best gained through air charter operations. While one might at first assume that this would be a relatively low number of operations, the sheer number of schools, combined with the number of students whose families employ air charter, in addition to the number of holidays and school breaks, as well as events that draw parents to the school, result in a significant number of accumulated air charter trips every school year. Airports like

Northampton, Turners Falls, Marlboro, Worcester Regional, Westover Air Reserve Base/Metropolitan, Westfield-Barnes Regional, Fitchburg Municipal, Lawrence Municipal, Orange Municipal, Harriman-and-West, Minuteman Air Field, and Pittsfield Municipal all experience substantial air charter activities based on their proximity to these various schools and camps.

- Sports – Sports plays a prominent role in life throughout the Commonwealth – and air charter operations play important roles in transporting teams and individuals, moving sporting fans in and out of the area, and in other capacities that support the leagues. The Boston area is rife with professional sports teams in all of the primary sports leagues, including the NFL, MLB, NHL, NBA, and MLS. For sporting individuals, there is the annual Boston Marathon, as well as PGA championship tournaments. Additionally, there are minor league, semi-professional, amateur and club teams throughout the state for a variety of sports, including rugby, lacrosse, tennis, soccer, football, baseball, hockey, softball, and even paintball. Nearly all of these activities generate various levels of air charter activity. Following are several of the more noteworthy professional sporting events that occur in the state:



- o Started in 1897, the Boston Marathon is the world's oldest annual marathon and ranks as one of the world's best-known road racing events. It is one of six World Marathon Majors and is hosted by several cities in the Greater Boston area. It annually attracts approximately 25,000 runners and between 500,000 and one million spectators.
- o The PGA Tour Deutsche Bank Championship is a regular professional golf tour stop in the state. Massachusetts has played host to nine U.S. Opens, four U.S. Women's Opens, two Ryder Cups, and one U.S. Senior Open. Note that PGA events typically generate significant air charter activities.
- o The Basketball Hall of Fame is also located in Springfield, MA, generating many air charter operations during its annual induction ceremonies, among other events.

With 115 colleges and universities (including seven NCAA Division I schools), Massachusetts also experiences a substantial amount of activities through the full range of collegiate sports. Similar to professional sports, each event can generate a varying degree of air charter activities at nearby airports; however, of greatest prominence is hockey, football, and basketball. Following are several of the more noteworthy professional sporting events that occur in the state:

- o The Head Of The Charles Regatta is the country's premier rowing race held each year on the Charles River. It is the largest two-day regatta in the world, with nearly 9,000 athletes rowing in over 1,900 boats in 61 events, attracting roughly 300,000 spectators during regatta weekend.
- o Massachusetts has hosted major NCAA tournaments, including the Frozen Four, and March Madness Regional Tournaments.
- o The Cape Cod Baseball League is the nation's premier collegiate baseball league where many future Major League Baseball players have started their professional careers. MLB has provided financial support to the Cape League for over 40 years.

Depending on the event, most airports can experience some air charter operations as a result of sports-related activities; however, the majority of sports team charters utilize airports like Westover Air Reserve Base/Metropolitan, Westfield-Barnes, Laurence G. Hanscom Field, and Boston Logan International.

- Military - Air charter operations by the military branches are limited to Hanscom Air Force Base, Barnes Air National Guard Base, and Westover Air Reserve Base. These types of operations are relatively infrequent and are generally related to troop deployments to overseas destinations or troop returns from overseas. By using these airports, military personnel can clear through customs much more efficiently and privately. Occasionally, these airports are the site of Fallen Hero Ceremonies.



- Quality of Life - Massachusetts, located in the heart of New England, is the region's most populous state. Lively urban areas, picturesque seaside communities, and tiny rural towns offer a unique ambiance which attracts many new residents every year. Some of these new residents are vacation home owners that wish to be part of the state's picturesque vacation destinations; others simply want to make Massachusetts their permanent home. For both of those potential resident types, air charter operations can help make living in Massachusetts more reachable.

For the many vacation home owners that live outside of Massachusetts (most notably around New York City), air charter operations enable these residents to work out-of-state during the week, but still enjoy their vacation homes on the weekends. Specifically, traveling to Cape Cod and the Islands is notoriously difficult in the summer months with tens of thousands of motorists regularly clogging the two bridges that provide access to Cape Cod. Air charter provides immediate access to one of the area's

eight airports; in fact, it has been reported that during the summer months there are affinity charter operators that regularly fly groups of unaffiliated businesspeople every Friday evening from White Plains to Nantucket, and returning them every Sunday night as a sort of “car pool”. For other full-time residents whose business lies outside of the region, air charter is the vital transportation connection for their professional livelihood. There are multiple examples of corporate executives that choose to live in Massachusetts, but utilize air charter to essentially “commute” to their out-of-state offices several times a week.

- Medical Air Transportation - One of the most important roles that an airport plays in its community is that of a transportation site for potential medical air charter operations. Medical air transportation is a comprehensive term that encompasses the use of air transportation (aircraft or helicopter) to move patients to and from healthcare facilities and accident scenes. Personnel provide comprehensive pre-hospital and emergency and critical care to all types of patients during aeromedical evacuation or rescue operations aboard helicopter and propeller aircraft or jet aircraft. Following are several examples of medical air transportation charter services that are experienced at Massachusetts airports:

- o Boston MedFlight - Boston MedFlight is a world renowned, critical care transport program established in 1985 by a consortium of Boston's leading academic medical centers. For almost three decades, the founding institutions have partnered together to create and sustain a regional critical care transport system focused on patient care excellence, high reliability, and safety. Their mission is to provide the right aircraft vehicle to the right patient at the right time and transport them to the right facility. Every year, two-person, nurse/ paramedic teams transport approximately 3,000 gravely ill or injured patients to lifesaving tertiary care on medically equipped helicopters and aircraft from accident sites or local airports. Boston MedFlight currently has bases at Laurence G. Hanscom Field, Plymouth Municipal Airport, and Lawrence Municipal Airport.



- o Angel Flight – Angel Flight is a nonprofit organization dedicated to serving the community by facilitating free air transportation for children and adults with medical conditions who need to get to treatment far from home. Each Angel Flight organization covers designated areas of the United States, and for destinations beyond their regions, they link with other volunteer pilot organizations. Those that request a flight must be medically stable, able to board an aircraft, and fly in a small single or twin engine aircraft. Angel Flight volunteer

pilots use their private planes to fly patients to their destinations, paying for all expenses for each mission they fly. Based at Lawrence Municipal Airport in Massachusetts since 1996, Angel Flight Northeast's volunteer pilots have flown free-of-charge those who need help in getting to hospitals to receive much needed medical care. More than 1,000 volunteer pilots have flown over 65,000 free flights (13 million miles) and provided some 62,000 patients and their families free air transportation to medical care. Nearly every airport in Massachusetts accommodates Angel Flights, and most airports have pilots that volunteer for the program.



- o Corporate Angel Network – The Corporate Angel Network is the only charitable organization in the United States whose sole mission is to help cancer patients access the best possible treatment for their specific type of cancer by arranging free travel to treatment across the country using empty seats on corporate jets. This not only improves the patients' chances of survival but at the same time, it reduces their emotional stress, physical discomfort, and financial burden. Based in White Plains, NY, Corporate Angel Network's staff works with patients, physicians, corporate flight departments, and leading treatment centers to arrange more than 3,000 flights a year. Eligibility to participate in the program is open to all cancer patients, bone marrow donors, and bone marrow recipients who are ambulatory and not in need of medical support while traveling. Eligibility is not based on financial need, and patients may travel as often as necessary. Thanks to the generous cooperation of 500 of America's top corporations, including half of the top 100 in the Fortune 500, Corporate Angel Network has coordinated more than 45,000 flights since its founding in 1981. The program offers an obvious and meaningful benefit to cancer patients along with the opportunity for companies with corporate aircraft to provide a wonderful community service by merging business activities with corporate social responsibility.



- o Veterans Airlift Command (VAC) – Similar to the previously listed medical transportation providers, the Veterans Airlift Command provides free air transportation to post 9/11 combat wounded and their families for medical and other compassionate purposes through a national network of volunteer aircraft owners and pilots. VAC can and have operated at most airports in Massachusetts. It should also be noted that members of the VAC at Fitchburg Memorial Airport also flew 34 sorties to Long Island with clothing in support of relief efforts associated with Hurricane Sandy in 2012.



METHODOLOGY FOR ESTIMATING THE ECONOMIC IMPACTS OF AIR CHARTER ACTIVITY IN MASSACHUSETTS

This study estimated the economic impacts generated by 21 air charter operators based in Massachusetts. The methodology used in the analysis mirrored the process used to estimate the economic impacts of aviation education in the previous chapter. Please refer to Chapter 6 for a detailed discussion of the economic modeling and data collection process that was also applied to Massachusetts air charter operators.

EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS FOR AIR CHARTER OPERATORS

Table 7-3 presents the direct, multiplier, and total impacts generated by on-airport air charter operators in Massachusetts. Direct employment is estimated at 221 jobs receiving an annual payroll of \$12.5 million. Direct output is estimated at approximately \$63.5 million. Multiplier impacts add 187 jobs, \$9.6 million in annual payroll, and \$36.2 million in annual output. Total impacts are estimated at 408 jobs, \$22.1 million in annual payroll, and nearly \$100.0 million in annual output. It is important to note that, as with the aviation education impacts identified in Chapter 6, the economic impacts in Table 7-3 are included in, not additive to, the economic impacts presented in Chapter 4.

**Table 7-3: Economic Impacts of Air Charter Activity
at Massachusetts Airports**

	Direct Impacts	Multiplier Impacts	Total Impacts
Employment	221	187	408
Payroll	\$12,509,000	\$9,581,000	\$22,089,000
Output	\$63,458,000	\$36,163,000	\$99,621,000

Source: CDM Smith and IMPLAN multipliers

SUMMARY

Massachusetts realizes and benefits from significant air charter operations throughout its airport system. With 21 air charter companies currently based within the Commonwealth, in addition to multiple companies operating as brokers for other air charter companies both inside of and outside of the state, air charter is a driving force for the quality-of-life and economy of Massachusetts. As evidenced by the pronounced use of Massachusetts airports by NetJets, Flight Options, Rectrix, PlaneSense, and other air charter operators and brokerages that service Fortune 500 companies, air charter is an important tool that helps businesses to continue to operate and their people live here, while also serving as a potential incentive for new businesses to locate to the Commonwealth. In total, this important segment of the aviation industry is responsible for an estimated 408 total jobs, \$22.1 million in total annual payroll, and nearly \$100.0 million in total annual output.

APPENDIX A: ECONOMIC IMPACT TABLES

This section of the *Massachusetts Statewide Airport Economic Impact Study Update* contains tables providing details of the 2013 economic impact for each individual Massachusetts airport included in the study. 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	True Transient Percent (Note 1)	GA True Transient Arrivals
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	92,010	33%	15,182
Boston	Boston Logan International Airport	26,682	100%	13,341
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	13,097	33%	2,161
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	39,470	75%	14,801
Nantucket	Nantucket Memorial Airport	54,921	75%	20,595
New Bedford	New Bedford Regional Airport	23,972	33%	3,955
Provincetown	Provincetown Municipal Airport	68,025	33%	11,224
Vineyard Haven	Martha's Vineyard Airport	24,050	75%	9,019
Worcester	Worcester Regional Airport	28,069	33%	4,631
COMMERCIAL SERVICE AIRPORTS TOTAL		370,296		94,910
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	80	33%	13
Berkley	Myricks Airport	155	33%	26
Beverly	Beverly Municipal Airport	34,500	33%	5,693
Chatham	Chatham Municipal Airport	10,170	75%	3,814
Edgartown	Katama Airpark	4,000	75%	1,500
Falmouth	Falmouth Airpark	820	33%	135
Fitchburg	Fitchburg Municipal Airport	22,210	33%	3,665
Gardner	Gardner Municipal Airport	4,315	33%	712
Great Barrington	Walter J. Koladza Airport	15,770	75%	5,914
Hanson	Cranland Airport	2,410	33%	398
Hopedale	Hopedale Industrial Park Airport	18,350	33%	3,028
Lawrence	Lawrence Municipal Airport	31,050	33%	5,123
Mansfield	Mansfield Municipal Airport	17,950	33%	2,962
Marlborough	Marlboro Airport	675	33%	111
Marshfield	Marshfield Municipal Airport - George Harlow Field	8,500	33%	1,403
Marstons Mills	Cape Cod Airport	175	33%	29
Montague	Turners Falls Airport	5,100	33%	842
Newburyport	Plum Island Airport	925	33%	153
North Adams	Harriman-and-West Airport	13,900	33%	2,294
Northampton	Northampton Airport	1,556	33%	257
Norwood	Norwood Memorial Airport	59,800	33%	9,867
Orange	Orange Municipal Airport	36,000	33%	5,940
Pittsfield	Pittsfield Municipal Airport	16,500	33%	2,723
Plymouth	Plymouth Municipal Airport	25,350	33%	4,183
Southbridge	Southbridge Municipal Airport	15,950	33%	2,632
Spencer	Spencer Airport	2,100	33%	347
Sterling	Sterling Airport	14,055	33%	2,319
Stow	Minute Man Air Field	28,765	33%	4,746
Taunton	Taunton Municipal Airport - King Field	3,550	33%	586
Westfield/Springfield	Westfield-Barnes Regional Airport	29,469	33%	4,862
GENERAL AVIATION AIRPORTS TOTAL		424,150		76,272
ALL AIRPORTS TOTAL		794,446		171,182

Source: CDM Smith, FAA 5010 Forms, airport management estimates, air traffic control tower data. Note 1: True transient percentages based on 2010 Massachusetts Statewide Airport Economic Impact Study.

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
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	15,182	3.3	51,795
Boston	Boston Logan International Airport	13,341	3.3	44,025
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	2,161	2.5	5,646
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	14,801	3.3	48,844
Nantucket	Nantucket Memorial Airport	20,595	3.3	67,964
New Bedford	New Bedford Regional Airport	3,955	2.5	9,888
Provincetown	Provincetown Municipal Airport	11,224	2.5	28,060
Vineyard Haven	Martha's Vineyard Airport	9,019	3.3	29,762
Worcester	Worcester Regional Airport	4,631	2.5	11,578
COMMERCIAL SERVICE AIRPORTS TOTAL		94,910		297,563
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	13	1.8	24
Berkley	Myricks Airport	26	1.8	46
Beverly	Beverly Municipal Airport	5,693	2.5	14,231
Chatham	Chatham Municipal Airport	3,814	3.3	12,585
Edgartown	Katama Airpark	1,500	1.8	2,700
Falmouth	Falmouth Airpark	135	2.5	338
Fitchburg	Fitchburg Municipal Airport	3,665	2.3	8,429
Gardner	Gardner Municipal Airport	712	1.8	1,282
Great Barrington	Walter J. Koladza Airport	5,914	1.8	10,645
Hanson	Cranland Airport	398	1.8	716
Hopedale	Hopedale Industrial Park Airport	3,028	1.8	5,450
Lawrence	Lawrence Municipal Airport	5,123	2.3	11,783
Mansfield	Mansfield Municipal Airport	2,962	1.8	5,331
Marlborough	Marlboro Airport	111	1.8	200
Marshfield	Marshfield Municipal Airport - George Harlow Field	1,403	2.3	3,226
Marstons Mills	Cape Cod Airport	29	1.8	52
Montague	Turners Falls Airport	842	1.8	1,515
Newburyport	Plum Island Airport	153	1.8	275
North Adams	Harriman-and-West Airport	2,294	2.3	5,275
Northampton	Northampton Airport	257	1.8	462
Norwood	Norwood Memorial Airport	9,867	2.5	24,668
Orange	Orange Municipal Airport	5,940	2.3	13,662
Pittsfield	Pittsfield Municipal Airport	2,723	2.5	6,806
Plymouth	Plymouth Municipal Airport	4,183	2.3	9,620
Southbridge	Southbridge Municipal Airport	2,632	1.8	4,737
Spencer	Spencer Airport	347	1.8	624
Sterling	Sterling Airport	2,319	1.8	4,174
Stow	Minute Man Air Field	4,746	2.3	10,916
Taunton	Taunton Municipal Airport - King Field	586	1.8	1,054
Westfield/Springfield	Westfield-Barnes Regional Airport	4,862	2.5	12,156
GENERAL AVIATION AIRPORTS TOTAL		76,272		172,983
ALL AIRPORTS TOTAL		171,182		470,546

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
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	51,795	\$430	\$22,272,000
Boston	Boston Logan International Airport	44,025	\$430	\$18,931,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	5,646	\$320	\$1,807,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	48,844	\$430	\$21,003,000
Nantucket	Nantucket Memorial Airport	67,964	\$430	\$29,225,000
New Bedford	New Bedford Regional Airport	9,888	\$320	\$3,164,000
Provincetown	Provincetown Municipal Airport	28,060	\$320	\$8,979,000
Vineyard Haven	Martha's Vineyard Airport	29,762	\$430	\$12,798,000
Worcester	Worcester Regional Airport	11,578	\$320	\$3,705,000
COMMERCIAL SERVICE AIRPORTS TOTAL		297,563	\$410	\$121,884,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	24	\$80	\$2,000
Berkley	Myricks Airport	46	\$80	\$4,000
Beverly	Beverly Municipal Airport	14,231	\$320	\$4,554,000
Chatham	Chatham Municipal Airport	12,585	\$430	\$5,412,000
Edgartown	Katama Airpark	2,700	\$80	\$216,000
Falmouth	Falmouth Airpark	338	\$320	\$108,000
Fitchburg	Fitchburg Municipal Airport	8,429	\$280	\$2,360,000
Gardner	Gardner Municipal Airport	1,282	\$80	\$103,000
Great Barrington	Walter J. Koladza Airport	10,645	\$120	\$1,277,000
Hanson	Cranland Airport	716	\$80	\$57,000
Hopedale	Hopedale Industrial Park Airport	5,450	\$80	\$436,000
Lawrence	Lawrence Municipal Airport	11,783	\$280	\$3,299,000
Mansfield	Mansfield Municipal Airport	5,331	\$120	\$640,000
Marlborough	Marlboro Airport	200	\$80	\$16,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	3,226	\$280	\$903,000
Marstons Mills	Cape Cod Airport	52	\$80	\$4,000
Montague	Turners Falls Airport	1,515	\$120	\$182,000
Newburyport	Plum Island Airport	275	\$80	\$22,000
North Adams	Harriman-and-West Airport	5,275	\$280	\$1,477,000
Northampton	Northampton Airport	462	\$120	\$55,000
Norwood	Norwood Memorial Airport	24,668	\$320	\$7,894,000
Orange	Orange Municipal Airport	13,662	\$280	\$3,825,000
Pittsfield	Pittsfield Municipal Airport	6,806	\$320	\$2,178,000
Plymouth	Plymouth Municipal Airport	9,620	\$280	\$2,694,000
Southbridge	Southbridge Municipal Airport	4,737	\$80	\$379,000
Spencer	Spencer Airport	624	\$80	\$50,000
Sterling	Sterling Airport	4,174	\$120	\$501,000
Stow	Minute Man Air Field	10,916	\$280	\$3,057,000
Taunton	Taunton Municipal Airport - King Field	1,054	\$120	\$127,000
Westfield/Springfield	Westfield-Barnes Regional Airport	12,156	\$320	\$3,890,000
GENERAL AVIATION AIRPORTS TOTAL		172,983	\$264	\$45,722,000
ALL AIRPORTS TOTAL		470,546	\$356	\$167,606,000

Source: CDM Smith

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

Associated City	Airport Name	2013 Enplanements	Percent Visitors	Visitors
COMMERCIAL SERVICE AIRPORTS				
Boston	Boston Logan International Airport	15,109,485	45%	6,527,734
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	90,332	51%	46,070
Nantucket	Nantucket Memorial Airport	175,328	70%	122,730
New Bedford	New Bedford Regional Airport	10,500	10%	1,050
Provincetown	Provincetown Municipal Airport	11,208	90%	10,090
Vineyard Haven	Martha's Vineyard Airport	50,957	70%	35,670
Worcester	Worcester Regional Airport	11,156	23%	2,570
COMMERCIAL SERVICE AIRPORTS TOTAL		15,458,966	44%	6,745,914

Source: Airport management, 2011 Massachusetts Statewide Airport Economic Impact Study, and US DOT O&D data

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
COMMERCIAL SERVICE AIRPORTS				
Boston	Boston Logan International Airport	6,527,734	\$837	\$5,461,541,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	46,070	\$530	\$24,417,000
Nantucket	Nantucket Memorial Airport	122,730	\$1,110	\$136,230,000
New Bedford	New Bedford Regional Airport	1,050	\$320	\$336,000
Provincetown	Provincetown Municipal Airport	10,090	\$530	\$5,348,000
Vineyard Haven	Martha's Vineyard Airport	35,670	\$1,110	\$39,594,000
Worcester	Worcester Regional Airport	2,570	\$530	\$1,362,000
COMMERCIAL SERVICE AIRPORTS TOTAL		6,745,914	\$840	\$5,668,828,000

Source: CDM Smith and Massport

Table A-6: Massachusetts On-Airport Employment

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	6,854	5,001	11,855
Boston	Boston Logan International Airport	13,877	8,945	22,822
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	3,978	1,223	5,201
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	650	529	1,179
Nantucket	Nantucket Memorial Airport	253	182	435
New Bedford	New Bedford Regional Airport	126	94	220
Provincetown	Provincetown Municipal Airport	42	30	72
Vineyard Haven	Martha's Vineyard Airport	94	63	157
Worcester	Worcester Regional Airport	143	105	248
COMMERCIAL SERVICE AIRPORTS TOTAL		26,017	16,172	42,189
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	3	2	5
Berkley	Myricks Airport	2	1	3
Beverly	Beverly Municipal Airport	79	64	143
Chatham	Chatham Municipal Airport	16	12	28
Edgartown	Katama Airpark	9	4	13
Falmouth	Falmouth Airpark	2	2	4
Fitchburg	Fitchburg Municipal Airport	44	32	76
Gardner	Gardner Municipal Airport	3	2	5
Great Barrington	Walter J. Koladza Airport	8	7	15
Hanson	Cranland Airport	5	3	8
Hopedale	Hopedale Industrial Park Airport	2	2	4
Lawrence	Lawrence Municipal Airport	107	86	193
Mansfield	Mansfield Municipal Airport	22	17	39
Marlborough	Marlboro Airport	3	2	5
Marshfield	Marshfield Municipal Airport - George Harlow Field	29	24	53
Marstons Mills	Cape Cod Airport	5	3	8
Montague	Turners Falls Airport	6	4	10
Newburyport	Plum Island Airport	1	1	2
North Adams	Harriman-and-West Airport	35	29	64
Northampton	Northampton Airport	13	11	24
Norwood	Norwood Memorial Airport	120	97	217
Orange	Orange Municipal Airport	34	27	61
Pittsfield	Pittsfield Municipal Airport	97	80	177
Plymouth	Plymouth Municipal Airport	147	111	258
Southbridge	Southbridge Municipal Airport	6	5	11
Spencer	Spencer Airport	1	1	2
Sterling	Sterling Airport	5	4	9
Stow	Minute Man Air Field	44	29	73
Taunton	Taunton Municipal Airport - King Field	16	12	28
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	1,174	728	1,902
GENERAL AVIATION AIRPORTS TOTAL		2,038	1,402	3,440
ALL AIRPORTS TOTAL		28,055	17,574	45,629

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-7: Massachusetts General Aviation Visitor-Related Employment

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	338	162	500
Boston	Boston Logan International Airport	287	137	424
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	27	13	40
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	318	152	470
Nantucket	Nantucket Memorial Airport	443	212	655
New Bedford	New Bedford Regional Airport	48	23	71
Provincetown	Provincetown Municipal Airport	136	65	201
Vineyard Haven	Martha's Vineyard Airport	194	93	287
Worcester	Worcester Regional Airport	56	27	83
COMMERCIAL SERVICE AIRPORTS TOTAL		1,847	884	2,731
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	0	0	0
Berkley	Myricks Airport	0	0	0
Beverly	Beverly Municipal Airport	69	33	102
Chatham	Chatham Municipal Airport	82	39	121
Edgartown	Katama Airpark	3	1	4
Falmouth	Falmouth Airpark	2	1	3
Fitchburg	Fitchburg Municipal Airport	36	17	53
Gardner	Gardner Municipal Airport	2	1	3
Great Barrington	Walter J. Koladza Airport	19	9	28
Hanson	Cranland Airport	1	0	1
Hopedale	Hopedale Industrial Park Airport	7	3	10
Lawrence	Lawrence Municipal Airport	50	24	74
Mansfield	Mansfield Municipal Airport	10	5	15
Marlborough	Marlboro Airport	0	0	0
Marshfield	Marshfield Municipal Airport - George Harlow Field	14	7	21
Marstons Mills	Cape Cod Airport	0	0	0
Montague	Turners Falls Airport	3	1	4
Newburyport	Plum Island Airport	0	0	0
North Adams	Harriman-and-West Airport	22	11	33
Northampton	Northampton Airport	1	0	1
Norwood	Norwood Memorial Airport	120	57	177
Orange	Orange Municipal Airport	58	28	86
Pittsfield	Pittsfield Municipal Airport	33	16	49
Plymouth	Plymouth Municipal Airport	41	20	61
Southbridge	Southbridge Municipal Airport	6	3	9
Spencer	Spencer Airport	1	0	1
Sterling	Sterling Airport	8	4	12
Stow	Minute Man Air Field	46	22	68
Taunton	Taunton Municipal Airport - King Field	2	1	3
Westfield/Springfield	Westfield-Barnes Regional Airport	59	28	87
GENERAL AVIATION AIRPORTS TOTAL		695	331	1,026
ALL AIRPORTS TOTAL		2,542	1,215	3,757

Source: CDM Smith and IMPLAN multipliers

Table A-8: Massachusetts Commercial Service Visitor-Related Employment

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
COMMERCIAL SERVICE AIRPORTS				
Boston	Boston Logan International Airport	68,847	39,898	108,745
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	308	178	486
Nantucket	Nantucket Memorial Airport	1,717	995	2,712
New Bedford	New Bedford Regional Airport	4	2	6
Provincetown	Provincetown Municipal Airport	67	39	106
Vineyard Haven	Martha's Vineyard Airport	499	289	788
Worcester	Worcester Regional Airport	17	10	27
COMMERCIAL SERVICE AIRPORTS TOTAL		71,459	41,411	112,870

Source: CDM Smith and IMPLAN multipliers

Table A-9: Massachusetts Airports Total Employment

Associated City	Airport Name	Direct Employment	Multiplier Employment	Total Employment
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	7,192	5,163	12,355
Boston	Boston Logan International Airport	83,011	48,980	131,991
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	4,005	1,236	5,241
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	1,276	859	2,135
Nantucket	Nantucket Memorial Airport	2,413	1,389	3,802
New Bedford	New Bedford Regional Airport	178	119	297
Provincetown	Provincetown Municipal Airport	245	134	379
Vineyard Haven	Martha's Vineyard Airport	787	445	1,232
Worcester	Worcester Regional Airport	216	142	358
COMMERCIAL SERVICE AIRPORTS TOTAL		99,323	58,467	157,790
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	3	2	5
Berkley	Myricks Airport	2	1	3
Beverly	Beverly Municipal Airport	148	97	245
Chatham	Chatham Municipal Airport	98	51	149
Edgartown	Katama Airpark	12	5	17
Falmouth	Falmouth Airpark	4	3	7
Fitchburg	Fitchburg Municipal Airport	80	49	129
Gardner	Gardner Municipal Airport	5	3	8
Great Barrington	Walter J. Koladza Airport	27	16	43
Hanson	Cranland Airport	6	3	9
Hopedale	Hopedale Industrial Park Airport	9	5	14
Lawrence	Lawrence Municipal Airport	157	110	267
Mansfield	Mansfield Municipal Airport	32	22	54
Marlborough	Marlboro Airport	3	2	5
Marshfield	Marshfield Municipal Airport - George Harlow Field	43	31	74
Marstons Mills	Cape Cod Airport	5	3	8
Montague	Turners Falls Airport	9	5	14
Newburyport	Plum Island Airport	1	1	2
North Adams	Harriman-and-West Airport	57	40	97
Northampton	Northampton Airport	14	11	25
Norwood	Norwood Memorial Airport	240	154	394
Orange	Orange Municipal Airport	92	55	147
Pittsfield	Pittsfield Municipal Airport	130	96	226
Plymouth	Plymouth Municipal Airport	188	131	319
Southbridge	Southbridge Municipal Airport	12	8	20
Spencer	Spencer Airport	2	1	3
Sterling	Sterling Airport	13	8	21
Stow	Minute Man Air Field	90	51	141
Taunton	Taunton Municipal Airport - King Field	18	13	31
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	1,233	756	1,989
GENERAL AVIATION AIRPORTS TOTAL		2,733	1,733	4,466
ALL AIRPORTS TOTAL		102,056	60,200	162,256

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-10: Massachusetts On-Airport Payroll

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	\$847,779,000	\$299,670,000	\$1,147,449,000
Boston	Boston Logan International Airport	\$716,622,000	\$439,837,000	\$1,156,459,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	\$148,128,000	\$45,777,000	\$193,905,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$33,620,000	\$23,934,000	\$57,554,000
Nantucket	Nantucket Memorial Airport	\$12,317,000	\$7,199,000	\$19,516,000
New Bedford	New Bedford Regional Airport	\$4,945,000	\$3,411,000	\$8,356,000
Provincetown	Provincetown Municipal Airport	\$1,512,000	\$866,000	\$2,378,000
Vineyard Haven	Martha's Vineyard Airport	\$4,680,000	\$2,422,000	\$7,102,000
Worcester	Worcester Regional Airport	\$7,470,000	\$4,245,000	\$11,715,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$1,777,073,000	\$827,361,000	\$2,604,434,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	\$53,000	\$41,000	\$94,000
Berkley	Myricks Airport	\$19,000	\$15,000	\$34,000
Beverly	Beverly Municipal Airport	\$4,163,000	\$2,956,000	\$7,119,000
Chatham	Chatham Municipal Airport	\$456,000	\$322,000	\$778,000
Edgartown	Katama Airpark	\$235,000	\$155,000	\$390,000
Falmouth	Falmouth Airpark	\$104,000	\$79,000	\$183,000
Fitchburg	Fitchburg Municipal Airport	\$1,858,000	\$1,327,000	\$3,185,000
Gardner	Gardner Municipal Airport	\$92,000	\$57,000	\$149,000
Great Barrington	Walter J. Koladza Airport	\$191,000	\$146,000	\$337,000
Hanson	Cranland Airport	\$141,000	\$106,000	\$247,000
Hopedale	Hopedale Industrial Park Airport	\$59,000	\$44,000	\$103,000
Lawrence	Lawrence Municipal Airport	\$4,777,000	\$3,259,000	\$8,036,000
Mansfield	Mansfield Municipal Airport	\$776,000	\$593,000	\$1,369,000
Marlborough	Marlboro Airport	\$82,000	\$62,000	\$144,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$1,713,000	\$1,305,000	\$3,018,000
Marstons Mills	Cape Cod Airport	\$134,000	\$79,000	\$213,000
Montague	Turners Falls Airport	\$213,000	\$155,000	\$368,000
Newburyport	Plum Island Airport	\$20,000	\$15,000	\$35,000
North Adams	Harriman-and-West Airport	\$1,473,000	\$1,126,000	\$2,599,000
Northampton	Northampton Airport	\$247,000	\$189,000	\$436,000
Norwood	Norwood Memorial Airport	\$6,736,000	\$4,904,000	\$11,640,000
Orange	Orange Municipal Airport	\$1,337,000	\$989,000	\$2,326,000
Pittsfield	Pittsfield Municipal Airport	\$5,039,000	\$3,786,000	\$8,825,000
Plymouth	Plymouth Municipal Airport	\$7,055,000	\$4,829,000	\$11,884,000
Southbridge	Southbridge Municipal Airport	\$167,000	\$128,000	\$295,000
Spencer	Spencer Airport	\$11,000	\$8,000	\$19,000
Sterling	Sterling Airport	\$45,000	\$34,000	\$79,000
Stow	Minute Man Air Field	\$1,490,000	\$1,071,000	\$2,561,000
Taunton	Taunton Municipal Airport - King Field	\$521,000	\$369,000	\$890,000
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	\$47,176,000	\$24,324,000	\$71,500,000
GENERAL AVIATION AIRPORTS TOTAL		\$86,383,000	\$52,473,000	\$138,856,000
ALL AIRPORTS TOTAL		\$1,863,456,000	\$879,834,000	\$2,743,290,000

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-11: Massachusetts General Aviation Visitor-Related Payroll

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	\$8,044,000	\$6,665,000	\$14,709,000
Boston	Boston Logan International Airport	\$6,831,000	\$5,660,000	\$12,491,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$643,000	\$533,000	\$1,176,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$7,568,000	\$6,271,000	\$13,839,000
Nantucket	Nantucket Memorial Airport	\$10,543,000	\$8,736,000	\$19,279,000
New Bedford	New Bedford Regional Airport	\$1,142,000	\$946,000	\$2,088,000
Provincetown	Provincetown Municipal Airport	\$3,237,000	\$2,682,000	\$5,919,000
Vineyard Haven	Martha's Vineyard Airport	\$4,617,000	\$3,826,000	\$8,443,000
Worcester	Worcester Regional Airport	\$1,333,000	\$1,105,000	\$2,438,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$43,958,000	\$36,424,000	\$80,382,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	\$0	\$0	\$0
Berkley	Myricks Airport	\$0	\$0	\$0
Beverly	Beverly Municipal Airport	\$1,642,000	\$1,361,000	\$3,003,000
Chatham	Chatham Municipal Airport	\$1,952,000	\$1,617,000	\$3,569,000
Edgartown	Katama Airpark	\$71,000	\$59,000	\$130,000
Falmouth	Falmouth Airpark	\$48,000	\$40,000	\$88,000
Fitchburg	Fitchburg Municipal Airport	\$857,000	\$710,000	\$1,567,000
Gardner	Gardner Municipal Airport	\$48,000	\$40,000	\$88,000
Great Barrington	Walter J. Koladza Airport	\$452,000	\$375,000	\$827,000
Hanson	Cranland Airport	\$24,000	\$20,000	\$44,000
Hopedale	Hopedale Industrial Park Airport	\$167,000	\$138,000	\$305,000
Lawrence	Lawrence Municipal Airport	\$1,190,000	\$986,000	\$2,176,000
Mansfield	Mansfield Municipal Airport	\$238,000	\$197,000	\$435,000
Marlborough	Marlboro Airport	\$0	\$0	\$0
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$333,000	\$276,000	\$609,000
Marstons Mills	Cape Cod Airport	\$0	\$0	\$0
Montague	Turners Falls Airport	\$71,000	\$59,000	\$130,000
Newburyport	Plum Island Airport	\$0	\$0	\$0
North Adams	Harriman-and-West Airport	\$524,000	\$434,000	\$958,000
Northampton	Northampton Airport	\$24,000	\$20,000	\$44,000
Norwood	Norwood Memorial Airport	\$2,856,000	\$2,367,000	\$5,223,000
Orange	Orange Municipal Airport	\$1,380,000	\$1,143,000	\$2,523,000
Pittsfield	Pittsfield Municipal Airport	\$785,000	\$650,000	\$1,435,000
Plymouth	Plymouth Municipal Airport	\$976,000	\$809,000	\$1,785,000
Southbridge	Southbridge Municipal Airport	\$143,000	\$118,000	\$261,000
Spencer	Spencer Airport	\$24,000	\$20,000	\$44,000
Sterling	Sterling Airport	\$190,000	\$157,000	\$347,000
Stow	Minute Man Air Field	\$1,095,000	\$907,000	\$2,002,000
Taunton	Taunton Municipal Airport - King Field	\$48,000	\$40,000	\$88,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$1,404,000	\$1,163,000	\$2,567,000
GENERAL AVIATION AIRPORTS TOTAL		\$16,542,000	\$13,706,000	\$30,248,000
ALL AIRPORTS TOTAL		\$60,500,000	\$50,130,000	\$110,630,000

Source: CDM Smith and IMPLAN multipliers

Table A-12: Massachusetts Commercial Service Visitor-Related Payroll

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
COMMERCIAL SERVICE AIRPORTS				
Boston	Boston Logan International Airport	\$1,638,559,000	\$1,483,088,000	\$3,121,647,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$7,330,000	\$6,635,000	\$13,965,000
Nantucket	Nantucket Memorial Airport	\$40,865,000	\$36,988,000	\$77,853,000
New Bedford	New Bedford Regional Airport	\$95,000	\$86,000	\$181,000
Provincetown	Provincetown Municipal Airport	\$1,595,000	\$1,444,000	\$3,039,000
Vineyard Haven	Martha's Vineyard Airport	\$11,876,000	\$10,749,000	\$22,625,000
Worcester	Worcester Regional Airport	\$405,000	\$367,000	\$772,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$1,700,725,000	\$1,539,357,000	\$3,240,082,000

Source: CDM Smith and IMPLAN multipliers

Table A-13: Massachusetts Airports Total Payroll

Associated City	Airport Name	Direct Payroll	Multiplier Payroll	Total Payroll
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	\$855,823,000	\$306,335,000	\$1,162,158,000
Boston	Boston Logan International Airport	\$2,362,012,000	\$1,928,585,000	\$4,290,597,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	\$148,771,000	\$46,310,000	\$195,081,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$48,518,000	\$36,840,000	\$85,358,000
Nantucket	Nantucket Memorial Airport	\$63,725,000	\$52,923,000	\$116,648,000
New Bedford	New Bedford Regional Airport	\$6,182,000	\$4,443,000	\$10,625,000
Provincetown	Provincetown Municipal Airport	\$6,344,000	\$4,992,000	\$11,336,000
Vineyard Haven	Martha's Vineyard Airport	\$21,173,000	\$16,997,000	\$38,170,000
Worcester	Worcester Regional Airport	\$9,208,000	\$5,717,000	\$14,925,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$3,521,756,000	\$2,403,142,000	\$5,924,898,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	\$53,000	\$41,000	\$94,000
Berkley	Myricks Airport	\$19,000	\$15,000	\$34,000
Beverly	Beverly Municipal Airport	\$5,805,000	\$4,317,000	\$10,122,000
Chatham	Chatham Municipal Airport	\$2,408,000	\$1,939,000	\$4,347,000
Edgartown	Katama Airpark	\$306,000	\$214,000	\$520,000
Falmouth	Falmouth Airpark	\$152,000	\$119,000	\$271,000
Fitchburg	Fitchburg Municipal Airport	\$2,715,000	\$2,037,000	\$4,752,000
Gardner	Gardner Municipal Airport	\$140,000	\$97,000	\$237,000
Great Barrington	Walter J. Koladza Airport	\$643,000	\$521,000	\$1,164,000
Hanson	Cranland Airport	\$165,000	\$126,000	\$291,000
Hopedale	Hopedale Industrial Park Airport	\$226,000	\$182,000	\$408,000
Lawrence	Lawrence Municipal Airport	\$5,967,000	\$4,245,000	\$10,212,000
Mansfield	Mansfield Municipal Airport	\$1,014,000	\$790,000	\$1,804,000
Marlborough	Marlboro Airport	\$82,000	\$62,000	\$144,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$2,046,000	\$1,581,000	\$3,627,000
Marstons Mills	Cape Cod Airport	\$134,000	\$79,000	\$213,000
Montague	Turners Falls Airport	\$284,000	\$214,000	\$498,000
Newburyport	Plum Island Airport	\$20,000	\$15,000	\$35,000
North Adams	Harriman-and-West Airport	\$1,997,000	\$1,560,000	\$3,557,000
Northampton	Northampton Airport	\$271,000	\$209,000	\$480,000
Norwood	Norwood Memorial Airport	\$9,592,000	\$7,271,000	\$16,863,000
Orange	Orange Municipal Airport	\$2,717,000	\$2,132,000	\$4,849,000
Pittsfield	Pittsfield Municipal Airport	\$5,824,000	\$4,436,000	\$10,260,000
Plymouth	Plymouth Municipal Airport	\$8,031,000	\$5,638,000	\$13,669,000
Southbridge	Southbridge Municipal Airport	\$310,000	\$246,000	\$556,000
Spencer	Spencer Airport	\$35,000	\$28,000	\$63,000
Sterling	Sterling Airport	\$235,000	\$191,000	\$426,000
Stow	Minute Man Air Field	\$2,585,000	\$1,978,000	\$4,563,000
Taunton	Taunton Municipal Airport - King Field	\$569,000	\$409,000	\$978,000
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	\$48,580,000	\$25,487,000	\$74,067,000
GENERAL AVIATION AIRPORTS TOTAL		\$102,925,000	\$66,179,000	\$169,104,000
ALL AIRPORTS TOTAL		\$3,624,681,000	\$2,469,321,000	\$6,094,002,000

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-14: Massachusetts On-Airport Output

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	\$1,106,294,000	\$457,358,000	\$1,563,652,000
Boston	Boston Logan International Airport	\$1,848,325,000	\$1,467,924,000	\$3,316,249,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	\$191,867,000	\$60,544,000	\$252,411,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$73,824,000	\$51,327,000	\$125,151,000
Nantucket	Nantucket Memorial Airport	\$44,012,000	\$31,807,000	\$75,819,000
New Bedford	New Bedford Regional Airport	\$14,637,000	\$11,438,000	\$26,075,000
Provincetown	Provincetown Municipal Airport	\$4,336,000	\$3,510,000	\$7,846,000
Vineyard Haven	Martha's Vineyard Airport	\$13,695,000	\$10,561,000	\$24,256,000
Worcester	Worcester Regional Airport	\$21,631,000	\$15,581,000	\$37,212,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$3,318,621,000	\$2,110,050,000	\$5,428,671,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	\$344,000	\$200,000	\$544,000
Berkley	Myricks Airport	\$39,000	\$28,000	\$67,000
Beverly	Beverly Municipal Airport	\$14,771,000	\$9,465,000	\$24,236,000
Chatham	Chatham Municipal Airport	\$1,584,000	\$1,111,000	\$2,695,000
Edgartown	Katama Airpark	\$842,000	\$661,000	\$1,503,000
Falmouth	Falmouth Airpark	\$251,000	\$174,000	\$425,000
Fitchburg	Fitchburg Municipal Airport	\$6,299,000	\$4,036,000	\$10,335,000
Gardner	Gardner Municipal Airport	\$339,000	\$274,000	\$613,000
Great Barrington	Walter J. Koladza Airport	\$639,000	\$364,000	\$1,003,000
Hanson	Cranland Airport	\$512,000	\$357,000	\$869,000
Hopedale	Hopedale Industrial Park Airport	\$69,000	\$39,000	\$108,000
Lawrence	Lawrence Municipal Airport	\$14,880,000	\$9,279,000	\$24,159,000
Mansfield	Mansfield Municipal Airport	\$5,158,000	\$3,072,000	\$8,230,000
Marlborough	Marlboro Airport	\$280,000	\$159,000	\$439,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$4,421,000	\$3,094,000	\$7,515,000
Marstons Mills	Cape Cod Airport	\$512,000	\$357,000	\$869,000
Montague	Turners Falls Airport	\$824,000	\$647,000	\$1,471,000
Newburyport	Plum Island Airport	\$50,000	\$31,000	\$81,000
North Adams	Harriman-and-West Airport	\$5,454,000	\$3,124,000	\$8,578,000
Northampton	Northampton Airport	\$1,212,000	\$688,000	\$1,900,000
Norwood	Norwood Memorial Airport	\$23,141,000	\$14,763,000	\$37,904,000
Orange	Orange Municipal Airport	\$4,128,000	\$2,921,000	\$7,049,000
Pittsfield	Pittsfield Municipal Airport	\$18,365,000	\$13,069,000	\$31,434,000
Plymouth	Plymouth Municipal Airport	\$25,838,000	\$17,139,000	\$42,977,000
Southbridge	Southbridge Municipal Airport	\$641,000	\$383,000	\$1,024,000
Spencer	Spencer Airport	\$32,000	\$18,000	\$50,000
Sterling	Sterling Airport	\$397,000	\$240,000	\$637,000
Stow	Minute Man Air Field	\$3,981,000	\$2,785,000	\$6,766,000
Taunton	Taunton Municipal Airport - King Field	\$1,830,000	\$1,200,000	\$3,030,000
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	\$133,097,000	\$73,470,000	\$206,567,000
GENERAL AVIATION AIRPORTS TOTAL		\$269,930,000	\$163,148,000	\$433,078,000
ALL AIRPORTS TOTAL		\$3,588,551,000	\$2,273,198,000	\$5,861,749,000

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-15: Massachusetts General Aviation Visitor-Related Output

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	\$22,272,000	\$18,154,000	\$40,426,000
Boston	Boston Logan International Airport	\$18,931,000	\$15,431,000	\$34,362,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$1,807,000	\$1,473,000	\$3,280,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$21,003,000	\$17,120,000	\$38,123,000
Nantucket	Nantucket Memorial Airport	\$29,225,000	\$23,821,000	\$53,046,000
New Bedford	New Bedford Regional Airport	\$3,164,000	\$2,579,000	\$5,743,000
Provincetown	Provincetown Municipal Airport	\$8,979,000	\$7,319,000	\$16,298,000
Vineyard Haven	Martha's Vineyard Airport	\$12,798,000	\$10,432,000	\$23,230,000
Worcester	Worcester Regional Airport	\$3,705,000	\$3,020,000	\$6,725,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$121,884,000	\$99,349,000	\$221,233,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	\$2,000	\$2,000	\$4,000
Berkley	Myricks Airport	\$4,000	\$3,000	\$7,000
Beverly	Beverly Municipal Airport	\$4,554,000	\$3,712,000	\$8,266,000
Chatham	Chatham Municipal Airport	\$5,412,000	\$4,411,000	\$9,823,000
Edgartown	Katama Airpark	\$216,000	\$176,000	\$392,000
Falmouth	Falmouth Airpark	\$108,000	\$88,000	\$196,000
Fitchburg	Fitchburg Municipal Airport	\$2,360,000	\$1,924,000	\$4,284,000
Gardner	Gardner Municipal Airport	\$103,000	\$84,000	\$187,000
Great Barrington	Walter J. Koladza Airport	\$1,277,000	\$1,041,000	\$2,318,000
Hanson	Cranland Airport	\$57,000	\$46,000	\$103,000
Hopedale	Hopedale Industrial Park Airport	\$436,000	\$355,000	\$791,000
Lawrence	Lawrence Municipal Airport	\$3,299,000	\$2,689,000	\$5,988,000
Mansfield	Mansfield Municipal Airport	\$640,000	\$522,000	\$1,162,000
Marlborough	Marlboro Airport	\$16,000	\$13,000	\$29,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$903,000	\$736,000	\$1,639,000
Marstons Mills	Cape Cod Airport	\$4,000	\$3,000	\$7,000
Montague	Turners Falls Airport	\$182,000	\$148,000	\$330,000
Newburyport	Plum Island Airport	\$22,000	\$18,000	\$40,000
North Adams	Harriman-and-West Airport	\$1,477,000	\$1,204,000	\$2,681,000
Northampton	Northampton Airport	\$55,000	\$45,000	\$100,000
Norwood	Norwood Memorial Airport	\$7,894,000	\$6,434,000	\$14,328,000
Orange	Orange Municipal Airport	\$3,825,000	\$3,118,000	\$6,943,000
Pittsfield	Pittsfield Municipal Airport	\$2,178,000	\$1,775,000	\$3,953,000
Plymouth	Plymouth Municipal Airport	\$2,694,000	\$2,196,000	\$4,890,000
Southbridge	Southbridge Municipal Airport	\$379,000	\$309,000	\$688,000
Spencer	Spencer Airport	\$50,000	\$41,000	\$91,000
Sterling	Sterling Airport	\$501,000	\$408,000	\$909,000
Stow	Minute Man Air Field	\$3,057,000	\$2,492,000	\$5,549,000
Taunton	Taunton Municipal Airport - King Field	\$127,000	\$104,000	\$231,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$3,890,000	\$3,171,000	\$7,061,000
GENERAL AVIATION AIRPORTS TOTAL		\$45,722,000	\$37,268,000	\$82,990,000
ALL AIRPORTS TOTAL		\$167,606,000	\$136,617,000	\$304,223,000

Source: CDM Smith and IMPLAN multipliers

Table A-16: Massachusetts Commercial Service Visitor-Related Output

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
COMMERCIAL SERVICE AIRPORTS				
Boston	Boston Logan International Airport	\$5,461,541,000	\$4,547,713,000	\$10,009,254,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$24,417,000	\$20,332,000	\$44,749,000
Nantucket	Nantucket Memorial Airport	\$136,230,000	\$113,436,000	\$249,666,000
New Bedford	New Bedford Regional Airport	\$336,000	\$280,000	\$616,000
Provincetown	Provincetown Municipal Airport	\$5,348,000	\$4,453,000	\$9,801,000
Vineyard Haven	Martha's Vineyard Airport	\$39,594,000	\$32,969,000	\$72,563,000
Worcester	Worcester Regional Airport	\$1,362,000	\$1,134,000	\$2,496,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$5,668,828,000	\$4,720,317,000	\$10,389,145,000

Source: CDM Smith and IMPLAN multipliers

Table A-17: Massachusetts Airports Total Output

Associated City	Airport Name	Direct Output	Multiplier Output	Total Output
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field	\$1,128,566,000	\$475,512,000	\$1,604,078,000
Boston	Boston Logan International Airport	\$7,328,797,000	\$6,031,068,000	\$13,359,865,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	\$193,674,000	\$62,017,000	\$255,691,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$119,244,000	\$88,779,000	\$208,023,000
Nantucket	Nantucket Memorial Airport	\$209,467,000	\$169,064,000	\$378,531,000
New Bedford	New Bedford Regional Airport	\$18,137,000	\$14,297,000	\$32,434,000
Provincetown	Provincetown Municipal Airport	\$18,663,000	\$15,282,000	\$33,945,000
Vineyard Haven	Martha's Vineyard Airport	\$66,087,000	\$53,962,000	\$120,049,000
Worcester	Worcester Regional Airport	\$26,698,000	\$19,735,000	\$46,433,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$9,109,333,000	\$6,929,716,000	\$16,039,049,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	\$346,000	\$202,000	\$548,000
Berkley	Myricks Airport	\$43,000	\$31,000	\$74,000
Beverly	Beverly Municipal Airport	\$19,325,000	\$13,177,000	\$32,502,000
Chatham	Chatham Municipal Airport	\$6,996,000	\$5,522,000	\$12,518,000
Edgartown	Katama Airpark	\$1,058,000	\$837,000	\$1,895,000
Falmouth	Falmouth Airpark	\$359,000	\$262,000	\$621,000
Fitchburg	Fitchburg Municipal Airport	\$8,659,000	\$5,960,000	\$14,619,000
Gardner	Gardner Municipal Airport	\$442,000	\$358,000	\$800,000
Great Barrington	Walter J. Koladza Airport	\$1,916,000	\$1,405,000	\$3,321,000
Hanson	Cranland Airport	\$569,000	\$403,000	\$972,000
Hopedale	Hopedale Industrial Park Airport	\$505,000	\$394,000	\$899,000
Lawrence	Lawrence Municipal Airport	\$18,179,000	\$11,968,000	\$30,147,000
Mansfield	Mansfield Municipal Airport	\$5,798,000	\$3,594,000	\$9,392,000
Marlborough	Marlboro Airport	\$296,000	\$172,000	\$468,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	\$5,324,000	\$3,830,000	\$9,154,000
Marstons Mills	Cape Cod Airport	\$516,000	\$360,000	\$876,000
Montague	Turners Falls Airport	\$1,006,000	\$795,000	\$1,801,000
Newburyport	Plum Island Airport	\$72,000	\$49,000	\$121,000
North Adams	Harriman-and-West Airport	\$6,931,000	\$4,328,000	\$11,259,000
Northampton	Northampton Airport	\$1,267,000	\$733,000	\$2,000,000
Norwood	Norwood Memorial Airport	\$31,035,000	\$21,197,000	\$52,232,000
Orange	Orange Municipal Airport	\$7,953,000	\$6,039,000	\$13,992,000
Pittsfield	Pittsfield Municipal Airport	\$20,543,000	\$14,844,000	\$35,387,000
Plymouth	Plymouth Municipal Airport	\$28,532,000	\$19,335,000	\$47,867,000
Southbridge	Southbridge Municipal Airport	\$1,020,000	\$692,000	\$1,712,000
Spencer	Spencer Airport	\$82,000	\$59,000	\$141,000
Sterling	Sterling Airport	\$898,000	\$648,000	\$1,546,000
Stow	Minute Man Air Field	\$7,038,000	\$5,277,000	\$12,315,000
Taunton	Taunton Municipal Airport - King Field	\$1,957,000	\$1,304,000	\$3,261,000
Westfield/Springfield	Westfield-Barnes Regional Airport	\$136,987,000	\$76,641,000	\$213,628,000
GENERAL AVIATION AIRPORTS TOTAL		\$315,652,000	\$200,416,000	\$516,068,000
ALL AIRPORTS TOTAL		\$9,424,985,000	\$7,130,132,000	\$16,555,117,000

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-18: Massachusetts Airports Total Economic Impacts

Associated City	Airport Name	Total Employment	Total Payroll	Total Output
COMMERCIAL SERVICE AIRPORTS				
Bedford	Laurence G. Hanscom Field (Note 1)	12,355	\$1,162,158,000	\$1,604,078,000
Boston	Boston Logan International Airport	131,991	\$4,290,597,000	\$13,359,865,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	5,241	\$195,081,000	\$255,691,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	2,135	\$85,358,000	\$208,023,000
Nantucket	Nantucket Memorial Airport	3,802	\$116,648,000	\$378,531,000
New Bedford	New Bedford Regional Airport	297	\$10,625,000	\$32,434,000
Provincetown	Provincetown Municipal Airport	379	\$11,336,000	\$33,945,000
Vineyard Haven	Martha's Vineyard Airport	1,232	\$38,170,000	\$120,049,000
Worcester	Worcester Regional Airport	358	\$14,925,000	\$46,433,000
COMMERCIAL SERVICE AIRPORTS TOTAL		157,790	\$5,924,898,000	\$16,039,049,000
GENERAL AVIATION AIRPORTS				
Barre/Barre Plains	Tanner-Hiller Airport	5	\$94,000	\$548,000
Berkley	Myricks Airport	3	\$34,000	\$74,000
Beverly	Beverly Municipal Airport	245	\$10,122,000	\$32,502,000
Chatham	Chatham Municipal Airport	149	\$4,347,000	\$12,518,000
Edgartown	Katama Airpark	17	\$520,000	\$1,895,000
Falmouth	Falmouth Airpark	7	\$271,000	\$621,000
Fitchburg	Fitchburg Municipal Airport	129	\$4,752,000	\$14,619,000
Gardner	Gardner Municipal Airport	8	\$237,000	\$800,000
Great Barrington	Walter J. Koladza Airport	43	\$1,164,000	\$3,321,000
Hanson	Cranland Airport	9	\$291,000	\$972,000
Hopedale	Hopedale Industrial Park Airport	14	\$408,000	\$899,000
Lawrence	Lawrence Municipal Airport	267	\$10,212,000	\$30,147,000
Mansfield	Mansfield Municipal Airport	54	\$1,804,000	\$9,392,000
Marlborough	Marlboro Airport	5	\$144,000	\$468,000
Marshfield	Marshfield Municipal Airport - George Harlow Field	74	\$3,627,000	\$9,154,000
Marstons Mills	Cape Cod Airport	8	\$213,000	\$876,000
Montague	Turners Falls Airport	14	\$498,000	\$1,801,000
Newburyport	Plum Island Airport	2	\$35,000	\$121,000
North Adams	Harriman-and-West Airport	97	\$3,557,000	\$11,259,000
Northampton	Northampton Airport	25	\$480,000	\$2,000,000
Norwood	Norwood Memorial Airport	394	\$16,863,000	\$52,232,000
Orange	Orange Municipal Airport	147	\$4,849,000	\$13,992,000
Pittsfield	Pittsfield Municipal Airport	226	\$10,260,000	\$35,387,000
Plymouth	Plymouth Municipal Airport	319	\$13,669,000	\$47,867,000
Southbridge	Southbridge Municipal Airport	20	\$556,000	\$1,712,000
Spencer	Spencer Airport	3	\$63,000	\$141,000
Sterling	Sterling Airport	21	\$426,000	\$1,546,000
Stow	Minute Man Air Field	141	\$4,563,000	\$12,315,000
Taunton	Taunton Municipal Airport - King Field	31	\$978,000	\$3,261,000
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	1,989	\$74,067,000	\$213,628,000
GENERAL AVIATION AIRPORTS TOTAL		4,466	\$169,104,000	\$516,068,000
ALL AIRPORTS TOTAL		162,256	\$6,094,002,000	\$16,555,117,000

Source: CDM Smith and IMPLAN multipliers; Note 1: Includes economic impacts associated with military aviation activities.

Table A-19: Qualitative Benefits of Massachusetts Airports

<div><div>D = Daily W = Weekly M = Monthly S = Seasonal O = Occasionally N = Never - = No response</div></div>																							
		Recreational flying	Aerial Application	Corporate/business activity	Aerial inspections	Air cargo	Flight training	Gateway for resort visitors	Staging area for events	Police/law enforcement	Prisoner transport	Military exercises/training	Aviation career training	Search & rescue/CAP (Note 1)	Environmental patrol	Emergency medical evacuation	Medical doctor transport	Forest/wildlands firefighting	Aerial photography/surveying	Real estate tours	Aerial advertising	Youth outreach	
Associated City	Airport Name																						
COMMERCIAL SERVICE AIRPORTS																							
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	D	N	D	O	D	D	D	O	D	W	O	D	O	S	D	D	N	M	N	N	N	
Bedford	Laurence G. Hanscom Field	D	N	D	O	W	D	N	N	O	O	D	D	W	O	D	O	N	O	N	N	O	
Boston	Boston Logan International Airport	M	N	D	M	D	W	D	O	D	M	M	D	S	M	W	D	N	M	W	S	S	
Vineyard Haven	Martha's Vineyard Airport	D	N	D	O	D	W	D	S	S	N	O	O	O	O	D	N	O	O	O	N	S	
Nantucket	Nantucket Memorial Airport	D	N	D	S	D	S	D	S	D	W	W	S	M	M	D	M	N	M	S	O	S	
New Bedford	New Bedford Regional Airport	D	S	D	S	D	D	D	O	W	O	W	D	-	W	W	-	-	O	O	N	-	
Provincetown	Provincetown Municipal Airport	D	N	O	N	N	D	S	N	S	N	M	N	O	N	M	N	N	N	N	N	N	
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport	D	N	D	S	S	M	W	S	D	S	D	S	W	-	M	M	S	S	N	N	N	
Worcester	Worcester Regional Airport	D	N	D	S	O	O	O	N	D	W	W	D	W	M	D	W	N	S	N	N	S	
GENERAL AVIATION AIRPORTS																							
Westfield/Springfield	Westfield-Barnes Regional Airport	D	S	D	S	N	D	S	S	S	N	D	D	S	N	M	M	N	S	N	N	M	
Beverly	Beverly Municipal Airport	D	N	D	-	N	D	N	S	O	N	O	O	O	N	M	-	N	O	-	O	N	
Marstons Mills	Cape Cod Airport	D	N	S	N	N	S	S	O	M	N	O	O	O	N	M	O	N	M	O	S	O	
Chatham	Chatham Municipal Airport	D	N	D	O	O	W	D	S	W	N	W	S	M	W	O	O	N	M	O	N	S	
Hanson	Cranland Airport	D	O	M	S	N	N	N	S	M	N	M	O	N	N	O	N	N	S	N	N	N	
Falmouth	Falmouth Airpark	D	N	W	N	N	N	D	M	S	N	S	S	S	D	W	N	N	W	M	N	M	
Fitchburg	Fitchburg Municipal Airport	D	N	D	W	O	D	M	S	W	M	M	D	D	S	W	N	N	W	W	S	S	
Gardner	Gardner Municipal Airport	D	N	W	S	M	W	S	S	S	N	M	N	N	N	N	N	N	N	N	N	N	
North Adams	Harriman-and-West Airport	D	N	D	S	N	D	S	N	M	N	W	N	N	N	M	N	N	D	N	S	S	
Hopedale	Hopedale Industrial Park Airport	D	N	W	N	N	S	N	-	N	N	S	N	N	N	N	N	N	O	N	N	N	
Edgartown	Katama Airpark	S	-	S	-	-	S	S	S	-	-	-	-	-	-	-	-	-	S	S	-	S	
Lawrence	Lawrence Municipal Airport	D	N	D	M	S	D	N	O	D	O	S	W	W	S	D	N	S	W	O	S	S	
Mansfield	Mansfield Municipal Airport	D	N	W	S	N	D	N	N	S	N	M	D	S	S	M	S	S	S	S	S	S	
Marlborough	Marlboro Airport	D	N	M	O	O	D	M	O	O	N	O	O	O	N	O	N	N	M	M	-	M	
Marshfield	Marshfield Municipal Airport - George Harlow Field	D	N	D	W	N	D	D	S	W	N	W	D	W	M	M	M	S	M	M	O	M	
Stow	Minute Man Air Field	D	S	D	M	O	D	W	M	M	O	O	D	W	S	O	O	N	W	M	O	W	
Berkley	Myricks Airport	D	N	N	N	N	W	N	S	S	N	S	N	N	S	S	N	N	M	N	N	N	

Table A-19: Qualitative Benefits of Massachusetts Airports (cont.)

Associated City	Airport Name	<div>D = Daily W = Weekly M = Monthly S = Seasonal O = Occasionally N = Never - = No response</div>																				
		Recreational flying	Aerial Application	Corporate/business activity	Aerial inspections	Air cargo	Flight training	Gateway for resort visitors	Staging area for events	Police/law enforcement	Prisoner transport	Military exercises/training	Aviation career training	Search & rescue/CAP (Note 1)	Environmental patrol	Emergency medical evacuation	Medical doctor transport	Forest/wildlands firefighting	Aerial photography/surveying	Real estate tours	Aerial advertising	Youth outreach
Northampton	Northampton Airport	D	N	W	W	-	D	N	-	D	N	W	S	W	S	N	N	N	S	N	N	M
Norwood	Norwood Memorial Airport	D	S	D	W	W	D	S	S	M	N	S	D	M	S	D	M	N	D	W	N	M
Orange	Orange Municipal Airport	D	N	D	W	W	D	M	W	D	N	D	D	M	M	M	O	S	W	W	N	W
Pittsfield	Pittsfield Municipal Airport	W	N	D	S	O	W	W	S	S	N	D	M	O	S	W	O	N	S	O	N	O
Newburyport	Plum Island Airport	D	N	M	N	N	W	W	M	W	N	M	M	M	S	O	N	N	O	O	S	O
Plymouth	Plymouth Municipal Airport	D	D	D	M	W	D	D	M	M	M	W	M	W	M	D	W	S	W	O	S	S
Southbridge	Southbridge Municipal Airport	D	O	W	O	O	D	M	M	M	N	M	D	M	N	M	N	O	M	M	S	M
Spencer	Spencer Airport	D	N	O	N	N	D	S	N	S	N	N	N	O	N	M	N	N	D	N	N	M
Sterling	Sterling Airport	D	N	M	S	N	D	N	S	M	N	S	D	S	S	S	S	N	S	S	S	S
Barre/Barre Plains	Tanner-Hiller Airport	D	N	O	O	N	D	D	O	O	N	M	O	O	O	O	O	O	O	O	S	
Taunton	Taunton Municipal Airport - King Field	D	N	D	S	N	D	N	S	D	N	M	N	D	N	O	N	N	S	N	S	N
Montague	Turners Falls Airport	D	N	W	M	N	W	S	S	S	N	S	M	N	S	O	N	N	N	N	N	M
Great Barrington	Walter J. Koladza Airport	D	N	D	O	N	D	W	S	M	N	W	D	M	O	W	O	O	W	S	S	O

Source: CDM Smith

Note 1: CAP = Civil Air Patrol

Table A-20: 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
COMMERCIAL SERVICE AIRPORTS								
Bedford	Laurence G. Hanscom Field (Note 1)	\$8,356,000	\$1,684,000	\$5,644,000	\$102,000	\$44,508,000	\$422,000	\$60,716,000
Boston	Boston Logan International Airport	\$66,571,000	\$463,723,000	\$6,779,000	\$20,879,000	\$37,623,000	\$86,383,000	\$681,958,000
Hyannis	Barnstable Municipal Airport-Boardman/Polando Field	\$2,365,000	\$3,434,000	\$318,000	\$189,000	\$1,765,000	\$782,000	\$8,853,000
Nantucket	Nantucket Memorial Airport	\$1,864,000	\$12,508,000	\$110,000	\$653,000	\$647,000	\$2,699,000	\$18,481,000
New Bedford	New Bedford Regional Airport	\$570,000	\$258,000	\$47,000	\$15,000	\$260,000	\$65,000	\$1,215,000
Provincetown	Provincetown Municipal Airport	\$166,000	\$1,053,000	\$16,000	\$61,000	\$79,000	\$254,000	\$1,629,000
Chicopee/Springfield	Westover Air Reserve Base/Metropolitan Airport (Note 1)	\$420,000	\$140,000	\$1,478,000	\$8,000	\$7,777,000	\$34,000	\$9,857,000
Vineyard Haven	Martha's Vineyard Airport	\$530,000	\$3,578,000	\$41,000	\$210,000	\$246,000	\$865,000	\$5,470,000
Worcester	Worcester Regional Airport	\$833,000	\$418,000	\$70,000	\$22,000	\$392,000	\$91,000	\$1,826,000
COMMERCIAL SERVICE AIRPORTS TOTAL		\$81,675,000	\$486,796,000	\$14,503,000	\$22,139,000	\$93,297,000	\$91,595,000	\$790,005,000
GENERAL AVIATION AIRPORTS								
Barre/Barre Plains	Tanner-Hiller Airport	\$17,000	<\$1,000	\$1,000	\$0	\$3,000	\$0	\$21,000
Berkley	Myricks Airport	\$1,000	<\$1,000	<\$1,000	\$0	\$1,000	\$0	\$2,000
Beverly	Beverly Municipal Airport	\$537,000	\$335,000	\$39,000	\$21,000	\$219,000	\$86,000	\$1,237,000
Chatham	Chatham Municipal Airport	\$66,000	\$381,000	\$5,000	\$25,000	\$24,000	\$102,000	\$603,000
Edgartown	Katama Airpark	\$36,000	\$15,000	\$3,000	\$1,000	\$12,000	\$4,000	\$71,000
Falmouth	Falmouth Airpark	\$9,000	\$8,000	\$1,000	\$1,000	\$5,000	\$3,000	\$27,000
Fitchburg	Fitchburg Municipal Airport	\$243,000	\$161,000	\$19,000	\$11,000	\$98,000	\$45,000	\$577,000
Gardner	Gardner Municipal Airport	\$15,000	\$7,000	\$1,000	\$1,000	\$5,000	\$3,000	\$32,000
Great Barrington	Walter J. Koladza Airport	\$26,000	\$94,000	\$2,000	\$6,000	\$10,000	\$24,000	\$162,000
Hanson	Cranland Airport	\$22,000	\$3,000	\$2,000	<\$1,000	\$7,000	\$1,000	\$35,000
Hopedale	Hopedale Industrial Park Airport	\$1,000	\$25,000	\$1,000	\$2,000	\$3,000	\$9,000	\$41,000
Lawrence	Lawrence Municipal Airport	\$594,000	\$243,000	\$46,000	\$15,000	\$251,000	\$62,000	\$1,211,000
Mansfield	Mansfield Municipal Airport	\$258,000	\$45,000	\$8,000	\$3,000	\$41,000	\$12,000	\$367,000
Marlborough	Marlboro Airport	\$12,000	\$1,000	\$1,000	\$0	\$4,000	\$0	\$18,000

Table A-20: 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	\$103,000	\$62,000	\$14,000	\$4,000	\$90,000	\$17,000	\$290,000
Marstons Mills	Cape Cod Airport	\$22,000	<\$1,000	\$2,000	\$0	\$7,000	\$0	\$31,000
Montague	Turners Falls Airport	\$36,000	\$10,000	\$2,000	\$1,000	\$11,000	\$4,000	\$64,000
Newburyport	Plum Island Airport	\$2,000	\$2,000	<\$1,000	\$0	\$1,000	\$0	\$5,000
North Adams	Harriman-and-West Airport	\$231,000	\$109,000	\$15,000	\$7,000	\$77,000	\$28,000	\$467,000
Northampton	Northampton Airport	\$57,000	\$4,000	\$2,000	<\$1,000	\$13,000	\$1,000	\$77,000
Norwood	Norwood Memorial Airport	\$965,000	\$597,000	\$59,000	\$36,000	\$354,000	\$150,000	\$2,161,000
Orange	Orange Municipal Airport	\$164,000	\$289,000	\$13,000	\$18,000	\$70,000	\$72,000	\$626,000
Pittsfield	Pittsfield Municipal Airport	\$533,000	\$165,000	\$47,000	\$10,000	\$265,000	\$41,000	\$1,061,000
Plymouth	Plymouth Municipal Airport	\$1,105,000	\$198,000	\$64,000	\$12,000	\$370,000	\$51,000	\$1,800,000
Southbridge	Southbridge Municipal Airport	\$28,000	\$29,000	\$2,000	\$2,000	\$9,000	\$8,000	\$78,000
Spencer	Spencer Airport	\$1,000	\$3,000	<\$1,000	<\$1,000	\$1,000	\$1,000	\$6,000
Sterling	Sterling Airport	\$18,000	\$34,000	\$1,000	\$2,000	\$2,000	\$10,000	\$67,000
Stow	Minute Man Air Field	\$147,000	\$175,000	\$16,000	\$14,000	\$78,000	\$57,000	\$487,000
Taunton	Taunton Municipal Airport - King Field	\$77,000	\$10,000	\$6,000	\$1,000	\$27,000	\$3,000	\$124,000
Westfield/Springfield	Westfield-Barnes Regional Airport (Note 1)	\$2,384,000	\$266,000	\$508,000	\$18,000	\$2,477,000	\$74,000	\$5,727,000
GENERAL AVIATION AIRPORTS TOTAL		\$7,710,000	\$3,271,000	\$880,000	\$211,000	\$4,535,000	\$868,000	\$17,475,000
ALL AIRPORTS TOTAL		\$89,385,000	\$490,067,000	\$15,383,000	\$22,350,000	\$97,832,000	\$92,463,000	\$807,480,000

Source: CDM Smith; Note: The methodology describing how the figures in this table were derived can be found in Chapter 5.

Note 1: Includes sales and income taxes paid by employees of military air facilities based on the airport.

APPENDIX B: UPDATE OF ECONOMIC IMPACTS FOR BOSTON LOGAN INTERNATIONAL AIRPORT

INTRODUCTION

As explained in Chapter 3, the 2013 economic impacts of Massachusetts' airports were quantified through an extensive data collection effort. This effort did not include Boston Logan International Airport, however. For that airport, the economic impacts from the *2011 Massachusetts Statewide Airport Economic Impact Study* were updated using a methodology described in this appendix. The updated economic impacts for Boston Logan International are presented below.

BOSTON LOGAN INTERNATIONAL AIRPORT BACKGROUND

Accommodating more than 30 million passengers and 361,000 aircraft operations in 2013, Boston Logan International Airport is the largest airport in New England and one of the 19 busiest airports in the United States. The airport is a vital transportation hub linking the city of Boston, the Commonwealth of Massachusetts, and the entire New England region to destinations across the United States and throughout the world.



Boston Logan International is located 15 minutes from the intersection of Route 128 and I-90 and five minutes from downtown Boston. Ground access is supported by two transit lines. The airport is served by four passenger terminals and six runways, the longest of which is 10,081 feet, allowing the airport to accommodate a full range of commercial service aircraft. Over the past decade, Massport, owner and operator of Boston Logan International, spent over \$4.5 billion on a modernization program that includes new terminals, parking facilities, roadways, and airport concessions, transforming the airport into a world-class 21st century facility.

Boston Logan International is served by more than 40 airlines that provide nonstop service to over 100 domestic and international destinations. Nonstop flights are available within the continental U.S. and to Canada, the Caribbean, Central America, Europe, Asia, and the Middle East. In addition, the airport is served by several express package and all-freight cargo carriers. These domestic and global connections are



essential to the residents and businesses in the Greater Boston region as well as the millions of

domestic and international visitors who are drawn to the many attractions and amenities of Boston, Massachusetts and New England each year, including historic sites, museums, Cape Cod and the islands, the Berkshires, area sports teams, premier healthcare facilities, and the region's multitude of elite higher education institutions.

ECONOMIC IMPACT UPDATE APPROACH

As with the other study airports, direct, multiplier, and total economic impacts of Boston Logan International were estimated in terms of employment, payroll, and output. Output represents total spending or economic activity and accounts for the total value of aviation-related activities supported by Boston Logan International. The following four groups of economic impacts were updated for the airport:

- On-airport tenants
- On-airport construction
- Commercial service visitors
- General aviation visitors

For a description of these categories, please refer to Chapter 3.

Data Collection

The 2011 *Massachusetts Statewide Airport Economic Impact Study* was used to update the direct impacts for Boston Logan International. In addition, Massport provided the following information:

- Number of full-time and part-time airport management employees in 2013
- Estimated total annual wages and benefits paid to these employees in 2013
- Estimated total capital improvement expenditures by airport management for each year, 2011 through 2013
- Estimated total operating expenses (excluding payroll and capital improvements previously identified) for airport management in 2013
- Enplanements and aircraft operations in 2013
- Expenditures per person for domestic and international commercial service visitors at Boston Logan International
- Gross sales data for airport concessions for 2013

Study Multipliers

The same multipliers used to estimate multiplier impacts for the other study airports were used for Boston Logan International. Please refer to Chapter 3 for a discussion of these multipliers.

PROCESS FOR ESTIMATING DIRECT ECONOMIC IMPACTS

The discussion below details the process used to estimate the direct employment, payroll, and output impacts for Boston Logan International.

Direct On-Airport Tenant Impacts

Direct employment impacts for on-airport tenants were updated using a combination of Massport data, ratios of enplanements per employee based on the airport's 2010 and 2013 enplanements, and on-airport tenant employment data from the 2011 *Massachusetts Statewide Airport Economic Impact Study*. 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 2011 *Massachusetts Statewide Airport Economic Impact Study* 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 2011 *Massachusetts Statewide Airport Economic Impact Study*, gross sales data for airport concessions, and the percentage increase in the cost of jet fuel since 2010.

Direct On-Airport Construction Impacts

Capital improvement projects (CIP) expenditure data for 2011-2013 provided by Massport was used to estimate direct employment and output impacts generated by on-airport construction projects. Employment impacts associated with CIP expenditures were identified 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 2013 (\$49,200), which was obtained from the Bureau of Labor Statistics (BLS).

Direct Commercial Service Visitor Impacts

Commercial service visitor expenditures for Boston Logan International were estimated using a methodology similar to that used for the other commercial service airports (see Chapter 3). Calendar year 2013 domestic and international passenger enplanements and visitor percentages were provided by Massport. **Table B-1** presents this data. Average visitor spending for domestic and international visitors was also provided by Massport. Employment and payroll impacts associated with commercial service visitor expenditures were identified using the methodology explained in Chapter 3.

**Table B-1: Enplanements & Percent Visitors
at Boston Logan International Airport**

	2013 Enplanements	Percent Visitors	Visitors
Domestic Passengers (Note 1)	12,836,476	45.9%	5,631,575
International Passengers (Note 1)	2,273,009	43.1%	896,159
TOTAL	15,109,485		6,527,734

Source: Massport

Note 1: Visitors do not include connecting passengers.

Direct General Aviation Visitor Impacts

General aviation visitor impacts for Boston Logan International were estimated following the methodology used for the study airports explained in Chapter 3.

Multiplier Impacts

Massachusetts-specific IMPLAN multipliers were applied to the direct on-airport, direct on-airport construction, and direct visitor impacts to estimate multiplier impacts.

Total Impacts

Total impacts were estimated by summing the direct on-airport, direct on-airport construction, direct visitor, and multiplier impacts.

UPDATED ECONOMIC IMPACTS OF BOSTON LOGAN INTERNATIONAL AIRPORT

The updated direct, multiplier, and total economic impacts for Boston Logan International Airport, estimated based on the methodology described above, are presented in **Table B-2**. As shown, total employment generated by the airport is estimated at nearly 132,000 jobs with a total annual payroll of approximately \$4.3 billion. Total annual output is estimated at approximately \$13.4 billion.

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

	Direct Impacts	Multiplier Impacts	Total Impacts
EMPLOYMENT			
On-Airport Tenants	11,902	7,303	19,205
On-Airport Construction	1,975	1,642	3,617
Commercial Service Visitors	68,847	39,898	108,745
<i>Domestic Visitors</i>	52,817	30,608	83,425
<i>International Visitors</i>	16,030	9,290	25,320
General Aviation Visitors	287	137	424
TOTAL EMPLOYMENT	83,011	48,980	131,991
PAYROLL			
On-Airport Tenants	\$619,452,000	\$366,702,000	\$986,154,000
On-Airport Construction	\$97,170,000	\$73,135,000	\$170,305,000
Commercial Service Visitors	\$1,638,559,000	\$1,483,088,000	\$3,121,647,000
<i>Domestic Visitors</i>	\$1,257,045,000	\$1,137,773,000	\$2,394,818,000
<i>International Visitors</i>	\$381,514,000	\$345,315,000	\$726,829,000
General Aviation Visitors	\$6,831,000	\$5,660,000	\$12,491,000
TOTAL PAYROLL	\$2,362,012,000	\$1,928,585,000	\$4,290,597,000
OUTPUT			
On-Airport Tenants	\$1,593,205,000	\$1,226,075,000	\$2,819,280,000
On-Airport Construction	\$255,120,000	\$241,849,000	\$496,969,000
Commercial Service Visitors	\$5,461,541,000	\$4,547,713,000	\$10,009,254,000
<i>Domestic Visitors</i>	\$4,189,891,000	\$3,488,836,000	\$7,678,727,000
<i>International Visitors</i>	\$1,271,650,000	\$1,058,877,000	\$2,330,527,000
General Aviation Visitors	\$18,931,000	\$15,431,000	\$34,362,000
TOTAL OUTPUT	\$7,328,797,000	\$6,031,068,000	\$13,359,865,000

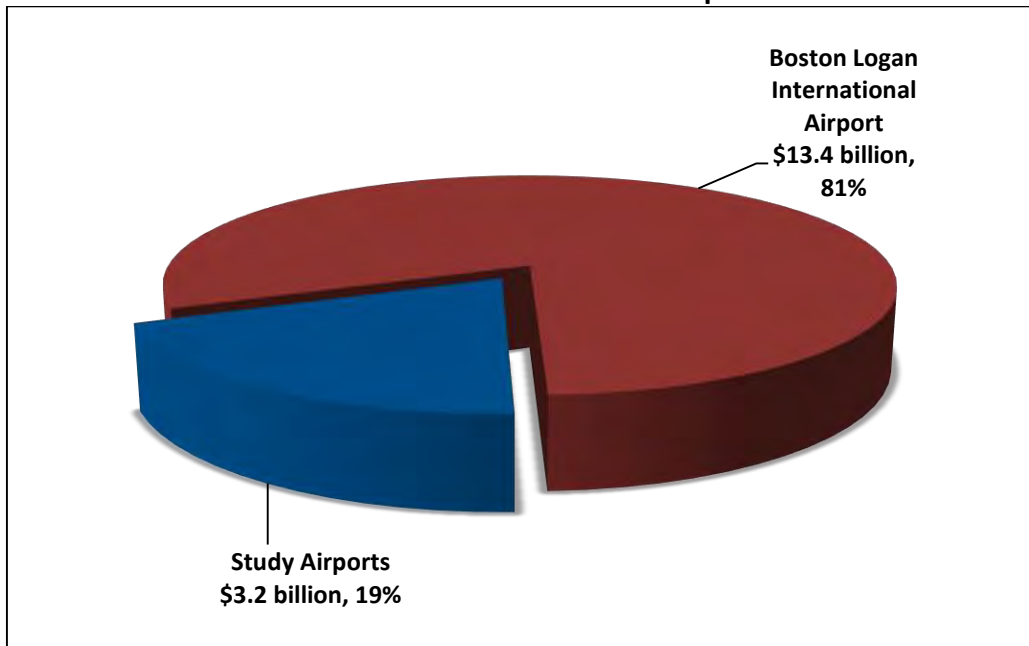
Source: CDM Smith and IMPLAN multipliers

SUMMARY

This appendix detailed the methodology to update the economic impacts for Boston Logan International Airport. As shown in Table B-2, the airport serves as a critical economic engine for Boston, Massachusetts and the entire Commonwealth. The airport's total annual output is estimated at nearly \$13.4 billion. These expenditures support approximately 132,000 total jobs with a total annual payroll of nearly \$4.3 billion.

Boston Logan International's contribution to the total annual output measured for the 39 public-use airports in this study (including military aviation at Hanscom AFB, Westover ARB, and Barnes ANGB) is identified in **Figure B-1**. This analysis estimated that Boston Logan International Airport generates more than 80 percent of the total annual output of the study airports.

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



Source: CDM Smith

APPENDIX C: ECONOMIC IMPACTS OF MILITARY AVIATION

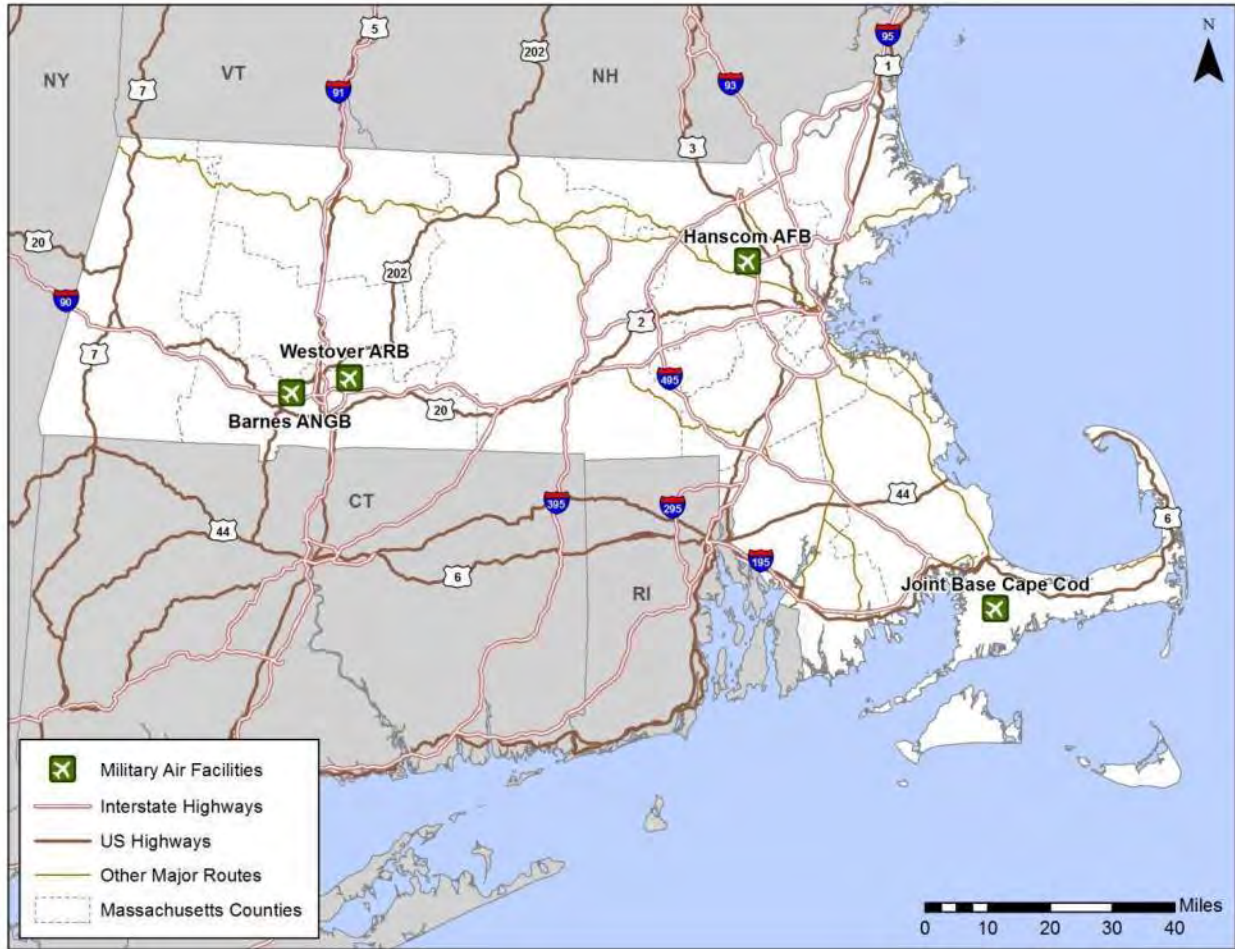
INTRODUCTION

Massachusetts has long been a leader in national defense. This military tradition dates back to the nation's founding and has continued through the present. Throughout this storied history, the Commonwealth has been an important source of military personnel and has fulfilled a significant role in arms research, development, and production. Additionally, given its traditional location on the front lines of major conflicts from the Revolutionary War in the 1700s through the World Wars of the 1900s to the ongoing global conflicts, Massachusetts has 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.

Today's Massachusetts military facilities, many of which support aviation activities, afford the Commonwealth a significant economic benefit that includes employment for residents, sales revenue for companies, and tax revenues for state and local governments. 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 2011 *Massachusetts Statewide Airport Economic Impact Study*, it is important to include the same analysis in this study update so that a direct comparison between the two studies is possible. This appendix discusses the economic impacts associated with the four major military air facilities in Massachusetts. 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 in this appendix, it is helpful to first provide profiles of the Commonwealth's four military air facilities. Background information is discussed for each facility in the following sections.

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 AFB is currently home to the 66th Air Base Group, assigned to the Electronic Systems Center (ESC), a branch of the Air Force Materiel Command (AFMC). The mission of the ESC is the research, development, testing, production, and deployment of command and control, computers, communications, and intelligence systems for U.S. Air Force (USAF) use. These systems gather and analyze information of potentially hostile forces, enabling commanders to make quick decisions and rapidly pass them on to their forces. They essentially assist command and control

decisions in directing air-power to the right target at the right time. However, in this current role, the AFB no longer accommodates conventional USAF flight activities, and less than one percent of aircraft landing at Hanscom Field are military.¹ The AFB has two runways, Runway 05/23 and Runway 11/29, which are 5,106 and 7,001 feet in length, respectively. The total area of Hanscom AFB is 1,125 acres.



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 85th Fighter Squadron and the 318th 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.

The secondary 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. The inclusion of this activity served as the catalyst for the base's postwar role. World War II unequivocally affirmed the essential military importance of radar. 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 to accomplishing this massive project. The Commonwealth of Massachusetts agreed in 1952 to transfer land on

¹ Although the United States Air Force (USAF) units at Hanscom AFB are non-flying units, the base's impact is still counted for this study due to its aviation-related nature.

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 USAF's electronic and geophysics laboratories began to occupy facilities in Bedford in 1954, the airfield's runways were revamped in 1953, and new hangars, headquarters, and facilities were built.

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 6520th 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 also 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. Since 1992, Hanscom has been part of the USAF Materiel Command with the ESD renamed the Electronic Systems Center.

As with any military base today, it is important to also acknowledge Hanscom's current status in Base Realignment and Closure (BRAC), a process by which the federal government seeks to close excess military installations and realign the total Armed Forces asset inventory to reduce expenditures on operations and maintenance. In 2004, ESC was reorganized into a named wing, group and squadron unit, and in 2006, the wings, groups and squadrons were given numbered designations. In 2010, the ESC reverted back to an organization of program offices and the 38th Engineering Installation Wing was reassigned. New USAF standards caused the 66th Air Base Wing, because of its size, to be re-designated the 66th Air Base Group.

In June 2011, the Air Force Research Laboratory Sensors Directorate moved from Hanscom to Wright-Patterson AFB, Ohio, and the Space Vehicles Directorate moved to Kirtland Air Force Base, New Mexico, closing more than 60 years of laboratory presence on Hanscom. The Electronic Systems Center as an organization was realigned in July 2012 and became a part of the newly-created USAF Life Cycle Management Center 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

Home to the 439th Airlift Wing, a unit of the Air Force Reserve Command (AFRC), Westover ARB is the largest Air Force Reserve Base in the United States. The mission of the 439th Airlift Wing is to provide worldwide air movement of troops, supplies, equipment, and medical patients. Westover ARB is located in the communities of Chicopee and Ludlow approximately 10 miles northeast of Springfield, Massachusetts. The base is also a joint-use, military-civilian facility, the civilian part of which is known as Westover Metropolitan Airport.

The 337th Airlift Squadron, the Wing's flying unit, is comprised of 16 C-5A Galaxy Aircraft, representing five percent of United States airlift capabilities. The 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.

Aircraft operations at Westover ARB are supported by two runways, Runway 05/23 and Runway 15/33, which are 11,597 feet and 7,082 feet in length, respectively. These exceptionally long runways, 05/23 being the third longest military runway on the east coast, originally constructed to serve long-range nuclear bombers, are now utilized by the AFRC's largest cargo aircraft. Runway 05/23 was also an alternative landing site for the Space Shuttle. The total area of the facility, including military and civilian uses, is over 2,500 acres and is the largest reserve base in the United States by land mass.



Westover ARB's history dates back to World War II. Westover Field was originally constructed with a \$750,000 Works Progress Administration (WPA) project in 1939. The base 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 ground breaking 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 Oscar Westover was a key advocate responsible for beginning the period of military aviation expansion that ultimately ended with the emergence of the United States Air Force (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, as well as an essential base for regional antisubmarine operations against German U-Boats. After the USAF became its own 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 that began 19 years of operations at Westover that included B-52 nuclear bombers and KC-135 air refueling operations. Westover was also a major USAF base of operations during the Korean Conflict, 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 Galaxy C-5A military transport aircraft.

The Department of Defense's (DoD) 2005 BRAC Recommendations 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 (Springfield, Massachusetts), the United States Army Reserve Area Maintenance Support Activity (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 ten to four by disestablishing one major peacetime administrative headquarters and creating a new deployable headquarters on Westover ARB.

Barnes Air National Guard Base

Located in Hampden Plains on the northern side of Westfield, Massachusetts, Westfield-Barnes Regional Airport, a joint-use, military-civilian facility, hosts Barnes Air National Guard Base (ANGB). Barnes ANGB is the home of the 104th 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. Westfield-Barnes Regional Airport is also home to the



Army National Guard 226th Division - Army Aviation Support Battalion. Aircraft operations are supported by two runways, Runway 02/20 and Runway 15/33, at 9,000 and 5,000 feet in length, respectively. The airport's total area covers 1,200 acres.

In 1923, a group of influential businessmen from Westfield and nearby Holyoke set out to build an airport. With the assistance of both the Westfield and Holyoke Chambers of Commerce, this group led construction of Westfield Aviation Field on lands effectively donated for that use by Vincent E. Barnes, another local businessman. The 27-acre airport was officially dedicated on October 12 1923. As the field gained in popularity, 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.

The airport served as a fighter training base for local enlistees during World War II. 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 02/20 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 15/33 to a length of 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 103rd Fighter Wing at Bradley International Airport and ANGB in Windsor Locks, Connecticut to the 104th 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 other competitors including Bradley International Airport and ANGB.

Joint Base Cape Cod

Joint Base Cape Cod 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 05/23 at 8,000 feet in length and Runway 14/32 at 9,500 feet in length. In 2013, the Massachusetts Military Reservation was officially designated as the Joint Base Cape Cod (JBCC) to more accurately reflect the joint partnership taking place on the installation.

The JBCC is home to five military commands, including the Massachusetts Army National Guard at Camp Edwards; the Massachusetts Air National Guard at Otis ANGB; the 253rd Combat Communications Group, also at Otis ANGB; the 6th Space Warning Squadron phased array radar site at Cape Cod Air Force Station; and the U.S. Coast Guard at Air Station Cape Cod. As this joint military installation protects the air, land, and sea stateside, many military units and service members who work and train at the JBCC are also preparing for and participating in missions around the world. Tactical Training Base Kelley is used as a theatre immersion training center, replicating a forward operating base soldiers occupy when deployed overseas in the Global War on Terrorism. Cape Cod Air Force Station is the only land based radar site providing missile warning for the eastern coast of the United States and southern Canada against intercontinental and sea-launched ballistic missiles.

The area's use for military purposes 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 Air Force and Army 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 (ADC) 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. Of note is Otis ANGB's role during the terrorist attacks of

September 11th, 2001. It was Otis ANGB that was contacted by the Federal Aviation Administration after American Airlines Flight 11 was hijacked. The base sent out F-15 fighters towards New York City to intercept the plane.

As noted above, the U.S. Department of Defense originally called for the closure of Otis ANGB in its 2005 BRAC Recommendations, but the facility was spared in last minute decisions; however, the 102nd Fighter Wing lost its fleet of F-15 Eagles and transitioned to a non-flying mission, re-designated as the 102nd Intelligence Wing. The current mission of the 102nd is to provide worldwide precision intelligence and command and control, as well as trained and experienced airmen for expeditionary combat support and homeland security.

ECONOMIC IMPACT METHODOLOGY

Data regarding economic activity (employment, payroll, and expenditures) for the military air facilities was collected from a variety of sources. Data was obtained either through base websites and fact sheets, existing base-specific economic impact studies, or in the case of Barnes ANGB, the airport management and tenant survey effort described in Chapter 3.

In addition to these data sources, the economic impacts generated by the military air facilities were measured by using data from an input-output model that estimates purchases and sales between various sectors of the economy. The model incorporates multipliers and data tables specific to Massachusetts and requires impact estimates for four separate components of the economy as follows:

- **Employment:** Employment is divided into military and civilian categories and is based on full-time equivalent positions. 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 is the annual salary, wages, and benefits paid to all aviation-related employees, both military and civilian.
- **Expenditures:** Expenditures include general operating costs associated with each base, such as construction costs, service contracts, materials, equipment, supplies, and procurement.
- **Output (Spending):** Output is the sum of total annual payroll and expenditures per military air facility.

All economic impacts from the four military air facilities included in this study were calculated using an input-output model. The input-output model considers three impact categories to assess the economic impacts associated with each military air facility. These categories are:

- **Direct Impacts:** Direct impacts are the benefits associated with the day-to-day operation of each military air facility. Direct impacts include the employment, payroll, expenditures, and output of each military air facility.
- **Multiplier Impacts:** Multiplier impacts, or indirect and induced impacts, are the benefits resulting from the recirculation of direct impacts within the economy. Multiplier impacts

were estimated using the Impact Analysis for Planning (IMPLAN) model. See Chapter 3 for a more detailed discussion of multiplier impacts and the IMPLAN model.

- Total Impacts: Total impacts are the sum of all direct and multiplier economic activities attributable to the military air facilities.

To estimate construction impacts associated with capital improvement projects (CIPs) at the military air facilities, the same methodology used to estimate construction impacts at the study airports was followed (see Chapter 3). This methodology consisted of the following steps:

- Where available, CIP data for 2011-2013 for each military air facility was used.
- CIP data for the period was averaged to avoid showing peaks or troughs in construction activity.
- The IMPLAN model indicates that every \$1 million spent annually on construction activity supports approximately 7.7 construction-related 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 determine average pay for construction workers in Massachusetts, and this average was applied to each construction-related employee to determine payroll related to CIP activity.

MILITARY EMPLOYMENT, PAYROLL, AND OUTPUT IMPACTS

This study found that military aviation activities in Massachusetts are not only critical to national defense, they are also significant sources of employment and economic activity for the Commonwealth. Total economic impacts are the sum of the direct and multiplier impacts of the four military air facilities in Massachusetts. **Table C-1** presents the total impacts at these facilities. Total employment supported by military aviation in Massachusetts is estimated at 18,187 jobs, with an associated annual payroll of \$1.4 billion.² Total annual output is estimated at \$1.7 billion.

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

Military Air Facility	Employment	Payroll	Output
Hanscom AFB	10,610	\$1,066,163,000	\$1,255,196,000
Westover ARB	5,083	\$188,105,000	\$233,482,000
Barnes ANGB	1,302	\$32,685,000	\$106,359,000
Joint Base Cape Cod	1,192	\$92,990,000	\$134,571,000
TOTAL	18,187	\$1,379,943,000	\$1,729,608,000

Source: CDM Smith and IMPLAN multipliers

² Total employment includes full-time, part-time reservists, and associated multiplier jobs.

SUMMARY

This appendix quantified the economic impacts of Massachusetts' four military air facilities. **Table C-2** provides a summary of economic impacts for these facilities. As shown, military aviation helps to support a total of 18,187 jobs that have an annual payroll of approximately \$1.4 billion. The military air facilities in Massachusetts account for more than \$1.7 billion in total annual output.



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

	Direct Impacts	Multiplier Impacts	Total Impacts
Employment	11,683	6,504	18,187
Payroll	\$1,039,100,000	\$340,843,000	\$1,379,943,000
Output	\$1,263,182,000	\$466,426,000	\$1,729,608,000

Source: CDM Smith, IMPLAN multipliers, and primary and secondary data sources

APPENDIX D: PROJECTED 2018 ECONOMIC IMPACTS FOR MASSACHUSETTS AIRPORTS

INTRODUCTION

In addition to the 2013 economic impacts for Massachusetts' 39 public-use airports presented in this report, the Massachusetts Department of Transportation (MassDOT) Aeronautics Division desired to estimate the future economic impacts of the airport system. The analysis presented in this appendix estimates the future total employment and total output impacts of the Massachusetts airport system for 2018.¹ The future impacts were estimated based on a variety of factors including projected changes in passenger enplanements and aircraft operations, anticipated capital improvement project (CIP) expenditures, and in the case of Boston Logan International Airport, forecasts of concessions gross sales. The 2018 economic impacts are presented in constant dollars to allow for direct comparison with the airport system's 2013 economic impacts.

METHODOLOGY FOR ESTIMATING 2018 ECONOMIC IMPACTS

The 2018 economic impacts were estimated separately for the airports included in the 2010 *Massachusetts Statewide Airport System Plan* (MSASP) and the airports owned and operated by the Massachusetts Port Authority (Massport). The sections below describe the methodology used to estimate the 2018 economic impacts for both groups of airports.

MSASP Airports

The 2018 projections of total employment and total output for the MSASP airports were estimated using a regression analysis. Regression analysis is a method of estimating a dependent variable from an independent variable when there is a high degree of correlation between the two. The degree of correlation is expressed with a correlation coefficient, R , where a coefficient of zero indicates no relationship between the variables and a coefficient of one indicates a perfect relationship between the two variables.

For this analysis, 2018 total employment and total output (dependent variables) were estimated using correlations that were found with datasets for each airport (independent variable). A number of independent variables were obtained for each airport and included passenger enplanements, aircraft operations, and based aircraft.² The correlations between these dependent and independent variables were evaluated to obtain the highest correlation value for each dependent variable. For the MSASP airports, total aircraft operations were used as the independent variable to project total employment and total output for 2018.

¹ Total employment and total output impacts include multiplier impacts.

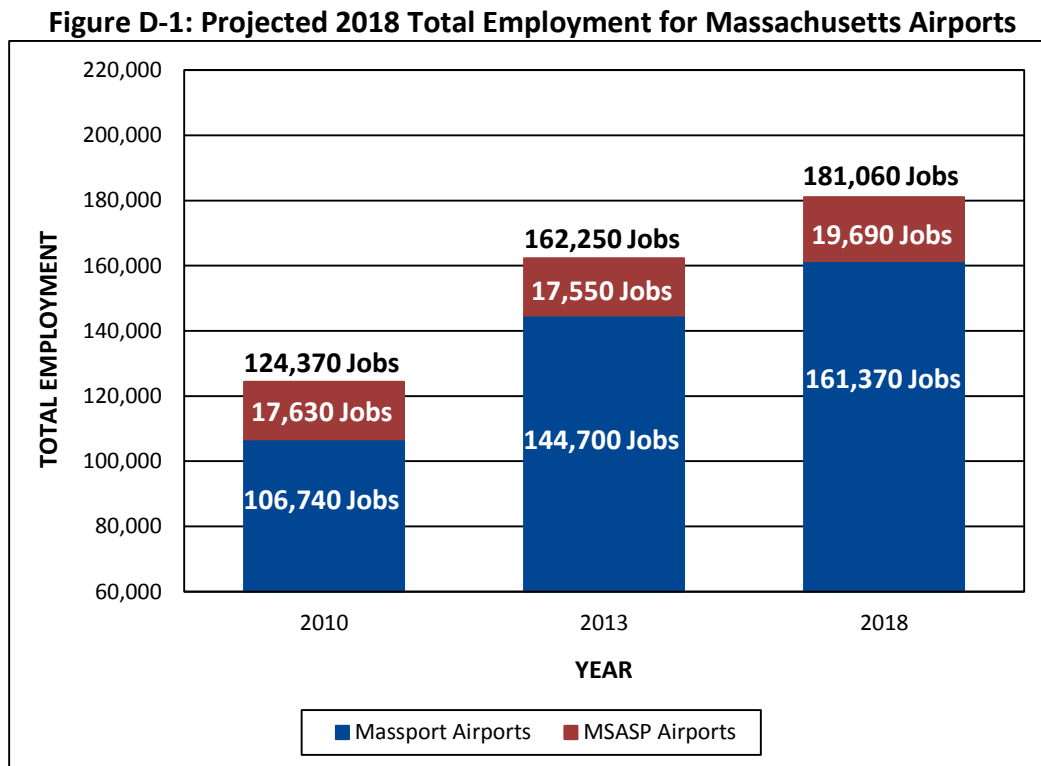
² Growth rates for passenger enplanements, aircraft operations, and based aircraft were obtained from the 2010 *Massachusetts Statewide Airport System Plan*.

Massport Airports

The 2018 total employment and total output impacts for the Massport airports were estimated using forecasts of enplanements, aircraft operations, CIP expenditures, and for Boston Logan International, concessions gross sales. The majority of this data was provided by Massport.

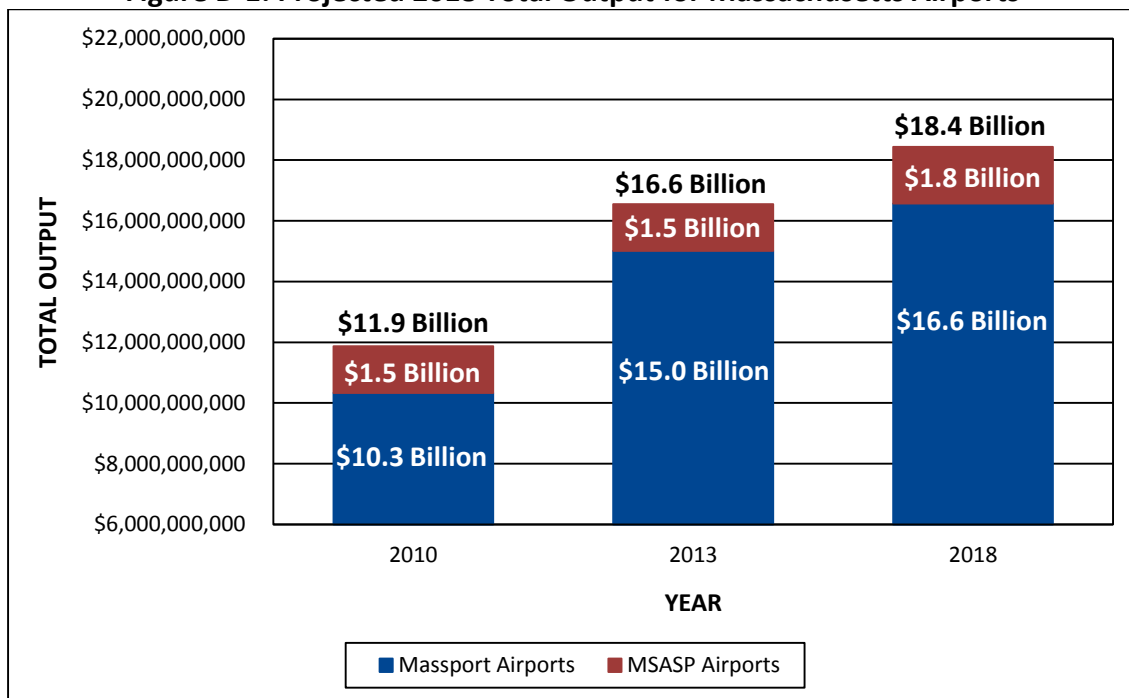
PROJECTED 2018 ECONOMIC IMPACTS

The projected 2018 total employment and total output impacts for the 39 public-use airports in Massachusetts are presented in **Figures D-1** and **D-2**. As shown in Figure D-1, total employment is projected to increase from more than 162,000 jobs in 2013 to approximately 181,000 jobs by 2018. Total employment (124,370 jobs) for 2010 from the 2011 *Massachusetts Statewide Airport Economic Impact Study* is included in Figure D-1 to illustrate the trend of growth in jobs during the 2010 to 2018 period.



As shown in Figure D-2, total output is projected to increase from \$16.6 billion in 2013 to \$18.4 billion by 2018. Similar to Figure D-1, total output (\$11.9 billion) for 2010 from the 2011 *Massachusetts Statewide Airport Economic Impact Study* is included in Figure D-2 to illustrate the trend of growth in output for the 2010 to 2018 period.

Figure D-1: Projected 2018 Total Output for Massachusetts Airports¹



¹ Numbers may not sum due to rounding.

Source: CDM Smith

SUMMARY

This appendix presented the projected 2018 total employment and total output impacts for the 39 public-use airports in Massachusetts. The future impacts were estimated based on several factors including projected changes in enplanements, aircraft operations, CIP expenditures, and concessions gross sales for Boston Logan International. **Table D-1** summarizes the total employment and total output impacts for the Massachusetts airport system for 2010, 2013, and 2018. Total employment is estimated to reach approximately 181,000 jobs by 2018 and total output is projected to grow to \$18.4 billion.

**Table D-1: Total Employment and Output Impacts
for Massachusetts Airports, 2010-2018**

	Total Employment	Total Output
2010		
MSASP Airports	17,630	\$1,545,263,000
Massport Airports	106,740	\$10,325,124,000
TOTAL	124,370	\$11,870,387,000
2013		
MSASP Airports	17,550	\$1,544,741,000
Massport Airports	144,700	\$15,010,376,000
TOTAL	162,250	\$16,555,117,000
2018		
MSASP Airports	19,690	\$1,859,937,000
Massport Airports	161,370	\$16,573,539,000
TOTAL	181,060	\$18,433,476,000

Source: CDM Smith

Massachusetts Airport System



COMMERCIAL SERVICE AIRPORTS



GENERAL AVIATION AIRPORTS



For More Information, Contact:

MassDOT Aeronautics Division

Logan Office Center
One Harborside Drive
Suite 205N
East Boston, MA 02128-2909
617-412-3680
www.massdot.state.ma.us/aeronautics/

Project Management Team:

- Federal Aviation Administration (FAA)
- MassDOT Aeronautics Division
- Aircraft Owners and Pilots Association (AOPA)
- Massachusetts Airport Management Association (MAMA)
- Massachusetts Office of Business Development (MOBD)
- Massachusetts Port Authority (Massport)
- National Business Aviation Association (NBAA)

Photo Credits:

- Gulfstream Aerospace Corporation
- Massachusetts Department of Transportation
- Massachusetts Office of Travel and Tourism
- Massachusetts Port Authority
- Rectrix Commercial Aviation Services, Inc.
- 3-126th AVN TBOS, Camp Edwards

Report Prepared by:



CDM Smith Inc.
with Airport Solutions Group, LLC.
& Spotlight Communications

