The Future of Tipton Airport in Anne Arundel County

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Executive Summary

Tipton Airport is located in Anne Arundel County, Maryland. It is a General (GA) airport, classified as a reliever airport by the Federal Aviation Administration (FAA). It is the reliever airport to the Baltimore/Washington International Thurgood Marshall Airport (BWI), which is located less than 13 miles from Tipton.

The airport plans to extend their runway from 3,000 feet to 4,200 feet. The main objective for this expansion is to increase the number of larger turbo-planes and business aircrafts, which require longer runways that can use the facility. This will expand the airport's market reach and user base, allowing it to improve the ease of flying for potential users.

The purpose of this study is to determine the future demand for corporate service and other air traffic at the airport in light of the runway expansion, and to recommend additional variables that will help increase air traffic.

The report provides a detailed description of Tipton Airport, including its location and context, airport services, and a comparison of these services with similar airports in Maryland. It also includes an analysis of the strengths, weaknesses, opportunities, and threats for the airport, based on a review of FAA records and recommendations, market analysis, general aviation airport demand drivers, the Maryland Aviation Administration (MAA) reports, and information from airport experts. It should be noted that a client and flying database is important for detailed analysis, but currently the airport does not maintain this database.

The report briefly discusses the forecast and recommendations made in the Tipton Master Plan 2010. The forecast indicated a steady growth in aviation activity at the airport over the next 20 years and made several facility and service recommendations. However, the 9/11 terrorist attacks and national economic recession negatively affected general aviation activities, and significantly impacted the future demand. This report discusses the significant effects on general aviation, which include a decrease in aviation activity, pilot population and public perception, and an increase in flying rules and regulations.

The report's section on general aviation outlook provides an insight into the benefits of having a general aviation airport, future projections, and trends for airport activities at a national level, as well as the factors that drive these trends. This section highlights the changes in general aviation activity since the 2008-2009 recession-related impacts, as mentioned in the previous section. The FAA has forecasted that nationally, the number of general aviation hours flown is projected to increase by an average of 1.2% per year through 2036. General aviation operations are forecast to

increase by an average of 0.2% a year. Some of the drivers for general aviation trends include pilot population, aircraft population, fuel, and other socioeconomic trends such as population and employment growth. Future trends for these factors are described in this section to help forecast the general aviation trends.

The report forecasts aircraft operation activity at the airport based on the factors described above. The forecast is based on four scenarios: straight line projections from 2001 to 2015 at Tipton airport; FAA projected trend, where general aviation is expected to increase annually by an average of 0.2% over the 21-year forecast period; a 25% additional increase in aircraft operations due to expansion of runway and service improvements; and projections for population and employment growth in Maryland. Based on all these scenarios, the airport can expect approximately from 47,906 in 2015 to 60,000 to 65,000 aircraft operations annually by 2040.

Using the forecasted aircraft operations, based aircrafts (aircrafts that are flight-worthy and based at a particular airport) were calculated for 2040. Using an approach similar to the Tipton Master Plan, a total of 139 based aircrafts is projected. Based aircraft projections are further used to estimate the total number of T-hangars and conventional hangar storage space. The Tipton Master Plan forecasted a total of 56 T-hangars and 121,473 square feet of storage space for 215 aircrafts. In the current scenario-based forecast, a total of 36 T-hangars and a total of approximately 80,000 square feet will be required by 2040.

Extending the runway should help Tipton Airport attract new customers and increase air traffic, further expanding its service area in Baltimore, Washington, D.C., and Virginia. Through a combination of short- and long-term recommendations, the Airport Authority can implement strategies to improve quality of services, provide additional services, and build a stronger customer association. This study's recommendations are based on the FAA and the MAA records and recommendations, Tipton Airport Authority Master Plan, Tipton Business Plan, study of other airports analogous to Tipton airport, SWOT analysis, demand drivers, market analysis, and interviews with airport experts and the County's Economic Development team.

As part of the short-term strategies, it is strongly recommended that the airport starts maintaining a database of customers and flying activities along with customer feedback. This will help track the need for improvement, and quality of services provided based on customer satisfaction. Along with fuel sales and storage facilities, providing mechanical services will help make the airport a one-stop shop destination for flyers. While the airport already provides taxi service, a shuttle service will help improve accessibility and travel time. Currently flight training is available at 22 airports in Maryland, and per the FAA, student pilot certification is expected to increase over the years. Having this facility at the airport will help attract more flyers and increase recreational activities.

As part of the long-term strategies, the airport can plan to offer additional services such as covered hangar spaces, snow removal, de-icing, etc. Services like these will help improve customer satisfaction, since studies suggest that most customers would prefer quality over price. Building a fence and an air control tower will help improve safety and meet FAA recommendations for general aviation airports. With airports expanding their activities to include non-aviation services, the airport could increase its revenue stream with retail, services, food and beverages, parking, and passenger access. The potential for onsite commercial offices should be explored..

Acknowledgements

Contents

1. Introduction

Tipton Airport is a public airport in Anne Arundel County, Maryland. It is a General (GA) airport, which is classified as a reliever airport by the Federal Aviation Administration (FAA). The airport opened in 1999 on the site of a former United States Army airfield that was closed in 1995. Currently it is an independent airport, owned and operated by the Tipton Airport Authority, and serving the eastern-central Maryland area including Anne Arundel County. Tipton is one of six FAA-designated reliever airports in Maryland, serving as a reliever facility for the Baltimore/Washington International Airport (BWI).

The Tipton Airport Authority plans to extend its runway length from 3,000 feet to 4,200 feet, with the goal of .accommodating more large aircrafts that require longer runways. This report analyzes existing activities at the airport and determines the feasibility of expanding corporate services, with recommendations that will help increase air traffic and determine changes in infrastructure and service requirements. This report will assist the Tipton Airport Authority to plan the airport's facility needs based on analysis of current operations and forecasted trends.

The sequence of this report is listed below:
- Analyze the airport's location, layout, facilities, and services provided.
- Review the 2010 Tipton Airport Master Plan and the 2012 Business Plan, focusing on airport projections and recommendations.
- Review existing reliever airports in Maryland that are analogous to Tipton Airport and provide a comparative analysis based on location, facilities, and uses.
- Develop a forecast of aviation activity at Tipton Airport.
- Determine effective use of the existing services and recommend future development at the airport to ensure continued growth.

2. Overview of Tipton Airport

2.1. Location and Context

Tipton airport is located just south of Fort George G. Meade in Odenton, Anne Arundel County, Maryland. The airport is the largest general aviation airport between Washington, D.C., and Baltimore, approximately equidistant to Baltimore (20 miles), Washington, D.C. (23 miles) and Annapolis (20 miles). The facility is bordered to the north by Fort Meade and the National Security Agency, and on its other three sides by the Patuxent Wildlife Research Center. It covers an area of 366 acres with a runway currently measuring 3,000 x 75 feet (914 x 23 m). [1] As seen in Figures 1 and 2, it is optimally located adjacent to major interstate and state routes: MD 198, I-95, I-97, Route 32, MD 295/BW Parkway, and the Patuxent Freeway. The closest transit is the Odenton MARC and AMTRAK train station, which is 3.5 miles from the airport.

Figure 1: Tipton Airport location
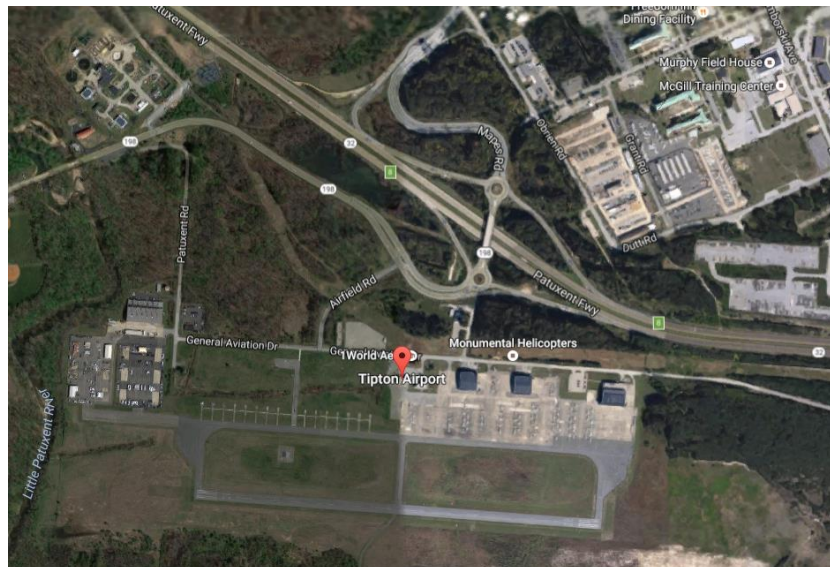
Source: Google My Maps

Following the terrorist attacks of September 11, 2001, significant restrictions were placed on general aviation airport operations in the Washington region [9]. Airports in Washington, D.C. and three airports in Maryland were particularly impacted—College Park (CGS), Washington Executive (W32), and Potomac Airfield (VKX). These airports are still operating with Flight Restricted Zone restrictions, and are required to file flight plans following special rules, obtain discrete transponder codes, and remain in contact with air traffic control. [9] Tipton airport has benefitted from not being subject to these requirements. Its central location encourages its use for business and corporate travel, which

is further strengthened by the ongoing security measures implemented at commercial service airports resulting in increased personal travel times.

Figure 2: Tipton Airport from nearby major metropolitan areas
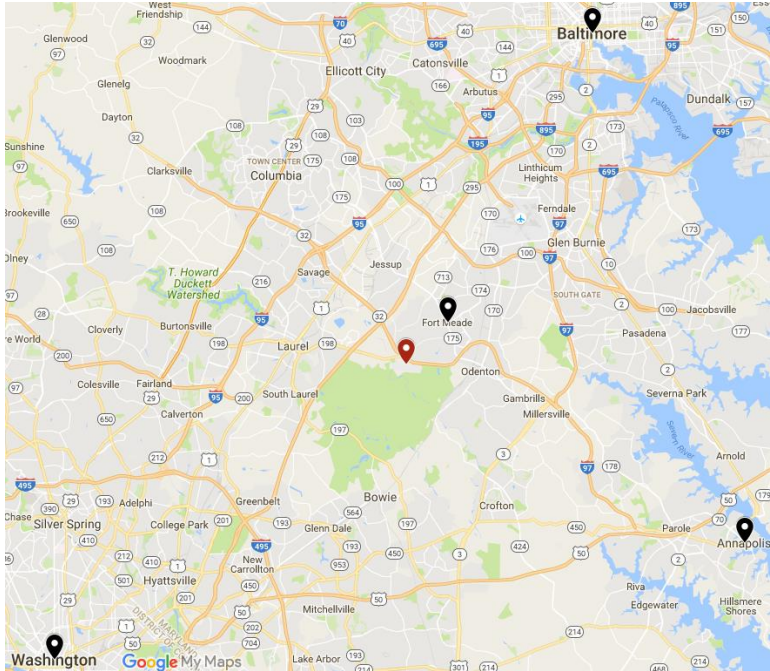
Source: Google My Maps

The Air Defense Identification Zone (ADIZ) covers much of North America—namely airspace over the United States and Canada—in which the ready identification, location, and control of civil aircraft over land or water is required in the interest of national security. The ADIZ is less sensitive compared to a Flight Restricted Zone. Tipton Airport, Lee Airport, Montgomery County Airpark, and BWI Airport all operate under ADIZ rules.

2.2. Airport Services

Tipton airport currently serves the eastern-central Maryland area including North Anne Arundel County. It also routinely services aircrafts from outside of Maryland, serving as a reliever facility for BWI. The airport provides services such as fuel sales, tie-downs, minor airframe and power plant services, maintenance and storage, pilot supplies, air taxi/charter, and flight training. The fuel charges are comparatively lower than other general aviation airports in Maryland, $4.55 for 100LL and $3.15 for Jet-A compared to Frederick Municipal Airport, Lee Airport, Carroll County Regional Airport, Montgomery County Airpark, and BWI Airport, where fuel charges range from $3.99-$8.31 for 100LL and $3.15-$7.93 for Jet-A. The airport also has a fixed-base operator service, a commercial business granted the right to operate on airport grounds and provide end-to-end aeronautical

services. [22] Currently this is provided by the Tipton Airport Authority. According to the Aircraft Owners and Pilots Association, 50% of Maryland's public-use airports are privately owned. According to the FAA, the airport's revenue does not go to the County.

As of 2016, the airport handles an average of 130 flights per day. The Airport Authority does not keep records of their flights by trip purpose but estimates that 60% of trips are for recreational activities, 15-20% for business purposes, 10% for flight training, with the remainder unknown. As seen in Table 1, the airport has 106 aircrafts based on field, 89 single and 6 multi-engine airplanes, and 11 helicopters. As of 2015, airport activity comprised 98% local general aviation, 2% transient general aviation (generally from more than 25 miles away), and less than 1% of air taxi and military. The airport additionally has a pilot lounge and a flight planning conference room. It has 120 paved tie-downs and 4 conventional hangars. Currently the airport does not have any T-Hangars. An Environmental Assessment (EA) study for the 4,200-foot runway extension is in progress and the airport has an FAA approval to construct 22 T-hangars, which will help provide more services to flyers.

The annual aircraft operations at Tipton Airport include 46,866 local general aviation, 885 transient general aviation, 67 military, and 104 air taxi flights, for a total of 47,922 aircraft operations. The MAA report, *The Economic Impact of Airports* found that the airport generated a total of 193 jobs, which include 74 direct jobs, 40 induced jobs, and 79 indirect jobs. The airport's business revenue as of 2015 was $18,859, with $4,553 from direct, $4,067 from induced, and $4,299 from indirect income. [12]

Figure 3: Tipton Airport layout

Source: Talbert & Bright; Tipton Airport Master Plan, 2010

Table 1: FAA recorded statistics (*for 12-month period ending 18 March 2016)*

Aircraft based on the field	106
Single engine airplanes	89
Multi engine airplanes	6
Helicopters	11
Aircraft operations	Avg 130/day *
Local general aviation	98%
Transient general aviation	2%
Air Taxi	< 1%
Military	< 1%

Source: www.airnav.com*; * for 12-month period ending 18 March 2016*

3. Prior Planning

The 2010 Tipton Master Plan provided a 20-year forecast (2008-2027) upon which recommendations were made to meet future demand. The plan forecasted that the total number of based aircrafts was projected to grow from 115 in 2007 to 215 in 2027. The 2008 forecasts were a straight-line projection of 2001-2007 aircraft numbers. These based aircraft projections were used to forecast the aircraft operations, which were projected to grow from 49,225 in 2007 to 92,020 in 2027. [4] This forecast indicated a steady growth in the aviation activity over the next 20 years.

Based on this forecast the plan made several recommendations to be implemented in phases, one of them being construction of 56 T-Hangar and a total of 121,473 square feet of conventional hangar storage by 2027. New projections for number of T-hangars and conventional hangar storage space are shown in Section 8 of this report.

Growth in the general aviation industry had slowed considerably after 2000, negatively impacted by the national economic recession and events surrounding the 9/11 terrorist attacks. General aviation activity was affected by the 9/11 terrorist attacks, fuel prices throughout most of the decade, and a worldwide economic recession at the end of the decade. The terrorist attacks resulted in the immediate halt of all activity for days and prolonged effects came in the form of poor public perception, increased airport security procedures, and tighter regulation of air space. These safety issues affected how the public, users, or potential student pilots view general aviation, and this affected aviation activities.

A comparison of general aviation's impact on jobs and on the economy between 2008 and 2009, shows a 20% decrease in jobs and a 21% decrease in total economic impact during a year. There was also a significant decreasing trend in the active pilot population, along with steady decreases in general aviation flight hours and towered operations. [25] These could be some of the reasons why the plan's projections were not met in the years to follow.

4. General and Maryland Aviation Outlook

General aviation is an important component of U.S. aviation. The FAA states that general aviation airports serve many vital needs that scheduled airline services are unable to meet, such as emergency medical flights, aerial firefighting, law enforcement, flight training, time-sensitive cargo services, business travel, personal travel, and agricultural functions. [7] Local businesses benefit the most by using general aviation airports as an effective tool offering:

- flexibility to use aircrafts on demand since they do not operate on a system of scheduled departures, like the air carrier airports

- easy and quick access to multiple locations, making it more productive for employees

- convenient locations that makes it easier to fly in without a schedule and saves travel time

- access to locations that may not be reachable via commercial airlines

- quick response to business needs.

Despite slow economic growth, 2015 was a good year for U.S. aviation. With a stable demand for aviation activity and lower cost of operations, the U.S. airline industry recorded profits. Total operations at FAA and contract towers rose in 2015 by 0.2%. Air carrier activity increased by 5.7%, more than offsetting declines in the air taxi, general aviation, and military categories. The general aviation market showed continued improvements in single-engine piston and business. General

aviation operations accounted for 52% of operations in 2015. [15] The FAA conducted an aerospace analysis for fiscal years 2016-2036 and forecasted a favorable outlook for general aviation, with gains in turbine aircraft activities. The number of general aviation hours flown is projected to increase by an average of 1.2% per year through 2036. General aviation operations are forecast to increase an average of 0.2% a year. [6] (Detailed forecasts are in Appendix H.) Tables 2, 3, and 4 show historical and projected data for aircraft and hours flown, projected by the FAA for 2015-2036. Overall, the data forecasts an increase in active general aviation and air taxi aircrafts with an increase in hours flown.

Table 2: Forecasts for aircrafts

Active GA and Air Taxi Aircraft			
Avg Annual Growth	Total GA Fleet	Total Pistons	Total Turbines
2001-15	-0.3%	-1.1%	3.1%
2015-36	0.2%	-0.6%	2.1%

Source: 2001-2010, 2012-2014, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

Table 3: Forecasts for hours flown

Active GA and Air Taxi Hours Flown			
Avg Annual Growth	Total GA Fleet	Total Pistons	Total Turbines
2001-15	-1%	-3%	3%
2015-36	1%	0%	3%

Source: 2001-2010, 2012-2014, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

Some of the drivers for general aviation trends include pilot population, aircraft population, fuel, and other socioeconomic activities. The pilot population in the United States has declined since 1980s across all categories of certification. However, there has been an increase in student certificates due to the extension of validity of the certificates by FAA to 60 months. The decline in pilot population suggests that pilots are retiring at a very high rate and there is slow addition of new pilots. [8] Based on statistics compiled by the FAA's Mike Monroney Aeronautical Center, the number of student pilots at the end of 2010 increased by 64.8%, approximately 47,000 pilots, compared to 2009. While the impact of extending the validity of pilot certificates on the long-term trend in student pilots has yet to be determined, the number of student pilots showed a small increase of 0.2% from its 2013 to 2015. [8]

Table 4: Forecast for active pilots based on type certification

Forecast: Active Pilots by Type Certification									
Avg Annual Growth	Students	Recreational	Sports Pilot	Private	Commercial	Airline Transport	Rotorcraft	Glider	Total
2001-15	2%	-4%	N/A	-3%	-1%	0%	5%	6%	-0.4%
2015-36	0%	0%	5%	-1%	-1%	0%	2%	0%	0.1%

Source: FAA APO Estimates

There has also been a decrease in manufacturing of general aviation aircrafts and aging of the aircraft fleet. There was a stark reduction of 94% in the number of aircraft shipments from 1970s to 1993. However, after the General Aviation Revitalization Act (GARA) passed in 1994, shipments began to grow after more than a decade of decline.

Fuel cost is one of the most basic drivers of aviation activity. It determines general aviation demand since it represents the most important component of aircraft operation cost. With increase in fuel prices, flying activity will be affected negatively, and may threaten future operations. However, the national average price of gasoline has declined each year beginning from 2012, as seen in the below Table 5.

Table 5: Historical trends in gasoline prices   Table 6: Fuel consumption at National Level for GA aircrafts

Year	Gasoline Price
2012	$3.60
2013	$3.48
2014	$3.34
2015	$2.40
2016	$2.28

Source: Gas Buddy Fuel Price Outlook, 2016

Forecast: GA Aircraft Fuel Consumption			
	Total Fuel Consumed		
Avg Annual Growth	AVGAS	Jet Fuel	Total
2001-15	-2.1%	3.4%	2.4%
2015-36	0.0%	2.1%	1.9%

Source: Gas Buddy Fuel Price Outlook, 2016

The airline industry will need to boost infrastructure, hire more pilots, and temper fuel costs to meet this projection.

4.1. Maryland Aviation Outlook

Maryland has a vibrant airport system and a robust aviation industry that directly impacts economic activity, and acts as a driver for the State's economic growth and development. The total employment numbers for Maryland's public-use general aviation and scheduled commercial service airports include nearly 4,800 direct jobs created by airport and visitor activity at these airports. Over 1,700 jobs were supported in local economic sectors from purchases of goods and services by those 4,800 directly-employed workers. Almost 2,400 indirect jobs were supported by $239.4 million of local purchases by airport tenants. [12] All these airports generate revenues for activities such as aircraft operations, fuel sales, cargo and package freight service, aircraft rental and sales, facilities and services provided to pilots and passengers, as well as non-aeronautical activities such as rents, leases, and services of on-airport businesses. As of 2014, aviation activity in Maryland created approximately 107,105 direct, induced, and indirect jobs, and a business revenue of $7.8 billion.

As of 2015, the total aircraft operations for all of Maryland's 36 general aviation airports (including BWI) was 105,861. Table 7 shows a forecast for aircraft operations in Maryland through 2040. The forecast is based on FAA projections, where the annual average growth for aircraft operations is 0.2% per year. Figure 4 shows the growth trend for general aviation activities in Maryland. As seen in Figure 5, the maximum aviation activity in the State is local general aviation.

Table 7: Forecast for Aircraft Operation in Maryland based on FAA Forecast

Year	Local GA	Itinerant	Militiary	Air Taxi	Commercial	Charter	Corporate	Total Operations
2015	450,248	301,153	47,629	47,806	209,192	417	1,416	1,057,861
2020	451,148	301,755	47,724	47,902	209,610	418	1,419	1,059,977
2025	452,051	302,359	47,820	47,997	210,030	419	1,422	1,062,097
2030	452,955	302,964	47,915	48,093	210,450	420	1,425	1,064,221
2035	453,861	303,569	48,011	48,190	210,871	420	1,427	1,066,349
2040	454,769	304,177	48,107	48,286	211,292	421	1,430	1,068,482

Source: FAA APO Estimates

Figure 4: Forecast Aircraft Operations in Maryland
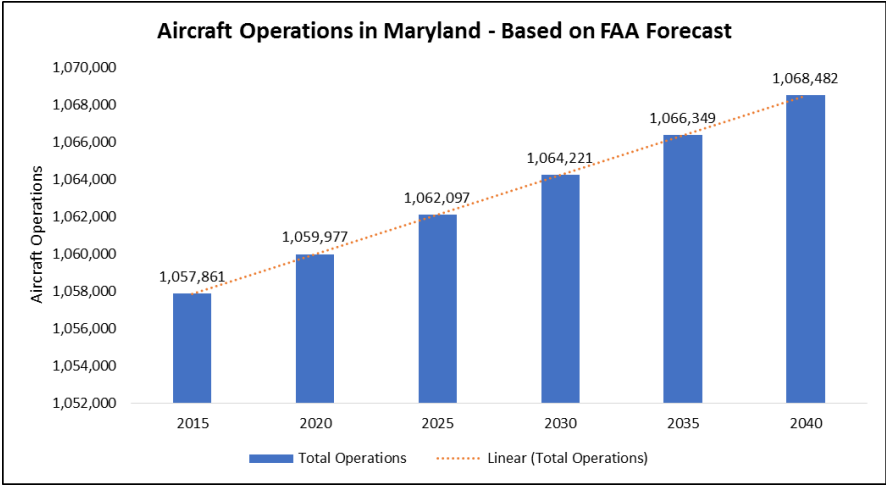
Source: FAA APO Estimates

Figure 5: Aircraft Operation for the State of Maryland
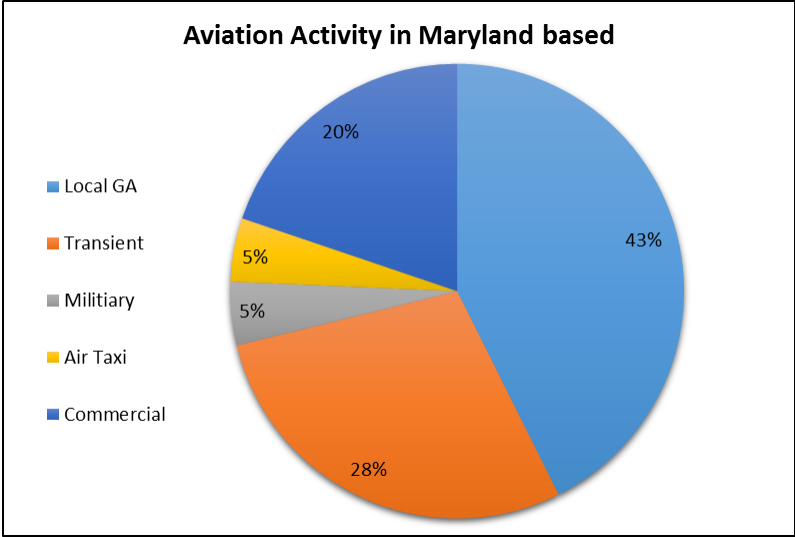
Source: Maryland Economic Impact of Airports - Final Report, 2015

5. Competing airports

5.1. Airports in Maryland

Current aeronautics statistics indicate that there are 141 airports in the State, of which 36 are public use (or general aviation) facilities, with 3,000 civil aircrafts based at system airports, and over 8,000 active pilots and flight instructors. In the 'Airports Categorization" report by FAA, airports are classified as below and depicted in Figure 6.

1. **Air Carrier Airports:** A business using the airport for the transport of passengers or goods and operating under the terms and conditions of Federal Aviation Regulations (FAR). [22] There are 3 air carrier airports in Maryland.
2. **Reliever Airports:** Airports designated by the FAA to relieve congestion at commercial service airports and to provide improved general aviation access to the overall community than standard general aviation airports. These may be publicly or privately-owned. There are 6 reliever airports in Maryland and 5 of them appear to compete with Tipton's geographic market.
3. **General Aviation Airports:** Public-use airports that do not have scheduled service or have less than 2,500 annual passenger boardings (49 USC 47102(8)). Currently Maryland has 16 general aviation airports.
4. **Local Airports:** Local Airports include facilities that support small general aviation aircraft. Single-engine aircraft represent the primary aircraft type; however, some light twin-engine aircraft are also accommodated. There are 9 local airports in Maryland.
5. **Special Facility:** Special Facilities serve unique aviation roles in the system. Havre de Grace Seaplane Base and Pier 7 Heliport are included in this category.

In this section, aircraft operations have been classified into local general aviation, itinerant, military, air taxi, and commercial. Itinerant or transient aircrafts are "home based" elsewhere but may park or hangar at the airport for short periods of time.

Figure 6: Maryland System Airports

Source: Wilbur Smith Team, Maryland Aviation System Plan, 2008

5.2. *Airports Analogous to Tipton Airport*

General aviation airports not only have to compete with each other but also with other regional and international airports. Among the airports shown in the Figure 6, 5 were identified as analogous to Tipton Airport, based on discussion with the Tipton Airport Authority and the Maryland Aviation Administration. These airports were identified based on their classification, proximity to major metropolitan areas, and runway length. The following pages briefly summarize each analogous airport, and the section ends with a comparative summary table, with additional details in Appendix H. To provide a sense of scale, the report also includes BWI Airport in the description although it clearly operates at a different level. Of the 5 competing airports, only Tipton has significant onsite expansion opportunities.

1) Frederick Municipal Airport
2) Lee Airport

3) Martin State Airport
4) Carroll County Regional Airport
5) Montgomery County Airpark
6) Baltimore/Washington International Thurgood Marshall

Figure 7 shows the aviation activity at each of these airports as a percentage of the State as a whole (excluding BWI). Data for aircraft operations at these airports is retrieved from Aircraft Owners and Pilots Association, Federal Airport Administration as of 2016, and the Maryland Aviation Administration.

Figure 7: Capture of Aviation Activity of Airports Analogous to Tipton Airport
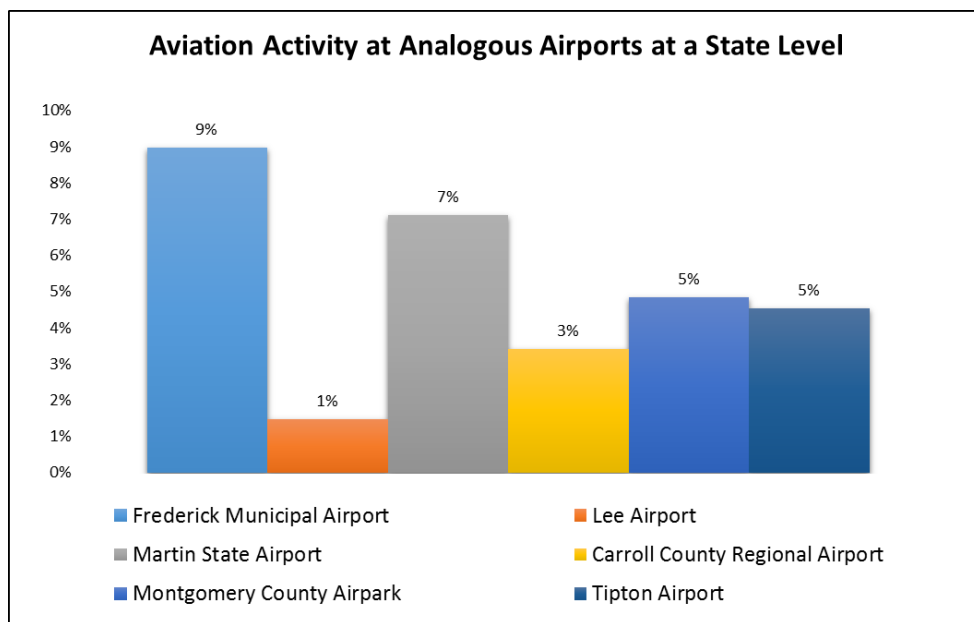
Source: Maryland Economic Impacts 2015, MAA

5.2.1. Frederick Municipal Airport

The airport is categorized as a reliever airport and is publicly owned by the City of Frederick. It is almost equidistant from Baltimore, Washington, D.C., and Virginia and handles an average of 260 flights per day. It offers several services such as fuel sales, hangars and tie-downs, major airframe and power plant service, high/low bottled oxygen, glider operation, avionics service, and aircraft rental and sale, and a flight school. The airport additionally has covered night storage, de-icing, and snow removal.

With two runways of 5,219 feet and 3,600 feet, it has 189 aircrafts based on field: 156 single- and 15 multi- engine airplanes, 6 jets, and 12 helicopters. The passengers also have access to additional services, including food service, public transportation, and rental car services. The closest transit is

the Frederick train station, which is 1.8 miles from the airport. The airport is surrounded on most sides by non-residential uses that include commercial, office, industrial west of the airport, and recreational and private open spaces north of the airport. There are some low- and medium-density residential uses farther west of the airport, which may limit the airport's expansion. [26]

Frederick airport activity comprises 54% general aviation, 40% itinerant, 4% air taxi and 1% military. The airport contributes to 11% of the general aviation, 13% of itinerant, 3% military, and 8% air taxi operations at a regional level, making up 9% of the total general aviation operations in Maryland.

This airport is relevant to the analysis because it is one of Maryland's reliever airports with the most developed facilities and highest usage. Although is it farther from metropolitan areas compared to Tipton, Frederick Airport has the highest number of aircraft operations compared to the other airports in this analysis, possibly because it has two runways, its runway length, and the number of services provided.

Figure 8: Frederick Municipal Airport

Source: Google Maps

5.2.2. Lee Airport

Lee airport is categorized as a general aviation airport, but not a reliever airport, and is privately owned by the Lee Airport Authority. It is 31 miles from Baltimore and Washington, D.C. and 40-50 miles from Virginia. It offers several services such as fuel sales, hangars and tie-downs, major airframe and power plant service, and aircraft rental and sale. The airport additionally has covered night storage and snow removal. With a runway of 2,500 x 48 ft., it has 82 aircraft based on field: 80 single- and 2 multi-engine airplanes. The airport also provides additional services such as flight

training, and four eateries at the airport. The airport is surrounded on most sides by residential and mixed-use development and by Beards Creek in the northwest. This creates a major limitation for airport expansion.

Airport activity comprises 84% general aviation, 13% itinerant, 3% military. The airport contributes to 3% of the general aviation, 1% of itinerant and military, making up 1% of the total general aviation operations in Maryland.

The proposed runway extension will enable Tipton Airport to expand its service area. With Lee airport's proximity to Annapolis, Tipton Airport should consider it as a competing airport, when Lee plans to expand its service area to Annapolis.

Figure 9: Lee Airport

Source: Google Maps

5.2.3. Martin State Airport

Martin State Airport is categorized as a reliever airport and is publicly owned by the Maryland Aviation Administration. It is 22 miles from Baltimore, 55 miles from Washington, D.C., and 60 miles from Virginia. It handles an average of 229 flights per day. It offers several services such as fuel, hangars with paved and turf tie-downs, major airframe and power plant services, air taxi and charter, avionics and aircraft sales, air ambulance, corporate flight departments, and flight training. The airport also provides covered overnight aircraft storage, deicing, and snow removal. With a

runway of 6,997 x 180 feet and a 65-foot helipad Martin, has 240 aircraft: 166 single- and 25 multi-engine planes, 14 jets, and 11 helicopters. Passengers have access to additional services such as food service, pilot/passenger lounge, snooze room, conference room, courtesy van, public shuttles, limousine, and rental car service. The airport is surrounded by Middle River and high-density mixed-use and residential development. This creates a major limitation for airport expansion.

Airport activity comprises 38% general aviation, 56% itinerant, 6% military, and 2% corporate. The airport contributes to 6% of the general aviation, 14% of itinerant, 9% military, 3% air taxi, and 100% of commercial operations at a regional level, making up 7% of the total general aviation operations in Maryland.

The airport has higher number of aircraft operations compared to Tipton even though it is farther away from important metropolitan areas compared to Tipton. This could be due to greater runway length, superior services, and more based aircrafts, as compared to Tipton airport, and thus is relevant to this analysis.

Figure 10: Martin State Airport

Source: Google Maps

5.2.4. Carroll County Regional Airport

Carroll County Regional airport is categorized as a reliever airport and is publicly owned by Carroll County. It is 38 miles from Baltimore, 67 miles from Washington, D.C., and 59-63 miles from Virginia. It handles an average of 99 flights per day. It offers several services such as fuel sales, hangar and tie-

downs, major airframe and power plant service, high/low bottled oxygen, air taxi and charter flights, aircraft rental and sale, and flight school. The airport additionally has covered night storage, deicing and snow removal. The airport has a runway of 5,100 x 100 feet, and 102 aircraft based on field: 83 single- and 14 multi-engine airplanes, 3 jets and 2 helicopters. The closest transit is the Owing Mills train station, which is 20.2 miles from the airport. Compared to Frederick, Lee, and Martin State airports, this airport has more space for expansion since it has only a few office buildings to the east and is surrounded by open space on the other three sides.

Airport activity comprises 74% general aviation, 25% itinerant, less than 1% of military, and 1% air taxi. The airport contributes to 6% of the general aviation, 3% of itinerant, 10% air taxi, and less than 1% of military of the total general aviation operations in Maryland.

Although the airport's aircraft operations are lower than those at Tipton airport, it generates much higher business revenue. It is important to consider the services provided at this airport for a comparative analysis with Tipton Airport.

Figure 11: Carroll County Regional Airport

Source: Google Maps

5.2.5. Montgomery County Airpark

The Montgomery County Airpark is categorized as a reliever airport and is publicly owned by the Montgomery County Revenue Authority. It is 43 miles from Baltimore, 26 miles from Washington, D.C., and 23-29 miles from Virginia. It handles an average of 131 flights per day. It offers several

services such as fuel sales, hangars and tie-downs for parking, minor airframe and major power plant service, low bottled oxygen, charter flights, avionics service, aircraft rental and sale, and a flight school. The airport additionally has covered night storage and snow removal. With a runway of 4,202 x 75 feet, it has 146 aircraft based on field: 128 single- and 14 multi-engine airplanes, 3 jets and 1 helicopter. The passengers also have access to additional services such as pilot supplies, pilot lounge, outside deck for viewing aircraft, and van and rental car service. The closest transit is the Shady Grove Metro station, which is 3.4 miles from the airport and the Gaithersburg MARC train station, which is 4.5 miles from the airport. The airport is surrounded on most sides by residential development, which limits any future expansion plans. However, there are smaller open spaces toward the airport's north side, which may be used for expansion.

Airport activity comprises 54% general aviation, 30% itinerant, and 16% air taxi. The airport contributes to 6% of the general aviation, 5% of itinerant, and 18% air taxi, with a 5% of the total general aviation operations in Maryland.

With a similar number of based aircrafts, this airport has a higher number of aircraft operations than Tipton Airport. Since it has similar runway length to Tipton's planned runway extension, it is important to consider this in a comparative analysis of services and service area.

Figure 12: Montgomery County Airpark
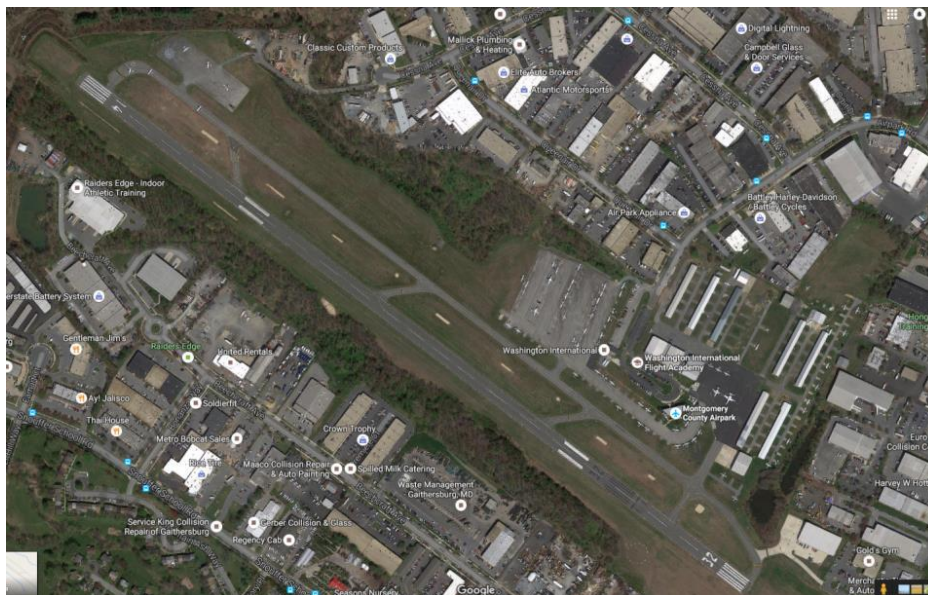
Source: Google Maps

5.2.6. Baltimore/Washington International Thurgood Marshall Airport (BWI)

BWI Airport is categorized as an air carrier airport and is publicly owned by the State of Maryland. It is 12 miles from Baltimore, 31 miles from Washington, D.C., and 36-38 miles from Virginia. It handles an average of 675 flights per day. It offers several services such as fuel sales, hangars and tie-downs, major airframe and power plant service, high/low bottled oxygen, air taxi and charter flights, avionics service, and aircraft rental and sale, and flight school. The airport additionally has covered night storage, deicing and snow removal. With three runways of 10,502 x 150 feet, 9,500 x 150 feet, and 5,000 x 100 feet, the airport has 76 aircraft based on field, 73 single- and 2 multi-engine airplanes. The passengers also have access to additional services such lockers, nursing, pet relief areas, and van and rental car service. The airport also provides courtesy car service and the closest transit is the BWI Light Rail service, which is 1.7 miles away.

Airport activity comprises of less than 1% of local general aviation, 6% itinerant, less than 1% military, 11% taxi and 82% commercial. The airport contributes to less than 1% local general aviation, 5% itinerant, 3% military, 54% air taxi and 97% commercial, with a 23% of the total general aviation operations in Maryland.

Tipton Airport acts as a reliever to this airport and so is relevant to this analysis. BWI wishes to send more of its GA traffic to reliever airports, which is a market opportunity for Tipton.

Figure 13: BWI Airport

Source: Google Maps

5.3. Analogous Airport Analysis – Summary

Table 8 is a comparative analysis of the previously described airports, with details categorized into:
- Operational Characteristics: the average aircraft operations per day, runway length, and total aircraft operations.
- Hangars: the number of T-hangars and conventional hangars.
- Current Attributes: Airports are scored based on attributes such as location, service, performance, and site capacity. The scale of scoring is 1-3, 1 being the highest. The scoring is based on Table 1-6, Services at System Airports, and Table 3-6 for scoring the performance, in the 2008 Maryland Aviation System Plan [9]. Each check mark in each table for the airports below is counted and the totals are divided into high, medium, and low. These tables are included as Appendix G. Location scores are based on proximity to the core job and population centers of Maryland along the I-95 corridor including Baltimore and Washington, D.C.

Based on the table, Frederick Municipal airport outscores the other airports and Tipton is in the middle of the group. Clearly, Tipton Airport has the potential for increased runway length, improvements in airport services, construction of T-hangars and conventional hangars and more. However, even with this potential, whether and how much it can move up in its capture depends on the outlook for aviation generally and on demand in Maryland specifically. As mentioned above, most of these airports have no space or very limited space for expansion, unlike Tipton Airport, which can use available surrounding space for further expansion. Tipton can also consider providing value added services like those provided at Frederick Municipal Airport, Montgomery County Airpark, and Martin State Airport, to attract more flyers.

Table 8: Summary of the Airports Analogous to Tipton Airport

Airport	Operational Characteristics (2015)				Hangars (2015)		Current Attributes (1=best; 3 = worst)			
	Ops/day	Based aircraft	Runway (feet)	Total ops 2015	T-hangars	Convention al hangars	Location score	Services score	Perform score	Site capacity
Frederick Municipal Airport	260	189	5219	94,901	125	3	3	1	1	No
Martin State Airport	229	240	6997	73,766	190	14	2	1	1	No
Montgomery County Airpark	131	146	4202	51,097	80	5	2	2	2	No
Tipton Airport	130	106	3000	47,906	0	4	1	3	3	Yes
Carroll County Regional Airport	99	102	5100	36,090	14	7	3	3	2	No
Lee Airport	43	82	2500	15,528	44	0	3	2	3	No

6. Summary of Opportunities and Constraints

The following listing of opportunities and constraints is based on location and context analysis, airport services, FAA records and recommendations, and discussions with interviewees and the 2010/2012 Tipton consultants.

Strengths
1. The airport is optimally located adjacent to major interstate and State routes and is the largest general aviation airport between Washington, D.C., and Baltimore, increasing its accessibility to important metropolitan areas.
2. Fuel sales are one of the biggest revenue generators for Tipton Airport. It charges less for fuel compared to other general aviation and reliever airports in Maryland. This is a strength in a scenario where fuel charges do not decrease drastically.
3. The airport does not charge a non-commercial landing fee.
4. Tipton is an ideal airport for travelers who do not want to deal with the hassle of security, frequent delays, and traffic at the surrounding major airports. They can avoid the long security wait, baggage claim, parking and other logistic issues which are commonly experienced at regional airports.
5. The airport provides fixed base operator services, a key element for providing quality services to passengers.
6. The airport's improved and updated website content creates accessibility and visibility for potential users. Given that many people rely on Internet searches for their basic research, the website offers easy-to-find comprehensive information about facilities, pricing, and booking.

Weakness
1. The closest public transit to the airport is Odenton train station, 3.5 miles away.
2. Tipton Airport does not currently have any T-hangar units. However, the airport has received approval from the FAA for two projects, the first being construction of 22 T-hangars.
3. The airport does not have an air traffic control tower to keep detailed records of aircraft operations.
4. The airport does not have a customer survey/feedback and flight or client database.
5. A large portion of the airport is non-developable due to wetlands. The military base restricts development in the industrial area and around the airport .

Opportunities

1. It has the ability to expand not only the runway, but also hangars, aprons, and the terminal area.
2. Out of 111 acres, the airport has 11 acres of land available for airport-related development, which will help generate revenue.
3. The airport can lease some of its area for commercial activities, which will help add non-aeronautical activities.
4. The airport can provide flight training facilities. Even though the pilot population has been decreasing, student pilot certificates continue to increase. Having flight training will help improve number of recreational activities, further increasing fuel consumption.
5. The airport can provide services and amenities to flyers (such as a restaurant, improved lounge, etc.) to enhance its ability to attract patrons.

Threats
1. Planes have nearly doubled their fuel efficiency since 1978. While this is good for the industry, it is a negative factor for small general aviation airports that rely on fuel sales as a source of income.
2. Small general aviation airports may be ideal training grounds for new drone users. However, drones are illegal in this context and location.
3. Fuel prices have been dropping over the years. In a scenario where this continues, lower prices are a threat to the airport since fuel sales contribute to the airport's revenue.

7. Airport Demand

Section 2 presented the results and methodology of the 2010 Plan's projections for demand and noted how differently things turned out because of the impacts of the recession and broader industry trends. The difficulties of projecting demand in this volatile climate are obvious and severe. Accordingly, the approach has been to develop four demand scenarios, see how close the results are, and then develop a more secure and "triangulated" set of projections with a range of possibilities.

This section forecasts aircraft operations at Tipton Airport from 2016 to 2040. Projections in this section are based on an analytical process that uses more than one technique to generate more reliable results. Base data for the forecast is retrieved from FAA records. Aircraft operations have been forecasted based on the following scenarios:
1. Scenario 1: a straight-line projection of 2001-2015 Tipton trends.

2. Scenario 2: FAA records, in which general aviation operations are forecasted to increase by an average of 0.2% each year.
3. Scenario 3: the assumption of a 25% additional growth over national trends generated by airport improvements.
4. Scenario 4: based on population and employment projections.

Aircraft operations count either a takeoff or landing and is used to help measure overall airport activity and estimate future requirements. For this analysis only aircraft operations are used to forecast future trends.

7.1. Scenario 1: Straight line projection of 2001-2015 Tipton trends

Trend line and time-series projections are one of the simplest forecasting techniques. This scenario assumes that external factors will continue to affect general aviation demand as they have in the past. Table 9 shows a forecast of aircraft operations at Tipton based on the current operations and Figure 14 compares the forecasted aircraft operations from the Tipton Master Plan with forecast based on current operations. Focusing on the operations results, we see a total of 102,024 operations, the new 2040 trend line being slightly flatter than that of the 2010 plan which used 2001-2007 as its basis. The average growth rate based on this forecast is approximately 3% per year. (Forecasts from 2016 to 2040 are in Appendix E.)

Table 9: Forecast for Aircraft Operations at Tipton Airport based on Historical Trends

Year	Forecast for Aircraft Operations
2015	47,906
2020	62,799
2025	72,606
2030	82,412
2035	92,218
2040	102,024

Figure 14: Comparison of Forecast from Scenario 1 and Tipton Master Plan
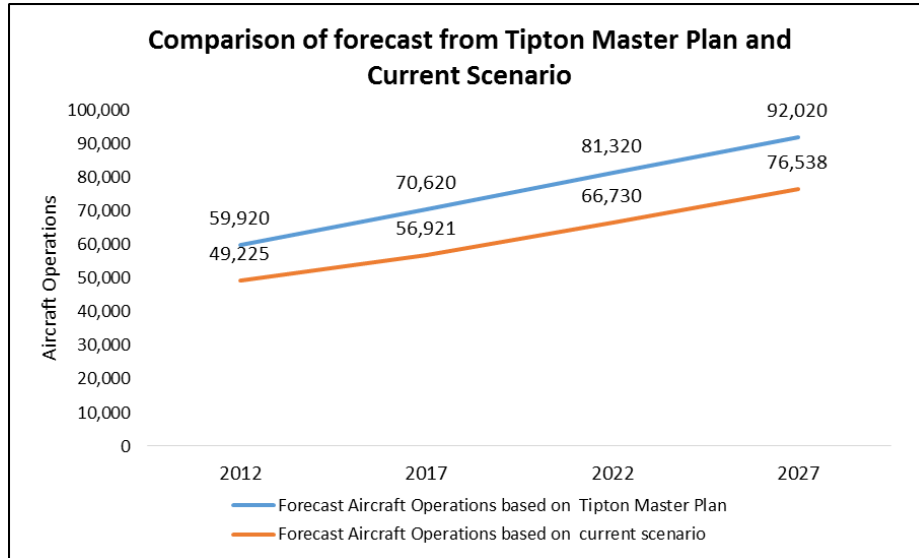
Source: Tipton Master Plan 2010

7.2. Scenario 2: Projection based on FAA Trends

As reported by FAA, general aviation operations are forecast to increase by an average of 0.2% a year. This scenario forecasts future growth based on that national annual average growth. The base data is for the year 2015 and aircraft operations are projected with an increment of 0.2% for each year. With an annual growth of 0.2%, the aircraft operations at Tipton are projected to increase to 50,360 by 2040. Table 10 shows projections based on this scenario and Figure 15 shows the forecasted trend.

Table 10: Forecast for Aircraft Operations at Tipton Airport based on FAA Forecast

Year	Tipton Aircraft Operations
2015	47,922
2020	48,403
2025	48,889
2030	49,380
2035	49,876
2040	50,376

Figure 15: Trend in Forecasted Aircraft Operations at Tipton Airport based on FAA Forecast
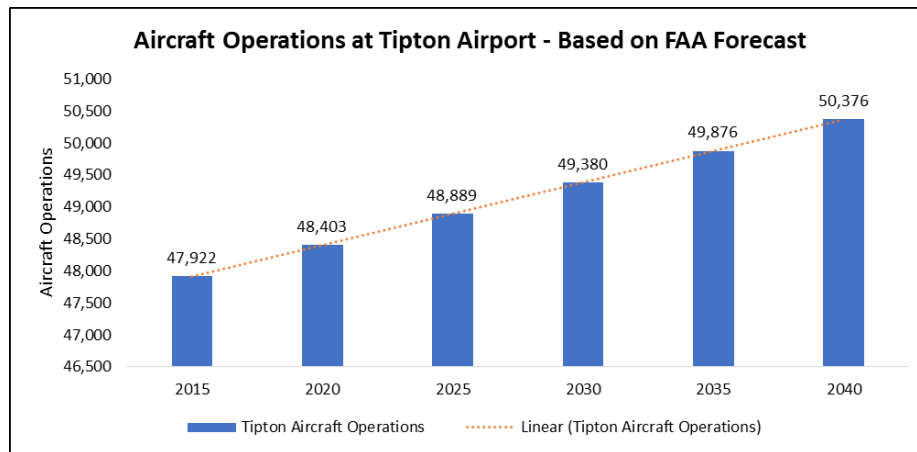
7.3. Scenario 3: 25% More Growth over Trends from Improvements at Airport

The County's Economic Development team expects an increase in economic activity in and around the airport over time. There are several business development plans that could generate approximately 10 million square feet of office development within 5 miles of the airport. This should boost the aircraft operations. The airport will also begin the construction of its T-hangars for single-engine aircraft next year and they anticipate building the second T-hangar by 2018. There is also an opportunity for a biomedical firm to explore an office development plan near the airport. With the increase in runway length, the airport can expect frequent flying activities, which will boost annual revenue. Assuming improvements are also made to airport services, this very much more competitive posture will increase market capture rates.

Considering these developmental factors and an average growth rate of 0.2% for each year as forecasted by FAA, this scenario assumes that Tipton increases its growth rate by an additional 25%

based on runway expansion and service improvements. With this additional increase, aircraft operations are forecasted to increase to 62,971 by 2040. As of 2015, Tipton airport has 98% local general aviation activities while itinerant, military, and air taxi make 2% of its total activities. Depending on future changes, this percentage of activities could change. In a scenario where general aviation activity increases, the total number of operations would increase and this scenario's 25% increment could further increase. Table 11 shows aircraft operations based on the FAA forecast and an additional 25% increase. Figure 17 compares aircraft operations based on current operations, forecast at 0.2% annual growth, and an additional 25% increase every year to 2040.

Table 11: Forecast for Aircraft Operations at Tipton airport based on 25% additional increase

Year	Tipton Aircraft Operations
2015	61,583
2020	60,504
2025	61,111
2030	61,725
2035	62,345
2040	62,971

Figure 17: Aircraft Operations at Tipton Airport based on FAA forecast and additional 25% increase
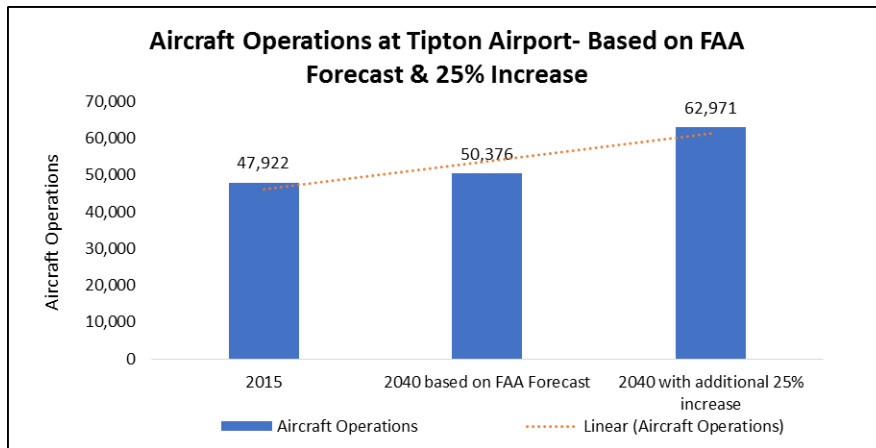
7.4. Scenario 4: Based on Projections for Population and Employment

Some of the factors that influence demand at an airport include the socioeconomic characteristics of the service area, the level of service and facilities provided compared to other airports, and location with respect to demand generators for originating or transient users and passengers.

County population and employment are significant demographic variables that may affect aviation activity at general aviation airports. With 564,195 people, Anne Arundel County is the 4th most populated county in Maryland with a projected growth rate of 4% from 2015 to 2020. It had a total of 13,881 employers in 2014 with a very low unemployment rate of 3.5 as of September 2016. [16]

This scenario is based on the forecast for population and employment from 2015 to 2040 prepared by the Maryland Department of Planning. Historic data are from U.S. Bureau of Economic Analysis, Table CA-25N, November 2014. Population and employment is projected for every 5 years from 2015 to 2040. The projected aircraft operations are directly proportional to the projected growth in employment and population. The aircraft operations are projected to increase between 54,935 to 56,135 by the year 2040. Figure 18 shows the increase in aircraft operations based on population and employment. With an average growth of 3% in population and employment every 5 years, from 2015 to 2040, aircraft operations are projected to increase between 15-17% by 2040.

Figure 18: Forecast Aircraft Operations at Tipton Airport based on Population and Employment
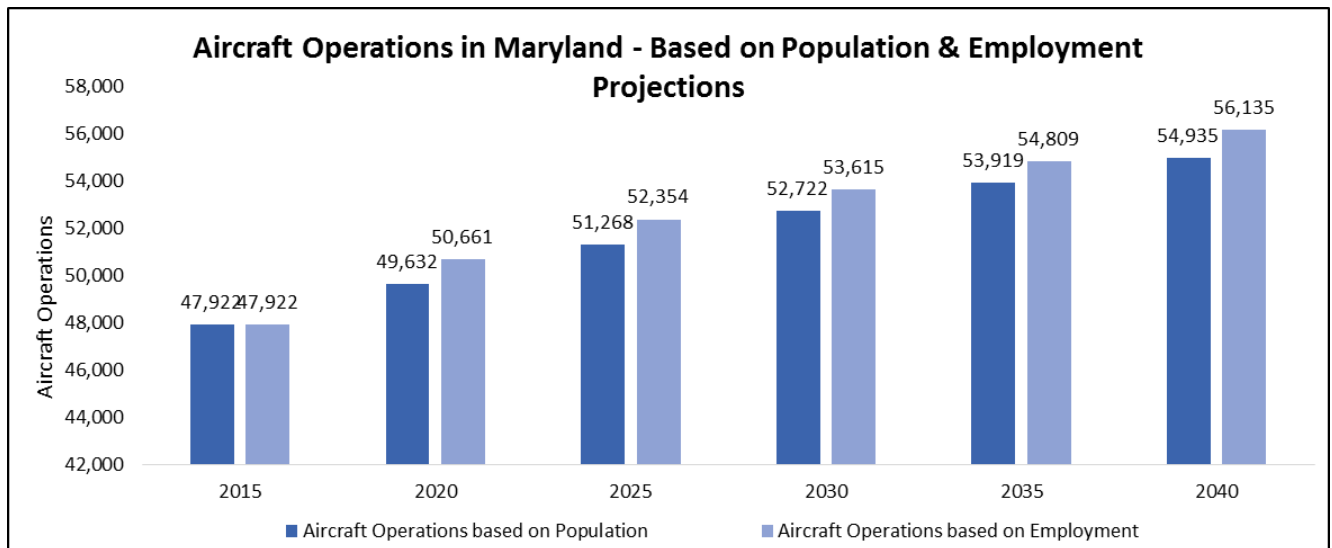
Table 11: Forecast for Aircraft Population in Maryland based on population projections

Table 12: Forecast for Aircraft Population in Maryland based on Employment projections

Year	Population	Growth	Aircraft Operations based on Population
2015	6,010,150		47,922
2020	6,224,550	4%	49,632
2025	6,429,750	3%	51,268
2030	6,612,200	3%	52,722
2035	6,762,300	2%	53,919
2040	6,889,700	2%	54,935

Year	Employment	Growth	Aircraft
2015	3,552,200		47,922
2020	3,755,200	6%	50,661
2025	3,880,700	3%	52,354
2030	3,974,200	2%	53,615
2035	4,062,700	2%	54,809
2040	4,161,000	2%	56,135

7.5. Summary of Forecasts

Considering all the scenarios, Tipton airport can expect approximately 60,000 to 65,000 aircraft operations by 2040. This is a realistic number of aircraft operations based on runway expansion and service improvements, an increase in economic activity around the airport, and other socioeconomic and demographic factors.

However, it is important to note that there are fewer pilots. Thus, population increase does not necessarily increase general aviation activities. Hence, the multiple scenarios and a comparative study of other Maryland airports helps make a realistic judgment of projected aircraft operations by 2040.

These scenarios are based on the assumption that fuel prices remain steady. Stark changes in the fuel price will affect aviation activity negatively. An increase in fuel price may threaten flying activities, while a decrease in price will affect Tipton Airport's annual revenue. These scenarios are thus based on assumptions of steady growth in employment, economic activity, and fuel price. Table 14 provides forecast details from the Tipton Master Plan and all the scenarios.

Table 14: Comparison of Aircraft Operations Forecast based all Scenarios

	Based Aircrafts	Aircraft Operations
Conditions in 2007 and 2015	115 (2007) 106 (2015)	49,225 (2007) 47,906 (2015)
1. Master Plan 2010: Based aircraft: Straight line 2001 – 2007; Ops 2007 OPBA ratio used to 2027	215 (2027)	92,000 (2027)
2. Based on straight line of historical trends: 2001 - 2015		102,040
3. Tipton as a % of MD projections (from FAA growth rate of 0.2% p.a.)	139	50,376
4. Same as above but Tipton increases growth by 25% based on improvements at the airport		62,971
5. Based on Population and Employment projections for MD to 2040		54,935 – 56,135

8. Implications for Facility Planning

The 2010 Tipton Master Plan provided a forecast on aircraft storage requirements. Table 15 lists the historical and current number of based aircraft at Tipton Airport and Table 16 lists the forecast for aircrafts from the Master Plan. The projections estimated 215 based aircrafts by 2027.

Table 15: Based Aircrafts at Tipton Airport

Year	Based Aircrafts
2001	72
2002	97
2003	99
2004	121
2005	113
2006	111
2007	115
2008	95
2009	110
2010	110
2011	110
2012	112
2013	111
2014	112
2015	111
2016	106

Table 15: Forecast of Based Aircrafts from Tipton Master Plan

Year	Forecast of aircrafts from Master Plan
2008	120
2012	140
2017	165
2022	190
2027	215

With forecasted aircraft operations approximately 63,000-62,950 by 2040, the Tipton Master Plan the aircraft operations were estimated based on number of based aircrafts. The number of

operations per based aircraft was computed by multiplying a constant of 428 with the forecasted aircraft operations (constant = current aircraft operations/current number of based aircraft). Using the same methodology, there were 106 aircrafts and 47,906 aircraft operations in 2015, which gives a constant of 452. Using this 452 as a constant, Table 17 shows projections for number of based aircrafts, projected to be 139 by 2040.

Table 17: Projections for Based Aircrafts

Year	0.2% Increase in Aircrafts Operations	25% Increase in Aircraft Operations	Number of Based Aircrafts
2020	48387	60484	134
2025	48873	61091	135
2030	49363	61704	137
2035	49859	62324	138
2040	50360	62950	139

Using the ratio of number of aircrafts to hanger from the Tipton Master Plan, a total of 36 T-hangars will be required for 139 based aircrafts. Using the same aircraft projections, the Tipton Master Plan also recommended 121,473 square feet of storage space for conventional hangars. Under the same methodology for the projected conventional hangar storage space, 139 based aircrafts will require a total space of approximately 79,000 square feet for conventional hangar storage. Table 18 lists forecasted aircrafts and hangar spaces based on the Tipton Master Plan and current scenario.

Table 18: Required Aircraft Storage based on Projected Based Aircrafts

Year	Number of aircrafts	Number of Hangers	Convetional Hangar Space (Sq. Ft)
2010 Master Plan	215 in 2027	56	121473
Revised Projection	139 in 2040	36	78957

9. Recommendations

By extending its runway, Tipton Airport has the potential to increase its air traffic. Considering that Tipton services light and medium general aviation, the additional 1,200 feet will help attract those flights which could not previously land due to length limitations. Other factors that influence the demand for aviation activity include the socioeconomic characteristics, the level of service and facilities compared to other airports in the region, and its location near demand generators.

Based on the findings on general aviation trends, SWOT analysis, forecasting scenarios, and a comparison with other general aviation airports in Maryland, this section provides recommendations for future development. These recommendations also consider the Federal Aviation Administration recommendations for general aviation airports, mentioned in the MAA's 2008 Maryland Aviation System Plan. Further recommendations consider the potential need for future facilities.

1) Management
   a) Maintaining customer feedback

   The goal of any business is to foster and build a strong relationship with its customers. Customer service surveys help understand general problems and unmet needs. With runway extension, customer feedback will help develop effective strategies to retain current customers and attract new ones. Surveys will also provide insight and ideas on generating revenue for the airport. This recommendation will help measure the performance of the airport and verify if the airport has met its goals, as stated in the Tipton Business Plan.

   b) Maintaining a database of clients and flights

   Currently the airport authority does not maintain a database of clients or flight information such as frequency, purpose of flying, number of passengers traveling, and destination. Maintaining a database will help keep an up-to-date record of current customers. It will help study the current client base and retain existing customers. It will also help build loyalty and generate referrals from satisfied customers, tracking potential customers.

2) Operational Services
   a) Mechanical services and facilities

   Tipton airport can begin to service avionic repairs, and sell and repair radios, navigation instruments, and other gear. Currently Frederick Municipal Airport, Martin State Airport,

and BWI provide this service. Tipton Airport can generate revenue gains by providing this service.

b) Flying school/Flight training

FAA forecasts an increase in the number of pilots and the interest in flying because of the Sport Aviation rule. [9] Flight training is available at 22 airports in Maryland. Frederick Municipal Airport, Martin State Airport, Carroll County Regional Airport, and BWI have flight training facilities, while Lee Airport and Montgomery County Airpark have flight instruction facilities. A flight instruction facility is based in the field while flight training is given to pilots in their own aircraft. As mentioned in the general aviation outlook section, while private and commercial pilot categories had a declining trend, student pilot certificates continued to increase. [8] Flight training services will help attract passengers and encourage recreational activities. With the increase in recreational activities, fuel sales will rise, particularly since recreational activities use more fuel than business activities. This will further boost the Airport's revenue, most of which is generated from fuel sales.

c) Quality services

Airport experts stated that frequent flyers choose an airport based on proximity to their destination and the quality of airport services. They may not necessarily choose the cheapest but will choose service quality over cost. Tipton Airport needs to redefine its value by increasing some its services to secure a stronger place in the market. Frederick Municipal Airport, Lee Airport, Martin State Airport, Montgomery County Airpark, and BWI have additional services such as deicing, snow removal, food service, and covered overnight storage. Tipton Airport will benefit from adding these services to improve their clientele base. Passengers will return to the airport if they have a positive experience. Along with the runway extension, quality services are directly linked to customer retention.

3) Customer Services

a) Shuttle service

Providing a shuttle service from the airport to destinations within a specific area will help ease the passenger trip, making it more productive. BWI provides a courtesy service to its passengers. For some customers, providing hangars with heating services or de-icing capability may not be as important as the available hangar space or a shuttle service. Either a shuttle service to important stops or a bus route connected to existing public transportation and surrounding areas will help.

4) Construction
   a) Fence around the airport
   The 2008 Maryland Aviation System Plan lists fencing around property as a general facility objective recommended to support each airport's role, [9] and was identified as an objective for all local, general, reliever, and air carrier airports. Fencing will provide additional security as well as reduce wildlife incursion. Passengers may consider this as an additional service. Fencing an entire perimeter may not be necessary or economically feasible and partial fencing may also serve the purpose, such as fencing the terminal area, aircraft storage, and maintenance areas. [19]

   b) T-Hangars
   In a general discussion of facilities, the FAA's system evaluation mentions that all airports should have some form of aircraft storage to protect based aircrafts from weather, vandalism, theft, etc. With the current Environmental Assessment (EA) in progress and the FAA's approval to construct 22 T-hangars, building hangars will help increase the customer base.

   c) Renovation of the operations building
   The airport operations building or terminal is an important facility that needs substantial modernization to provide the services passengers expect. Tipton Airport was originally a military airfield and was constructed in 1960 over a landfill. Building renovation will allow significant improvements in air services that are important to customers. Maintenance and cleanliness of an airport help maintain customer satisfaction and encourage return visits. The airport needs modern equipment and interior finishes. Improvements in indoor quality, improved lighting, and comfortable spaces can provide a safer and more pleasant work environment. Modernization also offers an opportunity for the terminal to consider energy conservation measures that allow operations at reduced costs while improving services.

   d) Air traffic control tower
   Control towers contribute to airport safety and efficiency. A tower is not necessarily needed for an airport to serve a specific aeronautical function. Some airports can be used for several different functions and by different types of aircraft even with a short runway, no control tower, and no fuel services. [11] The Maryland Aviation System Plan reports that 67% of the State's reliever airports meet the air traffic control tower objective. Frederick Municipal Airport and Martin State Airport, based on their annual operations justify a tower. Tipton Airport may benefit from a tower within the near-term.

e) Ultimate runway extension

A 5,000-foot runway, which seems like the maximum possible given site boundaries, would allow Tipton to accommodate a larger mix of corporate jet aircraft. The feasibility of a 5,000-foot runway has not been studied in depth as there has not yet been the justification for it. If the Tipton is successful in extending the existing runway to 4,200 feet, analysis may then be warranted to determine if a 5,000-foot runway is prudent. A runway this long would probably fall under an "ultimate" set of airport goals, beyond the next 20 years.

5) Other non-aviation activities

MAA experts said that non-aviation activities have increased in recent years and have become increasingly important for airports. Airports are no longer providing only infrastructure for aircrafts and airlines, but have diversified their revenue streams. Non-aviation activities include fuel sales, hangar leases, agricultural leases, etc. Tipton already provides fuel, and tie-down and hangar services. However, it can explore activities that are not tied to passengers or aircrafts. Out of the total 366 acres available at the airport, 11 acres could be used for development. The potential for commercial office development appears strong and should be explored further.

Tipton could consider retail, services, food and beverage, parking, and passenger access as revenue generators.

a) The closest restaurant is a mile from the airport. Having refreshments at the airport as do Frederick Airport, Lee airport and Montgomery County Airpark, will ease a customer's travel.

b) According to the 2010 Tipton Airport Master Plan, there are 216 auto parking spaces at the airport for airport employees, tenants, and the public. Considering that parking is a reliable funding source for airport operators, the airport can plan to provide premium parking services, enhance its current parking lots, and provide parking for non-airport use.

c) Tipton can also generate revenue by leasing its space for non-aviation activities such as manufacturing, warehousing, freight forwarding, golf course land lease etc. Commercial development and land uses have been implemented through coordinated planning efforts and consideration of FAA restrictions on land development. [15]

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[26] The City of Frederick, Maryland, http://www.cityoffrederick.com/231/Comprehensive-Planning

[27] Baltimore County Government, http://www.baltimorecountymd.gov/

11. Appendix

Appendix A

Detailed description of the airports analogous to Tipton Airport

	Tipton Airport Authority	Frederick Municipal Airport	Lee Airport	Martin State Airport	Carroll County Regional	Montgomery County Airpark	BVI
Distance from Tiptop		49	20	36.1	48	34	13
Distance from Washington DC (Miles)	19	48	31	22	38	43	12
	23	46	31	55	67	26	31
Distance from Virgina	30-37	46-49	38-50	60-65	59-63	23-29	36-38
Service Level	Reliever	Reliever	General Aviation	Reliever	Reliever	Reliever	Air Carrier
Services	Fuel, paved tiedowns and hangars, minor airframe, minor powerplant, pilot supplies, air taxi/charter	Fuel, hangars and paved tiedowns, major airframe, major powerplant, high/low bottled oxygen, flight training, glider operations, charter flights, avionics service, aircraft rental and sales, engine repair, air taxi, covered overnight storage, deicing, snow removal	Fuel, T-hangars and turf tiedowns, major airframe, major powerplant, flight instructions, aircraft rentals, flight training, air taxi, covered overnight aircraft storage, snow removal	Fuel, community and T-hangars, paved and turf tiedowns, major airframe and powerplant service, flight instructions, air ambulance, corporate flight departments, air taxi/charter, avionics sales, aircraft sales, covered overnight aircraft storage, deicing, snow removal	Fuel, tiedown and hangars, major airframe, major powerplant, high/low bottled oxygen, aircraft rental and sales, flight instructions, air taxi/charter, flight training	Fuel, tiedown and hangars, minor airframe, major powerplant, low bottled oxygen, flight instructions, aircraft rental and sales, charter flights, corporate flight departments, air taxi/charter, covered overnight aircraft storage, snow removal	Fuel, hangars and tiedowns, major airframe, major powerplant, high/low taxi/charter, US. customs, avionics sales, aircraft rental and sales, covered overnight aircraft storage, deicing, snow removal, flight instructions
Length of runways	3000 x 75 ft.	5219 x 100 ft., 3600 x 75 ft.	2500 x 48 ft.	6997 x 180 ft., 65 x 65 ft.(Helipad)	5100 x 100 ft.	4202 x 75 ft	10502 x 150 ft., 9500 x 150 ft., 5000 x 100 ft.
Ownership	Publicly-owned, Tipton Airport Authority	Publicly-owned, City of Frederick	Privately-owned, Lee Airport Authority LLC	Publicly-owned, MAA	Publicly-owned, Carroll county comm	Publicly-owned, Montgomery county rev authority	Privately-owned, Freeway Airport Inc.
Control tower	No	Yes	No	Yes	No	No	No
Aircraft based on field	106	189	82	240	102	146	76
Single engine airplanes	89	156	80	166	83	128	73
Multi engine airplanes	6	15	2	25	14	14	2
Jet airplanes	0	6	0	14	3	3	
Helicopters	11	12	0	11	2	1	
Aircraft operations	Avg 130 / day	Avg 260 / days	Avg 43 / day	Avg 229 / day	Avg 99 / day	Avg 131 / day	Avg 675 / day
General aviation	98%	54%	84%	40%	74%	54%	1%
Transient general	2%	40%	13%	53%	25%	30%	6%
Air taxi	1%	4%		2%	1%	16%	11%
Militiary	1%	1%	3%		1%	1%	1%
Commercial							82%
Fees	Tiedown, parking	Tiedown, hangar		Tiedown, hangar, parking	Tiedowns, hangar	Parking, tiedown, hangar, ramp	Tiedown, ramp, hangar, landing, parking
Fuel	100 LL - $4.55, Jet-A - $3.15	100LL - $4.60, $5.35, Jet-A - $5.44	100LL - $5.50 (Full service)	100LL - $3.99/$4.19, Jet-A - $4.04	100LL - $4.33/$4.93, Jet-A - $4.60	100LL - $5.05/$5.60, Jet-A - $5.30	100LL - $8.31, Jet-A - $7.93
Number of restaurant	2 within 1 mile, 9 within 3 miles	1 at the airport, 14 within 1 mile, 4 within 2 miles	4 at the airport, 2 within 1 mile	1 within 1 mile, 5 within 2 miles	4 within 1 mile, 9 within 3 miles	2 at the airport, 7 within 1 mile	
Transportation	Limousine, enterprise rental cars, Odenton train station (3.5 m), Savage train station (4.4 m)	Limousine, enterprise rental cars, bay runner airport shuttle service (0.2 m), Frederick train station (1.8 m)		Van, Shuttle Bus, Limousine, enterprise rental cars, Edgewood (18 m), courtesy car	Owing Mills station (20.2 m)	Limousine, Van, rental car service, Washington Grove station (3.4 m), Gaithersburg train station (4.5 m)	Shuttle bus, limousine, van, rental car service, BVI Light rail (1.7 m), courtesy car
Maintenance facilities/Aircraft repairs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other service	Pilot lounge, flight planning conference room			Refreshments, pilot/passenger lounge, snooze room, conference room, courtesy van, de-icining		Pilot supplies, pilot lounge, outside deck for viewing aircraft	lockers, nursing stations, pet relief areas
Airport Activity	GA Local: 46850; GA Transient: 885; Militiary: 67; Air Taxi: 104	GA Local: 51627; GA Transient: 38177; Militiary: 1399; Air Taxi: 4058	GA Local: 13028; GA Transient: 2000; Militiary: 500	GA Local: 28385; GA Transient: 41280; Militiary: 4101; Corporate: 1416	GA Local: 26625; Militiary: 90; Air Taxi: 500	GA Local: 27418; GA Transient: 15329; Air Taxi: 8350	GA Local: 2081; GA Transient: 14730; Militiary: 1288; Air Taxi: 25783; Commercial: 202578
Revenue	Total jobs: 193, personal income: $12920, business revenue: $18859	Total jobs: 1059, personal income: $59585, business revenue: $110513	Total jobs: 48, personal income: $1815, business revenue: $2703	Total jobs: 2529, personal income: $152205, business revenue: $287791	Total jobs: 224, personal income: $10487, business revenue: $75965	Total jobs: 290, personal income: $11259, business revenue: $11839	Total jobs: 23419, personal income: $1559386, business revenue: $3242671
Hangar Information	T-hangars: 0, Convential: 4	T-hangars: 125, Convential: 3	T-hangars: 44, Convential: 0	T-hangars: 190, Convential: 14	T-hangars: 14, Convential: 7	T-hangars: 80, Convential: 5	T-hangars: 30, Convential: 3
Tie-downs	Paved: 120, grass: 0	Paved: 70, grass: 20	Paved: 0, grass: 94	Paved: 20, grass: 0		Paved: 200, grass: 50	Paved: 60, grass: 0
Inside FRZ/ADIZ	ADIZ	None	ADIZ	None	None	ADIZ	ADIZ
FBO	Tipton Airport Authority	Signature Flight Support	Lee Runway Manager	Martin State Airport	Skytech, Inc.	DC Metro Aviation Services	Signature Flight Support

Appendix B

Aircraft Operations at Airports in Maryland from Federal Aviation Administration, 2015.

Maryland Aviation Activities - 2015								
	Local GA	Transient	Military	Air Taxi	Commercial	Charter	Corporate	Total
Bay Bridge Airport	22400	12768	0	112	0	0	0	35280
Bennett Airport	1837	300	0	0	0	0	0	2137
Cambridge-Dorchester Air	2910	19742	450	0	0	0	0	23102
Carroll County Regional Airport	26625	8875	90	500	0	0	0	36090
Claremont Airport	8974	2840	723	89	0	0	0	12626
Clearview Airpark	13770	1530	0	0	0	0	0	15300
College Park Airport	2265	1554	200	0	0	42	0	4061
Crisfield-Somerset County Airport	1157	804	0	0	0	0	0	1961
Davis Airport	5100	100	0	0	0	0	0	5200
Easton Airport/Newnam Field	24580	27830	13622	1657	0	0	0	67689
Essex Skypark	7954	593	0	0	0	0	0	8547
Fallston Airport	3753	1251	100	0	0	0	0	5104
Frederick Municipal Airport	51267	38177	1399	4058	0	0	0	94901
Freeway Airport	23000	1000	100	15	0	0	0	24115
Garrett County Airport	7400	6500	250	300	0	0	0	14450
Greater Cumberland Regional Airport	11500	2500	300	0	0	0	0	14300
Hagerstown Regional Airport – Richard A. Henson Field	18659	22503	8704	5732	0	0	0	55598
Harford County Airport	13249	4416	175	0	0	0	0	17840
Havre de Grace Seaplane Base	0	30	0	0	0	0	0	30
Kentmorr Airpark	350	560	40	0	0	0	0	950
Lee Airport	13028	2000	500	0	0	0	0	15528
Martin State Airport	28385	41280	4101	0	0	0	1416	75182
Maryland Airport	15000	1000	1000	20	0	0	0	17020
Massey Aerodrome	3600	1200	350	0	0	0	0	5150
Mexico Farms Airport	825	436	0	0	0	0	0	1261
Montgomery County Airpark	27418	15329	0	8350	0	0	0	51097
Ocean City Municipal Airport	7400	29600	300	150	0	0	0	37450
Pier 7 Heliport	650	3000	0	0	0	50	0	3700
Potomac Airfield	10000	1999	0	0	0	0	0	11999
Ridgely Airpark	6500	5400	0	0	0	0	0	11900
Salisbury-Ocean City: Wicomico Regional Airport	11278	14347	13567	0	6614	0	0	45806
St. Mary's County Regional Airport	23707	15804	254	936	0	0	0	40701
Suburban Airpark	1500	10	0	0	0	0	0	1510
Tipton Airport	46866	885	67	104	0	0	0	47922
Washington Executive Airport/Hyde Field	5260	260	49	0	0	325	0	5894
BWI	2081	14730	1288	25783	202578	0	0	246460
Total	450248	301153	47629	47806	209192	417	1416	1057861

Appendix C

Aircraft Operation at all General Aviation Airports in Maryland

Forecast for GA Aircraft Operations In Maryland							
Year	Local GA	Itinerant	Militiary	Air Taxi	Commercial	Charter	Corporate	Total
2015	450248	301153	47629	47806	209192	417	1416	1057861
2016	451148	301755	47724	47902	209610	418	1419	1059977
2017	452051	302359	47820	47997	210030	419	1422	1062097
2018	452955	302964	47915	48093	210450	420	1425	1064221
2019	453861	303569	48011	48190	210871	420	1427	1066349
2020	454769	304177	48107	48286	211292	421	1430	1068482
2021	455678	304785	48203	48383	211715	422	1433	1070619
2022	456589	305395	48300	48479	212138	423	1436	1072760
2023	457503	306005	48396	48576	212563	424	1439	1074906
2024	458418	306617	48493	48673	212988	425	1442	1077056
2025	459334	307231	48590	48771	213414	425	1445	1079210
2026	460253	307845	48687	48868	213841	426	1447	1081368
2027	461174	308461	48785	48966	214268	427	1450	1083531
2028	462096	309078	48882	49064	214697	428	1453	1085698
2029	463020	309696	48980	49162	215126	429	1456	1087869
2030	463946	310315	49078	49260	215556	430	1459	1090045
2031	464874	310936	49176	49359	215987	431	1462	1092225
2032	465804	311558	49275	49458	216419	431	1465	1094410
2033	466735	312181	49373	49557	216852	432	1468	1096598
2034	467669	312805	49472	49656	217286	433	1471	1098792
2035	468604	313431	49571	49755	217721	434	1474	1100989
2036	469541	314058	49670	49855	218156	435	1477	1103191
2037	470481	314686	49769	49954	218592	436	1480	1105398
2038	471422	315315	49869	50054	219030	437	1483	1107608
2039	472364	315946	49969	50154	219468	437	1486	1109824
2040	473309	316578	50068	50255	219907	438	1489	1112043

Appendix D

Forecast for Aircraft Operations at Tipton Airport based on Annual Growth of 0.2%

Forecast for Tipton Airport Aviation Activity - FAA Forecast of 0.2%					
Year	Local GA	Itinerant	Militiary	Air Taxi	Total
2015	46866	885	67	104	47922
2016	46960	887	67	104	48018
2017	47054	889	67	104	48114
2018	47148	890	67	105	48210
2019	47242	892	68	105	48307
2020	47337	894	68	105	48403
2021	47431	896	68	105	48500
2022	47526	897	68	105	48597
2023	47621	899	68	106	48694
2024	47716	901	68	106	48792
2025	47812	903	68	106	48889
2026	47907	905	68	106	48987
2027	48003	906	69	107	49085
2028	48099	908	69	107	49183
2029	48195	910	69	107	49281
2030	48292	912	69	107	49380
2031	48388	914	69	107	49479
2032	48485	916	69	108	49578
2033	48582	917	69	108	49677
2034	48679	919	70	108	49776
2035	48777	921	70	108	49876
2036	48874	923	70	108	49975
2037	48972	925	70	109	50075
2038	49070	927	70	109	50176
2039	49168	928	70	109	50276
2040	49266	930	70	109	50376

**Based on FAA Forecast of 0.2% per year for GA

Appendix E

Forecast of Aircraft Operations at Tipton based on Straight Line Projections

Year	Aircraft Operations at Tipton Airport
2015	47,922
2016	54,960
2017	56,921
2018	58,883
2019	60,845
2020	62,806
2021	64,768
2022	66,730
2023	68,691
2024	70,653
2025	72,615
2026	74,576
2027	76,538
2028	78,500
2029	80,461
2030	82,423
2031	84,385
2032	86,346
2033	88,308
2034	90,270
2035	92,231
2036	94,193
2037	96,155
2038	98,116
2039	100,078
2040	102,040

Appendix F

Services at Maryland Airports

TABLE 1-6 **SERVICES AT SYSTEM AIRPORTS**																
Airport Name	Associated City	Air Taxi/Charter	U.S. Customs	Crop Dusting	Aircraft Repair	Avionics Repair	Avionics Sales	Aircraft Sales	Covered Overnight Aircraft Storage	Oxygen	Deicing	Snow Removal	Aircraft Rental	Flight Instruction	Car Rental	Courtesy Car/Loaner Car
Airports with Commercial Service																
Baltimore/Washington Int'l Thurgood Marshall	Baltimore	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hagerstown Regional Richard A. Henson Field	Hagerstown	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Salisbury – Ocean City Wicomico Regional	Salisbury	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NPIAS General Aviation Airports																
Bay Bridge	Stevensville				✓			✓				✓	✓	✓	✓		
Cambridge-Dorchester	Cambridge			✓	✓			✓						✓	✓		
Carroll County Regional[2]	Westminster																
Cecil County (Proposed)					To Be Determined											
College Park	College Park											✓	✓			✓	
Crisfield-Somerset County	Crisfield			✓										✓			✓
Easton/Newnam Field	Easton	✓			✓	✓	✓	✓	✓				✓	✓	✓	✓	✓
Frederick Municipal	Frederick	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	
Garrett County	Oakland												✓	✓	✓	✓	
Greater Cumberland Regional	Cumberland				✓				✓	✓	✓	✓		✓	✓	✓	
Martin State	Baltimore	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maryland	Indian Head				✓								✓	✓	✓	✓	
Montgomery County	Gaithersburg	✓			✓			✓	✓	✓			✓	✓	✓	✓	
Ocean City Municipal	Ocean City	✓			✓	✓		✓	✓					✓	✓	✓	
Potomac Airfield - Friendly	Friendly				✓				✓					✓	✓		
Ridgely Airpark[1]	Ridgely			✓	✓				✓								
St. Mary's County Regional	Leonardtown	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Tipton	Odenton	✓			✓									✓	✓	✓	
Washington Executive/Hyde Field	Clinton				✓				✓					✓	✓	✓	
Non-NPIAS General Aviation Airports																
Bennett	Salisbury			✓	✓				✓								
Cecil County	Elkton	✓			✓			✓				✓	✓	✓	✓		✓
Clearview	Westminster												✓				
Davis[2]	Laytonsville																
Essex Skypark	Baltimore																
Fallston	Fallston													✓	✓		
Freeway	Mitchellville				✓	✓	✓	✓					✓	✓	✓	✓	✓
Harford County	Churchville				✓									✓	✓		
Havre de Grace Seaplane Base	Havre de Grace																
Kentmorr	Stevensville																
Lee	Annapolis	✓			✓				✓				✓	✓	✓	✓	
Massey Aerodrome	Massey																✓
Mexico Farms	Cumberland																
Suburban Airpark[2]	Laurel																

[1]Ridgely Airpark - future inclusion in NPIAS. [2]Airport did not respond to survey. Source: Airport Survey

Appendix G

Maryland Airport System Performance

TABLE 3-7
CURRENT SYSTEM PERFORMANCE SUMMARY – RELIEVER AIRPORTS

Reliever Airports	Primary Runway Length (5,000')	ARC (C-II)	Taxiway Type (Full Parallel)	Approach Type (Precision)	ATCT (Yes)[1]	ATC Communications (Yes)	Runway Lighting (HIRL and Beacon)	Wind Cone – Lighted (Yes)	Runway End Identifier Lights (Yes)	Vertical Glide Slope Indicator (Yes)	Weather Reporting (Yes)	GA Terminal/Admin. Building (Yes)	Fuel (Jet-A, 100LL)	Paved Aircraft Parking (Yes)	Hangar (Yes)	Covered Overnight Secure Storage (Yes)	Property Enclosed by Fence (Yes)	Snow Removal (Yes)
Carroll County Regional Jack B. Poage Field	✓	✓	✓		N/A	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	
Frederick Municipal	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
Martin State	✓	✓	✓	✓	N/A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maryland					N/A				✓					✓	✓			✓
Montgomery County			✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tipton			✓		N/A	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	

Note: ✓ represents compliance with facility objective. N/A represents Not Applicable for this Airport Category
[1] Only for airports with 120,000 annual operations or more.
Source: Wilbur Smith Associates, MAA

TABLE 3-6
CURRENT SYSTEM PERFORMANCE SUMMARY – AIR CARRIER AIRPORTS

Air Carrier Airports	Primary Runway Length (5,500')	ARC (C-III or greater)	Taxiway Type (Full Parallel)	Approach Type (Precision)	ATCT (Yes)	ATC Communications (Yes)	Runway Lighting (HIRL and Beacon)	Wind Cone – Lighted (Yes)	Runway end Identifier Lights (Yes)	Vertical Glide Slope Indicator (Yes)	Weather Reporting (Yes)	GA Terminal/Admin. Building (Yes)	Fuel (Jet-A, 100LL)	Paved Aircraft Parking (Yes)	Hangar (Yes)	Covered Overnight Secure Storage (Yes)	Property Enclosed by Fence (Yes)	Snow Removal (Yes)
Baltimore/Washington Int'l Thurgood Marshall	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hagerstown Regional Richard A. Henson Field	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Salisbury – Ocean City Wicomico Regional	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: ✓ represents compliance with facility objective
Source: Wilbur Smith Associates, MAA

Appendix H

Active General Aviation – FAA Forecast

AS OF DEC. 31	FIXED WING PISTON SINGLE ENGINE	PISTON MULTI-ENGINE	PISTON TOTAL	TURBINE TURBO PROP	TURBINE TURBO JET	TURBINE TOTAL	ROTORCRAFT PISTON	ROTORCRAFT TURBINE	ROTORCRAFT TOTAL	EXPERI-MENTAL**	SPORT AIRCRAFT**	OTHER	TOTAL GENERAL AVIATION FLEET	TOTAL PISTONS	TOTAL TURBINES
Historical*															
2001	145,034	18,192	163,226	6,596	7,787	14,383	2,292	4,491	6,783	20,421	N/A	6,633	211,446	165,518	18,874
2008	145,497	17,515	163,012	8,907	11,042	19,949	3,498	6,378	9,876	23,364	6,811	5,652	228,664	166,510	26,327
2009	140,649	16,474	157,123	9,055	11,268	20,323	3,499	6,485	9,984	24,419	6,547	5,480	223,876	160,622	26,808
2010	139,519	15,900	155,419	9,369	11,484	20,853	3,588	6,514	10,102	24,784	6,528	5,684	223,370	159,007	27,367
2011E	136,895	15,702	152,597	9,523	11,650	21,173	3,411	6,671	10,082	24,275	6,645	5,681	220,453	156,008	27,844
2012	128,847	14,313	143,160	10,304	11,793	22,097	3,292	6,763	10,055	26,715	2,001	5,006	209,034	146,452	28,860
2013	124,398	13,257	137,655	9,619	11,637	21,256	3,137	6,628	9,765	24,918	2,056	4,277	199,927	140,792	27,884
2014	126,036	13,146	139,182	9,777	12,362	22,139	3,154	6,812	9,966	26,191	2,231	4,699	204,408	142,336	28,951
2015E	125,050	13,085	138,135	9,570	12,475	22,045	3,245	6,995	10,240	26,435	2,410	4,615	203,880	141,380	29,040
Forecast															
2016	124,055	13,025	137,080	9,420	12,635	22,055	3,340	7,200	10,540	26,590	2,590	4,570	203,425	140,420	29,255
2017	123,140	12,955	136,095	9,310	12,870	22,180	3,435	7,410	10,845	26,850	2,770	4,560	203,300	139,530	29,590
2018	122,245	12,905	135,150	9,235	13,125	22,360	3,525	7,615	11,140	27,055	2,945	4,550	203,200	138,675	29,975
2019	121,365	12,855	134,220	9,195	13,395	22,590	3,610	7,820	11,430	27,270	3,130	4,545	203,185	137,830	30,410
2020	120,485	12,810	133,295	9,190	13,680	22,870	3,690	8,020	11,710	27,485	3,310	4,525	203,195	136,985	30,890
2021	119,585	12,760	132,345	9,215	13,975	23,190	3,770	8,215	11,985	27,690	3,490	4,525	203,225	136,115	31,405
2022	118,690	12,715	131,405	9,270	14,285	23,555	3,850	8,410	12,260	27,925	3,675	4,520	203,340	135,255	31,965
2023	117,785	12,655	130,440	9,350	14,610	23,960	3,930	8,605	12,535	28,060	3,860	4,510	203,365	134,370	32,565
2024	116,875	12,595	129,470	9,465	14,965	24,430	4,010	8,795	12,805	28,310	4,040	4,500	203,555	133,480	33,225
2025	115,960	12,545	128,505	9,600	15,340	24,940	4,090	8,990	13,080	28,500	4,230	4,490	203,745	132,595	33,930
2026	115,045	12,480	127,525	9,775	15,735	25,510	4,170	9,185	13,355	28,735	4,410	4,495	204,030	131,695	34,695
2027	114,130	12,420	126,550	9,985	16,150	26,135	4,250	9,380	13,630	29,010	4,585	4,485	204,395	130,800	35,515
2028	113,225	12,340	125,565	10,205	16,580	26,785	4,330	9,575	13,905	29,340	4,760	4,480	204,835	129,895	36,360
2029	112,345	12,260	124,605	10,440	17,040	27,480	4,410	9,770	14,180	29,525	4,935	4,465	205,190	129,015	37,250
2030	111,495	12,175	123,670	10,705	17,520	28,225	4,490	9,960	14,450	29,850	5,110	4,470	205,775	128,160	38,185
2031	110,685	12,095	122,780	10,990	18,015	29,005	4,570	10,160	14,730	30,155	5,275	4,465	206,410	127,350	39,165
2032	109,905	12,015	121,920	11,295	18,520	29,815	4,655	10,365	15,020	30,455	5,445	4,465	207,120	126,575	40,180
2033	109,155	11,930	121,085	11,610	19,045	30,655	4,740	10,580	15,320	30,755	5,610	4,460	207,885	125,825	41,235
2034	108,445	11,850	120,295	11,935	19,600	31,535	4,825	10,795	15,620	31,090	5,775	4,445	208,760	125,120	42,330
2035	107,780	11,765	119,545	12,280	20,175	32,455	4,915	11,020	15,935	31,365	5,940	4,445	209,685	124,460	43,475
2036	107,160	11,695	118,855	12,635	20,770	33,405	5,005	11,250	16,255	31,640	6,100	4,440	210,695	123,860	44,655
Avg Annual Growth															
2001-15	-1.1%	-2.3%	-1.2%	2.7%	3.4%	3.1%	2.5%	3.2%	3.0%	1.9%	N/A	-2.6%	-0.3%	-1.1%	3.1%
2015-16	-0.8%	-0.5%	-0.8%	-1.6%	1.3%	0.0%	2.9%	2.9%	2.9%	0.6%	7.5%	-1.0%	-0.2%	-0.7%	0.7%
2015-25	-0.8%	-0.4%	-0.7%	0.0%	2.1%	1.2%	2.3%	2.5%	2.5%	0.8%	5.8%	-0.3%	0.0%	-0.6%	1.6%
2015-36	-0.7%	-0.5%	-0.7%	1.3%	2.5%	2.0%	2.1%	2.3%	2.2%	0.9%	4.5%	-0.2%	0.2%	-0.6%	2.1%

* Source: 2001-2010, 2012-2014, FAA General Aviation and Air Taxi Activity (and Avionics) Surveys.

**Experimental Light-sport category that was previously shown under Sport Aircraft is moved under Experimental Aircraft category, starting in 2012.

Note: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.