WASHINGTON-BALTIMORE REGIONAL AIR CARGO STUDY – 2015

February 2017

National Capital Region
Transportation Planning Board

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Prepared by the National Capital Region Transportation Planning Board in cooperation with the Federal Aviation Administration.
February 2017

ABOUT THE TPB

The National Capital Region Transportation Planning Board (TPB) is the federally designated metropolitan planning organization (MPO) for metropolitan Washington. It is responsible for developing and carrying out a continuing, cooperative, and comprehensive transportation planning process in the metropolitan area. Members of the TPB include representatives of the transportation agencies of the states of Maryland and Virginia and the District of Columbia, 23 local governments, the Washington Metropolitan Area Transit Authority, the Maryland and Virginia General Assemblies, and nonvoting members from the Metropolitan Washington Airports Authority and federal agencies. The TPB is staffed by the Department of Transportation Planning at the Metropolitan Washington Council of Governments (COG).

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This study was prepared as part of MWCOG's Continuous Airport System Planning (CASP) program, an iterative process that supports the planning, development and operation of airport and airport-serving facilities in the region. The National Capital Region Transportation Planning Board (TPB), which carries out transportation planning at the regional level, oversees the CASP program through its Aviation Technical Subcommittee of the TPB Technical Advisory Committee. The air system planning region is composed of 21 jurisdictions in Maryland, Virginia, West Virginia and the District of Columbia, and is served by three major commercial airports: BWI, IAD and Ronald Reagan Washington National Airport (DCA).

Air cargo has been characterized as the fastest-growing of the transportation modes used for moving freight shipments. Among the various freight modes, which include: truck, rail, ship, air and pipeline, air cargo accounts for the smallest share of freight in terms of volume (weight), but it conversely accounts for the largest share in terms of monetary value per unit of weight (typically measured in tons). Air cargo is used to transport high-value commodities and/or commodities requiring just-in-time delivery. These may include medicines and vaccines, fresh food, flowers, or other perishable items, as well as precision-engineered and manufactured electronic components that are frequently part of a larger global supply chain (e.g., semiconductors for consumer devices such as mobile phone, tablets, and televisions).

Historically, the air system planning region has been among the most prosperous in the nation, boasting high educational attainment rates among both residents and workers, as well as leading other regions in developing and utilizing cutting-edge technologies. As such, the demographic and economic composition of the region make it well-suited to benefit from high-value, just-in-time air cargo services. Based on forecasts of population, households and jobs, the planning area is expected to sustain the growth that is underway. Between 2015 and 2040, the number of persons, households and jobs will each increase by approximately 30 percent. This projected growth points to increased demand for air cargo services in the region provided by BWI and IAD.

Yet as the air system region continues to grow, it faces a challenge: the region's collective population, households, and employers consume more goods than they produce. This trend is resulting in - and will continue to result in – additional in-flows of commodities originating outside of the region (both domestic and international) headed to local destinations by all travel modes (including air cargo) greatly exceeding out-flows of commodities originating within the region being transported to markets outside the region. The region has responded to this trend by successfully marketing its available outgoing belly cargo capacity and connecting a core network of producers, logistics professionals, freight forwarders, and others to have a set of established relationships with regional and single-day drive time producers who need reliable truck-to-air cargo service to move their goods to market.

Moreover, the air cargo industry is forecast to expand worldwide, fueled by long-term increases in worldwide GDP and rapid growth in other markets, such as China. In terms of demand, both BWI and IAD are poised to embrace this growth. BWI has historically served domestic demand for air cargo. That market is expected to

continue through the planning period. Contrastingly, IAD's growth in air cargo will be more focused in the international sector during the planning period. Both markets are forecast to grow through the year 2040.

Both BWI and IAD have planned and constructed facilities in a comprehensive manner to ensure efficient transport of air cargo. Both have specialized facilities including climate-controlled warehousing for sensitive items, ramps and apron areas dedicated for air cargo support, Free Trade Zones (FTZs), and on-site federal regulators and inspectors to provide necessary clearances for air cargo commodities. BWI and IAD are continuing capital improvement programs designed to establish operational efficiencies and expand capacity for current and future air operations. These improvements are necessary given the presence of competing air cargo services at other airports within a six to eight-hour truck trip from BWI and IAD.

Nevertheless, most of these improvements have been confined to the airports' property footprints or to areas immediately adjacent to the airport. The improvements did not address ground access systems far beyond the airport boundary other than those facilities that directly serve the airports, which can be addressed by the regional surface transportation planning process overseen by the TPB. Accessibility from the airports to other parts of the region will generally constrict between 2015 and 2040 due to increased traffic volumes, even though regional transportation improvements will be implemented during the period. This constriction has substantial implications for the movement of air cargo goods that are transferred from aircraft onto trucks for final delivery over the highway network. Because air cargo serves a time-sensitive market, impaired accessibility can undermine efficient delivery of air cargo shipments - and therefore the region's air cargo industry as a whole.

Due to these accessibility issues, it will be important for airport operators and their parent agencies to ensure that ground access considerations are adequately addressed in the regional transportation planning process. Therefore, the following recommendations are made:

- As part of the airports' ongoing planning and construction programs, specific consideration should be given to the need to plan internal circulation systems and parking facilities in a manner that alleviates congestion in and around cargo facilities and improves truck access to and from cargo facilities. This will help mitigate compromised accessibility to other parts of the region by improving travel time from on-airport cargo facilities to the airport exit. During periods of heavy air operations traffic, congestion at the airports themselves can result in long waits to reach the airport exits.

- Airports should continue to incorporate air cargo needs into their comprehensive planning activities. This will help ensure that air cargo facilities, passenger facilities, air operations facilities, and infrastructure improvements are planned in a systematic manner that seeks to maximize operational efficiencies and reduce unnecessary capital and operational costs. Such savings can result in fiscal benefits that can be otherwise allocated to addressing other documented needs.

- Airports should continue to actively participate in the regional transportation planning process to ensure ground access needs are identified and analyzed as part of the regional process and that suitable ground access systems are planned and implemented. Ongoing participation provides leverage in assuring that identified surface transportation needs of airports are addressed and incorporated into the regional long-range transportation plan (both the constrained element and the unconstrained element expect to be included as part of the next major plan update in 2018) and the Transportation Improvement Program (TIP). As participants in the regional process, airports can advocate for the need to analyze ground access projects in the regional travel demand model, which informs decision-makers of key transportation priorities. Both of the region's air cargo airports are important components of sustained regional prosperity, and as such, critically-needed ground access improvements can be given regional priority for limited resources.

- Area jurisdictions should continue to work together to collaboratively identify financially beneficial opportunities for improving airport ground access in the Washington-Baltimore region

I. INTRODUCTION

The Metropolitan Washington Council of Governments (COG) last completed the air cargo element of the regional air system plan in 2008. The 2008 Washington-Baltimore Regional Air Cargo Study provided an analysis of existing and future demand for air cargo at Baltimore Washington International Thurgood Marshall Airport (BWI) in Maryland and Washington Dulles International Airport (IAD) in Virginia, as well as an examination of the suitability of current and planned cargo facilities to accommodate future air cargo demand. This 2016 update builds on the 2008 analysis by providing updated information on regional demographic and air cargo trends and forecasts. This report provides additional analysis on ground access issues associated with transporting air cargo shipments across the region's highway network, and makes planning recommendations to ensure continued effective delivery of air cargo services throughout the air system planning region.

Regional Air System Planning

COG, in cooperation with the Federal Aviation Administration (FAA), the District of Columbia Department of Transportation, (DDOT), the Maryland Aviation Administration (MAA), and the Metropolitan Washington Airports Authority (MWAA), has conducted a metropolitan airport system planning process since 1978. The goal of this Continuous Airport System Planning (CASP) program is to provide a process that supports the planning, development and operation of airport and airport-serving facilities in a systematic framework for the Washington-Baltimore region.

Transportation planning at the regional level is coordinated in the Washington area by the National Capital Region Transportation Planning Board (TPB), which is staffed by MWCOG's Department of Transportation Planning. The TPB is composed of representatives of the transportation agencies of the states of Maryland and Virginia, and the District of Columbia, local governments, the Washington Metropolitan Area Transit Authority (WMATA), the Maryland and Virginia General Assemblies, and members from the MWAA and federal agencies. Established in 1965, the TPB is the official Metropolitan Planning Organization (MPO) designated by the federal government to carry out the comprehensive regional transportation planning process under the authority of the Federal-Aid Highway Act of 1962, as amended. The TPB has a Technical Advisory Committee, which in turn has several standing subcommittees. One such subcommittee, the Aviation Technical Subcommittee (ATS), provides oversight and direction to the CASP program. The Washington-Baltimore Regional Air Cargo Study 2015 was prepared as an element of the CASP work program with the oversight of the Aviation Technical Subcommittee.

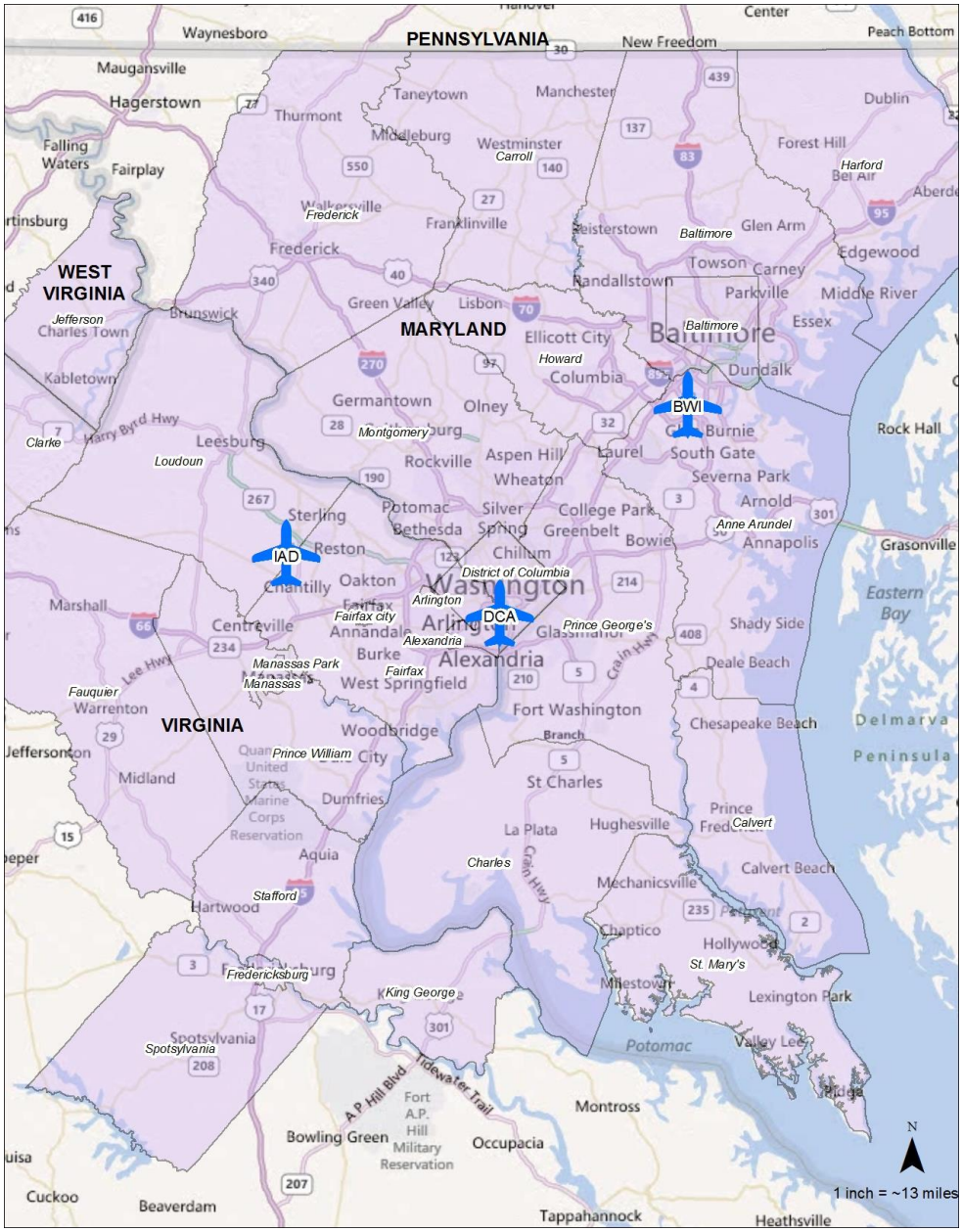
In its role as the MPO, the TPB prepares the region's Constrained Long-Range Plan (CLRP) and Transportation Improvement Program (TIP). A key step in the CLRP and TIP preparation is the preparation of forecasts. Air passenger forecasts are directly used in the development of forecasts of locally originating ground access (passenger) vehicle trips to the region's three commercial airports. These forecasts of airport trips are included in the travel demand modeling for the CLRP. Air cargo forecasts to the airport are not directly estimated as such and thus are not specifically included in the CLRP modeling. However, air cargo trips are "indirectly" included in the origin and destination forecasts of truck travel by Transportation Analysis Zones (TAZs) and are included in the forecasts of truck travel to and from the airports TAZs.

The Aviation Technical Subcommittee deals specifically with aviation issues related to transportation planning. Such issues include air cargo, ground access travel time, as well as the travel characteristics of regional air passengers. The TPB also has a very active Regional Freight Subcommittee, which focuses on the role of freight - including all modes - in regional transportation. Because air cargo represents one of the modes to transport freight, it is a subject of interest to both the Aviation Technical Subcommittee and the Freight Subcommittee.

Washington-Baltimore Air System Planning Region

Cities and counties making up the Washington-Baltimore air service market area, or the air system planning area, encompass an area larger than those normally within the purview of the Metropolitan Washington Council of Governments (MWCOG) and the Baltimore Metropolitan Council (BMC). From north to south, the air system planning area stretches from Harford County, Maryland on the Susquehanna River at the Pennsylvania border to Spotsylvania County, Virginia, halfway between Washington, DC, and Richmond, VA. From east to west, the air system planning region extends from the Chesapeake Bay to beyond the front range of the Appalachian Mountains. Figure 1 shows the 21 jurisdictions constituting the air system planning region, as well as the three commercial airports: Baltimore-Washington Thurgood Marshall Airport (BWI), Ronald Reagan Washington National Airport (DCA), and Washington Dulles International Airport (IAD).

Figure 1: Washington / Baltimore Air System Planning Region



Source: 2015 Washington-Baltimore Regional Air Cargo Study

Air Cargo

There are several transport options, or "modes," when considering freight movement in the region. Commodities can be transported by truck, rail, ship, pipeline, and by air. Air commodities are generally flown for one leg of the commodity's multimodal journey. These commodities typically reach their final destination by surface transportation, typically on trucks. Consumer goods are often discharged at warehouses in a metropolitan region before being transported in another truck to local vendors. Consumers are able to check the labels and investigate where their products originate.

Airports are among the biggest economic drivers of regional and local economies. According to national data, air cargo represents the smallest proportion by weight of all modes transported; however, air cargo represents the fastest-growing segment of the nation's freight movement (by weight) and is forecast to continue to be the fastest growing segment to the year 2040.[1] Nationally, air freight moved less than one-tenth of one percent of total tonnage in 2007 but carried 6.5 percent of total value of shipments; that percentage did not change for the year 2013.[2] By 2040, air cargo is forecast to move just under one-fifth of one percent of total tonnage nationwide, representing nearly 13 percent of total value of shipments.[3]

AIR CARGO CHARACTERISTICS AND REGIONAL AIR CARGO MARKET

Air cargo entails the shipment of commercial freight transported in domestic and international freighter aircraft or even passenger aircraft. Air cargo is used for special commodities that must be transported quickly due to the high value or perishability of the commodity or the speed the commodity needs to be transported over long hauls. Examples of air cargo include goods such as computer chips, automotive parts, pharmaceuticals, medical supplies, and perishable commodities like fruits, fish, vegetables and flowers.

The Washington-Baltimore region is served by the three major airports shown in Figure 1 on the previous page. While these three airports are more widely known for their role in transporting thousands of travelers on a daily basis, both BWI and IAD also play a substantial role in the movement of goods, or cargo, to and from the region.[4] Each airport competes for their share of the air cargo market by ensuring reliable ground access via major highways to the airport, warehouse space, ramp facilities, specialized services such as refrigerated and heated areas, access to U.S. Fish and Wildlife inspectors, etc.

Airports are similar to ports in that they serve as entry border gateways into the country. As such, it is important to have nearby cargo storage facilities and to maintain efficient surface transportation for truck or rail to move cargo to and from the airport. With the growth expected in air cargo markets, airport planners need to consider the ground access that shippers need to transport the cargo.

With growing international economic trade, numerous agencies predict a growing domestic and particularly international air cargo market. The Federal Highway Administration (FHWA) Freight Analysis Framework (FAF) shows a four percent growth in international shipments between 2007 and 2013, and forecasts more than a 150 percent increase in international shipments by the year 2040.[5] FAA's forecasts predict growth in domestic cargo revenue ton-miles of 0.5 percent annually to the year 2035.[6]

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[1] See *Freight Facts and Figures 2015*, USDOT, Bureau of Transportation Statistics, Table 2-1.

[2] *Ibid.,* Table 2-1 and Table 2-2. 2013 data are provisional estimates.

[3] *Ibid.* According to ACI-NA, worldwide the share is 1.5 percent of weight and 30 percent of value.

[4] Since 1990, DCA's share of the air cargo market has declined steadily as BWI and IAD's shares have increased, due to the smaller size and capacity of DCA. Because of the limited role in regional air cargo activity and limited capacity for future expansion, DCA is not included hereafter in this report.

[5] *Ibid., Table 2-1.*

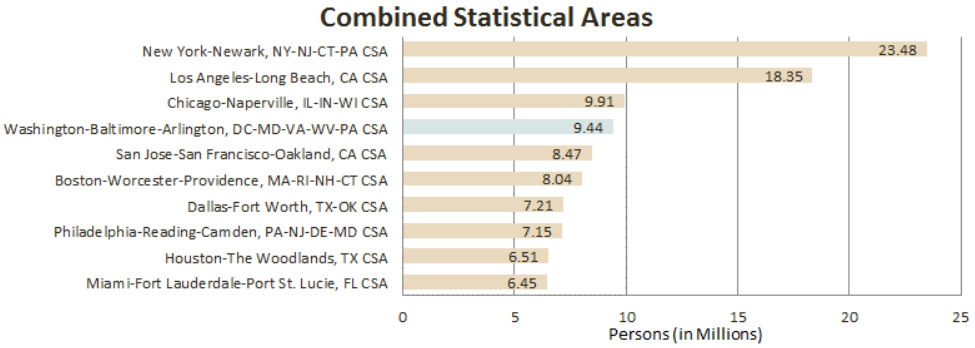
[6] *FAA Aerospace Forecast FY 2015-2035. International cargo was not forecast.*

Washington-Baltimore Region Industrial and Demographic Profile

POPULATION

The Washington-Baltimore region is a major population, employment, and consumer center for both the East Coast and the entire United States. In terms of 2013 population estimates, when considered together as the Washington-Baltimore Consolidated Metropolitan Statistical Area (CMSA), the Washington and Baltimore regions collectively are ranked fourth in the nation by population.[7] Figure 2 shows the 2013 population estimates for the largest metropolitan areas.

Figure 2: 2013 Population Estimates by Metropolitan Area (In Millions)



Source: Census Bureau

LABOR FORCE AND UNEMPLOYMENT

In terms of civilian employment trends, the civilian labor force in the air system planning area is comparatively strong with respect to the nation overall. During every year since 2000, both the Washington and Baltimore regions recorded lower annual unemployment rates than the nation as a whole. Table 1 and Figure 2 show unemployment trends for the planning region and the U.S. as a whole, and underscore the relative health of the labor market in the air system planning area. Moreover, these data suggest a relatively strong consumer market when compared to the nation as whole.

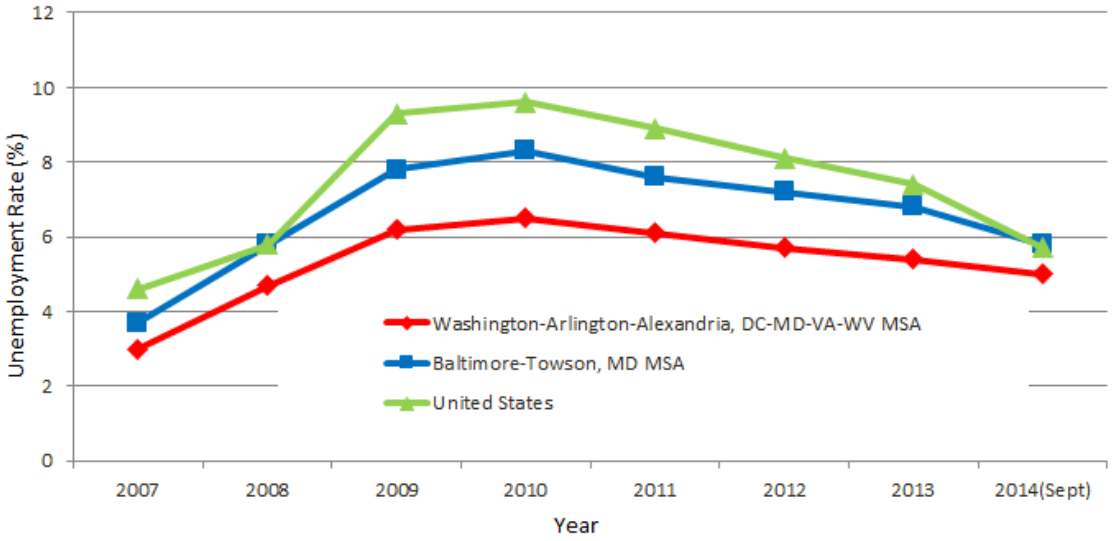
Table 1: Annual Unemployment Rates (Not Seasonally Adjusted)

	2007	2008	2009	2010	2011	2012	2013	2014(Sept)
Washington-Arlington-Alexandria, DC-MD-VA-WV MSA	3	4.7	6.2	6.5	6.1	5.7	5.4	5
Baltimore-Towson, MD MSA	3.7	5.8	7.8	8.3	7.6	7.2	6.8	5.8
United States	4.6	5.8	9.3	9.6	8.9	8.1	7.4	5.7

Source:U.S. Department of Labor, Bureau of Labor Statistics.

[7] Note: The "Washington region" refers to the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, and the "Baltimore region" refers to the Baltimore-Towson, MD MSA.

Figure 3: Annual Unemployment Rates (Not Seasonally Adjusted) By Region, Nation and Year



Source:U.S. Department of Labor, Bureau of Labor Statistics

AT-PLACE EMPLOYMENT

More than a fifth of all jobs in the air system planning area are in the professional and business services industry. Other industries containing substantial job shares in the region include the trade, transportation, warehousing and utilities industry (14 percent), and the educational and health care and social assistance industry (15 percent). Table 2 provides 2014 at-place employment statistics for the Baltimore and Washington regions, and aggregates these data at the combined Washington-Baltimore region.

Table 2: At-place Employment by Industry (In Thousands)

Industry Title	Washington-Arlington-Alexandria, DC-VA-MD-WV MSA (2014 Average)		Baltimore-Towson, MD MSA		Combined Region	
	Jobs	%	Jobs	%	Jobs	%
Natural Resources, Mining & Construction	115.3	4.5%	72.3	5.4%	187.6	4.8%
Manufacturing	33.8	1.3%	54.4	4.0%	88.2	2.3%
Trade, Transportation, Warehousing, Utilities	319.9	12.6%	236.7	17.6%	556.6	14.3%
Information	63.8	2.5%	16.4	1.2%	80.2	2.1%
Financial Activities	113.0	4.5%	77.3	5.7%	190.3	4.9%
Professional and Business Services	581.7	22.9%	220.6	16.4%	802.3	20.7%
Educational & Health Care & Social Assistance	320.6	12.6%	254.8	18.9%	575.4	14.8%
Leisure & Hospitality	246.9	9.7%	129.9	9.7%	376.8	9.7%
Other Services	161.8	6.4%	53.4	4.0%	215.2	5.5%
Federal Government	312.2	12.3%	50.7	3.8%	362.9	9.3%
State Government	80.8	3.2%	68.5	5.1%	149.3	3.8%
Local Government	186.4	7.3%	110.1	8.2%	296.5	7.6%
Total Non-farm	**2,536.2**	**100%**	**1,345.1**	**100%**	**3,881.3**	**100%**

Sources:District of Columbia Department of Employment Services Office of Labor Market Research and Information and Maryland Department of Labor, Licensing and Regulation, Office of Workforce Information and Performance

INCOME

The Washington and Baltimore regions consistently record higher per capita income levels among most metropolitan areas nationwide and register per capita income levels higher than the national U.S. level. The 2014 per capita personal income reported by the BEA for the Washington MSA was nearly $63,000, which was 137 percent of the national average. The Baltimore MSA figure was nearly $54,000, which was 117 percent of the national average. In fact, the Washington MSA ranked eighth in the nation among all metropolitan statistical areas (MSAs) in 2014, and the Baltimore-Towson, MD MSA ranked 22nd, further indicating the comparative income strength of the air system planning area.

AIR CARGO DEMAND ANALYSIS

This section begins with an analysis of demographic and economic drivers in the region that may affect demand for air cargo services. Indicators such as growing population, workforce and employment provide insight into how regional demand may be sustained or grow. Following that discussion, this section examines the air cargo industry outlook from a macro, global perspective, which is then followed by how this outlook, when considered with demographic and economic drivers in the region, translates into regional demand for air cargo at BWI and IAD.

Residential Demand

MWCOG and BMC prepare population estimates and projections for the jurisdictions in the Washington and Baltimore regions, respectively. According to the latest round of forecasts, the air system planning area population is forecast to increase between 2010 and 2040. Table 3 provides population forecasts for all the jurisdictions constituting the air system planning region. Similarly, the number of households is expected to grow during the same forecast period. Household growth is expected to increase slightly faster than the overall population during this time, which is the result of a continuing trend toward fewer persons per household. Nevertheless, households are typically the key input factor in determining residential demand over a planning period; thus, transportation investment decisions are usually driven by household and employment forecasts, rather than population and employment forecasts. Table 4 shows the household growth anticipated in the planning region through 2040.

Overall, residential growth is expected to continue in the planning region for at least the next 20 years, with the outlying areas in the planning area expected to grow the fastest. Between 2030 and 2040, outlying jurisdictions are expected to grow at the highest rate. This is notable because it underscores that since the fastest residential demand is expected to occur in the outlying areas, it is important to ensure that efficient air cargo delivery to the region's growing residential market is maintained.

Although outlying jurisdictions will grow the fastest during the period, inner suburbs as well as some of the outer suburbs will experience the most absolute growth in terms of population and households. As such, while much of the focus will be on faster-growing areas, growth in closer-in areas will also be significant.

In summary, growing regional demand for air cargo from a residential standpoint will not be confined to a specific area. Demand is expected to grow throughout the region during the period. Sustaining efficient air cargo delivery to accommodate this growing demand will continue to be an important transportation planning consideration.

Table 3: Population by Jurisdiction Washington / Baltimore Air System Planning Region

Jurisdiction	Population							
	2010	2013	2015	2020	2025	2030	2035	2040
District of Columbia	601,764	637,030	660,528	715,494	764,267	808,718	852,428	883,568
Montgomery County	972,603	1,001,058	1,020,036	1,067,030	1,109,953	1,153,912	1,184,641	1,202,769
Prince George's County	863,420	874,193	881,379	899,912	926,944	950,030	973,126	995,503
Arlington County	207,627	216,787	222,885	236,083	248,682	258,757	266,401	276,072
City of Alexandria	139,958	145,089	148,513	158,102	167,085	174,030	184,741	194,890
Fairfax County	1,116,800	1,139,206	1,154,153	1,193,606	1,254,384	1,308,944	1,361,950	1,414,154
Loudoun County	312,310	345,709	367,957	417,986	452,242	468,664	478,635	484,498
PrinceWilliam County	454,094	485,104	505,772	551,967	589,645	623,113	651,753	675,953
Frederick County	233,383	238,321	241,616	258,849	278,654	297,708	314,297	329,955
Howard County	287,085	296,156	302,206	321,370	334,991	343,327	348,238	350,116
Anne Arundel County	537,293	548,017	555,160	573,463	585,522	597,136	606,853	615,625
Charles County	144,594	153,900	160,098	175,953	191,475	202,552	213,651	224,871
Carroll County	167,134	169,182	170,549	175,901	179,437	183,258	186,180	189,574
Calvert County	91,748	94,602	96,500	100,450	103,253	105,099	106,980	108,882
St. Mary's County	104,854	112,854	118,184	130,098	141,135	151,403	162,572	173,832
King George County	23,584	25,581	26,911	30,226	34,029	37,819	41,273	44,707
City of Fredericksburg	24,286	25,152	25,728	27,160	28,870	30,570	32,095	33,610
Stafford County	128,950	141,212	149,386	169,774	191,249	212,671	232,289	251,851
Spotsylvania County	95,973	102,991	107,675	119,355	129,406	139,424	147,448	155,442
Fauquier County	65,201	67,877	69,658	74,114	78,710	83,306	88,163	93,022
Clarke County	14,031	14,330	14,530	15,026	15,447	15,872	16,252	16,632
Jefferson County	53,498	56,133	57,889	62,688	67,071	71,203	75,300	79,065
Baltimore City	620,961	630,409	636,722	647,282	656,314	667,210	676,726	680,262
Baltimore County	805,029	815,880	823,121	832,393	846,771	858,183	869,523	880,726
Harford County	244,826	249,121	251,991	258,668	265,098	273,127	281,029	291,089
Total	**8,311,006**	**8,585,894**	**8,769,147**	**9,212,950**	**9,640,634**	**10,016,036**	**10,352,544**	**10,646,668**

Source: MWCOG Round 8.3 and BMC Round 8A Cooperative Land Use Forecast

Table 4: Air System Planning Region - Households by Jurisdiction

	Households							
Jurisdiction	2010	2013	2015	2020	2025	2030	2035	2040
District of Columbia	266,707	278,951	287,112	305,550	323,191	340,307	356,923	370,758
Montgomery County	361,030	370,938	377,524	396,955	414,873	434,767	449,928	460,161
Prince George's County	304,042	315,621	323,364	336,107	348,307	359,878	369,847	379,020
Arlington County	98,050	102,638	105,692	112,211	117,332	121,383	124,417	128,605
City of Alexandria	68,131	70,640	72,306	76,978	81,352	84,717	89,941	94,890
Fairfax County	399,616	407,172	412,183	429,673	455,610	478,867	501,339	523,521
Loudoun County	104,583	115,428	122,644	139,505	151,558	158,142	162,221	164,297
Prince William County	147,819	158,782	166,083	183,321	197,890	210,450	221,111	229,944
Frederick County	84,800	87,878	89,935	96,471	103,944	111,118	117,365	123,247
Howard County	104,749	111,771	116,453	126,806	133,807	137,635	139,966	140,696
Anne Arundel County	199,378	203,614	206,441	213,504	220,567	227,628	234,688	241,619
Charles County	50,950	54,893	57,528	64,299	70,833	75,847	80,876	85,901
Carroll County	62,406	63,447	64,142	66,219	68,025	69,692	71,305	72,853
Calvert County	32,046	33,396	34,298	36,027	37,374	38,348	39,322	40,301
St. Mary's County	38,870	42,208	44,443	49,352	53,960	58,143	62,326	66,509
King George County	8,373	9,233	9,808	11,237	12,808	14,366	15,761	17,142
City of Fredericksburg	9,507	9,948	10,239	10,969	11,761	12,547	13,147	13,739
Stafford County	41,769	46,510	49,673	57,533	65,473	73,367	80,539	87,670
Spotsylvania County	32,824	35,630	37,503	42,153	46,117	50,057	52,825	55,567
Fauquier County	23,658	24,665	25,337	26,954	28,616	30,272	32,028	33,801
Clarke County	5,507	5,669	5,779	5,979	6,150	6,322	6,475	6,631
Jefferson County	19,931	22,132	23,599	26,085	28,633	31,025	33,419	35,740
Baltimore City	249,903	254,107	256,904	261,374	265,100	269,632	273,496	274,976
Baltimore County	316,715	319,883	321,983	325,447	331,311	335,748	340,160	344,536
Harford County	90,218	92,546	94,095	97,892	101,689	105,488	109,298	113,090
Total	**3,121,582**	**3,237,700**	**3,315,068**	**3,498,601**	**3,676,281**	**3,835,746**	**3,978,723**	**4,105,214**

Source: MWCOG Round 8.3 and BMC Round 8A Cooperative Land Use Forecast

Commercial Demand

JOB GROWTH

At-place employment forecasts prepared by both MWCOG and BMC for the air system planning area jurisdictions call for continued growth in employment through at least 2040. Table 5 shows employment forecasts for the jurisdictions in the air system planning region.

Like residential demand, new jobs will generally grow the fastest in jurisdictions farther away from the combined region's center cities. As with residential growth, jurisdictions that will experience the fastest job growth are not necessarily the same as those that will experience the most growth. Therefore, (and similar to population and household growth) new jobs added to the region during the period will not be confined to a specific area. This unconfined growth will contribute to regional demand for air cargo services. Any improvements necessary to accommodate this added demand will be important considerations for transportation planning.

Table 5: At-Place Employment by Jurisdiction Washington/Baltimore Air System Planning Region

	Employment							
Jurisdiction	2010	2013	2015	2020	2025	2030	2035	2040
District of Columbia	783,457	802,356	814,957	861,814	905,846	944,096	972,955	1,001,814
Montgomery County	510,277	523,316	532,004	564,377	598,824	635,264	673,976	715,121
Prince George's County	342,588	351,225	356,958	377,879	403,134	427,514	457,275	497,652
Arlington County	223,264	237,783	247,460	276,281	292,078	303,044	305,970	308,830
City of Alexandria	102,895	107,309	110,248	116,812	131,152	149,552	157,405	167,598
Fairfax County	657,546	679,308	693,803	758,260	814,740	866,739	900,065	930,665
Loudoun County	145,083	156,353	163,850	197,265	224,249	248,803	264,159	278,216
PrinceWilliam County	143,579	155,476	163,423	186,215	207,340	230,047	253,511	278,151
Frederick County	98,695	100,689	102,014	106,242	109,802	114,558	116,332	125,556
Howard County	181,381	190,378	196,381	211,381	226,381	241,381	251,710	260,309
Anne Arundel County	323,149	334,467	342,012	361,688	376,086	391,312	404,987	424,061
Charles County	62,199	65,933	68,405	71,695	74,695	77,499	80,298	83,097
Carroll County	70,890	72,191	73,057	76,100	78,420	80,883	83,003	85,351
Calvert County	35,200	38,737	41,097	44,501	46,305	47,206	48,102	49,003
St. Mary's County	62,994	66,117	68,202	71,601	74,599	76,596	78,637	80,731
King George County	16,233	17,175	17,804	19,377	20,947	22,490	24,124	25,747
City of Fredericksburg	31,492	33,948	35,586	39,662	43,729	47,779	51,298	54,819
Stafford County	46,664	50,274	52,681	58,399	64,304	70,170	77,198	84,159
Spotsylvania County	40,093	41,944	43,173	46,219	49,168	52,086	56,731	61,356
Fauquier County	22,371	23,290	23,902	25,426	27,007	28,581	30,241	31,917
Clarke County	4,241	4,330	4,391	4,539	4,668	4,797	4,912	5,026
Jefferson County	15,937	16,721	17,247	18,675	19,989	21,212	22,434	23,555
Baltimore City	381,772	385,920	388,651	402,534	415,971	428,751	441,346	454,167
Baltimore County	446,250	457,981	465,801	484,533	492,436	499,296	504,820	510,565
Harford County	104,670	111,209	115,562	126,040	135,775	146,269	157,191	167,261
Total	**4,852,920**	**5,024,430**	**5,138,669**	**5,507,515**	**5,837,645**	**6,155,925**	**6,418,680**	**6,704,727**

Source: MWCOG Round 8.3 and BMC Round 8A Cooperative Land Use Forecast

Commodities

Freight transported through air cargo modes consists predominantly of high-dollar and/or time-sensitive commodities. Table 6 highlights the top commodities traded to and from the Washington region by air or a combination of truck and air. Air cargo is distinguished by the fact that although it accounts for a small share of total freight tonnage shipped by mode, it conversely accounts for a high share of freight value. In contrast, the FHWA Freight Analysis Framework defines the top commodities transported to and from the region in terms of tonnage, regardless of mode. They are: gravel, coal and other non-metal mineral products.

Table 6: Commodities Transported by Air and Truck, To/From DC, Baltimore Metro Regions by Value - 2007, 2012

Commodity in DC MSA	Total Current M$ in 2012	Inbound	Outbound	Total M$ in 2007	Inbound	Outbound
Grand Total	5,858	72%	28%	5,321	71%	29%
Electronics	3,160	56%	44%	2,906	56%	44%
Precision Instruments	1,421	94%	6%	1,258	94%	6%
Textiles/Leather	343	100%	0%	330	100%	0%
Nonmetal Mineral Products	245	96%	4%	216	96%	4%
Miscellaneous Manufacturing Products	205	93%	7%	180	93%	7%
Pharmaceuticals	120	78%	22%	108	78%	22%
Transportation Equipment	94	18%	82%	87	19%	81%
Printed Products	70	91%	9%	62	91%	9%
Machinery	62	49%	51%	54	48%	52%
Motorized Vehicles	47	98%	2%	42	98%	2%
Commodity in Balt MSA	Total Current M$ in 2012	Inbound	Outbound	Total M$ in 2007	Inbound	Outbound
Total	1,739	61%	39%	1,585	60%	40%
Transportation Equipment	572	58%	42%	521	59%	41%
Electronics	400	68%	32%	366	69%	31%
Precision Instruments	269	82%	18%	233	82%	18%
Miscellaneous Manufacturing Products	202	27%	73%	197	27%	73%
Pharmaceuticals	81	66%	34%	74	65%	35%
Machinery	47	28%	72%	44	26%	74%
Chemical Products	33	3%	97%	29	2%	98%
Textiles/Leather	23	88%	12%	21	88%	12%
Plastics/Rubber	22	61%	39%	20	62%	38%
Motorized Vehicles	22	74%	26%	20	74%	26%

Source: Freight Analysis Framework, FHWA, 2012

Air cargo also satisfies time-sensitive requirements. Among others, these may include: live animals, fresh foods, flowers and other agricultural/horticultural products, or perishables. For example, some of the top exports of BWI are finfish and shellfish, which are harvested from the Chesapeake Bay and other waterways near BWI. Timely delivery of such products is critical to the success of businesses that export perishable items. Dependable and expedient air cargo service is an essential component of the supply chain for delivering time-sensitive items to consumers. This critical need creates demand not only for air cargo service alone, but for adjunct services such as forwarding, climate-controlled storage, and the like—all of which contribute to the success of the just-in-time business model.

With respect to demand by commodity or commodity type, air cargo fulfills a niche demand for high-dollar, time-sensitive items. As the air system planning area continues to grow in population and affluence, as past trends and forecasts indicate, demand for this specialized niche service can be expected to increase as well. As noted earlier, the fastest growing sector in freight is air cargo, which points to growth in demand for commodities shipped via air cargo. As this demand increases, due, in part, to long-term growth in the regional economy, BWI and IAD can be expected to handle larger volumes of air cargo.

Air Cargo Industry Growth

Air cargo demand typically tracks with economic output as measured by gross domestic product (GDP). Air cargo revenue ton-miles (RTMs), following sustained growth between 2002 and 2007, contracted sharply in 2008 and 2009 due to the recession and has been highly variable since recovering in 2010, with an average increase of only 1.4 percent between 2000 and 2014. FAA forecasts growth of 0.5 percent per year in domestic cargo RTMs through the year 2035 and growth of 4.7 percent per year in international RTMs. Boeing's forecasts are more optimistic, with growth of between 1.8 percent and 2.4 percent per year for domestic revenue-ton kilometers (RTKs) and between 4.1 percent and 5.6 percent per year for international RTKs.

Both FAA and Boeing air cargo forecasts maintain that growth in air cargo will correlate strongly with capital spending and the overall economy. Short-term fluctuations may be expected in the air cargo industry over the forecast period, just as normal, short-term business cycle fluctuations occur in the economy (and as seen historically since 2000). As a long-term forecast, however, substantial growth in air cargo continues to be anticipated through 2035, as GDP growth continues to occur over the long-term. Although recent historic economic conditions may suggest pre-downturn exuberance driving this conclusion, it nevertheless underscores the universal acknowledgment that sustained long-term growth in global markets will drive faster growth in international air cargo demand over the forecast period.

Air Cargo Growth in the Region

Table 7 shows the Airports Council International - North America (ACI-NA) 2014 rankings of the top 50 North American airports for total air cargo, as well as their world ranking. The table shows IAD was ranked 23th overall and BWI was ranked 36th within North America.

Changes in air cargo activity at both BWI and IAD are tied heavily to changes in air passenger service provided to different markets from BWI and IAD. As service changes are made that result in markets no longer being served by air passenger flights, the obvious implication is that the air cargo shipments made in the bellies of those aircraft would cease as well. It is important to underscore that there is a strong correlation between air cargo operations at both IAD and BWI, and air passenger operations.

Table 7: Top 50 North American Airports 2014 Cargo Traffic

World Ranking	NAM Ranking	Region/ Country	City / Airport Code	Total Cargo 2014	% Change 2014-2013
2	1	USA	Memphis TN (MEM)	4 258 531.0	2.9
5	2	USA	Anchorage AK (ANC)	2 492 754.0	3.0
7	3	USA	Louisville KY (SDF)	2 293 231.0	3.5
12	4	USA	Miami FL (MIA)	1 998 779.0	2.8
15	5	USA	Los Angeles CA (LAX)	1 816 269.0	3.7
19	6	USA	Chicago IL (ORD)	1 377 663.9	12.1
20	7	USA	New York NY (JFK)	1 303 889.0	0.6
23	8	USA	Indianapolis IN (IND)	1 070 196.0	(0.1)
36	9	USA	Cincinnati OH (CVG)	652 666.0	10.5
37	10	USA	Newark NJ (EWR)	639 930.0	(2.0)
39	11	USA	Dallas/Fort Worth TX (DFW)	634 997.0	7.3
41	12	USA	Atlanta GA (ATL)	601 269.0	(2.4)
46	13	USA	Oakland CA (OAK)	503 568.2	4.0
49	14	USA	Houston TX (IAH)	461 492.0	8.1
50	15	Canada	Toronto ON (YYZ)	448 634.0	8.3
53	16	USA	Ontario CA (ONT)	430 319.0	3.0
56	17	USA	Honolulu HI (HNL)	414 870.0	0.5
60	18	USA	San Francisco CA (SFO)	400 614.0	10.1
62	19	USA	Philadelphia PA (PHL)	392 506.0	3.3
68	20	USA	Seattle WA (SEA)	326 582.0	11.6
79	21	USA	Phoenix AZ (PHX)	283 739.0	2.8
81	22	USA	Boston MA (BOS)	275 522.6	9.0
83	23	USA	Washington DC (IAD)	267 735.0	6.0
87	24	Canada	Vancouver BC (YVR)	256 935.0	12.6
90	25	USA	Denver CO (DEN)	235 572.0	4.1
100	26	USA	Portland OR (PDX)	207 785.0	4.2
104	27	USA	Detroit MI (DTW)	202 032.0	(6.7)
105	28	USA	Minneapolis MN (MSP)	198 574.0	0.6
114	29	USA	Orlando FL (MCO)	172 869.0	1.3
116	30	USA	Salt Lake City UT (SLC)	161 860.8	(2.7)
117	31	USA	San Diego CA (SAN)	156 149.4	6.4
144	32	USA	Fort Worth TX (AFW)	110 329.0	0.9
149	33	USA	Charlotte NC (CLT)	105 845.0	(0.1)

Source: Airports Council International - North America, 2014

Table 7 Continued

World Ranking	NAM Ranking	Region/ Country	City/Airport Code	Total Cargo 2014	% Change 2014-2013
150	34	USA	San Antonio TX (SAT)	105 839.0	0.7
151	35	USA	Hartford CT (BDL)	105 310.0	(2.9)
152	36	USA	Baltimore MD (BWI)	105 153.0	(3.5)
155	37	USA	Rockford IL (RFD)	101 912.0	4.6
158	38	USA	Las Vegas NV (LAS)	98 658.0	6.1
166	39	USA	Huntsville AL (HSV)	86 752.2	1.1
168	40	USA	Kansas City MO (MCI)	85 002.0	(14.4)
169	41	USA	Tampa FL (TPA)	84 975.0	0.1
171	42	Canada	Montreal QC (YMX)	82 972.0	(6.8)
172	43	Canada	Montreal QC (YUL)	82 463.0	(2.3)
175	44	USA	El Paso TX (ELP)	78 435.0	(2.2)
178	45	USA	Fort Lauderdale, FL (FLL)	77 967.0	2.2
183	46	USA	Raleigh-Durham NC (RDU)	76 200.0	(0.7)
184	47	USA	Pittsburgh PA (PIT)	75 658.0	(3.2)
185	48	USA	Cleveland OH (CLE)	75 012.0	3.3
186	49	USA	Greensboro NC (GSO)	74 284.0	(15.3)
189	50	USA	Manchester, NH (MHT)	72 289.0	(4.7)

Source: Airports Council International - North America, 2014

For purposes of this analysis, regional air cargo demand consists of air freight and air mail that originate or terminate in the market region of Dulles and BWI airports. The overall market region is defined as an eight-state region consisting of North Carolina, Virginia, West Virginia, the District of Columbia, Maryland, Delaware, Pennsylvania, and New Jersey. The region is within 250 miles of one of these airports, or within 500 miles of the airports and not closer to a major cargo airport (such as New York-Kennedy [JFK], Atlanta Hartsfield-Jackson International [ATL], or Chicago-O'Hare [ORD]). This definition is based on analysis of cargo flow patterns, trucking services, and the marketing systems for the air carriers at those airports.

Airport forecasts used in the following subsections are provided by the respective airports and are based on assumed annual growth rates. Airport statistical analysts caution that air cargo forecasts are based on assumptions of industry factors that typically have a high degree of variability. These variables can affect air cargo trends considerably from one year to the next. Air cargo forecasts are prepared to show the general trend anticipated over a planning period and do not necessarily capture year-to-year fluctuations that may actually occur.

BWI

Air cargo trends for BWI are presented in Table 8. Between 2008 and 2014, air cargo increased slightly from 102,000 to 105,000 metric tons, with larger year-over-year variability due to changing economic conditions. Air cargo at BWI is expected to increase annually through the year 2040, although at modest levels. By far, domestic air cargo accounts for the greatest share of total freight handled at BWI and this share is expected to hover over 90%, underscoring the dominance of domestic air cargo as a percentage of total freight at BWI.

Table 8: Historic Enplaned and Deplaned Air Cargo (Metric Tons) BWI

Year	Total Freight (tonnes)
2008	102,183
2009	100,381
2010	102,379
2011	107,759
2012	111,750
2013	108,996
2014	105,130

Source: Washington-Baltimore Regional Air Cargo Study 2015

IAD

Between 2008 and 2014, air cargo at IAD decreased sharply from 334,000 metric tons to 267,000 metric tons. The vast majority of the decline was in domestic air cargo and mirrored the decrease in domestic passenger travel and belly cargo capacity. Table 9 shows air cargo trends for IAD.

Forecasts call for more robust air cargo growth between 2010 and 2040 at IAD. This illustrates the increasing dominance of the international air cargo sector at IAD and stresses the need to ensure air cargo services provided at IAD are sufficient to capture the ballooning demand for international air cargo. Growth between 2010 and 2040 will be markedly greater at IAD both in absolute and percentage terms compared to BWI, and this growth will build off an already larger baseline amount at IAD. IAD's air cargo market share position in the air system planning region will continue to expand during the forecast period. This expansion will be fueled by increases in international air cargo demand for which IAD is well poised, particularly to east Asian markets, Europe, the Persian Gulf region, and Africa. IAD's service to China tethers the air system planning region to one of the fastest growing economies in the world; and that represents a significant opportunity to capitalize on the prospect for robust trading between two regions expecting long-term economic growth. IAD also has extensive international service to other markets, including Europe and Latin America, which fuel the bulk of the international air cargo demand.

Table 9: Historic and Forecast Enplaned and Deplaned Air Cargo (Metric Tons) – IAD

Year	Total Freight (tonnes)
2008	333,842
2009	292,774
2010	329,273
2011	302,662
2012	267,872
2013	253,335
2014	267,148

Source: Washington-Baltimore Regional Air Cargo Study 2015

Demand Conclusions

Historically, the region has been among the most prosperous in the nation, boasting high educational attainment rates among residents and workers, as well as leading other regions in developing and utilizing cutting-edge technologies. As such, the demographic and economic composition of the region make it well suited to benefit from high-value, just-in-time air cargo services. Based on forecasts of population, households and jobs, the planning area is expected to sustain the growth that is underway. Between 2010 and 2040, the number of persons, households and jobs will each increase by approximately one-fifth. This points to increased demand for air cargo services in the region provided by BWI and IAD.

Moreover, the air cargo industry is forecast to expand worldwide, fueled by long-term increases in worldwide GDP and rapid growth in other markets, such as China. BWI and IAD are both poised to embrace this growth from a demand perspective. BWI has historically served domestic demand for air cargo. By 2040, the share of domestic air cargo as a percent of total air cargo at BWI will increase and account for 97 percent of air cargo handled by BWI. By contrast, growth in air cargo handled by IAD will be more focused in the international sector during the planning period. Most of the growth between 2010 and 2040 will be international air cargo, which will account for more than twice the amount of domestic air cargo freight handled at IAD.

The economic health of the planning region depends on robust, domestic, inter-regional commerce as well as increasing participation in global commerce. Therefore, it is important that air cargo services in the region can respond to increasing domestic and international air cargo demand.

REGIONAL AIRPORTS CARGO FACILITIES

Cargo facilities were originally designed based on the predominant type of air cargo service occurring at the major airports—belly freight on passenger aircraft. Air cargo facilities were placed within or close proximity to passenger terminals without considering that substantial growth in air cargo facility expansion may be necessary in the future. Most facilities were not planned in a comprehensive manner to support air cargo as a primary activity; rather, they were planned and constructed within the pretext that air cargo operations occurred adjunct to air passenger service.

Rapid expansion of the Washington and Baltimore regions, coupled with the emerging importance of all-cargo carriers, such as FedEx and UPS, prompted the need to rethink air cargo facilities planning and make specific accommodations for consolidated air cargo facilities in airport layout plans (ALPs). The emergence of the importance of air cargo as a substantial revenue generating activity of carriers spawned the need to strategically plan air cargo facilities at major airports. In short, the strategic planning and development of air cargo infrastructure became an economic development necessity for major airports seeking to maintain their competitiveness, if not expand their prominence and desirability. To do otherwise could result in missed opportunities to retain market share among major commercial airports. BWI and IAD are the two commercial airports in the air system planning region containing substantial air cargo operations and infrastructure to support them.

Section 2 states that air cargo demand is forecast to increase during the planning period. Increased demand is anticipated for both domestic and international air cargo service. As noted, even continued expansion of international service to previously underserved markets such as China and other Asian countries further contributes to this increased demand and the need to provide air cargo facilities needed to support long-haul air cargo shipments.

This section provides an overview of the facilities and infrastructure in place at BWI and IAD necessary to support air cargo. It also identifies considerations that may be necessary in future facility planning activities to continue to effectively accommodate air cargo operations.

BWI

On average, 16 daily cargo flights occur at BWI. To support these operations, as well as passenger operations that also carry in-belly cargo shipments, BWI has numerous air cargo and operations facilities. There are three runways operating around the clock. Runway 10 approach of Runway 10/28 has the highest-classified Instrument Landing System (ILS), Category III (CAT III), which is necessary to support aircraft landings in the least favorable weather conditions. This will ensure all types of aircraft can be accommodated in unfavorable conditions. Runway 10/28 is 10,500 feet in length, 15R/33L is 9,500 feet, and 15L/33R is 5,000 feet. BWI encompasses a total of 3,500 acres.

Ten (10) cargo buildings accounting for 414,900 square feet of warehouse space are present to support air cargo operations. This space includes a cold storage facility with direct ramp access to support time-sensitive air cargo shipments such as flowers or other perishables. Such facilities are important components to the supply chain for delivering time-sensitive commodities and are necessary to demonstrate to air cargo users that the quality of their products will not be undermined because of inadequate conditions that may occur in the air cargo shipping process.

BWI has direct nose-in access for 15 freighter positions and air cargo ramps that can accommodate up to 24 aircraft. These facilities enable multiple air cargo operations to be supported simultaneously, which in turn, bolsters the through-put—ultimately resulting in increased capacity for air cargo operations at BWI. This is particularly beneficial to BWI because of its primary focus on domestic air cargo services. Domestic

operations are typically supported by more frequent flights but with smaller aircraft. Sufficient through-put is needed to support such operations.

The only U.S. Fish and Wildlife Service (USFWS) inspection gateway in the mid-Atlantic is located at BWI. USFWS inspectors provide on-site inspection of live animals, fish and game to expedite clearance and ultimate delivery of live air cargo to their final destination. Similarly, the U.S. Department of Agriculture (USDA) has on-premises inspectors to expedite clearance of plants and other vegetative resources included in air cargo shipments.

BWI is a designated international airport and as such, it is both an origin and destination for international air cargo shipments. Permanently-assigned staff from the Department of Homeland Security's (DHS) U.S. Customs and Border Protection (CBP) are located at BWI around the clock for all international air passenger and air cargo operations occurring at the airport. This 24/7 presence helps expedite the flow of air cargo through this key transfer point in the supply chain. Another key facility at BWI that supports expedient air cargo movements is the Foreign Trade Zone (FTZ).[8]

Interstate highways are readily accessible to BWI, including major national north-south and east-west highways. (See Section 4 for additional information on highway accessibility).

IAD

Four runways support operations at IAD, all of which are CAT III ILS. Runways 1C/19C and 1R/19L are both 11,500 feet long, runway 12/30 is 10,500 feet long, and runway 1L/19R, A fifth runway has been planned, but construction of this facility (which will be parallel to runway 12/30) has not been scheduled. Like BWI, IAD conducts 24-hour operations.

IAD houses seven cargo buildings accounting for 540,000 square feet of warehouse space, and it contains 23 acres of air cargo ramp area. These facilities accommodate specialized services, including refrigerated and heated areas to protect sensitive, perishable shipments; special handling for live animals to provide protection from noise and temperature extremes; and security areas for short-term storage of high value cargo.

In addition to the facilities that accommodate air cargo operational capacity, IAD also includes facilities that support expedient transfer of air cargo shipments. These include an FTZ for conducting international trade.

IAD is also a designated international airport and as such, it accommodates international air cargo shipment. To help facilitate this, IAD has permanently-assigned staff from DHS CPB to provide continuous customs support for all air passenger and air cargo operations.

Located on the border of Loudoun and Fairfax counties in Virginia, IAD is served by three limited access highways as well as a major primary route that is being upgraded to limited access near the airport. (See Section 4 for additional information on highway accessibility).

The airport property itself is composed of nearly 12,000 acres, or 18.5 square miles, and much of the property is still undeveloped. There is room for substantial facility expansion to support the increased carrying capacity that will occur with the completion of the fifth runway. This capital construction program seeks to ensure that future needs will be addressed in a systematic, comprehensive airport expansion occurring within the 12,000-acre footprint.

[8] See entry for FTZ at http://www.bwiairport.com/en/about/cargo/glossary

Facilities Conclusions

Sustained growth in the air cargo market is anticipated through 2040. While both BWI and IAD have implemented capital improvement projects to accommodate air cargo growth and activities, careful consideration will be needed when planning future facilities and related improvements, as was done to accommodate aircraft like the Airbus A380, which now serves IAD. It will be necessary to ensure that existing facilities, including cargo ramps, aprons, runways, etc. will be suitable to accommodate other next generation aircraft from an air cargo perspective.

Increased security requirements have been attributed to delays in timely airport operations. Security needs will require augmented consideration in the development of facility requirements for future airport facilities, and air cargo facilities will be no exception. This is consistent with previous responses to increased regulatory requirements that have been imposed on air operations. When new regulations such as USFWS or USDA inspections were implemented for air cargo, airports responded by developing dedicated space where regulatory agencies could conduct their work efficiently and expeditiously. Air security will simply be another such regulatory activity that will need to be incorporated into facility planning at commercial airports.

Efficient ground access systems will continue to be a paramount consideration. Ground access conclusions are included in the following section.

ACCESSIBILITY ANALYSIS

As part of this study, the recent accessibility analysis from the 2015 Ground Access Forecast Update / Ground Access Element Update was used to demonstrate forecast future changes in accessibility on the region's highway network from the region's commercial airports. The accessibility analysis included BWI and IAD. The purpose of the analysis is: to determine if accessibility to various parts of the region can be expected to change over time, to identify the implications that such changes may have on air cargo shipments, and to make recommendations to help offset potential adverse impacts that may result due to changes in travel time. With air cargo being the fastest-growing freight segment, the need to maintain suitable airports and airport ground access infrastructure will be critical.

Data from MWCOG's and BMC's regional travel demand models were used to conduct this analysis. These models collectively cover the entire air system planning area. Each model contains a zone system composed of thousands of transportation analysis zones (TAZs) that cover the modeled area. In these models, travel time from each of the TAZs to one another is estimated based on the current highway network conditions as well as future conditions that will be expected from the future completion of planned transportation improvement projects contained in the CLRP. Estimated travel times are available in the current year, as well as future years through 2040 in these models.

From an air cargo perspective, favorable highway accessibility originating from an airport is necessary to ensure air cargo shipments are delivered in a timely manner to their ultimate destination in the region. (Similarly, efficient ground access to an airport is necessary to transfer freight shipments en route to their destinations via air cargo). This accessibility analysis portrays travel time or vehicle trips originating at the airports and terminating at various points in the region or traveling through the region. It should be understood, however, that characteristics of the trips taken to transfer air cargo shipments to their ultimate destination via the highway system differ from those captured in the travel demand model. For instance, air cargo shipments, once transferred to vehicles along the highway network, may undergo several intermediate steps before reaching their destination.

For example, mail or parcel shipments are frequently transferred from the aircraft to an off-site (away from the airport property) sorting facility. This transfer would constitute one portion of the highway travel encountered for any given parcel. From the sorting facility, the parcel could then be transferred again to an intermediate facility, such as a local post office, or to its final destination of a business or residence. Transfer of air cargo from the aircraft to its final destination often requires multiple vehicle trips. Therefore, the travel times portrayed in this accessibility analysis may understate the actual time it could take to deliver an air cargo shipment to its destination along the highway network.

The key to this analysis is in understanding the change in accessibility over the planning period. The analysis shows that the land area accessible within specific ranges of time will generally become constricted between today and 2040. For any given destination in the region, the travel time along the highway system may become longer from the airport to that destination; and this could potentially adversely affect timely delivery of air cargo shipments to regional customers.

In comparison to peak travel conditions, accessibility improves during the off-peak travel conditions. This underscores why most freight movements along highway networks are conducted during off-peak hours in areas containing higher levels of residential and commercial activity. In these areas, freight movements may occur at odd hours of the night when other activities are at their lowest levels. This helps ensure timely delivery of freight. Moreover, off-peak freight travel enables more efficient use of regional highway infrastructure through increased utilization of roadways during low-use periods.

Between 2015 and 2040, the number of households accessible from the airports within 45 minutes is forecast to increase by nine percent over the entire region. Specific locations or routes may be less accessible due to congested conditions.

BWI

In general, the primary difference in accessibility from BWI between peak and off-peak conditions is that areas in Prince George's and Montgomery counties in Maryland as well as portions of the District of Columbia have favorable accessibility during the off-peak period.

Good accessibility to interstates 95, 97 and 70 will continue to occur from BWI. This will be an important travel condition for BWI because it will help ensure timely transport of air cargo goods onto major national north-south and east-west highway corridors. I-95 serves states along the eastern seaboard and provides highway access to major markets, including Philadelphia, New York and Boston, among others, to the north, and Richmond, Raleigh-Durham, Jacksonville and Miami, among others, to the south. I-70 originates in Baltimore and extends west to major metropolitan areas, including Pittsburgh, Columbus, St. Louis, and Denver, among others, before terminating in Utah at I-15, which extends from Canada to Los Angeles, CA, and serves regions including Salt Lake City and Las Vegas.

IAD

Accessibility of air cargo originating at IAD to areas east of the airport is good because there is a dedicated, limited access freeway, the Dulles Airport Access Road, which better accommodates morning vehicular trips that can only originate at IAD to its terminus, I-66 inside the Capital Beltway (I-495). It is reasonable to conclude that air cargo shipments coming directly from the IAD property destined east of the airport would be transported along this facility, rather than along the toll road. Therefore, it is important to underscore that the good and favorable accessibility contours should likely extend farther east in the future.

Nevertheless, it is also notable to mention that considerable volumes of air cargo are transferred to trucks at off-airport facilities. In such cases, the freight destined east toward the District of Columbia or the closer-in suburbs must be routed onto the Dulles Toll Road (VA 267), rather than the Dulles Airport Access Road since access to the latter is limited to trips originating on the airport property. The Dulles Toll Road is typically congested during the morning peak period, and it connects to a truck-restricted, high occupancy vehicle (HOV)-restricted highway at its eastern terminus, I-66 inside the Capital Beltway. Although a truck may travel east on the Toll Road at an additional cost in the morning peak period and endure congested conditions, it must still get off the limited access highway network and take circuitous routes on primary and secondary roads into the District because of HOV and truck restrictions. This results in compromised access to points east during the morning peak period for those shipments that arrived at IAD but were sorted or handled at off-site facilities.

By contrast, air cargo shipments originating at IAD have excellent accessibility to IAD. The dedicated, limited-access Dulles Airport Access Road provides direct access to IAD from the Capital Beltway and I-66 in Virginia. Access onto this highway is controlled with limited interchanges; and once on this highway, all trips must terminate at the airport. All travel on this highway is for airport purposes only—i.e. air passengers, discharging/picking up passengers, airport employees commuting to their jobs, air cargo shipments, or airport services—so congestion seldom occurs except in the event of vehicle incidents. In general, good accessibility from IAD extends well into Loudoun and Fairfax counties, even farther in the Virginia suburbs, as well as to portions of Maryland and West Virginia.

There are other important highway facilities that provide service for long-haul destinations or important connections to long-haul facilities. I-66 connects Washington, DC, and I-81 in the Shenandoah Valley; I-81 provides north-south service to major metropolitan areas, including Syracuse, NY, Harrisburg, PA, Roanoke, VA, and Knoxville, TN, among others; plus it connects with major cross-country interstate highways, including Interstates 90, 80, 70, and 40. Similar to I-66, VA 7 connects Northern Virginia to I-81 in Winchester, VA, and provides other important connections to popular north-south truck routes, including US Highways 15 and 340. A direct connection to the Washington region's Capital Beltway is provided via the Dulles Airport Access Road.

VA 28 (Sully Road) is a north-south primary route running immediately adjacent to IAD. It provides key connections to VA 7, the Dulles Greenway, US 50, and I-66, among others. This road has experienced substantial widening in recent years to accommodate increased traffic volumes, and many of the at-grade intersections are in the process of being upgraded to interchanges. This will result in improved traffic flows and more efficient accessibility for freight and delivery trucks originating at or near IAD to other key regional connections.

Accessibility Conclusions

Although overall regional accessibility from BWI and IAD is expected to constrict slightly between today and 2040, key highway connections located in proximity to these airports will continue to have good accessibility. This will aid ground transport of air cargo shipments across the regional highway networks.

Of greater concern is the general pattern of reduced accessibility that will occur from each of the airports to other parts of the region considered in this analysis between now and 2040. This accessibility reduction has implications for transport of air cargo shipments to destinations inside the planning area, and could adversely affect timely delivery of such shipments to their residential or commercial destinations. The highway system in and around BWI and IAD includes roadways heavily-used by commuters as well as commercial passengers and airport employees. Increasing congestion is a concern as the region continues to grow and demand increases at these airports and on the highway system. Expanded use of the ground access system by regional commuters, air passengers, and other users will make it increasingly challenging for timely transfer and delivery of (1) air cargo shipments to their destinations in the region along the road network, as well as (2) freight shipments originating in the region and transferred to an air cargo carrier as part of the delivery chain.

Further consideration may be needed to identify appropriate time-of-day delivery as the region's roads get further congested during the planning period. Such considerations could have implications for siting warehousing, sorting and distribution facilities. These location decisions should optimize access to the highway network to mitigate obstacles, such as traffic congestion, that could undermine timely delivery of air cargo shipments to their destinations.

RECOMMENDATIONS

Air cargo is the fastest-growing mode in the freight sector. It is characterized by the fact that although it carries the least freight in terms of weight, it is the highest-ranking freight mode in terms of value per unit of weight (tons). Air cargo serves a niche market requiring high-value and/or just-in-time delivery.

The Washington-Baltimore air system planning area ranks high among metropolitan areas in terms of educational attainment of its population and workforce, per capita income, and its services sector employment base. These demographic and economic attributes suggest the region is ripe for air cargo services. Moreover, the regional population and households, as well as the number of jobs, are forecast to increase by approximately one-fifth by 2040, and this points to increased demand for air cargo from a purely demographic and economic standpoint.

The long-term prospect for air cargo growth is good. This is fueled by robust growth in the economy of China as well as other markets, including Europe and other Asian markets. Moreover, industry forecasts of air cargo call for sustained growth through the period for both domestic and international shipments, but the heaviest growth will occur in the international sector.

Both BWI and IAD have responded to past growth and future increases in demand by planning and implementing ambitious capital improvement programs intended to modernize and increase the capacity and efficiency of all operations. This includes the development of new runway capacity, terminal expansion and modernization, air traffic control (ATC) improvements, and cargo facilities.

While these improvements serve to ensure the airports continue to operate as efficiently as possible, they are confined to the footprint of airport property or to areas immediately adjacent to the airports. The accessibility analysis in Section 4 of this study reveals that as regional traffic volumes increase throughout the planning period, planned regional transportation improvements will be insufficient for maintaining the same level of accessibility to all areas from the airports through 2040. This has implications for the continuation of journeys, whether they are air passenger trips or air cargo shipments transferred to trucks that must then travel over the road network.

In order to ensure (1) air cargo and over-the-road freight handlers continue to efficiently provide timely service all the way to their final destinations, and (2) suitable access to airports is maintained for shipments originating in the region, the following recommendations are reaffirmed from the 2008 study:

- As part of the airports' ongoing planning and construction programs, specific consideration should be given to the need to plan internal circulation systems and parking facilities in a manner that alleviates congestion in and around cargo facilities and improves truck access to and from cargo facilities. This will help mitigate compromised accessibility to other parts of the region by improving travel time from on-airport cargo facilities to the airport exit. During periods of heavy air operations traffic, congestion at the airports themselves can result in long waits to reach the airport exits.

- Airports should continue to incorporate air cargo needs into their comprehensive planning activities. This will help ensure that air cargo facilities, passenger facilities, air operations facilities, and infrastructure improvements are planned in a systematic manner that seeks to maximize operational efficiencies and reduce unnecessary capital and operational costs. Such savings can result in fiscal benefits that can be otherwise allocated to addressing other documented needs.

- Airports should continue to actively participate in the regional transportation planning process to ensure ground access needs are identified and analyzed as part of the regional process and that suitable ground access systems are planned and implemented. Ongoing participation provides leverage in assuring that identified surface transportation needs of airports are addressed and incorporated into the regional long-range plan (both constrained and unconstrained elements) and

TIP. As participants in the regional process, airports can advocate for the need to analyze ground access projects in the regional travel demand model, which informs decision-makers of key transportation priorities. Both airports are important components of sustained regional prosperity, and as such, critically needed ground access improvements can be given regional priority for limited resources.

- As a corollary to the preceding recommendation, it is further recommended that area jurisdictions continue to work together to collaboratively identify opportunities that are financially beneficial to the region for improving airport ground access in the Washington-Baltimore region.

- Not previously included in the 2008 study, it is recommended here that future updates of this study be jointly undertaken with the TPB regional freight program, with commensurate sharing of staff resources and committee oversight from both the Aviation Technical Subcommittee and the Regional Freight Subcommittee.