A SWOT Analysis of Maryland's Department of Defense Intensive Landscape

Prepared for
Maryland Department of Commerce

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Acronyms and Abbreviations

ATRA	American Taxpayer Relief Act
BBA	Bipartisan Budget Act
BCA	Budget Control Act
BLS	Bureau of Labor Statistics
BRAC	Base Realignment and Closure
DIUx	Defense Innovation Unit Experimental
DoD	Department of Defense
MMIC	Maryland Military Installation Council
NAICS	North American Industry Classification System
O-Net	Occupational Information Network
OES	Occupational Employment Statistics
PSC	Product or Service Code
QCEW	Quarterly Census of Employment and Wages
R&D	Research and Development
REMI PI+	Regional Economic Models, Inc. Policy Insight+
RESI	Regional Economic Studies Institute
SOC	Standard Occupational Classification
SWOT	Strengths, Weaknesses, Opportunities, Threats
VA	Department of Veterans Affairs

Section 1: Executive Summary

Maryland is home to a strong military community. The state contains 20 military facilities, including 11 major military installations, as well as a network of defense contractors drawn to the area by these military facilities and proximity to the Pentagon. Although defense installations and defense contracting are vital to Maryland's economy, this reliance on the industry has associated risks. Recent cuts to the defense budget and five rounds of base realignment and closure (BRAC) have closed bases across the country, moved programs, and realigned military goals. When bases leave and programs transfer out of a state, the communities that rely on the military as anchor employers are often left devastated. By some estimates, Maryland added 19,090 direct jobs and will gain 60,000 total direct and supporting jobs through 2020 as result of the 2005 BRAC. [1] However, there is still a risk that future BRAC rounds will lead to base closures or program loss.

To understand the scope and nature of Maryland's reliance on the Department of Defense (DoD), the DoD's Office of Economic Adjustment (OEA) provided a Defense Industry Adjustment grant to the Maryland Department of Commerce (Commerce). Commerce partnered with the Regional Economic Studies Institute (RESI) of Towson University to conduct the analysis. This analysis aims to explore the extent of Maryland's dependence on the defense industry and to identify ways to help minimize the impact to Maryland's communities in the event of future budget reductions. As part of this process, the RESI team has conducted and presents in this report an analysis of the defense-intensive landscape within Maryland, examining its strengths, weaknesses, opportunities, and threats (SWOT).

1.1 SWOT Findings

As part of the SWOT analysis, RESI contacted and held focus groups and interviews with economic developers, legislators, business leaders, leaders of military alliances, and other key stakeholders in Maryland's DoD-intensive economy. The findings from these focus groups and interviews are summarized below in Figure 1.

[1] Maryland Department of Commerce. "BRAC and Related Jobs Summary." White Paper. April 2014. Accessed December 21, 2017. http://commerce.maryland.gov/Documents/ResearchDocument/BRACJobsSummary2014.pdf

Figure 1: Strengths, Weaknesses, Opportunities, and Threats

Strengths	Weaknesses
• Maryland's Military Bases • Military Bases' Proximity to Each Other • Proximity to Washington, D.C. • Access to Logistics Infrastructure • High Levels of Congressional Support • Educated Workforce • Existing Military Personnel	• Infrastructure • Zoning and Land Use Regulations • Worker Shortage • Lack of Public-Private Partnerships • Overreliance on DOD • Access to Capital/Funding • Lack of Existing Incubators

Opportunities	Threats
• BRAC • Commercialization • Workforce training • 3D/Additive Manufacturing • Cybersecurity in Maryland • Cyber Command Becoming Combatant • Unmanned Vehicles	• BRAC • Sequestration • Changes in Maryland Congressional Representation • Aging Military Workforce

Overall, focus group participants and interviewees were extremely positive about Maryland's position within the DoD landscape. Maryland has established a network of military installations close to major federal employers in Washington, D.C. This network allows DoD contractors to more easily contract with numerous federal clients and allows Maryland's DoD contractors to withstand funding cuts from any one agency. Additionally, Maryland's highly educated workforce, network of highly ranked colleges and universities, number of existing military personnel and retirees, and logistics infrastructure contribute to Maryland's extremely strong position.

Although the state is in an advantageous position, it is not without its weaknesses. In some ways, Maryland has become a victim of its own success, as the state's infrastructure has failed to keep pace with its rapidly expanding population. A focus on infrastructure issues, such as reducing traffic or extending broadband internet access to all corners of the state, will help Maryland attract and retain talent.

Attracting a modern workforce may be the biggest challenge facing the state, and all of the challenges identified in Section 5.2 relate back to the issue in some manner. Maryland should focus on making the state a more attractive place for workers to settle, graduating more high-quality workers from Maryland colleges and universities, and ensuring that its entrepreneurs have the tools they need to succeed.

Although Maryland has its challenges, and faces threats such as future BRAC rounds or changes in defense spending, the state is still in a strong position. Maryland's defense community has provided the state with tools such as a highly educated workforce and a network of businesses with experience in different industries. With the opportunities that Maryland has to commercialize some of the technology developed on its bases and to capitalize on the increasing importance of its cybersecurity resources, the state can continue its strong relationship with the defense industry while also diversifying its communities to deal with adverse shocks. A summary of the strengths, weaknesses, opportunities, and threats facing the State of Maryland are discussed in further detail in Section 5.

1.2 Maryland's Reliance on Defense Contracting

RESI's analysis confirms that the defense industry constitutes a large part of Maryland's economy. Figure 2 displays the average annual impacts of defense contracting on private nonfarm employment in Maryland between 2011 and 2015.

Figure 2: Average Annual Economic Impacts of Defense Contracting in Maryland, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	61,546	51,731	113,277
Output	$8,449,660,189	$6,631,685,483	$15,081,345,672
Wages	$3,465,598,993	$2,203,058,108	$5,668,657,102

Sources: REMI PI+, RESI

Between 2011 and 2015, the $16 billion obligated to Maryland vendors and companies doing business in Maryland directly employed 61,546 private-sector workers in Maryland. These employees supported 51,731 indirect and induced jobs for a total of 113,277 private-sector jobs that are reliant on contracting through the DoD. These Maryland workers generated over $15 billion in output and were paid wages of over $5.5 billion. Jobs in the defense industry are, on average, better paying than the average job in the state. The average wage of those directly affected by DoD contracting is $56,309, higher than the Maryland average wage of $54,777.[2] However, the average annual wage of those workers indirectly associated with DoD contracting is only $42,587. This difference is not necessarily surprising, as indirect and induced jobs typically include service jobs with lower salaries.

However, RESI's analysis found that reliance on defense contracting varied across the state. To determine the relative dependence on DoD contracting across Maryland, the RESI team analyzed five separate regions, as well as the state as a whole. The definitions for the five regions can be found below.

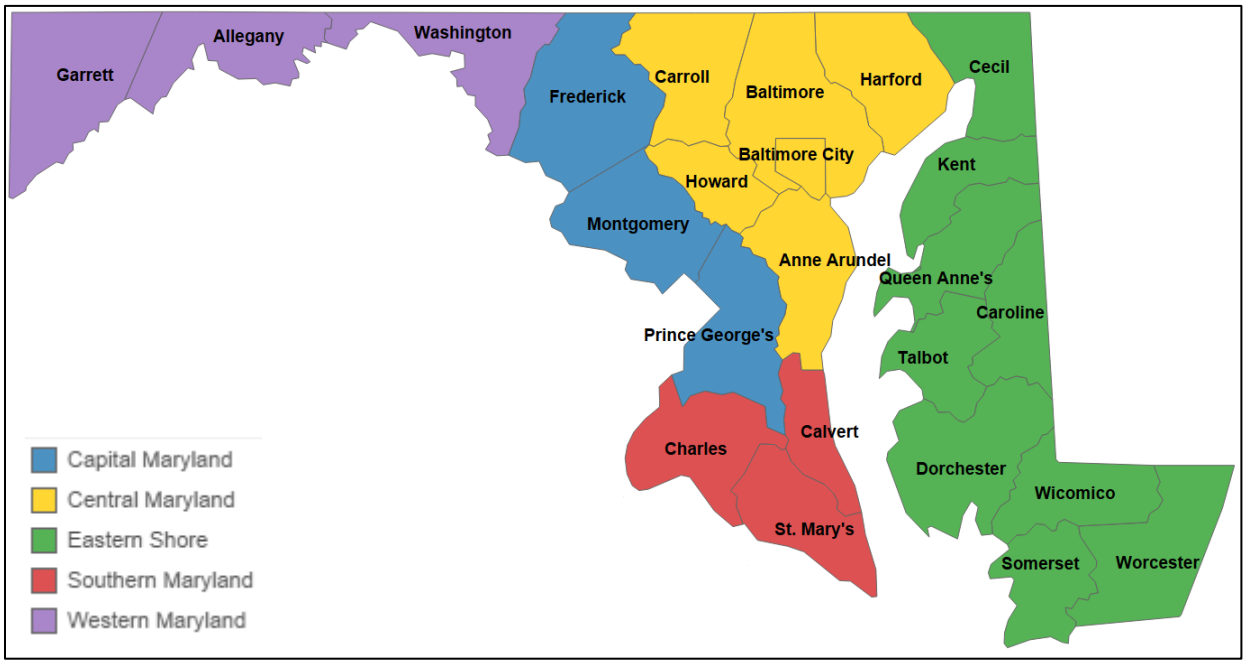
1. **Central Maryland**: Baltimore City and Harford, Baltimore, Carroll, Anne Arundel, and Howard Counties

[2] QCEW. "Private, All Industry Aggregations, Maryland; 2015 Annual Averages, All Establishment Sizes." Accessed October 18, 2016. https://data.bls.gov/cew/apps/data_views/data_views.htm#tab=Tables.

2. **Southern Maryland**: St. Mary's, Charles, and Calvert Counties
3. **Capital Maryland**: Frederick, Montgomery, and Prince George's Counties
4. **Western Maryland**: Garrett, Allegany, and Washington Counties
5. **Eastern Shore**: Cecil, Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester Counties

A map of the five regions used in RESI's analysis is shown in Figure 3.

Figure 3: Maryland Counties in Five Regions Used for Analysis



Source: RESI

Figure 4 highlights the economic impacts of DoD contracting on employment in each region.

Figure 4: Total Annual Economic Impacts of DoD Contracting on Employment and Dependency Ratios by Region, 2011–2015

Region	Total Jobs Impacted by DoD Contracting	Total Jobs in Region	Dependency Ratio
Southern Maryland	8,301	131,688	6.30%
Capital Maryland	45,121	1,072,737	4.21%
Central Maryland	57,673	1,502,589	3.84%
Western Maryland	827	124,746	0.66%
Eastern Shore	1,355	208,395	0.65%
Statewide	**113,277**	**3,040,155**	**3.73%**

Statewide, 3.7 percent of all jobs are dependent on DoD contracting. Southern Maryland, consisting of St. Mary's, Charles, and Calvert Counties, is particularly vulnerable to shifts in DoD

funding, as 6.3 percent of the jobs in the region are reliant on DoD funding. In contrast, the Eastern Shore and Western Maryland do not rely as much on the DoD relative to other regions in Maryland, reflecting both their distance from Washington, D.C., and the lack of military bases in the area. In these areas, only about 0.7 percent of the regions' economies are reliant on DoD contracting, although this still poses a risk in the event of budget cuts.

1.3 Maryland's Reliance on the Defense Industry

Focus group participants and interviewees frequently noted how intertwined DoD contracting was with Maryland's military installations. To gather a complete picture of the defense industry's impact on Maryland, the RESI team combined several estimates to get an overall defense dependency ratio for each region. The team examined several variables, as presented below in Figure 5:

1. **Total Impact of DoD Contracting**: The RESI team calculated total impact, discussed in Section 6.2 of this report, using REMI PI+ and represents the private non-farm impact of DoD contracting on each region in Maryland. This data represents average annual impacts for the period between 2011 and 2015.
2. **Total Military Base Impact**: The RESI team estimated these calculations, presented in Section 6.9, using IMPLAN. Estimates are for fiscal year (FY) 2012, although one installation, Joint Base Andrews, submitted payroll and procurement information for FY 2013. Impacts for this variable include private non-farm and government non-farm employment, output, and wages.[3]
3. **Total Defense Impact**: This is a sum of the "Total Impact of DoD Contracting" and the "Total Military Base Impact" fields.
4. **Total for Region**: This estimation of the total output, wages, and employment for each region is reported from REMI PI+. REMI PI+ uses BEA and BLS data to calculate totals by region. Data here are total non-farm employment, output, and wages, and therefore differ from the regional totals reported in Section 6.2, which only examined the impact to the private sector.[4]
5. **Defense Dependency Ratio**: The RESI team calculated this ratio by dividing the "Total Defense Impact" into the "Total for Region."

[3] There are potential issues with combining prior research conducted on Maryland's military installations with the current analysis of DoD contracting highlighted in Figure 4. For one, the two analyses were conducted using different software, and impacts are reported differently. REMI PI+, used in this report's analysis, has detailed regional linkages, while IMPLAN, used in the 2015 report, does not. Additionally, the 2015 report only covers 15 of Maryland's 20 military installations. Finally, the 2015 report only examines impacts for a single year, instead of examining a five-year average. These caveats are discussed in more detail in Section 6.10. Despite concerns regarding this analysis, RESI believes that all totals and dependency ratios presented in this report are likely conservative given that USA Spending data does not include classified contracts or those with the NSA, and that the 2015 report does not measure the impact of five military installations.

[4] Section 6.2 only examines the private sector to present findings that are more meaningful for diversification and to be consistent with calculations within the Cluster Analysis.

Figure 5: Estimated Annual Economic Impacts of the Defense Industry and Dependency Ratios by Impact Type and Region

Region	Total Impact of DoD Contracting	Total Military Base Impact	Total Defense Impact	Total for Region	Defense Dependency Ratio
Employment					
Southern Maryland	8,301	41,990	50,291	163,760	30.71%
Central Maryland	57,673	272,838	330,511	1,779,737	18.57%
Capital Maryland	45,121	95,391	140,512	1,286,850	10.92%
Western Maryland	827	0	827	145,101	0.57%
Eastern Shore	1,355	0	1,355	245,561	0.55%
Statewide	***113,277***	***410,219***	***523,496***	***3,621,009***	***14.46%***
Output					
Southern Maryland	$955,899,850	$8,032,150,132	$8,988,049,982	$19,858,643,824	45.26%
Central Maryland	$8,060,322,890	$36,850,097,069	$44,910,419,959	$267,837,072,955	16.77%
Capital Maryland	$5,831,964,103	$12,504,130,923	$18,336,095,026	$200,386,535,700	9.15%
Eastern Shore	$149,789,129	$0	$149,789,129	$27,922,484,964	0.54%
Western Maryland	$83,369,699	$0	$83,369,699	$17,853,352,702	0.47%
Statewide	***$15,081,345,672***	***$57,386,378,124***	***$72,467,723,796***	***$533,858,090,145***	***13.57%***
Wages					
Southern Maryland	$393,807,679	$2,729,530,311	$3,123,337,990	$6,698,898,370	46.62%
Central Maryland	$2,966,951,811	$17,710,137,516	$20,677,089,327	$88,968,988,310	23.24%
Capital Maryland	$2,242,669,120	$5,255,017,282	$7,497,686,402	$64,514,564,998	11.62%
Eastern Shore	$40,060,355	$0	$40,060,355	$7,937,732,578	0.50%
Western Maryland	$25,168,137	$0	$25,168,137	$5,139,517,401	0.49%
Statewide	***$5,668,657,102***	***$25,694,685,109***	***$31,363,342,211***	***$173,259,701,656***	***18.10%***

Source: RESI, Maryland Department of Commerce, IMPLAN, REMI PI+

Maryland's economy, as shown in Figure 5, is heavily reliant on both DoD contracting and its military installations. In total, 14.5 percent of Maryland's jobs, 13.6 percent of its output, and 18 percent of its total wages rely directly or indirectly on the defense industry. Crucially, Southern Maryland, comprising Charles, St. Mary's, and Calvert Counties, is extremely reliant on the defense industry: 30.7 percent of the jobs, 45.2 percent of total output, and 46.7 percent of the total wages in the region rely on either DoD contracting or local installations. Central Maryland is also heavily dependent on the defense industry. For example, 18.6 percent of the employment in the region is supported by the defense industry. As noted in Section 6.2, Central Maryland and Capital Maryland have similar levels of reliance on DoD contracting (4.2 percent and 3.8 percent respectively). However, the Central Maryland region is much more heavily dependent on the defense industry as a whole than the Capital Maryland region. The Central Maryland region has two of the largest military bases in the state (Fort Meade and Aberdeen Proving Ground).

Although Maryland's economy is reliant on the defense industry, this analysis shows that the jobs are high-paying jobs. The average defense-reliant job in Maryland has an annual salary of $59,911, above the Maryland average of $54,777. Wages are highest in the Central Maryland region, where the average worker earns $62,561. These numbers are similar in Southern Maryland, where the average defense-reliant worker earns an annual salary of $62,105. Wages are lowest on the Eastern Shore, where workers only earn an average wage of $29,565. This low wage is due to a lack of well-paying jobs on military installations and the presence of few contractors. Instead, most DoD-reliant jobs on the Eastern Shore are indirect and induced jobs typically consisting of service jobs, as discussed in Section 6.8.

If adverse shocks do occur to the defense industry within Maryland, the Professional, Scientific, and Technical Services industry will be particularly hard hit. For example, a ten percent reduction in DoD contracts in Maryland would lead to a job loss of 11,475 jobs, 3,824 of which would be in Professional, Scientific, and Technical Services. This industry includes highly-educated engineers and cybersecurity experts. Throughout the different scenarios our team modeled, this industry was the most affected by changes in the defense industry.

1.4 Pathways Towards Diversification

Combining the results of RESI's economic impact analysis of DoD contracting on Maryland's economy with the report on the impact of the state's military installations illustrates just how important the defense industry is to the state. It also underscores how important it is for Maryland to identify ways to diversify its economy, especially in Southern Maryland, where 45 percent of the output is reliant on defense spending. Focus group participants and interviewees stressed that diversification in Maryland was best accomplished by focusing on three key initiatives:

1. The attraction and retention of skilled workers;
2. The creation of a favorable climate for entrepreneurs; and
3. The maintenance of Maryland's military installations and DoD contracting core.

Economic developers contacted during the SWOT emphasized that their jobs have rapidly evolved from the recruitment of companies to the recruitment of workers. Companies are increasingly mobile due to advancements in communications software. It has become less of a hindrance to locate away from a client or end user, since technology such as Skype allows for easy collaboration and communication. As a result, companies have increasingly begun to focus on locating near skilled workers. Strategies that interviewees and focus group participants listed to help attract and retain workers included strengthening workforce development programs, increasing the number of makerspaces, decreasing the tax rate on federal pensions, and improving Maryland's transportation infrastructure.

Diversifying Maryland's economy will not come solely by attracting skilled labor to the state. For Maryland to support sectors other than DoD contracting, it will be crucial to nurture small businesses and less developed industries. Focus group participants and interviewees had many suggestions on how the State of Maryland could help provide these industries and small businesses with support. For example, respondents suggested using tax incentives to attract businesses in target sectors, creating additional incubators, and the creation of business conferences to increase collaboration.

Finally, focus group participants and interviewees stated that, although economic diversification was an important goal, the state should be careful not to view economic growth as zero-sum. Increasing the number of commercial cybersecurity firms in the state, for example, does not and should not have to come at the expense of Maryland's existing cybersecurity resources. Subject matter experts stressed that the state should focus on growing both its defense-reliant and non-defense-reliant economy, but that the non-defense-reliant portion should grow faster. Over time, this approach will balance Maryland's economy to better withstand cutbacks in defense spending. To accomplish this, respondents indicated that the state needs to focus on maintaining Maryland's defense communities, beginning with preparing for future BRAC rounds. To do so, respondents advocated that Maryland support the BRAC Advisory Group, continue the use of enhanced use leases, and focus on commercializing technology developed at Maryland's military installations.

Maryland is in an excellent position to draw upon its strengths to create a diversified economy, capable of sustaining even a downturn in defense spending. Many of the policy recommendations that focus group participants and interviewees put forward, such as the development of new incubators and the commercialization of products developed at Maryland's military installations, are approaches that the state is already working on, and signal that Maryland may be able to diversify its economy with relative ease.

Section 2: Introduction

Maryland is home to a strong military community. The state contains 20 military facilities, as well as a network of defense contractors drawn to the area by these military facilities and proximity to the Pentagon. Although defense installations and defense contracting are vital to Maryland's economy, this reliance on this industry has associated risks. Recent cuts to the defense budget and five rounds of base realignment and closure (BRAC) have closed bases across the country, moved programs, and realigned military goals. When bases leave and programs transfer out of a state, the communities that rely on the military as anchor employers are often left devastated.

To understand the scope and nature of Maryland's reliance on the Department of Defense (DoD), the DoD's Office of Economic Adjustment (OEA) provided a defense industry Adjustment grant to the Maryland Department of Commerce (Commerce). Commerce partnered with the Regional Economic Studies Institute (RESI) of Towson University to conduct the analysis. This analysis aims to explore the extent of Maryland's dependence on the defense industry and to identify ways to help minimize the impact to Maryland's communities in the event of future budget reductions. As part of this process, the RESI team has conducted and presents in this report an analysis of the defense-intensive landscape within Maryland, examining its strengths, weaknesses, opportunities, and threats (SWOT).

This report consists of two analyses: (1) a traditional SWOT analysis and (2) a series of economic impact models that examine how contracting with the DoD impacts Maryland's economy. The SWOT analysis is discussed in Sections 3, 4, and 5.

- **Section 3** discusses the methodology used to analyze the defense-intensive landscape within Maryland.
- **Section 4** contains background information on Maryland's defense industry.
- **Section 5** contains the results of the SWOT analysis: a traditional SWOT matrix, as well as descriptions of each strength, weakness, opportunity, and threat identified during focus groups and interviews with subject matter experts.

Sections 6 and 7 contain the second piece of the analysis: a set of economic impact models exploring the relationship between defense contracting and Maryland's economy. **Section 6** explores how reliant Maryland's overall economy is on defense contracting and measures how vulnerable the economies of five distinct regions within Maryland are to adverse shocks to the defense industry. **Section 7** models the impact of four scenarios on Maryland's economy to explore how the economy would react to different key scenarios discussed in focus groups and interviews.

Section 8 contains recommendations from focus group participants and interviewees for how the state should diversify its economy away from a reliance on defense contracting. Finally, **Section 9** of this white paper contains the conclusion, summarizing the results of the SWOT

analysis and findings from the economic impact models. **Appendices** contain examples of the interview and focus group guides as well as additional tables outlining in detail the impact of different scenarios on employment, wages, and output on Maryland's economy.

Section 3: SWOT Analysis Methodology

To evaluate the strengths, weaknesses, opportunities, and threats (SWOT) of the defense-related businesses and communities in Maryland, the RESI team first conducted background research to establish a framework for analysis. The team then conducted focus groups and interviews with subject matter experts across Maryland to better understand Maryland's defense industry. The methodology for conducting each piece of the SWOT analysis is discussed in greater detail below.

3.1 Framework Methodology

To guide the SWOT analysis, the RESI team conducted background research on the defense-intensive landscape in Maryland. The team first spoke with defense contracting subject matter experts Todd Harrison and Guy Timberlake. Mr. Harrison and Mr. Timberlake have extensive experience with defense budgets, working with policymakers in Washington, D.C., and helping contractors navigate the procurement and contracting process. Mr. Harrison is the director of defense budget analysis and a senior fellow in the International Security Program at the Center for Strategic and International Studies. Mr. Timberlake is the CEO of the American Small Business Coalition, an organization dedicated to helping small businesses identify federal funding opportunities. These subject matter experts detailed the current trends in the defense industry, defense contracting, and defense budgeting. Discussions also centered on the political landscape, establishing a broader context for some of the budgetary and company-specific findings they discussed.

In addition to exploring trends within the defense industry, the team examined Maryland's current demographics and economy to better understand the changes occurring within the state. The team collected demographic data from the U.S. Census and from the Maryland Department of Planning. Economic data were gathered from two sources: the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) and the Occupational Employment Statistics (OES). QCEW data contain employment and wages for different industries, while OES data can help evaluate changes in specific occupations over time. Changes were examined at five- and ten-year periods.

3.2 Focus Groups

Along with the background research described in Section 3.1, the RESI team conducted a literature review, examining previous SWOT analyses of defense-intensive landscapes. Based on common categories across SWOTs, the team developed a draft set of questions for focus group participants and interviewees. The subject matter experts then reviewed and edited the questions.

The team conducted four focus groups with subject matter experts across the state. To best understand the industries related to DoD contracting and the communities they impact, the team identified four key audiences for large focus groups:

1. Economic Development Managers,

2. Legislators,
3. Industry Groups/Members of Military Alliances, and
4. Technology Transfer Officers.

The team selected each group of participants based on their ability to speak to a variety of defense-related issues. For example, economic development managers were selected because they have intimate knowledge of the industries and economic trends in their respective areas. Legislators have in-depth knowledge of constituent needs and the ever-changing political climate, while military alliance members and heads of industry groups understand with how military bases and local businesses partner and coexist. Technology transfer officers were selected to understand new technologies emerging from military bases and the industries those technologies could support.

The team identified Southern Maryland (Charles, Calvert, and St. Mary's Counties) as a crucial first step to understanding the defense industry's impact in Maryland, given the importance of the defense industry and military bases to the area. Commerce staff coordinated the first two focus groups with a group of economic development managers and technology transfer officers from Southern Maryland.

Attempts to coordinate schedules for a focus group for legislators and industry groups/members of the military alliances proved challenging, and perspectives from these individuals were gathered through interviews, as described in Section 3.3 below. The remaining two focus groups were held with economic development managers from areas with a heavy DoD presence: Frederick, Montgomery, Anne Arundel, Howard, and Baltimore Counties.

Focus groups were semi-structured and participants were encouraged to raise topics that the moderators, Todd Harrison and Michael Siers, did not address. Specific information for focus groups, including attendee lists and questions, can be found in Appendix A.

3.3 Subject Matter Expert Interviews

To expand on findings from the focus groups and to provide additional context to the cluster analysis and business survey results conducted as separate pieces of the evaluation, the RESI team held phone interviews with 22 subject matter experts. Interviewees consisted of several key groups:

1. Legislators whose schedules would not allow them to participate in focus groups,
2. Presidents of military alliances who were not able to attend a focus group,
3. Members of the Maryland Military Installation Council (MMIC),
4. Members of the BRAC Commission,
5. Presidents of firms who participated in the business survey discussed in Section 3.4, and
6. Defense industry subject matter experts that the RESI team identified.

More information on interviewees and questions asked is included in Appendix A. Interviews were 30 to 45 minutes and semi-structured. Because interviewees' backgrounds were so diverse, the interviewer probed beyond the questions found in Appendix A to center on the unique experiences that each interviewee had.

3.4 Business Survey

To better understand the issues facing companies contracting with and supporting the DoD, the RESI team conducted a survey of businesses identified as being a part of the DoD supply chain. An initial list of companies was compiled using data from USA Spending, as well as by researching lists of companies participating in key sectors. For example, the team compiled a list of businesses identified by Cyber Maryland as member firms. The team sent these companies a web survey and also asked each respondent to identify businesses with which they partner on DoD contracts. These businesses were then contacted as part of the survey process. Identified firms were contacted via email and then via telephone to complete the survey.

Survey questions ranged from the businesses' characteristics, such as the number of employees or their primary NAICS code, to their dependency on DoD contracting and their plans for the future. In all, 565 unique businesses responded to the survey and 477 fully completed the survey through October 19, 2016. The survey is currently ongoing.

3.5 SWOT Analysis

After conducting interviews and focus groups and compiling notes, the RESI team identified common themes across interviews and focus groups. These themes were then categorized as strengths, weaknesses, opportunities, and threats. The team conducted additional research to determine the scope of the issues identified, as explored in more detail in Section 5. Additionally, the team identified several key points relevant to helping Maryland diversify its economy which are covered in more detail in Section 8.

Section 4: Framework Overview

To understand the defense-related industry within Maryland, and its corresponding strengths, weaknesses, opportunities, and threats, it is necessary to understand the larger trends occurring both within the defense industry and within Maryland. This section examines trends in defense budget and spending, the defense industry as a whole, political trends, and changes in Maryland's demographics and economy.

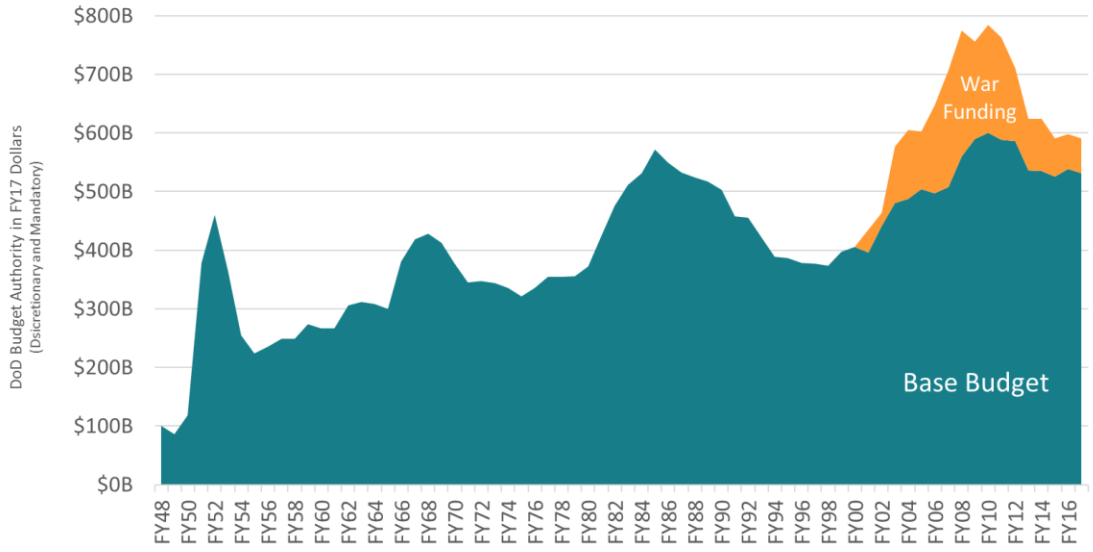
4.1 Defense Budget and Spending

This section outlines key trends in the budget for the DoD. The section discusses macro-level budget trends as well as trends in how the DoD handles contracting.

4.1.1 Macro Budget Trends

As shown in the figure below, defense spending has historically been highly cyclical. Since the end of World War II, there have been four major cycles of defense spending driven by military conflicts and peacetime competition. In the most recent budget cycle, the overall defense budget grew from its low point in FY 1998 to a post-World War II high in FY 2010. Since then, however, the budget has declined by 25 percent, adjusting for inflation, through FY 2015. Much of this decline was due to a reduction in operations in Iraq and Afghanistan. If war-related funding is excluded, the "base" defense budget declined by only 12 percent. In FY 2016, the base defense budget began to grow again due in part to a budget deal enacted by Congress in November 2015, marking what could be an end to this downturn.[5]

Figure 6: DoD Budget FY 1948 to FY 2016, Adjusted for Inflation



Source: Department of Defense, National Defense Budget Estimates for FY 2017

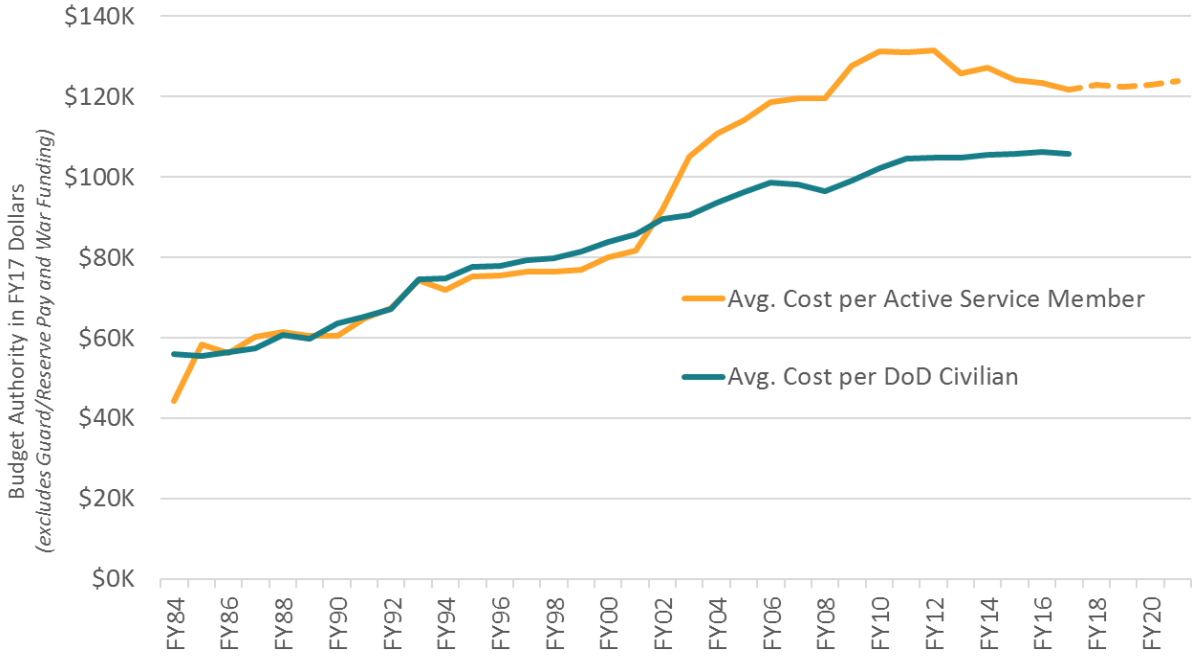
[5] Todd Harrison, *Analysis of the FY 2017 Defense Budget* (Washington, DC: CSIS, April 2016).

The most recent budget cycle differs from previous budget cycles in several important ways. Compared to previous defense drawdowns, this drawdown has been modest in both magnitude and duration. In the defense drawdown that occurred from FY 1985 through FY 1998, for example, defense spending declined by 35 percent, adjusting for inflation, over 13 years. This budget cycle was also different because, while the budget grew throughout the 2000s, the size of the military did not. The number of active-duty service members hovered between 1.4 and 1.5 million during this time, with the Army and Marine Corps adding troops while the Air Force and Navy downsized. Since the budget began declining in FY 2011, however, the size of the force has started to contract and is projected to reach 1.3 million.[6]

This trend indicates that the military is spending more for a smaller force due to growing personnel costs. Nearly half of the DoD budget is used for military and DoD civilian compensation costs. The FY 2017 defense budget request includes $188.9 billion in military personnel-related costs for 1,281,900 active and 801,200 guard and reserve personnel. It also includes $80.8 billion for 763,975 civilian full time equivalents (FTEs).[7] Military personnel costs have grown at a rapid pace, as shown in Figure 7 below. The average cost per active-duty service member increased by 72 percent above inflation from FY 1998 to its peak in FY 2012. In more recent years, healthcare reforms and reduced pay raises that Congress has enacted have flattened the cost curve for military personnel. While the cost of DoD civilian personnel did not grow as fast as military personnel costs, the number of DoD civilian personnel is now at the highest level relative to the size of the active duty force of any time since the end of World War II, as shown in Figure 8.[8]

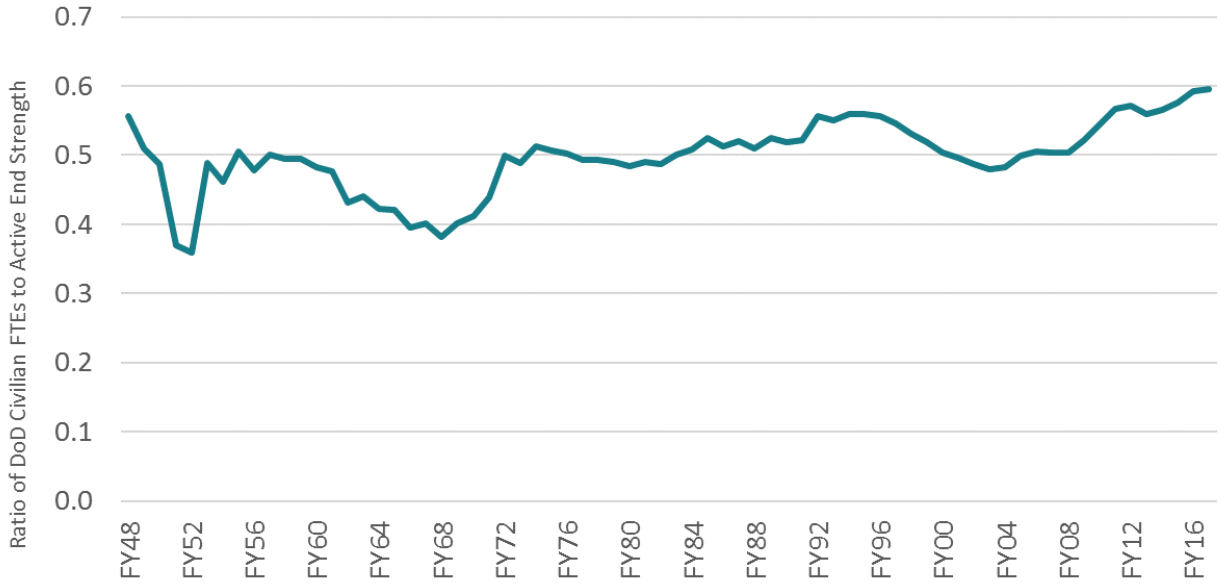
[6] Todd Harrison, *Analysis of the FY 2017 Defense Budget* (Washington, DC: CSIS, April 2016).
[7] Office of the Under Secretary of Defense (Comptroller), *Operation and Maintenance Overview: Fiscal Year 2017 Budget Estimates* (Washington, DC: DOD, February 2006), 294–5.
[8] Ibid.

Figure 7: Average Cost per Person, Adjusted for Inflation



Source: Department of Defense, National Defense Budget Estimates for FY 2017

Figure 8: Ratio of DoD Civilians to Active Service Members



Source: Department of Defense, National Defense Budget Estimates for FY 2017

4.1.2 Contracting Trends

The other major component of the defense budget—roughly half—is for contracted goods and services. These contracts are for the acquisition of major weapons systems, logistics services, supplies, engineering and administrative services, and depot-level maintenance, among other uses. In recent years, roughly 40 percent of DoD contracts have been for products, 40 percent for services, and 20 percent for research and development activities.[9]

The DoD uses thousands of different contract vehicles to contract with vendors each year. Some military installations have made efforts to consolidate contracts into larger contract vehicles that are easier to administer. This consolidation occurs more often for service contracts where the military can combine contracts for various types of services (e.g., systems engineering, administrative support, security, etc.) into one larger contract for competition. Combining a variety of activities into one larger contract vehicle tends to favor large prime contractors because of the scale involved, although the primes will often team with smaller businesses that can provide specialized expertise in key areas.

The way competitive awards (competitions) and contracts are structured can also vary significantly. Some competitions award a contract to a single offeror. Other competitions may award contracts to multiple offerors and can be structured to allow for ongoing competition between companies over some period, often splitting the award each round to keep both firms in the market. For services contracts, it is common for the government to award multiple indefinite delivery, indefinite quantity (IDIQ) contracts and then compete specific delivery orders among those vendors repeatedly over the duration of the contract vehicle.

Since the Weapon Systems Acquisition Reform Act was passed in 2009,[10] the DoD has made efforts to increase the use of competition rather than relying on sole source awards. Even when the DoD offers a full and open competition, often only one company will bid. The rate of "effective" competition—when more than one company bids for a contract—varies by the type of contract and the military service awarding the contract. Services contracts typically have a higher rate of effective competition, with more than 65 percent of services contracts being awarded competitively since 2009. In contrast, less than 40 percent of contracts for products and less than 50 percent of contracts for research and development were awarded competitively since 2009. Within services contracts, the Army tends to have a significantly higher rate of competition with more than 70 percent of contracts awarded competitively in recent years. In comparison, the rate for the Navy has hovered around 60 percent and the rate for the Air Force has fallen precipitously to just over 40 percent of contracts competitively awarded.[11]

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[9] Andrew Hunter and Greg Sanders, *Analysis of Defense Products Contract Trends, 1990–2014* (Washington, DC: CSIS, 2015) p. 6.
[10] *Weapon Systems Acquisition Reform Act of 2009*, Public Law 111-23, U.S. Statutes at Large 123 (2009): 1704-1733.
[11] Andrew Hunter, et. al., *The Industrial Base After the Drawdown* (Washington, DC: CSIS, October 2015), slides 7-9.

The type of contract used can also be an important factor for defense firms. A cost-reimbursable contract type means that the DoD will pay the contractor for the actual costs it incurs plus an agreed-to fee. Fixed-price contracts typically set a price upfront that does not vary with the contractor's actual costs incurred. In general, cost-reimbursable contracts are lower risk for the vendor because the government assumes responsibility for any cost overruns. Fixed-price contracts tend to be riskier for the vendor, but can result in much higher profit margins if well managed. Cost-reimbursable contracts also require that the company meet the DoD's contract audit standards so that the government can verify the company's invoiced costs are true and accurate. Meeting these standards—many of which are unique to the DoD and require special management and accounting processes and software—can be time-consuming and require significant upfront costs for a contractor. This process can be prohibitive for small businesses and even large businesses that are new to the defense market.

Congress, particularly the Senate Armed Services Committee chaired by Senator John McCain, has become increasingly frustrated with the DoD's use of cost-reimbursable contracts for programs in which a fixed-price contract could have been used. One of the reasons for the push against cost-reimbursable contracts is that the government bears virtually all of the risk for cost overruns and contractors have less incentive to control costs. Current legislation pending in Congress would require the DoD to use fixed-price contractors in many situations in which it currently does not, although it is not clear if this provision will ultimately be enacted into law.[12] Leaders in the House Armed Services Committee and the White House oppose mandating the use of fixed-price contracts because in many defense acquisitions it is difficult for contractors and the government to accurately estimate the amount of work required, making it difficult to know in advance what a fair price would be.

The fiercest competition among vendors often occurs at the subcontractor level. Once DoD awards a major contract, the prime contractor may then award subcontracts for some elements of the work. This approach is often how small businesses break into the defense market, using the connections and leverage of an experienced prime contractor. Prime contractors can charge a fee on the work that subcontractors perform, so the profit margins for subcontractors tend to be smaller. A subcontractor often has very specialized capability in a niche area, and their focus allows them to work as a subcontractor for multiple primes across a variety of contracts in the same niche area. This can create "hidden monopolies," in which a single subcontractor effectively corners the market among all of the primes for specific work without the primes or DoD realizing they are all dependent on the same subcontractor.

When selecting prime contractors, the DoD often looks for experience in relevant areas. Large-scale defense acquisitions therefore tend to favor incumbent contractors, and a small number of large contractors have come to dominate the prime contractor market. Price can also be an important factor. The current leadership in the DoD, particularly in the office of the

[12] Joe Gould, "Policy Bill Aims to Tame Cost-Plus Contracts," *Defense News*, May 16, 2016.

Undersecretary of Defense for Acquisition, Technology, and Logistics (AT&L), has been intently focused on driving down prices for contracts. For cost-reimbursable contracts, where DoD reimburses the contractor for all of their costs plus a fee, that means negotiating lower fees and thus driving down profit margins for companies. Despite this pressure on prices, many major defense contractors have been delivering relatively high earnings and their stocks have performed well even during this period of reduced defense spending. One of the reasons for their continued performance is that defense firms recognized the downturn in spending was coming and downsized their workforce and infrastructure accordingly.

4.1.3 Third Offset Strategy

For the past two years, DoD has placed a much greater emphasis on incorporating new technologies and warfighting capabilities into its long-term strategy and plans. This effort has been spearheaded by Deputy Secretary of Defense Bob Work, who has termed it the "Third Offset Strategy." As the name implies, this effort is modeled on two previous offset strategies: President Eisenhower's "New Look" strategy at the end of the Korean War and Defense Secretary Harold Brown's offset strategy following the end of the Vietnam War.[13] Eisenhower's offset strategy focused on countering growing Soviet influence and power and the loss of a monopoly on nuclear weapons technology. Instead of fighting future ground wars in Asia, like the costly Korean War, Eisenhower sought to offset Soviet power by building up U.S. nuclear forces, specifically long-range bombers and missiles, to deter Soviet aggression. Brown's second offset strategy in the 1970s again sought to offset Soviet power (as it had then reached parity with U.S. nuclear forces) by developing precision-guided conventional weapons and stealthy aircraft against which it would be costly for the Soviets to defend.[14]

Both previous offset strategies had a profound influence on defense spending and defense contractors. The first offset strategy led to a dramatic shift in funding among the military services, with the Army's share of the budget falling and the Air Force's rising. At one point in the late 1950s, the Air Force received roughly half of the total defense budget as it built up fleets of long-range bombers and intercontinental ballistic missiles—a remarkable feat, considering it had only been a decade since the Air Force was made an independent military service. This second offset strategy shifted funding within each of the services to more advanced technologies. It ultimately led to the creation of systems like GPS, smart bombs, and stealthy aircraft that have revolutionized the way that the U.S. military engages. Maryland defense companies and universities played important roles in each of the previous offset strategies, although much of

[13] Robert Work, "The Third U.S. Offset Strategy and its Implications for Partners and Allies" (speech, Washington, DC, January 28, 2015), available at http://www.defense.gov/News/Speeches/Speech-View/Article/606641/the-third-us-offset-strategy-and-its-implications-for-partners-and-allies.
[14] Robert Martinage, *Toward a New Offset Strategy: Exploiting U.S. Long-Term Advantages to Restore U.S. Global Power Projection Capability* (Washington, DC: CSBA, October 2014).

the work was classified at the time. The idea of using satellites for navigation, for example, originated at Johns Hopkins University's Applied Physics Laboratory.[15]

Although the Pentagon has been working on the Third Offset Strategy for two years, a definitive definition of what the strategy is has not yet emerged. However, senior leaders have indicated that advances in unmanned systems, automation, machine learning, and human-machine interfaces will likely play an important role in whatever strategy emerges. It also seems likely that space systems, cyber-attack and defense systems, and electronic warfare will play greater roles in future conflicts, and investment in these areas is already increasing. Maryland's military installations and companies are involved in unmanned systems and cybersecurity, representing an opportunity for Maryland companies to receive more contracts under the Third Offset Strategy.[16]

4.1.4 Innovation Initiative

In parallel with the Third Offset Strategy, the DoD has begun reaching out to commercial firms to tap into commercial technologies that may have defense applications. Defense Secretary Ash Carter has created three "innovation hubs" around the country to advance this initiative. The first of these, Defense Innovation Unit Experimental (DIUx), was created in Silicon Valley to facilitate greater cooperation with tech firms engaged in advanced machine learning, automation, and other activities.[17] A second DIUx was created in Boston to engage with biotech and engineering firms in that area, and a third DIUx is planned for Austin.[18] There has been no discussion to date of opening a DIUx in Maryland. The innovation initiative reflects a concern within the DoD that traditional defense contractors may not be at the forefront of modern technology. It is an effort that shifts toward more innovative contractors in the private sector. If continued in the next administration, such an initiative could ultimately reshape the defense industry and the distribution of defense contracts by expanding the base of defense contractors to include more commercially-oriented firms and increasing the geographic concentration of contracts around the DIUx hubs. Increasing the number of contracts around DIUx hubs could correspond to a decrease of contracts within Maryland, unless a DIUx is opened in the state.

4.2 Defense Industry Trends

This section outlines key trends in the defense industry, including trends in consolidation and workforce requirements.

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[15] Dan Cho, "Space Tracker: The earliest satellite watchers' ideas led to GPS" *MIT Technology Review*, December 1, 2004.

[16] The opportunity represented by cybersecurity and unmanned systems are discussed in greater detail in Sections 5.3.5 and 5.3.7.

[17] Cheryl Pellerin, "DOD's Silicon Valley Innovation Experiment Begins," *DoD News*, October 29, 2015.

[18] Department of Defense, "Secretary Carter Announces DIUx Presence in Austin, Texas," DoD Press Release, Release No: NR-321-16, September 14, 2016.

4.2.1 Mergers and Consolidation

In the early 1980s, the Reagan Administration embarked on a rapid buildup of the defense industry. In FY 1985 alone, the DoD procured 32,714 tactical missiles, 2,031 combat vehicles, 535 fixed-wing aircraft, 390 helicopters, and 24 ships and submarines. The defense industrial base at that time had more than 20 prime contractors competing for a share of the market.[19]

As the defense budget began to decline, acquisition spending was cut by 54 percent in real terms from FY 1985 to FY 1995, resulting in widespread consolidation throughout the defense industry. The number of contractors declined in 10 of the 12 markets that DoD identified as important to national security from 1990 to 1998. Missile contractors decreased from 13 to 3; fixed-wing aircraft contractors declined from 8 to 2; and surface ship contractors decreased from 8 to 5.[20] The reduction in military spending left significant excess capacity in the defense industry. However, in many cases consolidation did not remove this excess capacity because newly merged companies were slow to close facilities.[21] As a result, overhead costs remained high, and the profitability of defense firms suffered. This effect was reflected in lower price-earnings ratios for aerospace and defense stocks of only 5 to 8 times earnings as compared to 13 to 14 for other firms in the Dow Jones index in late 1990.[22]

Pentagon leaders encouraged this industry consolidation through the 1990s. In 1993, Secretary of Defense Les Aspin invited the CEOs of the top 15 defense firms to the Pentagon. At this meeting, defense officials made clear to these CEOs that DoD could not afford to support the industry's excess capacity, and it would be up to these companies to adjust.[23] What followed was a remarkable period of consolidation that was unprecedented in modern history. The character of the defense industrial base was also transformed; many of the major nondefense companies that still had significant investments in defense left the sector, including many iconic American companies: IBM, Texas Instruments, Ford, Chrysler, and Westinghouse.

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[19] Lieutenant General Ronald Kadish (USAF, Ret.), et al., *Defense Acquisition Performance Assessment Report* (Washington, DC: DOD, January 2006), p. 7; and Clark A. Murdock, Michèle A. Flournoy (Project Leaders), et al., *Beyond Goldwater-Nichols: US Government and Defense Reform for a New Strategic Era, Phase 2 Report* (Washington DC: CSIS, July 2005), p. 89.

[20] David E. Cooper, "Defense Industry Consolidation: Competitive Effects of Mergers and Acquisitions," General Accounting Office GAO/T-NSIAD-98-112, March 4, 1998, p. 2, at http://www.gao.gov/archive/1998/ns98112t.pdf, accessed December 31, 2010.2.

[21] Eugene Gholz and Harvey Sapolsky, "Restructuring the U.S. Defense Industry," *International Security*, Vol. 24, No. 3, Winter 1999/2000, pp. 22-30.

[22] U.S. Congress, Office of Technology Assessment, *After the Cold War: Living With Lower Defense Spending*, OTA-1TE-524 (Washington, DC: U.S. Government Printing Office, February 1992), p. 216.

[23] Norman Augustine, "The Last Supper, Revisited: Meeting Ignited Inevitable Consolidation," *Defense News*, June 26, 2006..., at http://integrator.hanscom.af.mil/2006/june/06292006/06292006-13.htm, accessed December 31, 2010..

Among the remaining defense firms, a class of "super-primes" emerged at the top of the pyramid—those companies that survived the consolidation of the 1990s and emerged as firms solely (or predominately) in the business of defense. The top six defense primes—Boeing, Lockheed Martin, Northrop Grumman, General Dynamics, Raytheon, and United Technologies Corporation—received less than 20 percent of funding for defense products in 1990 but garnered nearly 45 percent by the end of the decade. In addition, these firms, except for Boeing, receive the clear majority of their revenue from defense-related contracts. The increase in market share for the top primes came largely from medium-sized defense firms, which saw market share fall from 28 to 20 percent over the same period.[24] The industry consolidation of the 1990s was largely a result of the largest firms buying or merging with medium-sized firms.

Things began to turn around for the defense industry in the late 1990s. Defense spending leveled out and then began rising again in FY 1999. But unlike previous periods of military expansion and mobilization, the post-9/11 buildup did not result in a larger force structure. In terms of equipment, the increase in acquisition funding largely resulted in a "hollow" buildup—the number of ships in the fleet fell, the number of aircraft fell, the average age of aircraft increased, and several high-profile acquisition programs were cancelled without any systems being fielded

In the most recent defense drawdown that began in FY 2011, industry consolidation began to take a different form than in the 1990s. There have been a few major spinoffs and mergers, such as SAIC spinning off Leidos and Leidos subsequently merging with Lockheed's Information Systems and Global Solutions (IS&GS) business, but nothing approaching the massive, systemic consolidation of the 1990s. The market shares for the top six contractors fluctuated during the 2000s but ultimately returned to roughly the same level as 1999. Contracts going to medium-sized firms, however, declined to 14 percent in 2014, while contracts awarded to large firms (excluding the top six) increased from 21 to 30 percent. This suggests that a second wave of consolidation occurred mainly from large firms buying or merging with medium-sized firms. As of 2014, more than 70 percent of contracts for products went to large firms and the top six firms combined.[25]

4.2.2 Payloads Not Platforms

While the general trend in industry has been consolidation into larger firms, the DoD's interest in innovation and tapping into commercial technology with potential defense applications is moving in the opposite direction. One concrete manifestation of these trends working at cross purposes is the DoD's push to focus on a "payloads not platforms" approach to weapons acquisitions. Rather than buying single-purpose platforms that are difficult to upgrade and

[24] Jesse Ellman and Jacob Bell, *Analysis of Defense Products Contract Trends, 1990–2014* (Washington, DC: Center for Strategic and International Studies, October 2015), 26–28, http://csis.org/files/publication/151020_Ellman_AnalysisDefenseProductsContractTrends1990-2014_Web.pdf.
[25] Ibid.

modify, the DoD is pursuing more modular platforms that can carry a wide array of payloads and can be used for multiple purposes. An example of this approach is the B-52 bomber, which has been in the Air Force inventory for more than 60 years and is projected to continue flying through the 2040s. Through incremental upgrades and the integration of modern weapons, such as GPS and laser-guided bombs, the B-52 remains a military workhorse.[26]

The shift toward focusing on payloads (such as advanced sensors and munitions) rather than large platforms could have substantial implications for the defense industry. Major weapons platforms tend to favor large firms because of the scale of the programs and workforce needed to build them, making it difficult for new firms to break into the market. Programs to build new payloads, however, tend to be much smaller in scale and can often rely on new or breakthrough technology in which no company has incumbency. The "payloads not platforms" approach is still in its infancy, and it is not clear if DoD will follow through in future years. But if it comes to fruition as envisioned, it could create opportunities for many medium- and small-sized defense firms to regain market share and for new companies to enter the defense business. For example, the barriers to entry (such as startup capital, manufacturing space, and the number of skilled workers) needed to develop new sensors to go on a weapon system are lower than those required to develop the entire weapon system.

4.2.3 Competition for Talent

The Third Offset Strategy, Innovation Initiative, and Payloads Not Platforms all point to a demand for more highly skilled defense workers in industry and government. Workers with advanced skills and degrees in computer science and electrical engineering are likely to be in increasingly higher demand in the coming years as unmanned systems, autonomous systems, cyber warfare/cybersecurity, and electronic warfare play a greater role in national security.

One of the underlying motivations behind the Innovation Initiative is that defense leaders have not been satisfied with the access to talent they currently have through traditional defense contractors and the DoD civilian workforce. To address its own internal talent management issues, DoD started an initiative known as Force of the Future in 2015. This initiative was intended to develop a plan for modernizing the military and civilian personnel systems within DoD to better attract and retain highly skilled personnel.[27] It was met with sharp criticism within the DoD, and its initial set of sweeping reforms were scaled back to a series of relatively minor changes and pilot programs, reflecting the difficulty of changing long-entrenched bureaucracies.[28]

Defense firms, however, have a different set of hurdles to overcome when it comes to modernizing their personnel systems to attract and retain highly skilled workers. For defense companies, and particularly for many of those located in Maryland, location can be a significant

[26] Ryan Faith, "Here's What the Pentagon's Top Cost Estimator Has to Say About the Death Star," *Vice News*, December 21, 2015.
[27] Jim Garamone, "Carter Details Force of the Future Initiatives," *DoD News*, November 18, 2015.
[28] Katherine Kidder and Amy Schaffer, "Jumpstarting the Force of the Future," *War on the Rocks*, June 10, 2016.

impediment to recruiting younger workers. Companies that must be geographically located near their customers can have problems with recruiting if their customers are in rural or otherwise isolated areas where workers may not be willing to relocate. At the other extreme, some firms may find it difficult to retain workers at offices located in dense, high-traffic areas. In both cases, firms are turning toward telework options and distributed offices to better accommodate workers' geographic preferences.

4.3 Political Landscape

This section identifies several of the key federal-level trends affecting the defense industry. One of the most important issues facing Maryland's DoD intensive landscape, Base Realignment and Closure (BRAC), is discussed in Section 4.3.2.

4.3.1 Macro Budget Politics

For the past five years, the dominant factor in the defense budget debate has been the Budget Control Act of 2011 (BCA). The BCA was enacted in August 2011 amid soaring federal deficits, mainly due to the Great Recession and the stimulus package that Congress enacted in 2009. At the time, the deficit was projected to peak at a record level of $1.5 trillion.[29] Republicans had just taken control of the House of Representatives and refused to increase the debt ceiling unless Democrats agreed to dollar-for-dollar cuts in spending. This forced a fiscal standoff in August 2011 and resulted in the BCA as a last-minute compromise just hours before the debt ceiling was breached. The BCA was designed to be a forcing function for a broader budget deal because it would automatically impose painful spending cuts if no deal was reached.

The BCA placed caps on the budget for a 10-year period ending in FY 2021 with separate caps for the defense and nondefense parts of the discretionary budget. For defense, the budget caps are $1 trillion less over 10 years than what the president had proposed in the FY 2012 budget request. The law created a bipartisan joint committee, known as the Super Committee, with special authority to propose a deficit-reduction budget deal without having to meet the 60-vote threshold in the Senate. The Super Committee met several times, but in November 2011 it was announced that they had reached an impasse.[30]

Over the past five years, Congress has modified the BCA three times. In January 2013, before the budget caps went into enforcement, Congress passed a budget deal known as the American Taxpayer Relief Act of 2012 (ATRA). The ATRA raised the budget caps slightly for FY 2013, with equal increases on the defense and nondefense sides of the budget caps, and paid for these

[29] Congressional Budget Office, The Budget and Economic Outlook: Fiscal Years 2011 to 2021 (Washington DC: GPO, January 2011) p. xii.
[30] Ted Barrett, Kate Bolduan and Deirdre Walsh, "'Super committee' fails to reach agreement," *CNN.com*, November 21, 2011.

increases by lowering the caps in FY 2014.[31] Congress modified the BCA for a second time in December 2013 with the Bipartisan Budget Act of 2013 (BBA 2013). This budget deal raised the caps for FY 2014 and FY 2015, again with equal increases for the defense and nondefense sides of the budget.[32] In late 2015, Congress passed a third modification to the BCA known as the Bipartisan Budget Act of 2015. Like the BBA 2013, it raised the budget caps for two years (FY 2016 and FY 2017) with equal increases for defense and nondefense.[33]

The pattern of behavior observed in Congress over the past five years suggests that, while there appears to be majority support for increasing the defense budget, that desire is being tempered by divisions over the nondefense portion of the budget. While Republicans have generally advocated for increases in defense offset by cuts in other parts of the budget, Democrats have insisted on equal increases and defense and nondefense spending. With the 2016 election results, and Republicans controlling the House, Senate, and White House, it is likely that there will be an increase in the defense portion of the budget. Whether this is successfully resisted by the minority party remains to be seen. On January 27, 2017, President Trump signed an executive order designed to "begin a great rebuilding" of the United States military.[34] Although the administration has not yet submitted an official budget, any increase in defense spending likely benefits Maryland, given the number of contractors and installations in the state.

4.3.2 Base Closures

In the most recent round of base closures, which began in 2005, Maryland fared well compared to other states. Overall, Maryland benefited from the 2005 BRAC because several major installations and commands were realigned into the state from other jurisdictions. Maryland added 19,090 direct jobs and anticipates gaining 60,000 total direct and supporting jobs through 2020 as result of the 2005 BRAC.[35] For example, Walter Reed Army Medical Center in Washington, D.C., was closed and its operations were moved to the National Naval Medical Center in Bethesda to form the Walter Reed National Military Medical Center. The Army also moved many of its units from Fort Monmouth in New Jersey to Aberdeen Proving Ground in Maryland, and the Defense Information Systems Agency relocated its headquarters from Northern Virginia to Fort Meade in Maryland. Previous rounds of base closures, however, were

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[31] U.S. Congress, Senate Committee on Finance, *Summary of Provisions in the American Taxpayer Relief Act of 2012*, p. 20.
[32] U.S. Congress, House Committee on Budget, *Summary of the Bipartisan Budget Act of 2013*, December 10, 2013, p. 1.
[33] U.S. Congress, House Committee on Budget. *Summary of the Bipartisan Budget Act of 2015*, pp. 1–2.
[34] Hagen, Lisa. "Trump Signs Directive Spurring 'Great Rebuilding' of Armed Forces." The Hill. January 27, 2017. Accessed January 31, 2017. http://thehill.com/policy/defense/316591-trump-signs-order-to-grow-military-modernize-nuke-arsenal
[35] Maryland Department of Commerce. "BRAC and Related Jobs Summary." White Paper. April 2014. Accessed December 21, 2017. http://commerce.maryland.gov/Documents/ResearchDocument/BRACJobsSummary2014.pdf

not as kind to Maryland. The 1995 BRAC closed Fort Richie in Cascade, the Naval Surface Warfare Centers in Silver Spring and Annapolis, and Fort Holabird near Baltimore, to name a few.[36]

The Obama administration proposed initiating another round of base closures for several years, and Congress rejected these proposals year after year. In the most recent budget request for FY 2017, DoD proposed a round of base closures that would start in FY 2019, and it included $2.1 billion in funding to pay for initial closures and environmental remediation.[37] As in past years, this request was promptly rejected by members of Congress. In May 2016, the Commerce created a committee to "fight for Maryland's interests" and build on the gains made in the previous round of consolidation.[38]

This year, however, in a change from previous BRAC requests, the DoD provided Congress with an estimate of its excess infrastructure. This report showed that excess capacity primarily resides in the Air Force and Army, each having 32 percent and 33 percent excess, respectively. The Navy, however, only reported 7 percent excess capacity. More specifically, the Army estimates that it has 46 percent excess capacity in test and evaluation facilities and laboratories.[39] Maryland is home to Fort Detrick, a major Army lab, and Aberdeen Proving Ground, a major Army test and evaluation center. However, it should be noted that the existence of excess capacity alone is not sufficient to warrant closure. Certain types of facilities have unique characteristics that may warrant their protection in a future round of closures because they cannot be easily replicated elsewhere, such as the testing and training ranges at Aberdeen Proving Ground. The largest areas of excess capacity in the Air Force and Navy do not appear to affect the types of facilities that these services have in Maryland.

Beyond the political challenge of getting members of Congress to enact legislation to create a new base closure commission, the fiscal challenge of base closures is also a barrier to implementation. While base closures do eventually save money, they require new spending up front before the long-term savings can be realized. The 2005 BRAC was an anomaly because the upfront costs were much higher than expected—higher than all previous BRACs—and the long-term savings were lower than projected. DoD has indicated that the round of base closures it is now requesting would be much more like the first four rounds in the 1990s than the 2005 BRAC.

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[36] Defense Base Closure and Realignment Commission, *Final Report* (Washington, DC: DoD, September 8, 2005) Vol. 2, Appendix F.
[37] Department of Defense, *DoD Base Realignment and Closure Executive Summary FY 2017 Budget Estimates* (Washington, DC: DOD, February 2016), 8.
[38] Ian Duncan, "State forms group to fight for Maryland in future round of BRAC," *The Baltimore Sun*, May 11, 2016.
[39] Department of Defense, *Department of Defense Infrastructure Capacity* (Washington, DC: DOD, March 2016).

4.4 Military Retirees in Maryland

Aside from direct defense contract spending, Maryland also benefits from the economic activity of military retirees who reside in the state. According to the DoD Office of the Actuary, some 55,046 military retirees lived in Maryland in 2015.[40] This section examines key statistics on their pay and location.

4.4.1 Military Retirement Pay

Collectively, Maryland's military retirees received some $1.5 billion annually in retirement pay.[41] To qualify for military retirement pay, a service member needs to serve at least 20 years or meet the requirements for a medical retirement. Military retirees tend to cluster in several areas around the state, as shown in the figures below. Figure 9 shows the total number of military retirees living in Maryland aggregated by three-digit zip code, the finest level of detail reported by the US DoD Office of the Actuary. As seen in Figure 9, most retirees live in the three digit zip codes 206 and 207. These two zip codes make up Southern Maryland and the area around Fort Meade. The highest concentration of retirees, as shown in Figure 10, lives in congressional district 5, with more than twice as many retirees than any other district.[42] As the data confirm, military retirees tend to reside near military installations. Maryland's ability to attract and retain military retirees in the future (and the income they bring to the state) depends in large part on Maryland's ability to maintain or even grow its military installations.

[40] DoD Office of the Actuary, *Statistical Report on the Military Retirement System: Fiscal Year 2015* (Washington, DC: DOD, July 2016) p. 28.
[41] Ibid.
[42] DoD Office of the Actuary, Military Retirees and Survivors by Congressional District (Washington, DC: DOD, December 2015) p. 24.

Figure 9: Number of Military Retirees by Zip Code, 2015[43]

Zip Code	Number of Retirees (2015)
205XX	9
206XX	10,979
207XX	11,801
208XX	3,687
209XX	1,492
210XX	8,364
211XX	5,689
212XX	4,014
214XX	1,623
215XX	578
216XX	1,206
217XX	3,781
218XX	1,006
219XX	826

Source: DoD Office of the Actuary

Figure 10: Number of Military Retirees and Survivors by Congressional District, 2015

Congressional District	Number of Retirees and Survivors (2015)
1	5,039
2	6,764
3	5,816
4	8,396
5	17,040
6	4,693
7	3,205
8	4,223

Source: DoD Office of the Actuary

4.4.2 Veterans Benefits and Services

Veterans benefits and services are funded through the Department of Veterans Affairs (VA) and therefore are not part of the defense budget. Because VA benefits are connected to military service, they represent an indirect form of defense spending that benefits Maryland. According to the VA, nearly 438,000 veterans resided in Maryland in 2014. These veterans receive $2.7

[43] Total number of retirees in this table is slightly larger (by 9 people) because some of the three-digit zip codes included in this table may include residents from another state.

billion in benefits annually, including $1.2 billion in cash compensation and pensions to 76,000 Maryland veterans. The VA spends $1.0 billion annually on medical and construction programs in Maryland, and more than 28,000 Maryland residents are using the GI Bill and other educational benefits provided by the VA. The VA estimates that the VA loan program guarantees $3.8 billion in Maryland home loans.[44] For the past decade, veterans benefits and services has been one of the fastest growing areas in the federal budget. Moreover, the recent budget downturn did not affect VA spending—the budget continuing growing to the highest level in history. Budget projections indicate that VA spending will continue to grow in the coming years.

4.5 Maryland's Framework

In addition to considering macro-level trends affecting the defense industry, the RESI team also examined data relating to Maryland's demographics and economy. These trends, in addition to the trends discussed earlier, guided the development of interview and focus group guides.

4.5.1 Maryland's Demographics

To understand Maryland's defense industry, it is necessary to consider the current and potential future workforce within the state. Maryland's population has been steadily increasing over time and is projected to continue to grow. In 2015 the U.S. Census estimated that Maryland's population was just over 6 million, up 4 percent from 5.7 million in 2010. Figure 11 below shows the population growth for each county as well as statewide, as calculated by the Maryland Department of Planning. Notably, no county's population is projected to decrease over the next 25 years.

[44] U.S. Department of Veterans Affairs, "Maryland and the U.S. Department of Veterans Affairs," Fact Sheet, November 2015.

Figure 11: Population Projections for Maryland and Its Counties, 2015–2040

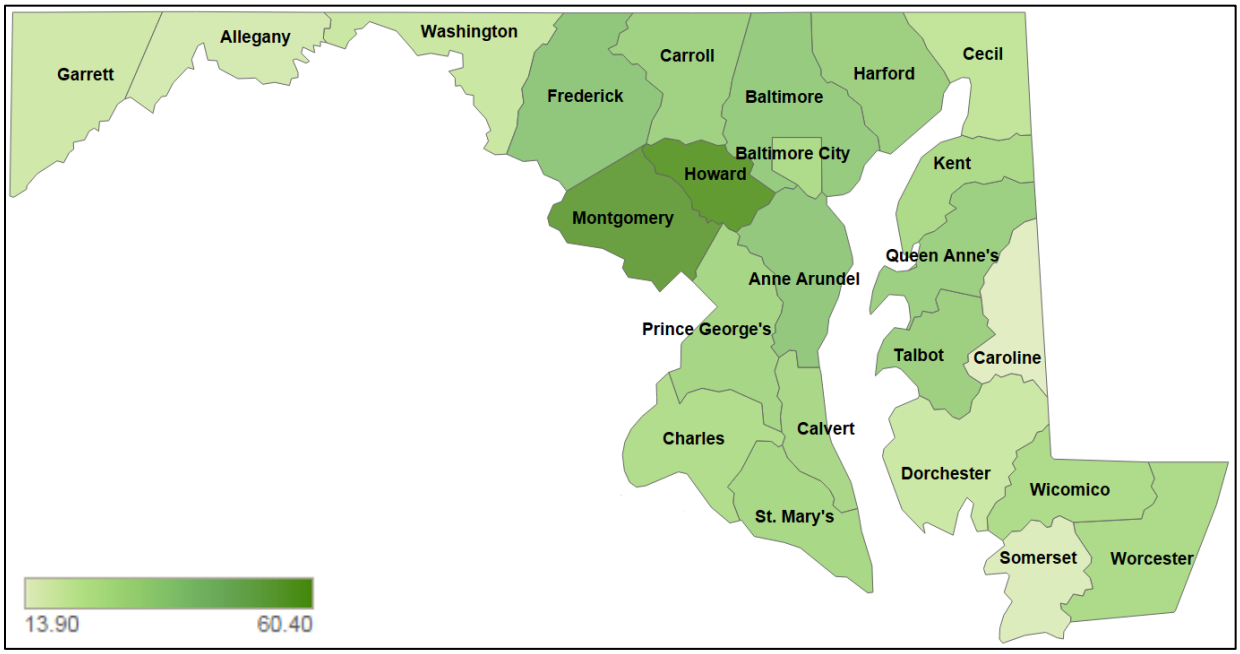
County	Population Projections					
	2015	2020	2025	2030	2035	2040
Allegany County	72,528	75,150	75,900	76,650	76,910	77,050
Anne Arundel County	564,195	580,000	593,600	606,700	618,200	628,050
Baltimore City	621,849	634,090	644,000	651,100	655,650	659,100
Baltimore County	831,128	847,000	857,000	862,200	869,500	880,750
Calvert County	90,595	95,600	98,350	100,200	101,050	101,450
Caroline County	32,579	36,050	38,250	40,450	42,750	44,950
Carroll County	167,627	175,900	179,450	183,250	186,200	189,550
Cecil County	102,382	108,600	117,300	125,250	132,900	139,660
Charles County	156,118	174,350	190,650	202,150	212,300	220,850
Dorchester County	32,384	34,800	36,550	37,850	39,100	40,000
Frederick County	245,322	265,650	285,950	304,050	319,800	334,100
Garrett County	29,460	30,600	31,200	31,550	31,700	31,750
Harford County	250,290	258,650	265,100	273,150	281,050	291,100
Howard County	313,414	332,250	346,500	357,100	363,500	366,350
Kent County	19,787	21,400	22,100	22,600	23,050	23,490
Montgomery County	1,040,116	1,067,000	1,110,000	1,153,900	1,186,600	1,206,800
Prince George's County	909,535	914,500	929,650	944,550	957,650	967,850
Queen Anne's County	48,904	53,600	57,350	60,350	63,150	65,750
St. Mary's County	111,413	125,150	137,200	148,750	156,150	163,350
Somerset County	25,768	27,750	28,490	28,950	29,350	29,550
Talbot County	37,512	40,850	42,050	42,900	43,550	44,000
Washington County	149,585	160,300	169,950	178,890	186,610	193,450
Wicomico County	102,370	109,200	114,400	119,200	123,650	127,650
Worcester County	51,540	56,100	58,750	60,450	61,950	63,100
Statewide	**6,006,401**	**6,224,510**	**6,429,750**	**6,612,190**	**6,762,300**	**6,889,690**

Source: US Census, Maryland Department of Planning

Maryland is a well-educated state. According to Census data from 2010, Maryland has the fourth highest percentage of residents with a Bachelor's degree or higher, though it has the 24th highest percentage of residents with a high school degree or more. Although there appears to be a large discrepancy in rankings, the proportion of Maryland residents with a high school degree in 2010 (88.1 percent) is only 4.2 percentage points below the total for Wyoming (92.3 percent), the state with the highest proportion.

Figure 12 maps the distribution of Bachelor's degrees by county.

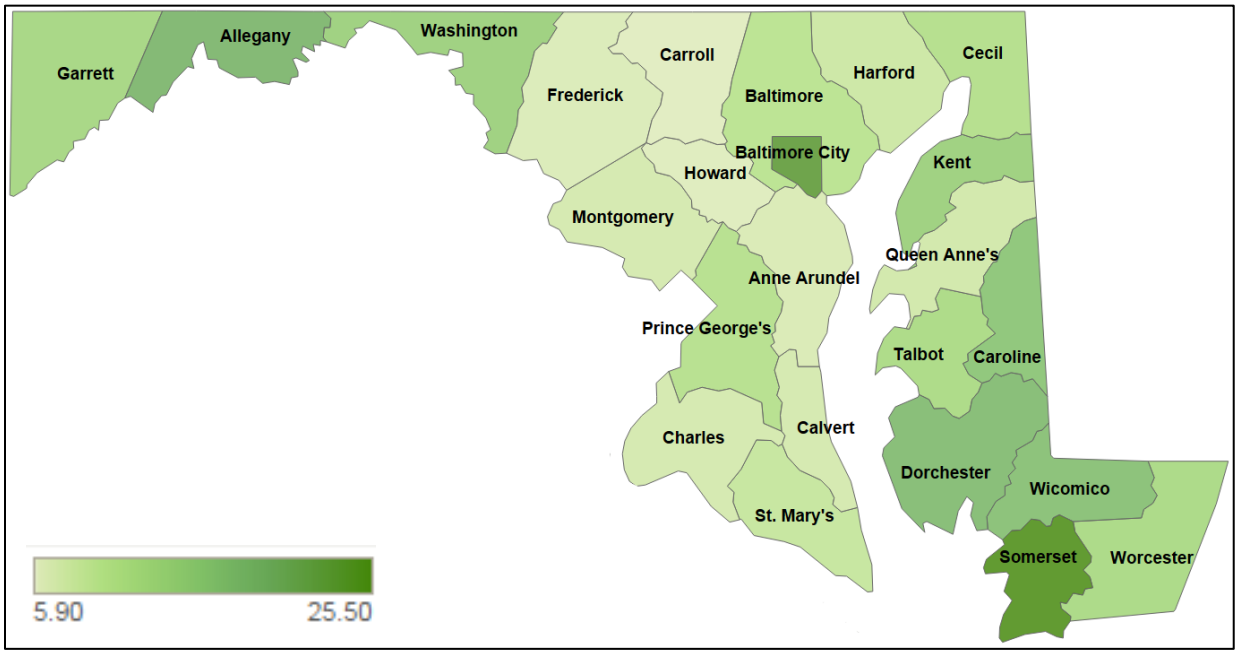
Figure 12: Bachelor's Degrees by County



Source: U.S. Census

As Figure 12 shows, Bachelor's degrees are most common in Howard and Montgomery Counties. The Eastern Shore and Western Maryland have lower percentages of college-educated residents. This distribution tends to mirror the distribution of the poverty rate across Maryland, as shown in Figure 13.

Figure 13: Maryland's Poverty Rate by County



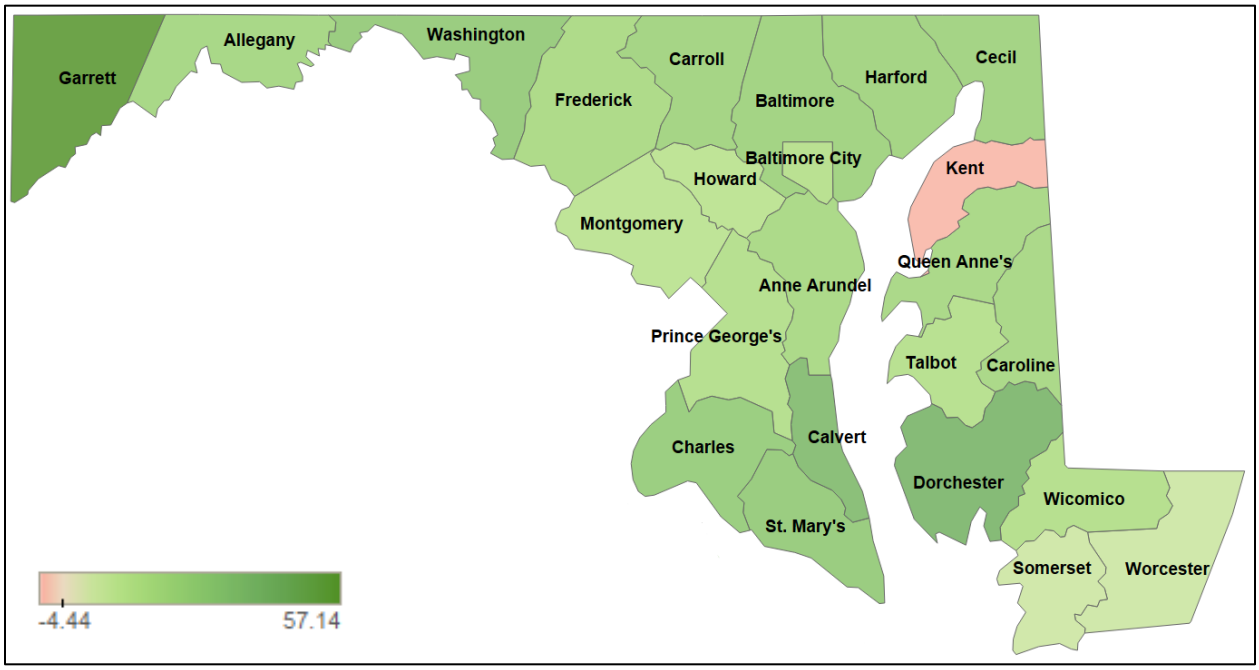
Source: U.S. Census

The Central and Capital regions are generally wealthier than the Eastern Shore and Western Maryland. The main exception is Baltimore City, with a poverty rate of 23.3 percent.

Maryland is a diverse state, and is becoming more diverse. In 2010 the Census estimated that minorities, defined as all persons excluding Non-Hispanic Whites, comprised 45.3 percent of Maryland's population. By 2015 this proportion rose by 6 percent to 48 percent of Maryland's total population. Forecasts from Maryland's Department of Legislative Services predict that the proportion of minorities in the state will continue to increase, driven primarily by the Hispanic population.[45]

Figure 14 shows how the Hispanic population has increased throughout Maryland between 2010 and 2015. Only Kent County experienced a decline in the Hispanic population. This demographic primarily resides in Montgomery County (19 percent) and Prince George's County (17.6 percent).

Figure 14: Percent Change in Hispanics, by County 2010-2015



Source: U.S. Census

4.5.2 Maryland's Changing Economy

To examine broad trends within Maryland's economy, the RESI team examined employment and wage information from the Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) database. To get a clearer understanding of recent trends in Maryland's economy, Figure 15 reports on changes in employment by high-level industry over the past five years.

[45] Department of Legislative Services. Office of Policy Analysis. "Maryland 2020: A State in Transition." September, 2008

Figure 15: Changes in Employment by Supersector, 2011–2015

2-Digit NAICS Code	Description	Number of Jobs, 2011	Number of Jobs, 2015	Five-Year Difference (#)	Five-Year Difference (%)	Average Annual Wage, 2015
21	Mining, quarrying, and oil and gas extraction	1,441	1,305	-136	-9.44%	$60,231
31-33	Manufacturing	113,033	103,757	-9,276	-8.21%	$73,363
51	Information	41,676	38,352	-3,324	-7.98%	$84,234
22	Utilities	10,071	9,577	-494	-4.91%	$118,117
42	Wholesale trade	86,208	85,935	-273	-0.32%	$77,667
52	Finance and insurance	94,526	94,255	-271	-0.29%	$98,351
11	Agriculture, forestry, fishing and hunting	5,103	5,149	46	0.90%	$34,329
81	Other services, except public administration	87,760	89,645	1,885	2.15%	$39,226
44-45	Retail trade	280,592	289,489	8,897	3.17%	$30,174
61	Educational services	61,252	63,300	2,048	3.34%	$54,223
54	Professional and technical services	229,279	242,160	12,881	5.62%	$92,612
53	Real estate and rental and leasing	41,868	44,652	2,784	6.65%	$61,194
62	Health care and social assistance	330,488	355,040	24,552	7.43%	$51,141
23	Construction	143,334	154,424	11,090	7.74%	$60,028
56	Administrative and waste services	146,018	163,460	17,442	11.95%	$40,497
72	Accommodation and food services	197,443	222,096	24,653	12.49%	$19,722
55	Management of companies and enterprises	21,972	24,906	2,934	13.35%	$112,778
48-49	Transportation and warehousing	62,893	73,015	10,122	16.09%	$50,793
71	Arts, entertainment, and recreation	36,099	45,397	9,298	25.76%	$30,707

Source: QCEW

Maryland's economy has grown substantially over the past five years, adding nearly 115,000 jobs for a 5.8 percent growth rate. The sectors of the economy with the greatest growth were Arts, Entertainment, and Recreation, which grew by 25.8 percent; Transportation and Warehousing, which grew by 16.1 percent; and Management of Companies and Enterprises, which grew by 13.4 percent. Broadly, Mining, Information, and Manufacturing have experienced the largest percentage decreases in employment over the past five years in Maryland. This trend is significant because these industries all have relatively high average wages above Maryland's average wage of $54,777. In fact, of the six sectors experiencing a decline in employment over the previous five years, all six had average wages greater than the Maryland average. Declining

employment in industries such as Manufacturing, Mining, and Construction reflects national trends in these industries, and declines are generally seen across all subsectors.

While the state has lost jobs in high-paying industries, it is gaining jobs in low-paying industries. Of the 13 high-level industries experiencing an increase in employment over the previous five years, nine had salaries below the state average. The exceptions are four industries, Professional and Technical Services, Management of Companies and Enterprises, Construction, and Real Estate and Rental and Leasing. However, Maryland workers are earning more overall. The average wage in 2011 was $50,620, meaning wages have increased by over eight percent in the last five years. This indicates that employment is transferring from lower-wage to higher-wage jobs within sectors.

The high salaries in the Professional and Technical Services industry are notable, as the industry is one of the most common sectors under which cybersecurity work is classified. Cybersecurity can be classified under a variety of NAICS codes, though one of the most common codes is the five-digit code 54151 for Computer Systems Design and Related Services.[46] Figure 16 shows how employment for Computer Systems Design and Related Services and the industry's three subsectors, reported at the six-digit NAICS code level, have changed over the past five years. Notably, the subsector's employment gains outpaced the average for Professional, Scientific, and Technical services, growing by 7.8 percent compared to the overall industry rate of 5.6 percent. Also of note is that wages in the Computer Systems Design and Related Services industry are twice the Maryland average of $54,777.

Figure 16: Changes in Employment in a Cybersecurity-Related Sector, 2011–2015

NAICS Code	Description	Number of Jobs, 2011	Number of Jobs, 2015	Five-Year Difference (#)	Five-Year Difference (%)	Average Annual Wage, 2015
54151	Computer systems design and related services	64,687	69,725	5,038	7.8%	$110,196
6-Digit NAICS Codes For NAICS Code 54151						
541511	Custom computer programming services	23,328	23,726	398	1.7%	$118,192
541512	Computer systems design services	37,153	42,244	5,091	13.7%	$106,729
541513	Computer facilities management services	585	753	168	28.7%	$87,007

Source: QCEW

To better understand how the industries are changing, the RESI team examined Occupational Employment Statistics (OES) data for the previous five years. While QCEW data focus on

[46] National University System Institute for Policy Research. "Cybersecurity in San Diego: An Economic Impact and Industry Assessment. Sponsored by Sentek Global, Produced by San Diego Regional EDC. March, 2014.

industries, OES data explore occupations across industries. Occupational data are often useful because a cybersecurity worker could easily work in both the Healthcare and Social Services industry as well as the Professional and Technical Services industry. OES data, therefore, provides a truer sense of the workforce capabilities within the state, while QCEW provides information on how those workers are employed. Figure 17 reports the change in employment over the past five years and the average salary in 2015.

Figure 17: Change in Employment in Major Occupations, 2011–2015

OES Occupation Group	Number of Jobs, 2011	Number of Jobs, 2015	Change in Jobs (#)	Change in Jobs (%)	Mean Salary, 2015
Farming, Fishing, and Forestry Occupations	2,720	2,380	-340	-12.50%	$33,890
Production Occupations	82,630	77,700	-4,930	-5.97%	$38,520
Management Occupations	151,890	146,970	-4,920	-3.24%	$122,800
Architecture and Engineering Occupations	56,990	56,800	-190	-0.33%	$93,680
Office and Administrative Support Occupations	402,510	402,900	390	0.10%	$39,170
Education, Training, and Library Occupations	172,420	172,650	230	0.13%	$60,940
Arts, Design, Entertainment, Sports, and Media Occupations	30,540	30,670	130	0.43%	$58,940
Legal Occupations	23,930	24,180	250	1.04%	$87,990
Healthcare Support Occupations	70,330	72,180	1,850	2.63%	$31,870
Construction and Extraction Occupations	109,070	112,200	3,130	2.87%	$47,290
Business and Financial Operations Occupations	156,420	162,980	6,560	4.19%	$78,840
Building and Grounds Cleaning and Maintenance Occupations	80,640	84,720	4,080	5.06%	$27,900
Protective Service Occupations	68,050	71,850	3,800	5.58%	$46,860
Life, Physical, and Social Science Occupations	38,290	40,520	2,230	5.82%	$85,730
Community and Social Service Occupations	38,640	40,970	2,330	6.03%	$49,070
Healthcare Practitioners and Technical Occupations	154,160	164,160	10,000	6.49%	$83,580
Food Preparation and Serving Related Occupations	200,020	213,120	13,100	6.55%	$23,910
Installation, Maintenance, and Repair Occupations	93,530	100,700	7,170	7.67%	$49,230
Sales and Related Occupations	244,670	263,580	18,910	7.73%	$38,780
Computer and Mathematical Occupations	104,620	120,360	15,740	15.04%	$95,640
Transportation and Material Moving Occupations	134,570	156,230	21,660	16.10%	$37,030
Personal Care and Service Occupations	64,030	78,820	14,790	23.10%	$28,050

Source: OES

Several of the industry-level findings hold true when looking at occupation data. For example, five of the six occupations exhibiting the largest percentage increase in jobs have average salaries

below the Maryland average wage of $54,777. The exception are Computer and Mathematical Occupations, which grew by 15 percent and have an average wage of $95,640. This occupation group also experienced the second largest increase in salaries over the previous five years, with the average salary increasing 9.9 percent.

Interestingly, the largest salary increases over the last five years occurred in occupations that saw a decrease in employment. For example, the number of people in Farming, Fishing, and Forestry Occupations decreased by 12.5 percent, although the average salary rose by 20.7 percent. Similarly, the number of Maryland workers employed in Productions Occupations fell by six percent while average wages rose by 7.4 percent. This trend may be due to low-skilled workers being replaced by new machines and automation processes, allowing fewer employees to produce more. An increase in production per employee generally leads wages in an industry to rise, and this is likely behind the wage increases in Productions and Farming, Fishing, and Forestry occupations.

Of note is that employment in Architecture and Engineering occupations fell by 190 jobs, a decrease of 0.3 percent. Subject matter experts mentioned engineering as an in-demand profession in Maryland, making a decrease in employment unexpected. Within this major occupation, the greatest decreases are among relatively unskilled engineering technicians, while electronics engineers, mechanical engineers, and engineering occupations requiring an advanced degree increased and exhibited increased wages.

Maryland's economy is trending toward jobs with higher salaries and higher educational requirements. Fortunately, Maryland's workforce is highly educated and growing to meet this demand. Given the DoD's push toward research and contracts for increasingly complicated work, such as cybersecurity and the Third Offset Strategy, Maryland's workforce appears to be well positioned to take advantage of the new economy.

Section 5: SWOT Analysis

Using trends in the defense industry and Maryland's economy as a framework, the RESI team conducted four focus groups and 20 interviews with 22 subject matter experts to understand the defense-intensive landscape within Maryland. Focus group participants and interviewees included economic development managers, technology transfer officers, presidents of military alliances in Maryland, aides familiar with military issues to Maryland's congressional representatives, members of the BRAC Advisory Group, and MMIC members. Focus group participants and interviewed subject matter experts identified numerous aspects of the landscape in Maryland as strengths, weaknesses, opportunities, and threats. Figure 18, the SWOT matrix, summarizes these key findings. Each point is also discussed in detail in the sections below.

Figure 18: Strengths, Weaknesses, Opportunities, and Threats

Strengths	Weaknesses
• Maryland's Military Bases • Military Bases' Proximity to Each Other • Proximity to Washington, D.C. • Access to Logistics Infrastructure • High Levels of Congressional Support • Educated Workforce • Existing Military Personnel	• Infrastructure • Zoning and Land Use Regulations • Worker Shortage • Lack of Public-Private Partnerships • Overreliance on DOD • Access to Capital/Funding • Lack of Existing Incubators
Opportunities	**Threats**
• BRAC • Commercialization • Workforce training • 3D/Additive Manufacturing • Cybersecurity in Maryland • Cyber Command Becoming Combatant • Unmanned Vehicles	• BRAC • Sequestration • Changes in Maryland Congressional Representation • Aging Military Workforce

5.1 Strengths

Interviewees and focus group participants mentioned that Maryland's DoD-intensive landscape has several strengths compared to other regions, as described in further detail in the subsequent sections. Maryland has a strong network of military bases and federal installations supported by a highly educated workforce. Additionally, Maryland is supported by strong logistical infrastructure and a dedicated Congressional delegation.

5.1.1 Maryland's Military Bases

Participants noted that Maryland's military bases are a considerable strength, pointing to the fact that bases are established and serve as anchor employers for the surrounding regions (a map of Maryland's major military installations can be found in Figure 19). The bases in Maryland tend to have very specialized and unique programs—leading them to be better positioned for another round of BRAC. For example, numerous participants mentioned that the facilities at NAS Patuxent River were unique given the access to water and airspace, while Fort Meade's established cyber programs were cited as a boon. Respondents felt that, although there was always the risk of program loss in BRAC, or that future rounds of sequestration could cause cutbacks in budgets, Maryland bases were relatively permanent. This certainty allows entrepreneurs and economic development managers to develop long-term plans based upon the installations.

"There are companies we have gone out to who said specifically that they are located in Frederick because of Fort Detrick. It's a huge attraction for bringing in new businesses to the county."

5.1.2 Military Bases' Proximity to Each Other

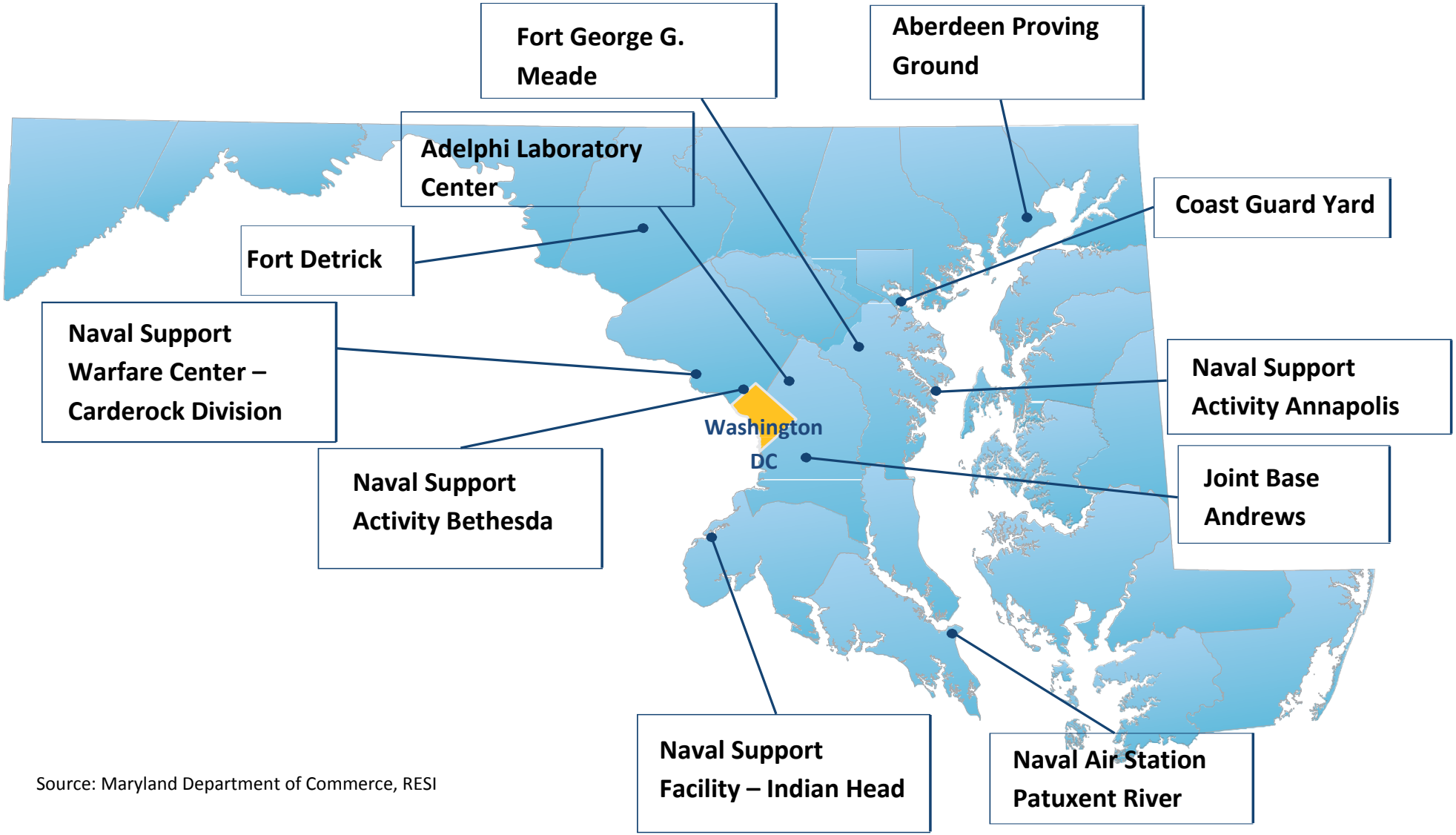
In addition to the relative permanence of Maryland's military bases, experts cited the overall ecosystem developed as a result of so many nearby bases as an asset to Maryland. This proximity enables DoD-related businesses to thrive. Southern Maryland was commonly cited as an example, with bases at Indian Head, Patuxent River, and Dahlgren in northern Virginia providing a support system for local businesses. However, focus group participants and interviewees cited links between all other Maryland installations as well, noting that business may locate outside Fort Detrick, for example, but still do a lot of business with Fort Meade and Aberdeen Proving Ground. Promoting this synergy was touted by several interviewees who have familiarity with the BRAC process as a selling point for keeping programs in Maryland, as well as attracting new programs to the area.

"Fort Meade has the analysts and the people who are doing 'defensive' and 'offensive' cyber, but a lot of the tools they are using were made at Aberdeen Proving Ground."

5.1.3 Proximity to Washington, D.C.

Respondents cited the Maryland area's access to Washington, D.C., as a strength for the area. Maryland contractors, especially those in Central and Southern Maryland, are close to the Pentagon. This proximity allows businesses to travel onsite for meetings with Contracting Officers, providing them with a competitive advantage when bidding on new work. This advantage creates a strong ecosystem of DoD-related businesses, as more contractors move to the area to take advantage of a strong labor pool and access to a primary client.

Figure 19: Maryland's 11 Major Military Installations



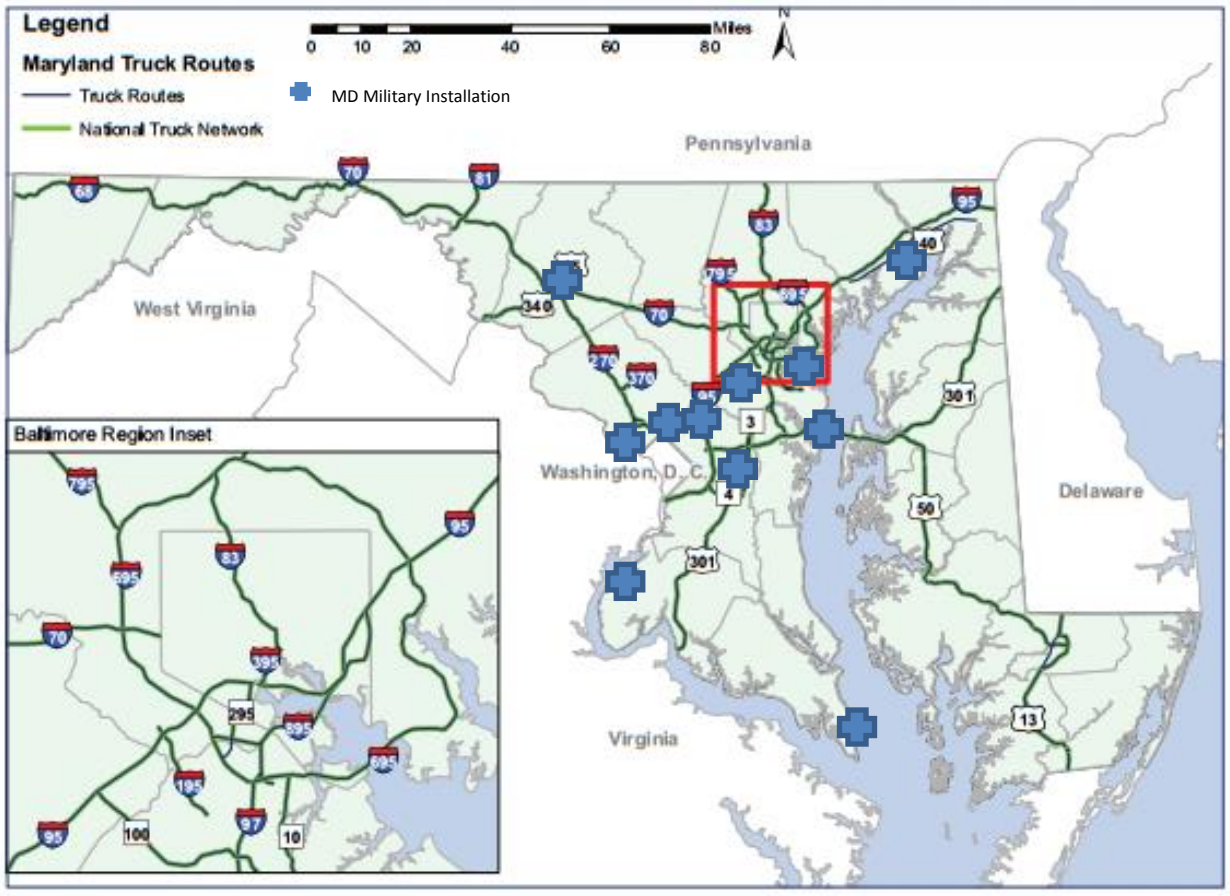
Source: Maryland Department of Commerce, RESI

5.1.4 Access to Logistics Infrastructure

Easy access to various types of logistical infrastructure, such as truck routes, railroads, and ports, were viewed as another of Maryland's environmental strengths. Not only can companies easily access Baltimore; Annapolis; and Washington, D.C.; but companies within Maryland have access to international markets through the Port of Baltimore and the area's three international airports (BWI, Dulles, and Reagan). Companies can quickly ship goods throughout the country by rail or truck as well. Respondents in Frederick were especially quick to highlight this as a strength, noting that the ability to quickly access Baltimore and Washington, D.C., airports and ports provided a strong draw for companies looking to locate in the area.

> **"If they are here in Frederick, they have Fort Detrick in their backyard. They have NIH down I-270…They have Johns Hopkins they can connect with…And then they have three airports…where they can get their [products] out quickly."**

Figure 20: Maryland's Truck Routes and Major Military Installations

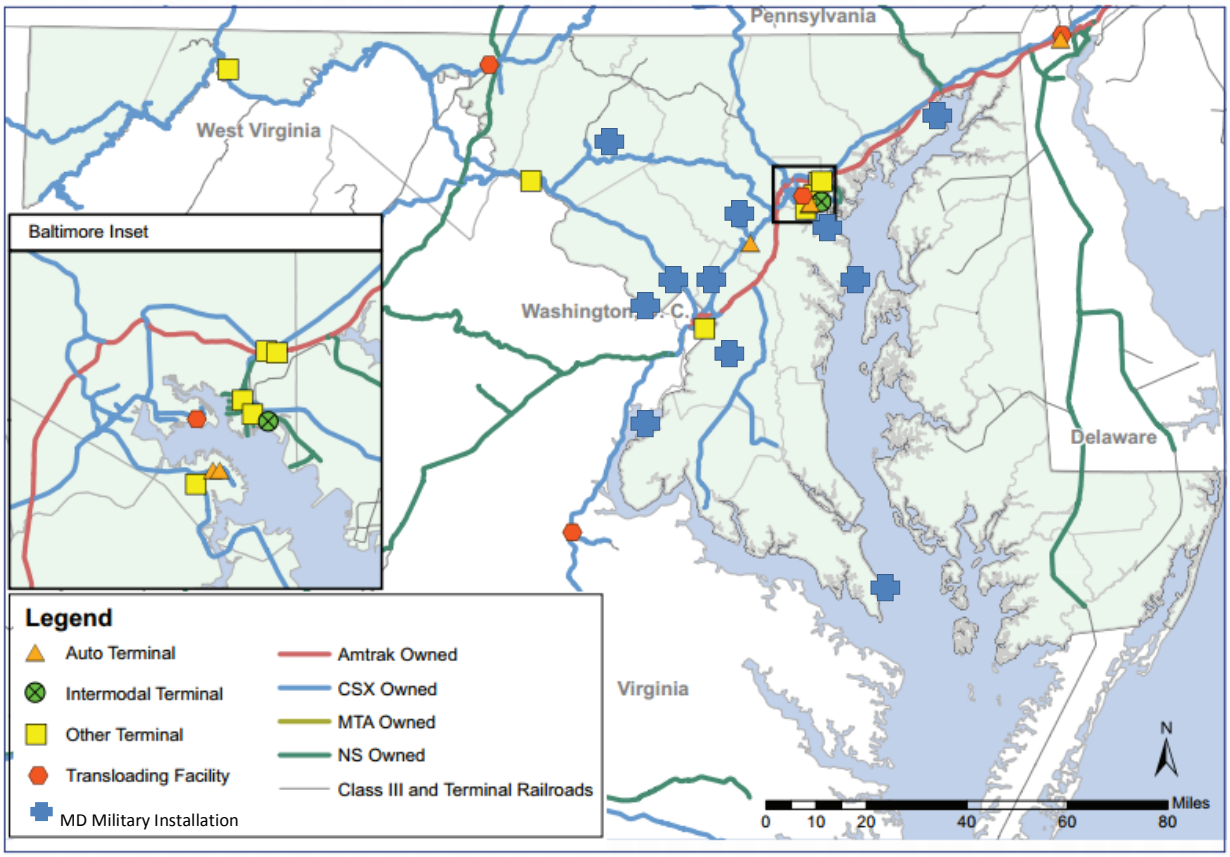


Source: MD DOT, Maryland Department of Commerce

Figure 20, showing Maryland's truck routes and the location of its 11 major military installations, highlights the accessibility of Maryland's military installations and demonstrates the ease with

which contractors across the state can transport goods to these bases as well as outside the state. Additionally, Maryland has a strong rail network, as highlighted in Figure 21. Maryland has approximately 1,152 miles of track and four Class I railroad lines. Maryland's rail network connects with the Port of Baltimore, one of only two ports on the East Coast with a 50-foot channel capable of receiving post-Panamax ships. The ability for multimodal shipping within Maryland allows businesses in the state to ship their goods quickly and relatively affordably to customers across the world.

Figure 21: Maryland's Rail Network and Major Military Installations



Source: MD DOT, Maryland Department of Commerce

Maryland's strong network of highways, railroads, and ports are important in attracting businesses to the area. Each year, Area Development Magazine,[47] a leading publication examining site selection and development needs for manufacturing, service sector, consulting, and real estate firms, conducts a survey of its readers to understand their criteria in selecting a

[47] Area Development Magazine. "30th Annual Survey of Coprorate Executives." 2016. Available at: http://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2016/corporate-executive-site-selection-facility-plans-441729.shtml

business location. Three-fourths of the respondents to the site selection survey in 2015 were responsible for either the preliminary recommendation of site selection or had the final location decision. These respondents ranked highway accessibility as the second most important factor in site selection in the 2015 iteration of the survey, as seen below in Figure 22. Previous iterations of the survey in 2010 and 2005 found that highway accessibility was the most important factor. Accessibility to a major airport, one of the strengths of Maryland's ecosystem, was ranked as 'important' or 'very important' by at least 50 percent of respondents in 2005, 2010, and 2015.

Figure 22: Important Factors for Site Selection by Nationwide CEOs

Site Selection Factor	Factor was 'Very Important' or 'Important' in 2015	Factor was 'Very Important' or 'Important' in 2010	Factor was 'Very Important' or 'Important' in 2005
Availability of Skilled Labor	92.9%	85.9%	87.2%
Highway Accessibility	88%	97.3%	91.4%
Quality of Life	87.6%	62.1%	54.7%
Occupancy or Construction Costs	85.4%	89.8%	83.7%
Labor Costs	80.8%	91%	87.9%
Corporate Tax Rate	78.8%	86.3%	85%
Proximity to Major Markets	76.3%	66.4%	83.2%
State and Tax Local Incentives	75.8%	89.3%	86%
Energy Availability and Costs	75.3%	82.1%	82.8%
Tax Exemptions	74.7%	90.9%	83.6%
Available Land	73.9%	73.4%	75%
Environmental Regulations	69.8%	74.8%	71.1%
Training Programs	68.7%	56.7%	59.6%
Right-to-Work State	67.7%	67.9%	69.7%
Availability of Long-Term Financing	67.7%	58.5%	56.5%
Low Union Profile	66.3%	75.4%	77%
Proximity to Suppliers	64.3%	63.6%	66.7%
Accessibility to Major Airport	58.6%	50%	50%
Raw Materials Availability	52.6%	61.5%	62.3%
Availability of Unskilled Labor	47.8%	45.4%	50.6%
Railroad Service	32.4%	36%	28.9%
Waterway or Ocean Port Accessibility	24%	21.9%	20.2%

Source: Area Development

5.1.5 High Levels of Congressional Support

Almost all respondents highlighted that Maryland's Congressional representatives, especially Senator Barbara Mikulski, were crucial to the success of Maryland's DoD-intensive landscape. For

example, respondents emphasized that Maryland's delegation was extremely helpful in prior rounds of BRAC. There were reports that Congressman Hoyer was instrumental in removing Indian Head from the list of bases to be closed in 1995.[48] Senator Mikulski was routinely praised for her efforts in advocating for Maryland's military bases and making compelling arguments to the BRAC Commission for why these bases and programs should stay in the state. Overall, Senator Mikulski was viewed as a key ally to members of the defense community in Maryland who crucial to bringing cybersecurity resources to Maryland. For example, Senator Mikulski recently introduced a bill, along with Senator Cardin, to make the cyber command at Fort Meade be a combatant command.[49] Making the cyber command a combatant unit, as discussed further in Section 5.3.6, would bring more high-paying jobs to Maryland. With Senator Mikulski's retirement, however, there is some uncertainty regarding how well Maryland's interests will be represented in a new round of BRAC.

One measure of how supportive Maryland's delegation has been of issues relating to the defense industry is to examine the campaign contributions made to Maryland's senators and delegates. According to data gathered from the Federal Election Commission (FEC) and compiled by the independent Center for Responsive Politics, members of the defense industry give heavily to Maryland representatives. In the 2014 midterm election cycle, Senator Barbara Mikulski received $151,400 in donations. While the average U.S. Senator received $46,473 in donations from the defense industry, Maryland senators received an average of $80,200.[50] Similarly, Maryland's delegates in the House of Representatives received $54,527 on average from defense contractors, compared to the national average of $38,796 for all Congressional representatives.[51]

5.1.6 Educated Workforce

Maryland has the second highest percentage of residents with a Bachelor's degree and the second highest percentage of residents with an advanced degree.[52] Additionally, Maryland's colleges and universities are highly ranked, especially for in-demand STEM majors. Focus group respondents and interviewees indicated that Maryland workers graduating from these institutions are high-quality and in high demand. Maryland has two graduate schools ranked in the top 25 for engineering. The engineering program at The Whiting School of Engineering at Johns Hopkins University is ranked 21st in the nation, and the program at the University of

[48] Partlow, Joshua. "Indian Head Vulnerable to Base Closure." Washington Post. 3/6/2005. Accessed December 20, 2016. http://www.washingtonpost.com/wp-dyn/content/article/2005/03/25/AR2005032502505.html
[49] Williams, Katie Bo. "Lawmakers Push to Elevate Cyber Command in Senate Defense Bill." The Hill. May 25, 2016. Accessed December 20, 2016. http://thehill.com/policy/cybersecurity/281232-lawmakers-push-to-elevate-cyber-command-in-senate-defense-bill
[50] Center for Responsive Politics. Defense: Money to Congress. 2015. Accessed November 11, 2016. https://www.opensecrets.org/industries/summary.php?ind=D&cycle=2014&recipdetail=H&sortorder=A&mem=Y&page=4
[51] Ibid.
[52] US Census. Education Attainment for States. Fact Sheet. 2015

Maryland, College Park is ranked 24th.[53] Additionally, Maryland has several strong cybersecurity programs at its colleges and universities. Maryland has 17 colleges and universities certified by the NSA and Department of Homeland Security as a Center of Academic Excellence in Cyber Defense, more than any other state.[54] Additionally, the University of Maryland, Baltimore County (UMBC) is one of only 15 schools nationwide to hold a dual designation from the NSA and DHS as a four-year Center of Academic Excellence in both Cyber Defense Education and in Information Assurance Education.[55]

Having quality schools is important, as Maryland is a state that retains many its college graduates. According to a 2013 study conducted by the Federal Reserve Bank of Boston, 65.8 percent of college graduates graduating from Maryland institutions in 2008 lived in Maryland one year after graduation.[56] However, this proportion is decreasing, as highlighted in Figure 23 below.

Figure 23: Maryland's Retention of College Graduates

Region	Class of 1993	Class of 2000	Class of 2008
Maryland	78.4	69.5	65.8
United States (average)	72.1	69.2	69.4

Source: Federal Reserve Bank of Boston

As shown in Figure 23, the proportion of graduates from Maryland's colleges and universities remaining in state has dropped steadily from 1993 through 2008, and has fallen below the national average. One reason for this decline is that Maryland may be a victim of its own success. Focus group participants and interviewees repeatedly rated graduates from Maryland's colleges and universities as high-quality. However, this quality is likely not noticed by only in-state employers, and the declining proportion of Maryland graduates remaining in-state is likely due to out-of-state employers out-competing Maryland employers in hiring this talent. In the Middle Atlantic region, most recent graduates (54 percent) who moved out of the state in which they graduated cited employment as their primary reason.[57] Other reasons included moving to be

[53] US News and World Report. "Best Engineering Schools." 2016. Accessed November 11, 2016. http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-engineering-schools/eng-rankings?int=a74509.
[54] IAD. "NSA/DHS Current National CAE Designated Institutions." The Information Assurance Directorate at the NSA. 2016. Accessed December 20, 2016. https://www.iad.gov/NIETP/reports/current_cae_designated_institutions.cfm
[55] Ibid.
[56] Modestino, Alicia Sasser. "Retaining Recent College Graduates in New England: An Update on Current Trends." New England Public Policy Center Policy Briefs. 13-2. 2013
[57] Ibid.

closer to family (9.6 percent), finding cheaper housing (5.2 percent), and other unspecified reasons (31.1 percent).[58]

However, this does not mean that Maryland is an unattractive place to locate. An analysis of American Community Survey data by City Observatory found that the Washington, D.C., and Baltimore metro areas exhibited some of the highest growth rates in the number of 25- to 34-year-olds with college degrees.[59] The analysis found that the number of young, educated residents increased by 36.3 percent in Washington, D.C., between 2000 and 2012, the sixth highest growth rate in the nation. Over this same time, the Baltimore metro area's amount of young, college-educated residents increased by 32 percent, the eighth highest growth rate in the nation.[60]

Despite the quality of Maryland's colleges and universities, some focus group respondents and interviewees indicated that one problem with these institutions is that they are concentrated in Central Maryland, and the labor pool is often reluctant to move to areas such as Frederick County or Southern Maryland. Respondents indicated that it was difficult for companies in rural areas to compete with the high salaries in Baltimore and the Washington, D.C., suburbs. Additionally, respondents mentioned that workers, especially younger workers, are interested in living in a location close to nightlife, museums, and other amenities that are frequently lacking in rural areas.

"It's important that [the Maryland government] find ways to elevate and better distribute education from Central Maryland out to Lexington Park, to Aberdeen, or to Frederick."

However, focus group participants from Southern Maryland indicated that they were having some success in attracting skilled workers to live in the region, primarily due to a lower cost of living. Focus group participants cited the cost of housing as one of the main attractants to the region. However, participants indicated that, even with this skilled workforce, it was difficult to grow the local economy because the residents generally commuted to the Washington, D.C., suburbs for higher salaries. For example, the number of employed Calvert County residents in 2015 was 45,466. [61] However, on average in 2015, only 22,639 people had a job within the county.[62] This means that only 49.8 percent of the workforce in Calvert County had a job located in the county. This disparity indicates that even when the workforce does locate in more rural areas, there are still significant challenges in building up the local economy.

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[58] Ibid.
[59] Cortright, Joe. "The Young and Restless and the Nation's Cities." City Report. City Observatory. 2014.
[60] Ibid.
[61] BEA. "Labor Force Data by County, 2015 Annual Averages." Local Area Unemployment Statistics. 2016.
[62] BLS. "NAICS Industries by Geography: All Industry Levels, One Area." Quarterly Census of Employment and Wages. 2016.

5.1.7 Existing Military Personnel

The number of military bases in the area means that Maryland has many veterans and retired military personnel in the workforce. According to the most recent estimates from the BLS, approximately 428,000 veterans live in Maryland.[63] As discussed in Section 4.4, there were 54,641 military retirees living in the state in 2014. Interviewees mentioned that many Maryland businesses, such as Lockheed Martin and Battelle, draw heavily on this talent pool. These businesses look to hire veterans and military retirees due to their familiarity with DoD operations and trends, and are viewed as a way to give companies a competitive advantage when bidding for new work. However, despite this preference, the unemployment rate in Maryland for veterans is 7.2 percent, 2.6 percentage points higher than the national average of 4.6 percent.[64] This suggests that there may be a problem in linking veterans and retired military personnel to businesses looking to hire them. Maryland has an advantage over other areas with the number of military personnel in the state, and reducing the veteran unemployment rate, as discussed more in Section 8, in the state is one way to capitalize on this strength.

"We have a lot of smart PhDs with grandiose ideas, but you need someone else who understands the roles [in the military] to make it work."

5.2 Weaknesses

Despite the strengths of Maryland's DoD-intensive landscape, participants in the focus groups and interviews noted that the state could still improve in certain areas. Although Maryland's infrastructure was hailed as a strength, respondents identified several issues with it. Additionally, respondents noted a shortage of skilled workers, a lack of public-private partnerships and incubators, as well as a relative shortage of venture capital compared to other states. Focus group participants and interviewees gave numerous suggestions on how to diversify Maryland's economy and address Maryland's weaknesses. These solutions are discussed where relevant in this section and are discussed in detail in Section 8.

5.2.1 Infrastructure

Although respondents praised the region's access to ports, airports, and interstates as a strength, most highlighted several issues with Maryland's infrastructure. One of the largest complaints was Maryland's traffic. Traffic was described by several respondents as "a ticking time bomb." Respondents highlighted that bad traffic threatened to drive key businesses away due to delays in shipping or difficulties recruiting employees due to long commute times. Traffic was most commonly cited as a concern around the Washington, D.C., suburbs. For example, the I-270 corridor was described as having "a permanent rush hour."

"People fly in to interview for a job, and all they see is BWI, their hotel, and the traffic."

[63] BLS. "Employment Situation of Veterans Summary: Table 6A. Employment Status of Veterans 18 Years and Over by State, 2015 Averages." 2016.
[64] Ibid.

According to a 2016 report by TRIP, a national transportation research group, 16 percent of the state's freeways and expressways were heavily or severely congested in 2014 during the morning rush hour, while 24 percent were congested during the evening rush hour.[65] This number increased slightly from 2013, and TRIP estimated that travel on Maryland's roads will increase 20 percent by 2030 as more people move to the state. The TRIP report indicated that two of the nation's most congested urban areas are located in the Maryland region. Washington, D.C., was ranked 1st in traffic cost per commuter, with traffic costing each commuter in the MSA $1,834 annually and causing 82 hours of delays.[66] The Baltimore urban area was ranked 25th in terms of costs per commuter, costing each commuter $1,115 annually and causing 47 hours of delays. Figure 24 displays the top 30 bottlenecks as ranked by Maryland's State Highway Administration using duration, intensity, frequency, and average length of congestion. I-270, a 35-mile highway, has six bottlenecks listed, for a total of 48 miles (19 miles southbound and 29 miles northbound) of bottleneck. A separate bottleneck identified where I-495 and I-270 intersect is listed as the worst bottleneck in the state.

[65] TRIP. "Keeping Maryland Mobile: Progress and Challenges in Providing an Efficient, Safe, and Well-Maintained Transportation System." White Paper. 2016

[66] The cost to the average consumer is calculated in terms of the value of the travel time delay and excess fuel consumption. The travel time delay is estimated to be $17.67 per hour of person travel and $94.04 per hour of truck time. Excess fuel consumption is calculated using the average cost per gallon for gasoline and diesel in each state.

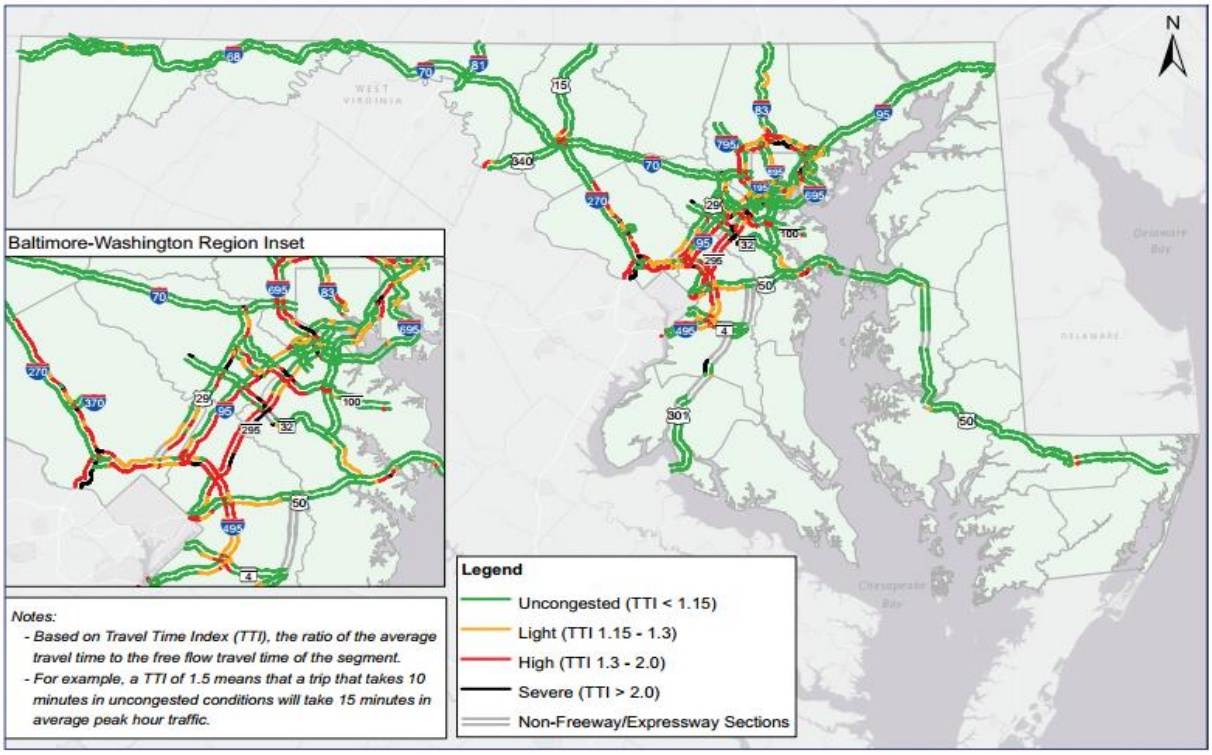
Figure 24: Maryland's Top 30 Traffic Bottlenecks, 2014

Rank	Location	Route	Direction	Average Duration (Mins)	Average Max Length (Miles)
1	I-495 IL @ I-270 Spur	I-495	Inner Loop	168.75	12.3
2	I-95 OL @ Greenbelt Metro	I-95	Outer Loop	125.5	19.46
3	I-95 N @ MD-100/Exit 43	I-95	Northbound	120	9.41
4	I-270 Spur S @ I-270	I-270	Southbound	111	10.78
5	MD-295 N @ I-195	MD-295	Northbound	138.5	13.21
6	MD-295 N @ MD-175	MD-295	Northbound	150.5	8.66
7	I-695 OL @ Edmondson Ave/Exit	I-695	Outer Loop	121.5	8.82
8	I-695 IL @ I-795/Exit 19	I-695	Inner Loop	122.25	8.68
9	I-695 IL @ MD-147/Harford	I-695	Inner Loop	159.25	10.43
10	MD-295 N @ MD-197/EXIT 111	MD-295	Northbound	169.75	6.33
11	I-695 IL @ MD-41/Perring	I-695	Inner Loop	107.25	7.59
12	I-95 OL @ US-50/Exit 19	I-95	Outer Loop	107.75	5.7
13	I-270 Local N @ MD 124	I-270	Northbound	126.5	4.17
14	I-95 S @ I-495/Exit 27-25	I-95	Southbound	92	5.43
15	I-95 IL @ MD-214/ Exit 15	I-95	Inner Loop	101.75	5.15
16	MD-295 S @ MD-1931	MD-295	Southbound	94.5	7.76
17	MD-295 S @ Powder Mill Rd1	MD-295	Southbound	97.5	5.2
18	I-695 IL @ I-83/MD-25/Exit 23	I-695	Inner Loop	86.5	6.6
19	I-695 OL @ US-40/Exit 15	I-695	Outer Loop	82.5	6.68
20	I-270 N @ MD-80/Exit 26	I-270	Northbound	85.25	8.02
21	I-95 IL @ MD-4/Pennsylvania	I-95	Inner Loop	105.25	7.25
22	MD-295 N @ MD-1001	MD 295	Northbound	87	6.11
23	I-495 IL @ MD-97/Georgia	I-495	Outer Loop	100.75	3.5
24	I-270 S @ MD-109/Exit 22	I-270	Southbound	78.5	4.15
25	I-270 N @ MD-109/Exit 22	I-270	Northbound	96.75	8.67
26	I-495 CCW @ MD-	I-495	Outer Loop	122.25	5.48
27	MD-295 N @ Powder Mill Rd1	MD-295	Northbound	85	3.16
28	I-270 N @ I-70/US-40	I-270	Northbound	68.75	8.06
29	I-270 Local S @ I-270	I-270	Southbound	82.5	4.53
30	I-695 IL @ MD 26	I-695	Inner Loop	107.75	6.24

Source: Maryland State Highway Administration

Figure 25, from the Maryland Department of Transportation, shows the average congestion on the state's freeways and expressways during peak evening rush hour, from 5:00 PM to 6:00 PM.

Figure 25: Average Evening Rush Hour Congestion within Maryland



Source: MDOT

In Southern Maryland, traffic on bridges in the area, especially the U.S. Route 301 Harry Nice Bridge connecting Maryland and Virginia and the Maryland Route 4 Thomas Johnson bridge connecting Calvert County and St. Mary's County, was noted and emphasized as a significant weakness to businesses in the area. Several respondents indicated that they thought high traffic would push businesses into Virginia since businesses would be unable to rely on the bridge for shipping their goods quickly. Several respondents from Southern Maryland indicated that updating the bridges, especially the Route 301 Bridge, was the number one thing the state could do to help support economic growth and diversification in the region.

"If I was the one or two other energetics programs…and I wanted to take the [energetics] mission away from Indian Head, I would use [the 301 bridge] as a reason for the Department of Defense to move that mission somewhere else."

On November 21, 2016, Governor Hogan announced plans to construct a new Route 301 bridge.[67] The new bridge design addresses many of the concerns raised by focus group participants and

[67] MDTA. "Governor Larry Hogan Announces $765 Million for New Harry W. Nice Memorial Bridge." Accessed December 21, 2016 at (http://www.mdta.maryland.gov/nicebridge/nice_index.html).

interviewees familiar with the bridge. The new bridge will have four lanes of traffic instead of the existing two lanes, will have a median between the northbound and southbound lanes, and includes plans for a bike and pedestrian path.[68]

Aside from transportation, focus group participants and interviewees identified broadband internet access as a critical piece of infrastructure in need of updating across the state. Maryland has extended broadband access to many rural areas. For example, in 2015, the state completed linking the Eastern Shore and NAS Patuxent River to an existing broadband network terminating at NASA's Wallops Island Flight Facility in Virginia. However, broadband access has not extended everywhere.[69] Respondents from Southern Maryland expressed how difficult it was to entice businesses to locate in the area—even next to a military base—considering the poor access to high-speed internet. Indian Head was mentioned as one place with especially poor broadband access, as the broadband cable laid along Maryland Route 210 stopped at the outskirts of Indian Head and did not extend to the Naval Surface Warfare Center.[70] Respondents praised the efforts of Governor Hogan's administration to continue to increase access to broadband, specifically mentioning his visits to Indian Head and commitments to increase broadband access there. In fact, Indian Head recently received a state grant to pay 69 percent of the cost of extending broadband access in the town, including to the NSWC.[71] State funding is critical, because counties often do not have the funding necessary to be able to build broadband networks.[72]

The lack of reliable broadband access poses a major hurdle for the type of high-tech industries (e.g., cybersecurity) that are growing in the state. Even when broadband access is available in a city, it can be difficult and cost-prohibitive to retrofit old buildings to access the broadband network. Focus group participants in Frederick noted this as a challenge that they face in attracting new businesses to a downtown filled with older buildings. Most respondents throughout all focus groups cited broadband internet as a barrier to Maryland's economic growth and diversification, and hoped the state could do more to ensure all areas gained access.

The topic of access to water and sewer infrastructure varied across the state. Respondents from south-central and western Maryland did not mention this as an issue. In fact, several respondents from Frederick said access to water was one of the region's strengths, as it allowed the area to

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[68] Ibid.
[69] DelmarvaNow. "Public Works approval enables Md. broadband expansion." Demarva Now Staff Report. 6/19/2014. Accessed February 1, 2017. http://www.delmarvanow.com/story/news/local/maryland/2014/06/19/broadband-expansion/10903473/.
[70] Norris, Joseph. "Town Receives Grant and Funding for Fiber Optic Cable." The Bay Net. 7/7/16. Accessed December 21, 2016 at http://www.thebaynet.com/articles/0716/town-receives-grant-and-funding-for-fiber-optic-cable.html.
[71] Ibid.
[72] Charles County IT Division. "Information Technology FY15 Strategic Plan." Accessed November 13, 2016. http://www.charlescountymd.gov/sites/default/files/fas/it/strategic.pdf

attract life sciences businesses. However, focus group participants and interviewees from Southern Maryland indicated that water and sewer access was lacking. Most water in Southern Maryland is drawn from aquifers, and the state government places restrictions on how much water local jurisdictions can withdraw. Focus group participants stated that one way the state could encourage growth in the region would be to loosen the restrictions on aquifer drainage.

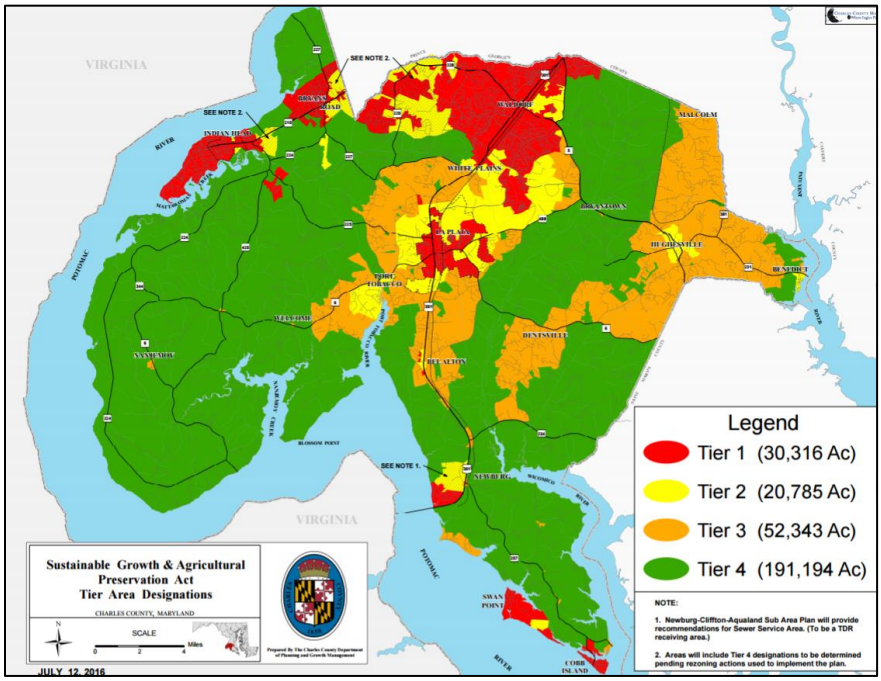
Sewer issues in Southern Maryland were tied heavily to the state's Tier Program, which classifies areas into one of four tiers depending on the sewer access:

- Tier 1: Areas currently served by sewers,
- Tier 2: Areas planned for sewer access,
- Tier 3: Large lot developments and "rural villages" on septic access, and
- Tier 4: Preservation and conservation areas where only minor subdivisions are on septic.[73]

The tiers limit where development can occur, and focus group participants noted that many farmers were upset because their land is classified in Tier 4, limiting farmers' ability to sell their land to a developer. In effect, the Tier Program has made it more difficult to develop in heavily rural Southern Maryland, focus group participants stated. As an example, Figure 26 shows how land in Charles County is classified as of July 2016.[74] Tier 4 land comprises 65 percent of the total acreage in the county, making future growth and expansion difficult outside of areas already classified as Tier 1 or Tier 2. The Tier Program can be especially frustrating to landowners in Tier 4, as their land may directly border Tier 1 land and be able to be connected to existing sewer systems with little difficulty.

[73] Maryland Department of Planning. "Implementation Guidance for The Sustainable Growth and Agricultural Preservation Act of 2012." May 22, 2012. Accessed January 3, 2017. http://planning.maryland.gov/pdf/ourwork/roundtable/20120524/sb236implementationguidancev1.pdf
[74] Charles County Maryland. "PGM Maps." Accessed January 3, 2017. https://www.charlescountymd.gov/pgm/rim/pgm-maps

Figure 26: Tier Program Land Designation in Charles County, July 2016



Source: Charles County MD Government

Water issues are not limited to Southern Maryland, however; interviewees from the Aberdeen Proving Ground area also mentioned the availability of water as an issue, saying "water is always an issue up here because we get most of our water from someplace else." Currently, Harford County receives the bulk of its water from Baltimore City.[75] Harford County's existing water sources will be able to handle projected population and development until 2038.[76] Providing additional water to the region will not be cheap, and may be a challenge sooner than expected if Aberdeen Proving Ground expands, perhaps as a result of a future BRAC round.

5.2.2 Zoning and Land Use Regulations

In addition to infrastructure limitations, respondents, primarily from Southern Maryland, indicated that zoning and land use regulations at the state level made it difficult for them to develop new areas for businesses to locate. Focus group participants from Southern Maryland indicated that zoning was difficult, and that county governments in all three counties had a difficult time properly zoning industrial areas. Southern Maryland focus group participants indicated that the current zoning rules, where the county handles zoning, was too restrictive, and argued that local jurisdictions should oversee zoning in their towns.

[75] Zumer, Bryna. "Harford May Need New Water Sources in the Future, DPW Engineer Says." Baltimore Sun. 10/3/2013. Accessed January 30, 2017. http://www.baltimoresun.com/news/maryland/harford/belair/ph-ag-water-system-1004-20131003-story.html
[76] Ibid.

Focus group participants from Southern Maryland also argued that the current "Critical Area" designations that the state adopted make it too difficult for landowners to develop their properties. Critical Areas encompass all land with 1,000 feet of the high-water mark of a tidal wetland, such as the Chesapeake Bay. There are numerous restrictions on land use within Critical Areas, even if the land will not be redeveloped; for example, trees, shrubs, and even vines of any size are considered habitat in Critical Areas, and require paperwork and planning to remove, even for dead trees.[77] Focus group participants stated that these restrictions inhibit Southern Maryland counties' ability to diversify and grow their tourism industries, as landowners have a hard time developing near one of Southern Maryland's best assets: its shoreline. Limiting the region's use of one of its best resources inhibits the ability of the region to diversify, especially since Southern Maryland, as discussed further in Section 6, is more reliant on DoD contracting and the region's military installations than other areas of the state.

One business owner, identified through the business survey, felt that Maryland's environmental regulations were overly strict, and stated that if the State of Maryland was not providing tax credits to their business, they would move to either Pennsylvania or West Virginia, where regulations are laxer. The interviewee stated that there was no single regulation that could be lifted to better support local businesses, but that the overall business climate needed to change to incentivize local businesses to stay. The business owner stated that the burden of compliance with environmental regulations was difficult for their relatively small business, and that compliance paperwork required a significant time commitment.

5.2.3 Worker Shortage

Although interviewees and participants in the focus groups mentioned that Maryland's universities graduated highly skilled workers, they consistently noted that not enough workers graduated each year. Engineers were the most commonly cited needed profession, along with all manner of IT professionals to support Maryland's growing cybersecurity industry. Participants mentioned that the demand growth for cyber-security jobs was not solely driven by military bases, but also by the technical supporting industries, such as healthcare. A shortage of skilled workers is important not just to ensure that Maryland businesses have enough workers; one interviewee noted that a shortage of skilled workers could have consequences in a future round of BRAC. The interviewee stated that if Maryland has a shortage of cybersecurity professionals compared to another area, there is a risk that Maryland's military programs could be transferred to the other area.

> **"There's a big gap between how [many STEM graduates] we're pushing out of our schools [and our needs], as well as ensuring there are people coming to Maryland because you can't just fill [the state's needs] with entry-level positions."**

[77] Anne Arundel County. "Frequently Asked Questions: Critical Areas." 2016. Accessed November 10, 2016. http://www.aacounty.org/departments/planning-and-zoning/development/frequently-asked-questions/

One shortage that almost all respondents identified was a lack of workers with security clearances. Although respondents understood and agreed with the requirements for security clearances, the requirement limits the number of workers able to work on military bases or with federal clients. One solution that many respondents identified is a continuation and expansion of Project SCOPE (Security Clearance Overview and Preparation Education) carried out through the Fort Meade Alliance. Project SCOPE serves as an educational resource, primarily for high-school and college students, that describes the security clearance process and increases awareness about what steps students can take while young to prepare themselves for a security clearance. Respondents believed that education was critical to increasing the rate of skilled workers in Maryland with a security clearance because many people who are eligible for a security clearance did not undertake the process to obtain one, despite the associated increase in pay that often accompanies a clearance. Respondents theorized this was due to a combination of people not knowing enough about the benefits of having a clearance and viewing the application process as too difficult or lengthy. Those respondents familiar with Project SCOPE indicated that the program has helped educate people on both the benefits and application process and therefore has increased the number of people who would apply for a clearance.

"Small and medium size businesses are struggling to compete because clearances can't get processed fast enough and they don't want to hire someone on contingency and have the salary expense until they know they can actually put that person on a contract."

In addition to the benefits of Program SCOPE, one interviewee, identified through the business survey, highlighted the existing NSA and DoD internship programs as ways to further develop a workforce in Maryland to with security clearances. These internships frequently provide students with security clearances. Because students already have security clearances from the internship, they are able to be hired and begin working on projects immediately after graduation. This approach benefits small businesses that would otherwise be forced to hire a recent graduate on contingency.

An additional cause cited for worker shortage in the region is the high cost of living and associated quality of life. Maryland was identified as a very expensive state to live in, especially compared to neighboring Pennsylvania and portions of Virginia. Taxes were consistently identified as a factor driving skilled workers out of state, especially valued military personnel. Maryland's tax rate on pensions and other retirement plans was noted as being too high. One interviewee at a military alliance who is in regular contact with various companies stated: "what we're hearing is that the taxation on federal pensions is an issue for companies when they are trying to recruit." Several respondents indicated that when military personnel reach retirement age, they inevitably move out of state. These retirees move to states with lower taxes, such as Pennsylvania and Delaware. As mentioned previously, retired personnel and the benefits that they can bring to companies are a competitive advantage to the state.

"If somebody got into the military at a pretty young age, they could retire with another 10 or 20 years on their career. However, they could go to North or South Carolina and not have any of their pension taxed."

However, the loss of so many military retirees means that Maryland is missing out on a potential stream of workers.

For some areas across the state, the need for a high quality of life was identified as a major roadblock for economic growth and diversification. In respondents' experiences, younger workers wanted to live in bigger cities, such as Baltimore or Washington, D.C., and did not want to commute long distances. Respondents from all areas across Maryland identified a need for more public transportation, specifically citing the need for more rail-based transport, such as light rail, commuter rail, and MARC trains. Additional focus should go into developing urban centers across the state, as respondents believed this would attract and retain millennial workers.

"One of the challenges Carderock has, being in Montgomery County, is cost of living. When a person comes in, they have to settle in that area, which is a desirable but expensive area. The laboratory can't do much to help them."

To understand potential shortages facing the defense industry in Maryland, the RESI team used its proprietary Predictive Regional Occupational Matrix (PROM) tool. The PROM tool incorporates data from the BLS OES database, information on job openings and separations at the regional level from the BLS Job Openings and Labor Turnover Survey (JOLTS), and forecasts of Maryland's economy, as reported in Section 4 of the Cluster Analysis, to map forecasts at the industry level to occupations.[78] Figure 27 displays the PROM tool's forecasts for separations in computer-related occupations for the next three years (2017 through 2019). Separations occur whenever an individual retires or changes industries or when a new job is created.

Figure 27: Forecasted Separations for Computer-Related Occupations, 2017-2019

	Separations in 2017	Separations in 2018	Separations in 2019	3 Year Total	Annual Average
Separations for Computer-Related Occupations	8,434	7,446	7,368	23,248	7,749

Source: RESI

As seen in Figure 27, RESI's PROM tool projects that there will be an annual average of 7,749 computer-related job openings in Maryland between 2017 and 2019. These openings may be filled by hiring recent college graduates, hiring workers from out of state, or recruiting workers from other occupations. As evidence of the worker shortage in Maryland, the Maryland Higher Education Commission (MHEC) reports that in 2015, 5,131 Computer Science Bachelor's,

[78] Regional Economic Studies Institute of Towson University. "The Impact of Department of Defense Funding on Industry Clusters in the State of Maryland." 2017

Master's, and Doctoral degrees were awarded.[79] If these recent graduates all found employment in Maryland in computer-related occupations, there would still be a deficit of 2,618 job openings that would need out-of-state workers or workers from other industries to fill them.

To understand the skilled workforce issues facing companies in the DoD supply chain, the RESI team surveyed companies in the supply chain.[80] Respondents to the survey indicated that they faced difficulties in hiring qualified workers. As shown in Figure 28, only 31 percent of companies indicated they had "no difficulty" in hiring workers. Very small companies made up of 10 or fewer employees were more likely to indicate they had no difficulties finding workers than larger companies.[81] For example, companies with 2 to 10 employees indicated that they had no difficulty finding qualified employees nearly twice as much as expected. Conversely, companies with 51 to 200 workers responded they had no trouble finding qualified candidates half as often as expected. Larger companies made up of more than 10 workers were more likely to indicate they had trouble finding qualified workers.

Figure 28: Difficulty Finding Qualified Workers by Company Size

Company Size	A Lot of Difficulty		Some Difficulty		No Difficulty		Total	
	#	%	#	%	#	%	#	%
1	3	3.13%	7	3.68%	18	13.95%	28	6.75%
2-10	34	35.42%	67	35.26%	64	49.61%	165	39.76%
11-50	34	35.42%	72	37.89%	36	27.91%	142	34.22%
51-200	19	19.79%	31	16.32%	9	6.98%	59	14.22%
>200	6	6.25%	13	6.84%	2	1.55%	21	5.06%
Total	96	100%	190	100%	129	100%	415	100%
Percentage of Companies with Dependency Level		23.13%		45.78%		31.08%		100%

Source: RESI Business Industry Survey

Companies were also asked about their recent hiring decisions. Figure 29 shows how the difficulty companies have had finding qualified workers varies depending on the recent hiring trends in the company. In general, if a company had been hiring recently, they were most likely to mention

[79] Maryland Higher Education Commission. "2016 Data Book: Creating a State of Achievement." 2016. Accessed January 3, 2017.
http://mhec.maryland.gov/publications/Documents/Research/AnnualPublications/2016Databook.pdf
[80] The survey methodology is discussed in Section 3.4.
[81] This cross-tabulation is presented where the columns sum to 100%. Therefore, the expected percentage for a given cell, assuming no relationship exists between the two tabulated variables, is located at the far-right under the total column. For example, businesses with only 1 employee make up 6.75 percent of the responses in the business survey. Therefore, if there were no relationship between business size and difficulty finding qualified workers, we would expect to see all percentages in the first row be close to 6.75 percent. The results indicate that there is likely a relationship between business size and difficulty finding qualified workers.

having a lot of difficulty finding qualified workers. Companies that had not recently been hiring were more likely to indicate that it was easier to find qualified workers.

Figure 29: Difficulty Finding Qualified Workers by Company Recent Hiring Decisions

Recent Hiring	A Lot of Difficulty		Some Difficulty		No Difficulty		Total	
	#	%	#	%	#	%	#	%
Company has Been Hiring Recently	73	76.04%	115	60.85%	47	36.43%	235	56.76%
Company is Considering Hiring	7	7.29%	15	7.94%	6	4.65%	28	6.76%
Company has Not Been Hiring Recently	16	16.67%	59	31.22%	76	58.91%	151	36.47%
Total	96	100%	189	100%	129	100%	414	100%
Percentage of Companies with Dependency Level		23.19%		45.65%		31.16%		100%

Source: RESI Business Industry Survey

Companies responding to the business survey were asked what proportion of their revenues was reliant on DoD funding. These self-reported dependency scores are reported in Figure 30 and roughly broken into thirds for intuitive reporting. As seen in Figure 30, 32 percent of respondents reported that between 70 and 100 percent of their revenues were dependent on DoD funding, and an additional 10 percent of respondents indicated their business relied on DoD funding for 35 to 69 percent of their revenues.

Figure 30: Reliance on Department of Defense Contracting

Dependency on DoD Contracting	Frequency	Percentage
High Dependency (70-100%)	158	31.98
Medium Dependency (35-69%)	50	10.12
Low Dependency (0-34%)	286	57.89

Source: RESI Business Industry Survey

Figure 31 shows how the difficulty of hiring qualified candidates varies by reliance on DoD funding. Critically, companies reporting a high level of dependency on DoD funding were more likely to have a lot or some difficulty finding qualified candidates compared to businesses which reported having a medium or low dependency on DoD funding. This indicates that the traits most in demand, such as programming skills and security clearances, by the DoD and its contractors are in short supply in Maryland. Strategies for increasing the number of qualified workers in Maryland is discussed in more detail in Section 8.

Figure 31: Dependency on DoD Funding by Difficulty in Hiring Qualified Employees

Difficulty Hiring	High Dependency		Medium Dependency		Low Dependency		Total	
	#	%	#	%	#	%	#	%
A Lot of Difficulty Hiring	38	28.79%	10	22.22%	47	20.61%	95	23.46%
Some Difficulty Hiring	66	50%	22	48.89%	96	42.11%	184	45.43%
No Difficulty Hiring	28	21.21%	13	28.89%	85	37.28%	126	31.11%
Total	132	100%	45	100%	228	100%	405	100%
Percentage of Companies with Dependency Level		32.59%		11.11%		56.30%		100%

Source: RESI Business Industry Survey

Despite the difficulties finding qualified workers, only 3.5 percent of businesses that responded to the survey noted that they expected to decrease their hiring rate in the future, indicating that if Maryland increases the supply of qualified workers, there will be plenty of jobs available.

5.2.4 Lack of Public-Private Partnerships for Workforce Training

One commonly cited solution to help train a workforce that would meet Maryland's current needs is the creation of more public-private partnerships. Public-private partnerships are partnerships between the public and private sectors. They have become a common tool to handle workforce development and training across the country because they connect employers who struggle finding qualified candidates with workers who have trouble finding jobs. For example, in 2010, President Obama launched a nationwide public-private partnership called "Skills for America's Future" that connected community colleges to different industry leaders in an effort to make education reflect the skills needed by employers.[82] Under the program, businesses work with community colleges to design curriculum so that students in the programs graduate with the skills that employers actually need, limiting employers' need to provide costly training and enhancing students' job prospects.[83] Focus group respondents and interviewees did mention that Maryland has a number of public-private partnerships already in place for workforce training. However, as noted previously in Section 5.2.3, Maryland employers are having a difficult time finding qualified workers. Respondents noted that one reason is that existing public-private partnerships are not as robust as they need to be and need to be strengthened and expanded.

One issue respondents identified with the state of public-private partnerships in Maryland is that there is no one centralized entity in charge of administering these programs. Respondents indicated that Commerce once organized and developed workforce training programs but that is no longer the case. Instead, respondents pointed to a patchwork of small programs across the state meeting this need. For example, respondents cited a program between Montgomery

[82] Sabochik, Katelyn. "Building Skills for America's Future." White House. 10/4/2010. Accessed Januray 4, 2017. https://www.whitehouse.gov/blog/2010/10/04/building-skills-america-s-future
[83] Ibid.

College and the local business community through which the school conducted focus groups with local business leaders to understand their desired skillsets. Another program involves a partnership between the NSA and STEM-centered schools in Anne Arundel County to teach needed skills and to track students with needed skillsets.

On October 18, 2016, the University System of Maryland announced a public-private partnership to establish a cybersecurity workforce development program.[84] The program, taking place at the UMBC Training Centers and Bowie State University, trains a small cohort of students at each of the universities for 18 weeks. Once this training is complete, students will be placed in a fellowship with private employers for 12 weeks to further develop the skills that employers in the area need.[85] Similar small-scale programs were identified across all areas in Maryland, but respondents consistently believed that larger, better funded, and more centrally organized efforts would better help Maryland's workforce meet the needs of Maryland's employers.

Another issue identified by interviewees was a mismatch between existing training programs and the needs of military bases and employers across the state. Interviewees stated that the skills students would learn in their programs may not be the skills that local military bases need. To alleviate this issue, military bases like Fort Meade and Aberdeen Proving Ground have begun to publish the skills they need, using standards from the National Institute of Standards and Technology (NIST). NIST publishes a series of standards and guidelines—including guidelines for cybersecurity—that guide businesses in how to structure their data security and management activities. By publishing how their cybersecurity programs follow nationally-recognized NIST standards, military bases like Fort Meade and Aberdeen Proving Ground are enabling local colleges and training programs to better tailor their training to the needs of the bases.

Although many focus group participants and interviewees believe the state lacks an adequate number of public-private partnerships, most of those same participants and interviewees also identified a program that they saw as a success and a step in the right direction. Most respondents simply wanted the state to play a larger role in coordinating training programs and for existing training programs to be expanded to additional school systems. Given Commerce's ability to act as a matchmaker between industry and school systems across the state, this weakness may be one of the easier ones to address.

5.2.5 Overreliance on the Department of Defense

A common refrain in some areas of Maryland was how reliant the areas were on military installations and DoD contractors. Losing a military base in most areas was seen as "crippling." For example, some respondents from the Frederick area compared Fort Detrick to "a city within the city [of Frederick]" and stated that if the fort closed, the effects would be catastrophic for the

[84] University System of Maryland. "USM Celebrates Public Private Partnership to Develop Cyber Security Workforce Training through Resources of UMBC Training Centers, Bowie State University." USM. 10/28/2016. Accessed December 20, 2016. http://www.usmd.edu/newsroom/news/1662
[85] Ibid.

area. Respondents in Southern Maryland indicated that, although they would like to diversify their economy, they are only doing so slowly, and that the economy is still dominated by contracting jobs and jobs associated with the military installations. Respondents from Southern Maryland indicated that diversification tends to involve an increase in retail jobs, which tend to have lower salaries than many defense-related jobs. As such, participants stated that reductions in funding from BRAC or sequestration hit these areas particularly hard, hurting small businesses that often seek to diversify through partnering with both federal and private clients. Focus group participants and interviewees from the region stated that sequestration had a greater impact on the region than the recession in 2008, and said that the effects of future reductions in defense funding would be especially difficult for the region to mitigate. Further information on the dependency of Southern Maryland and other regions of the state on defense contracting is available in Section 6.

"For the professional workforce, the folks with advanced degrees, there's no other place for them to work in Frederick. A few might get jobs, but where would they go?"

This overreliance on DoD funding was captured in the business survey that the RESI team conducted of companies working with the DoD. As discussed in Section 5.2.3, roughly 32 percent of companies reported having 70 to 100 percent of their revenues come from DoD sources. Figure 32 shows how the level of dependency reported by survey respondents varied by company size.[86] Very small businesses of 10 or fewer employees were less likely to report having a medium or high level of dependence on DoD funding compared to larger companies. Business with 50 or more employees were more likely than other companies to report a high or medium level of dependence on DoD funding than other companies.

[86] This cross-tabulation is presented where the columns sum to 100%. Therefore, the expected percentage for a given cell, assuming no relationship exists between the two tabulated variables, is located at the far-right under the total column. For example, businesses with only 1 employee make up 9.8 percent of the responses in the business survey. Therefore, if there were no relationship between business size and difficulty finding qualified workers, we would expect to see all percentages in the first row be close to 9.8 percent. The results indicate that there is likely a relationship between business size and difficulty finding qualified workers.

Figure 32: Dependency on DoD Funding by Company Size

Size	High Dependency		Medium Dependency		Low Dependency		Total	
	#	%	#	%	#	%	#	%
1	14	8.92%	1	2%	33	11.66%	48	9.8%
2-10	51	32.48%	18	36%	122	43.11%	191	38.98%
11-50	54	34.39%	19	38%	89	31.45%	162	33.06%
51-200	30	19.11%	9	18%	29	10.25%	68	13.88%
>200	8	5.1%	3	6%	10	3.53%	21	4.29%
Total	157	100%	50	100%	283	100%	490	100%
Percentage of Companies with Dependency Level		32.04%		10.20%		57.76%		100%

Source: RESI Business Industry Survey

5.2.6 Access to Capital/Funding

Several small business owners and county economic development managers indicated that it is often difficult for small businesses to gain access to adequate start-up funding. This lack of start-up funding access limits entrepreneurs' ability to develop their ideas, therefore limiting the growth of the local economy. Respondents mentioned that, while additional state funding could help businesses, one solution would be a system to better connect entrepreneurs to angel investors and other funding sources. During industry user groups, several small business owners also mentioned this as a potential solution to the access to capital issue, since they often did not know who could assist them with further developing and refining their ideas. One small business owner, identified through the business survey, indicated that one onerous way to secure funding is to use their home as collateral. The business owner indicated that having to use a home as collateral is burdensome, especially for small companies. The interviewee stated that this requirement is in place even for entrepreneurs who have previously led other successful companies. Making access to capital easier and less burdensome was a common request from both business owners and economic developers.

Interestingly, Maryland MSAs are ranked as some of the best in the country in terms of access to capital. Statistics compiled by the National Venture Capital Association show that the Washington, D.C., and Baltimore MSAs are ranked among the top twenty in the nation in terms of access to venture capital.[87] The issue, which both local business owners and economic developers noted, is that it can be hard to connect businesses to venture capital and that the amount of money available in Maryland is dwarfed by the funding available in other areas, such as San Francisco.

[87] National Venture Capital Association. "US Venture Capital Investment Spanned 133 MSAs in 2015." 2016. Accessed at: http://nvca.org/pressreleases/u-s-venture-capital-investment-spanned-133-msas-in-2015/

Figure 33 lists metropolitan statistical areas by the number of venture capital deals made, the number of companies funded, and the amount invested.

Figure 33: Top Twenty MSAs for Access to Capital

Rank	MSA	Number of Deals	Number of Companies	Amount Invested
1	San Francisco-Oakland-Fremont, CA	942	797	$21,043,061,400
2	New York-Northern New Jersey-Long Island, NY-NJ-PA	478	416	$6,981,436,400
3	Boston-Cambridge-Quincy, MA-NH	428	348	$5,581,687,300
4	San Jose-Sunnyvale-Santa Clara, CA	379	321	$6,238,491,900
5	Los Angeles-Long Beach-Santa Ana, CA	293	240	$4,481,612,100
6	Seattle-Tacoma-Bellevue, WA	110	95	$1,171,961,700
7	Washington-Arlington-Alexandria, DC-VA-MD-WV	111	93	$923,988,400
8	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	115	93	$516,330,500
9	San Diego-Carlsbad-San Marcos, CA	100	83	$1,166,538,700
10	Pittsburgh, PA	93	83	$199,259,700
11	Chicago-Naperville-Joliet, IL-IN-WI	87	81	$1,103,907,600
12	Austin-Round Rock, TX	99	78	$739,989,300
13	Atlanta-Sandy Springs-Marietta, GA	70	58	$836,057,800
14	Denver-Aurora, CO	51	41	$540,260,200
15	Baltimore-Towson, MD	41	37	$445,075,600
16	Nashville-Davidson-Murfreesboro-Franklin, TN	41	34	$135,891,900
17	Portland-Vancouver-Beaverton, OR-WA	41	32	$161,304,100
18	St. Louis, MO-IL	41	30	$254,395,300
19	Minneapolis-St. Paul-Bloomington, MN-WI	29	28	$369,276,400
20	Boulder, CO	29	27	$230,908,400

Source: National Venture Capital Association

Notably, although Baltimore and Washington, D.C., are in the top 20 MSAs in terms of companies financed and money invested, both metro areas fall far behind larger investing hotspots. In 2015 investors in San Francisco invested over $21 billion in almost 800 companies, which is more than 47 times the Baltimore region's roughly $445 million invested in 37 companies. Much of the reason that MSAs such as San Francisco, New York City, and Boston have such a large amount of venture capital invested is because the areas are well-established as entrepreneurial hotspots and startups are able to benefit from the availability of talent and similar companies in the area for networking. The hotspots of San Francisco and Los Angeles, for example, have been ranked

in the top five MSAs for venture capital for the past 16 years.[88] To illustrate the disparity in funding, economic developers gave the example of one company that received an offer of $7.5 million to start their business in Silicon Valley and was only able to receive $4.5 million to start in Baltimore. Although this business remained in Maryland, the differences in capital accessibility is likely to drive innovation out of the state.

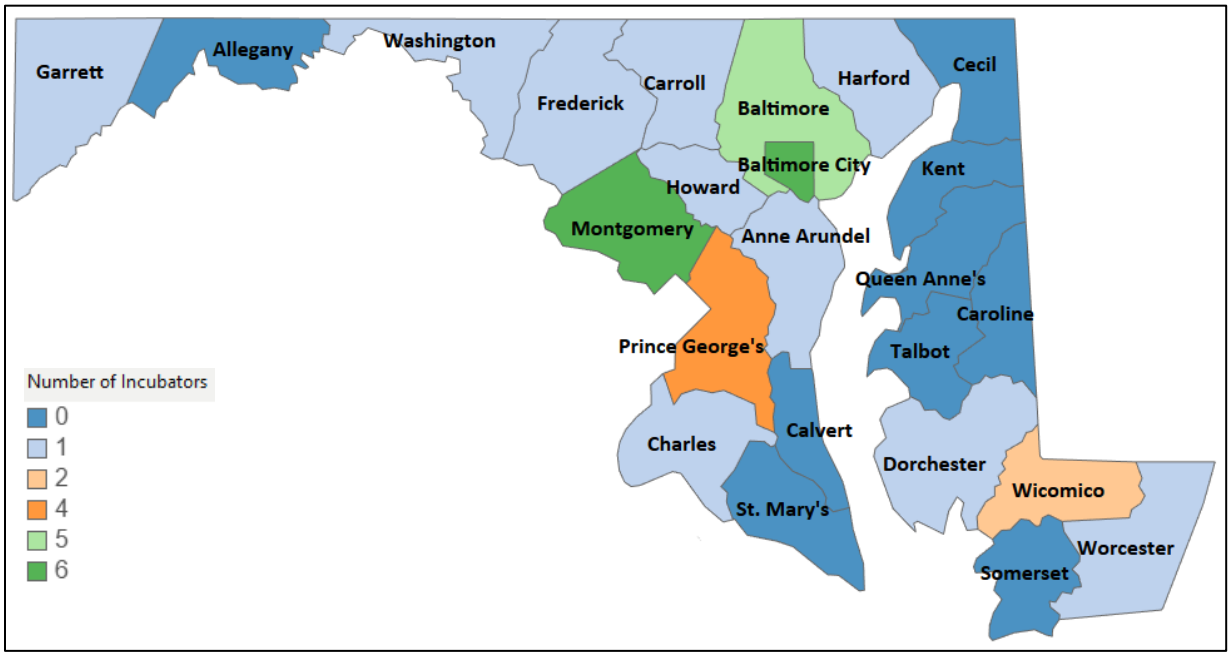
An instructive lesson for Maryland is the experience of Charlottesville, Virginia, ranked as the fastest growing MSA for venture capital between 2010 and 2015.[89] Between 2010 and 2015, venture capital investment in the region increased from $250,000 to $27.7 million, much of which went to nine companies.[90] Of these nine companies, six worked closely with the University of Virginia's Licensing and Ventures Group, an incubator and consulting group based out of the University.[91] One way to attract more investment to Maryland is to increase the number of startups who participate in incubators and therefore have better business plans, better patents and legal protections, and a better understanding of the demand for their product in the market. However, as discussed in Section 5.2.7, focus group respondents and interviewees indicated that Maryland does not currently have a robust network of incubators.

5.2.7 Lack of Existing Incubators

Business incubators are crucial to helping entrepreneurs refine and develop their ideas. However, focus group participants and interviewees indicated that there were not enough incubators operating within the state and that this lack posed a challenge in diversifying Maryland's economy as well as supporting existing DoD contracting. Although several counties are in the process of launching incubators, not every county currently has one, and entrepreneurs often do not know where to turn. Several respondents indicated that it would be helpful to publish a resource guide listing the location of incubators and other resources, such as Makerspaces and small business consultants, to help support entrepreneurs. However, this type of resource does exist in several places. For example, the Department of Commerce lists the location and focus areas of 33 Maryland incubators on its website.[92] Figure 34 shows the number of incubators in Maryland by county.

[88] National Venture Capital Association. "US Venture Capital Investment Spanned 133 MSAs in 2015." 2016. Accessed at: http://nvca.org/pressreleases/u-s-venture-capital-investment-spanned-133-msas-in-2015/
[89] Ibid.
[90] McNally, Katie. "New Capital for Venture Capital." UVA Today. 2/1/2016. Accessed December 20, 2016. https://news.virginia.edu/content/charlottesville-new-capital-venture-capital
[91] Ibid.
[92] Maryland Department of Commerce. "Incubators." 2016. Accessed November 9, 2016. http://commerce.maryland.gov/move/find-a-location/incubators

Figure 34: Number of Incubators in Maryland by County



Source: Maryland Department of Commerce

One reason economic developers and entrepreneurs may feel that the state is lacking incubators is that 26 out of 33 incubators in the state are in the Baltimore and Capital regions, and only one incubator is listed for Southern Maryland. There are nine counties in the state without a single incubator. Additionally, even if an entrepreneur lives in a county with an incubator, that incubator may not be relevant to the startup the entrepreneur is creating. Figure 35 lists the names, locations, and focus areas of the 33 incubators in Maryland. Entrepreneurs in Baltimore County or Montgomery County typically have easy access to a relevant incubator regardless of their focus. However, an entrepreneur in St. Mary's County may have to commute to Montgomery County to find a relevant incubator.

"I think there should be more collaboration between the incubators. Some do their job well and others don't. Here in Harford County, I don't think they understand the technology or what Millennials are looking for in terms of space and environment. If you go downtown [in Baltimore], they understand completely."

Figure 35: Incubators in Maryland by Region and Focus Area

Incubator Name	Region	County	City	Focus
Chesapeake Innovation Center (CIC)	Baltimore	Anne Arundel	Odenton	Cyber, Defense
Catapult Space	Baltimore	Baltimore	Towson	Mixed use
Cyber Incubator@bwtech	Baltimore	Baltimore	Baltimore	Cyber
Life Sciences Incubator@bwtech (LSI)	Baltimore	Baltimore	Baltimore	Bio

Incubator Name	Region	County	City	Focus
Maryland Clean Energy Technology Incubator (CETI)	Baltimore	Baltimore	Baltimore	Clean Tech
TU Incubator	Baltimore	Baltimore	Towson	Ed Tech
Betamore	Baltimore	Baltimore City	Baltimore	IT
BioInnovation Center	Baltimore	Baltimore City	Baltimore	Bio
Emerging Technology Centers (ETC) Haven Street	Baltimore	Baltimore City	Baltimore	Bio, Ed Tech, IT
Emerging Technology Centers (ETC) JHU Eastern Campus	Baltimore	Baltimore City	Baltimore	Bio, Ed Tech, IT
FastForward Homewood	Baltimore	Baltimore City	Baltimore	Bio, Health IT
Harbor Launch at IMET	Baltimore	Baltimore City	Baltimore	Environmental, Bio, Clean Tech
Carroll Innovation Center at Overton	Baltimore	Carroll	Westminster	Mixed use
Ground Floor Harford	Baltimore	Harford	Havre De Grace	Entrepreneurs, Technology, Startups
Innovation Catalyst (iCat)	Baltimore	Howard	Columbia	Technology
Frederick Innovative Technology Center, Inc. (FITCI)	Capital	Frederick	Frederick	Bio, Clean Tech, IT
Bethesda Green Business Incubator	Capital	Montgomery	Bethesda	Clean Tech, Environmental
Biomedical Research Institute	Capital	Montgomery	Rockville	Bio
Germantown Innovation Center	Capital	Montgomery	Germantown	Bio, Technology
Rockville Innovation Center	Capital	Montgomery	Rockville	Bio, Clean Tech, IT
Silver Spring Innovation Center	Capital	Montgomery	Silver Spring	IT
TechFire - Silver Spring	Capital	Montgomery	Silver Spring	Cyber, Defense, Technology, IT
Bowie Business Innovation Center	Capital	Prince George's	Bowie	Mixed use
Prince George's County Technology Assistance Center (TAC)	Capital	Prince George's	Largo	Technology
Maryland International Incubator (MI2)	Capital	Prince George's	College Park	Bio, Clean Tech, Health IT, IT
Technology Advancement Program (TAP)	Capital	Prince George's	College Park	IT
Eastern Shore Innovation Center	Eastern	Dorchester	Cambridge	Startups
hotDesks (Eastern Shore Entrepreneurship Center)	Eastern	Wicomico	Salisbury	Mixed use
Salisbury Airport Incubator	Eastern	Wicomico	Salisbury	Technology

Incubator Name	Region	County	City	Focus
Worcester County Small Business Incubator	Eastern	Worcester	Pocomoke City	Mixed use
TechFire - Southern Maryland	Southern	Charles	St. Charles	Cyber, Defense, Technology, IT
Garrett Information Enterprise Center	Western	Garrett	McHenry	Mixed use
Technical Innovation Center (Hagerstown)	Western	Washington	Hagerstown	Technology

Source: MD Department of Commerce

Creating additional incubators across the state will help budding entrepreneurs develop small businesses and grow Maryland's economy. Additional incubators are being established in Maryland, and these efforts should continue to be supported. For example, St. Mary's County recently received $1.9 million from TEDCO through the Technology Transfer Office of the Naval Air Warfare Center Aircraft Division to establish an incubator at St. Mary's airport.[93] Additionally, better marketing the resources already available to Maryland's entrepreneurs will help these resources be used more often. Although these resources are available online, it may be worthwhile for Commerce to visit entrepreneur conventions and gatherings to market the resources directly to small business owners.

5.3 Opportunities

Respondents identified several key opportunities for Maryland to further develop and refine the DoD-intensive landscape across the state. Although respondents cautioned that the outcome of future BRAC rounds is uncertain, respondents were optimistic that the state could gain jobs during a future BRAC round. Additionally, focus group participants and interviewees identified other opportunities for the state such as commercialization, unmanned vehicles, a growing cybersecurity presence in the state, and the development of workforce training programs

5.3.1 BRAC

Although most respondents were wary about the upcoming round of BRAC, most felt that Maryland had the potential to experience a net gain in jobs, as the state did after the preceding round. Respondents cautioned that this feeling should not cause complacency, as no one is sure of future BRAC rounds exact priorities. Most respondents did not feel that any base was under a real threat of closure, although Indian Head was mentioned as a concern. In fact, some bases, such as Fort Meade, are thought to be well positioned to benefit from a new round of BRAC. Fort Meade currently has five of the nation's seven major cyber centers, and respondents felt that there was a good chance additional cyber jobs would come to Fort Meade in another round of BRAC.

[93] Southern Maryland Online. "NAWC-AD Funds $1.9M to Seed Business Incubator at St. Mary's Airport." Southern Maryland Online. 9/28/2016. Accessed February 1, 2017. http://somd.com/news/headlines/2016/21376.php

Respondents identified several actions Maryland can take to ensure that the next round of BRAC is a success. For example, respondents suggested that Maryland should stress the interconnectedness of its bases. As discussed in Section 5.1.2, one of the strengths of Maryland's DoD-intensive landscape is that the state's military installations are interconnected. For example, interviewees mentioned that many of the tools used by cybersecurity forces at Fort Meade originated at Aberdeen Proving Ground. In this example, these connections make the work done at the Fort Meade and Aberdeen Proving Ground harder to replicate in other areas of the country, since the military benefits by having collaboration between the creator and user of its technologies. Additionally, numerous Maryland businesses contract with several installations in Maryland at once. If a program those contractors work on leaves the state, it could lead to efficiency losses for the military, since the business will now need to have an additional office location staffed, resulting in higher overhead rates.

"Because we have so much [in Maryland], we became a receptor site [in the previous round of BRAC]. I think that is still possible in a future round of BRAC. There is just so much the military has invested in Maryland that it's likely to be a receptor site again."

Another way the state can seize the opportunity that BRAC presents is to proactively highlight the strengths and uniqueness of its military installations. For example, respondents noted that NAS Patuxent River has access to water, restricted airspace, and unrestricted airspace, offering a unique testing ground for all types of aircraft and unmanned vehicles. Fort Meade has strong cybersecurity facilities and a unique connection with the NSA. Fort Detrick hosts most programs in the nation's biological defense program. While many of the strengths are well known, interviewees argued that publicizing the unique programs and research done at Maryland bases would make this knowledge more well known to members of the BRAC Commission as well. Respondents believed that if members of the BRAC Commission were more aware of the strengths of Maryland's installations and programs, they would be less likely to move programs or shut down bases in the state.

"We are competing for brain power. We will succeed [in BRAC] if we continue to attract [well-educated] people."

Interviewees and focus group participants emphasized that Maryland's Congressional delegation needs to be heavily involved in the BRAC process. As discussed in Section 5.1.5, they stated that Maryland's delegation was extremely helpful in prior rounds of BRAC. For example, there were reports that Congressman Hoyer was instrumental in removing Indian Head from the list of bases to be closed in 1995.[94] Senator Mikulski was routinely praised for her efforts in advocating for Maryland's military bases and making compelling arguments to the BRAC Commission for why these bases and programs should stay in the state.

[94] Partlow, Joshua. "Indian Head Vulnerable to Base Closure." Washington Post. 3/6/2005. Accessed December 20, 2016. http://www.washingtonpost.com/wp-dyn/content/article/2005/03/25/AR2005032502505.html

One respondent also highlighted increasing energy efficiency and expanding on the use of renewable energy sources as a way for Maryland to distinguish itself during BRAC deliberations. The interviewee argued that because the DoD is seeking to become increasingly energy efficient, anything Maryland can do to help boost its green energy industry could benefit the state during the next round of BRAC. The interviewee was quick to note that energy efficiency would not be the primary reason the DoD would use to close one base over another. However, the BRAC Commission has previously considered costs of operating at different bases, and a shift towards green energy could make Maryland installations more attractive. Although Maryland does not have the same access to affordable and abundant solar and wind resources as the Midwest or Texas, for example, focusing on these issues could give Maryland installations an edge.

Even if BRAC does result in some base closures, some respondents noted that it might not be an overall loss to the state as jobs would shift to other facilities and the installation could be repurposed. For instance, respondents cited the closure of the Federal Research Center at White Oak, which led to jobs from the base being shifted to several other facilities, notably Indian Head, PAX River, and Dahlgren. The Federal Research Center at White Oak then became, through the efforts of community leaders, a center for the FDA. The research center went from employing roughly 2,700 people to currently being on track to employ 10,000 people through the FDA. This case study is a prime example of how it is possible, given Maryland's strong military and DoD-intensive landscape, to grow the state economy even in the face of BRAC closures and program loss.

Maryland was a net gainer in the previous round of BRAC, and much of the state's success can be attributed to the coordination between military leaders, the state's Congressional delegation, and the state government. In a 2011 BRAC Progress Report, recapping the state's progress in reacting to the 2005 BRAC, the Maryland government noted the success of the BRAC Subcabinet and various state agencies in providing infrastructure, new homes, and securing new teachers for Maryland's new residents. This level of coordination should continue for Maryland to have similar success in future rounds of BRAC. In May 2016 the Maryland Military Installation Council created a BRAC Advisory Group to accomplish this goal.[95] The BRAC Advisory Group seeks to accomplish many of the recommendations that focus group participants and interviewees outlined. Namely, the group advocates for Maryland's military installations and serves as liaisons between the installations, local stakeholders, and Maryland's congressional delegation. By coordinating efforts to promote Maryland's military installations, market the area's strengths, and address its weaknesses, the BRAC Advisory Group will be a key part of Maryland's BRAC strategy moving forward.

[95] Maryland Department of Commerce. "Maryland Creates BRAC Advisory Group." 5/11/2016. Accessed December 22, 2016. http://commerce.maryland.gov/media/maryland-creates-brac-advisory-group

5.3.2 Commercialization

Respondents repeatedly highlighted the research and development occurring on military bases as a great way to grow and diversify the economy. Technology Transfer Officers and county economic development managers repeatedly stressed the opportunities that existed in opening military research to commercialization. Frederick County, in an effort to capitalize on the research conducted at Fort Detrick, is opening an IT incubator downtown with technology transfer officers from Fort Detrick working in the incubator. This partnership, where technology transfer officers are stationed away from the installation they represent is a unique way to ensure that entrepreneurs have easier access to experts and potentially useful technology.

As part of the Southern Maryland Technology Commercialization Pilot Program (SMTCPP), Commerce is leading efforts to identify patents developed at Southern Maryland's Naval bases with potential for commercialization. Entrepreneurs and contractors will then be able to take these patents and develop them for commercial uses with the aid of newly created incubators and small business assistance. Another commercialization project in Maryland is a 2015 partnership between Maryland Technology Development Corporation (TEDCO) and NIST to encourage entrepreneurs to commercialize NIST technologies.[96] Under the program, employees of NIST and guest researchers will be able to commercialize NIST technologies and will receive training from TEDCO as well as mentorship and advising.[97]

"Get the patent effort that is going on at PAX River to the rest of the state as quickly as possible. Even my company, who doesn't do anything with the Navy, is looking at the patent list."

Despite the increased focus on commercializing military patents, some focus group participants and interviewees commented that technology transfer did not exist in all areas of the state. For example, one respondent cited Aberdeen Proving Ground as an example where little technology transfer occurred. The interviewee referenced previous efforts led by TEDCO which created the Aberdeen Technology Transfer Initiative (ATTI). ATTI had two rounds of federal funding: between May 2004 and September 2005 and between December 2005 and October 2007.[98] The program supported collaborative research between local companies and Aberdeen Proving Ground. However, while technology transfer programs at other military installations such as Fort Detrick

[96] NIST. "NIST and Maryland TEDCO Partner to Encourage Entrepreneurship." 11/17/2015. Accessed December 21, 2016. https://www.nist.gov/news-events/news/2015/11/nist-and-maryland-tedco-partner-encourage-entrepreneurship

[97] Ibid.

[98] Maryland Technology Development Corporation. "Maryland Technology Development Corporation (TEDCO) Annual Report Fiscal Year 2007." 2007. Accessed January 10, 2016. http://msa.maryland.gov/megafile/msa/speccol/sc5300/sc5339/000113/011000/011069/unrestricted/20080537e.pdf

continued to receive funding, ATTI has not received additional funding since 2007.[99] However, in 2013 the Harford Business Innovation Center (HBIC) partnered with Aberdeen Proving Ground to create a technology transfer office to assist local businesses in commercializing products from Aberdeen Proving Ground.[100] The fact that the interviewee mentioned that limited technology transfer is occurring in the region may signal that better promotion of technology transfer programs across the state needs to occur. This marketing may best be handled by a central organization such as Commerce.

"From the perspective around Aberdeen Proving Ground, most companies supporting SECOM could also be supporting industry in information assurance given the huge push for the 'internet of things.' All of the research and support being done in communications, RF technology, information assurance, equipment and logistics support can be made consumerist."

Respondents overwhelmingly indicated that the more businesses can commercialize products developed here in Maryland, the better the overall economy of Maryland will be. New businesses help grow Maryland's economy, and commercialization helps to diversify the economy to protect against the negative impacts from future rounds of BRAC or sequestration. Respondents also indicated that the DoD favors commercialization of military technologies. Because of this, respondents indicated that the DoD may view military installations with high levels of commercialization and strong local private-sector ties more favorably during future BRAC rounds. Commercialization may help to not only grow and diversify Maryland's economy, but therefore may also help immunize local military installations from closing, avoiding job loss in Maryland's communities.

"If you have a lot of innovation, they don't want to break it up [in a BRAC]."

5.3.3 Workforce Training

Training Maryland's workforce to meet the demands of Maryland businesses is seen as one of the best ways to grow Maryland's economy and strengthen DoD-related businesses. As discussed in Section 5.2.4, respondents frequently requested additional public-private partnerships. Economic developers across the state repeatedly mentioned that training and attracting workers was their top priority. Further strengthening Maryland's workforce will go a long way to attracting companies, encouraging innovation, and diversifying Maryland's economy.

"We [Economic Development Managers]aren't in the business of recruiting companies anymore; we're in the business of recruiting people. If you can get the workforce, the companies will

[99] Maryland Technology Development Corporation. "Operating Budget Data." 2013. Accessed January 10, 2017. http://mgaleg.maryland.gov/pubs/budgetfiscal/2013fy-budget-docs-operating-t50t01-tedco-maryland-technology-development-corp.pdf

[100] The Baltimore Sun. "Tech Transfer Office established at Harford Business Innovation Center." 10/21/2013. Accessed January 10, 2017. http://www.baltimoresun.com/news/maryland/harford/abingdon/ph-ag-tech-transfer-office-20131021-story.html

One potentially underserved population the state can help reach are minorities. One respondent indicated that efforts spent to help train and work with minority entrepreneurs could have the biggest impact, since this population often does not have the same access to resources that others do.

One interviewee mentioned that workforce training programs, while an opportunity for the state to better meet the needs of local businesses, are not without challenges in implementation. To be successful, this interviewee stated that one of two criteria will need to be met:

1. The training needs to be for something the person wants to do.
2. There needs to be a job at the end of the training.

The interviewee stated that making these programs work can be challenging, because there is often no job waiting for a person completing a retraining program. A second challenge is that successful workforce training programs need to target the future growth sector industries and forecasting trends is not always an exact science. For example, although it is very likely that cybersecurity or additive manufacturing will be growth industries in Maryland, it is difficult to predict precisely how many new jobs will be created and how many workers will be needed any given year. Challenges aside, training presents a major opportunity for Maryland to develop a workforce that meets the needs of local defense contractors and other businesses, ultimately strengthening both Maryland's economy and its competitive advantage in subsequent rounds of BRAC. Perhaps the best way to ensure workforce training programs meet the needs of Maryland's employers is through public-private partnerships, as discussed in Section 5.2.4. These partnerships allow Maryland employers to help guide the state on how many employees they anticipate needing as well as precisely which skills employees need to have.

5.3.4 3D/Additive Manufacturing

Respondents in both focus groups and interviews pointed to 3D/additive manufacturing as a potential growth area for Maryland. Focus group participants familiar with economic development in the Central and Capital regions mentioned that 3D manufacturing already has a presence in the area and presents a major opportunity to grow the manufacturing industry in Maryland. For example, the Howard County Economic Development Authority has partnered with Howard Community College to create a "3D Innovation Hub," allowing students to gain first-hand experience with the technology.[101] In 2014 the Maryland General Assembly established the Regional Additive Manufacturing Partnership of Maryland (RAMP MD) to promote and grow the additive manufacturing industry within

"I think that 3D Manufacturing, or additive manufacturing, is an area for potential that should be growing…There's going to have to be a push to create jobs that are less degree-required and technical…Automation is key. If you can combine a lesser-skilled person with that automation, that would be a big boon for the state."

[101] Howard County Economic Development Authority. "3D Maryland: Introducing the 3D Innovation Hub at Howard Community College." Accessed November 10, 2016. http://www.hceda.org/maryland-center-for-entrepreneurship/3d-maryland.aspx

Maryland. One of RAMP MD's successes has been to establish a Cooperative Research and Development Agreement with the U.S. Army Research Development and Engineering Command, allowing private businesses to utilize the facilities at the U.S. Army Research Laboratory and Edgewood Chemical Biological Center.[102] Additional development of this industry could help diversify Maryland's economy.

5.3.5 Cybersecurity in Maryland

Most focus group participants and interviewees described Maryland's cybersecurity industry as one of the fastest growing industries in the state. As documented in the Cluster Analysis that the RESI team prepared, the Information Technology and Cybersecurity cluster is estimated to employ over 200,000 Marylanders, including all positions funded and not funded by the DoD.[103] Workers in the sector are employed in Computer and Mathematical Occupations more than any other occupation type, and the average wage in the sector is $83,000, significantly higher than the average wage in Maryland. Cybersecurity plays a key role in Maryland's DoD infrastructure, especially at Fort Meade. For example, Fort Meade contains the NSA, the Defense Information Systems Agency, and five of the country's top seven cyber commands.

However, while much of the cybersecurity industry is reliant on DoD spending, subject matter experts noted that cybersecurity in Maryland has begun to grow to encompass other industries. For example, an increase in healthcare analytics and the use of electronic medical records has led to an increased need for healthcare cybersecurity.[104] To address this need, the Department of Health and Human Services established the Health Care Industry Cybersecurity Task Force in March 2016.[105] The task force was created to identify ways to safeguard patient safety and privacy.

The health care industry is especially important in Maryland, as Maryland received the most contract awards of any state (27,311) in FY 2016 from the Department of Health and Human Services.[106] The state with the second highest number of contract awards was California, with 16,979. As cybersecurity becomes more important in healthcare, Maryland companies will likely be demanding skilled workers with cybersecurity skills.

However, as discussed in Section 5.2.3, there is a shortage of Maryland residents and recent college graduates with cybersecurity skills necessary to fill DoD-intensive jobs, let alone supply the labor for another growing sector. Maryland will need to significantly increase its supply of

[102] RAMP MD. "Regional Additive Manufacturing Partnership of Maryland 2016 Annual Report." 2016.
[103] Regional Economic Studies Institute of Towson University. "The Impact of Department of Defense Funding on Industry Clusters in the State of Maryland." 2017
[104] Wakefield, Mary K. "The Health Care Industry Cybersecurity Task Force." HHS. 3/16/2016. Accessed january 9, 2016. https://www.hhs.gov/blog/2016/03/16/healthcare-industry-cybersecurity-task-force.html
[105] Ibid.
[106] USASpending. "Department of Health and Human Services: Awards by States/Territories - FY 2016." Accessed January 5, 2016. https://www.usaspending.gov/Pages/TextView.aspx?data=AgencyMostFundedStates&agencycode=7500&fiscalyear=2016

skilled workers in order to take advantage of cybersecurity opportunities in the healthcare industry. To accomplish this, Maryland should look toward increased workforce training programs, as discussed in Section 5.3.3, and use public-private partnerships, discussed in Section 5.2.4, to ensure as many Maryland residents as possible are trained in these high-demand skills. If Maryland can attract and retain a skilled workforce with cybersecurity qualifications, the state will be well positioned to capitalize on national trends and grow its economy.

5.3.6 Cyber Command Becoming Combatant

Several interviewees mentioned a major opportunity for Maryland is if the U.S. Cyber Command is made a full combatant command. Fort Meade already has five of the country's top seven cyber command centers (the other two are located at Fort Gordon, Georgia, and Lackland Air Force Base, Texas), and focus group participants and interviewees believe that another round of BRAC could move the two out-of-state commands to the fort. In addition, if the U.S. Cyber Command were made combatant, it has the potential to increase the number of jobs in the area in the long term. Subject matter experts stated that there is support from inside the Pentagon for this to occur, and believe that a decision could be made relatively soon. However, they cautioned that the impact to Maryland's labor force and economy may not be felt immediately. One interviewee noted that although Ft. Meade's cyber command becoming a combatant command would mean more resources and more missions, it is unclear at this point how the additional funding would be split between direct government workers and government contractors. Regardless of sector, additional employment in Maryland would be a boon to the state's economy.

"The potential for cyber command to become a full combatant command would be incredible for Maryland… That means more resources, more jobs, more missions, and more work for them to do."

5.3.7 Unmanned Vehicles

Focus group participants and interviewees, especially in Southern Maryland, identified unmanned vehicles as a potential opportunity for the state. Already, substantial testing of unmanned vehicles, both aerial and underwater, occurs at NAS Patuxent River. For example, the installation has recently hosted testing for Northrop Grumman's MQ-4C Triton unmanned aerial system (UAS) for naval reconnaissance and the Navy's X-47B UAS.[107] [108] Additionally, the Navy has tested underwater unmanned systems at NAS Patuxent River, especially those in charge of

[107] Bach, James. "Northrop Grumman's naval reconnaissance drone clears hurdle as it nears production." Washington Business Journal. 2/16/2016. Accessed December 21, 2016. http://www.bizjournals.com/washington/blog/fedbiz_daily/2016/02/northrop-grumman-s-naval-reconnaissance-drone.html

[108] The Associated Press. "US navy to attempt drone landing on aircraft carrier for first time." The Guardian. 7/10/2013. Accessed December 21, 2016. https://www.theguardian.com/world/2013/jul/10/us-navy-drone-landing-aircraft-carrier

mine countermeasures.[109] The work at NAS Patuxent River is likely to increase, given the increasing importance of unmanned vehicles in military warfare. For example, the Navy has plans to expand the use of unmanned underwater systems to "large-scale deployment" in the near future.[110]

While the proposed increase in the military's use of unmanned vehicles will benefit Maryland's military installations and make them less vulnerable to BRAC closures, commercial unmanned systems have the potential to greatly improve Maryland's economy if the state becomes a center of production and testing. Unmanned systems, especially aerial ones, have a variety of potential commercial uses. For example, UAS have been used for real estate photography, aerial surveying, and crop monitoring.[111] UAS have also been proposed as delivery vehicles. For example, Amazon is beginning to test using UAS to deliver small packages, and researchers at Johns Hopkins have experimented with delivering blood and medications to patients in need.[112] [113] The Association for Unmanned Vehicle Systems International (AUVSI), the main industry group for UAS, estimated that UAS will add 100,000 jobs and $82 billion to the economy between 2015 and 2025.[114] AUVSI further estimated that UAS would add 2,500 jobs and $2 billion to Maryland's economy over the same time span.[115]

Maryland is in a good position to capitalize on its existing UAS resources to expand into commercial applications. The state participates in the Mid-Atlantic Aviation Partnership (MAAP), a joint venture between Maryland, Virginia, and New Jersey, which serves as one of six UAS testing sites approved by the FAA.[116] Although the MAAP is led by Virginia Tech, Maryland is

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[109] McCaney, Kevin. "ONR Tests the Latest in Underwater Drone Technology." Defense Systems. 10/5/2015. Accessed december 21, 2016. https://defensesystems.com/articles/2015/10/05/onr-uuvs-pax-river-demonstrations.aspx

[110] Pomerleau, Mark. "Navy leaders: Future rides on unmanned systems." Defense Systems. 8/5/2015. Accessed December 21, 2016. https://defensesystems.com/articles/2015/08/05/navy-csis-plans-for-unamnned-systems.aspx

[111] Dussault, Joseph. "Seven Commercial Uses for Drones." Boston.com 3/14/2014. Accessed december 21, 2016. http://archive.boston.com/business/2014/03/14/commercial-uses-for-drones/dscS47PsQdPneIB2UQeY0M/singlepage.html

[112] Amazon. "Amazon Prime Air." Accessed December 21, 2016. https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011

[113] Cohn, Meredith. "Drones could soon get crucial medical supplies to patients in need." Baltimore Sun. 1/1/2017. Accessed January 3, 2017. http://www.baltimoresun.com/health/maryland-health/bs-hs-drones-for-blood-20161223-story.html

[114] Brown, Matthew Hay. "University of Maryland opens drone test site." Baltimore Sun. 8/5/2014. Accessed December 21, 2016. http://articles.baltimoresun.com/2014-08-05/news/bs-md-unmanned-test-site-20140805_1_test-site-southern-maryland-pax-river

[115] Ibid.

[116] Mid-Atlantic Aviation Partnership. "MAAP Overview." Virginia Tech. Accessed december 21, 2016. http://maap.ictas.vt.edu/About/about-us.html

heavily involved in the program, contributing testing sites and researchers. In 2014 the University of Maryland opened a commercial UAS testing facility near NAS Patuxent River; the facility will serve as a site for FAA testing as well as for commercial and academic research.[117]

In addition to launch sites and researchers, Maryland has a series of existing UAS manufacturers. Notable companies with locations in Maryland include AAI, UAV Solutions, Proxy Technologies, and Lockheed Martin. Additionally, Maryland has several industries in the state that can complement Maryland's fledgling UAS industry. For example, Maryland's cybersecurity industry, as discussed in Section 5.3.5, is strong and projected to grow further. Experts believe cybersecurity will become increasingly important in the UAS industry given the need to securely transmit information that UAS capture.[118] Additionally, Maryland's additive manufacturing industry, described in Section 5.3.4, has the potential to transform the UAS industry by creating custom UAS. In December 2016, engineers from the US Army Research laboratory demonstrated the ability to manufacture a UAS custom designed for a variety of combat missions including aerial surveillance, communication, and delivery.[119] These UAS take 24 hours to design, test, and deliver.[120] Supporting Maryland's additive manufacturing businesses may enable Maryland companies to use this technology for commercial uses.

Commercial UAS have the potential to boost Maryland's economy, and the state can undertake several actions to boost this growing industry. For example, Maryland could work with federal labs and military installations to incentivize commercialization, as mentioned in Section 5.3.2, of patents for UAS by Maryland companies. The state could also support incubators, especially in Southern Maryland, which focus on UAS. Efforts to explore synergies with the cybersecurity and additive manufacturing industries in the state, such as through conferences and forums, could also encourage increased UAS activity in the state.

5.4 Threats

Despite the strengths of Maryland's defense-intensive industry and communities, focus group participants and interviewees highlighted a few threats facing the state. For example, the outcome of any BRAC round is uncertain, and respondents noted that Maryland may not be a net gainer of jobs in a future BRAC round. Similarly, another round of sequestration would have

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[117] Brown, Matthew Hay. "University of Maryland opens drone test site." Baltimore Sun. 8/5/2014. Accessed December 21, 2016. http://articles.baltimoresun.com/2014-08-05/news/bs-md-unmanned-test-site-20140805_1_test-site-southern-maryland-pax-river

[118] Horowitz, Barry M. "Cybersecurity for Unmanned Aerial Vehicle Missions." Signal Magazine. 4/1/2016. Accessed december 21, 2016. http://www.afcea.org/content/?q=Article-cybersecurity-unmanned-aerial-vehicle-missions

[119] AUVSI. "US Army Research Laboratory Can Develop 3D Printed UAS for Army in 24 Hours." AUVSI News. 1/3/2017. Accessed January 3, 2017. http://www.auvsi.org/blogs/auvsi-news/2017/01/03/us-army-research-laboratory-can-develop-3d-printed-uas-for-army-in-24-hours

[120] Ibid.

broad implications for Maryland's economy. Additionally, respondents mentioned changes to Maryland's Congressional delegation and an aging military workforce as threats facing the state.

5.4.1 BRAC

Although respondents were generally optimistic about Maryland's chances during the next round of BRAC and saw it as an opportunity to grow the state's economy, they mentioned that BRAC could very easily be a net negative for the state if it is not properly prepared in a timely manner. Respondents expressed concern about the possibility of Indian Head being closed, since the base had been close to closure in previous BRAC rounds.[121] Most interviewees and focus group participants indicated that program loss from any of Maryland's installations was a very real threat. Many of the research activities being conducted at Maryland facilities can be conducted anywhere, and Maryland needs to work diligently to ensure that the BRAC Commission is adequately presented with and understands the value of each facility's research and operations. For example, Carderock is in the process of developing several white papers indicating why the facility and the work undertaken there is unique. Similar efforts outlining why each program should stay in Maryland could lessen BRAC's impact on the state.

Respondents also indicated that other areas around the country posed a threat to Maryland given that they have already begun the BRAC preparation process. Huntsville, Alabama, was commonly cited as an area that is doing all of the right things to prepare for the next round of BRAC. For example, Huntsville is heavily advertising the quality of life in the area and providing examples of why programs in the area should stay in place. Interviewees also mentioned the Naval Surface Warfare Center–Crane Division in Indiana as another base preparing for a potential future BRAC round. One interviewee mentioned that Crane was actively campaigning for local colleges and universities to open locations outside the base to foster technology transfer and collaboration. Maintaining Maryland's advantage over Crane is critical, as one interviewee mentioned that the battery technology division at Carderock was particularly vulnerable to being absorbed by Crane's larger division in another round of BRAC.

5.4.2 Sequestration

Focus group participants and interviewees repeatedly mentioned that the previous round of sequestration had negatively impacted their economies and communities, and that another round of sequestration could be devastating. Across Maryland, sequestration is estimated to have caused the loss of 25,000 jobs, and over $1.6 billion in lost wages.[122] Respondents in Southern Maryland were especially worried about sequestration, mentioning that it had, in some ways, been worse than the previous recession. Focus group participants argued that the recession's effects had been slightly mitigated across Maryland due to the state's reliance on government contracting. During the recession, government funding remained relatively

[121] Partlow, Joshua. "Indian Head Vulnerable to Base Closure." Washington Post. 3/6/2005. Accessed December 20, 2016. http://www.washingtonpost.com/wp-dyn/content/article/2005/03/25/AR2005032502505.html
[122] Cox, Erin. "State estimates 21,000 Md. jobs lost to sequester cuts." Baltimore Sun. 9/27/2013. Accessed January 9, 2017. http://www.baltimoresun.com/bs-md-sequester-job-cuts-20130926-story.html.

constant, allowing Maryland's economy to be less affected than other states. However, given how reliant many of the industries in the area are on defense spending, sequestration had more of an impact in areas reliant on DoD funding. As explored in Section 6, some Maryland regions such as Western Maryland and the Eastern Shore, are less reliant on DoD spending and thus less likely to be impacted by future rounds of sequestration.

5.4.3 Changes in Maryland Congressional Representation

Respondents almost universally indicated that they appreciated the efforts of Maryland's representatives during the last round of BRAC, and repeatedly praised Senator Mikulski for her efforts in helping to keep Maryland's DoD structure strong. As mentioned in Section 5.1.5, respondents repeatedly praised Senator Mikulski for her arguments to the BRAC Commission on the value of Maryland's military installations and why Maryland bases deserved to remain in Maryland and receive new programs. Overall, Senator Mikulski was viewed as a key ally to members of the Maryland defense community and who was crucial to bringing cybersecurity resources to Maryland. For example, Senator Mikulski, along with Senator Cardin, recently introduced a bill to make the cyber command at Fort Meade a combatant command.[123] However, respondents indicated that they were nervous about Senator Mikulski's retirement and about what losing a strong advocate could mean for the State during another round of BRAC. Overall, respondents were worried about losing a consistent ally in the Senate.

Respondents who cited her retirement as a threat were not as familiar with Chris Van Hollen, the eventual winner of Mikulski's Senate seat. However, respondents were also optimistic that Senator-elect Van Hollen would be an ally to Maryland's military installations in the BRAC process. Although replacing Senator Mikulski's contributions may be difficult, continuing to have Maryland's representatives advocating for Maryland installations and taking steps outside of BRAC rounds to increase the installations' importance will allow Maryland to be in the best possible situation in the event of a future BRAC round.

5.4.4 Aging Military Workforce

Repeatedly, respondents indicated that another concern was Maryland's aging military workforce.[124] Fort Meade, for example, was frequently cited as having one of the most rapidly aging workforces across Maryland's military installations. Respondents were concerned that when these workers retire, there will be a shortage of available workers to replace them. This

[123] Williams, Katie Bo. "Lawmakers Push to Elevate Cyber Command in Senate Defense Bill." The Hill. May 25, 2016. Accessed December 20, 2016. http://thehill.com/policy/cybersecurity/281232-lawmakers-push-to-elevate-cyber-command-in-senate-defense-bill

[124] The RESI Team was not able to acquire demographic data to support this statement. However, the comments made in this section were made by several focus group participants and interviewees, and the team felt this information should be highlighted.

concern is further compounded by fears over whether Maryland's high tax rate on military retirees, as discussed in Section 5.2.3, will drive these workers out of the state entirely, hurting contractors and businesses based in Maryland and not associated with the installation.

"We're going to bottom out. Twenty percent or more of every military installation's personnel are going to start retiring. We're going to have a very large opening. But unless people are willing to move to Maryland, we're going to have a very hard time filling these roles."

5.5 Overall Assessment

Overall, focus group participants and interviewees were extremely positive about Maryland's position within the DoD landscape. Maryland has 20 military facilities, including 11 major installations, with access to critical and often unique resources. These installations, as well as the close proximity of the Pentagon, located just outside Maryland, have led to the growth of a strong network of private companies working in the defense industry. The installations and associated contractors have created a thriving ecosystem that led Maryland to be a net gainer during the last round of BRAC, and should—with timely preparation—allow Maryland to thrive in an upcoming round.

Although the state is in an extremely good position, it is not without its weaknesses. In some ways, Maryland has become a victim of its own success, as Maryland's infrastructure has failed to keep pace with its rapidly expanding population. A focus on infrastructure, such as reducing traffic or extending broadband internet to all corners of the state, will help the state attract and retain talent.

Attracting and retaining a modern workforce to Maryland may be the biggest challenge facing the state, and all of the challenges identified in Section 5.2 relate to that issue in some manner. Maryland's focus should be on making the state a more attractive place for workers to settle, on graduating greater numbers of high-quality workers from Maryland colleges and universities, and ensuring that Maryland entrepreneurs have the tools they need to succeed.

Although Maryland has its challenges, and faces threats such as future BRAC rounds or changes in defense spending, the state is in an extremely strong position. Maryland's defense community has provided the state with a highly- educated workforce and a network of businesses with experience in different industries. Maryland has opportunities to commercialize technology developed on its bases and to capitalize on the increasing importance of its cybersecurity resources. If it takes advantage of these opportunities, the state can continue its strong relationship with the defense industry while adequately diversifying its communities to mitigate adverse shocks, such as another round of BRAC or sequestration.

Section 6: Maryland's Dependence on Defense Contracting

This section discusses defense contracting's impact on Maryland by examining jobs directly relating to DoD contracts as well as indirect and induced jobs that rely on defense contracting. This section reports on the impacts of the defense industry for the state and each region and highlights the dependency of each region on defense contracting as a percentage of total employment, output, and wages. Appendix C contains tables showing the economic impacts of defense contracting on each region in terms of output and wages by NAICS code. When examining the impact of DoD contracting, RESI only considered the impact in terms of private-sector jobs.

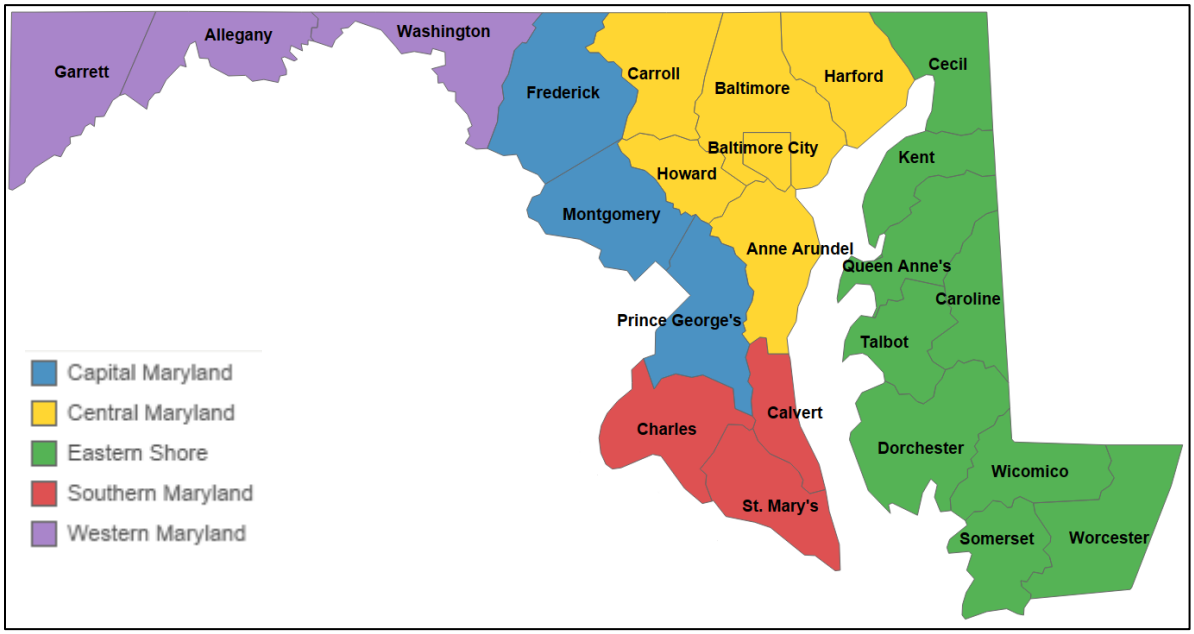
6.1 Methodology

To determine the relative dependence on DoD contracting across Maryland, the RESI team analyzed five separate regions, as well as the state as a whole. The definitions for the five regions can be found below.

1. **Central Maryland**: Baltimore City and Harford, Baltimore, Carroll, Anne Arundel, and Howard Counties
2. **Southern Maryland**: St. Mary's, Charles, and Calvert Counties
3. **Capital Maryland**: Frederick, Montgomery, and Prince George's Counties
4. **Western Maryland**: Garrett, Allegany, and Washington Counties
5. **Eastern Shore**: Cecil, Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester Counties

A map of the five regions used in RESI's analysis is found in Figure 36.

Figure 36: Maryland Counties in Five Regions Used for Analysis



Source: RESI

The team used Regional Economic Models, Inc. (REMI) PI+ model version 1.7, economic impact analysis software, to model the impacts of defense contracting on each region and the state. The REMI PI+ model is a high-end dynamic modeling tool that various federal and state government agencies use in economic policy analysis. This model separates direct effects (jobs supported and dollars spent as a direct result of DoD contracts) from indirect and induced effects (jobs and output supported by direct employees' and businesses' purchases either for business or from personal salaries).

RESI's analysis covered a five-year period between 2011 and 2015. This period kept the analysis current and allowed the RESI team to reduce the influence of outliers from year to year, thus estimating more accurate trends in Maryland's economy. The team totaled dollars obligated within USA Spending by NAICS code and region and mapped this information into REMI PI+ using REMI PI+'s industry codes. USA Spending is a publicly available dataset containing information on all businesses and individuals receiving federal funds. The team then ran the REMI PI+ model to determine the economic impacts per region in terms of employment, output, and wages. REMI PI+ also reports employment impacts by NAICS code. Impacts are reported only for Maryland and do not account for employment effects in neighboring states, such as Pennsylvania or Virginia.

To quantify vulnerability, the RESI team calculated a dependency ratio for each region and the state. The dependency ratio measures the extent to which the area's jobs, output, and total wages rely on DoD contracting. For employment, this ratio was calculated as the total economic impact of defense contracting (including direct, indirect, and induced jobs) divided by the total number of jobs in the region, as calculated by REMI PI+. Output and wages followed a similar calculation.

Appendix B describes the methodology for this analysis in more detail.

Section 6.10, which examines the impact of Maryland's military installations on Maryland's economy, uses data that RESI collected for Commerce in a 2015 report on the economic impact of Maryland's military installations. This economic impact analysis was conducted using IMPLAN, a similar software to REMI PI+, and information on the number of base employees and procurement was provided by the bases through a RESI-administered survey.[125]

6.2 Regional and State Vulnerability for DoD Contracting

To determine the level of dependence on DoD contracting for each region, and therefore the region's level of vulnerability to a downturn in funding through sequestration or a shift in defense priorities, the RESI team estimated the impact of DoD contracting using the methodology described in Section 6.1 and in further detail in Appendix B. To determine what percentage of

[125] Irani, Daraius and Jessica Grimm. "Maryland Economic Impact Study of Military Facilities: FY12 Results." 2015. Accessed January 4, 2017. http://commerce.maryland.gov/Documents/ResearchDocument/MarylandMilitaryInstallationEconomicImpactStudy2015.pdf

each region's employment, output, and wages was reliant on DoD contracting, RESI compared the economic impacts calculated using REMI PI+ with REMI PI+'s overall estimates of regional employment, output, and wages. Figure 37 shows the total impacts (direct, indirect, and induced) of DoD contracting, the overall estimates of employment, output, and wages for each region, and finally a dependency ratio indicating the level of reliance on DoD contracting for each the region. The impacts of DoD contracting by region are examined in more detail in Sections 6.3 through 6.8.

Figure 37: Total Annual Economic Impacts of DoD Contracting and Dependency Ratios by Impact Type and Region, 2011–2015

Region	Total Impact of DOD Contracting	Total for Region	Dependency Ratio
Employment			
Southern Maryland	8,301	131,688	6.30%
Capital Maryland	45,121	1,072,737	4.21%
Central Maryland	57,673	1,502,589	3.84%
Western Maryland	827	124,746	0.66%
Eastern Shore	1,355	208,395	0.65%
Statewide	***113,277***	***3,040,155***	***3.73%***
Output			
Southern Maryland	$955,899,850	$13,505,989,954	7.08%
Capital Maryland	$5,831,964,103	$157,996,243,908	3.69%
Central Maryland	$8,060,322,890	$218,424,743,601	3.69%
Eastern Shore	$149,789,129	$24,234,261,017	0.62%
Western Maryland	$83,369,699	$15,773,768,895	0.53%
Statewide	***$15,081,345,672***	***$429,935,007,375***	***3.51%***
Wages			
Southern Maryland	$393,807,679	$4,357,593,174	9.04%
Capital Maryland	$2,242,669,120	$47,826,759,152	4.69%
Central Maryland	$2,966,951,811	$69,746,153,313	4.25%
Eastern Shore	$40,060,355	$6,252,346,440	0.64%
Western Maryland	$25,168,137	$4,224,005,063	0.60%
Statewide	***$5,668,657,102***	***$132,406,857,142***	***4.28%***

Sources: REMI PI+, RESI

As seen in Figure 37, 3.7 percent of all Maryland jobs are dependent on DoD contracting. Southern Maryland is particularly vulnerable to shifts in DoD funding, as 6.3 percent of the jobs in the region are reliant on DoD funding. From Figure 37, it appears that future rounds of sequestration and defense budget cuts will likely hit Southern Maryland the hardest. The Capital region has the second highest percentage of jobs reliant on DoD contracting, with 4.2 percent. The Eastern Shore and Western Maryland do not rely much on the DoD relative to the other

regions in Maryland, reflecting both their distance from Washington, D.C., and the lack of military bases in the area. However, 0.65 percent of these regions' economies being reliant on DoD contracting still poses a risk in the event of budget cuts.

These levels of vulnerability are similar for wages and output. Of note is that DoD contracting jobs in Maryland tend to be better paying than average, since the percent of wages reliant on DoD contracting is higher than the percent of jobs reliant on DoD contracting. This difference is largest in Southern Maryland, where 6.3 percent of jobs and 9 percent of wages rely on DoD contracting. A similar, albeit lesser pattern can be seen in the Capital and Central regions.

This figure does not include the number of jobs reliant on military bases, which would increase the dependency ratio. Note that Section 6.9 examines the impact of military bases on Maryland's economy using prior research that the RESI team conducted. Similarly, USA Spending data does not capture NSA funding, much of which goes to contractors supporting Fort Meade in the Central region. Therefore, we expect these numbers to be a very conservative estimate of the impacts of defense contracting on the local economies. Given the overall impact of DoD contracting on the state, as well as the relative quality of the jobs in the associated industries, Maryland's economy will be at risk in the event of significant and prolonged budget cuts.

Companies in the business survey also reported on their dependency on DoD contracts, as reported in Section 5.2.5. Figure 38 shows company dependency by region.

Figure 38: Self-Reported Company Dependency by Region

Region	High Dependency (70–100%)		Medium Dependency (35–69%)		Low Dependency (0–34%)		Total	
	#	%	#	%	#	%	#	%
Capital Maryland	25	16.56%	18	39.13%	114	42.38%	157	33.69%
Central Maryland	77	50.99%	22	47.83%	128	47.58%	227	48.71%
Eastern Shore	13	8.61%	2	4.35%	8	2.97%	23	4.94%
Southern Maryland	31	20.53%	3	6.52%	14	5.2%	48	10.3%
Western Maryland	5	3.31%	1	2.17%	5	1.86%	11	2.36%
Total	**151**	**100%**	**46**	**100%**	**269**	**100%**	**466**	**100%**

Source: RESI

As seen in Figure 38, nearly twice as many companies in Southern Maryland reported having a high level of dependency on DoD funding, as expected. Although only 10 percent of companies responding to the survey were located in Southern Maryland, more than 20 percent of those

same companies indicated a high level of reliance on DoD funds. This finding aligns with the dependency ratios that the RESI team calculated.

Interestingly, companies in the Capital Maryland region were less likely than expected to report having a high dependency on DoD funding. Companies in the region were 50 percent less likely to report that they had a high dependency than if there were no relationship between region and dependency. Given that the Capital Maryland region has the second-highest dependency as reported in Figure 39, this outcome is surprising. One potential explanation for this discrepancy is that DoD-reliant jobs in the Capital Maryland region are more concentrated in relatively few companies when compared to other regions. As an example, Figure 39 presents hypothetical employment numbers in two regions.

Figure 39: Hypothetical Employment Numbers for Two Regions

Company	Region 1			Region 2		
	DoD-Reliant Jobs	Non-DoD-Reliant Jobs	Company Dependency Ratio	DoD-Reliant Jobs	Non-DoD-Reliant Jobs	Company Dependency Ratio
Company 1	10	4	71%	90	4	96%
Company 2	20	5	80%	0	5	0.00%
Company 3	40	5	89%	0	5	0.00%
Company 4	15	190	7%	0	190	0.00%
Company 5	5	100	5%	0	100	0.00%
Total	**90**	**304**	**23%**	**90**	**304**	**23%**

Source: RESI

In Figure 39, both Region 1 and Region 2 have the same number of workers in DoD-reliant jobs and non-DoD-reliant jobs. Therefore, both regions have a dependency ratio of 23 percent. The number of non-DoD-reliant jobs in each company is also the same between both regions. However, because the DoD-reliant jobs are distributed between companies differently in each region, Region 1 has three companies with a dependency score of 70 percent or more while Region 2 only has one company. This effect may be what is happening in the Capital Maryland region. If this is the case, the effects of future rounds of sequestration or BRAC will be concentrated in relatively few companies in the Capital Maryland region compared to other regions, such as Southern Maryland or Central Maryland.

6.3 The Impact of Defense Contracting on Maryland

As seen in Figure 40, defense contracting plays a large role in Maryland's economy, both in terms of direct effects and the ripple effects seen in the broader economy through indirect and induced impacts.

Figure 40: Average Annual Economic Impacts of DoD Contracting on Maryland, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	61,546	51,731	113,277
Output	$8,449,660,189	$6,631,685,483	$15,081,345,672
Wages	$3,465,598,993	$2,203,058,108	$5,668,657,102

Sources: REMI PI+, RESI

Between 2011 and 2015, the $16 billion obligated by the DoD to Maryland vendors and companies doing business in Maryland directly employed 61,546 private-sector workers in Maryland. These employees supported 51,731 indirect and induced jobs for a total of 113,277 private-sector jobs that are reliant on DoD contracting. These Maryland workers generated over $15 billion in output and were paid wages of over $5.5 billion. Dividing wages by employment to determine the average wage finds that the average wage of those directly affected by DoD contracting is $56,309, higher than the Maryland average wage of $54,777. However, the average annual wage of those workers indirectly associated with DoD contracting is only $42,587. This is not necessarily surprising, as indirect and induced jobs typically include service jobs with lower salaries.

Figure 41 shows how these jobs are distributed across Maryland industries, reported at the two-digit NAICS code level.

Figure 41: Average Yearly Direct, Indirect/Induced, and Total Jobs Impacted by DoD Contracting in Maryland by NAICS Code, 2011–2015

Industry	Direct	Indirect/ Induced	Total
Professional, Scientific, and Technical Services	32,165	6,075	38,240
Construction	11,068	10,425	21,492
Administrative and Waste Management Services	7,616	5,205	12,821
Retail Trade	840	7,125	7,965
Health Care and Social Assistance	2,677	5,248	7,925
Accommodation and Food Services	2,440	4,051	6,491
Other Services, except Public Administration	570	3,328	3,898
Transportation and Warehousing	1,065	1,485	2,550
Manufacturing	1,194	932	2,127
Real Estate and Rental and Leasing	10	1,983	1,993
Finance and Insurance	224	1,596	1,820
Educational Services	681	738	1,420
Information	729	674	1,403
Wholesale Trade	136	1,098	1,234
Arts, Entertainment, and Recreation	22	1,059	1,082
Management of Companies and Enterprises	0	419	419
Utilities	91	148	238
Mining	1	104	105
Forestry, Fishing, and Related Activities	18	37	55

Sources: REMI PI+, RESI

As Figure 41 shows, the plurality of DoD contracting-dependent jobs in Maryland are Professional, Scientific, and Technical Services jobs. Given the nature of DoD contracting, including a reliance on biotech and cybersecurity, this is unsurprising. The second largest industry supporting the defense industry in Maryland is Construction, with the second highest number of direct jobs and the highest number of indirect and induced jobs. The only industry not directly affected by defense contracting is Management of Companies and Enterprises. Entities in this industry will likely be managing companies receiving DoD contracts rather than directly receiving DoD funding themselves, so this is not surprising.

Construction and Professional Services typically require two very different levels of experience and education. To determine the education requirements within these industries, the RESI team used its proprietary Predictive Regional Occupational Matrix (PROM) tool, which incorporates data from the OES database as well as O*NET OnLine data, to map forecasts at the industry level to occupations. O*NET OnLine, a database published by the U.S. Department of Labor, categorizes occupations by different job zones, reflecting the degree and experience needed to

obtain the job. Figure 42 outlines O*NET OnLine's job zones, describing the experience and degrees associated with each.

Figure 42: Description of O-Net Job Zones

Job Zone	Preparation Needed	Example	Degrees/Experience
5	Extensive	Doctors	Doctorate's and Master's with experience
4	Considerable	Teachers	Bachelor's and Master's
3	Medium	Electricians	Associate's, Bachelor's, and apprenticeships
2	Some	Tellers	Some on-the-job training
1	Little to No	Waiters	Minimal on-the-job training

Source: O-Net

Figure 43 maps these job zones to occupations to show the number of jobs for each major occupation group by experience required. The number of jobs in this table does not match the number of total jobs impacted by defense contracting as some jobs do not precisely map to an occupation.

Figure 43: Average Number of Jobs Impacted by DoD Contracting by Occupation and Job Zone, 2011–2015

SOC Code	SOC Group	Impact for Job Zone 1	Impact for Job Zone 2	Impact for Job Zone 3	Impact for Job Zone 4	Impact for Job Zone 5	Total Impact
43-0000	Office and Administrative Support Occupations	0	8,841	8,174	26	0	17,041
47-0000	Construction and Extraction Occupations	31	9,382	5,384	0	0	14,796
15-0000	Computer and Mathematical Occupations	0	0	1,229	8,084	653	9,966
13-0000	Business and Financial Operations Occupations	0	0	1,240	8,050	0	9,290
41-0000	Sales and Related Occupations	2,537	3,123	415	2,938	0	9,014
11-0000	Management Occupations	0	0	328	5,479	1,436	7,243
35-0000	Food Preparation and Serving Related Occupations	4,645	1,342	72	0	0	6,059
53-0000	Transportation and Material Moving Occupations	275	4,666	92	0	0	5,033
17-0000	Architecture and Engineering Occupations	0	98	620	4,111	129	4,958
49-0000	Installation, Maintenance, and Repair Occupations	0	1,001	3,648	0	0	4,649
29-0000	Healthcare Practitioners and Technical Occupations	0	5	2,860	203	1,242	4,311
37-0000	Building and Grounds Cleaning and Maintenance Occupations	1,022	2,849	137	0	0	4,009
19-0000	Life, Physical, and Social Science Occupations	0	0	292	1,012	1,434	2,738
23-0000	Legal Occupations	0	0	1,079	0	1,541	2,620
39-0000	Personal Care and Service Occupations	404	874	876	81	0	2,234
33-0000	Protective Service Occupations	16	1,817	109	0	0	1,942
51-0000	Production Occupations	246	1,336	348	0	0	1,930
31-0000	Healthcare Support Occupations	0	982	943	0	0	1,925
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	0	75	302	1,368	10	1,755
25-0000	Education, Training, and Library Occupations	0	0	403	481	216	1,100
21-0000	Community and Social Service Occupations	0	0	0	292	334	626
45-0000	Farming, Fishing, and Forestry Occupations	31	10	0	0	0	40
	Total	9,207	36,400	28,549	32,125	6,996	113,277

Sources: REMI PI+, RESI

As shown in Figure 43, the plurality of defense-reliant jobs are in Office and Administrative Support Occupations, most of which are relatively low-skill. In 2015, the average wage for these occupations was just under $40,000. Similarly, Construction and Extraction Occupations are the second largest group of occupations impacted by DoD contracting; the average wage in these occupations is roughly $47,000—less than the average wage in Maryland. These two occupation groups account for 28 percent of all jobs affected by defense contracting statewide. This demonstrates that even though DoD contracting jobs are generally higher skill, losing these jobs would have large ripple effects throughout the economy, impacting those with lower education. Because these employees have fewer job skills and typically lower educational attainment rates, another round of sequestration or BRAC could leave these employees with relatively fewer options compared to workers in Computer and Mathematics Occupations. This underscores the need for workforce training programs targeted at all levels of education and job skill.

However, not all occupations reliant on DoD contracting are low-skill. The occupations third-most reliant on DoD contracting are Computer and Mathematical Occupations. Over 8,700 of these jobs are in job zones 4 and 5, meaning they require at least a college education. Overall, over one-third of the jobs reliant on defense contracting in Maryland require at least a college education, while an additional 25 percent require some level of higher education. In the event of another round of BRAC or sequestration, these workers would likely have more options for occupations to transition into than workers in lower-skill occupations. However, without a corresponding expansion of other areas of the economy, there would still be an increase in unemployment.

In the event of another round of BRAC or sequestration, higher-skilled workers may simply end up displacing lower-skilled workers. This effect was seen in the most recent recession, where workers with college and advanced degrees began working jobs which did not require the degrees, pushing people without those degrees out of the workforce.[126] For example, in 1970, only 2 percent of firefighters had a college degree. In 2013 that proportion rose to 18 percent.[127] Maryland policymakers will need to pay special attention to blue-collar workers in the event of an adverse shock to the defense community, even though many of the jobs impacted by DoD contracting require higher education.

6.4 The Impact of Defense Contracting on Central Maryland

This section examines the impact of defense contracting on Central Maryland, comprising Baltimore City and Harford, Baltimore, Carroll, Anne Arundel, and Howard Counties. Figure 44 shows the economic impacts associated with defense contracting in the region.

[126] Semuels, Alana. "College-educated workers are taking jobs that don't require degrees." Los Angeles Times. 9/20/2013. Accessed December 21, 2016. http://www.latimes.com/business/la-fi-college-grads-20130920-story.html.
[127] Ibid.

Figure 44: Average Annual Economic Impacts of DoD Contracting on Central Maryland, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	27,407	30,266	57,673
Output	$4,110,685,340	$3,949,637,550	$8,060,322,890
Wages	$1,640,471,515	$1,326,480,296	$2,966,951,811

Sources: REMI PI+, RESI

As shown in Figure 44, between 2011 and 2015, Central Maryland averaged 27,407 jobs directly reliant on the $7.2 billion on average in DoD contracting spent in the region each year. This is roughly 45 percent of the total direct jobs from DoD contracting in Maryland. These direct jobs support an additional 30,266 indirect and induced jobs, for a total of 57,673 jobs, or 3.8 percent of the total jobs in the region. The defense industry in Central Maryland region produces $8 billion in output and generates almost $3 billion in wages. The average salary for employees directly affected by DoD contracting is $59,856 in Central Maryland, roughly $5,000 higher than Maryland's average wage. The average wage for indirect and induced jobs is lower than the average salary in the state at $43,827.

Figure 45 displays the average annual private-sector employment reliant on DoD contracting by industry.

Figure 45: Average Annual Number of Direct, Indirect/Induced, and Total Jobs Reliant on DoD Contracting in Central Maryland, 2011–2015

Industry	Direct	Indirect/Induced	Total
Professional, Scientific, and Technical Services	14,186	3,168	17,353
Construction	5,827	5,927	11,754
Administrative and Waste Management Services	2,930	3,045	5,975
Health Care and Social Assistance	1,572	3,319	4,892
Retail Trade	216	4,257	4,473
Accommodation and Food Services	191	2,398	2,589
Other Services, except Public Administration	365	1,997	2,361
Manufacturing	849	613	1,462
Finance and Insurance	224	949	1,173
Real Estate and Rental and Leasing	5	1,126	1,132
Transportation and Warehousing	353	760	1,113
Wholesale Trade	74	765	839
Information	379	354	733
Educational Services	146	558	704
Arts, Entertainment, and Recreation	4	627	631
Management of Companies and Enterprises	0	231	231
Utilities	71	86	157
Mining	0	70	70
Forestry, Fishing, and Related Activities	15	15	30

Sources: REMI PI+, RESI

Similar to the distribution of industries statewide, the Professional, Scientific, and Technical Services industry has the plurality of jobs in the area, with Construction having the second most jobs impacted by contracting. These two industries make up 50 percent of the total private-sector jobs that depend on DoD contracting in the region. Notably, the majority of the Professional, Scientific, and Technical Services industry's jobs directly relate to DoD contracting, while jobs in Construction are split evenly between direct jobs and indirect and induced jobs. Since both industries had higher salaries than the Maryland average in 2015, this underscores how a decline in statewide DoD contracting could quickly lead to a decline in income and tax revenue across the state.

6.5 The Impact of Defense Contracting on Southern Maryland

This section examines the impact of defense contracting on Southern Maryland, comprising St. Mary's, Charles, and Calvert Counties.

Figure 46 shows the economic impacts associated with defense contracting in the region. The direct output listed below is the average annual total dollars obligated for the region between 2011 and 2015.

Figure 46: Average Annual Economic Impacts of DoD Contracting on Southern Maryland, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	4,734	3,567	8,301
Output	$618,898,095	$337,001,755	$955,899,850
Wages	$278,773,749	$115,033,930	$393,807,679

Sources: REMI PI+, RESI

Due largely to its smaller population and size, the Southern Maryland region has fewer workers directly and indirectly supported by defense contracting than Central Maryland, despite the number of military bases in the region. Defense contracting in the region still accounts for 8,301 total jobs of a regional total of 131,688 jobs, and a total output of almost $1 billion out of a regional total of roughly $13.5 billion, or approximately 7.1 percent. DoD contractors in Southern Maryland earn less than workers in Central Maryland, with an average wage of $58,888 (greater than the average wage of $54,777) for workers directly impacted by the defense industry, while workers in indirect and induced jobs earn, on average, $32,249 annually.

Figure 47 displays the average annual private-sector employment reliant on DoD contracting by industry for the region.

Figure 47: Average Annual Number of Direct, Indirect/Induced, and Total Jobs Reliant on DoD Contracting in Southern Maryland, 2011–2015

Industry	Direct	Indirect/Induced	Total
Professional, Scientific, and Technical Services	3,625	254	3,879
Construction	738	1,046	1,784
Retail Trade	41	653	694
Administrative and Waste Management Services	214	212	426
Accommodation and Food Services	7	327	334
Health Care and Social Assistance	24	308	332
Other Services, except Public Administration	55	205	260
Transportation and Warehousing	1	220	221
Real Estate and Rental and Leasing	2	96	98
Finance and Insurance	0	84	84
Manufacturing	11	35	45
Utilities	2	33	35
Information	11	23	33
Arts, Entertainment, and Recreation	0	21	21
Wholesale Trade	1	19	20
Educational Services	4	14	18
Management of Companies and Enterprises	0	14	14
Forestry, Fishing, and Related Activities	0	4	4
Mining	0	0	0

Sources: REMI PI+, RESI

The distribution of jobs across industries in Southern Maryland is similar to the distribution in Central Maryland and the rest of the state. However, the region is characterized by less diversity in the types of industries it supports. For example, no jobs at Finance and Insurance, Mining, or Forestry businesses are directly dependent on DoD contracting in the region. Construction and Professional Services make up 68 percent of the contracting-reliant jobs in the region, a proportion much higher than that found in Central Maryland. This is due in large part to a larger proportion of jobs occurring in the Professional, Scientific, and Technical Services industry. This indicates that the types of contractors in Southern Maryland are more technical in nature—for example, scientists and engineers supporting the UAS research at NAS Patuxent River or energetics work at Indian Head. In contrast, Central Maryland is slightly more diversified in the types of DoD contracts its companies receive. Because the Professional, Scientific, and Technical Services industry is so dominant in Southern Maryland, the region is more vulnerable to a reduction in dollars obligated in the industry than other areas of the state.

6.6 The Impact of Defense Contracting on Capital Maryland

This section examines the impact of defense contracting on Capital Maryland, comprising Frederick, Montgomery, and Prince George's Counties.

Figure 48 shows the economic impacts associated with defense contracting in the region. The direct output listed below is the average annual total dollars obligated for the region between 2011 and 2015.

Figure 48: Average Annual Economic Impacts of DoD Contracting on Capital Maryland, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	28,920	16,201	45,121
Output	$3,676,508,700	$2,155,455,403	$5,831,964,103
Wages	$1,532,727,540	$709,941,580	$2,242,669,120

Sources: REMI PI+, RESI

More jobs in Capital Maryland are directly reliant on DoD contracting than in Central Maryland. This region also has the lowest ratio of indirect and induced jobs to direct jobs of all other regions. Statewide, one direct job supports 0.84 indirect and induced jobs; in Capital Maryland, one direct job only supports 0.56 indirect and induced jobs. This indicates that indirect and induced labor for the jobs directly reliant on DoD contracting is likely found in other regions. For example, it may be cheaper for a contractor in Frederick to purchase supplies from Washington County than from Montgomery County, given the lower cost of land and labor in Western Maryland. Interestingly, the average worker directly affected by DoD contracting in Capital Maryland earns $52,999. This salary is lower than the Maryland average of $54,777, as well as the average for DoD contractors in Southern Maryland of $58,888, where the cost of living is lower. To understand why wages in the region are lower than the Maryland average, Figure 49 displays the average annual private-sector employment reliant on DoD contracting by industry for Capital Maryland.

Figure 49: Average Annual Number of Direct, Indirect/Induced, and Total Jobs Reliant on DoD Contracting in Capital Maryland, 2011–2015

Industry	Direct	Indirect/Induced	Total
Professional, Scientific, and Technical Services	14,203	2,543	16,746
Construction	4,355	3,177	7,533
Administrative and Waste Management Services	4,316	1,782	6,098
Accommodation and Food Services	2,240	1,174	3,414
Health Care and Social Assistance	1,081	1,436	2,517
Retail Trade	581	1,909	2,491
Other Services, except Public Administration	148	1,031	1,180
Transportation and Warehousing	711	451	1,162
Real Estate and Rental and Leasing	3	719	722
Educational Services	531	150	681
Information	339	278	618
Finance and Insurance	0	493	493
Manufacturing	320	170	490
Arts, Entertainment, and Recreation	18	386	405
Wholesale Trade	52	276	328
Management of Companies and Enterprises	0	165	165
Utilities	18	24	42
Mining	1	24	26
Forestry, Fishing, and Related Activities	2	10	12

Sources: REMI PI+, RESI

The distribution of DoD contracting-dependent jobs in Capital Maryland is similar to the distribution in Central Maryland. In Capital Maryland, the Administrative and Waste Management industry has the second highest number of total jobs in the region, driven primarily by the high number of direct jobs in the industry. The large numbers of workers directly affected by DoD contracting in the Administrative and Waste Management Services industry may explain the lower than expected salaries for this region, given that the average salary in the industry was roughly $40,500 in 2015.

6.7 The Impact of Defense Contracting on Western Maryland

This section examines the impact of defense contracting on Western Maryland, comprising Garrett, Allegany, and Washington Counties.

Figure 50 shows the economic impacts associated with defense contracting in the region. The direct output listed below is the average annual total dollars obligated for the region between 2011 and 2015.

Figure 50: Average Annual Economic Impacts of DoD Contracting on Western Maryland, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	221	606	827
Output	$15,703,105	$67,666,594	$83,369,699
Wages	$5,769,672	$19,398,465	$25,168,137

Sources: REMI PI+, RESI

Of the five regions, Western Maryland has the fewest jobs dependent on defense contracting in Maryland. Relatively few (221) jobs were directly reliant on DoD contracts, and these jobs supported only 606 indirect and induced jobs. Total output produced by these DoD-dependent jobs was only $83 million, and total wages were $25 million. Wages for jobs affected by defense contracting in Western Maryland are lower than the rest of the state. The average wage for direct and indirect/induced workers is only around $30,000.

Figure 51 displays the average annual private-sector employment reliant on DoD contracting by industry for Western Maryland.

Figure 51: Average Annual Number of Direct, Indirect/Induced, and Total Jobs Reliant on DoD Contracting in Western Maryland, 2011–2015

Industry	Direct	Indirect/Induced	Total
Administrative and Waste Management Services	144	62	206
Retail Trade	0	140	140
Construction	10	89	99
Professional, Scientific, and Technical Services	60	14	74
Health Care and Social Assistance	0	66	66
Accommodation and Food Services	0	58	58
Manufacturing	3	41	44
Finance and Insurance	0	34	34
Other Services, except Public Administration	1	30	31
Transportation and Warehousing	0	26	26
Wholesale Trade	1	11	12
Real Estate and Rental and Leasing	0	10	10
Information	0	7	7
Mining	0	5	5
Arts, Entertainment, and Recreation	0	5	5
Management of Companies and Enterprises	0	4	4
Educational Services	0	4	4
Utilities	0	1	1
Forestry, Fishing, and Related Activities	0	0	0

Sources: REMI PI+, RESI

Western Maryland has a very different distribution of DoD-reliant industries than the other regions in Maryland. Administrative and Waste Management Services has the most jobs employed, both directly and overall, while Professional, Scientific, and Technical Services has the second most regionally. The Construction industry in Western Maryland does not rely on DoD contracting as much as in other regions, while Retail Trade is more reliant in Western Maryland as opposed to other regions. This is interesting given that there are zero direct jobs for this industry in the region. Indirect and induced jobs in the Retail Trade industry are likely originating from purchases made by direct contractors in the Capital Region. For example, it may be cheaper for a contractor in Frederick to purchase supplies from Washington County than from Montgomery County, given the lower cost of land and labor in Western Maryland.

Low wages in the region are likely due to the prevalence of Retail Trade jobs as well as the relatively high number of Administrative and Waste Management Services jobs. In 2015 the average wage for the Administrative and Waste Management Services industry was $40,497 across Maryland, while the average wage for Retail Trade was only $30,174.

6.8 The Impact of Defense Contracting on the Eastern Shore

This section examines the impact of defense contracting on the Eastern Shore, comprising Cecil, Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester Counties. Figure 52 shows the economic impacts associated with defense contracting in the region. The direct output listed below is the average annual total dollars obligated for the region between 2011 and 2015.

Figure 52: Average Annual Economic Impacts of DoD Contracting on the Eastern Shore Region, 2011–2015

Impact Type	Direct	Indirect/Induced	Total
Employment	264	1,090	1,355
Output	$27,864,949	$121,924,180	$149,789,129
Wages	$7,856,519	$32,203,836	$40,060,355

Sources: REMI PI+, RESI

Like Western Maryland, the Eastern Shore has relatively few DoD-reliant jobs compared to the other regions in the state. Only 1,355 private sector jobs are directly or indirectly supported by defense contracting out of a total of 208,395 jobs. These jobs support $150 million in output and $40 million in wages. The proportion of direct to indirect and induced jobs is similar to Western Maryland and indicates that the Eastern Shore is closely tied to the Central Maryland region by providing low-cost supplies and labor. Wages for direct contractors in the Eastern Shore are significantly lower than the Maryland average. The average directly affected worker earns $29,760, while the average worker in an indirect or induced job earns only $29,545.

Figure 53 displays the average annual private-sector employment reliant on DoD contracting by industry for the Eastern Shore.

Figure 53: Average Annual Number of Direct, Indirect/Induced, and Total Jobs Reliant on DoD Contracting in the Eastern Shore Region, 2011–2015

Industry	Direct	Indirect/Induced	Total
Construction	137	185	322
Professional, Scientific, and Technical Services	91	96	187
Retail Trade	1	166	166
Health Care and Social Assistance	0	118	119
Administrative and Waste Management Services	12	104	116
Accommodation and Food Services	1	95	96
Manufacturing	12	74	86
Other Services, except Public Administration	1	66	67
Finance and Insurance	0	36	36
Wholesale Trade	8	26	34
Real Estate and Rental and Leasing	0	32	32
Transportation and Warehousing	0	28	28
Arts, Entertainment, and Recreation	0	20	20
Educational Services	0	12	13
Information	0	12	12
Forestry, Fishing, and Related Activities	1	7	8
Mining	0	5	5
Management of Companies and Enterprises	0	5	5
Utilities	0	3	3

Sources: REMI PI+, RESI

The distribution of jobs reliant on DoD contracts is similar to that of the state as a whole, although jobs are less concentrated in Professional, Scientific, and Technical Services. Statewide, as described in Section 6.3, roughly 34 percent of DoD-reliant jobs are in Professional, Scientific, and Technical Services. However, on the Eastern Shore, only 14 percent of DoD-reliant jobs are in this sector and a variety of sectors have employment levels above the Maryland average. Sectors with a higher proportion of jobs than the statewide average include Construction, Manufacturing, and Retail Trade. Given the high number of indirect and induced jobs in this region, this is not surprising.

6.9 The Impact of Military Bases on Maryland's Economy

Although DoD contracting is an important part of Maryland's economy, the state's military installations also play a substantial role in the economy. In 2015 RESI conducted an economic impact analysis of Maryland's military installations for the Maryland Department of Business and

Economic Development, now known as the Maryland Department of Commerce.[128] The report estimated the impact of 15 installations in FY 2012 based on base-specific employment and spending.[129] This section presents the findings of the 2015 report while Section 6.10 combines these findings with estimates from Section 6.2 of the impact of DoD contracting on the state to determine Maryland's overall reliance on the defense industry. Figure 54 below displays the impact of the 15 military bases in terms of employment.

Figure 54: Impact of Maryland's Military Installations on Employment, FY 2012

Military Installation	Region	Direct	Indirect/Induced	Total
Adelphi Laboratory Center	Capital Maryland	1,234	2,008	3,242
Fort Detrick	Capital Maryland	7,566	29,215	36,782
Joint Base Andrews	Capital Maryland	17,546	9,409	26,955
National Maritime Intelligence Center	Capital Maryland	1,890	2,137	4,027
Naval Support Activity Bethesda	Capital Maryland	11,686	8,640	20,326
Naval Surface Warfare Center—Carderock Division	Capital Maryland	1,563	2,497	4,059
Capital Maryland Total		**41,485**	**53,906**	**95,391**
Aberdeen Proving Ground	Central Maryland	15,780	42,560	58,339
Army Corps of Engineers—Baltimore District	Central Maryland	1,210	3,600	4,810
Coast Guard Yard	Central Maryland	1,691	1,375	3,066
Fort Meade	Central Maryland	64,727	125,536	190,264
Maryland National Guard	Central Maryland	2,098	1,411	3,509
Naval Support Activity Annapolis	Central Maryland	7,765	5,085	12,850
Central Maryland Total		**93,271**	**179,567**	**272,838**
Naval Air Station Patuxent River	Southern Maryland	11,724	25,232	36,956
Naval Research Lab—Chesapeake Bay Detachment	Southern Maryland	15	68	83
Naval Support Facility Indian Head	Southern Maryland	2,564	2,387	4,951
Southern Maryland Total		**14,303**	**27,687**	**41,990**
Statewide Total		**149,059**	**261,160**	**410,219**

Source: RESI, Maryland Department of Commerce, IMPLAN

[128] Irani, Daraius and Jessica Grimm. "Maryland Economic Impact Study of Military Facilities: FY12 Results." 2015. Accessed January 4, 2017. http://commerce.maryland.gov/Documents/ResearchDocument/MarylandMilitaryInstallationEconomicImpactStudy2015.pdf

[129] One installation, Joint Base Andrews, supplied data for FY 2013 and therefore impacts are estimated for FY2013 for this installation.

As seen in Figure 54, the 15 military installations that RESI analyzed in 2015 were directly responsible for over 149,000 jobs. These jobs supported over 261,000 indirect and induced jobs for a total statewide impact of 410,000 jobs. Of the bases studied, Fort Meade was responsible for the most jobs, supporting a total of 190,264 jobs, or 46 percent of the total jobs impacted by Maryland's military installations. The installation with the second greatest impact was Aberdeen Proving Ground, which supported a total of 58,339 jobs. The 15 bases explored in the 2015 report are located in three of Maryland's five regions: Capital Maryland, Central Maryland, and Southern Maryland.[130] Of these, by far the most jobs are supported in the Central Maryland region, home to both Fort Meade and Aberdeen Proving Ground.

Figure 55 presents the impact of Maryland's military installations on output for FY 2012 by region. In total, Maryland's military bases supported over $57 billion in output in FY 2012. Fort Meade generated nearly half of this impact (47 percent), or $27 billion in direct and indirect output. The base supporting the second greatest output was NAS Patuxent River, which supported $7.5 billion in output. Most output in Maryland was supported in the Central Maryland region, primarily as a result of Fort Meade and Aberdeen Proving Ground. The installations in the Capital Maryland region generated the second greatest output—$12.5 billion in direct and indirect output.

[130] Indirect and induced effects for a base are assumed to occur in the same region the base is located in. The 2015 analysis was conducted using IMPLAN, which is not as sophisticated as the REMI PI+ model used to model the impact of DoD contracting. As such, the 2015 report on Maryland's military installations does not capture regional linkages.

Figure 55: Impact of Maryland's Military Installations on Output, FY 2012

Region	Military Installation	Direct	Indirect/Induced	Total
Capital Maryland	Adelphi Laboratory Center	$122,495,301	$178,240,606	$300,735,906
Capital Maryland	Fort Detrick	$2,127,218,489	$4,831,983,651	$6,959,202,140
Capital Maryland	Joint Base Andrews	$1,624,153,235	$710,124,303	$2,334,277,538
Capital Maryland	National Maritime Intelligence Center	$578,370,032	$276,538,219	$854,908,251
Capital Maryland	Naval Support Activity Bethesda	$838,885,156	$659,606,028	$1,498,491,183
Capital Maryland	Naval Surface Warfare Center—Carderock Division	$236,081,475	$320,434,430	$556,515,905
Capital Maryland Total		**$5,527,203,688**	**$6,976,927,237**	**$12,504,130,923**
Central Maryland	Aberdeen Proving Ground	$1,622,488,066	$5,426,074,494	$7,048,562,560
Central Maryland	Army Corps of Engineers—Baltimore District	$134,601,206	$482,391,520	$616,992,726
Central Maryland	Coast Guard Yard	$169,287,260	$129,634,265	$298,921,525
Central Maryland	Fort Meade	$9,351,490,819	$17,570,704,409	$26,922,195,228
Central Maryland	Maryland National Guard	$347,757,250	$168,205,804	$515,963,054
Central Maryland	Naval Support Activity Annapolis	$936,442,527	$511,019,449	$1,447,461,976
Central Maryland Total		**$12,562,067,128**	**$24,288,029,941**	**$36,850,097,069**
Southern Maryland	Naval Air Station Patuxent River	$3,795,718,487	$3,679,871,105	$7,475,589,592
Southern Maryland	Naval Research Lab—Chesapeake Bay Detachment	$2,116,438	$9,740,591	$11,857,029
Southern Maryland	Naval Support Facility Indian Head	$333,639,541	$211,063,970	$544,703,511
Southern Maryland Total		**$4,131,474,466**	**$3,900,675,666**	**$8,032,150,132**
Statewide Total		**$22,220,745,282**	**$35,165,632,844**	**$57,386,378,124**

Source: RESI, Maryland Department of Commerce, IMPLAN

Figure 56 presents the impact of Maryland's military installations on total wages for FY 2012 by region.

Figure 56: Impact of Maryland's Military Installations on Wages, FY 2012

Region	Military Installation	Direct	Indirect/Induced	Total
Capital Maryland	Adelphi Laboratory Center	$88,415,433	$73,486,101	$161,901,533
Capital Maryland	Fort Detrick	$842,023,092	$1,821,978,061	$2,664,001,153
Capital Maryland	Joint Base Andrews	$874,650,596	$233,284,086	$1,107,934,682
Capital Maryland	National Maritime Intelligence Center	$199,234,967	$103,419,796	$302,654,763
Capital Maryland	Naval Support Activity Bethesda	$527,456,102	$200,912,043	$728,368,145
Capital Maryland	Naval Surface Warfare Center—Carderock Division	$173,999,996	$116,157,010	$290,157,006
Capital Maryland Total		**$2,705,780,186**	**$2,549,237,097**	**$5,255,017,282**
Central Maryland	Aberdeen Proving Ground	$1,134,968,235	$2,217,930,150	$3,352,898,385
Central Maryland	Army Corps of Engineers—Baltimore District	$98,262,094	$172,474,305	$270,736,399
Central Maryland	Coast Guard Yard	$103,421,493	$43,975,977	$147,397,470
Central Maryland	Fort Meade	$6,371,999,159	$6,648,170,913	$13,020,170,072
Central Maryland	Maryland National Guard	$174,849,992	$57,029,306	$231,879,298
Central Maryland	Naval Support Activity Annapolis	$509,557,894	$177,497,998	$687,055,892
Central Maryland Total		**$8,393,058,867**	**$9,317,078,649**	**$17,710,137,516**
Southern Maryland	Naval Air Station Patuxent River	$1,006,004,573	$1,404,463,345	$2,410,467,918
Southern Maryland	Naval Research Lab—Chesapeake Bay Detachment	$1,563,200	$3,571,046	$5,134,246
Southern Maryland	Naval Support Facility Indian Head	$243,890,006	$70,038,141	$313,928,147
Southern Maryland Total		**$1,251,457,779**	**$1,478,072,532**	**$2,729,530,311**
Statewide Total		**$12,350,296,832**	**$13,344,388,278**	**$25,694,685,109**

Source: RESI, Maryland Department of Commerce, IMPLAN

Maryland's military installations directly supported jobs with over $12 billion in total wages. After accounting for indirect and induced wages, the installations supported $25.7 billion in total wages. Given that Maryland's installations supported 410,219 jobs across the state, the average

wage of a worker reliant on Maryland's military installations was $62,637, almost $8,000 higher than the average wage of $54,777 in Maryland. Salaries are raised due to wages paid to direct jobs; workers directly employed by Maryland's military installations earned $82,855 on average in FY 2012. Indirect and induced workers earned $51,096, nearly $4,000 less than the statewide wage. This finding is not surprising, given that indirect and induced jobs, as described in Section 6.2, typically include lower paying service jobs.

6.10 Regional and State Vulnerability for the Defense Industry

Focus group participants and interviewees frequently noted how intertwined DoD contracting was with Maryland's military installations. To gather a complete picture of the defense industry in Maryland, the RESI team combined several estimates to get an overall defense dependency ratio for each region. The team examined several variables as presented below in Figure 57:

1. **Total Impact of DoD Contracting**: This information, presented in Section 6.2, was calculated using REMI PI+ and represents the private non-farm impact of DoD contracting on each region in Maryland. These data represent average annual impacts for the period between 2011 and 2015.
2. **Total Military Base Impact**: These calculations, presented in Section 6.9, were estimated using IMPLAN. Estimates are for FY 2012, although one installation, Joint Base Andrews, submitted payroll and procurement information for FY 2013. Impacts for this variable include private non-farm and government non-farm employment, output, and wages.
3. **Total Defense Impact**: This is a sum of the "Total Impact of DoD Contracting" and the "Total Military Base Impact" fields.
4. **Total for Region**: This estimation of the total output, wages, and employment for each region is reported from REMI PI+. REMI PI+ uses BEA and BLS data to calculate totals by region. Data here is total non-farm employment, output, and wages, and therefore differs from the regional totals reported in Section 6.2, which only examined the impact to the private sector.[131]
5. **Defense Dependency Ratio**: This ratio is calculated by dividing the "Total Defense Impact" into the "Total for Region."

There are potential issues with combining prior research conducted on Maryland's military installations with the current analysis of DoD contracting reported in Section 6.2. For one, the two analyses were conducted using different software, and impacts are reported differently. IMPLAN, used in the 2015 report on Maryland's military installations, does not capture the regional linkages, while REMI PI+ does. Therefore, because no installations are located in Western Maryland or on the Eastern Shore, and the regional employment, output, and wage totals are higher due to the inclusion of government sector, dependency ratios for these two regions will, by design, be less than those calculated in Section 6.2. However, given the low government employment in these two regions, differences in the dependency ratios should be minimal.

[131] Section 6.2 only examines the private sector in order to present findings more meaningful for diversification and to be consistent with calculations within the Cluster Analysis.

Additionally, it is likely that at least some of the indirect employment supported by Maryland's military installations reported in the Capital Maryland region, for example, actually occurs in the Western Maryland region. This indicates that the totals, and therefore dependency ratios, may be biased in favor of the Capital Maryland region. This bias is likely an issue for the three regions containing military installations, but RESI believes that all totals and dependency ratios presented in this section may still be viewed as conservative given that USA Spending data does not include classified contracts or those with the NSA. Additionally, RESI's 2015 report only captured data on 15 of Maryland's 20 military facilities. Due to these unavoidable issues with missing data, RESI believes that all regional estimates of DoD reliance may be considered conservative. Finally, RESI's 2015 report only captures the impact of the military bases in 2012, instead of examining the average impact across five years as done in this report. It is unclear if the estimates of the impacts of Maryland's military installations would be significantly different, given the relative stable nature of military base employment.

Maryland's economy, as shown in Figure 57, is heavily reliant on both DoD contracting and military installations. In total, approximately 14.5 percent of the jobs, 13.6 percent of the output, and 18 percent of the total wages in Maryland rely directly or indirectly on the defense industry. Crucially, Southern Maryland, comprising Charles, St. Mary's, and Calvert Counties, is extremely reliant on the defense industry— with approximately 30.7 percent of the jobs, 45.2 percent of total output, and 46.7 percent of the total wages in the region rely on either DoD contracting or local installations. Central Maryland is also heavily dependent on the defense industry. For example, approximately 18.6 percent of the employment in the region is supported by the defense industry. As noted in Section 6.2, Central Maryland and Capital Maryland have similar levels of reliance on DoD contracting (approximately 4.2 percent and 3.8 percent respectively), however, the Central Maryland region is much more heavily dependent on the defense industry as a whole than the Capital Maryland region. The Central Maryland region has two of the largest military bases in the state, Fort Meade and Aberdeen Proving Ground.

Although Maryland's economy is reliant on the defense industry, this analysis shows that the jobs are high-paying jobs. The average defense-reliant job in Maryland has an annual salary of $59,911, above the Maryland average of $54,777. Wages are highest in the Central Maryland region, where the average worker earns $62,561. These numbers are similar in Southern Maryland, where the average defense-reliant worker earns an annual salary of $62,105. Wages are lowest in the Eastern Shore region, where workers only earn an average wage of $29,565. This low wage is due to a lack of well-paying jobs on military installations and the presence of few contractors. Instead, most DoD-reliant jobs on the Eastern Shore are indirect and induced jobs typically consisting of service jobs, as discussed in Section 6.8.

Figure 57: Estimated Annual Economic Impacts of the Defense Industry and Dependency Ratios by Impact Type and Region

Region	Total Impact of DoD Contracting	Total Military Base Impact	Total Defense Impact	Total for Region	Defense Dependency Ratio
Employment					
Southern Maryland	8,301	41,990	50,291	163,760	30.71%
Central Maryland	57,673	272,838	330,511	1,779,737	18.57%
Capital Maryland	45,121	95,391	140,512	1,286,850	10.92%
Western Maryland	827	0	827	145,101	0.57%
Eastern Shore	1,355	0	1,355	245,561	0.55%
Statewide	***113,277***	***410,219***	***523,496***	***3,621,009***	***14.46%***
Output					
Southern Maryland	$955,899,850	$8,032,150,132	$8,988,049,982	$19,858,643,824	45.26%
Central Maryland	$8,060,322,890	$36,850,097,069	$44,910,419,959	$267,837,072,955	16.77%
Capital Maryland	$5,831,964,103	$12,504,130,923	$18,336,095,026	$200,386,535,700	9.15%
Eastern Shore	$149,789,129	$0	$149,789,129	$27,922,484,964	0.54%
Western Maryland	$83,369,699	$0	$83,369,699	$17,853,352,702	0.47%
Statewide	***$15,081,345,672***	***$57,386,378,124***	***$72,467,723,796***	***$533,858,090,145***	***13.57%***
Wages					
Southern Maryland	$393,807,679	$2,729,530,311	$3,123,337,990	$6,698,898,370	46.62%
Central Maryland	$2,966,951,811	$17,710,137,516	$20,677,089,327	$88,968,988,310	23.24%
Capital Maryland	$2,242,669,120	$5,255,017,282	$7,497,686,402	$64,514,564,998	11.62%
Eastern Shore	$40,060,355	$0	$40,060,355	$7,937,732,578	0.50%
Western Maryland	$25,168,137	$0	$25,168,137	$5,139,517,401	0.49%
Statewide	***$5,668,657,102***	***$25,694,685,109***	***$31,363,342,211***	***$173,259,701,656***	***18.10%***

Source: RESI, Maryland Department of Commerce, IMPLAN, REMI PI+

Combining the results of RESI's economic impact analysis of DoD contracting on Maryland's economy with the report on the impact of the state's military installations illustrates just how important the defense industry is to the state. It also underscores how important it is for

Maryland to identify ways to diversify its economy, especially in Southern Maryland. Although there are efforts underway, such as the SMTCPP discussed in Section 5.3.2, there is more the state can do to encourage diversification. Strategies that focus group participants and interviewees proposed are discussed in further detail in Section 8.

Section 7: Policy Change Analysis

In addition to examining the overall dependence of Maryland's economy on defense spending, the RESI team forecasted the impact of four different scenarios on Maryland's economy. Scenarios were chosen based on discussions with subject matter experts from the SWOT analysis:

1. A ten percent reduction in all defense contracting within Maryland;
2. A ten percent reduction in the funding for R&D contracts in the state;
3. A ten percent increase in the funding for cybersecurity contracts in Maryland; and
4. The loss of a major defense contractor from the area.

Like the Regional and State Vulnerability Analysis, impacts were forecasted within REMI PI+ using USA Spending data. The scenarios, and the assumptions used to create them, are described below.

Each of the four scenarios is covered in the sections below. Appendices D through G display the employment, output, and wages by NAICS code for each region and each scenario.

7.1 Scenario 1: Ten Percent Budget Cut for All Defense Contracting

Focus group participants and interviewees all discussed the difficulties faced due to sequestration, and indicated that another round of sequestration could have significant negative effects on Maryland's economy. As highlighted in Section 6.8, 6.3 percent of the jobs in Southern Maryland rely on DoD contracting. To gauge the impacts of another round of sequestration, the RESI team estimated the impact from a ten percent reduction in defense contracts awarded to Maryland vendors and to vendors performing work inside Maryland.

7.1.1 Scenario Results

Figure 58 below describes the average annual impact from another round of sequestration on Maryland's economy.

Figure 58: Average Annual Impact of a Ten Percent Cut in Defense Contracting on Employment by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Employment in Region
Southern Maryland	-561	-382	-943	-0.72%
Capital Maryland	-2,910	-1,614	-4,524	-0.42%
Central Maryland	-2,738	-3,049	-5,787	-0.39%
Eastern Shore	-26	-112	-138	-0.07%
Western Maryland	-22	-61	-83	-0.07%
Total	**-6,257**	**-5,218**	**-11,475**	**-0.38%**

Sources: REMI PI+, RESI

As seen in Figure 58, a ten percent reduction in DoD contracts would decrease employment by 6,257 direct jobs and 11,475 total jobs statewide. The greatest number of direct jobs lost would be in Capital Maryland, while the most indirect and induced jobs lost would be lost in Central Maryland.

Figure 59 examines the impact on employment at the two-digit NAICS code industry-level. Note that for some industries, the sum of county-level job losses may be different from the statewide losses due to rounding. Following the patterns seen in Section 6, nearly half of the affected jobs would be in the Professional, Scientific, and Technical services and Construction industries. This is important given the high average annual wage in this industry, which was$92,612 in 2015. The Retail Trade, Administrative and Waste Management Services, and Health Care and Social Assistance industries would also be impacted by a cut in DoD contracts across the board. Insulated sectors include Forestry, Fishing, and Related Activities, Mining, and Utilities. These three industries lose only 40 total jobs across the state.

Figure 59: Average Annual Amount of Jobs Lost by Region and Industry from a Ten Percent Cut in Defense Contracting

Industry	Capital Maryland	Central Maryland	Eastern Shore	Southern Maryland	Western Maryland	State Total
Professional, Scientific, and Technical Services	-1,674	-1,735	-19	-389	-7	-3,824
Construction	-755	-1,179	-33	-192	-10	-2,169
Administrative and Waste Management Services	-610	-599	-12	-44	-21	-1,285
Retail Trade	-250	-451	-17	-77	-14	-809
Health Care and Social Assistance	-252	-492	-12	-37	-7	-800
Accommodation and Food Services	-342	-261	-10	-36	-6	-654
Other Services, except Public Administration	-119	-238	-7	-28	-3	-395
Transportation and Warehousing	-123	-114	-3	-100	-3	-343
Manufacturing	-49	-146	-9	-5	-4	-212
Real Estate and Rental and Leasing	-73	-114	-3	-11	-1	-202
Finance and Insurance	-50	-118	-4	-9	-3	-184
Educational Services	-68	-71	-1	-2	0	-143
Information	-62	-73	-1	-3	-1	-141
Wholesale Trade	-33	-85	-3	-2	-1	-124
Arts, Entertainment, and Recreation	-41	-64	-2	-2	0	-109
Management of Companies and Enterprises	-17	-23	-1	-2	0	-42
Utilities	-4	-16	0	-4	0	-24
Mining	-3	-7	0	0	0	-11
Forestry, Fishing, and Related Activities	-1	-3	-1	0	0	-5
Total	**-4,524**	**-5,787**	**-138**	**-943**	**-83**	**-11,475**

Sources: REMI PI+, RESI

Figure 60 shows the impact of another round of sequestration or other budget cut on the output of the state and each region. Similarly, Figure 61 displays the impact of sequestration and budget cuts on wages.

Figure 60: Average Annual Impact of a Ten Percent Cut in Defense Contracting on Output by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Output in Region
Southern Maryland	-$70,477,436	-$35,925,368	-$106,402,805	-0.79%
Capital Maryland	-$368,952,470	-$215,497,559	-$584,450,038	-0.37%
Central Maryland	-$410,694,486	-$397,691,874	-$808,386,360	-0.37%
Eastern Shore	-$2,786,080	-$12,478,360	-$15,264,440	-0.06%
Western Maryland	-$1,570,168	-$6,825,796	-$8,395,964	-0.05%
Total	**-$854,480,639**	**-$668,418,957**	**-$1,522,899,608**	**-0.35%**

Sources: REMI PI+, RESI

Figure 61: Average Annual Impact of a Ten Percent Cut in Defense Contracting on Wages by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Wages in Region
Southern Maryland	-$31,756,534	-$12,308,845	-$44,065,378	-1.01%
Capital Maryland	-$154,765,764	-$71,360,152	-$226,125,909	-0.47%
Central Maryland	-$165,111,776	-$134,484,536	-$299,596,313	-0.43%
Eastern Shore	-$786,850	-$3,305,635	-$4,092,485	-0.07%
Western Maryland	-$577,570	-$1,960,037	-$2,537,607	-0.06%
Total	**-$352,998,494**	**-$223,419,205**	**-$576,417,692**	**-0.44%**

Sources: REMI PI+, RESI

The impacts on wages and output from a budget cut are like the impacts in terms of employment. A ten percent reduction in DoD contracting would correspond to a decrease in output across the state of $1.5 billion, and a loss in total wages of $576 million. As with the total loss of employment, the greatest total losses in terms of output and wages would be in Central Maryland.

7.2 Scenario 2: Ten Percent Decrease in Research and Development Spending

Focus group participants and interviewees highlighted research and development (R&D) as a critical sector for Maryland's defense-intensive landscape. Focus group participants at Fort Meade highlighted the strengths of the biotech research conducted in the area, respondents in Southern Maryland touted the strength of NAS Patuxent River, and respondents in Central Maryland discussed the strong connections to research institutions like Johns Hopkins University and the University of Maryland.

However, this strength is also a potential risk. R&D, for the most part, can be conducted in any location, and is not as reliant on large buildings or land features as ship testing, for example. This indicates a risk for program transfer during BRAC, as the military looks to consolidate missions. To examine the significance of a loss in R&D spending as a result of program transfer, the RESI team modeled a ten percent loss in DoD contracts relating to R&D spending across the state.

"I think the biggest challenge for APG is that it is an R&D Facility. And actually, a lot of facilities in Maryland are R&D facilities. When the army says they are focused on readiness…a lot of times they shift money from R&D to manpower and equipment buys."

7.2.1 Scenario Results

Figure 62 below describes the average annual impact from a ten percent reduction in R&D contracts on Maryland's economy.

Figure 62: Average Annual Impact of a Ten Percent Cut in R&D Contracting on Employment by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Employment in Region
Central Maryland	-617	-629	-1,245	-0.08%
Southern Maryland	-62	-47	-109	-0.08%
Capital Maryland	-305	-251	-555	-0.05%
Eastern Shore	-7	-18	-25	-0.01%
Western Maryland	0	-7	-7	-0.01%
Total	**-991**	**-951**	**-1,942**	**-0.06%**

Sources: REMI PI+, RESI

Most of the jobs lost due to a cut in R&D funding would be in Central Maryland. Of the 1,942 direct, indirect, and induced jobs lost in this scenario, 1,245 would be from Central Maryland. Half of the jobs lost in the region would be direct jobs, with the other half being indirect and induced. Capital Maryland would lose 305 direct jobs and 251 indirect and induced jobs.

Figure 63 examines the impact on employment at the two-digit NAICS code industry-level. Note that for some industries, the sum of county-level job losses may be different from the statewide losses due to rounding. The industry-level breakdown of job losses resulting from a decrease in R&D funding follows a similar pattern to the industry-level effects of the ten percent cut to all DoD contracting discussed in Section 7.1.1. Most the job losses would be in the Professional, Scientific, and Technical Services industry, with the second-most impacted sector being Construction. Retail Trade, Health Care and Social Assistance, and Administrative and Waste Management Services constitute a larger proportion of the jobs lost in Central Maryland than Capital Maryland. Professional, Scientific, and Technical services represent a higher proportion of jobs lost in Capital Maryland (62 percent) compared to Central Maryland (52 percent).

Figure 63: Average Annual Amount of Jobs Lost by Region and Industry from a Ten Percent Cut in R&D Contracting

Industry	Capital Maryland	Central Maryland	Eastern Shore	Southern Maryland	Western Maryland	State Total
Professional, Scientific, and Technical Services	-342	-650	-9	-65	0	-1,066
Construction	-43	-146	-4	-14	-1	-208
Retail Trade	-27	-95	-3	-9	-2	-136
Health Care and Social Assistance	-21	-69	-2	-4	-1	-96
Administrative and Waste Management Services	-25	-64	-1	-2	0	-93
Accommodation and Food Services	-18	-53	-2	-4	-1	-78
Other Services, except Public Administration	-16	-43	-1	-3	0	-63
Real Estate and Rental and Leasing	-11	-25	-1	-1	0	-38
Manufacturing	-16	-15	-1	0	0	-33
Finance and Insurance	-7	-20	-1	-1	-1	-30
Transportation and Warehousing	-8	-14	0	-3	0	-25
Arts, Entertainment, and Recreation	-6	-14	0	0	0	-20
Wholesale Trade	-4	-14	0	0	0	-19
Educational Services	-5	-9	0	0	0	-14
Information	-4	-7	0	0	0	-11
Management of Companies and Enterprises	-3	-4	0	0	0	-7
Mining	0	-1	0	0	0	-2
Utilities	0	-2	0	0	0	-2
Forestry, Fishing, and Related Activities	0	0	0	0	0	-1
Total	**-555**	**-1,245**	**-25**	**-109**	**-7**	**-1,942**

Sources: REMI PI+, RESI

Figure 64 shows the impact of a ten percent reduction in R&D contracting on the output of the state and each region. Similarly, Figure 65 displays the impact of the cut in contracting on wages.

Figure 64: Average Annual Impact of a Ten Percent Cut in R&D Contracting on Output by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Output in Region
Southern Maryland	-$8,784,382	-$4,439,217	-$13,223,599	-0.10%
Central Maryland	-$93,126,751	-$81,590,543	-$174,717,292	-0.08%
Capital Maryland	-$49,701,495	-$33,525,876	-$83,227,370	-0.05%
Eastern Shore	-$634,076	-$1,877,910	-$2,511,987	-0.01%
Western Maryland	-$25,759	-$783,991	-$809,750	-0.01%
Total	**-$152,272,464**	**-$122,217,538**	**-$274,489,997**	**-0.06%**

Sources: REMI PI+, RESI

Figure 65: Average Annual Impact of a Ten Percent Cut in R&D Contracting on Wages by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Wages in Region
Southern Maryland	-$4,199,346	-$1,549,226	-$5,748,572	-0.13%
Central Maryland	-$43,969,052	-$27,381,557	-$71,350,609	-0.10%
Capital Maryland	-$21,219,031	-$11,596,211	-$32,815,241	-0.07%
Eastern Shore	-$207,658	-$524,298	-$731,956	-0.01%
Western Maryland	-$7,682	-$221,320	-$229,002	-0.01%
Total	**-$69,602,769**	**-$41,272,612**	**-$110,875,381**	**-0.08%**

Sources: REMI PI+, RESI

If the DoD were to change its funding priorities and R&D dollars obligated in Maryland were to decrease by ten percent, Maryland would lose $111 million in wages, and output would fall by $275 million. Like the effects on employment across the state, the greatest impact in terms of wages and output would occur in Central Maryland—the region would experience a decrease in output of $175 million and would lose $71 million in wages.

Although losses in employment, output, and wages are lower in Capital Maryland than Central Maryland, the output and wages associated with each lost job are higher in Capital Maryland. Dividing the loss in output by the number of lost jobs finds that the average output loss per lost job in Capital Maryland is $149,959 compared to $140,335 in Central Maryland. Similarly, the average wage per lost worker in Capital Maryland is $59,127 compared to $57,310 in Central Maryland.

7.3 Scenario 3: Ten Percent Increase in Cybersecurity Spending

Across all focus groups and interviews, cybersecurity was seen as one of Maryland's core industries. Respondents also indicated that cybersecurity was likely to be a growth industry in Maryland. The government's, especially the DoD's, demand for additional cyber capabilities was

expected to rise, along with demand from the private sector in industries such as healthcare that rely on protecting sensitive information.

One key opportunity for the state, as discussed in Section 5.3.6, was the U.S. Cyber Command becoming a combatant command. Interviewees predicted this would lead to additional funding for government contractors in the area. To determine what impacts additional cyber contracts would have on Maryland's economy, the RESI team modeled a ten percent increase in cybersecurity funding across the state. These estimates are likely conservative, since USA Spending data excludes data from classified contracts as well as the NSA, located at Fort Meade, for national security purposes.

7.3.1 Scenario Results

Figure 66 describes the average annual impact from a ten percent increase in DoD contracts to provide cybersecurity services on Maryland's economy.

Figure 66: Average Annual Impact of a Ten Percent Increase in Cybersecurity Contracting on Employment by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Employment in Region
Eastern Shore	0	8	8	0.00%
Western Maryland	3	7	10	0.01%
Central Maryland	179	279	458	0.03%
Southern Maryland	25	26	50	0.04%
Capital Maryland	337	224	561	0.05%
Total	**544**	**543**	**1,088**	**0.04%**

Sources: REMI PI+, RESI

Cybersecurity contracting is primarily concentrated in the Capital and Central Maryland regions, with 94 percent of the estimated direct job gains from a ten percent increase in funding being in these two regions. Despite the number of cybersecurity businesses located in Central Maryland around Fort Meade, most of the job gains are estimated to take place in Capital Maryland. This is likely due to the structure of the USA Spending data, which excludes data from the NSA.

Central Maryland is estimated to have the largest increase in indirect and induced jobs, following a pattern seen in Sections 7.1.1 and 7.2.1. It appears that many of the supporting businesses for DoD contracting are in Central Maryland, likely due to lower land costs and proximity to other metro areas, such as Baltimore. Figure 67 examines the impact on employment at the two-digit NAICS code industry-level. Note that for some industries, the sum of county-level job losses may be different from the statewide losses due to rounding.

Figure 67: Average Annual Amount of Jobs Gained by Region and Industry from a Ten Percent Increase in Cybersecurity Contracting

Industry	Capital Maryland	Central Maryland	Eastern Shore	Southern Maryland	Western Maryland	State Total
Professional, Scientific, and Technical Services	333	185	1	26	3	548
Construction	48	56	1	8	1	115
Retail Trade	40	40	1	5	2	88
Information	25	30	0	1	0	56
Administrative and Waste Management Services	26	26	0	1	0	54
Health Care and Social Assistance	20	28	1	2	1	51
Accommodation and Food Services	17	20	1	2	0	41
Other Services, except Public Administration	15	22	1	2	0	39
Real Estate and Rental and Leasing	9	10	0	1	0	21
Finance and Insurance	7	9	0	1	0	17
Arts, Entertainment, and Recreation	7	8	0	0	0	16
Transportation and Warehousing	5	5	0	0	0	11
Wholesale Trade	3	6	0	0	0	10
Educational Services	3	5	0	0	0	8
Manufacturing	2	5	0	0	0	7
Management of Companies and Enterprises	2	2	0	0	0	4
Mining	0	1	0	0	0	1
Utilities	0	1	0	0	0	1
Forestry, Fishing, and Related Activities	0	0	0	0	0	0
Total	561	458	8	50	10	1,088

Sources: REMI PI+, RESI

Most of the job gains resulting from an increase in cybersecurity funding within Maryland will occur within the Professional, Scientific, and Technical Services industry. Like the defense industry as a whole, Construction and Retail Trades were the second and third most impacted

industries. The REMI PI+ model estimates that the Information industry will also experience strong gains. This is unsurprising given the interaction between cybersecurity and information.

Figure 68 shows the impact of a ten percent increase in DoD contracts to provide cybersecurity services on the output of the state and each region. Similarly, Figure 69 displays the impact of additional cybersecurity funding on wages in the state.

Figure 68: Average Annual Impact of a Ten Percent Increase in Cybersecurity Contracting on Output by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Output in Region
Capital Maryland	$56,116,787	$30,766,140	$86,882,929	0.05%
Southern Maryland	$3,540,711	$2,510,932	$6,051,643	0.04%
Central Maryland	$36,980,050	$38,135,407	$75,115,456	0.03%
Western Maryland	$305,958	$779,929	$1,085,887	0.01%
Eastern Shore	$3,854	$1,011,914	$1,015,768	0.00%
Total	**$96,947,359**	**$73,204,321**	**$170,151,682**	**0.04%**

Sources: REMI PI+, RESI

Figure 69: Average Annual Impact of a Ten Percent Increase in Cybersecurity Contracting on Wages by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Wages in Region
Capital Maryland	$23,158,113	$9,744,665	$32,902,779	0.07%
Southern Maryland	$1,668,843	$835,274	$2,504,116	0.06%
Central Maryland	$12,568,769	$12,609,974	$25,178,743	0.04%
Western Maryland	$99,431	$212,614	$312,045	0.01%
Eastern Shore	$1,187	$244,237	$245,424	0.00%
Total	**$37,496,342**	**$23,646,764**	**$61,143,107**	**0.05%**

Sources: REMI PI+, RESI

Like employment, the plurality of the gains in output and wages are expected to occur in Capital Maryland. The region is forecast to gain $33 million in wages out of a total statewide increase of $61 million in wages. Output in the region is expected to rise by $87 million out of the statewide total of $111 million. Wages per new job are expected to be higher in Capital Maryland than Central Maryland, while the average output for every new job is expected to be higher in Central Maryland. The average job created as a result of increased cybersecurity funding will have an average wage of $58,650 in Capital Maryland and $54,975 in Central Maryland. The average output for every new job is estimated at $154,872 in Capital Maryland and $164,008 in Central Maryland.

One of the primary challenges Maryland will face as a result of an increase in cybersecurity funding will be attracting and retaining the workforce necessary to fill the new jobs. Focus group participants and interviewees repeatedly stated that Maryland schools did not produce enough graduates with cybersecurity skills. If the cyber command becomes combatant or funding increases due to a shift in military strategy, Maryland will struggle to fill the demand. Given the confidence that subject matter experts expressed that Maryland's cybersecurity sector will continue to grow, policy makers in Maryland should look for ways to fill this gap.

7.4 Scenario 4: Large Defense Contractor Moves Out of State

Maryland is home to several large defense contractors that take advantage of Maryland's numerous military bases and proximity to Washington, D.C. However, Maryland's neighboring states would benefit greatly from having one of these contractors move from Maryland to their state.

To determine what impact a defense contractor would have if it moved its business from Maryland, the team used USA Spending data to collect information on the four firms with the most dollars obligated within Maryland. These firms included AAI and Lockheed Martin. The team then used Reference USA, a marketing and employment database, to view the economic profile of these four companies. Reference USA lists the company name, the primary NAICS code for the location, and an estimate of sales volume for that company-NAICS code combination. Because most locations were spread across the Capital and Central Maryland regions for all companies examined, the RESI team's composite defense contractor was assumed to have half of its revenue generated in each of these regions. The RESI team took the average dollars obligated by NAICS code for the four large companies and created a profile to input into REMI PI+, as seen below in Figure 70.

Figure 70: Sales Per Region by NAICS Code for Aggregated Large Defense Contractor

Primary NAICS Code	REMI Industry Name	Sales Per Region (Capital and Central)
334511	Computer and electronic product manufacturing	$463,503,232
423690	Wholesale trade	$57,365,752
54	Professional, scientific, and technical services	$26,469,250
522130	Monetary authorities - central bank; Credit intermediation and related activities; Funds, trusts, & other financial vehicles	$499,375
811212	Repair and maintenance	$315,375
519190	Internet publishing and broadcasting; ISPs, search portals, and data processing; Other information services	$275,125
441228	Retail trade	$200,250
561210	Administrative and support services	$17,250

Sources: Reference USA, RESI

The RESI team incorporated these data into REMI PI+ and analyzed the output consistent with the method described in Section B.2.

7.4.1 Scenario *Results*

Figure 71 below describes the average annual impact from the loss of a large defense contractor on Maryland's economy.

Figure 71: Average Annual Impact of a Large Defense Contractor Maryland on Employment by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Employment in Region
Capital Maryland	-1,212	-1,215	-2,428	-0.23%
Central Maryland	-1,187	-2,219	-3,406	-0.23%
Southern Maryland	0	-59	-59	-0.04%
Western Maryland	0	-33	-33	-0.03%
Eastern Shore	0	-52	-52	-0.02%
Total	**-2,399**	**-3,578**	**-5,978**	**-0.20%**

Sources: REMI PI+, RESI

Using the revenues that the RESI team modeled in section 7.4 using Reference USA data, RESI estimates that the large defense contractor would employ 2,399 jobs across the Capital and Central Maryland regions. These direct jobs would support an additional 3,578 jobs, which would be lost if the contractor moved to Virginia, for example. In total, nearly 6,000 jobs would be lost if a large defense contractor employing nearly 2,400 workers left. This underscores the importance in attracting and retaining large defense contractors in state, especially because much of the work these companies do for the DoD can be done in neighboring Virginia or Pennsylvania.

Figure 72 examines the impact on employment at the two-digit NAICS code industry-level. Note that for some industries, the sum of county-level job losses may be different from the statewide losses due to rounding.

Figure 72: Average Annual Amount of Jobs Lost by Region and Industry from a Large Defense Contractor Leaving Maryland

Industry	Capital Maryland	Central Maryland	Eastern Shore	Southern Maryland	Western Maryland	State Total
Manufacturing	-864	-880	-3	-1	-2	-1,750
Construction	-269	-460	-10	-16	-5	-761
Professional, Scientific, and Technical Services	-311	-364	-1	-2	0	-678
Wholesale Trade	-260	-336	-3	-1	-1	-601
Retail Trade	-143	-316	-10	-12	-9	-490
Health Care and Social Assistance	-107	-234	-6	-6	-4	-356
Administrative and Waste Management Services	-93	-153	-2	-2	-1	-251
Other Services, except Public Administration	-78	-148	-4	-5	-2	-236
Accommodation and Food Services	-71	-142	-4	-4	-2	-224
Real Estate and Rental and Leasing	-50	-81	-2	-3	-1	-137
Finance and Insurance	-40	-73	-2	-2	-2	-119
Management of Companies and Enterprises	-58	-57	0	0	0	-116
Transportation and Warehousing	-26	-57	-1	-1	-1	-87
Arts, Entertainment, and Recreation	-24	-41	-1	-1	0	-68
Information	-20	-24	0	0	0	-45
Educational Services	-10	-27	0	0	0	-38
Utilities	-2	-7	0	-1	0	-10
Mining	-2	-5	0	0	0	-7
Forestry, Fishing, and Related Activities	-1	-1	0	0	0	-2
Total	**-2,428**	**-3,406**	**-52**	**-59**	**-33**	**-5,978**

Sources: REMI PI+, RESI

In the event that a large defense contractor was to leave the state, the employment losses would be spread across several different industries. The main industry that would experience job losses would be Manufacturing, losing 1,750 jobs, more than twice as much as any other sector. Manufacturing jobs are evenly split between direct and indirect/induced jobs. Construction,

losing a total of 761 jobs, is the second most affected industry after manufacturing. While Professional, Scientific, and Technical Services is still heavily affected, other industries such as Wholesale Trade face large employment losses.

Figure 73 shows the impact of a large defense contractor leaving the state on the output of the state and each region. Similarly, Figure 74 displays the impact of a contractor leaving on wages.

Figure 73: Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Output in Region
Capital Maryland	-$574,500,760	-$184,042,856	-$758,543,631	-0.48%
Central Maryland	-$564,816,836	-$324,523,889	-$889,340,709	-0.41%
Southern Maryland	$0	-$5,890,998	-$5,890,998	-0.04%
Eastern Shore	$0	-$5,814,730	-$5,814,730	-0.02%
Western Maryland	$0	-$3,779,355	-$3,779,355	-0.02%
Total	**-$1,139,317,596**	**-$524,051,828**	**-$1,663,369,424**	**-0.39%**

Sources: REMI PI+, RESI

Figure 74: Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages by Region

Region	Direct	Indirect/Induced	Total	Percent of Total Wages in Region
Capital Maryland	-$100,539,205	-$60,564,334	-$161,103,537	-0.34%
Central Maryland	-$91,253,777	-$104,657,612	-$195,911,392	-0.28%
Southern Maryland	$0	-$1,850,544	-$1,850,544	-0.04%
Western Maryland	$0	-$1,075,496	-$1,075,496	-0.03%
Eastern Shore	$0	-$1,552,589	-$1,552,589	-0.02%
Total	**-$191,792,983**	**-$169,700,576**	**-$361,493,558**	**-0.27%**

Sources: REMI PI+, RESI

The departure of a large defense contractor with offices in the Central and Capital Maryland regions would have a large impact on the wages and output across Maryland. Total Maryland wages would decrease by over $361 million, while output would fall by over $1.6 billion statewide. While nearly all of the losses would be felt in the Capital and Central Maryland regions, the other three regions would experience spillover effects. It is not surprising that the losses would be felt in the Capital and Central Maryland regions, given that the defense contractor is modeled as existing only in those two regions. The average wage for each job lost statewide would be over $60,000, reflecting the quality of the defense contractor jobs in Maryland. Given

the high wages and distribution of jobs in key sectors like manufacturing, maintaining a strong defense contractor presence in state will help keep Maryland's economy strong.

Section 8: Pathways Towards Diversification

Combining the results of RESI's analysis of the economic impacts of DoD contracting on Maryland's economy with the report on the impact of the state's military installations illustrates just how important the defense industry is. It also underscores how important it is for Maryland to identify ways to diversify its economy, especially in Southern Maryland, where 45 percent of the output is reliant on defense spending. Focus group participants and interviewees stressed that diversification in Maryland was best accomplished by focusing on three key initiatives:

1. The attraction and retention of skilled workers,
2. The creation of a favorable climate for entrepreneurs, and
3. The maintenance of Maryland's military bases and DoD contracting core.

This section explores recommendations from the focus group participants and interviewees on how to best diversify Maryland's economy.

8.1 Attracting and Retaining Skilled Workers

Economic developers contacted during the SWOT emphasized that their jobs have rapidly evolved from the recruitment of companies to the recruitment of workers. Companies are increasingly mobile due to advancements in communications software. It has become less of a hindrance to locate away from a client or end user, since technology such as Skype allows for easy collaboration and communication. As a result, companies have increasingly begun to focus on locating near skilled workers. As discussed in Section 5.1.4, each year, Area Development Magazine,[132] a leading publication examining site selection and development needs for manufacturing, service sector, consulting, and real estate firms, conducts a survey of its readers to understand their criteria in selecting a business location. Three-fourths of the respondents to the 2015 site selection survey were responsible for either the preliminary recommendation of site selection or had the final location decision. These respondents ranked the "availability of skilled labor" as the most important factor in site selection in the 2015 survey, up from the fifth most important factor in 2014. In 2015, 93 percent of respondents indicated skilled labor was "very important" or "important," up from 86 percent in 2010 and 87 percent in 2005.[133]

"We (Economic Development Managers) aren't in the business of recruiting companies anymore; we're in the business of recruiting people. If you can get the workforce, the companies will follow."

To diversify its economy, Maryland will need to ensure it is attracting and retaining the types of workers that employers need. Focus group participants and interviewees indicated that this was

[132] Area Development Magazine. "30th Annual Survey of Corporate Executives." 2016. Available at: http://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2016/corporate-executive-site-selection-facility-plans-441729.shtml
[133] Ibid.

the top goal the state should have when pursuing economic diversification, and they identified numerous strategies the state could take to accomplish this.

8.1.1 Strengthening Workforce Development Programs

Companies have found that it is often cheaper and easier to retain existing employees and train them to fill job needs than it is to recruit employees from outside the company. This same principle applies to economic development. Although Maryland companies indicate that they have a difficult time finding qualified workers, as discussed in Section 5.2.3, there is a significant number of unemployed or underemployed Marylanders. The U-6 unemployment rate measures the proportion of residents who are unemployed or underemployed for economic reasons. As of the third quarter of 2016, the U-6 unemployment rate for Maryland was 8.2 percent, signaling that there are still many workers in the state who want a job but cannot find one.[134]

A great number of people looking for work coupled with a great number of companies having difficulty hiring workers indicates that there is likely a mismatch in the labor pool. In other words, companies require employees with different skillsets than jobseekers currently have. One way to correct this mismatch is through workforce training programs, and there are already a number of them in the state. However, workforce training programs can be difficult to implement successfully. As one interviewee mentioned, for workforce training programs to succeed, program administrators need to understand what skills are currently required, what skills will be required in the future, and how many jobs will be required for those skills in the future. This can be a fairly daunting task for state and local government, which often run these programs due to the availability of funds despite not being able to react to industry-level changes as fast as the private sector.

One very successful workforce training program in the state is the Employment Advancement Right Now (EARN) Maryland program, established in 2014.[135] This model, funded by the State and run through the Maryland Department of Labor and Licensing Regulations (DLLR), allows industry stakeholders to design and run workforce training programs that best meet their needs. Through EARN Maryland, the State provides funding to regional and state workforce training programs led by industry leaders.

Training programs through EARN Maryland occur in a variety of high-priority industries. For example, one program funded in part through EARN Maryland is CyberWorks, a workforce

[134] Bureau of Labor Statistics. "Alternative Measures of Labor Underutilization for States, Fourth Quarter of 2015 through Third Quarter of 2016 Averages." Local Area Unemployment Statistics. Accessed January 11, 2017. https://www.bls.gov/lau/stalt.htm
[135] EARN Maryland. "2016 Annual Report." 2016. Accessed January 11, 2017. https://www.dllr.state.md.us/earn/earnannrep2016.pdf

training program that provides a two-week training from industry experts.[136] After this training, trainees meet with local companies and are initially hired for three to twelve months.

In the two and a half years since its inception, EARN Maryland has led to the training of over 3,000 workers.[137] The program's model has received praise from several outside groups. In 2015 the National Skills Coalition published a report exploring successful state-industry partnership programs, which discussed EARN Maryland in depth.[138] For example, the report mentioned EARN Maryland's support of Project Jumpstreet, a program that prepares workers for entry-level construction jobs. EARN Maryland funding enabled Project Jumpstreet to enroll 26 additional participants, all of whom graduated. Of the 26 additional graduates, 21 found employment earning an average wage of $11.50 an hour.[139]

Additionally, a 2016 report on workforce development programs across the country by the Urban Institute cited EARN Maryland's approach as one of several case studies showing how to successfully implement workforce development programs.[140] Conclusions from the Urban Institute's report echoed comments from focus group participants and interviewees. Both the report and subject matter experts in Maryland argued that industry buy-in was critical to the long-term success of workforce development programs. The Urban Institute found that stressing the return on investment to local companies was one of the best ways to generate interest in participation. Additionally, both the Urban Institute report and local economic developers stressed that successful workforce development should incorporate local businesses to stay flexible and adjust to changing employer demands.

To help local employers fill positions and reduce the number of unemployed and underemployed residents in Maryland, the State should focus on expanding EARN Maryland. The program, although relatively new, has a track record of success and has been cited as a model for programs across the country. One obvious strategy to expand the program is to increase its funding. A report by the Business Economic and Community Outreach Network (BEACON) at Salisbury University estimated that for every dollar invested in EARN Maryland, an additional $14.88 in

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[136] CyberWorks. "The Model: How Does it Work?" Accessed january 11, 2017. http://www.cyberworksmd.org/model.html

[137] EARN Maryland. "2016 Annual Report." 2016. Accessed January 11, 2017. https://www.dllr.state.md.us/earn/earnannrep2016.pdf

[138] DeRenzis, Brooke and Bryan Wilson. "Skills in the States: Sector Partnership Policy Toolkit." National Skills Coalition. October 2015. Accessed January 5, 2017. http://www.nationalskillscoalition.org/resources/publications/file/Final-Sector-Partnership-Policy-Toolkit-1.pdf

[139] Ibid.

[140] Eyster, lauren and Amanda Briggs. "State Workforce and Economic Development: Opportunities for Collaboration." Urban Institute Working Paper. November 2016. Accessed January 4, 2017. http://www.urban.org/sites/default/files/publication/86131/2001004-state-workforce-and-economic-development-opportunities-for-collaboration_2.pdf

economic activity is created.[141] The report noted that the nationwide average return on investment is only $3.41 for every dollar invested.[142] This signals that there is room for the State to invest more in the program, thereby increasing the number of Maryland residents able to work for Maryland employers.

8.1.2 Coordinating and Enhancing Student-Oriented Public-Private Partnerships

EARN Maryland, as discussed in Section 8.1.1, is an example of a successful public-private partnership. As covered in Section 5.2.4, focus group respondents and interviewees believed that Maryland needed more public-private partnerships to better train its workforce. Participants were especially concerned with the need for additional public-private partnerships focused on training students, rather than retraining unemployed or underemployed workers, as discussed in Section 8.1.1. Investing in student education was seen as more cost-effective than investing in retraining existing workers. In general, this is because resources already exist to handle students' training, and therefore companies interested in developing a skilled workforce only need to help guide curriculum development.

One issue that respondents identified with the state of public-private partnerships in Maryland is that there is no one centralized body in charge of administering these programs. Respondents indicated that Commerce used to organize and develop workforce training programs, but that they no longer do. Respondents noted that there are numerous public-private partnerships that already exist between local schools and Maryland companies, examples of which may be found in Section 5.4.2. However, respondents believed that these efforts could be more successful if they were coordinated by a central body, such as Commerce or the Maryland DLLR, which currently manages programs such as EARN Maryland.

Either Commerce or Maryland DLLR would be a natural fit to coordinate public-private partnerships with area schools, respondents argued, due to the two departments' familiarity running these programs in the past and their existing connections with industry. Having a central body in charge of creating and managing these programs would also allow for better program improvements, as lessons learned and best practices could be shared within a single division instead of attempting to coordinate between multiple programs. An additional benefit of expanding programs in Maryland's colleges and universities is that more students will graduate from Maryland institutions. As discussed in Section 5.1.6, roughly two-thirds of Maryland graduates remain in the state after graduation. Increasing the number of Maryland graduates may therefore help Maryland businesses hire qualified workers easier and faster.

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[141] EARN Maryland. "2016 Annual Report." 2016. Accessed January 11, 2017. https://www.dllr.state.md.us/earn/earnannrep2016.pdf
[142] Ibid.

8.1.3 Increasing Focus on Makerspaces

Several interviewees and focus group participants mentioned makerspaces as a tool to get Maryland residents interested and trained in skills needed for a variety of industries, from manufacturing to cybersecurity. Makerspaces are spaces where people come to work on different projects, such as 3D printing, software development, or welding.[143] Makerspaces are common on high school and college campuses, though there are also a large number of independent makerspaces in Maryland. Makerspaces, interviewees stated, should be a critical piece of the State's workforce development strategy. For one, makerspaces provide students with the opportunity to gain real-world experience in programming, welding, additive manufacturing, and other in-demand skills. Makerspaces also help train Maryland's workers in skills they can use immediately. One economic developer who was interviewed believed that makerspaces were critical to reducing veteran unemployment in the state, since the interviewee found that veterans tend to gravitate to makerspaces. Veterans are often used to working with their hands, and by developing additional skills that Maryland employers need, a makerspace allows them to more easily reenter the workforce.

There is no single list of all makerspaces within Maryland, and one way for the State to increase the effectiveness of these programs is to publish a makerspace guide, similar to the incubator information published on Commerce's website. Additionally, as interviewees recommended for other workforce development programs, the State could take a more active role in coordinating, though not necessarily running, makerspaces. Coordination could involve assisting makerspaces in identifying best practices, working with stakeholders to obtain new equipment and funding, or encouraging existing workforce development programs to utilize the people and equipment at makerspaces.

8.1.4 Increasing Awareness of Security Clearances

The majority of focus group participants and interviewees mentioned that Maryland businesses had difficulty finding workers with security clearances. Security clearances are difficult to obtain, and the approval process can take months. Respondents noted that there was little Maryland could do to help speed up the security clearance process, and respondents understood the need for security and thoroughness. To help address the need for more workers with clearances, respondents pointed to public-private partnerships such as Project SCOPE (Security Clearance Overview and Preparation Education) carried out through the Fort Meade Alliance. Project SCOPE serves as an educational resource, primarily for high-school and college students, that describes the security clearance process and increases awareness about what steps a student can take while young to prepare for a security clearance. Respondents believed that education was critical to increasing the rate of skilled workers with a security clearance in Maryland because many people who are eligible for a security clearance did not undertake the process to obtain one, despite the associated increase in pay that often accompanies a security clearance. Respondents

[143] Educase. "7 Things you Should Know About Makerspaces." Accessed January 10, 2017. https://net.educause.edu/ir/library/pdf/eli7095.pdf

theorized that cause was a combination of lack of awareness regarding the benefits of having a security clearance and the perception of a difficult or lengthy application process. Those respondents familiar with Project SCOPE indicated that the program has helped educate people on both the benefits and application process and therefore has increased the number of people who would apply for a clearance.

To increase the stock of Maryland workers with security clearances, the State should strengthen these programs with Maryland's students. Project SCOPE should be expanded to as many Maryland schools as possible. This approach would likely require funding assistance from the State as well as additional coordination to introduce the program in more Maryland schools.

8.1.5 Decreasing Tax on Federal Pensions

Several interviewees and focus group participants mentioned that Maryland's high tax on federal pensions made it more difficult for Maryland companies to attract skilled workers from out of state. Retired military personnel are sought after by DoD contractors due to their familiarity with military processes. These workers will be collecting a pension in addition to a salary paid by a private employer, and income taxes can quickly add up. According to a 2015 Pew report on the taxation of military pensions, nine states, including Maryland's neighbor Delaware, do not currently tax incomes.[144] Of the 41 states that do tax incomes, 14 states, including Pennsylvania, do not tax military pensions.[145] Twenty states, including Maryland, offer some tax benefits to retirees, while only seven states, including Virginia, offer no tax exemptions for military pensions.[146] In 2015 Maryland changed its tax exemption rules so that the first $10,000 of a retiree's pension is exempt from income taxes. This doubled the previous exemption, which only applied to the first $5,000. [147] Further increases to the exemptions offered to military retirees will make the state more attractive for these skilled workers. However, as with all recommendations that focus groups and interviewees put forward, further analysis should be conducted to ensure that the economic benefits of tax reduction outweigh the lost revenue. Maryland's government estimates that the increased exemptions will cost the State $2.7 million annually in waived taxes, while local governments will forgo an annual average of $2 million.[148]

[144] Povich, Elaine. "States Compete for Military Retirees." Pew Charitable Trusts. 8/10/2015. Accessed January 4, 2017. http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2015/08/10/states-compete-for-military-retirees
[145] Ibid
[146] Ibid.
[147] Ibid.
[148] Maryland Department of Legislative Services. "Income Tax - Subtraction Modification - Military Retirement Income - Individuals at Least 65 Years Old. 2015. Accessed January 4, 2017. http://mgaleg.maryland.gov/2015RS/fnotes/bil_0002/sb0592.pdf

8.1.6 Increasing Certificate and License Reciprocity

When a Maryland company recruits an out-of-state worker, the worker does not decide whether to come to Maryland based solely on the merits of the new job and salary. For many workers, they must also consider whether the move makes sense for their families. Whether the worker's spouse can also find employment in Maryland is a major financial consideration. If a spouse will be out of work for several months, it may strain household finances enough that a move becomes impractical. To attract more workers from outside Maryland, interviewees suggested easing requirements to transfer a license from out-of-state to Maryland, especially for targeted groups, such as the spouses of DoD contractors. One way Maryland can work to accomplish this is to sign reciprocity agreements with more states for licensing and certifications. For example, Maryland has signed reciprocity agreements with 46 other states for teaching certifications, but does not have any reciprocity agreements in place for EMTs.[149] [150] Signing additional reciprocity agreements increases the likelihood that families will move to Maryland and increase the pool of skilled labor in the state.

8.1.7 Improving Commuting in Maryland

One of the most important ways to attract and retain a skilled workforce in Maryland, respondents said, was to improve the quality of life for the state's residents. Respondents stated that one of the best ways for Maryland to accomplish this was to make additional investments in the state's physical infrastructure.

As discussed in Section 5.2.1, many of Maryland's roadways are heavily congested. Congestion lengthens workers' commutes, making the area less desirable. The most common suggestion to ease traffic in the state that focus group participants and interviewees provided was to invest in mass transit, especially trains, across the state. For example, respondents in Southern Maryland stated that a train between the tri-county area and Washington, D.C., could make the area more attractive for workers and businesses. Additionally, respondents cited the canceled Red Line project, which would have run west from downtown Baltimore to the intersection of I-70 and I-695, as an example of a project that would have reduced the burden on Maryland's congested highways. A 2015 Transportation for America report assessing the impact of two proposed light rail lines in Maryland estimated that the Red Line would increase access to

"We try to make use of rail from here (APG) to DC as much as possible, but there's just not enough scheduled trains to really make that viable."

[149] Teaching-Certification. "Maryland Teacher Reciprocity Agreements." Accessed January 4, 2017. http://www.teaching-certification.com/teaching/maryland-teacher-reciprocity.html
[150] EMT-Resources. "Can you Work There? EMT Reciprocity." Accessed January 4, 2017. http://www.emt-resources.com/emt-reciprocity.html

"frequent, high-quality transit" for an additional 83,000 Baltimore residents.[151] Governor Hogan canceled the Red Line project citing concerns about the cost and effectiveness of the project.[152] Governor Hogan is moving forward in funding a Purple Line project, a new metro line in the Washington, D.C., suburbs that will aim to ease traffic in the area.[153] According to the 2015 Transportation for America report, this rail line will expand access to high-quality transit for almost 92,000 people.

Projects to ease Maryland's traffic do not have to be limited to light rail or metro expansions. For example, respondents mentioned increased busing as an alternative to costly train developments. Bus Rapid Transit (BRT) has become more popular as a relatively lower cost way for municipalities to enhance their transit systems.[154] BRT uses buses with dedicated bus lanes and ticket payment systems at stations instead of on buses to approximate a light rail system at a fraction of the cost. BRTs have been implemented successfully in cities across the United States. A review of 20 BRT systems by the U.S. Government Accountability Office concluded that BRTs, especially those with fully dedicated express lanes, increased ridership and decreased transit times compared to previous transit options.[155] Montgomery County has begun implementing a BRT system, and Maryland should study the design and implementation of this system.

The State of Maryland should not just focus on mass transit, but should also focus on enhancing existing roadways. Governor Hogan's announcement of funding for a replacement for the Maryland Route 301 Harry Nice bridge demonstrates one step that the State can take in making Maryland easier to drive around for the average commuter. Additional work at the Maryland Route 4 Thomas Johnson bridge would further this goal.

8.1.8 Improving Maryland's Physical Infrastructure

In addition to issues with Maryland's transportation infrastructure, focus group participants and interviewees identified numerous issues with other aspects of Maryland's physical infrastructure, such as its sewer and broadband systems. As discussed in Section 5.2.1, Southern Maryland respondents raised issues with Maryland's Tier Program for sewer access, stating the program made it difficult to expand cities in their jurisdictions and add new housing developments, business parks, or government services. Loosening restrictions on the Tier Program would enable

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[151] Kline, Sarah. "Weighing Maryland's Economic Future: Assessing the Benefits from the Red and Purple Lines." Transportation for America. May 2015. Accessed January 5, 2017. http://t4america.org/wp-content/uploads/2015/05/Maryland-Transit-Report.pdf

[152] WBAL. "Hogan: State Will Not Proceed with Red Line as it's Currently Designed." 6/26/2015. Accessed January 5, 2017. http://www.wbaltv.com/article/hogan-state-will-not-proceed-with-red-line-as-it-s-currently-designed/7094342

[153] Ibid.

[154] ITDP. "What is BRT?" Institute for Transportation and Development Policy. Accessed January 5, 2017. https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/what-is-brt/

[155] US Government Accountability Office. "Bus Rapid Transit: Projects Improve Transit Service and Can Contribute to Economic Development." Report to Committee on Banking, Housing, and Urban Affairs. July 2012. Accessed January 5, 2017. http://www.gao.gov/products/GAO-12-811

municipalities in Southern Maryland to better attract and retain residents. To better enable expansion, Southern Maryland focus group participants also requested that the state lift restrictions on aquifer drainage. Current restrictions make it too costly for residents and businesses to locate in the region, respondents argued.

In addition to water and sewer, respondents indicated that additional State help in expanding broadband access throughout Maryland would be appreciated. Economic developers cited broadband access as a crucial way to attract and retain skilled labor. Broadband access is common in most metropolitan and suburban areas of the state. However, respondents argued that expanding broadband access to rural areas would help attract teleworkers to locate in the state as well as ensure that businesses have the freedom to locate anywhere in the state.

8.2 Making Maryland Open for Business

Diversifying Maryland's economy will not occur solely from attracting skilled labor to the state. For Maryland to support sectors other than DoD contracting, it will be crucial to nurture small businesses and less developed industries. Focus group participants and interviewees had many suggestions on how the State of Maryland could help support these industries and small businesses.

8.2.1 Tax Reform

One of the best tools Maryland's government has at its disposal to effect diversification, respondents stated, is the use of tax breaks. Tax breaks encourage companies to form and locate in Maryland. Tax breaks can be targeted toward specific industries such as healthcare or unmanned aerial systems, or can be a blanket reduction, such as on corporate income taxes. For example, Maryland's corporate income tax rate is 8.25 percent, higher than neighboring Virginia's corporate income tax rate of 6 percent.[156] However, Maryland's income tax rate is lower than Pennsylvania, for example, which has a 9.99 percent corporate interest rate.[157] Regardless, lowering taxes in Maryland could drive more businesses to the state.

Another strategy that Maryland could undertake to incentivize location into Maryland is to change the tax apportionment system that targeted industries use. Tax apportionment determines how corporate profits are measured for tax purposes and is typically either made up of one factor or three factors. A three-factor apportionment system weights in-state company sales, property within the state, and payroll to in-state employees in determining the share of corporate profits to tax. These factors can be weighted equally or unequally. For example, Maryland currently weights sales twice as much as it weights property and payroll in the state.

In contrast, a single-factor apportionment system only considers in-state company sales. Although corporate income tax revenues for the state would decline, a single-factor system could

[156] Maryland Department of Commerce. "Taxes." Accessed January 5, 2017. http://commerce.maryland.gov/about/taxes
[157] Ibid.

induce firms with sizable out-of-state sales to locate new in-state offices and hire Maryland employees, since locating property and payroll in Maryland would not increase the tax burden to the firm. If additional investment occurs, it would likely lead to an increase in employment within Maryland, and therefore an increase in private income taxes and property taxes. Depending on the level of induced investment, Maryland could benefit by switching from a three-factor apportionment system to single-factor apportionment system. In 2001 Maryland switched manufacturing to a single-factor apportionment system to boost the manufacturing industry.[158] As a result, the average manufacturing company's tax burden fell by 11 percent compared to the tax burden under a three-factor system.[159]Although no studies have been conducted on the effectiveness of the plan in inducing manufacturing jobs to stay, other studies suggest single-factor apportionment has led to employment increases in other states.[160]

Economic developers mentioned that Maryland should also consider offering tax incentives to data centers. Respondents noted that all states bordering Maryland do not tax the replacement of equipment in data centers. Developers mentioned that data centers are important because IT and cybersecurity firms locate nearby to take advantage of access to servers. Economic developers stressed that Maryland should consider adopting similar tax policies to better compete for data centers and the corresponding high-tech businesses that locate near them.

8.2.2 Additional Incubators

Although Maryland currently has 33 incubators, focus group participants and interviewees indicated that more are needed. For example, only one incubator currently exists in Southern Maryland, although there are plans for additional incubators in the region. Additionally, incubators have different focus areas, which means that even if an entrepreneur lives close to an incubator, it may not be useful for them. To better serve Maryland's entrepreneurs, focus group participants and interviewees requested additional incubators in the state. In addition to creating new incubators, the State should work on promoting existing resources, through the publication and dissemination of guides to Maryland's incubators.

While respondents indicated that additional incubators and marketing efforts were needed in the state, they also indicated that existing incubators could be improved. For example, one interviewee believed the incubators in Baltimore to be doing an excellent job, but commented that the incubators in other areas were not. The interviewee critiqued other incubators for being old-fashioned and not fully embracing new software or open design concepts that millennial entrepreneurs are more interested in. Interviewees suggested that a solution to different quality levels would be an increase in coordination between incubators. For example, hosting

[158] Department of Legislative Services. Office of Policy Analysis. "Maryland's Corporate Income Tax." Presentation to the Maryland Economic Development and Business Climate Commission. 2015. Accessed January 5, 2017. https://marylandassociationofcounties.files.wordpress.com/2015/08/corporate-income-tax.pdf
[159] Ibid.
[160] Swenson, Charles. On the Effectiveness of Single Sales Factors for State Taxation. Working paper, The University of Southern California, 2011.

conferences or brown bag seminars between entrepreneurs and incubator staff in the region would be an excellent opportunity for existing incubators to share best practices and lessons learned. Additionally, these meetings would allow entrepreneurs to update incubators on the types of resources they need. While the process to approve, fund, and staff an incubator may be lengthy, this coordination would be relatively easy to implement.

The enhancement of existing incubators and the addition of new ones would allow Maryland to develop businesses that are not reliant on DoD funding. Additionally, incubators have a snowball effect. As discussed in Section 5.2.6, one way to attract additional venture capital to Maryland is to increase the number of companies participating in incubators and to improve the quality of the incubators. Increasing the number of quality startups in Maryland will attract capital to the state and help to cement Maryland's reputation as an entrepreneurial hotspot.

8.2.3 Commercialization

One strategy for diversifying Maryland's economy, as discussed in Section 5.3.2, is commercializing technologies developed at Maryland's military installations. There are already efforts underway to commercialize some of these technologies. For example, as part of the Southern Maryland Technology Commercialization Pilot Program (SMTCPP), Commerce is leading efforts to identify patents developed at Southern Maryland's military bases with potential for commercialization. Entrepreneurs and contractors will then be able to take these patents and develop them for commercial uses with the aid of newly created incubators and small business assistance. Another commercialization project in Maryland is a 2015 partnership between Maryland Technology Development Corporation (TEDCO) and NIST to encourage entrepreneurs to commercialize NIST technologies.[161] Under the program, employees of NIST and guest researchers will be able to commercialize NIST technologies and will receive training from TEDCO as well as mentorship and advising.[162]

These existing programs should be continued and expanded where possible. Additionally, these efforts should be expanded to all of Maryland's military installations. When technology transfer is occurring, respondents indicated that better marketing of the programs may be necessary. Suggestions include marketing at different business conferences and ensuring that incubators and small business consultants across the state have access to the patent lists and are aware of what resources are available. For example, one economic developer cited work that had been done at the Chesapeake Innovation Center (CIC), an incubator in Anne Arundel County. The developer mentioned that the CIC had previously had technology transfer officers come showcase potential technologies in an effort to pique the interest of Maryland entrepreneurs. Continuing and expanding this program will help encourage new businesses to form, growing the economy and diversifying away from DoD-reliant jobs.

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[161] NIST. "NIST and Maryland TEDCO Partner to Encourage Entrepreneurship." 11/17/2015. Accessed December 21, 2016. https://www.nist.gov/news-events/news/2015/11/nist-and-maryland-tedco-partner-encourage-entrepreneurship

[162] Ibid.

8.2.4 Additional Business Conferences Within Maryland

Focus group participants and interviewees frequently mentioned the need for collaboration with other companies, the government, and university researchers. Conferences were cited as one of the best tools for companies to learn about best practices and success stories for other companies in similar industries. Conferences also serve as a way for companies to market themselves and make connections with similar firms. These benefits also extend to the state, as respondents noted that conferences allow the state with an opportunity to market itself to workers and companies who may relocate to the area. However, as beneficial as conferences are, they can be expensive, since companies have to pay for travel and lodging in addition to any conference admission fees.

"If [the state] could push for more collaborative conferences in the Baltimore area and find a way to keep the costs down and get government, DoD industry, commercial, and universities together on a regular basis, I think a lot more could happen that could spawn a lot of good ideas and good products."

As a solution, interviewees recommended that the state support additional business conferences in Maryland, especially in the Baltimore and Washington, D.C., suburbs. Conferences could be targeted to specific industries, such as cybersecurity, health care, or unmanned autonomous systems. These conferences would be a way for the private sector to collaborate with researchers and hear directly from local policy makers. The state could entice businesses to attend by maintaining low admission costs for Maryland companies or entrepreneurs. These conferences would also provide the state with an opportunity to market itself as an attractive place to relocate.

8.3 BRAC Preparation: Maintaining Maryland's DoD Core

Maryland's economy is heavily reliant on both DoD contracting and military installations, as discussed in Section 6. Diversifying Maryland's economy away from the defense industry is crucial to ensuring that communities across the state stay healthy and viable even during another sequestration or in the event of program loss or base closure during a future BRAC round. However, focus group participants and interviewees stressed that Maryland's ties to the DoD were crucial to the state's economy. They noted that many of Maryland's strengths, as discussed in Section 5.1, are due in large part to existing DoD infrastructure. For example, the skilled workforce within Maryland is due largely to the demand generated at Maryland's military installations and by the DoD contractors in the state.

Economic growth should not be viewed as zero-sum. Increasing the number of commercial cybersecurity firms in the state, for example, does not and should not have to come at the expense of Maryland's existing cybersecurity resources. Subject matter experts stressed that the state should instead focus on growing both its defense-reliant and non-defense-reliant economy, but that the non-defense-reliant portion should grow faster. Over time, this will balance Maryland's economy to better withstand cutbacks in defense spending.

To accomplish this, the state needs to focus on maintaining Maryland's defense communities, beginning with BRAC preparation. Preparing the state for BRAC is a challenge, because the

precise nature of a future BRAC round is unclear. In previous BRAC rounds, excess military capacity was the most important consideration in determining which bases to close and which programs to transfer. When comparing bases with similar military value, the military considers cost. This includes the cost to maintain the base as well as the cost of environmental remediation and cleanup that would occur were the base to close. To focus on preparing Maryland for a future round of BRAC, respondents argued that Maryland should focus on coordinating its preparations for BRAC, promoting the unique capabilities of Maryland's military installations, partnering with local businesses to reduce maintenance costs, and ensuring that Maryland firms commercialize the quality research undertaken at Maryland installations where possible.

8.3.1 White Papers Promoting Maryland's Military Bases

For Maryland to succeed in future BRAC rounds, respondents emphasized that members of the BRAC Commission needed to understand the benefits that Maryland bases and programs offered compared to other areas. If the BRAC Commission believed that Maryland's bases offered benefits beyond those offered by other bases, they would be less likely to close a base or transfer a program from the state. To this end, and as discussed in Section 5.3.1, respondents suggested that Maryland should stress the interconnectedness of its bases. As discussed in Section 5.1.2, one of the strengths of Maryland's DoD-intensive landscape is that the state's military installations are interconnected. For example, interviewees mentioned that many of the tools used by cybersecurity forces at Fort Meade originated at Aberdeen Proving Ground. In this example, these connections make the work done at the Fort Meade and Aberdeen Proving Ground harder to replicate in other areas of the country, since the military benefits by having collaboration between the creator and user of its technologies. Additionally, numerous Maryland businesses contract with several installations in Maryland at once. If a program that those contractors work on leaves the state, it could lead to efficiency losses for the military, since the business will now need to have an additional office location staffed, resulting in higher overhead rates.

In addition to discussing the interconnected nature of Maryland's installations, respondents stated that the state should also highlight the strengths and uniqueness of each military installation. While many of the strengths are well known inside the state, interviewees argued that publicizing the unique programs and research done at Maryland bases would make this knowledge more well known to members of the BRAC Commission as well. In turn, this may provide Maryland installations with an advantage when compared to installations that have not adequately publicized their strengths.

To promote the unique capabilities of and research conducted at Maryland's military installations, respondents argued that the state should help draft a series of white papers that explore the benefits that each installation offers. These white papers could be disseminated in advance of another round of BRAC and key findings could be used by Maryland's congressional delegation when lobbying the BRAC Commission to avoid program loss or when arguing for why out-of-state programs should be transferred to Maryland bases.

8.3.2 Coordinate BRAC Response

As discussed in Section 5.3.1, respondents stressed that one of the best ways to ensure Maryland is a net gainer in a future round of BRAC is to ensure that efforts to promote the state and its bases are coordinated. To this end, respondents stressed that the coordination efforts that the BRAC Advisory Group undertakes would be crucial. By acting as a liaison between Maryland's military installations, local stakeholders, and Maryland's congressional delegation, the BRAC Advisory Group can lead the promotion of Maryland's military installations, as discussed in Section 8.3.1. Serving as the point of contact for Maryland's congressional delegation also provides an additional layer of support for the group that many respondents identified as crucial for Maryland's success in a future round of BRAC, as discussed in Section 5.1. 5.

8.3.3 Enhanced Use Leases

An additional way for Maryland to support local companies and simultaneously demonstrate the value of its military bases is to sign enhanced use leases with local companies. Enhanced use leases allow local companies, generally DoD contractors, to rent unused office space on Maryland's military installations. These leases benefit local businesses that are closer to their clients and end users. The leases also benefit the military bases by effectively lowering their operating costs. Cost is a major consideration for the BRAC Commission after military value, so lowering the effective operating cost of a base is significant. Interviewees recommended that Maryland ensure that all military installations in the state utilize enhanced use leases in order to further insulate the state from risks posed by BRAC.

8.3.4 Commercialization

As discussed in Section 8.2.3, focus group respondents and interviewees believed that commercialization would benefit the state's economy by encouraging diversification and the growth of small businesses. However, interviewees mentioned that technology transfer and commercialization would also make it less likely for Maryland to experience base closure or program loss in a future round of BRAC. Interviewees argued that the DoD considered commercialization as a strength of a military installation, and would be less likely to close a base that was well integrated with the local economy.

Section 9: Conclusion

The defense industry constitutes a large part of Maryland's economy. Defense contracting drives over three percent of Maryland's private nonfarm employment, output, and wages. Jobs in the defense industry are, on average, better paying than the average job in the state. Maryland's military installations and associated contractors have created a thriving ecosystem that led Maryland to be a net gainer during the last round of BRAC and may allow Maryland to thrive in an upcoming round.

Although the state is in an extremely good position, it is not without its weaknesses. In some ways, Maryland has become a victim of its own success, as Maryland's infrastructure has failed to keep pace with its rapidly expanding population. A focus on infrastructure, such as reducing traffic or extending broadband internet to all corners of the state, will help the state attract and retain talent.

Attracting the modern workforce to Maryland may be the biggest challenge facing the state, and all of the challenges identified in Section 5.2 come back to the issue in some manner. Maryland's focus should be on making the state a more attractive place for workers to settle, on graduating more high-quality workers from Maryland colleges and universities, and making sure that Maryland entrepreneurs have the tools they need to succeed.

Although Maryland has its challenges, and faces threats such as future BRAC rounds or changes in defense spending, the state is in a strong position. Maryland's defense community has provided tools such as a highly educated workforce and a network of businesses with experience in different industries. With the opportunities that Maryland has to commercialize some of the technology developed on its bases and to capitalize on the increasing importance of its cybersecurity resources and unmanned aerial systems programs, Maryland can continue its strong relationship with the defense industry while also diversifying its communities to deal with adverse shocks.

If adverse shocks do occur to the defense industry within Maryland, the professional, scientific, and technical services industry will be particularly hard hit. For example, a ten percent reduction in DoD contracts in Maryland would lead to a job loss of 11,475 jobs, 3,824 of which would be in Professional, Scientific, and Technical services. This industry includes highly-educated engineers and cybersecurity experts. Throughout the different scenarios that the RESI team modeled, this industry was the most affected by changes in the defense industry.

This educated workforce can drive entrepreneurship and growth in the region and cement Maryland's place as a national innovation hub, like Boston, Austin, and San Francisco. The challenge is in creating an economy that provides opportunities and is diversified enough to withstand downturns in the defense budget. Focus group participants and subject matter experts highlighted several key policy ideas to help diversify Maryland's economy, including an increased

focus on workforce development programs, tax incentives for key industries, and BRAC-prepping Maryland's economy by promoting the unique strengths and capabilities of the state's military installations. Many of the policy recommendations, such as the development of new incubators and the commercialization of products developed at Maryland's military installations, are already occurring and signal that Maryland may be able to diversify its economy with relative ease.

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Appendix A: Focus Group and Interview Participants and Guides

To conduct the SWOT analysis, the RESI team conducted four focus groups and interviewed 22 subject matter experts. The A schedule of focus groups and interviews is presented below, along with a list of attendees.

June 13, 2016: Technology Transfer Officers from Southern Maryland Bases

Attendees:

- Christopher Wilhelm
- Loraine Harting
- Richard Tam
- Daniel Pines

June 17, 2016: County Economic Development Managers from Southern Maryland

Attendees:

- Robin Finnacom
- Marcia Keeth
- Kelly Slagle
- Linda Vassallo
- John Hartline

July 14, 2016: County Economic Development Managers from Central Maryland

Attendees:

- Laurie Boyer
- Will Anderson
- Miriam Pemberton
- Mary Burkholder
- Tom Sadowski
- Vernon Thompson

August 22, 2016: County Economic Development Managers from Frederick County

Attendees:

- Helen Propheter
- Jodie Bollinger
- Bobby Baumler
- Katie Albaugh
- Sandy Wagerman
- Sherman Coleman
- Patty McDonald
- Michele Day

In addition to focus groups, the RESI team conducted interviews with 22 subject matter experts, including:

- July 25, 2016: Jennifer Havermann
  - AFCEA Central Maryland Chapter President
- July 26, 2016: Ivan Caplan
  - President of Maritime Technology Alliance
- July 26, 2016: Jill McClune
  - President of the Army Alliance
- July 28, 2016: Delegate Sally Jameson
  - MMIC Council Member, member of BRAC Advisory Group, and Maryland State Delegate
- August 1, 2016: Deon Viergutz
  - President of Fort Meade Alliance and member of BRAC Advisory Group
- August 25, 2016: Betsy Bretz and Daniel Marin
  - Chair of Federal Research Center at White Oak
- August 26, 2016: Dr. Frazier Glenn
  - Member of BRAC Advisory Group
- August 30, 2016: Randy Rippin
  - NDIA Aberdeen Proving Ground Chapter President
- August 30, 2016: Patty Snee and Miriam Pemberton
  - Institute for Policy Studies Research Fellow; Progressive Maryland Member
- August 31, 2016: George Schlossberg
  - MMIC Council Member and member of BRAC Advisory Group
- September 22, 2016: David Berteau
  - CEO of Professional Services Council
- September 27, 2016: Jennifer Riggs-Driban
  - District Director for Congressman Ruppersberger
- September 29, 2016: Amy Stratton
  - Howard County District Manager for Congressman Elijah E. Cummings
- October 26, 2016: Jim Reid
  - Director of International Association of Machinists and Aerospace Workers Safety and Health
- November 17, 2016: Debra Shapiro
  - Maryland Business Owner and Survey Respondent
- November 17, 2016: Dean Johnson
  - Maryland Business Owner and Survey Respondent
- November 17, 2016: Donald Morin
  - Maryland Business Owner and Survey Respondent
- December 16, 2016: Dana Sleeper
  - Executive Director of Maryland, DC, Virginia Solar Energy Industries Association

- January 31, 2017: Kenneth Farquhar
  - President, Business Unit General manager at ManTech International
- February 2, 2017: Brian Simmons
  - Senior Vice President at Sigmatech, Inc.

Focus groups and interviews were semi-structured. As such, not all questions were asked from each guide, and many additional questions were asked to allow respondents to elaborate on points they raised, and to provide more information relevant to their knowledge area.

A.1 Focus Group Questions for Technology Transfer Officers (June 13th)

1. Tell me about your role as a TTO.
   a. What types of products are you responsible for taking to the private sector to commercialize?
   b. What industries are supported?
   c. What are the size of the companies you work with?
   d. What is the relative health of the companies you work with?
2. In your experience, how has the state of the local economy affected your ability to find firms to partner with?
   a. What makes it easier to find firms to partner with?
   b. What makes firms less willing to partner?
3. What about Southern Maryland's infrastructure, such as roads, manufacturing facilities, utilities, and internet, make it easy to find firms to partner with?
   a. What about Southern Maryland's infrastructure makes it difficult?
   b. Is this the same across Maryland?
   c. What about other states? Is there a region of the country you think is a model?
4. Often, products brought to businesses to commercialize may be a way from their final use state; how able are local businesses to commercialize a product that you bring to them?
   a. What would make Southern Maryland businesses better able to commercialize the products you bring them?
5. Is there support at the state and local government levels for these businesses while they try to commercialize products from your office?
   a. What are state and local barriers to commercialization?
   b. What would improve things?
6. How well suited is the local workforce to commercializing products originating from your office?
   a. What skillsets are lacking?
   b. Do the firms you work with have trouble recruiting skilled personnel?
7. How do you rate the education systems in Maryland?
   a. What should they focus on more to better support your current work?
8. Where do you see your research shifting to in 5-10 years?
   a. How can the area begin preparing to support that shift?
9. How was your role impacted by the recession?

   a. How would you anticipate your role changing under future BRACs?
10. Would you consider the companies you work with to be leading edge or innovative in their respective fields?
   a. Is this a strength or weakness?
   b. How can innovation in local companies be improved?

A.2 Focus Group Questions for Southern Maryland Economic Development Managers

1. Tell me a little about your role in economic development for your area.
2. How would you characterize the level of DoD funding in your area?
   a. What are the main industries that rely on DoD funding?
   b. How does this compare with the economic makeup of the county as a whole?
3. What is the current state of your county's economy?
4. How would you describe your county's infrastructure, such as roads, manufacturing facilities, utilities, internet, and telecommunications?
   a. What are its strengths?
   b. What is missing?
   c. What is present, but could be improved on?
   d. Do you have a sense of how the companies who rely on DoD funding use this infrastructure?
5. How is innovation supported in your county?
6. How do you account for DoD funding of military bases and DOD-specific industries in your economic development plans?
   a. Do you consider defense-related industries to be relatively stable or risky compared to other industries?
   b. How do you view the long-term potential for defense-related industries?
7. How does your office/county work with businesses to help them secure DoD funding?
   a. What could be improved?
   b. What should your office/county stop doing?
8. What is the workforce like in your county?
   a. What is their education level?
   b. What skillsets are most common?
   c. What are your strengths and weaknesses in this area?
9. How well suited is the workforce in your county to working with DoD?
   a. What industries do you think your workforce is best able to work on, currently?
   b. In 10 years, what industries do you think your workforce will best be able to support?
      i. How do these industries relate to the DoD?
10. What are the growth industries in your county/area now? Do these match where your workforce is heading?
   a. How do DoD-related industries fit into this?
11. What strategies would be most beneficial to attracting new businesses to the area?
12. How did your county handle the recession?
   a. What strategies did you employ to recover?

   b. How did changes in DoD funding contribute to this?

A.3 Focus Group for Central Maryland Economic Development Mangers

1. Tell us your name and role.
2. How would you characterize the level of DoD funding in your knowledge area?
   a. What are the main industries that rely on DoD funding?
   b. How does this compare with the economic makeup of the area as a whole?
3. How do you account for DoD funding of military bases and DoD-specific industries in your economic development plans or research?
   a. Do you consider defense-related industries to be relatively stable or risky compared to other industries?
   b. How do you view the long-term potential for defense-related industries?
4. How is innovation supported in your county, university system, or in Maryland as a whole?
   a. What would you like to do differently?
   b. What do you think limits innovation in your county, university system, or in Maryland as a whole?
5. How are you trying to diversify your economy, currently?
   a. What industries are you trying to attract?
   b. What challenges are you facing (e.g., infrastructure, workforce)?
   c. What would make it easier?
6. In your opinion, how well suited is the workforce to working with the DoD?
   a. In 10 years, what industries do you think the workforce will best be able to support?
7. What are the growth industries in your county/area now? Do these match where the workforce is heading?
   a. How do DoD-related industries fit into this?
8. What one or two things could the State of Maryland do to most effectively increase economic development and diversification?
9. How did your area handle the recession, the last round of Base Realignment and Closure (BRAC), and sequestration?

A.4 Focus Group Guide for Frederick Area Economic Development Managers

1. Tell us your name and role.
2. How would you characterize the level of DoD funding in Frederick County?
    a. How important is Fort Detrick to local businesses?
    b. What are the main industries that rely on DoD funding?
    c. How does this compare with the economic makeup of the area as a whole?
3. How do you account for DoD funding of military bases and DoD-specific industries in your economic development plans or research?
    a. Do you consider defense-related industries to be relatively stable or risky compared to other industries?
    b. How do you view the long-term potential for defense-related industries?
4. How is innovation supported in Frederick County, or in Maryland as a whole?
    c. What would you like to do differently?
    d. What do you think limits innovation in Frederick, or in Maryland as a whole?
5. How are you trying to diversify your economy, currently?
    a. What industries are you trying to attract?
    b. What challenges are you facing (e.g., infrastructure, workforce)?
    c. What would make it easier?
6. In your opinion, how well suited is the workforce to working with the DoD?
    b. In 10 years, what industries do you think the workforce will best be able to support?
7. What are the growth industries in Frederick County now? Do these match where the workforce is heading?
    b. How do DoD-related industries fit into this?
8. What do you see as the biggest threats to Fort Detrick?
    a. What impact would these threats have on the local economy?
    b. What do you think the impact to Fort Detrick will be from another round of BRAC?
9. What one or two things could the State of Maryland do to most effectively increase economic development and diversification?
10. How did Frederick and Fort Detrick handle the recession, the last round of Base Realignment and Closure (BRAC), and sequestration?

A.5 Example 1 of an Interview Guide

1. Tell me about your background and role as President and Executive Vice president of Central Maryland Chapter of the AFCEA.
2. In your opinion, how well suited is the Maryland (and Central Maryland especially) workforce to working with the DoD?
    a. What are the gaps?
    b. What professions are in the highest demand?
    c. What is the AFCEA doing to help develop the workforce?
    d. What could the state of Maryland do to address gaps or future needs?
        i. For example, are there successful public-private partnerships addressing these needs in other states that Maryland could adopt?
3. How innovative would you describe the business climate in Maryland?
    a. What would you like to do differently?
    b. What do you think limits innovation in Maryland as a whole?
4. What do you think of Maryland's infrastructure (i.e., roads, railroads, utilities, and internet)?
    a. How well does it support Maryland military installations?
    b. How well does it support Maryland businesses?
    c. What could be improved?
5. One important aspect of this grant is to identify ways to diversify Maryland's economy and to help local businesses diversify in the event of another round of sequestration or budget cuts. What can the State of Maryland do to most effectively increase economic development and diversification in the area?
    a. Are there other states nearby pursuing strategies that Maryland should adopt as well?
6. What do you see as the biggest threats to Maryland's DoD-infrastructure?
    a. What impact would these threats have on the local economy?
    b. What do you think the impact will be from another round of BRAC?
7. Out of everything we have talked about, what are your top two or three recommendations to the state of Maryland?

A.6 Example 2 of an Interview Guide

1. Tell me about your background and role as an MMIC council member.
    a. What is the nature of firms around APG? How many are tied into the military base?
    b. What other industries are common?
    c. How reliant is this area on DoD funding?
2. What do you think of Maryland's infrastructure (i.e., roads, railroads, utilities, and internet)?
    a. How well does it support Maryland military installations?
    b. How well does it support Maryland businesses?
    c. What could be improved?
3. In your opinion, how well suited is the workforce to working with the DoD in and around APG?
    a. What are the gaps?
    b. What professions are in the highest demand?
    c. What could the state of Maryland do to address gaps or future needs?
4. One important aspect of this grant is to identify ways to diversify Maryland's economy and to help local businesses diversify in the event of another round of sequestration or budget cuts. What are some ways that businesses partnering with APG can diversify and strengthen?
    a. What could the state of Maryland do to help businesses looking to grow and diversify?
5. How innovative would you describe the business climate around APG?
    a. What would you like to do differently?
    b. What do you think limits innovation around APG or in Maryland as a whole?
6. What do you see as the biggest threats to APG?
    a. What impact would these threats have on the local economy?
    b. What do you think the impact to APG will be from another round of BRAC?
7. Out of everything we have talked about, what are your top two or three recommendations to the state of Maryland?

Appendix B: Vulnerability and Policy Change Analysis Methodology

To determine the economic impacts of the defense-intensive industry, as well as the impact from several scenarios, the RESI team analyzed data from USA Spending using the economic modeling software Regional Economic Models, Inc. (REMI) PI+.

B.1 USA Spending Data

USA Spending is a publicly available dataset containing information on all businesses and individuals receiving federal funds. The RESI team downloaded the national dataset and used all records for contracts awarded either to Maryland-based vendors or where the listed place of performance was inside Maryland. The data for this analysis were extracted from USA Spending on June 15, 2016. The team then geocoded the data to determine the county of the vendor receiving funds. Although desirable, it is not possible to determine how much of each contract was spent within the county listed in USA Spending. For the purposes of our analysis, we assume that there is equal spillover across counties and states, and therefore used the full amount listed in USA Spending.

RESI's analysis covered a five-year period between 2011 and 2015. This period kept the analysis current and enabled the RESI team to reduce the influence of outliers from year to year, providing a better sense of the trends in Maryland's economy.

This analysis, as well as the *Cluster Analysis*,[163] relied on using NAICS codes from USA Spending to determine the effect of defense contracting on each sector of the economy. USA Spending includes over $300 million worth of entries with antiquated NAICS codes. To bring these observations into the analysis, 2002 and 2007 NAICS codes were mapped to 2012 NAICS codes using the NACIS code crosswalk from the U.S. Census Bureau.[164]

The team used the NAICS codes within USA Spending to map to the cluster definitions and the industry groupings within REMI PI+. However, a number of observations within USA Spending did not have a NAICS codes and were not able to be mapped and included in the analysis. Figure 75 displays the number of missing observations and the value of those observations. This number has generally trended downward due to better recordkeeping.

[163] Regional Economic Studies Institute of Towson University. "The Impact of Department of Defense Funding on Industry Clusters in the State of Maryland." 2017

[164] US Census Bureau, "North American Industry Classification System: Concordances," Accessed October 4, 2016, https://www.census.gov/eos/www/naics/concordances/concordances.html.

Figure 75: Number of Missing NAICS and Corresponding Dollars Obligated by Fiscal Year

Fiscal Year	Missing NAICS	Dollars Obligated
2011	122	$47,440,251
2012	74	$63,588,774
2013	51	$37,834,900
2014	38	$9,920,903
2015	28	$13,804,559

Sources: RESI, USA Spending

B.2 Regional and State Vulnerability Analysis

To determine the relative dependence on DoD contracting across Maryland, the RESI team examined five separate regions, as well as the state. The definitions for the five regions can be found below.

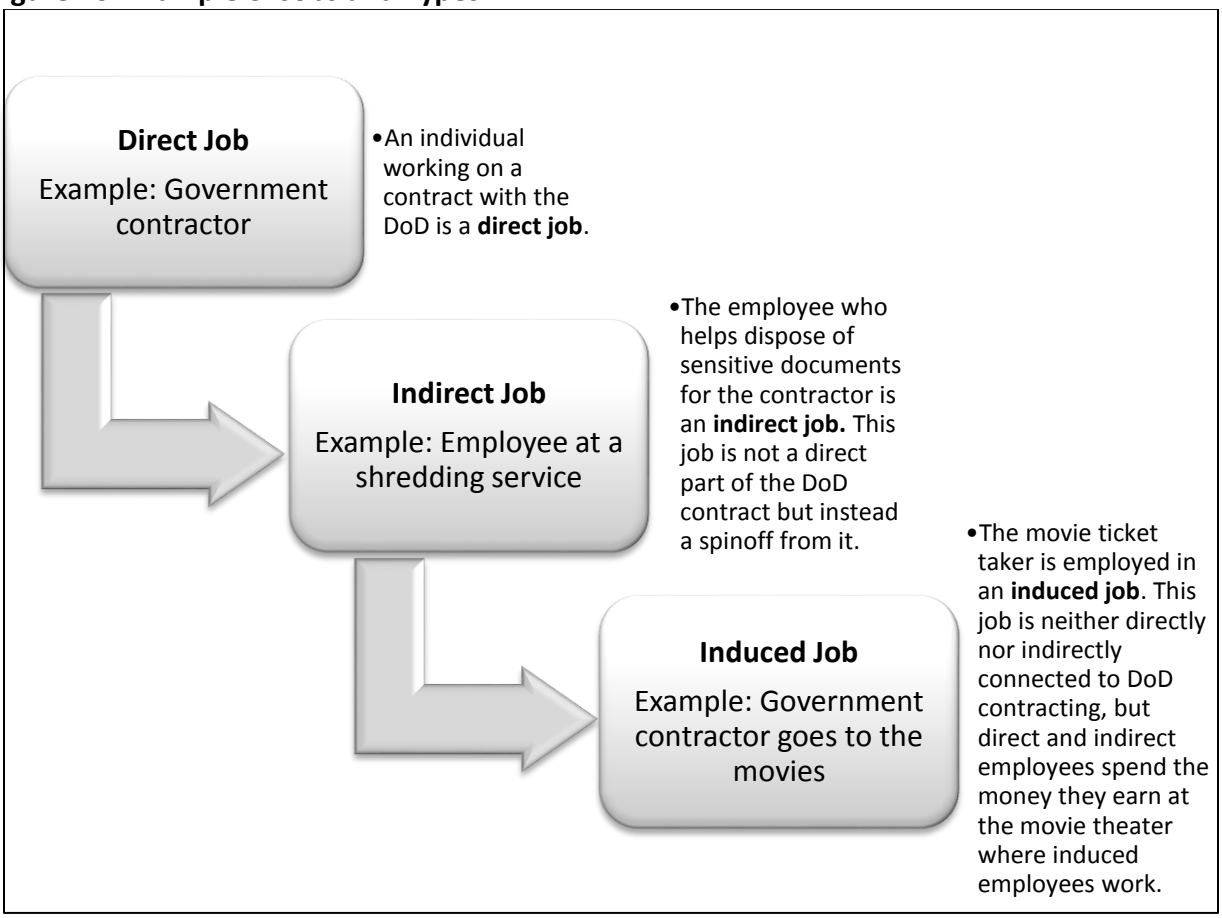
1. **Central Maryland**: Baltimore City and Harford, Baltimore, Carroll, Anne Arundel, and Howard Counties
2. **Southern Maryland**: St. Mary's, Charles, and Calvert Counties
3. **Capital Maryland**: Frederick, Montgomery, and Prince George's Counties
4. **Western Maryland**: Garrett, Allegany, and Washington Counties
5. **Eastern Shore**: Cecil, Kent, Queen Anne's, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester Counties

The team used Regional Economic Models, Inc. (REMI) PI+ model version 1.7, economic impact analysis software, to model the impact of defense contracting on each region and for the state. The REMI PI+ model is a high-end dynamic modeling tool that various federal and state government agencies use in economic policy analysis. Utilization of REMI PI+ helps RESI to build a sophisticated model calibrated to the specific demographic features of each region. This model enumerates the economic and fiscal impacts of each dollar earned and spent by the following: employees relating to the economic event, other supporting vendors (business services, retail, etc.), each dollar spent by these vendors on other firms, and each dollar spent by the households of the event's employees, other vendors' employees, and other businesses' employees.

REMI PI+ features the ability to capture price effects, wage changes, and behavioral effects through time. Another benefit of the model compared to traditional static models, such as IMPLAN, is that the regional constraint is built in to account for limited resources over time. This constraint is built into the model using current industry data and employment information from Bureau of Economic Analysis (BEA) data. The REMI PI+ model also allows RESI to capture the effects occurring between industries and minimize the potential for double-counting in employment, output, and wages. The ability to capture effects throughout time provides a detailed representation of an economic event and its effects on the study area over time.

Economic impacts include employment, output, and wages. Within each category, RESI has designated certain impacts as direct, indirect, and induced. To better understand these impacts and how they apply to this analysis, please refer to Figure 76 below.

Figure 76: Example of Jobs and Types



Source: RESI

REMI PI+ does not permit the user to separate the indirect and induced impacts. However, direct impacts have been separated to provide the user with a better sense of the impacts that are directly related to DoD contracting.

The team totaled dollars obligated within USA Spending by NAICS code and region and mapped this information into REMI PI+ using REMI PI+'s industry codes. The team then ran the REMI PI+ model to determine the economic impacts for each region in terms of employment, output, and wages. REMI PI+ also reports employment impacts at the NAICS code level. In this paper, wages estimated through REMI PI+ are presented in nominal dollars while output estimated through REMI PI+ is presented in chained 2009 dollars. Output is reported this way to remain consistent with how the BEA reports measures of output and GDP, while wages are reported in nominal

dollars to remain consistent with sources such as QCEW.[165] BEA uses chained dollars instead of real or nominal dollars because chain weighting is more accurate for GDP and output measures.[166]

The RESI team also examined the impact of defense contracting on occupations for Maryland. The RESI team used its proprietary PROM tool, which takes economic impact data at the NAICS level and, using County Business Pattern data and OES data, returns information on the impact to different occupation types.

To quantify vulnerability, the RESI team calculated a dependency ratio for each region, as well as for Maryland overall. The dependency ratio measures how much of the area's jobs, output, and total wages relies on DoD contracting. For employment, this ratio was calculated as the total economic impact of defense contracting (including direct, indirect, and induced jobs) divided by the total number of jobs in the region, as calculated by REMI PI+. Output and wages followed a similar calculation.

B.3 Policy Change Analysis

To conduct the policy change analysis, the RESI team examined four different scenarios, based upon focus groups, interviews, and the results of the cluster analysis, which measured the economic impact to Maryland and regional economies for different shocks to government contracting. These scenarios include the following:

1. A ten percent budget cut in defense contracting,
2. A ten percent reduction in R&D funding within Maryland,
3. A ten percent increase in cybersecurity funding within Maryland, and
4. The impact of a major defense contractor leaving the state.

Like the Regional and State Vulnerability Analysis, impacts were calculated within REMI PI+ using USA Spending data. The scenarios and the assumptions used to create them are described below.

B.3.1 Methodology Behind the Ten Percent Budget Cut in Defense Contracting

To analyze these data, the RESI team used the inputs for the Regional and State Vulnerability Analysis and reduced all dollars obligated by ten percent. Data were modeled using REMI PI+, as described in Section 6.2.

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[165] BEA. "National Income and Product Accounts - Gross Domestic Product: Third Quarter 2016 (Third Estimate) Corporate Profits: Third Quarter 2016 (Revised Estimate)." BEA (December 22, 2016). Accessed January 13, 2016. https://www.bea.gov/newsreleases/national/gdp/gdpnewsrelease.htm

[166] Steindel, Charles. "Chain-Weighting: The New Approach to Measuring GDP." Federal Reserve Bank of New York. Current Issues in Economics and Finance. (December 1995). Accessed January 13, 2017. http://users.wfu.edu/cottrell/ecn207/readings/chained.pdf

B.3.2 Methodology Behind the Ten Percent Reduction in R&D Funding Within Maryland

To collect the data for this scenario, the RESI team examined all contracts within USA Spending with a psc category code of "A," which signifies spending in R&D. Dollars obligated were summed across NAICS codes and regions. The RESI team took ten percent of the total dollars obligated per NAICS and region and entered these values into REMI PI+ as a decrease in industry sales/revenue. The models were then run as described in Section 6.2.

B.3.3 Methodology Behind the Ten Percent Increase in Cybersecurity Funding Within Maryland

Focus group participants, interviewees, and results from the cluster analysis all point to cybersecurity being a key industry in the area. To calculate the economic impacts of cybersecurity increasing, potentially due to new programs locating in-state due to BRAC or the cyber command becoming combatant, the RESI team looked at all contracts in the USA Spending data with a psc category code of "D," indicating spending on IT and cybersecurity. Like the steps described in Section 6.3.2, the RESI team summed up the total dollars obligated for each NAICS and region. For each NAICS and region combination, the RESI team calculated ten percent of the total dollars obligated and entered this into REMI PI+ as an increase in industry sales/revenue. The models were then run as described in Section 6.2.

B.3.4 Methodology Behind the Impact of a Major Defense Contractor Leaving the State

To determine the impact of a large contractor leaving the state, the team first created an economic profile of the defense contractor that would be leaving. The team used USA Spending data to collect information on the four firms with the most dollars obligated within Maryland. The team then used Reference USA, a marketing and employment database, to view the economic profiles of these four companies. Reference USA lists the company name, the primary NAICS code for the location, and an estimate of sales volume for that company-NAICS code combination. Because most locations were spread across the Capital and Central Maryland regions for all companies examined, the RESI team's composite defense contractor was assumed to have half of its revenue generated in each region. The RESI team took the average dollars obligated by NAICS code for the four large companies and created a profile to input into REMI PI+, as seen below in Figure 77.

Figure 77: Sales Per Region by NAICS Code for Aggregated Large Defense Contractor

Primary NAICS Code	REMI Industry Name	Sales Per Region (Capital and Central)
334511	Computer and electronic product manufacturing	$463,503,232
423690	Wholesale trade	$57,365,752
441228	Retail trade	$200,250
519190	Internet publishing and broadcasting; ISPs, search portals, and data processing; Other information services	$275,125
522130	Monetary authorities - central bank; Credit intermediation and related activities; Funds, trusts, & other financial vehicles	$499,375
54	Professional, scientific, and technical services	$26,469,250
561210	Administrative and support services	$17,250
811212	Repair and maintenance	$315,375

Sources: Reference USA, RESI

The RESI team incorporated these data into REMI PI+ and analyzed the output consistent with the method described in Section B.2.

Appendix C: Defense Contracting's Impact on Output and Wages in Maryland by NAICS Code

This Appendix contains detailed tables with additional information beyond that which is provided in Section 6. These tables show the direct, indirect/induced, and total impacts of defense contracting, in terms of wages and output, to the economies of Maryland and each of the five regions.

C.1 Defense Contracting's Impact on Output in Maryland by NAICS Code

The tables in this section present the impact of defense contracting on Maryland and each of the five regions in terms of output. Direct, indirect/induced, and total effects are separated out.

Figure 78: The Average Annual Impact of Defense Contracting on Output in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$321,531	$1,633,977	$1,955,508
Mining	$26,183	$14,411,978	$14,438,161
Utilities	$74,113,763	$112,766,217	$186,879,981
Construction	$1,361,283,762	$1,278,667,690	$2,639,951,452
Manufacturing	$594,495,049	$382,688,179	$977,183,228
Wholesale Trade	$28,391,837	$236,537,574	$264,929,411
Retail Trade	$66,484,977	$557,017,249	$623,502,226
Transportation and Warehousing	$96,002,523	$138,420,210	$234,422,733
Information	$419,212,809	$346,083,648	$765,296,457
Finance and Insurance	$49,824,691	$427,774,178	$477,598,869
Real Estate and Rental and Leasing	$3,862,681	$763,575,808	$767,438,489
Professional, Scientific, and Technical Services	$4,702,697,870	$909,740,109	$5,612,437,979
Management of Companies and Enterprises	$0	$84,845,635	$84,845,635
Administrative and Waste Management Services	$535,471,948	$359,828,303	$895,300,251
Educational Services	$36,308,994	$46,900,781	$83,209,775
Health Care and Social Assistance	$286,263,719	$470,691,559	$756,955,278
Arts, Entertainment, and Recreation	$1,021,197	$59,496,369	$60,517,566
Accommodation and Food Services	$148,985,834	$257,357,799	$406,343,633
Other Services, except Public Administration	$44,890,821	$183,248,219	$228,139,040
Total	**$8,449,660,189**	**$6,631,685,482**	**$15,081,345,672**

Sources: REMI PI+, RESI

Figure 79: The Average Annual Impact of Defense Contracting on Output in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$45,432	$510,932	$556,364
Mining	$23,876	$2,949,468	$2,973,344
Utilities	$14,649,306	$19,880,761	$34,530,068
Construction	$562,466,370	$414,917,433	$977,383,802
Manufacturing	$180,754,467	$69,067,818	$249,822,285
Wholesale Trade	$11,317,174	$62,069,686	$73,386,860
Retail Trade	$46,734,440	$154,363,459	$201,097,898
Transportation and Warehousing	$53,214,860	$31,699,979	$84,914,839
Information	$205,138,884	$154,718,821	$359,857,705
Finance and Insurance	$10,086	$140,447,228	$140,457,314
Real Estate and Rental and Leasing	$1,241,551	$300,214,783	$301,456,334
Professional, Scientific, and Technical Services	$2,043,632,771	$369,296,510	$2,412,929,281
Management of Companies and Enterprises	$0	$36,813,760	$36,813,760
Administrative and Waste Management Services	$275,398,906	$117,105,054	$392,503,960
Educational Services	$26,300,068	$7,464,572	$33,764,640
Health Care and Social Assistance	$106,851,535	$120,352,939	$227,204,474
Arts, Entertainment, and Recreation	$741,736	$14,722,357	$15,464,092
Accommodation and Food Services	$137,876,885	$85,610,335	$223,487,220
Other Services, except Public Administration	$10,110,353	$53,249,510	$63,359,863
Total	**$3,676,508,700**	**$2,155,455,405**	**$5,831,964,103**

Sources: REMI PI+, RESI

Figure 80: The Average Annual Impact of Defense Contracting on Output in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$261,253	$397,571	$658,824
Mining	$1,545	$9,927,877	$9,929,422
Utilities	$58,410,328	$72,237,266	$130,647,594
Construction	$711,198,610	$732,316,081	$1,443,514,691
Manufacturing	$404,095,124	$264,695,722	$668,790,846
Wholesale Trade	$15,432,883	$165,303,035	$180,735,918
Retail Trade	$16,734,627	$331,663,531	$348,398,159
Transportation and Warehousing	$42,685,776	$80,867,944	$123,553,720
Information	$210,498,469	$176,396,124	$386,894,592
Finance and Insurance	$49,814,576	$265,273,759	$315,088,336
Real Estate and Rental and Leasing	$2,292,113	$439,660,607	$441,952,719
Professional, Scientific, and Technical Services	$2,133,253,772	$493,640,564	$2,626,894,336
Management of Companies and Enterprises	$0	$45,421,951	$45,421,951
Administrative and Waste Management Services	$238,407,435	$219,453,551	$457,860,985
Educational Services	$9,835,942	$38,091,179	$47,927,121
Health Care and Social Assistance	$177,162,061	$310,068,469	$487,230,530
Arts, Entertainment, and Recreation	$270,220	$42,522,299	$42,792,519
Accommodation and Food Services	$10,614,739	$146,000,853	$156,615,593
Other Services, except Public Administration	$29,715,867	$115,699,166	$145,415,034
Total	**$4,110,685,340**	**$3,949,637,549**	**$8,060,322,890**

Sources: REMI PI+, RESI

Figure 81: The Average Annual Impact of Defense Contracting on Output in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$12,360	$349,724	$362,084
Mining	$762	$586,555	$587,317
Utilities	$17,957	$1,873,480	$1,891,437
Construction	$12,804,640	$17,136,997	$29,941,637
Manufacturing	$4,004,392	$27,040,943	$31,045,335
Wholesale Trade	$1,338,190	$4,350,133	$5,688,323
Retail Trade	$41,052	$13,101,337	$13,142,389
Transportation and Warehousing	$23,244	$3,194,735	$3,217,979
Information	$3,398	$5,445,076	$5,448,474
Finance and Insurance	$0	$4,734,358	$4,734,358
Real Estate and Rental and Leasing	$62,047	$6,512,057	$6,574,104
Professional, Scientific, and Technical Services	$8,638,680	$9,109,093	$17,747,774
Management of Companies and Enterprises	$0	$912,155	$912,155
Administrative and Waste Management Services	$680,597	$6,437,084	$7,117,681
Educational Services	$7,502	$570,601	$578,102
Health Care and Social Assistance	$18,372	$9,997,934	$10,016,305
Arts, Entertainment, and Recreation	$2,077	$1,093,819	$1,095,896
Accommodation and Food Services	$144,784	$6,039,582	$6,184,366
Other Services, except Public Administration	$64,894	$3,438,519	$3,503,413
Total	**$27,864,948**	**$121,924,182**	**$149,789,129**

Sources: REMI PI+, RESI

Figure 82: The Average Annual Impact of Defense Contracting on Output in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$352,354	$352,354
Mining	$0	$79,886	$79,886
Utilities	$940,131	$17,907,160	$18,847,292
Construction	$73,868,193	$105,287,971	$179,156,164
Manufacturing	$5,066,682	$9,597,262	$14,663,944
Wholesale Trade	$88,224	$2,920,952	$3,009,176
Retail Trade	$2,941,603	$47,113,981	$50,055,584
Transportation and Warehousing	$69,757	$20,194,809	$20,264,566
Information	$3,553,727	$6,952,943	$10,506,671
Finance and Insurance	$28	$9,311,734	$9,311,762
Real Estate and Rental and Leasing	$255,669	$14,869,884	$15,125,552
Professional, Scientific, and Technical Services	$511,061,792	$36,331,581	$547,393,373
Management of Companies and Enterprises	$0	$1,162,110	$1,162,110
Administrative and Waste Management Services	$13,409,426	$13,155,970	$26,565,397
Educational Services	$165,189	$554,070	$719,259
Health Care and Social Assistance	$2,231,751	$24,233,278	$26,465,029
Arts, Entertainment, and Recreation	$7,164	$952,487	$959,652
Accommodation and Food Services	$327,104	$16,744,742	$17,071,846
Other Services, except Public Administration	$4,911,653	$9,278,581	$14,190,234
Total	**$618,898,093**	**$337,001,755**	**$955,899,851**

Sources: REMI PI+, RESI

Figure 83: The Average Annual Impact of Defense Contracting on Output in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$2,486	$23,396	$25,882
Mining	$0	$868,191	$868,191
Utilities	$96,041	$867,550	$963,590
Construction	$945,949	$9,009,208	$9,955,157
Manufacturing	$574,384	$12,286,435	$12,860,819
Wholesale Trade	$215,366	$1,893,769	$2,109,134
Retail Trade	$33,254	$10,774,941	$10,808,195
Transportation and Warehousing	$8,886	$2,462,743	$2,471,629
Information	$18,331	$2,570,684	$2,589,015
Finance and Insurance	$0	$8,007,100	$8,007,100
Real Estate and Rental and Leasing	$11,301	$2,318,478	$2,329,779
Professional, Scientific, and Technical Services	$6,110,854	$1,362,361	$7,473,216
Management of Companies and Enterprises	$0	$535,659	$535,659
Administrative and Waste Management Services	$7,575,584	$3,676,645	$11,252,229
Educational Services	$294	$220,360	$220,654
Health Care and Social Assistance	$0	$6,038,939	$6,038,939
Arts, Entertainment, and Recreation	$0	$205,406	$205,406
Accommodation and Food Services	$22,322	$2,962,286	$2,984,608
Other Services, except Public Administration	$88,054	$1,582,443	$1,670,497
Total	**$15,703,106**	**$67,666,594**	**$83,369,699**

Sources: REMI PI+, RESI

C.2 Defense Contracting's Impact on Wages in Maryland by NAICS Code

The tables in this section present the impact of defense contracting on Maryland and each of the five regions in terms of total wages. Direct, indirect/induced, and total effects are separated out.

Figure 84: The Average Annual Impact of Defense Contracting on Wages in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$206,289	$422,693	$628,982
Mining	$21,708	$1,407,810	$1,429,518
Utilities	$12,253,678	$18,376,515	$30,630,193
Construction	$519,439,188	$483,689,941	$1,003,129,130
Manufacturing	$94,527,103	$70,222,474	$164,749,578
Wholesale Trade	$10,808,798	$86,812,885	$97,621,683
Retail Trade	$24,600,674	$199,570,325	$224,170,999
Transportation and Warehousing	$35,553,739	$58,092,803	$93,646,541
Information	$54,114,376	$48,780,884	$102,895,260
Finance and Insurance	$15,047,712	$99,906,935	$114,954,647
Real Estate and Rental and Leasing	$165,293	$35,225,552	$35,390,845
Professional, Scientific, and Technical Services	$2,251,596,514	$424,385,748	$2,675,982,262
Management of Companies and Enterprises	$0	$48,922,958	$48,922,958
Administrative and Waste Management Services	$236,681,920	$162,751,078	$399,432,998
Educational Services	$20,567,513	$30,276,190	$50,843,703
Health Care and Social Assistance	$119,034,138	$233,277,982	$352,312,120
Arts, Entertainment, and Recreation	$321,453	$19,528,324	$19,849,777
Accommodation and Food Services	$54,451,014	$86,280,599	$140,731,613
Other Services, except Public Administration	$16,207,886	$95,126,410	$111,334,296
Total	**$3,465,598,996**	**$2,203,058,106**	**$5,668,657,103**

Sources: REMI PI+, RESI

Figure 85: The Average Annual Impact of Defense Contracting on Wages in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$27,500	$151,795	$179,296
Mining	$21,525	$435,074	$456,599
Utilities	$1,826,735	$2,466,561	$4,293,296
Construction	$205,106,774	$149,618,634	$354,725,407
Manufacturing	$27,405,822	$14,540,686	$41,946,508
Wholesale Trade	$4,516,596	$23,931,000	$28,447,596
Retail Trade	$17,554,240	$57,642,537	$75,196,778
Transportation and Warehousing	$19,404,447	$12,302,217	$31,706,664
Information	$27,864,354	$22,856,086	$50,720,441
Finance and Insurance	$2,541	$31,363,832	$31,366,373
Real Estate and Rental and Leasing	$57,781	$14,309,777	$14,367,558
Professional, Scientific, and Technical Services	$982,899,876	$175,997,610	$1,158,897,486
Management of Companies and Enterprises	$0	$23,532,662	$23,532,662
Administrative and Waste Management Services	$132,317,905	$54,641,372	$186,959,276
Educational Services	$13,741,696	$3,885,855	$17,627,551
Health Care and Social Assistance	$45,069,897	$59,892,535	$104,962,432
Arts, Entertainment, and Recreation	$238,197	$4,971,648	$5,209,845
Accommodation and Food Services	$50,206,748	$26,312,397	$76,519,146
Other Services, except Public Administration	$4,464,905	$31,089,302	$35,554,207
Total	**$1,532,727,539**	**$709,941,580**	**$2,242,669,121**

Sources: REMI PI+, RESI

Figure 86: The Average Annual Impact of Defense Contracting on Wages in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$168,172	$174,179	$342,352
Mining	$89	$654,528	$654,617
Utilities	$10,254,910	$12,479,765	$22,734,675
Construction	$283,958,586	$288,814,147	$572,772,733
Manufacturing	$65,791,243	$47,525,372	$113,316,615
Wholesale Trade	$5,778,684	$59,910,237	$65,688,921
Retail Trade	$6,053,830	$119,230,961	$125,284,791
Transportation and Warehousing	$16,115,931	$34,727,403	$50,843,333
Information	$25,840,927	$24,187,213	$50,028,140
Finance and Insurance	$15,045,168	$63,822,538	$78,867,706
Real Estate and Rental and Leasing	$95,396	$20,007,796	$20,103,192
Professional, Scientific, and Technical Services	$1,020,468,317	$227,866,375	$1,248,334,691
Management of Companies and Enterprises	$0	$24,151,304	$24,151,304
Administrative and Waste Management Services	$96,428,913	$100,194,274	$196,623,186
Educational Services	$6,740,758	$25,686,844	$32,427,602
Health Care and Social Assistance	$73,066,320	$154,243,379	$227,309,700
Arts, Entertainment, and Recreation	$81,140	$14,009,318	$14,090,458
Accommodation and Food Services	$4,096,214	$51,411,583	$55,507,797
Other Services, except Public Administration	$10,486,917	$57,383,083	$67,870,000
Total	**$1,640,471,515**	**$1,326,480,299**	**$2,966,951,813**

Sources: REMI PI+, RESI

Figure 87: The Average Annual Impact of Defense Contracting on Wages in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$9,167	$58,637	$67,803
Mining	$94	$112,758	$112,852
Utilities	$2,862	$296,827	$299,688
Construction	$3,589,703	$4,831,967	$8,421,670
Manufacturing	$694,409	$4,275,846	$4,970,255
Wholesale Trade	$412,187	$1,386,154	$1,798,341
Retail Trade	$12,332	$3,856,140	$3,868,473
Transportation and Warehousing	$4,506	$1,057,725	$1,062,231
Information	$423	$566,281	$566,704
Finance and Insurance	$0	$1,069,256	$1,069,256
Real Estate and Rental and Leasing	$485	$229,541	$230,026
Professional, Scientific, and Technical Services	$2,839,981	$2,992,321	$5,832,302
Management of Companies and Enterprises	$0	$446,194	$446,194
Administrative and Waste Management Services	$238,042	$2,086,184	$2,324,226
Educational Services	$4,114	$316,002	$320,115
Health Care and Social Assistance	$7,187	$4,866,354	$4,873,541
Arts, Entertainment, and Recreation	$523	$333,824	$334,348
Accommodation and Food Services	$23,900	$1,956,911	$1,980,812
Other Services, except Public Administration	$16,604	$1,464,914	$1,481,518
Total	**$7,856,519**	**$32,203,836**	**$40,060,355**

Sources: REMI PI+, RESI

Figure 88: The Average Annual Impact of Defense Contracting on Wages in Southern Maryland by NAICS

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$35,316	$35,316
Mining	$0	$13,832	$13,832
Utilities	$155,617	$2,999,407	$3,155,024
Construction	$26,472,274	$37,537,425	$64,009,699
Manufacturing	$488,458	$1,551,894	$2,040,352
Wholesale Trade	$30,186	$973,913	$1,004,099
Retail Trade	$969,134	$15,333,966	$16,303,100
Transportation and Warehousing	$24,613	$8,894,103	$8,918,716
Information	$406,308	$849,270	$1,255,577
Finance and Insurance	$3	$2,044,886	$2,044,889
Real Estate and Rental and Leasing	$11,464	$588,124	$599,588
Professional, Scientific, and Technical Services	$243,434,486	$17,089,973	$260,524,459
Management of Companies and Enterprises	$0	$524,634	$524,634
Administrative and Waste Management Services	$4,479,491	$4,445,494	$8,924,984
Educational Services	$80,789	$270,292	$351,081
Health Care and Social Assistance	$890,733	$11,605,408	$12,496,141
Arts, Entertainment, and Recreation	$1,592	$160,917	$162,509
Accommodation and Food Services	$118,122	$5,611,794	$5,729,916
Other Services, except Public Administration	$1,210,480	$4,503,283	$5,713,763
Total	**$278,773,750**	**$115,033,931**	**$393,807,679**

Sources: REMI PI+, RESI

Figure 89: The Average Annual Impact of Defense Contracting on Wages in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$1,450	$2,765	$4,215
Mining	$0	$191,619	$191,619
Utilities	$13,554	$133,956	$147,510
Construction	$311,852	$2,887,769	$3,199,621
Manufacturing	$147,171	$2,328,676	$2,475,847
Wholesale Trade	$71,144	$611,581	$682,726
Retail Trade	$11,137	$3,506,720	$3,517,857
Transportation and Warehousing	$4,242	$1,111,356	$1,115,598
Information	$2,364	$322,035	$324,399
Finance and Insurance	$0	$1,606,422	$1,606,422
Real Estate and Rental and Leasing	$168	$90,314	$90,481
Professional, Scientific, and Technical Services	$1,953,855	$439,470	$2,393,324
Management of Companies and Enterprises	$0	$268,165	$268,165
Administrative and Waste Management Services	$3,217,569	$1,383,755	$4,601,325
Educational Services	$156	$117,197	$117,353
Health Care and Social Assistance	$0	$2,670,307	$2,670,307
Arts, Entertainment, and Recreation	$0	$52,617	$52,617
Accommodation and Food Services	$6,030	$987,913	$993,943
Other Services, except Public Administration	$28,978	$685,829	$714,807
Total	**$5,769,670**	**$19,398,466**	**$25,168,136**

Sources: REMI PI+, RESI

Appendix D: The Impact of a 10 Percent Cut in Defense Spending on Employment, Output, and Wages in Maryland by NAICS Code

This Appendix contains detailed tables with additional information beyond that which is provided in Section 7.1. These tables show the direct, indirect/induced, and total impacts of a ten percent reduction in defense contracting, in terms of employment, total wages, and output, to the economies of Maryland and each of the five regions.

D.1 The Impact of a 10 Percent Budget Cut on Employment in Maryland by NAICS Code

The tables in this section present the impact of a ten percent reduction in defense contracting on Maryland and each of the five regions in terms of output. Direct, indirect/induced, and total effects are separated out.

Figure 90: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Employment in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-2	-4	-5
Mining	0	-10	-11
Utilities	-9	-15	-24
Construction	-1,106	-1,063	-2,169
Manufacturing	-119	-93	-212
Wholesale Trade	-14	-111	-124
Retail Trade	-84	-725	-809
Transportation and Warehousing	-214	-129	-343
Information	-73	-68	-141
Finance and Insurance	-22	-161	-184
Real Estate and Rental and Leasing	-1	-201	-202
Professional, Scientific, and Technical Services	-3,214	-610	-3,824
Management of Companies and Enterprises	0	-42	-42
Administrative and Waste Management Services	-761	-524	-1,285
Educational Services	-68	-75	-143
Health Care and Social Assistance	-268	-532	-800
Arts, Entertainment, and Recreation	-2	-107	-109
Accommodation and Food Services	-244	-411	-654
Other Services, except Public Administration	-57	-338	-395
Total	**-6,258**	**-5,219**	**-11,476**

Sources: REMI PI+, RESI

Figure 91: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Employment in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	-1	-1
Mining	0	-2	-3
Utilities	-2	-2	-4
Construction	-435	-319	-755
Manufacturing	-32	-17	-49
Wholesale Trade	-5	-28	-33
Retail Trade	-58	-192	-250
Transportation and Warehousing	-91	-32	-123
Information	-34	-28	-62
Finance and Insurance	0	-50	-50
Real Estate and Rental and Leasing	0	-73	-73
Professional, Scientific, and Technical Services	-1,419	-255	-1,674
Management of Companies and Enterprises	0	-17	-17
Administrative and Waste Management Services	-431	-179	-610
Educational Services	-53	-15	-68
Health Care and Social Assistance	-108	-144	-252
Arts, Entertainment, and Recreation	-2	-39	-41
Accommodation and Food Services	-224	-118	-342
Other Services, except Public Administration	-15	-104	-119
Total	**-2,909**	**-1,615**	**-4,526**

Sources: REMI PI+, RESI

Figure 92: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Employment in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-1	-2	-3
Mining	0	-7	-7
Utilities	-7	-9	-16
Construction	-582	-597	-1,179
Manufacturing	-84	-61	-146
Wholesale Trade	-7	-77	-85
Retail Trade	-22	-429	-451
Transportation and Warehousing	-35	-79	-114
Information	-38	-36	-73
Finance and Insurance	-22	-96	-118
Real Estate and Rental and Leasing	-1	-114	-114
Professional, Scientific, and Technical Services	-1,417	-317	-1,735
Management of Companies and Enterprises	0	-23	-23
Administrative and Waste Management Services	-293	-306	-599
Educational Services	-15	-56	-71
Health Care and Social Assistance	-157	-335	-492
Arts, Entertainment, and Recreation	0	-63	-64
Accommodation and Food Services	-19	-242	-261
Other Services, except Public Administration	-36	-201	-238
Total	**-2,736**	**-3,050**	**-5,789**

Sources: REMI PI+, RESI

Figure 93: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Employment in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	-1	-1
Mining	0	0	0
Utilities	0	0	0
Construction	-14	-19	-33
Manufacturing	-1	-7	-9
Wholesale Trade	-1	-3	-3
Retail Trade	0	-17	-17
Transportation and Warehousing	0	-3	-3
Information	0	-1	-1
Finance and Insurance	0	-4	-4
Real Estate and Rental and Leasing	0	-3	-3
Professional, Scientific, and Technical Services	-9	-10	-19
Management of Companies and Enterprises	0	-1	-1
Administrative and Waste Management Services	-1	-10	-12
Educational Services	0	-1	-1
Health Care and Social Assistance	0	-12	-12
Arts, Entertainment, and Recreation	0	-2	-2
Accommodation and Food Services	0	-10	-10
Other Services, except Public Administration	0	-7	-7
Total	**- 26**	**- 111**	**- 138**

Sources: REMI PI+, RESI

Figure 94: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Employment in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	-3	-4
Construction	-74	-118	-192
Manufacturing	-1	-4	-5
Wholesale Trade	0	-2	-2
Retail Trade	-4	-73	-77
Transportation and Warehousing	-88	-12	-100
Information	-1	-2	-3
Finance and Insurance	0	-9	-9
Real Estate and Rental and Leasing	0	-10	-11
Professional, Scientific, and Technical Services	-362	-27	-389
Management of Companies and Enterprises	0	-2	-2
Administrative and Waste Management Services	-21	-23	-44
Educational Services	0	-1	-2
Health Care and Social Assistance	-2	-34	-37
Arts, Entertainment, and Recreation	0	-2	-2
Accommodation and Food Services	-1	-36	-36
Other Services, except Public Administration	-5	-23	-28
Total	**- 559**	**- 381**	**- 943**

Sources: REMI PI+, RESI

Figure 95: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Employment in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	-1	-9	-10
Manufacturing	0	-4	-4
Wholesale Trade	0	-1	-1
Retail Trade	0	-14	-14
Transportation and Warehousing	0	-3	-3
Information	0	-1	-1
Finance and Insurance	0	-3	-3
Real Estate and Rental and Leasing	0	-1	-1
Professional, Scientific, and Technical Services	-6	-1	-7
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	-14	-6	-21
Educational Services	0	0	0
Health Care and Social Assistance	0	-7	-7
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	-6	-6
Other Services, except Public Administration	0	-3	-3
Total	**- 21**	**- 59**	**- 81**

Sources: REMI PI+, RESI

D.2 The Impact of a 10 Percent Budget Cut on Output in Maryland by NAICS Code

The tables in this section present the impact of a ten percent reduction in defense contracting on Maryland and each of the five regions in terms of output. Direct, indirect/induced, and total effects are separated out.

Figure 96: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Output in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$32,110	-$165,669	-$197,779
Mining	-$2,618	-$1,448,699	-$1,451,317
Utilities	-$7,409,052	-$11,440,107	-$18,849,160
Construction	-$136,120,782	-$130,100,548	-$266,221,330
Manufacturing	-$59,005,722	-$38,387,574	-$97,393,296
Wholesale Trade	-$2,838,264	-$23,876,026	-$26,714,290
Retail Trade	-$6,642,404	-$56,654,832	-$63,297,237
Transportation and Warehousing	-$19,836,084	-$12,144,682	-$31,980,765
Information	-$41,901,909	-$34,799,917	-$76,701,826
Finance and Insurance	-$4,980,280	-$43,124,921	-$48,105,202
Real Estate and Rental and Leasing	-$386,218	-$77,155,746	-$77,541,964
Professional, Scientific, and Technical Services	-$470,074,243	-$91,356,030	-$561,430,273
Management of Companies and Enterprises	$0	-$8,509,475	-$8,509,475
Administrative and Waste Management Services	-$53,532,394	-$36,257,500	-$89,789,894
Educational Services	-$3,629,679	-$4,735,992	-$8,365,670
Health Care and Social Assistance	-$28,619,355	-$47,661,022	-$76,280,377
Arts, Entertainment, and Recreation	-$102,028	-$6,008,094	-$6,110,122
Accommodation and Food Services	-$14,884,127	-$26,045,127	-$40,929,254
Other Services, except Public Administration	-$4,483,375	-$18,546,996	-$23,030,372
Total	**-$854,480,644**	**-$668,418,957**	**-$1,522,899,603**

Sources: REMI PI+, RESI

Figure 97: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Output in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$4,539	-$51,175	-$55,714
Mining	-$2,387	-$295,888	-$298,275
Utilities	-$1,464,041	-$1,995,334	-$3,459,375
Construction	-$56,242,920	-$41,693,921	-$97,936,841
Manufacturing	-$17,925,775	-$6,917,023	-$24,842,798
Wholesale Trade	-$1,131,346	-$6,251,549	-$7,382,895
Retail Trade	-$4,668,888	-$15,500,002	-$20,168,890
Transportation and Warehousing	-$6,915,427	-$2,120,529	-$9,035,956
Information	-$20,505,366	-$15,534,697	-$36,040,063
Finance and Insurance	-$1,009	-$14,119,673	-$14,120,682
Real Estate and Rental and Leasing	-$124,139	-$30,281,059	-$30,405,198
Professional, Scientific, and Technical Services	-$204,266,790	-$36,992,073	-$241,258,863
Management of Companies and Enterprises	$0	-$3,688,770	-$3,688,770
Administrative and Waste Management Services	-$27,531,893	-$11,763,663	-$39,295,556
Educational Services	-$2,629,101	-$755,784	-$3,384,885
Health Care and Social Assistance	-$10,681,328	-$12,092,506	-$22,773,834
Arts, Entertainment, and Recreation	-$74,098	-$1,482,553	-$1,556,651
Accommodation and Food Services	-$13,773,902	-$8,601,736	-$22,375,638
Other Services, except Public Administration	-$1,009,527	-$5,359,625	-$6,369,152
Total	**-$368,952,476**	**-$215,497,560**	**-$584,450,036**

Sources: REMI PI+, RESI

Figure 98: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Output in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$26,087	-$39,929	-$66,016
Mining	-$154	-$995,993	-$996,148
Utilities	-$5,839,609	-$7,267,014	-$13,106,624
Construction	-$71,118,049	-$73,820,561	-$144,938,610
Manufacturing	-$40,121,268	-$26,472,585	-$66,593,853
Wholesale Trade	-$1,542,767	-$16,676,379	-$18,219,146
Retail Trade	-$1,672,247	-$33,464,535	-$35,136,782
Transportation and Warehousing	-$4,266,227	-$8,334,266	-$12,600,493
Information	-$21,039,326	-$17,731,011	-$38,770,337
Finance and Insurance	-$4,979,269	-$26,706,660	-$31,685,929
Real Estate and Rental and Leasing	-$229,188	-$44,363,002	-$44,592,190
Professional, Scientific, and Technical Services	-$213,272,671	-$49,491,089	-$262,763,761
Management of Companies and Enterprises	$0	-$4,545,954	-$4,545,954
Administrative and Waste Management Services	-$23,834,916	-$22,040,482	-$45,875,399
Educational Services	-$983,286	-$3,842,779	-$4,826,064
Health Care and Social Assistance	-$17,713,249	-$31,256,735	-$48,969,984
Arts, Entertainment, and Recreation	-$27,006	-$4,289,562	-$4,316,569
Accommodation and Food Services	-$1,060,845	-$14,700,587	-$15,761,431
Other Services, except Public Administration	-$2,968,323	-$11,652,745	-$14,621,069
Total	**-$410,694,487**	**-$397,691,868**	**-$808,386,359**

Sources: REMI PI+, RESI

Figure 99: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Output in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$1,236	-$35,338	-$36,574
Mining	-$76	-$60,226	-$60,302
Utilities	-$1,796	-$190,934	-$192,730
Construction	-$1,280,543	-$1,764,838	-$3,045,381
Manufacturing	-$399,949	-$2,732,966	-$3,132,915
Wholesale Trade	-$133,800	-$444,595	-$578,396
Retail Trade	-$4,105	-$1,348,966	-$1,353,071
Transportation and Warehousing	-$2,324	-$370,659	-$372,983
Information	-$340	-$549,988	-$550,328
Finance and Insurance	$0	-$483,040	-$483,040
Real Estate and Rental and Leasing	-$6,205	-$669,037	-$675,242
Professional, Scientific, and Technical Services	-$863,891	-$916,474	-$1,780,365
Management of Companies and Enterprises	$0	-$92,541	-$92,541
Administrative and Waste Management Services	-$68,057	-$652,456	-$720,513
Educational Services	-$750	-$57,735	-$58,485
Health Care and Social Assistance	-$1,837	-$1,025,642	-$1,027,479
Arts, Entertainment, and Recreation	-$208	-$111,957	-$112,165
Accommodation and Food Services	-$14,476	-$618,974	-$633,450
Other Services, except Public Administration	-$6,488	-$351,993	-$358,481
Total	**-$2,786,081**	**-$12,478,359**	**-$15,264,441**

Sources: REMI PI+, RESI

Figure 100: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Output in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$36,871	-$36,871
Mining	$0	-$8,906	-$8,906
Utilities	-$94,004	-$1,899,680	-$1,993,684
Construction	-$7,384,676	-$11,915,453	-$19,300,129
Manufacturing	-$501,365	-$1,028,931	-$1,530,296
Wholesale Trade	-$8,816	-$312,013	-$320,828
Retail Trade	-$293,840	-$5,255,406	-$5,549,246
Transportation and Warehousing	-$8,651,217	-$1,062,494	-$9,713,712
Information	-$355,044	-$725,860	-$1,080,904
Finance and Insurance	-$3	-$1,006,318	-$1,006,320
Real Estate and Rental and Leasing	-$25,557	-$1,607,919	-$1,633,476
Professional, Scientific, and Technical Services	-$51,059,806	-$3,819,504	-$54,879,310
Management of Companies and Enterprises	$0	-$128,267	-$128,267
Administrative and Waste Management Services	-$1,340,030	-$1,431,159	-$2,771,189
Educational Services	-$16,512	-$57,514	-$74,026
Health Care and Social Assistance	-$222,942	-$2,677,249	-$2,900,191
Arts, Entertainment, and Recreation	-$715	-$103,155	-$103,871
Accommodation and Food Services	-$32,672	-$1,825,746	-$1,858,418
Other Services, except Public Administration	-$490,236	-$1,022,923	-$1,513,159
Total	**-$70,477,435**	**-$35,925,368**	**-$106,402,803**

Sources: REMI PI+, RESI

Figure 101: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Output in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$249	-$2,357	-$2,605
Mining	$0	-$87,686	-$87,686
Utilities	-$9,602	-$87,145	-$96,746
Construction	-$94,595	-$905,774	-$1,000,369
Manufacturing	-$57,366	-$1,236,068	-$1,293,434
Wholesale Trade	-$21,534	-$191,490	-$213,025
Retail Trade	-$3,325	-$1,085,922	-$1,089,247
Transportation and Warehousing	-$888	-$256,733	-$257,621
Information	-$1,833	-$258,361	-$260,194
Finance and Insurance	$0	-$809,231	-$809,231
Real Estate and Rental and Leasing	-$1,130	-$234,728	-$235,858
Professional, Scientific, and Technical Services	-$611,085	-$136,889	-$747,974
Management of Companies and Enterprises	$0	-$53,942	-$53,942
Administrative and Waste Management Services	-$757,498	-$369,740	-$1,127,237
Educational Services	-$29	-$22,180	-$22,209
Health Care and Social Assistance	$0	-$608,889	-$608,889
Arts, Entertainment, and Recreation	$0	-$20,866	-$20,866
Accommodation and Food Services	-$2,232	-$298,085	-$300,317
Other Services, except Public Administration	-$8,802	-$159,710	-$168,511
Total	**-$1,570,168**	**-$6,825,796**	**-$8,395,961**

Sources: REMI PI+, RESI

D.3 The Impact of a 10 Percent Budget Cut on Wages in Maryland by NAICS Code

The tables in this section present the impact of a ten percent reduction in defense contracting on Maryland and each of the five regions in terms of total wages. Direct, indirect/induced, and total effects are separated out.

Figure 102: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Wages in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$20,747	-$42,832	-$63,578
Mining	-$2,208	-$143,894	-$146,101
Utilities	-$1,232,783	-$1,877,165	-$3,109,947
Construction	-$52,372,000	-$49,595,784	-$101,967,784
Manufacturing	-$9,483,907	-$7,099,190	-$16,583,097
Wholesale Trade	-$1,086,376	-$8,806,876	-$9,893,252
Retail Trade	-$2,469,903	-$20,379,519	-$22,849,422
Transportation and Warehousing	-$7,730,358	-$5,236,926	-$12,967,284
Information	-$5,451,256	-$4,941,860	-$10,393,115
Finance and Insurance	-$1,514,150	-$10,141,748	-$11,655,898
Real Estate and Rental and Leasing	-$16,628	-$3,581,887	-$3,598,515
Professional, Scientific, and Technical Services	-$226,672,090	-$42,909,835	-$269,581,925
Management of Companies and Enterprises	$0	-$4,935,731	-$4,935,731
Administrative and Waste Management Services	-$23,799,742	-$16,471,575	-$40,271,316
Educational Services	-$2,066,270	-$3,072,347	-$5,138,617
Health Care and Social Assistance	-$11,962,280	-$23,750,503	-$35,712,784
Arts, Entertainment, and Recreation	-$32,216	-$1,979,749	-$2,011,965
Accommodation and Food Services	-$5,459,878	-$8,771,769	-$14,231,647
Other Services, except Public Administration	-$1,625,698	-$9,680,016	-$11,305,714
Total	**-$352,998,490**	**-$223,419,206**	**-$576,417,692**

Sources: REMI PI+, RESI

Figure 103: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Wages in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$2,764	-$15,289	-$18,053
Mining	-$2,189	-$44,378	-$46,568
Utilities	-$183,637	-$248,961	-$432,598
Construction	-$20,664,170	-$15,144,668	-$35,808,838
Manufacturing	-$2,744,395	-$1,467,532	-$4,211,927
Wholesale Trade	-$453,994	-$2,422,145	-$2,876,139
Retail Trade	-$1,762,044	-$5,814,815	-$7,576,859
Transportation and Warehousing	-$2,515,219	-$888,545	-$3,403,764
Information	-$2,807,107	-$2,312,310	-$5,119,417
Finance and Insurance	-$256	-$3,175,773	-$3,176,029
Real Estate and Rental and Leasing	-$5,809	-$1,451,842	-$1,457,651
Professional, Scientific, and Technical Services	-$98,913,693	-$17,746,055	-$116,659,748
Management of Companies and Enterprises	$0	-$2,372,410	-$2,372,410
Administrative and Waste Management Services	-$13,297,368	-$5,514,387	-$18,811,755
Educational Services	-$1,380,478	-$395,383	-$1,775,861
Health Care and Social Assistance	-$4,527,744	-$6,048,718	-$10,576,463
Arts, Entertainment, and Recreation	-$23,851	-$501,541	-$525,392
Accommodation and Food Services	-$5,033,640	-$2,653,036	-$7,686,677
Other Services, except Public Administration	-$447,401	-$3,142,361	-$3,589,762
Total	**-$154,765,759**	**-$71,360,149**	**-$226,125,911**

Sources: REMI PI+, RESI

Figure 104: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Wages in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$16,921	-$17,625	-$34,546
Mining	-$9	-$66,947	-$66,956
Utilities	-$1,031,810	-$1,263,587	-$2,295,397
Construction	-$28,640,579	-$29,366,221	-$58,006,800
Manufacturing	-$6,606,238	-$4,800,192	-$11,406,430
Wholesale Trade	-$580,958	-$6,076,526	-$6,657,485
Retail Trade	-$608,100	-$12,093,069	-$12,701,169
Transportation and Warehousing	-$1,619,002	-$3,606,184	-$5,225,186
Information	-$2,602,881	-$2,450,399	-$5,053,280
Finance and Insurance	-$1,513,894	-$6,471,782	-$7,985,676
Real Estate and Rental and Leasing	-$9,598	-$2,032,683	-$2,042,281
Professional, Scientific, and Technical Services	-$102,682,673	-$23,001,315	-$125,683,988
Management of Companies and Enterprises	$0	-$2,432,503	-$2,432,503
Administrative and Waste Management Services	-$9,705,614	-$10,127,371	-$19,832,985
Educational Services	-$677,233	-$2,604,883	-$3,282,115
Health Care and Social Assistance	-$7,344,443	-$15,638,878	-$22,983,321
Arts, Entertainment, and Recreation	-$8,153	-$1,421,427	-$1,429,580
Accommodation and Food Services	-$411,380	-$5,203,253	-$5,614,633
Other Services, except Public Administration	-$1,052,289	-$5,809,689	-$6,861,978
Total	**-$165,111,775**	**-$134,484,534**	**-$299,596,309**

Sources: REMI PI+, RESI

Figure 105: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Wages in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$917	-$5,922	-$6,839
Mining	-$9	-$11,622	-$11,632
Utilities	-$287	-$30,286	-$30,572
Construction	-$359,597	-$498,431	-$858,028
Manufacturing	-$69,545	-$432,152	-$501,698
Wholesale Trade	-$41,261	-$141,809	-$183,070
Retail Trade	-$1,235	-$397,467	-$398,701
Transportation and Warehousing	-$451	-$120,973	-$121,424
Information	-$42	-$57,270	-$57,313
Finance and Insurance	$0	-$109,221	-$109,221
Real Estate and Rental and Leasing	-$49	-$23,670	-$23,719
Professional, Scientific, and Technical Services	-$284,386	-$301,444	-$585,830
Management of Companies and Enterprises	$0	-$45,320	-$45,320
Administrative and Waste Management Services	-$23,835	-$211,415	-$235,250
Educational Services	-$412	-$32,008	-$32,420
Health Care and Social Assistance	-$719	-$501,139	-$501,858
Arts, Entertainment, and Recreation	-$52	-$34,190	-$34,243
Accommodation and Food Services	-$2,392	-$200,621	-$203,013
Other Services, except Public Administration	-$1,661	-$150,672	-$152,333
Total	**-$786,850**	**-$3,305,632**	**-$4,092,484**

Sources: REMI PI+, RESI

Figure 106: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Wages in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$3,716	-$3,716
Mining	$0	-$1,557	-$1,557
Utilities	-$15,692	-$320,856	-$336,548
Construction	-$2,676,415	-$4,295,646	-$6,972,062
Manufacturing	-$49,033	-$164,726	-$213,759
Wholesale Trade	-$3,040	-$104,471	-$107,510
Retail Trade	-$97,409	-$1,720,250	-$1,817,660
Transportation and Warehousing	-$3,595,261	-$505,868	-$4,101,128
Information	-$40,989	-$89,461	-$130,450
Finance and Insurance	$0	-$222,395	-$222,395
Real Estate and Rental and Leasing	-$1,155	-$64,526	-$65,681
Professional, Scientific, and Technical Services	-$24,595,655	-$1,816,799	-$26,412,455
Management of Companies and Enterprises	$0	-$58,454	-$58,454
Administrative and Waste Management Services	-$450,908	-$479,221	-$930,129
Educational Services	-$8,132	-$28,262	-$36,394
Health Care and Social Assistance	-$89,374	-$1,292,072	-$1,381,446
Arts, Entertainment, and Recreation	-$160	-$17,231	-$17,391
Accommodation and Food Services	-$11,862	-$615,355	-$627,217
Other Services, except Public Administration	-$121,448	-$507,979	-$629,427
Total	**-$31,756,533**	**-$12,308,845**	**-$44,065,379**

Sources: REMI PI+, RESI

Figure 107: The Average Annual Impact of a 10 Percent Cut in Defense Contracting on Wages in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	-$145	-$279	-$424
Mining	$0	-$19,389	-$19,389
Utilities	-$1,357	-$13,475	-$14,832
Construction	-$31,238	-$290,817	-$322,055
Manufacturing	-$14,695	-$234,588	-$249,283
Wholesale Trade	-$7,124	-$61,925	-$69,049
Retail Trade	-$1,115	-$353,917	-$355,032
Transportation and Warehousing	-$425	-$115,357	-$115,781
Information	-$237	-$32,419	-$32,656
Finance and Insurance	$0	-$162,576	-$162,576
Real Estate and Rental and Leasing	-$17	-$9,166	-$9,183
Professional, Scientific, and Technical Services	-$195,683	-$44,221	-$239,904
Management of Companies and Enterprises	$0	-$27,043	-$27,043
Administrative and Waste Management Services	-$322,017	-$139,181	-$461,198
Educational Services	-$16	-$11,811	-$11,827
Health Care and Social Assistance	$0	-$269,695	-$269,695
Arts, Entertainment, and Recreation	$0	-$5,359	-$5,359
Accommodation and Food Services	-$604	-$99,503	-$100,107
Other Services, except Public Administration	-$2,899	-$69,315	-$72,213
Total	**-$577,572**	**-$1,960,036**	**-$2,537,606**

Sources: REMI PI+, RESI

Appendix E: The Impact of a 10 Percent Decrease in R&D Spending on Employment, Output, and Wages in Maryland by NAICS Code

This Appendix contains detailed tables with additional information beyond that which is provided in Section 7.2. These tables show the direct, indirect/induced, and total impacts of a ten percent reduction in research and development contracting, in terms of employment, total wages, and output, to the economies of Maryland and each of the five regions.

E.1 The Impact of a 10 Percent Reduction in R&D Spending on Employment in Maryland by NAICS Code

The tables in this section present the impact of a ten percent reduction in research and development contracting on Maryland and each of the five regions in terms of employment. Direct, indirect/induced, and total effects are separated out.

Figure 108: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Employment in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	-1	-1
Mining	0	-2	-2
Utilities	0	-2	-2
Construction	-21	-187	-208
Manufacturing	-17	-16	-33
Wholesale Trade	0	-19	-19
Retail Trade	0	-136	-136
Transportation and Warehousing	-6	-19	-25
Information	-1	-10	-11
Finance and Insurance	0	-30	-30
Real Estate and Rental and Leasing	0	-38	-38
Professional, Scientific, and Technical Services	-936	-130	-1,066
Management of Companies and Enterprises	0	-7	-7
Administrative and Waste Management Services	-7	-87	-93
Educational Services	-3	-11	-14
Health Care and Social Assistance	0	-96	-96
Arts, Entertainment, and Recreation	0	-20	-20
Accommodation and Food Services	0	-78	-78
Other Services, except Public Administration	0	-63	-63
Total	**- 991**	**- 952**	**-1,942**

Sources: REMI PI+, RESI

Figure 109: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Employment in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	-43	-43
Manufacturing	-14	-2	-16
Wholesale Trade	0	-4	-4
Retail Trade	0	-27	-27
Transportation and Warehousing	-3	-5	-8
Information	0	-4	-4
Finance and Insurance	0	-7	-7
Real Estate and Rental and Leasing	0	-11	-11
Professional, Scientific, and Technical Services	-284	-58	-342
Management of Companies and Enterprises	0	-3	-3
Administrative and Waste Management Services	-1	-24	-25
Educational Services	-2	-2	-5
Health Care and Social Assistance	0	-21	-21
Arts, Entertainment, and Recreation	0	-6	-6
Accommodation and Food Services	0	-18	-18
Other Services, except Public Administration	0	-16	-16
Total	**- 304**	**- 251**	**- 556**

Sources: REMI PI+, RESI

Figure 110: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Employment in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	-1	-1
Utilities	0	-2	-2
Construction	-21	-125	-146
Manufacturing	-3	-12	-15
Wholesale Trade	0	-14	-14
Retail Trade	0	-95	-95
Transportation and Warehousing	-1	-13	-14
Information	-1	-6	-7
Finance and Insurance	0	-20	-20
Real Estate and Rental and Leasing	0	-25	-25
Professional, Scientific, and Technical Services	-585	-65	-650
Management of Companies and Enterprises	0	-4	-4
Administrative and Waste Management Services	-6	-58	-64
Educational Services	0	-9	-9
Health Care and Social Assistance	0	-69	-69
Arts, Entertainment, and Recreation	0	-14	-14
Accommodation and Food Services	0	-53	-53
Other Services, except Public Administration	0	-43	-43
Total	**- 617**	**- 628**	**-1,245**

Sources: REMI PI+, RESI

Figure 111: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Employment in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	-4	-4
Manufacturing	0	-1	-1
Wholesale Trade	0	0	0
Retail Trade	0	-3	-3
Transportation and Warehousing	0	0	0
Information	0	0	0
Finance and Insurance	0	-1	-1
Real Estate and Rental and Leasing	0	-1	-1
Professional, Scientific, and Technical Services	-7	-3	-9
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	-1	-1
Educational Services	0	0	0
Health Care and Social Assistance	0	-2	-2
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	-2	-2
Other Services, except Public Administration	0	-1	-1
Total	**- 7**	**- 19**	**- 25**

Sources: REMI PI+, RESI

Figure 112: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Employment in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	-14	-14
Manufacturing	0	0	0
Wholesale Trade	0	0	0
Retail Trade	0	-9	-9
Transportation and Warehousing	-2	-1	-3
Information	0	0	0
Finance and Insurance	0	-1	-1
Real Estate and Rental and Leasing	0	-1	-1
Professional, Scientific, and Technical Services	-61	-5	-65
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	-2	-2
Educational Services	0	0	0
Health Care and Social Assistance	0	-4	-4
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	-4	-4
Other Services, except Public Administration	0	-3	-3
Total	**- 63**	**- 44**	**- 106**

Sources: REMI PI+, RESI

Figure 113: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Employment in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	-1	-1
Manufacturing	0	0	0
Wholesale Trade	0	0	0
Retail Trade	0	-2	-2
Transportation and Warehousing	0	0	0
Information	0	0	0
Finance and Insurance	0	-1	-1
Real Estate and Rental and Leasing	0	0	0
Professional, Scientific, and Technical Services	0	0	0
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	0	0
Educational Services	0	0	0
Health Care and Social Assistance	0	-1	-1
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	-1	-1
Other Services, except Public Administration	0	0	0
Total	**0**	**- 6**	**- 6**

Sources: REMI PI+, RESI

E.2 The Impact of a 10 Percent Decrease in R&D Spending on Output in Maryland by NAICS Code

The tables in this section present the impact of a ten percent reduction in research and development contracting on Maryland and each of the five regions in terms of output. Direct, indirect/induced, and total effects are separated out.

Figure 114: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$23,733	-$23,733
Mining	$0	-$210,531	-$210,531
Utilities	$0	-$1,824,006	-$1,824,006
Construction	-$2,457,837	-$22,874,782	-$25,332,619
Manufacturing	-$9,992,139	-$7,165,704	-$17,157,843
Wholesale Trade	-$3,935	-$4,094,724	-$4,098,658
Retail Trade	-$198	-$10,611,197	-$10,611,395
Transportation and Warehousing	-$480,675	-$1,789,454	-$2,270,128
Information	-$515,615	-$5,128,539	-$5,644,154
Finance and Insurance	$0	-$8,195,727	-$8,195,727
Real Estate and Rental and Leasing	-$471	-$14,543,977	-$14,544,448
Professional, Scientific, and Technical Services	-$138,219,377	-$19,574,703	-$157,794,081
Management of Companies and Enterprises	$0	-$1,479,478	-$1,479,478
Administrative and Waste Management Services	-$433,141	-$5,859,979	-$6,293,120
Educational Services	-$125,853	-$724,427	-$850,280
Health Care and Social Assistance	-$38,387	-$8,523,663	-$8,562,051
Arts, Entertainment, and Recreation	$0	-$1,184,548	-$1,184,548
Accommodation and Food Services	-$761	-$4,969,163	-$4,969,924
Other Services, except Public Administration	-$4,071	-$3,439,202	-$3,443,273
Total	**-$152,272,460**	**-$122,217,537**	**-$274,489,997**

Sources: REMI PI+, RESI

Figure 115: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$5,578	-$5,578
Mining	$0	-$31,877	-$31,877
Utilities	$0	-$255,392	-$255,392
Construction	-$1,566	-$5,641,379	-$5,642,945
Manufacturing	-$8,161,327	-$971,965	-$9,133,292
Wholesale Trade	-$278	-$877,365	-$877,643
Retail Trade	$0	-$2,176,177	-$2,176,177
Transportation and Warehousing	-$250,740	-$301,475	-$552,214
Information	-$123,674	-$1,858,604	-$1,982,278
Finance and Insurance	$0	-$2,123,603	-$2,123,603
Real Estate and Rental and Leasing	-$471	-$4,567,258	-$4,567,729
Professional, Scientific, and Technical Services	-$40,977,332	-$8,372,305	-$49,349,637
Management of Companies and Enterprises	$0	-$609,115	-$609,115
Administrative and Waste Management Services	-$65,862	-$1,559,837	-$1,625,698
Educational Services	-$116,121	-$112,420	-$228,541
Health Care and Social Assistance	-$2,971	-$1,715,535	-$1,718,506
Arts, Entertainment, and Recreation	$0	-$225,379	-$225,379
Accommodation and Food Services	-$252	-$1,340,243	-$1,340,495
Other Services, except Public Administration	-$903	-$780,370	-$781,273
Total	**-$49,701,497**	**-$33,525,877**	**-$83,227,372**

Sources: REMI PI+, RESI

Figure 116: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$8,383	-$8,383
Mining	$0	-$158,916	-$158,916
Utilities	$0	-$1,335,649	-$1,335,649
Construction	-$2,437,039	-$15,415,607	-$17,852,646
Manufacturing	-$1,825,125	-$5,717,250	-$7,542,374
Wholesale Trade	-$3,657	-$3,083,869	-$3,087,526
Retail Trade	-$198	-$7,395,628	-$7,395,827
Transportation and Warehousing	-$59,257	-$1,350,026	-$1,409,284
Information	-$391,941	-$3,127,893	-$3,519,834
Finance and Insurance	$0	-$5,714,070	-$5,714,070
Real Estate and Rental and Leasing	$0	-$9,600,604	-$9,600,604
Professional, Scientific, and Technical Services	-$87,995,582	-$10,250,875	-$98,246,456
Management of Companies and Enterprises	$0	-$838,746	-$838,746
Administrative and Waste Management Services	-$366,832	-$4,076,967	-$4,443,798
Educational Services	-$9,693	-$598,603	-$608,296
Health Care and Social Assistance	-$34,075	-$6,272,318	-$6,306,393
Arts, Entertainment, and Recreation	$0	-$919,460	-$919,460
Accommodation and Food Services	-$509	-$3,271,036	-$3,271,545
Other Services, except Public Administration	-$2,842	-$2,454,643	-$2,457,485
Total	**-$93,126,750**	**-$81,590,543**	**-$174,717,292**

Sources: REMI PI+, RESI

Figure 117: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$4,755	-$4,755
Mining	$0	-$8,590	-$8,590
Utilities	$0	-$27,299	-$27,299
Construction	-$490	-$326,142	-$326,632
Manufacturing	-$24	-$246,584	-$246,607
Wholesale Trade	$0	-$68,387	-$68,387
Retail Trade	$0	-$249,260	-$249,260
Transportation and Warehousing	$0	-$35,951	-$35,951
Information	$0	-$51,460	-$51,460
Finance and Insurance	$0	-$86,622	-$86,622
Real Estate and Rental and Leasing	$0	-$122,411	-$122,411
Professional, Scientific, and Technical Services	-$632,217	-$244,659	-$876,876
Management of Companies and Enterprises	$0	-$10,064	-$10,064
Administrative and Waste Management Services	$0	-$57,524	-$57,524
Educational Services	-$3	-$5,935	-$5,938
Health Care and Social Assistance	-$1,342	-$149,001	-$150,343
Arts, Entertainment, and Recreation	$0	-$21,070	-$21,070
Accommodation and Food Services	$0	-$106,795	-$106,795
Other Services, except Public Administration	$0	-$55,402	-$55,402
Total	**-$634,076**	**-$1,877,911**	**-$2,511,986**

Sources: REMI PI+, RESI

Figure 118: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$4,742	-$4,742
Mining	$0	-$876	-$876
Utilities	$0	-$196,355	-$196,355
Construction	-$8,476	-$1,387,300	-$1,395,776
Manufacturing	-$746	-$115,000	-$115,746
Wholesale Trade	$0	-$39,796	-$39,796
Retail Trade	$0	-$649,360	-$649,360
Transportation and Warehousing	-$170,421	-$77,234	-$247,655
Information	$0	-$71,071	-$71,071
Finance and Insurance	$0	-$138,616	-$138,616
Real Estate and Rental and Leasing	$0	-$219,345	-$219,345
Professional, Scientific, and Technical Services	-$8,604,341	-$688,231	-$9,292,571
Management of Companies and Enterprises	$0	-$16,603	-$16,603
Administrative and Waste Management Services	-$99	-$142,601	-$142,700
Educational Services	-$36	-$5,636	-$5,672
Health Care and Social Assistance	$0	-$320,266	-$320,266
Arts, Entertainment, and Recreation	$0	-$15,246	-$15,246
Accommodation and Food Services	$0	-$221,726	-$221,726
Other Services, except Public Administration	-$263	-$129,213	-$129,475
Total	**-$8,784,382**	**-$4,439,217**	**-$13,223,597**

Sources: REMI PI+, RESI

Figure 119: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$275	-$275
Mining	$0	-$10,272	-$10,272
Utilities	$0	-$9,311	-$9,311
Construction	-$10,267	-$104,354	-$114,621
Manufacturing	-$4,917	-$114,906	-$119,823
Wholesale Trade	$0	-$25,307	-$25,307
Retail Trade	$0	-$140,771	-$140,771
Transportation and Warehousing	-$256	-$24,769	-$25,025
Information	$0	-$19,510	-$19,510
Finance and Insurance	$0	-$132,816	-$132,816
Real Estate and Rental and Leasing	$0	-$34,359	-$34,359
Professional, Scientific, and Technical Services	-$9,906	-$18,634	-$28,540
Management of Companies and Enterprises	$0	-$4,950	-$4,950
Administrative and Waste Management Services	-$348	-$23,051	-$23,399
Educational Services	$0	-$1,833	-$1,833
Health Care and Social Assistance	$0	-$66,543	-$66,543
Arts, Entertainment, and Recreation	$0	-$3,392	-$3,392
Accommodation and Food Services	$0	-$29,364	-$29,364
Other Services, except Public Administration	-$64	-$19,574	-$19,638
Total	**-$25,758**	**-$783,991**	**-$809,749**

Sources: REMI PI+, RESI

E.3 The Impact of a 10 Percent Decrease in R&D Spending on Wages in Maryland by NAICS Code

The tables in this section present the impact of a ten percent reduction in research and development contracting on Maryland and each of the five regions in terms of total wages. Direct, indirect/induced, and total effects are separated out.

Figure 120: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Wages in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$7,147	-$7,147
Mining	$0	-$19,756	-$19,756
Utilities	$0	-$303,173	-$303,173
Construction	-$1,021,253	-$8,848,555	-$9,869,808
Manufacturing	-$1,467,279	-$1,218,067	-$2,685,346
Wholesale Trade	-$1,463	-$1,507,435	-$1,508,898
Retail Trade	-$76	-$3,824,272	-$3,824,347
Transportation and Warehousing	-$204,242	-$767,606	-$971,847
Information	-$62,881	-$753,223	-$816,104
Finance and Insurance	$0	-$1,911,663	-$1,911,663
Real Estate and Rental and Leasing	-$22	-$674,787	-$674,810
Professional, Scientific, and Technical Services	-$66,543,535	-$9,113,569	-$75,657,104
Management of Companies and Enterprises	$0	-$855,673	-$855,673
Administrative and Waste Management Services	-$216,362	-$2,770,333	-$2,986,695
Educational Services	-$68,285	-$471,165	-$539,450
Health Care and Social Assistance	-$15,757	-$4,344,542	-$4,360,299
Arts, Entertainment, and Recreation	$0	-$390,033	-$390,033
Accommodation and Food Services	-$218	-$1,672,548	-$1,672,766
Other Services, except Public Administration	-$1,394	-$1,819,065	-$1,820,459
Total	**-$69,602,767**	**-$41,272,612**	**-$110,875,378**

Sources: REMI PI+, RESI

Figure 121: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$1,838	-$1,838
Mining	$0	-$4,919	-$4,919
Utilities	$0	-$31,701	-$31,701
Construction	-$574	-$2,053,431	-$2,054,005
Manufacturing	-$1,224,924	-$187,284	-$1,412,208
Wholesale Trade	-$114	-$340,247	-$340,361
Retail Trade	$0	-$814,248	-$814,248
Transportation and Warehousing	-$87,118	-$129,297	-$216,415
Information	-$14,303	-$291,736	-$306,039
Finance and Insurance	$0	-$480,702	-$480,702
Real Estate and Rental and Leasing	-$22	-$218,671	-$218,694
Professional, Scientific, and Technical Services	-$19,796,146	-$4,023,502	-$23,819,648
Management of Companies and Enterprises	$0	-$392,520	-$392,520
Administrative and Waste Management Services	-$32,741	-$750,807	-$783,548
Educational Services	-$61,516	-$58,838	-$120,354
Health Care and Social Assistance	-$1,207	-$861,069	-$862,276
Arts, Entertainment, and Recreation	$0	-$75,113	-$75,113
Accommodation and Food Services	-$44	-$409,878	-$409,922
Other Services, except Public Administration	-$321	-$470,408	-$470,730
Total	**-$21,219,030**	**-$11,596,209**	**-$32,815,241**

Sources: REMI PI+, RESI

Figure 122: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$4,016	-$4,016
Mining	$0	-$10,823	-$10,823
Utilities	$0	-$232,872	-$232,872
Construction	-$1,013,961	-$6,170,250	-$7,184,211
Manufacturing	-$241,538	-$956,029	-$1,197,567
Wholesale Trade	-$1,349	-$1,123,926	-$1,125,275
Retail Trade	-$76	-$2,679,439	-$2,679,515
Transportation and Warehousing	-$45,663	-$575,094	-$620,757
Information	-$48,579	-$444,807	-$493,385
Finance and Insurance	$0	-$1,353,740	-$1,353,740
Real Estate and Rental and Leasing	$0	-$441,358	-$441,358
Professional, Scientific, and Technical Services	-$42,412,524	-$4,675,579	-$47,088,103
Management of Companies and Enterprises	$0	-$448,262	-$448,262
Administrative and Waste Management Services	-$183,437	-$1,939,395	-$2,122,832
Educational Services	-$6,749	-$405,280	-$412,029
Health Care and Social Assistance	-$14,015	-$3,219,842	-$3,233,856
Arts, Entertainment, and Recreation	$0	-$304,840	-$304,840
Accommodation and Food Services	-$173	-$1,146,893	-$1,147,066
Other Services, except Public Administration	-$989	-$1,249,112	-$1,250,101
Total	**-$43,969,053**	**-$27,381,557**	**-$71,350,608**

Sources: REMI PI+, RESI

Figure 123: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$772	-$772
Mining	$0	-$1,643	-$1,643
Utilities	$0	-$4,317	-$4,317
Construction	-$143	-$92,128	-$92,272
Manufacturing	-$4	-$37,013	-$37,016
Wholesale Trade	$0	-$21,737	-$21,737
Retail Trade	$0	-$73,412	-$73,412
Transportation and Warehousing	$0	-$11,717	-$11,717
Information	$0	-$5,430	-$5,430
Finance and Insurance	$0	-$20,048	-$20,048
Real Estate and Rental and Leasing	$0	-$4,435	-$4,435
Professional, Scientific, and Technical Services	-$206,974	-$80,347	-$287,320
Management of Companies and Enterprises	$0	-$4,927	-$4,927
Administrative and Waste Management Services	$0	-$20,638	-$20,638
Educational Services	-$2	-$3,293	-$3,295
Health Care and Social Assistance	-$535	-$76,891	-$77,426
Arts, Entertainment, and Recreation	$0	-$6,445	-$6,445
Accommodation and Food Services	$0	-$32,864	-$32,864
Other Services, except Public Administration	$0	-$26,241	-$26,241
Total	**-$207,658**	**-$524,298**	**-$731,955**

Sources: REMI PI+, RESI

Figure 124: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$489	-$489
Mining	$0	-$153	-$153
Utilities	$0	-$32,843	-$32,843
Construction	-$3,172	-$499,234	-$502,405
Manufacturing	-$80	-$16,839	-$16,919
Wholesale Trade	$0	-$13,326	-$13,326
Retail Trade	$0	-$211,358	-$211,358
Transportation and Warehousing	-$71,300	-$41,627	-$112,928
Information	$0	-$8,648	-$8,648
Finance and Insurance	$0	-$30,437	-$30,437
Real Estate and Rental and Leasing	$0	-$8,940	-$8,940
Professional, Scientific, and Technical Services	-$4,124,675	-$328,022	-$4,452,697
Management of Companies and Enterprises	$0	-$7,478	-$7,478
Administrative and Waste Management Services	-$38	-$50,451	-$50,489
Educational Services	-$18	-$2,771	-$2,790
Health Care and Social Assistance	$0	-$155,913	-$155,913
Arts, Entertainment, and Recreation	$0	-$2,719	-$2,719
Accommodation and Food Services	$0	-$73,501	-$73,501
Other Services, except Public Administration	-$63	-$64,476	-$64,540
Total	**-$4,199,346**	**-$1,549,225**	**-$5,748,573**

Sources: REMI PI+, RESI

Figure 125: The Average Annual Impact of a 10 Percent Cut in R&D Contracting on Output in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$32	-$32
Mining	$0	-$2,218	-$2,218
Utilities	$0	-$1,440	-$1,440
Construction	-$3,403	-$33,513	-$36,916
Manufacturing	-$734	-$20,902	-$21,636
Wholesale Trade	$0	-$8,200	-$8,200
Retail Trade	$0	-$45,815	-$45,815
Transportation and Warehousing	-$161	-$9,870	-$10,031
Information	$0	-$2,602	-$2,602
Finance and Insurance	$0	-$26,735	-$26,735
Real Estate and Rental and Leasing	$0	-$1,383	-$1,383
Professional, Scientific, and Technical Services	-$3,217	-$6,119	-$9,336
Management of Companies and Enterprises	$0	-$2,486	-$2,486
Administrative and Waste Management Services	-$146	-$9,043	-$9,189
Educational Services	$0	-$982	-$982
Health Care and Social Assistance	$0	-$30,827	-$30,827
Arts, Entertainment, and Recreation	$0	-$915	-$915
Accommodation and Food Services	$0	-$9,412	-$9,412
Other Services, except Public Administration	-$21	-$8,827	-$8,847
Total	**-$7,682**	**-$221,321**	**-$229,002**

Sources: REMI PI+, RESI

Appendix F: The Impact of a 10 Percent Increase in Cybersecurity Spending on Employment, Output, and Wages in Maryland by NAICS Code

This Appendix contains detailed tables with additional information beyond that which is provided in Section 7.3. These tables show the direct, indirect/induced, and total impacts of a ten percent Increase in cybersecurity contracting, in terms of employment, total wages, and output, to the economies of Maryland and each of the five regions.

F.1 The Impact of a 10 Percent Increase in Cybersecurity Spending on Employment in Maryland by NAICS Code

The tables in this section present the impact of a ten percent Increase in cybersecurity contracting on Maryland and each of the five regions in terms of employment. Direct, indirect/induced, and total effects are separated out.

Figure 126: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Employment in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	1	1
Utilities	0	1	1
Construction	0	114	115
Manufacturing	1	7	7
Wholesale Trade	0	10	10
Retail Trade	15	73	88
Transportation and Warehousing	0	11	11
Information	42	14	56
Finance and Insurance	0	17	17
Real Estate and Rental and Leasing	0	21	21
Professional, Scientific, and Technical Services	477	71	548
Management of Companies and Enterprises	0	4	4
Administrative and Waste Management Services	3	51	54
Educational Services	2	6	8
Health Care and Social Assistance	0	51	51
Arts, Entertainment, and Recreation	0	16	16
Accommodation and Food Services	0	41	41
Other Services, except Public Administration	5	34	39
Total	**545**	**543**	**1,088**

Sources: REMI PI+, RESI

Figure 127: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Employment in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	48	48
Manufacturing	0	2	2
Wholesale Trade	0	3	3
Retail Trade	12	27	40
Transportation and Warehousing	0	4	5
Information	19	6	25
Finance and Insurance	0	7	7
Real Estate and Rental and Leasing	0	9	9
Professional, Scientific, and Technical Services	302	31	333
Management of Companies and Enterprises	0	2	2
Administrative and Waste Management Services	2	24	26
Educational Services	1	2	3
Health Care and Social Assistance	0	20	20
Arts, Entertainment, and Recreation	0	7	7
Accommodation and Food Services	0	17	17
Other Services, except Public Administration	1	14	15
Total	**337**	**223**	**562**

Sources: REMI PI+, RESI

Figure 128: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Employment in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	1	1
Utilities	0	1	1
Construction	0	56	56
Manufacturing	0	4	5
Wholesale Trade	0	6	6
Retail Trade	2	37	40
Transportation and Warehousing	0	5	5
Information	23	7	30
Finance and Insurance	0	9	9
Real Estate and Rental and Leasing	0	10	10
Professional, Scientific, and Technical Services	148	37	185
Management of Companies and Enterprises	0	2	2
Administrative and Waste Management Services	1	25	26
Educational Services	1	4	5
Health Care and Social Assistance	0	28	28
Arts, Entertainment, and Recreation	0	8	8
Accommodation and Food Services	0	20	20
Other Services, except Public Administration	4	18	22
Total	**179**	**278**	**459**

Sources: REMI PI+, RESI

Figure 129: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Employment in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	1	1
Manufacturing	0	0	0
Wholesale Trade	0	0	0
Retail Trade	0	1	1
Transportation and Warehousing	0	0	0
Information	0	0	0
Finance and Insurance	0	0	0
Real Estate and Rental and Leasing	0	0	0
Professional, Scientific, and Technical Services	0	1	1
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	0	0
Educational Services	0	0	0
Health Care and Social Assistance	0	1	1
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	1	1
Other Services, except Public Administration	0	1	1
Total	**0**	**6**	**6**

Sources: REMI PI+, RESI

Figure 130: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Employment in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	8	8
Manufacturing	0	0	0
Wholesale Trade	0	0	0
Retail Trade	0	5	5
Transportation and Warehousing	0	0	0
Information	0	1	1
Finance and Insurance	0	1	1
Real Estate and Rental and Leasing	0	1	1
Professional, Scientific, and Technical Services	24	2	26
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	1	1
Educational Services	0	0	0
Health Care and Social Assistance	0	2	2
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	2	2
Other Services, except Public Administration	0	2	2
Total	**24**	**25**	**49**

Sources: REMI PI+, RESI

Figure 131: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Employment in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	1	1
Manufacturing	0	0	0
Wholesale Trade	0	0	0
Retail Trade	0	2	2
Transportation and Warehousing	0	0	0
Information	0	0	0
Finance and Insurance	0	0	0
Real Estate and Rental and Leasing	0	0	0
Professional, Scientific, and Technical Services	3	0	3
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	0	0
Educational Services	0	0	0
Health Care and Social Assistance	0	1	1
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	0	0
Other Services, except Public Administration	0	0	0
Total	**3**	**4**	**7**

Sources: REMI PI+, RESI

F.2 The Impact of a 10 Percent Increase in Cybersecurity Spending on Output in Maryland by NAICS Code

The tables in this section present the impact of a ten percent Increase in cybersecurity contracting on Maryland and each of the five regions in terms of output. Direct, indirect/induced, and total effects are separated out.

Figure 132: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Output in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$13,553	$13,553
Mining	$0	$147,611	$147,611
Utilities	$74,089	$1,042,303	$1,116,392
Construction	$4,511	$14,216,844	$14,221,355
Manufacturing	$437,319	$2,729,935	$3,167,254
Wholesale Trade	$16,524	$2,219,796	$2,236,320
Retail Trade	$1,193,121	$5,748,547	$6,941,668
Transportation and Warehousing	$965	$928,496	$929,461
Information	$25,010,579	$8,094,715	$33,105,294
Finance and Insurance	$0	$4,720,364	$4,720,364
Real Estate and Rental and Leasing	$1,070	$8,143,650	$8,144,720
Professional, Scientific, and Technical Services	$69,518,227	$10,733,091	$80,251,318
Management of Companies and Enterprises	$0	$752,688	$752,688
Administrative and Waste Management Services	$167,460	$3,419,800	$3,587,259
Educational Services	$109,881	$352,443	$462,325
Health Care and Social Assistance	$6,399	$4,502,856	$4,509,255
Arts, Entertainment, and Recreation	$0	$850,194	$850,194
Accommodation and Food Services	$0	$2,707,501	$2,707,501
Other Services, except Public Administration	$407,214	$1,879,935	$2,287,149
Total	**$96,947,359**	**$73,204,322**	**$170,151,681**

Sources: REMI PI+, RESI

Figure 133: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Output in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$5,271	$5,271
Mining	$0	$41,345	$41,345
Utilities	$0	$264,031	$264,031
Construction	$0	$6,252,740	$6,252,740
Manufacturing	$304,165	$658,073	$962,238
Wholesale Trade	$10,235	$739,449	$749,684
Retail Trade	$1,002,719	$2,196,775	$3,199,494
Transportation and Warehousing	$932	$275,929	$276,861
Information	$11,094,430	$4,029,526	$15,123,957
Finance and Insurance	$0	$1,948,139	$1,948,139
Real Estate and Rental and Leasing	$220	$3,952,747	$3,952,966
Professional, Scientific, and Technical Services	$43,481,116	$4,476,758	$47,957,874
Management of Companies and Enterprises	$0	$420,430	$420,430
Administrative and Waste Management Services	$115,844	$1,539,840	$1,655,685
Educational Services	$35,050	$95,446	$130,495
Health Care and Social Assistance	$6,399	$1,629,025	$1,635,423
Arts, Entertainment, and Recreation	$0	$251,932	$251,932
Accommodation and Food Services	$0	$1,275,670	$1,275,670
Other Services, except Public Administration	$65,677	$713,014	$778,691
Total	**$56,116,787**	**$30,766,140**	**$86,882,926**

Sources: REMI PI+, RESI

Figure 134: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Output in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$3,261	$3,261
Mining	$0	$88,386	$88,386
Utilities	$74,089	$627,192	$701,282
Construction	$3,603	$6,928,713	$6,932,315
Manufacturing	$132,725	$1,813,615	$1,946,340
Wholesale Trade	$6,275	$1,404,091	$1,410,366
Retail Trade	$185,861	$2,937,105	$3,122,966
Transportation and Warehousing	$0	$595,852	$595,852
Information	$13,797,814	$3,569,272	$17,367,086
Finance and Insurance	$0	$2,561,619	$2,561,619
Real Estate and Rental and Leasing	$850	$3,988,718	$3,989,568
Professional, Scientific, and Technical Services	$22,336,190	$5,845,718	$28,181,908
Management of Companies and Enterprises	$0	$316,105	$316,105
Administrative and Waste Management Services	$49,162	$1,760,320	$1,809,482
Educational Services	$74,823	$249,744	$324,567
Health Care and Social Assistance	$0	$2,576,586	$2,576,586
Arts, Entertainment, and Recreation	$0	$574,694	$574,694
Accommodation and Food Services	$0	$1,248,577	$1,248,577
Other Services, except Public Administration	$318,658	$1,045,839	$1,364,497
Total	**$36,980,050**	**$38,135,407**	**$75,115,457**

Sources: REMI PI+, RESI

Figure 135: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Output in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$2,309	$2,309
Mining	$0	$5,254	$5,254
Utilities	$0	$12,798	$12,798
Construction	$0	$129,517	$129,517
Manufacturing	$38	$122,347	$122,385
Wholesale Trade	$0	$35,056	$35,056
Retail Trade	$0	$112,675	$112,675
Transportation and Warehousing	$33	$17,219	$17,252
Information	$181	$211,619	$211,800
Finance and Insurance	$0	$40,455	$40,455
Real Estate and Rental and Leasing	$0	$56,765	$56,765
Professional, Scientific, and Technical Services	$3,586	$79,067	$82,653
Management of Companies and Enterprises	$0	$4,349	$4,349
Administrative and Waste Management Services	$8	$26,849	$26,858
Educational Services	$8	$3,166	$3,175
Health Care and Social Assistance	$0	$66,363	$66,363
Arts, Entertainment, and Recreation	$0	$12,122	$12,122
Accommodation and Food Services	$0	$44,524	$44,524
Other Services, except Public Administration	$0	$29,459	$29,459
Total	**$3,854**	**$1,011,913**	**$1,015,769**

Sources: REMI PI+, RESI

Figure 136: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Output in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$2,522	$2,522
Mining	$0	$531	$531
Utilities	$0	$128,737	$128,737
Construction	$0	$781,023	$781,023
Manufacturing	$391	$54,623	$55,014
Wholesale Trade	$15	$22,553	$22,568
Retail Trade	$4,541	$357,589	$362,130
Transportation and Warehousing	$0	$23,903	$23,903
Information	$116,505	$189,557	$306,062
Finance and Insurance	$0	$72,546	$72,546
Real Estate and Rental and Leasing	$0	$118,049	$118,049
Professional, Scientific, and Technical Services	$3,394,334	$310,674	$3,705,008
Management of Companies and Enterprises	$0	$7,192	$7,192
Administrative and Waste Management Services	$2,045	$71,469	$73,513
Educational Services	$0	$3,022	$3,022
Health Care and Social Assistance	$0	$173,287	$173,287
Arts, Entertainment, and Recreation	$0	$8,863	$8,863
Accommodation and Food Services	$0	$112,374	$112,374
Other Services, except Public Administration	$22,880	$72,416	$95,295
Total	**$3,540,711**	**$2,510,930**	**$6,051,639**

Sources: REMI PI+, RESI

Figure 137: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Output in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$190	$190
Mining	$0	$12,095	$12,095
Utilities	$0	$9,545	$9,545
Construction	$908	$124,851	$125,759
Manufacturing	$0	$81,276	$81,276
Wholesale Trade	$0	$18,646	$18,646
Retail Trade	$0	$144,403	$144,403
Transportation and Warehousing	$0	$15,592	$15,592
Information	$1,649	$94,740	$96,389
Finance and Insurance	$0	$97,604	$97,604
Real Estate and Rental and Leasing	$0	$27,371	$27,371
Professional, Scientific, and Technical Services	$303,001	$20,873	$323,874
Management of Companies and Enterprises	$0	$4,613	$4,613
Administrative and Waste Management Services	$400	$21,322	$21,722
Educational Services	$0	$1,065	$1,065
Health Care and Social Assistance	$0	$57,595	$57,595
Arts, Entertainment, and Recreation	$0	$2,584	$2,584
Accommodation and Food Services	$0	$26,356	$26,356
Other Services, except Public Administration	$0	$19,208	$19,208
Total	**$305,958**	**$779,929**	**$1,085,887**

Sources: REMI PI+, RESI

F.3 The Impact of a 10 Percent Increase in Cybersecurity Spending on Wages in Maryland by NAICS Code

The tables in this section present the impact of a ten percent Increase in cybersecurity contracting on Maryland and each of the five regions in terms of total wages. Direct, indirect/induced, and total effects are separated out.

Figure 138: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Wages in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$3,896	$3,896
Mining	$0	$15,310	$15,310
Utilities	$13,616	$166,038	$179,654
Construction	$1,735	$5,399,664	$5,401,399
Manufacturing	$59,514	$515,431	$574,945
Wholesale Trade	$6,403	$818,524	$824,927
Retail Trade	$448,229	$2,074,537	$2,522,766
Transportation and Warehousing	$269	$398,291	$398,560
Information	$3,161,444	$1,035,223	$4,196,667
Finance and Insurance	$0	$1,088,163	$1,088,163
Real Estate and Rental and Leasing	$44	$378,616	$378,660
Professional, Scientific, and Technical Services	$33,513,579	$5,036,729	$38,550,307
Management of Companies and Enterprises	$0	$442,993	$442,993
Administrative and Waste Management Services	$84,584	$1,610,844	$1,695,428
Educational Services	$69,613	$222,296	$291,908
Health Care and Social Assistance	$2,584	$2,277,512	$2,280,096
Arts, Entertainment, and Recreation	$0	$279,704	$279,704
Accommodation and Food Services	$0	$888,011	$888,011
Other Services, except Public Administration	$134,731	$994,982	$1,129,713
Total	**$37,496,345**	**$23,646,764**	**$61,143,107**

Sources: REMI PI+, RESI

Figure 139: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Wages in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$1,746	$1,746
Mining	$0	$6,081	$6,081
Utilities	$0	$32,840	$32,840
Construction	$0	$2,277,129	$2,277,129
Manufacturing	$41,154	$137,305	$178,459
Wholesale Trade	$4,037	$285,436	$289,473
Retail Trade	$377,917	$822,456	$1,200,373
Transportation and Warehousing	$259	$124,803	$125,062
Information	$1,568,042	$520,335	$2,088,376
Finance and Insurance	$0	$429,357	$429,357
Real Estate and Rental and Leasing	$10	$189,215	$189,225
Professional, Scientific, and Technical Services	$21,063,533	$2,136,699	$23,200,232
Management of Companies and Enterprises	$0	$269,232	$269,232
Administrative and Waste Management Services	$58,504	$740,417	$798,920
Educational Services	$18,541	$49,902	$68,443
Health Care and Social Assistance	$2,584	$821,075	$823,659
Arts, Entertainment, and Recreation	$0	$87,777	$87,777
Accommodation and Food Services	$0	$393,745	$393,745
Other Services, except Public Administration	$23,533	$419,116	$442,649
Total	**$23,158,114**	**$9,744,666**	**$32,902,778**

Sources: REMI PI+, RESI

Figure 140: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Wages in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$1,503	$1,503
Mining	$0	$5,590	$5,590
Utilities	$13,616	$107,936	$121,552
Construction	$1,447	$2,763,146	$2,764,594
Manufacturing	$18,323	$335,401	$353,724
Wholesale Trade	$2,361	$508,378	$510,739
Retail Trade	$68,894	$1,054,232	$1,123,126
Transportation and Warehousing	$0	$246,464	$246,464
Information	$1,579,005	$458,922	$2,037,927
Finance and Insurance	$0	$613,977	$613,977
Real Estate and Rental and Leasing	$34	$181,559	$181,593
Professional, Scientific, and Technical Services	$10,703,118	$2,718,906	$13,422,024
Management of Companies and Enterprises	$0	$166,000	$166,000
Administrative and Waste Management Services	$25,114	$827,399	$852,513
Educational Services	$51,067	$168,588	$219,654
Health Care and Social Assistance	$0	$1,311,422	$1,311,422
Arts, Entertainment, and Recreation	$0	$186,205	$186,205
Accommodation and Food Services	$0	$434,449	$434,449
Other Services, except Public Administration	$105,791	$519,896	$625,687
Total	**$12,568,770**	**$12,609,973**	**$25,178,743**

Sources: REMI PI+, RESI

Figure 141: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Wages in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$374	$374
Mining	$0	$937	$937
Utilities	$0	$2,017	$2,017
Construction	$0	$36,495	$36,495
Manufacturing	$3	$19,229	$19,232
Wholesale Trade	$0	$11,132	$11,132
Retail Trade	$0	$33,083	$33,083
Transportation and Warehousing	$10	$5,628	$5,637
Information	$18	$21,276	$21,294
Finance and Insurance	$0	$9,254	$9,254
Real Estate and Rental and Leasing	$0	$1,993	$1,993
Professional, Scientific, and Technical Services	$1,149	$26,057	$27,205
Management of Companies and Enterprises	$0	$2,118	$2,118
Administrative and Waste Management Services	$3	$9,437	$9,440
Educational Services	$5	$1,753	$1,758
Health Care and Social Assistance	$0	$33,869	$33,869
Arts, Entertainment, and Recreation	$0	$3,559	$3,559
Accommodation and Food Services	$0	$13,683	$13,683
Other Services, except Public Administration	$0	$12,343	$12,343
Total	**$1,188**	**$244,237**	**$245,423**

Sources: REMI PI+, RESI

Figure 142: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Wages in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$254	$254
Mining	$0	$92	$92
Utilities	$0	$21,771	$21,771
Construction	$0	$282,799	$282,799
Manufacturing	$34	$8,884	$8,918
Wholesale Trade	$5	$7,599	$7,604
Retail Trade	$1,417	$117,687	$119,104
Transportation and Warehousing	$0	$14,531	$14,531
Information	$14,178	$23,693	$37,872
Finance and Insurance	$0	$16,079	$16,079
Real Estate and Rental and Leasing	$0	$4,794	$4,794
Professional, Scientific, and Technical Services	$1,647,006	$148,372	$1,795,377
Management of Companies and Enterprises	$0	$3,313	$3,313
Administrative and Waste Management Services	$796	$25,220	$26,016
Educational Services	$0	$1,486	$1,486
Health Care and Social Assistance	$0	$84,223	$84,223
Arts, Entertainment, and Recreation	$0	$1,548	$1,548
Accommodation and Food Services	$0	$37,695	$37,695
Other Services, except Public Administration	$5,407	$35,232	$40,639
Total	**$1,668,843**	**$835,272**	**$2,504,115**

Sources: REMI PI+, RESI

Figure 143: The Average Annual Impact of a 10 Percent Increase in Cybersecurity Contracting on Wages in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	$19	$19
Mining	$0	$2,610	$2,610
Utilities	$0	$1,474	$1,474
Construction	$288	$40,094	$40,383
Manufacturing	$0	$14,612	$14,612
Wholesale Trade	$0	$5,978	$5,978
Retail Trade	$0	$47,080	$47,080
Transportation and Warehousing	$0	$6,864	$6,864
Information	$201	$10,997	$11,198
Finance and Insurance	$0	$19,496	$19,496
Real Estate and Rental and Leasing	$0	$1,054	$1,054
Professional, Scientific, and Technical Services	$98,774	$6,695	$105,469
Management of Companies and Enterprises	$0	$2,329	$2,329
Administrative and Waste Management Services	$168	$8,371	$8,539
Educational Services	$0	$567	$567
Health Care and Social Assistance	$0	$26,923	$26,923
Arts, Entertainment, and Recreation	$0	$615	$615
Accommodation and Food Services	$0	$8,439	$8,439
Other Services, except Public Administration	$0	$8,394	$8,394
Total	**$99,431**	**$212,611**	**$312,043**

Sources: REMI PI+, RESI

Appendix G: The Impact of a Large Defense Contractor Leaving Maryland on Employment, Output, and Wages in Maryland by NAICS Code

This Appendix contains detailed tables with additional information beyond that which is provided in Section 7.4. These tables show the direct, indirect/induced, and total impacts of a large defense contractor leaving Maryland, in terms of employment, total wages, and output, to the economies of Maryland and each of the five regions.

G.1 The Impact of a Large Defense Contractor Leaving Maryland on Employment in Maryland by NAICS Code

The tables in this section present the impact of a large defense contractor leaving Maryland on the state and each of the five regions in terms of employment. Direct, indirect/induced, and total effects are separated out.

Figure 144: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Employment in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	-2	-2
Mining	0	-7	-7
Utilities	0	-10	-10
Construction	0	-761	-761
Manufacturing	-1,607	-143	-1,750
Wholesale Trade	-456	-145	-601
Retail Trade	-5	-485	-490
Transportation and Warehousing	0	-87	-87
Information	-2	-43	-45
Finance and Insurance	-2	-116	-119
Real Estate and Rental and Leasing	0	-137	-137
Professional, Scientific, and Technical Services	-320	-358	-678
Management of Companies and Enterprises	0	-116	-116
Administrative and Waste Management Services	-1	-251	-251
Educational Services	0	-38	-38
Health Care and Social Assistance	0	-356	-356
Arts, Entertainment, and Recreation	0	-68	-68
Accommodation and Food Services	0	-224	-224
Other Services, except Public Administration	-6	-230	-236
Total	**-2,399**	**-3,577**	**-5,976**

Sources: REMI PI+, RESI

Figure 145: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Employment in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	-1	-1
Mining	0	-2	-2
Utilities	0	-2	-2
Construction	0	-269	-269
Manufacturing	-820	-44	-864
Wholesale Trade	-217	-43	-260
Retail Trade	-2	-141	-143
Transportation and Warehousing	0	-26	-26
Information	-1	-19	-20
Finance and Insurance	-1	-39	-40
Real Estate and Rental and Leasing	0	-50	-50
Professional, Scientific, and Technical Services	-167	-143	-311
Management of Companies and Enterprises	0	-58	-58
Administrative and Waste Management Services	0	-92	-93
Educational Services	0	-10	-10
Health Care and Social Assistance	0	-107	-107
Arts, Entertainment, and Recreation	0	-24	-24
Accommodation and Food Services	0	-71	-71
Other Services, except Public Administration	-3	-74	-78
Total	**-1,211**	**-1,215**	**-2,429**

Sources: REMI PI+, RESI

Figure 146: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Employment in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	-1	-1
Mining	0	-5	-5
Utilities	0	-7	-7
Construction	0	-460	-460
Manufacturing	-787	-93	-880
Wholesale Trade	-239	-97	-336
Retail Trade	-2	-313	-316
Transportation and Warehousing	0	-57	-57
Information	-1	-23	-24
Finance and Insurance	-1	-72	-73
Real Estate and Rental and Leasing	0	-81	-81
Professional, Scientific, and Technical Services	-153	-211	-364
Management of Companies and Enterprises	0	-57	-57
Administrative and Waste Management Services	0	-152	-153
Educational Services	0	-27	-27
Health Care and Social Assistance	0	-234	-234
Arts, Entertainment, and Recreation	0	-41	-41
Accommodation and Food Services	0	-142	-142
Other Services, except Public Administration	-3	-145	-148
Total	**-1,186**	**-2,218**	**-3,406**

Sources: REMI PI+, RESI

Figure 147: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Employment in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	-10	-10
Manufacturing	0	-3	-3
Wholesale Trade	0	-3	-3
Retail Trade	0	-10	-10
Transportation and Warehousing	0	-1	-1
Information	0	0	0
Finance and Insurance	0	-2	-2
Real Estate and Rental and Leasing	0	-2	-2
Professional, Scientific, and Technical Services	0	-1	-1
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	-2	-2
Educational Services	0	0	0
Health Care and Social Assistance	0	-6	-6
Arts, Entertainment, and Recreation	0	-1	-1
Accommodation and Food Services	0	-4	-4
Other Services, except Public Administration	0	-4	-4
Total	**0**	**- 49**	**- 49**

Sources: REMI PI+, RESI

Figure 148: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Employment in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	-1	-1
Construction	0	-16	-16
Manufacturing	0	-1	-1
Wholesale Trade	0	-1	-1
Retail Trade	0	-12	-12
Transportation and Warehousing	0	-1	-1
Information	0	0	0
Finance and Insurance	0	-2	-2
Real Estate and Rental and Leasing	0	-3	-3
Professional, Scientific, and Technical Services	0	-2	-2
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	-2	-2
Educational Services	0	0	0
Health Care and Social Assistance	0	-6	-6
Arts, Entertainment, and Recreation	0	-1	-1
Accommodation and Food Services	0	-4	-4
Other Services, except Public Administration	0	-5	-5
Total	**0**	**- 57**	**- 57**

Sources: REMI PI+, RESI

Figure 149: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Employment in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	0	0	0
Mining	0	0	0
Utilities	0	0	0
Construction	0	-5	-5
Manufacturing	0	-2	-2
Wholesale Trade	0	-1	-1
Retail Trade	0	-9	-9
Transportation and Warehousing	0	-1	-1
Information	0	0	0
Finance and Insurance	0	-2	-2
Real Estate and Rental and Leasing	0	-1	-1
Professional, Scientific, and Technical Services	0	0	0
Management of Companies and Enterprises	0	0	0
Administrative and Waste Management Services	0	-1	-1
Educational Services	0	0	0
Health Care and Social Assistance	0	-4	-4
Arts, Entertainment, and Recreation	0	0	0
Accommodation and Food Services	0	-2	-2
Other Services, except Public Administration	0	-2	-2
Total	**0**	**- 30**	**- 30**

Sources: REMI PI+, RESI

G.2 The Impact of a Large Defense Contractor Leaving Maryland on Output in Maryland by NAICS Code

The tables in this section present the impact of a large defense contractor leaving Maryland on the state and each of the five regions in terms of output. Direct, indirect/induced, and total effects are separated out.

Figure 150: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$77,635	-$77,635
Mining	$0	-$1,075,194	-$1,075,194
Utilities	$0	-$8,295,880	-$8,295,880
Construction	$0	-$94,786,610	-$94,786,610
Manufacturing	-$990,756,971	-$76,972,675	-$1,067,729,646
Wholesale Trade	-$99,106,553	-$31,487,935	-$130,594,489
Retail Trade	-$362,641	-$38,178,562	-$38,541,203
Transportation and Warehousing	$0	-$8,309,309	-$8,309,309
Information	-$632,259	-$20,775,315	-$21,407,573
Finance and Insurance	-$770,953	-$30,432,464	-$31,203,417
Real Estate and Rental and Leasing	$0	-$53,732,121	-$53,732,121
Professional, Scientific, and Technical Services	-$47,131,186	-$53,635,509	-$100,766,695
Management of Companies and Enterprises	$0	-$24,349,774	-$24,349,774
Administrative and Waste Management Services	-$32,094	-$17,226,226	-$17,258,320
Educational Services	$0	-$2,391,821	-$2,391,821
Health Care and Social Assistance	$0	-$31,599,265	-$31,599,265
Arts, Entertainment, and Recreation	$0	-$3,791,806	-$3,791,806
Accommodation and Food Services	$0	-$14,409,107	-$14,409,107
Other Services, except Public Administration	-$524,951	-$12,524,617	-$13,049,569
Total	**-$1,139,317,608**	**-$524,051,825**	**-$1,663,369,434**

Sources: REMI PI+, RESI

Figure 151: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$24,365	-$24,365
Mining	$0	-$279,863	-$279,863
Utilities	$0	-$1,783,488	-$1,783,488
Construction	$0	-$35,063,967	-$35,063,967
Manufacturing	-$500,888,109	-$24,085,455	-$524,973,565
Wholesale Trade	-$48,297,549	-$9,618,575	-$57,916,124
Retail Trade	-$177,561	-$11,403,169	-$11,580,730
Transportation and Warehousing	$0	-$1,906,892	-$1,906,892
Information	-$316,835	-$9,547,183	-$9,864,018
Finance and Insurance	-$408,473	-$10,142,397	-$10,550,870
Real Estate and Rental and Leasing	$0	-$21,029,144	-$21,029,144
Professional, Scientific, and Technical Services	-$24,133,024	-$20,826,206	-$44,959,229
Management of Companies and Enterprises	$0	-$13,024,148	-$13,024,148
Administrative and Waste Management Services	-$16,403	-$6,019,131	-$6,035,534
Educational Services	$0	-$513,032	-$513,032
Health Care and Social Assistance	$0	-$8,924,537	-$8,924,537
Arts, Entertainment, and Recreation	$0	-$943,682	-$943,682
Accommodation and Food Services	$0	-$5,125,919	-$5,125,919
Other Services, except Public Administration	-$262,820	-$3,781,701	-$4,044,521
Total	**-$574,500,774**	**-$184,042,854**	**-$758,543,628**

Sources: REMI PI+, RESI

Figure 152: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$23,358	-$23,358
Mining	$0	-$705,455	-$705,455
Utilities	$0	-$5,744,567	-$5,744,567
Construction	$0	-$56,593,476	-$56,593,476
Manufacturing	-$489,868,861	-$50,759,059	-$540,627,920
Wholesale Trade	-$50,809,004	-$21,082,340	-$71,891,345
Retail Trade	-$185,079	-$24,425,694	-$24,610,773
Transportation and Warehousing	$0	-$6,002,809	-$6,002,809
Information	-$315,424	-$10,874,324	-$11,189,747
Finance and Insurance	-$362,481	-$19,307,810	-$19,670,291
Real Estate and Rental and Leasing	$0	-$31,753,074	-$31,753,074
Professional, Scientific, and Technical Services	-$22,998,162	-$32,329,525	-$55,327,687
Management of Companies and Enterprises	$0	-$11,246,067	-$11,246,067
Administrative and Waste Management Services	-$15,691	-$10,834,202	-$10,849,893
Educational Services	$0	-$1,845,281	-$1,845,281
Health Care and Social Assistance	$0	-$21,359,897	-$21,359,897
Arts, Entertainment, and Recreation	$0	-$2,738,270	-$2,738,270
Accommodation and Food Services	$0	-$8,654,076	-$8,654,076
Other Services, except Public Administration	-$262,132	-$8,244,606	-$8,506,738
Total	**-$564,816,834**	**-$324,523,890**	**-$889,340,724**

Sources: REMI PI+, RESI

Figure 153: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$17,202	-$17,202
Mining	$0	-$30,871	-$30,871
Utilities	$0	-$96,952	-$96,952
Construction	$0	-$960,089	-$960,089
Manufacturing	$0	-$1,193,274	-$1,193,274
Wholesale Trade	$0	-$424,588	-$424,588
Retail Trade	$0	-$800,787	-$800,787
Transportation and Warehousing	$0	-$150,892	-$150,892
Information	$0	-$149,033	-$149,033
Finance and Insurance	$0	-$262,385	-$262,385
Real Estate and Rental and Leasing	$0	-$390,343	-$390,343
Professional, Scientific, and Technical Services	$0	-$136,110	-$136,110
Management of Companies and Enterprises	$0	-$39,132	-$39,132
Administrative and Waste Management Services	$0	-$137,491	-$137,491
Educational Services	$0	-$16,482	-$16,482
Health Care and Social Assistance	$0	-$485,665	-$485,665
Arts, Entertainment, and Recreation	$0	-$66,972	-$66,972
Accommodation and Food Services	$0	-$276,157	-$276,157
Other Services, except Public Administration	$0	-$180,306	-$180,306
Total	**$ 0**	**-$5,814,731**	**-$5,814,731**

Sources: REMI PI+, RESI

Figure 154: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$11,435	-$11,435
Mining	$0	-$1,140	-$1,140
Utilities	$0	-$621,591	-$621,591
Construction	$0	-$1,620,225	-$1,620,225
Manufacturing	$0	-$291,732	-$291,732
Wholesale Trade	$0	-$165,533	-$165,533
Retail Trade	$0	-$865,342	-$865,342
Transportation and Warehousing	$0	-$104,545	-$104,545
Information	$0	-$124,927	-$124,927
Finance and Insurance	$0	-$205,731	-$205,731
Real Estate and Rental and Leasing	$0	-$410,695	-$410,695
Professional, Scientific, and Technical Services	$0	-$298,199	-$298,199
Management of Companies and Enterprises	$0	-$14,232	-$14,232
Administrative and Waste Management Services	$0	-$152,531	-$152,531
Educational Services	$0	-$12,013	-$12,013
Health Care and Social Assistance	$0	-$508,144	-$508,144
Arts, Entertainment, and Recreation	$0	-$29,567	-$29,567
Accommodation and Food Services	$0	-$230,780	-$230,780
Other Services, except Public Administration	$0	-$222,634	-$222,634
Total	**$ 0**	**-$5,890,996**	**-$5,890,996**

Sources: REMI PI+, RESI

Figure 155: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Output in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$1,276	-$1,276
Mining	$0	-$57,863	-$57,863
Utilities	$0	-$49,283	-$49,283
Construction	$0	-$548,853	-$548,853
Manufacturing	$0	-$643,155	-$643,155
Wholesale Trade	$0	-$196,899	-$196,899
Retail Trade	$0	-$683,570	-$683,570
Transportation and Warehousing	$0	-$144,171	-$144,171
Information	$0	-$79,847	-$79,847
Finance and Insurance	$0	-$514,139	-$514,139
Real Estate and Rental and Leasing	$0	-$148,865	-$148,865
Professional, Scientific, and Technical Services	$0	-$45,470	-$45,470
Management of Companies and Enterprises	$0	-$26,196	-$26,196
Administrative and Waste Management Services	$0	-$82,870	-$82,870
Educational Services	$0	-$5,013	-$5,013
Health Care and Social Assistance	$0	-$321,022	-$321,022
Arts, Entertainment, and Recreation	$0	-$13,315	-$13,315
Accommodation and Food Services	$0	-$122,176	-$122,176
Other Services, except Public Administration	$0	-$95,370	-$95,370
Total	**$ 0**	**-$3,779,353**	**-$3,779,353**

Sources: REMI PI+, RESI

G.3 The Impact of a Large Defense Contractor Leaving Maryland on Wages in Maryland by NAICS Code

The tables in this section present the impact of a large defense contractor leaving Maryland on the state and each of the five regions in terms of total wages. Direct, indirect/induced, and total effects are separated out.

Figure 156: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages in Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$21,486	-$21,486
Mining	$0	-$101,819	-$101,819
Utilities	$0	-$1,348,475	-$1,348,475
Construction	$0	-$36,453,086	-$36,453,086
Manufacturing	-$130,649,199	-$11,293,060	-$141,942,258
Wholesale Trade	-$37,760,145	-$11,655,429	-$49,415,574
Retail Trade	-$133,977	-$13,836,108	-$13,970,085
Transportation and Warehousing	$0	-$3,498,667	-$3,498,667
Information	-$153,579	-$3,206,018	-$3,359,598
Finance and Insurance	-$142,895	-$7,548,656	-$7,691,551
Real Estate and Rental and Leasing	$0	-$2,494,765	-$2,494,765
Professional, Scientific, and Technical Services	-$22,754,622	-$25,467,742	-$48,222,364
Management of Companies and Enterprises	$0	-$14,374,573	-$14,374,573
Administrative and Waste Management Services	-$16,156	-$8,027,058	-$8,043,214
Educational Services	$0	-$1,540,589	-$1,540,589
Health Care and Social Assistance	$0	-$16,035,990	-$16,035,990
Arts, Entertainment, and Recreation	$0	-$1,260,101	-$1,260,101
Accommodation and Food Services	$0	-$4,869,158	-$4,869,158
Other Services, except Public Administration	-$182,410	-$6,667,797	-$6,850,207
Total	**-$191,792,983**	**-$169,700,577**	**-$361,493,560**

Sources: REMI PI+, RESI

Figure 157: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages in Capital Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$7,460	-$7,460
Mining	$0	-$38,773	-$38,773
Utilities	$0	-$221,635	-$221,635
Construction	$0	-$12,764,138	-$12,764,138
Manufacturing	-$69,613,702	-$3,703,243	-$73,316,945
Wholesale Trade	-$18,924,244	-$3,730,794	-$22,655,038
Retail Trade	-$66,587	-$4,266,526	-$4,333,112
Transportation and Warehousing	$0	-$729,560	-$729,560
Information	-$81,964	-$1,571,574	-$1,653,539
Finance and Insurance	-$75,629	-$2,472,282	-$2,547,912
Real Estate and Rental and Leasing	$0	-$1,008,539	-$1,008,539
Professional, Scientific, and Technical Services	-$11,673,803	-$9,996,970	-$21,670,773
Management of Companies and Enterprises	$0	-$8,305,374	-$8,305,374
Administrative and Waste Management Services	-$8,242	-$2,844,419	-$2,852,661
Educational Services	$0	-$268,805	-$268,805
Health Care and Social Assistance	$0	-$4,465,579	-$4,465,579
Arts, Entertainment, and Recreation	$0	-$313,385	-$313,385
Accommodation and Food Services	$0	-$1,604,082	-$1,604,082
Other Services, except Public Administration	-$95,032	-$2,251,195	-$2,346,227
Total	**-$100,539,203**	**-$60,564,333**	**-$161,103,537**

Sources: REMI PI+, RESI

Figure 158: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages in Central Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$10,275	-$10,275
Mining	$0	-$44,727	-$44,727
Utilities	$0	-$998,964	-$998,964
Construction	$0	-$22,655,167	-$22,655,167
Manufacturing	-$61,035,497	-$7,238,918	-$68,274,415
Wholesale Trade	-$18,835,901	-$7,668,533	-$26,504,433
Retail Trade	-$67,390	-$8,827,297	-$8,894,687
Transportation and Warehousing	$0	-$2,611,458	-$2,611,458
Information	-$71,615	-$1,591,173	-$1,662,788
Finance and Insurance	-$67,265	-$4,868,026	-$4,935,291
Real Estate and Rental and Leasing	$0	-$1,450,689	-$1,450,689
Professional, Scientific, and Technical Services	-$11,080,818	-$15,267,468	-$26,348,286
Management of Companies and Enterprises	$0	-$6,030,415	-$6,030,415
Administrative and Waste Management Services	-$7,915	-$5,051,729	-$5,059,643
Educational Services	$0	-$1,254,038	-$1,254,038
Health Care and Social Assistance	$0	-$10,933,868	-$10,933,868
Arts, Entertainment, and Recreation	$0	-$915,104	-$915,104
Accommodation and Food Services	$0	-$3,060,560	-$3,060,560
Other Services, except Public Administration	-$87,378	-$4,179,203	-$4,266,582
Total	**-$91,253,779**	**-$104,657,612**	**-$195,911,390**

Sources: REMI PI+, RESI

Figure 159: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages in the Eastern Shore by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$2,715	-$2,715
Mining	$0	-$5,807	-$5,807
Utilities	$0	-$15,428	-$15,428
Construction	$0	-$271,410	-$271,410
Manufacturing	$0	-$182,616	-$182,616
Wholesale Trade	$0	-$135,788	-$135,788
Retail Trade	$0	-$236,002	-$236,002
Transportation and Warehousing	$0	-$50,508	-$50,508
Information	$0	-$16,577	-$16,577
Finance and Insurance	$0	-$60,408	-$60,408
Real Estate and Rental and Leasing	$0	-$13,476	-$13,476
Professional, Scientific, and Technical Services	$0	-$44,834	-$44,834
Management of Companies and Enterprises	$0	-$19,166	-$19,166
Administrative and Waste Management Services	$0	-$47,400	-$47,400
Educational Services	$0	-$9,148	-$9,148
Health Care and Social Assistance	$0	-$248,168	-$248,168
Arts, Entertainment, and Recreation	$0	-$21,002	-$21,002
Accommodation and Food Services	$0	-$87,519	-$87,519
Other Services, except Public Administration	$0	-$84,618	-$84,618
Total	**$ 0**	**-$1,552,590**	**-$1,552,590**

Sources: REMI PI+, RESI

Figure 160: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages in Southern Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$929	-$929
Mining	$0	-$198	-$198
Utilities	$0	-$104,819	-$104,819
Construction	$0	-$586,270	-$586,270
Manufacturing	$0	-$51,777	-$51,777
Wholesale Trade	$0	-$56,388	-$56,388
Retail Trade	$0	-$283,857	-$283,857
Transportation and Warehousing	$0	-$48,769	-$48,769
Information	$0	-$15,574	-$15,574
Finance and Insurance	$0	-$44,303	-$44,303
Real Estate and Rental and Leasing	$0	-$16,343	-$16,343
Professional, Scientific, and Technical Services	$0	-$143,793	-$143,793
Management of Companies and Enterprises	$0	-$6,493	-$6,493
Administrative and Waste Management Services	$0	-$51,719	-$51,719
Educational Services	$0	-$5,915	-$5,915
Health Care and Social Assistance	$0	-$238,800	-$238,800
Arts, Entertainment, and Recreation	$0	-$7,068	-$7,068
Accommodation and Food Services	$0	-$77,551	-$77,551
Other Services, except Public Administration	$0	-$109,978	-$109,978
Total	**$ 0**	**-$1,850,544**	**-$1,850,544**

Sources: REMI PI+, RESI

Figure 161: The Average Annual Impact of a Large Defense Contractor Leaving Maryland on Wages in Western Maryland by NAICS Code

Industry	Direct	Indirect/Induced	Total
Forestry, Fishing, and Related Activities	$0	-$107	-$107
Mining	$0	-$12,314	-$12,314
Utilities	$0	-$7,629	-$7,629
Construction	$0	-$176,101	-$176,101
Manufacturing	$0	-$116,504	-$116,504
Wholesale Trade	$0	-$63,927	-$63,927
Retail Trade	$0	-$222,427	-$222,427
Transportation and Warehousing	$0	-$58,372	-$58,372
Information	$0	-$11,120	-$11,120
Finance and Insurance	$0	-$103,636	-$103,636
Real Estate and Rental and Leasing	$0	-$5,718	-$5,718
Professional, Scientific, and Technical Services	$0	-$14,676	-$14,676
Management of Companies and Enterprises	$0	-$13,126	-$13,126
Administrative and Waste Management Services	$0	-$31,791	-$31,791
Educational Services	$0	-$2,683	-$2,683
Health Care and Social Assistance	$0	-$149,574	-$149,574
Arts, Entertainment, and Recreation	$0	-$3,541	-$3,541
Accommodation and Food Services	$0	-$39,446	-$39,446
Other Services, except Public Administration	$0	-$42,802	-$42,802
Total	**$ 0**	**-$1,075,494**	**-$1,075,494**

Sources: REMI PI+, RESI

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