Talent Pathways Analysis & Strategic Development

CHMURA

Data Analytics, Cybersecurity, and Modeling & Simulation Cluster

Aerospace and Unmanned Systems Cluster

HAMPTONROADS
WORKFORCECOUNCIL
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Contents

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Report prepared by Chmura for Hampton Roads Workforce Council.

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EXECUTIVE SUMMARY

In 2017, the Hampton Roads region produced an "Economic Growth and Diversification Plan" for the GO Virginia Board as a guide for the GO Virginia Region 5 Regional Council. The plan outlined six priority industry clusters as targets to stimulate economic growth for Region 5. Of those six clusters, two were chosen as most important to the region: (1) Data Analytics, Cybersecurity, and Modeling & Simulation, and (2) Aerospace and Unmanned Systems.

The Hampton Roads Workforce Council (HRWC) has undertaken further research to understand if the region needs to build capacity for talent pathways across these two clusters. Chmura Economics & Analytics (Chmura)[1] was retained to engage regional stakeholders and provide data on cluster needs.

Cluster Analysis

Support from the HRWC can ensure a strong talent pipeline for future demand. The current growth trajectory in data analytics, cybersecurity, and modeling & simulation suggests an average annual growth rate of 0.6%, adding up to 10,400 jobs in the region over the next ten years. Similarly, the aerospace and unmanned systems cluster is expected to add up to 10,200 jobs in related occupations at a rate of 0.4% average annual growth. The aerospace and unmanned systems cluster matches the anticipated average growth rate of total employment in the region (0.4%) with the national forecast for total employment growth over the next ten years. The data analytics, cybersecurity, and modeling & simulation cluster's average total employment growth rate of 0.4% in the region trails national forecasts of 0.6% total employment growth over the next ten years.

Investment in talent pathways for these clusters may close this gap and accelerate growth for the region. These clusters, which pay better-than-average wages, will support wage gains in the region. More than 45% of the top 20 occupations pay over $100,000 in median wages for both clusters. Growth in high-paying jobs in

[1] Chmura provides economic software, consulting, and data to our clients that help them make informed decisions to benefit their communities. Chmura's PhD economists, data scientists, and strategic planners guide clients through their local labor market. Over the past 26 years, Chmura has served hundreds of clients nationwide with thoroughness, accuracy, and objectivity.

the region over the next ten years will increase average wages for the region and boost the local economy.

Information security analysts (annual average wage of $115,400 in the third quarter of 2023), computer and information systems managers ($152,300), and network and computer systems administrators ($98,100) accounted for 39% of job ads in the data analytics, cybersecurity, and modeling & simulation cluster in the last year. Top occupations include jobs in the entry- and mid-level fields. Except for computer user support specialists, the highest in-demand occupations in this cluster require a bachelor's degree.

In the aerospace and unmanned systems cluster, a blended mix of bachelor's degrees and high school diplomas are required for the top occupations posted in 2023. Examples include maintenance and repair (annual average wage of $43,900 in the third quarter of 2023), intelligence analysts ($82,900), software developers ($117,300), and industrial engineers ($93,500).

Top in-demand occupations for aerospace and unmanned systems are significantly lower than for data analytics, cybersecurity, and modeling & simulation. The top 20 occupations in the last year cover just over 220 job ads. Of those, three of the five top occupations required a high school diploma.

Strengths and Advantages

- **The data analytics, cybersecurity, and modeling & simulation cluster benefits from access to retired military and a defense talent pipeline.** Research and innovation assets in the region supporting these clusters include Virginia Modeling, Analysis and Simulation Center (VMASC), Old Dominion University, the College of William and Mary, and Christopher Newport University. The cybersecurity threat landscape, emerging technologies, and collaborative partnerships (such as Jefferson Lab/ VMASC) present opportunities for Hampton Roads in this cluster.
- **The aerospace and unmanned systems cluster benefits from military presence in the region as well as the established infrastructure with both the U.S. Navy and NASA Langley.** Top companies in this sector like DroneUp and Huntington Ingalls Industries Mission Systems provide significant strengths. Additionally, access to talent with secret clearances is an asset for both clusters. Opportunities exist with access to research, technology, collaborative partnerships, and invevstments in technologies like advanced air mobility.

FIGURE 1

CLUSTER QUICK FACTS

Data Analytics, Cybersecurity, and Modeling & Simulation

- The cluster is experiencing substantial growth in the U.S. market. In the region, this cluster is projected to add more than 10,000 jobs over the next 10 years.
- Cybersecurity needs have surged since the COVID pandemic, with malware attacks in the United States increasing by 169% in 2022 from the prior year.
- The modeling & simulation sector is projected to have a higher growth rate within the cluster, driven by the demand for online services like virtual training and data modeling.
- The top in-demand skills in the cluster include information security, Microsoft Excel, SQL, Python, and Java.

Aerospace and Unmanned Systems

- The aerospace and unmanned systems cluster in Hampton Roads has several advantages: strategic location, established infrastructure, and strong military presence.
- Growth in the aerospace and unmanned systems cluster is driven by the surge in geopolitical tensions rising across the globe, as well as the increasing adoption of drones for personal and business use.
- The development of advanced air mobility and electric Vertical Takeoff and Landing (eVTOL) services is projected to experience significant growth in Virginia.
- Defense manufacturers like Boeing, RTX, Northrop Grumman, and Huntington Ingalls dominate the market in the region.
- Over 75% of the Top 20 job postings for aerospace and unmanned systems occupations have median wages above $75,000.

Gaps and Threats

These two clusters face challenges such **as dependency on government contracts, competition, skills gaps, and limited diversity.**

- **Four-year and two-year degrees in cybersecurity have the largest gaps between graduating students and job ads over the last year.** The modeling & simulation sector had 26 awards for the 2021-22 academic year.
- **While experienced military talent is a strength of the region, younger talent for entry-level positions is more limited and should be a priority for HRWC.** Stakeholders engaged in small focus group interviews and surveys for the aerospace and unmanned systems cluster indicated that pilot training and local growth of talent are important factors to build the cluster. Many new hires are recruited from outside the region, such as from Texas, California, or Washington.
- **Top skills gaps exist in aerospace and unmanned systems with fundamental skill sets like Microsoft Excel and Outlook, mathematics, Python, Linux, and teaching/training included.** These skills overlap both clusters as well as other industries causing the entire region to compete for talent with these fundamental skills. There were no annual educational awards in the region for unmanned systems. In the aerospace sector, the region provides three times the required certificate and two-year degrees but falls significantly short of demand for four-year awards.

Looking Ahead

- **Significant growing demand in cybersecurity exists across all industries. Amid a shifting environment of artificial intelligence, some of the current demands in this cluster will change over the next two to five years.** HRWC's ability to anticipate and support the local workforce with those shifts will be important to meet talent demand. Continued regular engagement with these stakeholders through a model, such as the maritime industry employer collaborative, will help HRWC stay on top of these shifting trends.
- The development of **advanced air mobility and electric Vertical Takeoff and Landing (eVTOL) services is projected to have significant growth** in Virginia.

Recommendations

Further funding and continued engagement will be needed to keep pace with the regional demand and tap into the potential growth trajectory for both industry clusters. The following recommendations are based on regional needs identified in the quantitative and qualitative research:

- Pursue **additional programming to expand training opportunities** for both industry clusters.
- Support employers with **fundamental training for skills** like Microsoft products, Python, and Java.
- Develop **internships and apprenticeships** that build young or entry-level talent to develop pathways for local growth of in-demand occupations. Further on-the-job training can help young talent acquire skills and advance careers within the clusters.
- Encourage employers to continue engaging with programs like **Virginia Values Veterans (V3)**[2] **and SkillBridge**[3] as it builds the talent pathways program.
- **Create a small advisory group of employers and regional partners** to build regional cooperation, streamline engagement, and support further growth in both clusters. Cybersecurity skills are a natural starting point as they represent a shared need, well-defined skillset, and possibility for a quick win to build trust between employers and HRWC.

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[2] The Virginia Values Veterans (V3) Program helps employers develop and implement successful, long-term strategies to recruit, hire, and retain Virginia Veterans.

[3] The Department of Defense SkillBridge program connects service members with industry partners in real-world job experiences. It offers specific industry training, apprenticeships, or internships during the last 180 days of military service.

2

BACKGROUND AND METHODOLOGY

GO Virginia Region 5 completed a Growth and Diversification Plan in 2021 to identify priority industry clusters and support growth in the Hampton Roads region. The Hampton Roads Workforce Council (HRWC) was selected by GO Virginia as the lone recipient of a "talent pathways" award in May 2023: a planning grant to facilitate regional collaboration to grow and diversify the economy. Projects are required to be consistent with the strategies and targeted industry clusters outlined in the Growth and Diversification Plan.

The overarching goal of the grant is to develop a plan that will support sustained economic growth and talent development and retention in the Commonwealth. It establishes and funds a new "talent pathways" planning initiative that fosters collaboration of business and education—meeting workforce goals by developing, retaining, and attracting talent to the Commonwealth to meet the needs of Virginia businesses.

The HRWC's Growth and Diversification Plan from 2021 included information about two clusters that the HRWC successfully put forth for the GO Virginia planning grant:

1. **Cyber Security, Data Analytics, and Modeling & Simulation:** This cluster encompasses activities that are found in many different industries due to rapid technological advancements and applications.
2. **Unmanned Systems and Aerospace:** This key industry cluster covers aircraft manufacturing, drones, robotic manufacturing, and aerospace engineering.

Within these two clusters, the "talent pathways" project seeks to align training curricula with the needs of business through collaboration incentives as well as increased work-based learning experiences (internships, apprenticeships, on-the-job upskilling, and re-skilling programs) and develop entrepreneurial talent.

Chmura conducted a study of the economic growth that will benefit the Hampton Roads region based on full-scale talent pipeline development in each cluster. The first step was defining the clusters by standard industry and/or occupation codes. Chmura worked with HWRC and reviewed the previous GO Virginia Region 5 Growth and Diversification Plan to create definitions by North American Industry Classification System (NAICS) and Standard Occupation Classification (SOC) codes.[4] These custom cluster definitions enabled analysis of industry and occupation trends in Chmura's JobsEQ® platform.[5]

Next, Chmura completed a quantitative and qualitative situational (SWOT) analysis of the workforce needs for the selected clusters. Data were drawn from JobsEQ, Chmura's labor market information software, as well as from additional outside research. Chmura collected qualitative information by consulting with key stakeholders through a series of interviews and focus groups. Chmura received feedback and follow-up interviews from six focus groups of key employers. This stakeholder engagement served to both validate the secondary data analysis and lay the groundwork for forming an employer collaborative to continue regular coordination on talent strategies.

Lastly, a survey was distributed electronically among all firms in the "employer inventory"[6] to gather information about the current and future development of the clusters. The stakeholder engagement (focus groups, interviews, and survey) provided information to build a SWOT analysis of the clusters' current state and factors supporting or impeding their growth. With the results of this study, HRWC can commit to addressing regional industry needs and develop a strategic plan for cultivating the necessary growth within those industries.

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[4] Some occupations, including cybersecurity, data analytics, and modeling & simulation, have not been classified by the Bureau of Labor Statistics into an official SOC code. In these cases, Chmura used JobsEQ Real Time Intelligence (RTI) to identify the SOC codes that are associated with online job ads that include "cyber," "data science," and "modeling and simulation" in the job description.

[5] JobsEQ is Chmura's proprietary software that gathers insights from real-time job posting data and traditional labor market data in one platform.

[6] Chmura used a combination of the JobsEQ employer database, third-party research based on SOC codes, LinkedIn data, and online research to compile the final employer inventory provided to HRWC.

3

DATA ANALYTICS, CYBERSECURITY, AND MODELING & SIMULATION

This section discusses the growth and opportunities in the data analytics, cybersecurity, and modeling & simulation industry cluster in the U.S. market, with a focus on the Hampton Roads region. It covers the increase in cybersecurity needs due to the COVID pandemic, the projected growth in modeling & simulation, the role of large companies in supporting software-as-a-service (SaaS), and the selection of Jefferson Lab as the lead for the new High-Performance Data Facility (HPDF) hub. It also highlights the skills gap and the top in-demand skills in the cluster.

Key takeaways from this section include:

- The cluster is experiencing substantial growth in the U.S. market. It is projected to add more than 10,000 new jobs over the next 10 years in the region.
- Cybersecurity needs have surged since the COVID pandemic, with malware attacks in the United States increasing by 169% in 2022.
- The modeling & simulation sector is projected to have the highest growth rate relative to data analytics and cybersecurity, driven by the demand for online applications like virtual training and data modeling.
- Jefferson Lab has been selected as the lead for the new High-Performance Data Facility (HPDF) hub, which will provide advanced computing capabilities and support AI and exascale[7] computing research.
- Small and medium-sized companies are anticipated to embrace in-house analytics and enterprise software over the next five years.
- The Hampton Roads region is becoming an important hub for data analytics and cybersecurity, with the development of subsea cable connections and the presence of key employers.
- The cluster faces challenges such as dependency on government contracts, competition from other technology hubs, and a skills gap in specialized areas.
- The top in-demand skills in the cluster include information security, Microsoft Excel, SQL, Python, and Java.

[7] Exascale—the most recent milestone in computing achievement—marks a transformative change because of the degree of problem-solving capability it enables. This type of supercomputer is capable of calculating a quintillion operations per second. It can more realistically simulate the processes and challenges involved in medicine, climate, manufacturing, physics, national security, and more. Source: https://www.exascaleproject.org/about/.

3.1

BASELINE INDUSTRY ANALYSIS

The data analytics, cybersecurity, and modeling & simulation industry cluster has grown substantially in the U.S. market in recent years. For example, between 2018 and 2023, employment size has increased at an average annual rate of 2.9% in IT security consulting, 8.7% in business analytics and enterprise software publishing, and 10.1% in computer-aided design software development. [8,9,10] Cybersecurity needs have surged across the nation since the COVID pandemic. The Internet of things (IoT)[11] has expanded to all corners of daily life over the last five years. At the same time, malware attacks in the United States increased 169% in 2022, eclipsing the numbers seen in other malware and ransomware attacks before 2020.[12]

The national growth rate of industries in this cluster is projected to be highest in modeling & simulation as business operations demand more online applications such as virtual training, prototyping, and data modeling. In the Hampton Roads region, Jefferson Lab's recent selection as the lead for the new High-Performance Data Facility (HPDF) hub[13] and the development of three subsea cable connections providing high-capacity fiber to international markets[14] will provide unique advantages to capture growth in this cluster.

Data Analytics

Large companies have traditionally supported software-as-a-service (SaaS) for in-house data analysis. Now, many small and medium-sized companies in all industries are anticipated to embrace in-house analytics and enterprise software over the next five years. Although SaaS companies are growing as data mining and predictive analytics become more ingrained in business operations, Microsoft and SAP still have a large influence on the market of data analytics.[15]

In October 2023, the Department of Energy (DOE) announced that it selected Jefferson Lab in Newport News, Virginia as the Hub Director for the new High-Performance Data Facility (HPDF). This hub is a partnership between Jefferson Lab and Lawrence Berkeley National Laboratory. The HPDF will provide advanced computing capabilities, experimental user facilities, and the DOE's unique contributions to

STAKEHOLDERS' INSIGHTS:

Research has become important. In the 25 years that I've been in the M&S industry, what's going to happen over the next 5 years? It's going to quadruple.

Dr. Johnny Garcia, SimIS, Inc.

[8] IBIS World, "IT Security Consulting in the US - Market Size, Industry Analysis, Trends and Forecasts", last modified October 2023. https://www.ibisworld.com/united-states/market-research-reports/it-security-consulting-industry/#IndustryStatisticsAndTrends.

[9] IBIS World, "Business Analytics & Enterprise Software Publishing in the US", last modified October 2023. https://www.ibisworld.com/united-states/market-research-reports/business-analytics-enterprise-software-publishing-industry/#IndustryStatisticsAndTrends.

[10] IBIS World, "Computer-Aided Design Software Developers in the US - Market Size, Industry Analysis", last modified October 2023. https://www.ibisworld.com/united-states/market-research-reports/computer-aided-design-software-developers-industry/#IndustryStatisticsAndTrends.

[11] The Internet of Things refers to the network of connected objects that can collect and exchange data in real time using embedded sensors. Thermostats, cars, lights, and appliances can all be connected to the IoT.

[12] "2023 Sonicwall Cyber Threat Report," Sonicwall, last modified 2023, sonicwall.com/medialibrary/en/white-paper/2023-cyber-threat-report.pdf.

[13] "Jefferson Lab to Lead $300 Million High Performance Data Facility Hub," Jefferson Lab, last modified October 16, 2023, https://www.jlab.org/news/releases/jefferson-lab-lead-300-million-high-performance-data-facility-hub.

[14] "Key Industries: Digital Port," Virginia Beach, Virginia, last modified 2024, https://www.yesvirginiabeach.com/key-industries/digital-port.

[15] "Business Analytics & Enterprise Software Publishing Market Research Report," IBIS World, last modified November 2023, https://www.ibisworld.com/united-states/market-research-reports/business-analytics-enterprise-software-publishing-industry/#TableOfContents.

provide a national resource for artificial intelligence and exascale computing (supercomputer) research. The location of this hub in the Hampton Roads region[16] will encourage further development from other private sector businesses with contracts or partnerships with the DOE and defense agencies. Based on employer feedback, this new partnership will result in hiring more than 150 employees for Jefferson Lab. Most of these new hires will fall under data analytics, with a smaller portion of the new jobs focusing on cybersecurity and modeling & simulation.

Cybersecurity

In the post-pandemic world, the integration of remote work across a majority of business operations has created a strong demand for internet-based solutions. An increase in the use of social networks, e-commerce, and cloud computing demands an increasing amount of support to prevent online security attacks on vulnerable networks. An increasing number of customers are requiring support from this sector, including governments, banks, and B2B enterprises.[17]

Although Northern Virginia is the largest data center market in the world (due to its proximity to Washington, D.C.), Hampton Roads is quickly becoming an equally important hub. The installation of three intercontinental, high-capacity, low-latency subsea fiber optic telecommunication cables (MAREA, BRUSA, and Dunant) will connect Virginia Beach to Brazil, Puerto Rico, and Spain. PortOne's NAP of Virginia Beach, a carrier neutral data center and cable landing station, provides connection to all three subsea cables as data center growth is developing in Hampton Roads and Northern Virginia over the next five years.[18] This will help spur further growth concentration in cybersecurity occupations as both data centers and defense agencies continue to cement their presence in the Hampton Roads region.

Modeling & Simulation

Like the data analytics and cybersecurity industries, the growth of internet-based software applications in a post-pandemic environment has positively impacted the development of modeling & simulation-based industries in the United States. SaaS popularity is providing an increased demand for cloud-based computer-aided software in recent years.[19] With continuing improvements in technology, companies are also increasing their use of virtual reality software for a variety of applications like training modules and prototyping.[20]

The Virginia Modeling, Analysis and Simulation Center (VMASC) in Suffolk provides a unique advantage for the growing industry, actively partnering with companies like Booz Allen Hamilton, Huntington Ingalls, General Dynamics, Eastern Virginia Medical School, Lockheed Martin, MITRE, SAIC, SimIS, and Sentara Health. From small to large company-assisted research, VMASC has over 27 years of experience in modeling & simulation research with applications like disaster preparedness, manufacturing, supply chain management, entertainment, and training module deployment.[21]

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[16] The primary region of analysis is the Hampton Roads Workforce Council (HRWC) service area, including the localities of Chesapeake, Franklin, Gloucester, Hampton, Isle of Wight, James City, Newport News, Norfolk, Poquoson, Portsmouth, Southampton, Suffolk, Virginia Beach, Williamsburg, and York. Due to the economic connections with and location of key employers in the Eastern Shore, Northampton and Accomack counties may be included in some analyses under the broader "GO Virginia Region 5" classification.

[17] "IT Security Consulting Market Research Report," IBIS World, last modified October 2023, https://www.ibisworld.com/united-states/market-research-reports/it-security-consulting-industry/#IndustryStatisticsAndTrends.

[18] "Key Industries: Digital Port," Virginia Beach, Virginia, last modified 2024, https://www.yesvirginiabeach.com/key-industries/digital-port.

[19] "Computer-Aided Design Software Developers Market Research Report," IBIS World, last modified February 2023, https://www.ibisworld.com/united-states/market-research-reports/computer-aided-design-software-developers-industry/#IndustryStatisticsAndTrends.

[20] "Virtual Reality Software Industry Market Research Report," IBIS World, last modified 2023, https://www.ibisworld.com/united-states/market-research-reports/virtual-reality-software-industry/.

[21] "Industry Leaderships," Virginia Modeling, Analysis and Simulation Center, accessed February 14, 2024, https://vmasc.org/partnerships/industry-leadership/.

3.2

CLUSTER ANALYSIS

Digging deeper into a review of the average employment and wages in the data analytics, cybersecurity, and modeling & simulation cluster, location quotient (LQ) provides a measure of employment concentration in the Hampton Roads region. A location quotient identifies how a region compares to the national average concentration in a particular industry or occupation. A value above 1.0 means the region has a comparative advantage in that industry or occupation. For occupations in the data analytics, cybersecurity, and modeling & simulation cluster, the current LQ is 1.10 in the Hampton Roads region. Several occupations have a location quotient at a level indicating regional specialization, including metal and plastic layout workers (44.70), nuclear engineers (3.15), aerospace engineers (2.53), and information security analysts (2.20).

Current job openings identify an immediate skills gap for employers and opportunities for job seekers. Large numbers of job postings for individual occupations suggest an apparent skills gap, as different businesses need the same skills. As shown in Table 3.1, information security analysts, computer user support specialists, network and computer system administrators, and computer and information systems managers top the list of jobs posted online in GO Virginia Region 5.[22] All but one of the top 15 occupations require at least a bachelor's degree.

The data continue to align with the Growth and Diversification Plan from 2021 on the significance of this cluster in the Hampton Roads region. Job ads over the last year are highest in concentrations for business operations, management, and computer occupations. **Of the top 20 occupations in the cluster, 65% pay median wages over $100,000.**

Table 3.1

More than Half of the Top 20 Job Ads in Cybersecurity, Data Analytics, and Modeling & Simulation Pay over $100,000 in Median Wages

SOC	OCCUPATION	TYPICAL EDUCATION REQUIREMENTS	NUMBER OF ADS	MEDIAN WAGES
15-1212.00	Information Security Analysts	Bachelor's degree	787	$115,400
11-3021.00	Computer and Information Systems Managers	Bachelor's degree	674	$152,300
15-1244.00	Network and Computer Systems Administrators	Bachelor's degree	654	$98,100
15-2031.00	Operations Research Analysts	Bachelor's degree	399	$116,200
15-1232.00	Computer User Support Specialists	Some college, no degree	327	$54,900
13-1111.00	Management Analysts	Bachelor's degree	230	$100,900
15-1252.00	Software Developers	Bachelor's degree	185	$117,300
15-1299.08	Computer Systems Engineers/Architects	Bachelor's degree	169	$109,100
15-1221.00	Computer and Information Research Scientists	Master's degree	157	$132,900
11-9041.00	Architectural and Engineering Managers	Bachelor's degree	126	$151,100
13-1199.00	Business Operations Specialists, All Other	Bachelor's degree	92	$86,100
25-1021.00	Computer Science Teachers, Postsecondary	Doctoral or professional degree	72	$73,700
17-2071.00	Electrical Engineers	Bachelor's degree	70	$103,700
13-1151.00	Training and Development Specialists	Bachelor's degree	70	$62,700
17-2072.00	Electronics Engineers, Except Computer	Bachelor's degree	61	$113,000
13-2011.00	Accountants and Auditors	Bachelor's degree	53	$73,800
15-1211.00	Computer Systems Analysts	Bachelor's degree	52	$109,200
15-1299.05	Information Security Engineers	Bachelor's degree	50	$109,100
21-1093.00	Social and Human Service Assistants	High school diploma or equivalent	47	$38,900
15-1299.09	Information Technology Project Managers	Bachelor's degree	41	$109,100

Source: JobsEQ by Chmura

[22] Counts of unique job postings may not equate with actual job demand. For example, job postings may be placed in anticipation of possible openings that do not materialize. Moreover, slight variations of ads may be placed such that the number of ads exceeds the actual number of openings.

3.3

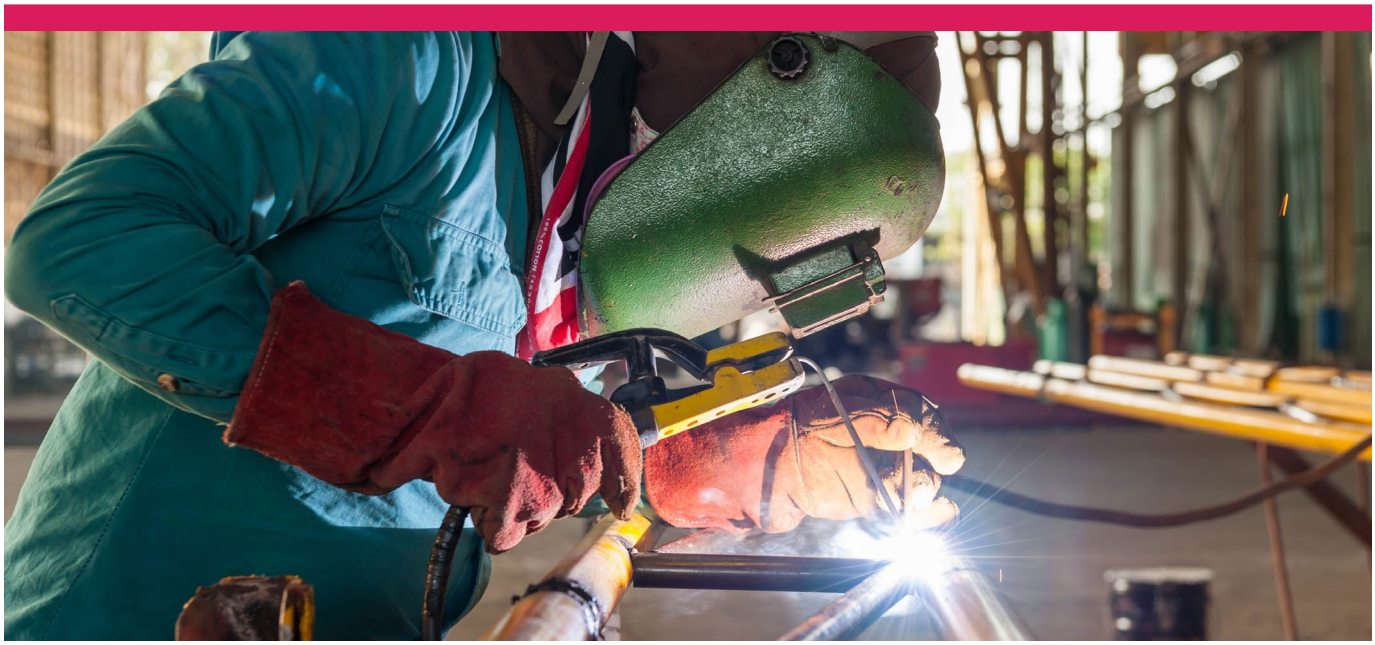
EMPLOYMENT FORECASTS

Over the next ten years, employment in the Hampton Roads region across all industries is forecast to grow at an average annual rate of 0.4%, compared with the national growth rate of 0.8% over the same period.[23] As shown in Figure 3.1 below, employment in key occupations for the data analytics, cybersecurity, and modeling & simulation sector was over 168,000 in Hampton Roads as of the third quarter of 2023. Employment in these key occupations dropped 5% following the COVID-19 recession in early 2020 (indicated by the gray area), but quickly rebounded and it is now 2.8% above its pre-COVID-19 level. Employment for the entire region, however, is still lagging 1.5% behind the pre-COVID peak. Of total sector employment in Hampton Roads, these key occupations for the data analytics, cybersecurity, and modeling & simulation cluster comprise nearly 37%. With average wages of $82,200 in the region, these are high-paying jobs compared to the regional average of $65,200. For this cluster, the average annual forecast employment growth rate over the next ten years is +0.6%, compared with +0.4% for the region overall and +0.7% for the nation. Based on this projection, the Hampton Roads region will need **10,374 jobs in the key occupations for this cluster by 2033.** (Note that key jobs are not mutually exclusive and may be counted in both clusters).

STAKEHOLDERS' INSIGHTS:

We're expecting rapid growth on the M&S and Cyber side in the next 5 years. All of our data analytics is done elsewhere.

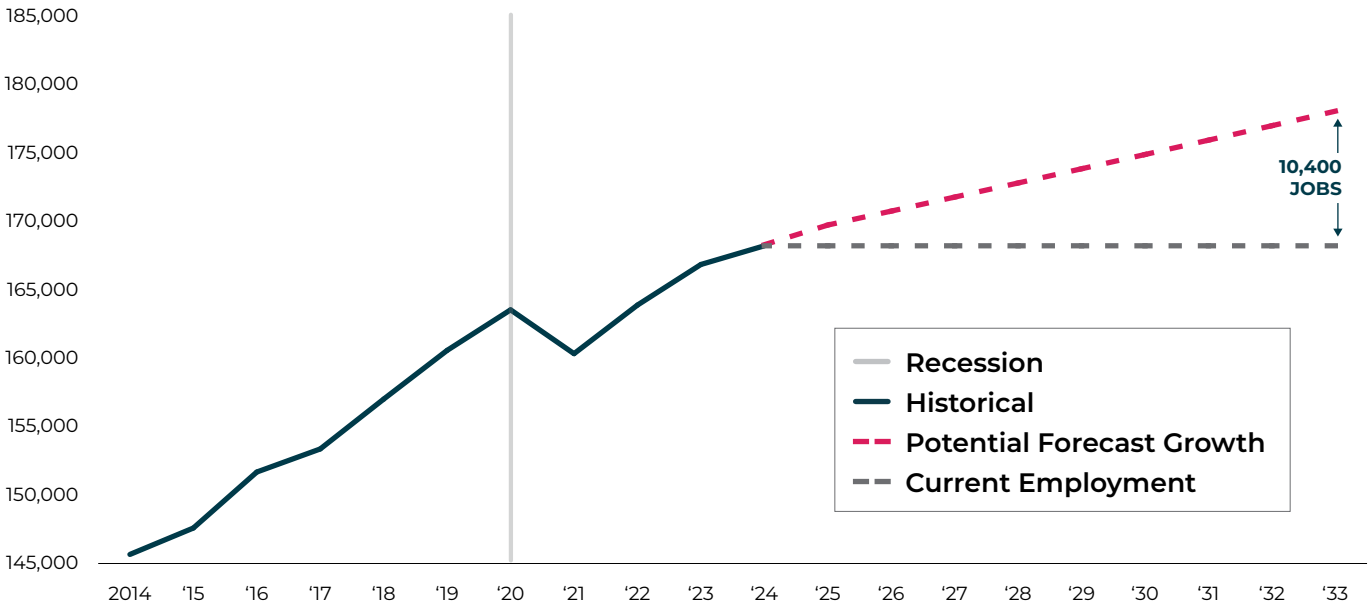
Dr. Johnny Garcia, SimIS, Inc.



[23] Forecasts for overall employment growth by county are developed by Chmura per historical trends and expected growth in the local labor force. On average over the last five years, total employment in the Hampton Roads region has declined 0.2% annually, while total employment has increased 0.9% nationally.

Figure 3.1

Cybersecurity, Data Analytics, and Modeling & Simulation Employment Has the Potential to Increase by 10,400 in the Next Ten Years



Source: JobsEQ by Chmura.

3.4

MAJOR EMPLOYERS IN THE REGION

The Hampton Roads region hosts several large employers in the cluster of data analytics, cybersecurity, and modeling & simulation. The figure below lists ten of the largest employers in the region. Employers that cover this sector, including CACI International, SAIC, Dollar Tree, Sentara Healthcare, and Jacobs are large national companies with 10,000 or more employees.

Figure 3.2

Top Employers in the Data Analytics, Cybersecurity, and Modeling & Simulation Cluster Include Diverse Industries such as Healthcare, Defense, Retail, Energy, Telecommunications, and Software

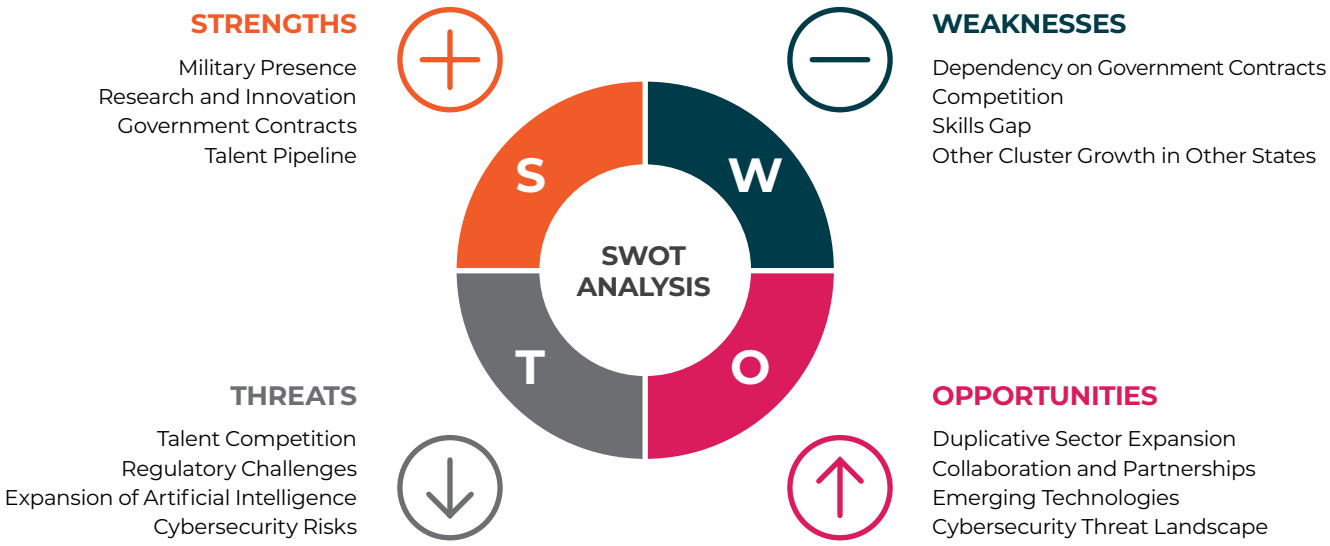
Sentara®
Jacobs
BOEING
Dominion Energy®
CACI
EVER VIGILANT
ADP
SAIC
Spectrum
DOLLAR TREE
Huntington Ingalls Industries

3.5

SWOT ANALYSIS

Figure 3.3

Hampton Roads has Strong Collaborative Partnerships but Employers Cite Talent Competition as a Threat to Data Analytics, Cybersecurity, and Modeling & Simulation



The above illustration summarizes the strengths, weaknesses, opportunities, and threats in the data analytics, cybersecurity, and modeling & simulation cluster in the Hampton Roads region. The SWOT feedback received from regional employers identifies the following highlights as important factors for the region:

Strengths:

Military Presence: Hampton Roads boasts a strong military presence, including major bases like Naval Station Norfolk and Joint Expeditionary Base Little Creek-Fort Story. This provides a steady demand for cybersecurity solutions and modeling & simulation services to support defense operations. Employers specifically cite the ability to recruit new hires from exiting military as a strong benefit to Hampton Roads.

Research and Innovation: The region is home to research institutions like the Virginia Modeling and Simulation Center and academic institutions such as the College of William and Mary University, Old Dominion University, and Christopher Newport University. These institutions foster innovation in data analytics, cybersecurity, and modeling & simulation technologies.

Government Contracts: The presence of government agencies and defense contractors in Hampton Roads creates opportunities for companies specializing in data analytics, cybersecurity, and modeling & simulation to secure government contracts and partnerships.

Talent Pipeline: Local universities and technical colleges produce a skilled workforce in fields related to data analytics, cybersecurity, and modeling & simulation, providing a reliable talent pipeline for industry growth. Additionally, programs like Virginia Values Veterans and SkillBridge help with military transitions to private sector jobs in this cluster.

Weaknesses:

Dependency on Government Contracts: A reliance on government contracts makes the industry vulnerable to budget cuts and fluctuations in defense spending, leading to revenue instability for businesses in the region. Additionally, employers noted a lack of experienced procurement specialists in the market—hindering efficient contracting.

Competition: Hampton Roads faces competition from other technology hubs across the country like San Francisco, Austin, Atlanta, Boston, Orlando, New York,

and Washington, D.C., which may challenge the ability to attract and retain talent and investment in data analytics, cybersecurity, and modeling & simulation.

Skills Gap: There may be a shortage of professionals with specialized skills in this cluster, particularly in emerging areas such as artificial intelligence and machine learning. Outlined in Figure 3.5, top in-demand skills include information security, Microsoft Excel, SQL, and Python. Figure 3.3's SWOT Analysis shows Microsoft Excel and Java with the largest skills gaps in the region.

Other Cluster Growth in Other States: Limited infrastructure for testing and validation of modeling & simulation solutions may hinder the industry's ability to fully capitalize on growth opportunities. Some data analytics employers also have an office in Florida where they hire talent in larger numbers. Employers cited the strength of central Florida, particularly tied to the University of Central Florida, as a limitation for growth in Hampton Roads.

Opportunities:

Duplicative Sector Expansion: The growing demand for data analytics and cybersecurity solutions in the commercial sector presents opportunities for companies in Hampton Roads to diversify their client base beyond government contracts. Growth in the aerospace and unmanned systems cluster will impact the overall growth in this cluster, particularly in cybersecurity and modeling & simulation. Employers note that unmanned systems growth from large employers like HII and DroneUp will drive growth across this cluster as well.

Collaboration and Partnerships: Collaborating with local universities, research institutions, and industry partners can stimulate innovation and drive growth in data analytics, cybersecurity, and modeling & simulation. Originally established in 1997 as a collaboration between the Department of Defense and Old Dominion University (ODU), the Virginia Modeling, Analysis, and Simulation Center is an example of this type of partnership that brings together industry and higher education. ODU has awarded 250 total certificates, graduate degrees, and postgraduate degrees in modeling & simulation over the last ten years. VMASC brings together students, military, and industry partners to apply innovative academic concepts with real-world experience.

Emerging Technologies: Investing in emerging technologies like artificial intelligence, blockchain, and quantum computing can position Hampton Roads as a leader in cutting-edge solutions for data analytics, cybersecurity, and modeling & simulation. Job postings

mentioning "artificial intelligence" are up 54% year over year, compared with a 14% decline in all ads in the region.

Cybersecurity Threat Landscape: The evolving cybersecurity threat landscape presents an ongoing need for advanced cybersecurity solutions and services, creating growth opportunities for companies in Hampton Roads.

Threats:

Talent Competition: Competition for skilled professionals in data analytics, cybersecurity, and modeling & simulation is fierce, both locally and nationally, making it challenging for companies in Hampton Roads to attract and retain top talent. Additionally, finding entry-level talent as opposed to retired or experienced military talent is a bigger obstacle for employers.

Regulatory Challenges: Evolving regulations and compliance requirements in data privacy and cybersecurity may pose challenges for businesses in Hampton Roads, requiring ongoing adaptation to regulatory changes.

Expansion of Artificial Intelligence: The impact of AI on long-term needs with data infrastructure and workforce development is largely unknown.

Cybersecurity Risks: The increasing sophistication of cyber threats poses risks to businesses and government agencies in Hampton Roads, requiring continuous investment in cybersecurity measures to mitigate vulnerabilities.

3.6

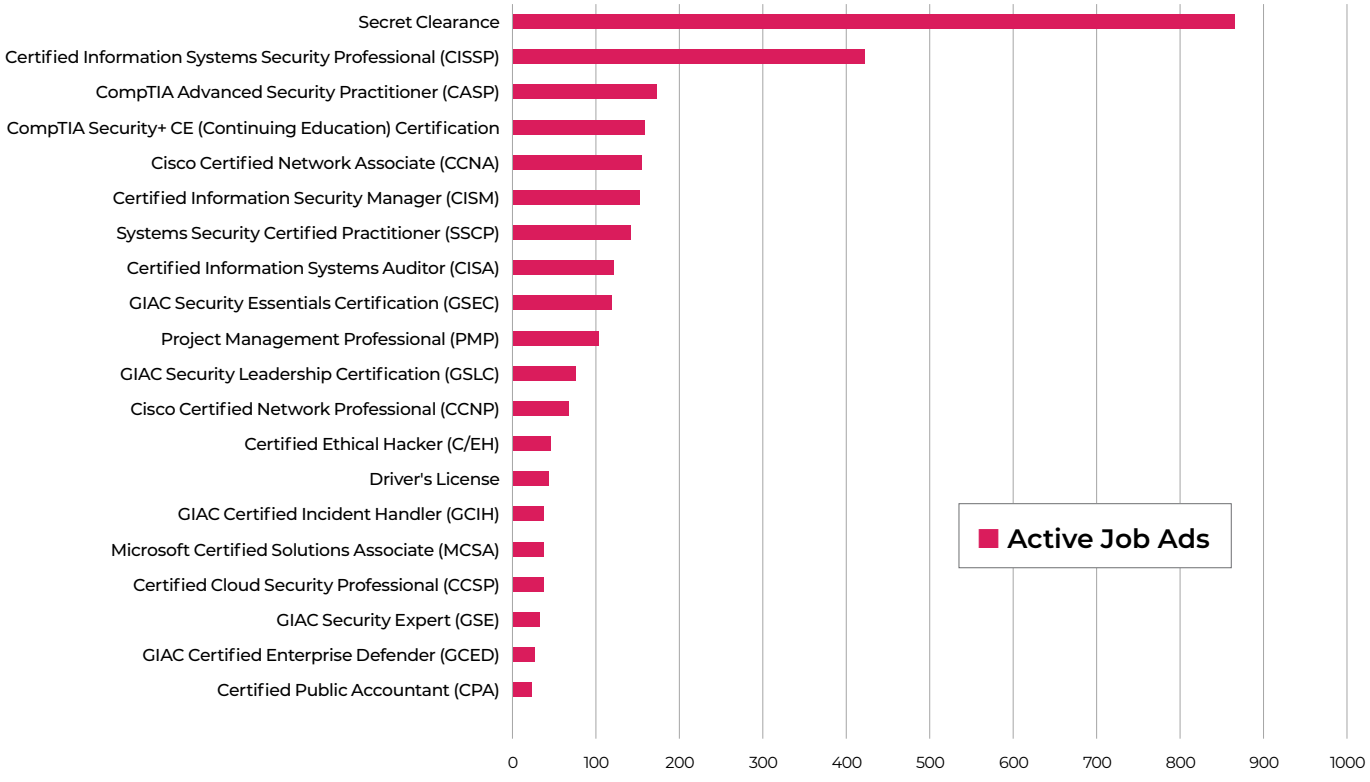
IN-DEMAND CERTIFICATIONS & SKILLS

Certifications

Top certifications requested in online job ads in the data analytics, cybersecurity, and modeling & simulation cluster show the highest need in cybersecurity. Consistent with employer feedback, secret clearances are the most in-demand single requirement for the sector and are tied to opportunities with federal contractors. Almost all remaining certifications (except for project management professional, driver's license, and certified public accountant) are related to cybersecurity. **The most in-demand certifications are for experienced workers.** The Certified Information System Security Professional (CISSP) and CompTIA Advanced Security Practitioner (CASP) both signify experienced security professionals with five to ten years of experience in a range of domains such as security and risk management, software vulnerability, and securing cloud technologies. Departing from technology certifications, the Certified Information Security Manager is designed to signal an ability to transfer from the technical roles of cybersecurity to a managerial role. Mid-level certifications typically requiring two to five years of work experience (some of which may be offset with a related degree) include Certified Ethical Hacker (penetration testing, attack detection) and Certified Information Systems Auditor (cybersecurity auditing). Other certifications are tied to creating and troubleshooting networks, such as Cisco Certified Network Associate (entry-level) and Cisco Certified Network Professional (experienced). Finally, **entry-level certifications, designed to demonstrate core cybersecurity skills, include CompTIA Security+ and GIAC Security Essential Certification.**

Figure 3.4

There are 864 Certification Requests for Secret Clearance in Data Analytics, Cybersecurity, and Modeling & Simulation Job Ads - More Than 400 Above the Second-Highest Certification Request



Source: JobsEQ by Chmura. Data reflect online job postings for the 365-day period ending 11/1/2023.

Skills

The most in-demand skills for data analytics, cybersecurity, and modeling & simulation range from basic computer skills to more complex programming (See Figure 3.5 above). Growing concern around cyberattacks, however, is a key reason why information security was the top skill required in job ads from November 2022 to 2023. Along similar lines, information assurance and network security are also quite commonly advertised by employers.

In terms of basic computer skills, proficiency in Microsoft Excel dominates the list followed by knowledge of Microsoft Office, PowerPoint, and SharePoint. More advanced computer-related skills include coding, computer networking, data analysis, and machine learning. The most common programming languages requested by employers are Python, SQL, and Linux. Given the growing importance of cloud computing, familiarity with Microsoft Azure and AWS platforms also appears in the list of most-requested skills. Finally, requiring skills in mathematics and statistics underscores their importance as a pathway to develop computer programming and data analytics skills.

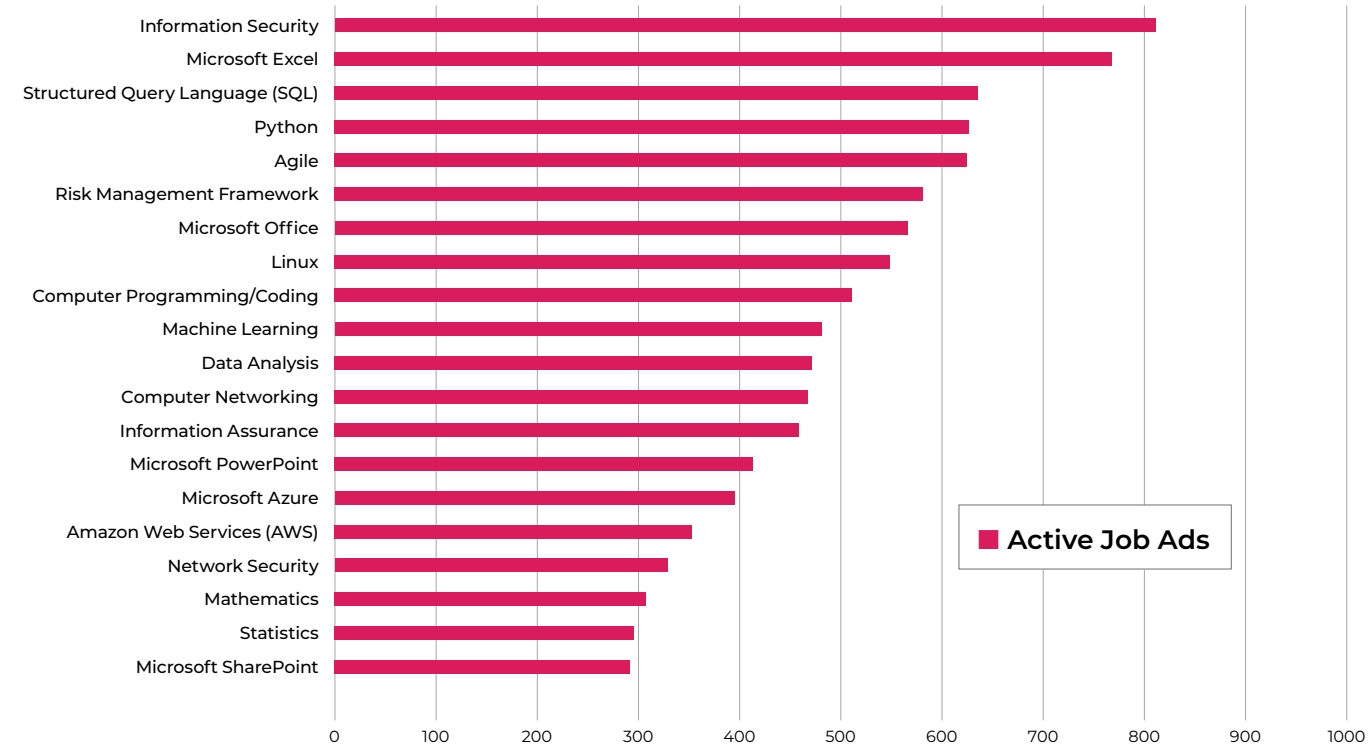
STAKEHOLDERS' INSIGHTS:

We're looking at a minimum of a bachelor's degree in statistics, computer science, economics or mathematics. That's not to say that we haven't had someone come in with Master python certifications, or Linux or SQL without a four-year degree. I think we've done a good job at balancing out the degree requirement and the certificate programs.

Regional Talent Acquisition Manager

Figure 3.5

Information Security and Microsoft Excel Top the Most In-Demand Skills for the Data Analytics, Cybersecurity, and Modeling & Simulation Cluster



Source: JobsEQ by Chmura. Data reflect online job postings for the 365-day period ending 11/1/2023.

3.7

REGIONAL SKILLS GAP

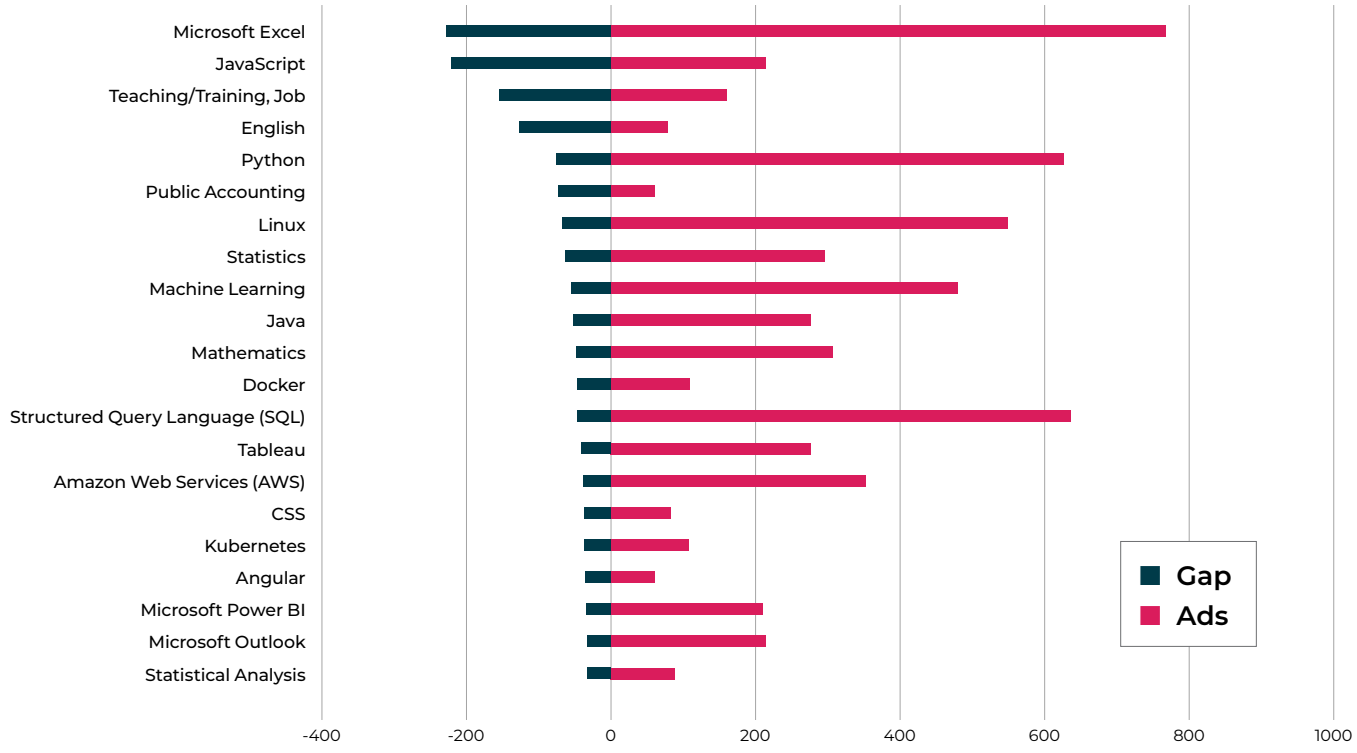
Figure 3.6 outlines the top workforce skills gaps in the data analytics, cybersecurity, and modeling & simulation cluster in the Hampton Roads region of Virginia. The right column identifies the total number of job ads in the cluster that reference a specific skill, while the left column highlights the regional gaps for such skills.[24] JavaScript is an example where the gap is larger than the listed demand from job ads. This suggests that employers in the cluster will have a hard time filling a position that requires Java knowledge since they are likely competing with other clusters in the region for that skill. Experience with Microsoft Excel is another skill where employers in the cluster face a larger regional gap. This result was confirmed during the focus group. Employers noted that they have difficulty finding young talent with knowledge of Microsoft products. They suspect that technology curriculum for K-12 and higher education and generational technology usage on tablets in lieu of personal computers have been negatively impacting standardized software skillsets—the ease of touch screens reduces the need to troubleshoot and potentially gain critical thinking skills related to technology.

Based on the data from JobsEQ and the qualitative feedback from focus groups and surveys, the following themes were identified for the data analytics, cybersecurity, and modeling & simulation cluster:

Technical Skills: There is a shortage of professionals with advanced technical skills specific to data analytics, cybersecurity, and modeling & simulation. This includes expertise in programming languages (e.g., Python, R, and Java), statistical analysis, data visualization tools

Figure 3.6

Microsoft Excel and JavaScript Have the Largest Skills Gap for theData Analytics, Cybersecurity, and Modeling & Simulation Cluster



Source: JobsEQ by Chmura. Data reflect a sample of online job postings and resumes compiled in July 2022.

[24] The regional skills gap is computed as the difference between the regional demand for a skill (measured by the number of job ads referencing that skill) and the regional supply (measured by the number of candidates in the area listing that skill on their resume) in 2022.

(e.g., Excel, Tableau, and Power BI), cybersecurity technologies, and simulation software.

Data Analysis and Interpretation: Proficiency in data analysis techniques is crucial; this includes data mining, machine learning, predictive analytics, and statistical modeling. However, there may be a **shortage of individuals with the ability to effectively interpret and communicate insights derived from complex data sets**.

Modeling & Simulation Skills: The industry requires professionals with expertise in developing and utilizing modeling & simulation tools and techniques for various applications, including defense, healthcare, transportation, and urban planning. This includes skills in simulation software (e.g., MATLAB, Simulink, and Arena), system dynamics, and discrete event simulation (DES).

Cybersecurity Expertise: There is demand for cybersecurity professionals with specialized skills in areas such as network security, cryptography, penetration testing, incident response, and security operations. Additionally, expertise in compliance frameworks (e.g., NIST or GDPR) and risk management is essential.

Cybersecurity Awareness and Training: There is a need for cybersecurity professionals who can not only implement technical solutions but also educate and train employees on cybersecurity best practices, policies, and procedures to mitigate human error and prevent cyber threats.

Soft Skills: While technical proficiency is essential, there is also demand for professionals with strong communication, problem-solving, teamwork, and project management skills. These soft skills are crucial for effectively collaborating with interdisciplinary teams, communicating complex concepts to stakeholders, and managing projects from conception to implementation.

STAKEHOLDERS' INSIGHTS:

Within the next 3 years we'll probably triple in size from the growth plan that we have in place so [data annotation and labelers] positions will be a lot tougher to find. So, if we can get them in, we will give them the certifications that they need as long as they want to do it."

Regional Head of Talent Acquisition

Addressing these skills gaps requires **a collaborative effort between industry stakeholders, educational institutions, and government agencies to develop tailored training programs, certifications, apprenticeships, and internships that equip individuals with the necessary skills to succeed** in the data analytics, cybersecurity, and modeling & simulation fields in the Hampton Roads region. Additionally, ongoing professional development and upskilling initiatives can help current workforce members stay abreast of evolving technologies and industry trends.

3.8

TALENT PIPELINE

In the cluster of data analytics, cybersecurity, and modeling & simulation, there were 5,915 total job ads posted in the Hampton Roads region from November 2022 to November 2023. Chmura included degrees in data science, data analytics, computer science, and information technology within this cluster. Annually, the region produces 418 degrees in data analytics. With 677 annual job ads in the region, the current award production will need to increase 38% to keep up with demand.

Within cybersecurity, Hampton Roads produces 827 degree awards annually—not nearly enough to match the 3,825 jobs posted annually in the region. Cybersecurity is an industry that expands its reach to several industries, including an overlap with the aerospace and unmanned systems cluster. The largest gaps to fill between degrees and posted jobs fall under certificates, two-year degrees, and four-year degrees. Outside of those numbers, 1,603 job ads required only a high school diploma or did not specify education requirements.

Old Dominion University (ODU) reported that five four-year degrees and 16 advanced degrees in modeling & simulation were awarded in the 2022-2023 school year. On average, ODU awards seven undergraduate and 16 postgraduate degrees in the region. While no certificate awards were reported in the most recent academic year, a certificate program exists at ODU to support the modeling & simulation cluster. By comparison, job ads totaled 1,413 for the industry in the region.

In Virginia, just over 200 degrees were awarded in modeling & simulation last year from George Mason University, University of Virginia, and Shenandoah University. Similarly, in North Carolina, 200 degrees were awarded from North Carolina State University, East Carolina University, Appalachian State University, and University of North Carolina Wilmington.

The trend of growth in the region indicates that modeling & simulation will need additional workforce development initiatives to support anticipated job openings over the next ten years. Based on current job ads compared to annual awards with a specified concentration in modeling & simulation, four-year degrees will be most needed in the region to fulfill the market's talent pipeline over the next ten years.

Figure 3.7

Gaps in Regional Awards are Largest for Cybersecurity and Modeling & Simulation

	DEGREE	AWARDS	vs	JOB ADS
Data Analytics	Certificate & Two-Year Degree	147		16
	Four-Year Degree	190		336
	Advanced Degree	81		24
	H.S. Diploma or None Specified			301

	DEGREE	AWARDS	vs	JOB ADS
Cybersecurity	Certificate & Two-Year Degree	80		238
	Four-Year Degree	572		1,721
	Advanced Degree	175		263
	H.S. Diploma or None Specified			1,603

	DEGREE	AWARDS	vs	JOB ADS
Modeling & Simulation	Certificate & Two-Year Degree	0		29
	Four-Year Degree	12		557
	Advanced Degree	14		76
	H.S. Diploma or None Specified			751

Source: JobsEQ. Data reflect awards for the 2021-2022 academic year and job ads for 2023Q2.

Other higher education programs could help support modeling & simulation needs. A college degree that falls under the "modeling & simulation" umbrella could be a Bachelor of Science (B.S.) or Master of Science (M.S.) in fields such as:

1. **Computer Science:** Especially with a focus on computer graphics, artificial intelligence, or computational modeling.
2. **Engineering:** Particularly disciplines like Mechanical Engineering, Aerospace Engineering, or Electrical Engineering, with a concentration on systems modeling & simulation.
3. **Applied Mathematics:** Degrees in applied mathematics often involve courses on numerical methods, differential equations, and mathematical modeling, which are crucial for simulation work.
4. **Physics:** Physics degrees may include coursework in computational physics or theoretical physics, which are relevant to modeling and simulating physical systems.
5. **Simulation and Game Development:** Some universities offer specialized degrees in simulation and game development that cover topics such as 3D modeling, animation, and simulation techniques.
6. **Operations Research:** This field involves mathematical modeling and optimization techniques applied to decision-making processes, which can be closely related to simulation.
7. **Information Technology:** Degrees in IT with a focus on systems analysis, software engineering, or data analytics may also incorporate elements of modeling & simulation.

The exact title of the degree program may vary depending on the university, but these fields typically cover the foundational knowledge and skills necessary for modeling and simulating various systems and phenomena.

STAKEHOLDERS' INSIGHTS:

JLab is partnering with Virginia universities in the workforce development areas relative to data science and the High-Performance Data Facility.

Rhonda Barbosa, Jefferson Lab

4

AEROSPACE AND UNMANNED SYSTEMS

This section discusses the growth and opportunities in the aerospace and unmanned systems cluster, which has been driven by geopolitical tensions, drone adoption, and advanced air mobility. It highlights the potential for commercial funding to surpass federal funding in the next 20 years as well as the development of a regional air mobility hub. This section also references the growth of drone delivery services and the dominance of defense manufacturers in the region. It identifies the top occupations and skills in demand, as well as the skills gaps and the need for collaboration to address them. This section concludes with a SWOT analysis and the importance of technical expertise, advanced manufacturing skills, cybersecurity, and regulatory compliance in the industry.

Key takeaways from this section include:

- The aerospace and unmanned systems cluster is driven by geopolitical tensions and the increasing adoption of drones for personal and business use.
- Commercial funding for rocket launches is expected to surpass federal funding in the next 20 years.
- The development of advanced air mobility and electric Vertical Takeoff and Landing (eVTOL) services is projected to have significant growth in Virginia.
- The Hampton Roads region is planning to build a dedicated vertiport and create a Regional Air Mobility hub for fast transportation between Norfolk and Washington, D.C.
- Drone delivery services, such as the partnership between DroneUp and Walmart, are showing significant growth.
- Defense manufacturers like Boeing, RTX, Northrop Grumman, and Huntington Ingalls dominate the market in the region.
- The aerospace and unmanned systems cluster in Hampton Roads has a strategic location, established infrastructure, and a strong military presence.
- The industry faces challenges such as dependency on government contracts, competition, skills gaps, and limited diversity.

4.1

BASELINE INDUSTRY ANALYSIS

Growth in the aerospace and unmanned systems cluster is driven by the surge in geopolitical tensions rising across the globe as well as the increasing adoption of drones for personal and business use. Improved engineering, increased volume of space launches, reuse of launch vehicles, and the development of smaller satellites have led to an increase in the private and public aerospace launch industry.[25] The post-COVID surge in travel as well as budget constraints has led to an increase in aerospace parts production, as more airlines strive to repair their existing stock in lieu of purchasing new aircraft.[26]

Hampton Roads is home to NASA Langley Research Center, the National Institute of Aerospace, and other centers for aerospace and unmanned systems research. Proximity to Wallops Island, Virginia (as one of four FAA-certified launch sites in the United States) provides the region with a unique ability to provide research and production resources for the space launch industry. Once considered only a federally funded industry, commercial funding for launches was over $10 billion in 2021, with the potential to surpass federal funding in the next 20 years.

The transformation of Advanced Air Mobility (AAM) in the aerospace and unmanned systems sector will support developments within both the United States and Hampton Roads. The Virginia Innovation Partnership Corporation estimates that **66 million people in Virginia will have traveled using new electric Vertical Takeoff and Landing (eVTOL) services by 2045**.[27] These aircraft will fly below 4,000 feet and provide carbon-free short trips between cities or rural communities across the state. To capture this future growth, the Hampton Roads Executive Airport is planning to build a dedicated vertiport to accommodate takeoff and landing; it will also provide charging/hydrogen fueling stations. With the world's largest naval base in Hampton Roads, the airport is creating a Regional Air Mobility hub for fast, small-scale transportation between Norfolk and Washington, D.C. by 2025 to service the needs of several Department of Defense (DoD) agencies.

STAKEHOLDERS' INSIGHTS:

> The Commonwealth is unique in that we have only one of 4 space ports in the United States. They can launch all the way to orbit. We're not going have that unique distinction forever. But we still have it. I think there's a real good potential to see growth in the commercial space market.
>
> **David Bowles, Virginia Institute for Spaceflight and Autonomy**

In the commercial space, companies like DroneUp are showing significant growth from retail, food, and medical drone delivery services. Their partnership in 2022 with Walmart allows last-mile delivery to sites across the nation in as little as 30 minutes. Another commercial application includes drone photography, which is growing within the public safety industry. Uses include risk assessment of dangerous environmental conditions like wildfires or mudslides, and health/safety assessments.

Defense manufacturers in the Hampton Roads region like Boeing, RTX, Northrop Grumman, and Huntington Ingalls continue to dominate the market in aerospace and unmanned systems research, manufacturing, supply chain management, and business operations. Huntington Ingalls is currently building a multi-phase development for their Unmanned Systems Center of Excellence in Newport News, where they are delivering a Navy contract for Boeing's Orca Extra-Large Unmanned Undersea Vehicle (XLUUV) program. Despite growth in private space program initiatives, federal funding comprises a majority of aerospace spending in the nation. Federal funding is projected to increase as international tensions continue to rise.[28]

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[25] "Aerospace and Defense Strategy," McKinsey, last modified 2024, https://www.mckinsey.com/industries/aerospace-and-defense/how-we-help-clients.

[26] "Aircraft, Engine & Parts Manufacturing Market Research Report," IBIS World, last modified November 2023, https://www.ibisworld.com/united-states/market-research-reports/aircraft-engine-parts-manufacturing-industry/#IndustryStatisticsAndTrends.

[27] "Virginia's Advanced Air Mobility Future," Virginia Innovation Partnership Corporation, last modified January 2023, https://www.virginiaipc.org/uploads/b/c0fd51a0-0c37-11ec-bf95-b11bf6ee8ae9/Website%20Virginias%20Advanced%20Air%20Mobility%20Future_OTk4Mj.pdf.

[28] "Space Vehicle & Missile Manufacturing Market Research Report," IBIS World, last modified January 2024, https://www.ibisworld.com/united-states/market-research-reports/space-vehicle-missile-manufacturing-industry/.

In the aerospace and unmanned systems industry, the Growth and Diversification Plan previously identified this cluster as a strong industry for the region. The industry analysis covers aircraft manufacturing (including drones); aircraft parts manufacturing; national security; space research and technology; navigational, measuring, electromedical, and control instruments manufacturing; robotic manufacturing; and aerospace engineering. The ship and boat building industry is also included in this report to cover the unmanned marine sector.

Drone delivery is expected to be the fastest-growing segment of last-mile delivery for companies like Amazon, FedEx, and UPS. One of the first drone deliveries in the nation was in March 2023 when a Walmart order was delivered to Lynnhaven Parkway by DroneUp in Virginia Beach. In October 2023, Riverside Health System partnered with DroneUp, Virginia Institute for Spaceflight and Autonomy (VISA), and the Accomack-Northampton Planning District Commission to deliver hypertension medications within a two-mile radius of the hospital in Onancock, Virginia. As part of the Elevating Health Care Access (EHCA) project from the Department of Transportation, the medication delivery program will expand over time to include further distance delivery and beyond visual line of sight operations (BVLOS).

Unmanned Aerial Vehicle (UAV) growth has been elevated recently as U.S. defense spending supports development and production programs. Over the next five years, however, defense spending on drone development is anticipated to decrease and federal funding will become more limited. Since the top four companies in the unmanned systems production industry cover almost 70% of the domestic market, much of the production industry will be reliant on a small number of companies for innovation and development. One positive sign in the industry is that commercial unmanned regulations have started easing, allowing more small commercial drone businesses to grow in the market.[29]

STAKEHOLDERS' INSIGHTS:

We are planning to double our workforce that would largely be in skilled positions. Mechanics, engineers, avionics, technicians, and pilots. Then certainly support staff would follow. But the technical side of it would be a large driver."

Scott Beale, Aery Aviation

[29] "Unmanned Aerial Vehicle (UAV) Manufacturing Market Research Report," IBIS World, last modified November 2023, https://www.ibisworld.com/united-states/market-research-reports/unmanned-aerial-vehicle-uav-manufacturing-industry/#IndustryStatisticsAndTrends.

4.2

CLUSTER ANALYSIS

As noted earlier in this report, the location quotient identifies how a region compares to the national average of concentration in an industry or occupation. For aerospace and unmanned systems, the current LQ is 7.93 in Hampton Roads, highlighting the predominant role that the cluster plays in the regional economy. Occupations with a high LQ include marine engineers and naval architects (17.76), aerospace engineers (2.53), and engineering technologists and technicians (2.20).

Examining current job openings in the industry can identify in-demand occupations for the Hampton Roads region. As shown in Table 4.1 below, aerospace engineers, network and computer system administrators, and computer and information systems managers top the list of jobs posted online in GO Virginia Region 5.[30] The cluster tends to hire skilled

STAKEHOLDERS' INSIGHTS:

As the technology gets more autonomous, actual flying skills become less relevant because it's basically all handled by software. I think a tech background, either in terms of software or hardware, is going to be very important.

Anthony Vittone, DroneUp

Table 4.1

Over 75% of the Top 20 Job Postings for Aerospace and Unmanned Systems Have Median Wages Above $75,000

SOC	OCCUPATION	TYPICAL EDUCATION REQUIREMENTS	NUMBER OF ADS	MEDIAN WAGES
15-1244.00	Network and Computer Systems Administrators	Bachelor's degree	43	$98,100
17-2011.00	Aerospace Engineers	Bachelor's degree	38	$133,800
11-3021.00	Computer and Information Systems Managers	Bachelor's degree	31	$152,300
11-9041.00	Architectural and Engineering Managers	Bachelor's degree	26	$151,100
49-3011.00	Aircraft Mechanics and Service Technicians	Postsecondary non-degree award	18	$69,000
53-7065.00	Stockers and Order Fillers	High school diploma or equivalent	19	$33,000
49-9071.00	Maintenance and Repair Workers, General	High school diploma or equivalent	16	$43,900
33-3021.06	Intelligence Analysts	High school diploma or equivalent	16	$82,900
13-1199.00	Business Operations Specialists, All Other	High school diploma or equivalent	18	$86,100
15-2031.00	Operations Research Analysts	High school diploma or equivalent	17	$116,200
15-1252.00	Software Developers	Bachelor's degree	15	$117,300
17-2072.00	Electronics Engineers, Except Computer	Bachelor's degree	13	$113,000
17-2112.00	Industrial Engineers	Bachelor's degree	12	$93,500
51-9199.00	Production Workers, All Other	Bachelor's degree	12	$27,700
17-2071.00	Electrical Engineers	Bachelor's degree	11	$103,700
13-1199.00	Business Operations Specialists, All Other	Bachelor's degree	10	$86,100
11-3051.00	Industrial Production Managers	Bachelor's degree	10	$128,800
51-1011.00	First-Line Supervisors of Production and Operating Workers	Bachelor's degree	10	$81,400
51-4041.00	Machinists	High school diploma or equivalent	10	$62,900
11-3031.01	Treasurers and Controllers	Bachelor's degree	9	$142,100

Source: JobsEQ by Chmura

[30] Counts of unique job postings may not equate with actual job demand. For example, job postings may be placed in anticipation of possible openings that do not materialize. Moreover, slight variations of ads may be placed such that the number of ads exceeds the actual number of openings.

labor, with 12 of the top 20 occupations requiring at least a bachelor's degree. Of the top 20 occupations in the cluster, 45% have median wages above $100,000 and 75% have median wages above $75,000. There are, however, a few **opportunities for workers with only a high school diploma to find employment in the cluster in occupations that provide high-paying median wages at $108,200 (Business Operations Specialist) and $122,400 (Intelligence Analyst).** Those positions requesting at least a high school education typically include five years of military or aviation experience in lieu of a degree.

The data in this report continue to align with the Growth and Diversification Plan from 2021 on the significance of this cluster in the Hampton Roads region. While aerospace manufacturing is not as prevalent in the region, national security, space research, and maritime unmanned (ship and boat building) have a significant advantage compared to the rest of the nation.

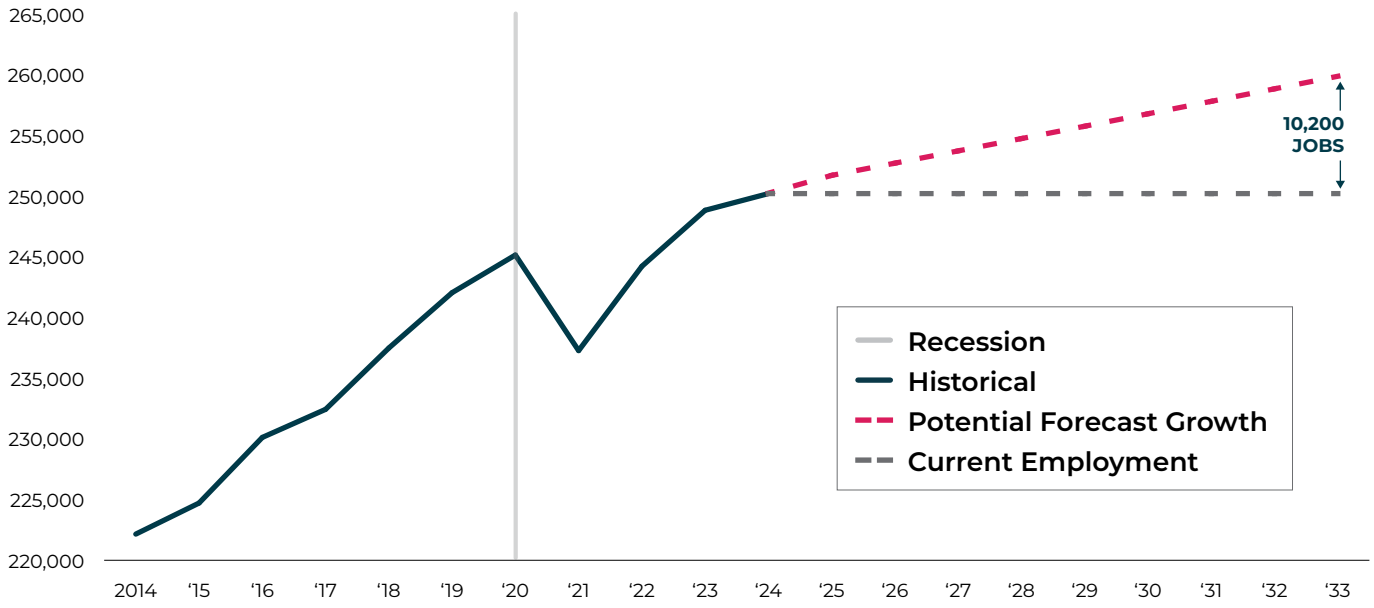
4.3

EMPLOYMENT FORECASTS

Employment in key occupations for the aerospace and unmanned systems cluster is over 250,000 as of 2023Q3, surpassing the pre-pandemic peak while total employment in the region remains below pre-COVID levels. The ten most-prevalent occupations for this cluster comprise more than 40% of total sector employment in Hampton Roads. These also represent high-paying jobs for the region, as the average annual salary is $74,100. Over the next ten years, based on local employment trends and national industry forecasts, cluster employment in the region is expected to grow at a pace of 0.4%, matching the 0.4% growth rate for the nation. As shown in Figure 4.1 below, this rate of growth could mean an **additional 10,196 jobs in these key occupations** by 2033 for Hampton Roads. (Note that key jobs are not mutually exclusive and may be counted in both clusters). This number represents net growth. Total hiring is expected to exceed this level as the sector will experience a massive exit in the coming years due to retirement; employers will have to replace some of their current labor force.

Figure 4.1

Aerospace and Unmanned Systems Has the Potential to Add 10,200 Jobs Over the Next Ten Years in Hampton Roads



Source: JobsEQ by Chmura.

Hampton Roads is uniquely positioned to serve multiple regions for aerospace parts production, which is limited in areas where manufacturing is less prevalent such as the Wallops Island and Washington, D.C. markets. Growth in private sector space exploration and international defense security contribute to the need for aerospace parts production. Demand will increase for satellite-monitored data such as environmental changes, crop production, critical utility infrastructure, insurance risk assessments, defense intelligence, and, as technology continues to advance, global internet connectivity. Chmura's JobsEQ forecast data do not consider companies that may eventually relocate or expand in the region. While there have been no project announcements specific to the cluster in recent years, many defense companies are less likely to publicize new jobs and expansions due to the secure nature of their business. The baseline forecast is based on national forecasts by detailed (four-digit NAICS industry) as well as historical economic and demographic trends in the region. As such, some of the employers in the following section may contribute to additional growth over the term of the forecast.

STAKEHOLDERS' INSIGHTS:

Experience is one of our concerns. To counteract that we have implemented some functions inside our company that will allow the young talent coming up that might have the education, but not the working hands yet, to shadow and work and develop along with some of our more senior folks who are experienced.

Scott Beale,
Aery Aviation

4.4

MAJOR EMPLOYERS IN THE REGION

Like the first cluster, aerospace and unmanned systems in the Hampton Roads region is supported by several large companies (more than 10,000 employees) with strong domestic and international presence. Most of these companies have a significant portion of their portfolio in military and defense.

Figure 4.2

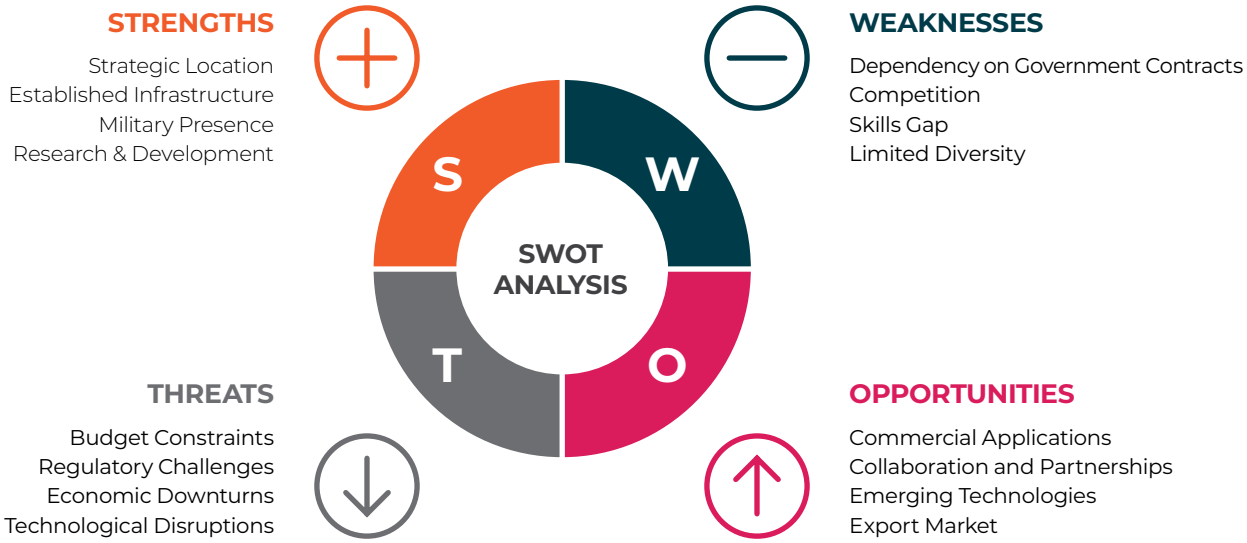
Top Large Employers in the Aerospace and Unmanned Systems Cluster Include Many Defense Contractors

4.5

SWOT ANALYSIS

Figure 4.3

Military Presence Serves as a Strength for the Workforce and a Threat to Diversifying the Regional Economy



The above chart summarizes the strengths, weaknesses, opportunities, and threats in the aerospace and unmanned systems cluster in the Hampton Roads region of Virginia. The SWOT feedback received from regional employers identified the following highlights as important factors for the region:

Strengths:

Strategic Location: Hampton Roads has a strategic geographic location with access to major ports and proximity to key military installations like Naval Station Norfolk, Langley Air Force Base, and NASA's Langley Research Center.

Established Infrastructure: The region has well-developed infrastructure including airports, research facilities, and academic institutions supporting aerospace and unmanned systems. The Hampton Roads Executive Airport is making investments in unmanned systems and advanced air mobility. The eAviation and Drone Academy is housed in the airport with research testing and coursework planned for Unmanned Air Systems and electric Vertical Takeoff and Landing. Additionally, there is a plan for the airport to provide testing and operations for Beyond Visual Line of Site (BVLOS) once the Federal Aviation Administration (FAA) completes its regulatory approvals nationwide.

Military Presence: The strong military presence in Hampton Roads provides a steady demand for aerospace products and services, including unmanned systems for defense applications. Employers cited the influx of retired military from one of the largest naval bases in the world as a reason they can recruit experienced talent with active secret clearances.

Research and Development: Presence of research institutions like NASA Langley Research Center and academic institutions such as Old Dominion University contribute to innovation and technological advancements in the industry.

Weaknesses:

Dependency on Government Contracts: The cluster in Hampton Roads is heavily reliant on government contracts, which can be subject to budget cuts and fluctuations in defense spending. Employers emphasized a shortage in contracting experience as an outside skillset that heavily impacts this cluster.

Competition: Competition from other aerospace hubs across the country poses a challenge for the region to attract and retain talent, investment, and businesses.

Workforce Skills Gap: There is a shortage of skilled

labor with expertise in aerospace engineering, software development, and unmanned systems technology, leading to recruitment challenges for local companies. As cited in the top 20 job postings for this cluster, all but five of the jobs listed require a bachelor's degree or higher.

Limited Diversity: The industry in Hampton Roads is concentrated in defense-related projects, which could limit diversification opportunities.

Opportunities:

Commercial Applications: Expanding commercial applications of unmanned systems such as agriculture, infrastructure inspection, and delivery services presents significant growth opportunities for companies in the region.

Collaboration and Partnerships: Agencies like the Virginia Institute for Spaceflight and Autonomy and the National Institute of Aerospace are located in the Hampton Roads region. They provide avenues for collaboration between higher education institutions such as Old Dominion University, and Virginia Innovation Partnership Corporation, industry, and federal government institutions like NASA Langley Research Center.

Emerging Technologies: Investing in emerging technologies such as artificial intelligence, machine learning, and autonomy can position Hampton Roads as a leader in the development of next-generation aerospace and unmanned systems.

Export Market: Leveraging the region's expertise and capabilities to tap into international markets for aerospace products and services can diversify revenue streams and reduce dependency on domestic contracts. While many defense companies have restrictions on usage of international products or partnerships, there are opportunities for companies to create a regional presence separate from their foreign offices to supply the growing demand for aerospace and unmanned systems components and services.

Threats:

Budget Constraints: Uncertainties in government budgets and defense spending could impact the flow of contracts and investment in the aerospace and unmanned systems cluster.

Regulatory Challenges: Evolving regulations and restrictions on airspace usage and unmanned systems operations may pose compliance challenges for companies operating in the region. Drone companies in the region cited significant challenges in approval of BVLOS regulations. The FAA's inability to establish regulations in this key component of unmanned systems has set the nation backwards in technological advances for the industry.

Economic Downturns: Economic downturns or global crises could lead to decreased demand for aerospace products and services, affecting businesses in Hampton Roads.

Technological Disruption: Rapid advancements in technology and the emergence of disruptive competitors could threaten the market position of established companies in the region if they fail to innovate and adapt accordingly. As the FAA slows progress with BVLOS regulations, other countries are developing more advanced technologies that will outpace the United States in development.

4.6

IN-DEMAND CERTIFICATIONS & SKILLS

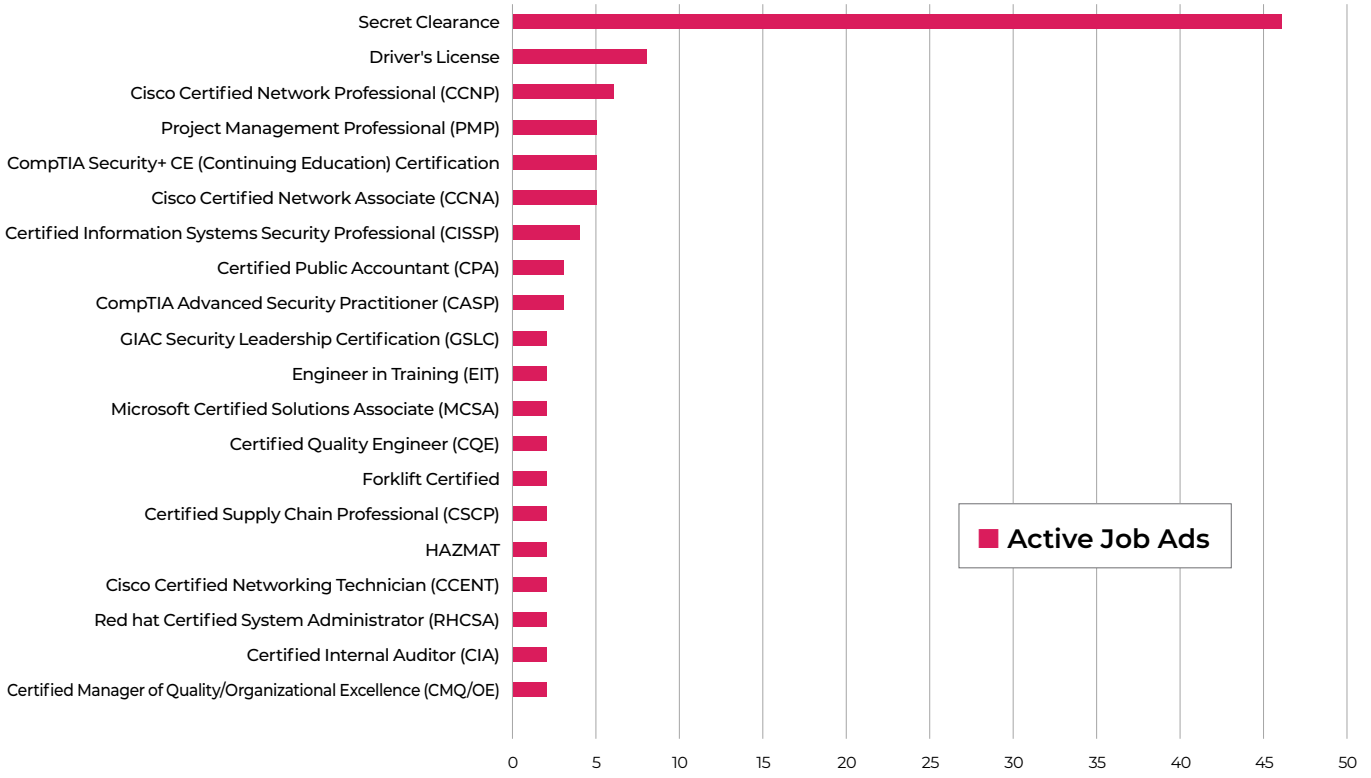
Certifications

Based on job ads from November 2022 to November 2023, the aerospace and unmanned systems industry cluster is less reliant on certifications. Secret clearance is still the top requested criteria for posted jobs in the cluster. Out of 225 total postings, secret clearances make up 20% of the active ads in the regional market. A driver's license is the second-highest request in the cluster, followed by information systems certifications.

Project Management Professional (PMP) certification is also in the top five, but it only represents 2% with a total of five job ads having this requirement. Among other information systems and information technology certifications, a small number of job ads include other professional and production certifications like engineering, HAZ-MAT, Six Sigma Green Belt, and forklift certification.

Figure 4.4

Secret Clearance is the Top Requested Certification in Job Ads in Aerospace and Unmanned Systems



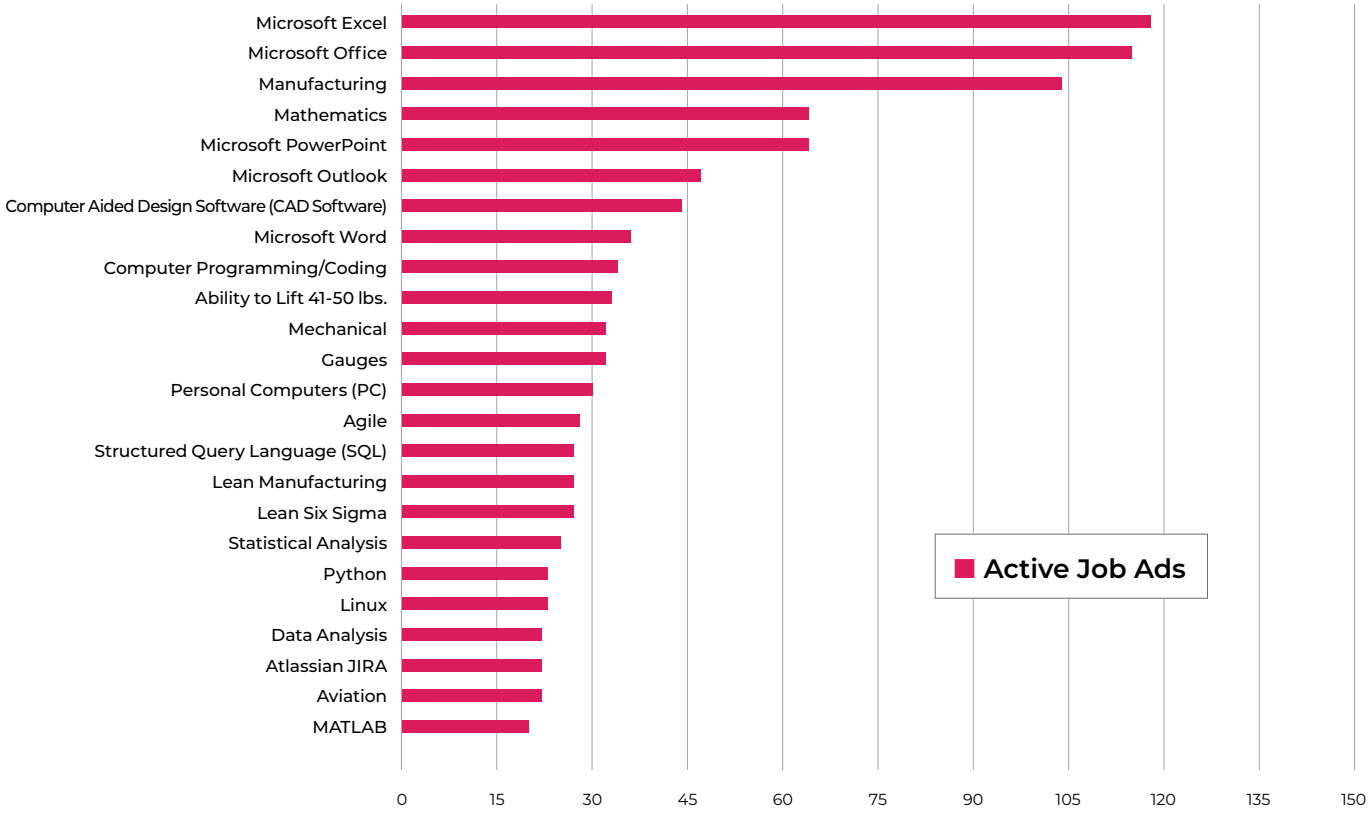
Source: JobsEQ by Chmura. Data reflect online job postings for the 365-day period ending 11/1/2023.

Skills

Similarly aligned with the data analytics, cybersecurity, and modeling & simulation cluster, Microsoft products remain a top skill requested in job ads over both clusters. Other general skill sets required in this cluster include working knowledge of concepts such as manufacturing, mathematics, computer coding, personal computers, lean manufacturing, statistical analysis, data analysis, and aviation (See Figure 4.5 above). Other skills required that are more specific to this cluster include CAD software, MATLAB, and Atlassian JIRA. With a lower number of job ads for this cluster, the total in-demand skills are fractionally smaller.

Figure 4.5

Microsoft Products and Manufacturing are the Top Three In-Demand Skills in Aerospace and Unmanned Systems



Source: JobsEQ by Chmura. Data reflect online job postings for the 365-day period ending 11/1/2023.

4.7

REGIONAL SKILLS GAP

Figure 4.6 outlines the top workforce skills gaps in the aerospace and unmanned systems cluster in the Hampton Roads region of Virginia. The right bars identify the total number of job ads in the cluster between November 2022 and November 2023, while the left bars highlight the regional skills gaps as of July 2022. So, although there are only 118 job ads in the cluster where Microsoft Excel is a requirement for the job, it may still be challenging for employers to fill this position since regionally there is a potential shortage of 248 workers with this required skill.

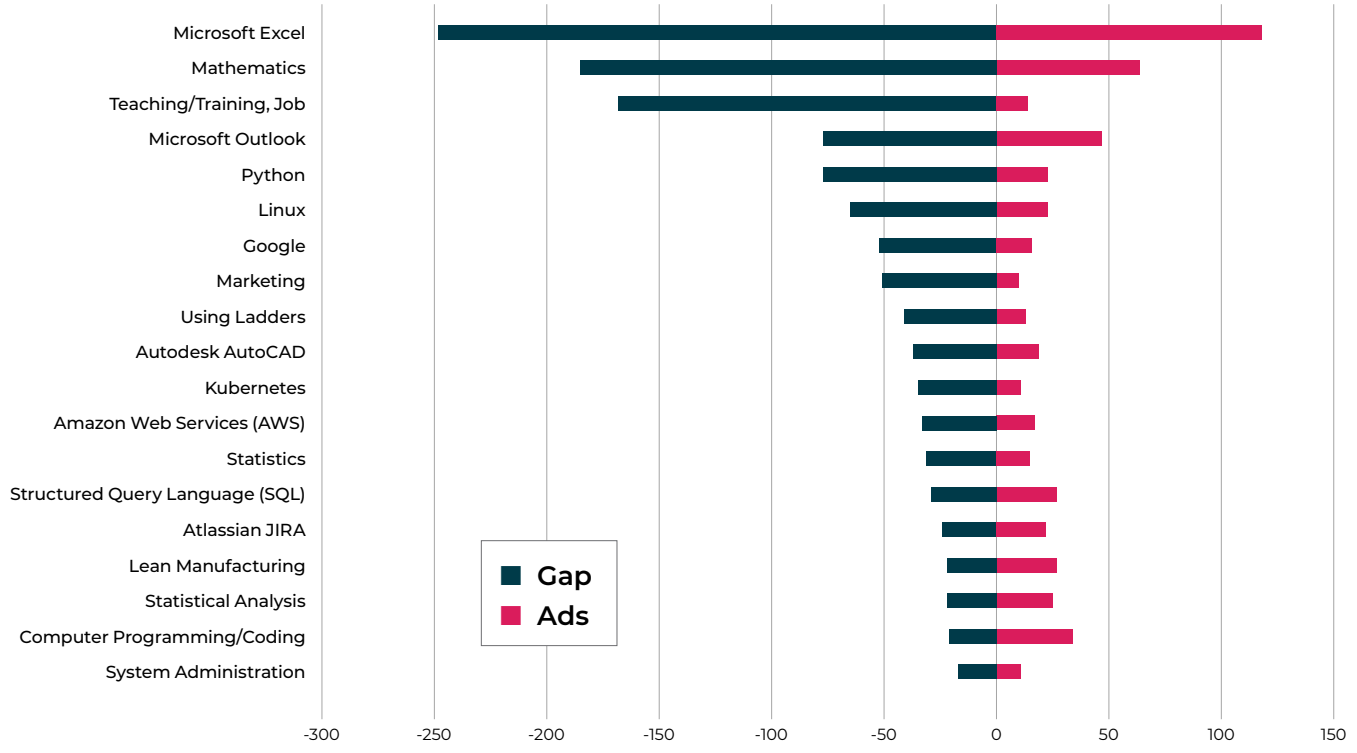
Mathematics, Teaching/Training, Python, and Linux are other examples where this cluster is likely competing with other industry clusters in the region for those skill sets.

Based on the data provided from JobsEQ and the qualitative feedback from focus groups and surveys, the following themes were identified for the aerospace and unmanned systems cluster:

Technical Expertise: There may be a shortage of professionals with specialized technical skills in areas such as aerospace engineering, avionics, software development, and unmanned systems technology. This includes proficiency in areas like flight control systems, propulsion, and aerodynamics.

Figure 4.6

Microsoft Excel, Mathematics, and Teaching Show the Largest Skills Gaps in the Aerospace and Unmanned Systems Cluster



Source: JobsEQ by Chmura. Data reflect a sample of online job postings and resumes compiled in July 2022.

Advanced Manufacturing Skills: The industry requires individuals with expertise in advanced manufacturing techniques relevant to aerospace and unmanned systems, such as additive manufacturing (3D printing), composite materials, precision machining, and quality control processes.

Cybersecurity: With the increasing integration of unmanned systems and aerospace technologies with digital systems, there's a growing need for cybersecurity professionals who can safeguard critical infrastructure, data, and communications systems against cyber threats.

Regulatory Compliance: Professionals with knowledge of federal regulations and standards governing aerospace and unmanned systems operations are essential to ensure compliance with safety, security, and operational requirements set forth by organizations such as the FAA (Federal Aviation Administration) and DoD (Department of Defense).

Project Management: Skilled project managers are needed to oversee complex aerospace and unmanned projects, from conceptualization and design to production, testing, and deployment. They must possess strong organizational, communication, and leadership skills to ensure projects are completed on time, within budget, and according to specifications.

Systems Integration: As aerospace and unmanned systems become increasingly complex and interconnected, there is a demand for professionals who can specialize in systems integration, ensuring seamless interoperability between different components and subsystems.

STAKEHOLDERS' INSIGHTS:

Data, analytics, and the use of data in general is going to be huge within the UAS community. [Data analytics will] be able to validate our satellite data, for example. It's all feeding in data that is very raw. With the right kind of entrepreneurial mind, you can take that raw data and turn it into apps and apply it to your home smart system.

Lena Little,
NASA Langley Research Center

Data Analytics and AI: With the proliferation of sensors and data-generating devices in aerospace and unmanned systems, there exists a need for individuals with expertise in data analytics, artificial intelligence (AI), and machine learning to extract insights, optimize performance, and enable autonomous decision making.

Addressing these skills gaps requires collaboration between industry stakeholders, educational institutions, and government agencies to develop targeted training programs, apprenticeships, and initiatives that align with the evolving needs of the aerospace and unmanned systems cluster in Hampton Roads.

4.8

TALENT PIPELINE

In the aerospace and unmanned systems cluster, direct jobs total 717 over 12 months from November 2022 to November 2023. In the aerospace industry, certificate and two-year degree requirements are met by annual job numbers. However, both four-year and advanced degree requirements do not meet regional needs. External to the region, however, four-year aerospace engineering degrees are awarded by Virginia Tech, North Carolina State University, University of Virginia, George Mason, and Duke University—totaling 313 awards for the 2021-2022 academic year. In addition, Liberty University awarded 418 four-year degrees in Aeronautics/Aviation/Aerospace Science and Technology.

The Hampton Roads region did not produce any awards in 2023 unique to the aerospace and unmanned systems industry skill-sets. There were 229 job ads placed over the last year with no local degree awards to support talent growth. On a national scale, only a handful of postsecondary schools supply two-year, four-year, or degree certificates, with Embry-Riddle Aeronautical University in Florida offering a majority of those 91 annual awards. In 2023, no advanced degrees were awarded in the nation that fulfilled the unique unmanned systems skillsets.

Other higher education programs could help support this industry cluster. A college degree that falls under the "unmanned systems" umbrella could be a Bachelor of Science (B.S.) or Master of Science (M.S.) in fields such as:

1. **Aerospace Engineering:** Focuses on the design, development, and testing of unmanned aerial vehicles (UAVs) and spacecraft.
2. **Electrical Engineering:** Provides a foundation in electronics and control systems, essential for designing and operating unmanned systems.
3. **Mechanical Engineering:** Covers principles of mechanics and materials important for building unmanned ground vehicles (UGVs) and robotic systems.
4. **Computer Science:** Offers skills in programming, artificial intelligence, and machine learning crucial for autonomous unmanned systems.
5. **Robotics Engineering:** Specifically tailored for designing and operating robotic systems, including unmanned vehicles.

These degrees provide a strong foundation and advanced expertise for pursuing a career in unmanned systems, whether in industry, academia, or government research.

Figure 4.7

Posted Job Ads in 2023 Show a Shortage in Four-Year Degrees in Aerospace; Zero Awards for Unmanned Systems

	DEGREE	AWARDS	vs	JOB ADS
Aerospace	Certificate & Two-Year Degree	96		32
	Four-Year Degree	2		229
	Advanced Degree	0		10
	H.S. Diploma or None Specified			217

	DEGREE	AWARDS	vs	JOB ADS
Unmanned Systems	Certificate & Two-Year Degree	0		27
	Four-Year Degree	0		95
	Advanced Degree	0		24
	H.S. Diploma or None Specified			83

Source: JobsEQ. Data reflect awards for the 2021-2022 academic year and job ads for 2023Q2.

STAKEHOLDERS' INSIGHTS:

With community colleges and other local universities around, some of them have developed some classes on [unmanned systems] to help educate people on it as well as help give them the information that there are these types of jobs out there. Sometimes it's new to them that they can even go do something like this.

Anthony Vittone, DroneUp

5

TALENT PATHWAYS RECOMMENDATIONS

This section discusses strategies for implementing impactful pathways in the future, focusing on the data analytics, cybersecurity, and modeling & simulation cluster and the aerospace and unmanned systems cluster. Based on the quantitative and qualitative analysis outlined above, Chmura identified strategies for implementing the most impactful pathway projects. Leveraging insights from the data collection and analysis, Chmura prepared recommendations for communicating strengths of the region, addressing potential weaknesses, and building training programs in alignment with future needs.

Ultimately, workforce development plays a crucial role across the entire talent pathway (Figure 5.1). Specific and tactical ideas/recommendations are described in further detail below.

Figure 5.1

HRWC Has a Crucial Role to Play in Developing a Talent Pathway

Identify Market Demand

Conduct research into emerging industries and identify opportunities for growth.

- **This Report**

Define Program and Develop Curriculum

Collaborate and facilitate partnerships with industry stakeholders and educational experts.

- **Hard Skill Training**
- **Advisory Group**

Obtain Resources; Get Accredited

Help with securing funding and grants and with navigating the accreditation process.

- **Additional Programming**

Student Recruitment & Marketing

Help develop marketing strategies and support scholarships/career services.

- **Internships and Apprenticeships**

Monitoring & Growth

Foster ongoing collaboration and consistent research updates to address any market shifts.

- **Successful Program Support**

Role of HRWC | Recommendation Section

1. **Additional Programming -** Expand training opportunities for the data analytics, cybersecurity, and modeling & simulation cluster and for the aerospace and unmanned systems cluster.

   In the Hampton Roads region, there were 21 degree awards in the 2022-2023 academic year in the modeling & simulation industry cluster, while there were 1,413 job ads in 2023. Similarly, in the last year there were 3,825 job ads posted for cybersecurity positions with only 827 degrees awarded. Both unmanned systems and modeling & simulation are similar as they are emerging sectors with specialized skillsets. Although 229 job ads were posted in the region, there are no graduate awards in Hampton Roads specializing in unmanned systems. Crossovers from other degrees and certificates like mechanical engineering or military experience might still apply to this sector. Awards in many of these industries are limited nationally as well; however, there are some examples of exemplary curriculums—after which the Hampton Roads region could model new programs:

   While workforce attraction is expected from outside the region, Hampton Roads will need to build a more robust talent pipeline for both clusters. Although research assets with VMASC and degree programs offered through regional universities and community colleges provide some tangible pipeline, there are still opportunities to graduate more students in data science, cybersecurity, modeling & simulation, and unmanned systems. With the current annual awards output, the number of graduates from these programs will not support the future demand for both industry clusters. Many cybersecurity jobs require security clearances and in-office workforce participation. As more growth occurs in the region for cybersecurity, research and development, modeling & simulation, and unmanned aerial and submersible vehicle production, priority should be given to meeting the demand of regional talent. A regional training program will be important to support current and future demand. That includes employer advisory participation to provide degree and certification recommendations.

Table 5.1

HRWC Can Seek Inspiration from Other Best-In-Class Programs

SCHOOL	CURRICULUM
RIT Rochester Institute of Technology	**Modeling and Simulation (Rochester Institute of Technology):** RIT specializes in modeling and simulation research, both mathematical and visual. Specific majors/degrees are usually combined in some engineering or science standard program, but having a strong research presence in these fields is crucial for developing necessary skills.[31]
Carnegie Mellon University	**Cybersecurity (Carnegie Mellon University):** CMU has a world-renowned cybersecurity program, offering both undergraduate and graduate level programs. This program highlights its technical focus in security and computer systems, further developed through research opportunities. CMU is consistently rated at the top of U.S. News and World Report for Cybersecurity programs nationwide.[32]
PURDUE UNIVERSITY	**Unmanned Systems (Purdue University):** Purdue University, one of the nation's most respected universities for engineering, has recently developed a degree specifically focusing on unmanned aerial systems. This program provides background engineering knowledge, information on safety policies and regulations, and hands-on testing/flight experience.[33]

Source: Chmura

[31] "Kate Gleason College of Engineering," Rochester Institute of Technology, accessed May 17, 2024, https://www.rit.edu/engineering/research/key-research-areas/data-analysis-modeling-and-simulations.

[32] "Information Networking Institute," Carnegie Mellon University, accessed May 17, 2024, https://www.cmu.edu/ini/academics/cyberdefense.html.

[33] "Unmanned Aerial Systems," Purdue University, accessed May 17, 2024, https://polytechnic.purdue.edu/degrees/unmanned-aerial-systems.

2. **Hard Skill Training -** Support employers with fundamental training for Microsoft products, Python, and Java.

   Data analysis and employer feedback emphasizes the importance of basic application knowledge like Microsoft Excel, Outlook, Python, Linux, JavaScript, statistics, and other fundamental mathematics skills. Workforce training support is needed for fundamentals that could be offered as certifications or custom training with local employers. Artificial intelligence (AI) is another growth opportunity for industry clusters across the globe. With the evolution of AI, employers in the cybersecurity and modeling & simulation clusters are already scrambling to attract those with machine learning and generative AI knowledge. While it's still an unpredictable industry, the technological advancements will require commercial and defense sectors to keep up with the changes. HRWC should consider supporting an AI learning lab for professionals to remain updated about the latest developments and collaboratively develop practices to share and apply that knowledge in their organizations. This could also include educators in the region interested in engaging with industry-driven collaborative initiatives in AI.

Table 5.2

Tactical Hard Skill Growth Strategies Can Be Considered for the Hampton Roads Region

IN-DEMAND SKILL	STRATEGY TO GROW LOCAL CAPABILITIES	STUDENT POPULATION TARGET
Machine Learning	• Directly partner with community colleges and local universities • Establish or support incubators and accelerators focused on machine learning startups to promote entrepreneurship and mentorship	• Four-Year Programs • Graduate Programs
Python & Java	• Upskill current workers – offer specific training programs/ workshops • Directly partner with community colleges and local universities (Tidewater Community College currently provides the most technology certificate awards in the region.)	• Four-Year Programs • Graduate Programs • Young Professionals
Microsoft Products	• Upskill current workers – offer specific training programs/ workshops • Offer access to resources, datasets, and other training materials	• High School • Two-Year Programs • Young Professionals

Source: Chmura

3. **Internships and Apprenticeships -** Build young or entry-level talent to develop pathways for local growth of in-demand occupations.

   During focus group interviews, several employers noted that the Hampton Roads region was successful with transitioning a retired military workforce to the private sector. However, young talent was more difficult to recruit and retain in the region. Internships and apprenticeship opportunities can help entry-level talent form connections with employers while they grow in their career. While some employers in specified industries like healthcare still require a four-year degree, most employers in Hampton Roads are willing to hire based on experience or train employees in the software they use. The internship pathway is crucial for local universities marketing their programs and for connecting students with jobs post-graduation. Figure 5.2 illustrates HRWC's possible role in this development.

Figure 5.2

Internship Development Starts Early, Helps Directly with Recruiting and Marketing and Student Conversion

Identify Market Demand

Identify internship goals/sectors

Define Program and Develop Curriculum

Collaborate and facilitate partnerships with industry stakeholders to create internship offerings

Obtain Resources; Get Accredited

Help with funding and resources for internships

Student Recruitment & Marketing

Internship Actioning: Execute internship and apprenticeship opportunities, market these opportunities to prospective students

Monitoring & Growth

Foster ongoing collaboration with industry partners and help interns convert to full-time jobs in the region

Role of HRWC | Recommendation Section

Employers would be interested in this internship and apprenticeship support from HRWC to limit the learning curve and help identify young talent to fill new full-time positions. GO Virginia and other regional workforce support providers such as Virginia's Community Colleges, the Community College Workforce Alliance, and the Virginia Space Grant Consortium have historically furnished incentives for the cybersecurity sector to boost talent retention. Through the Virginia Space Grant Consortium, the Commonwealth STEM Industry Internship Program (CSIIP) offers internship support for employers and employees in the Hampton Roads region. HRWC should incorporate any internship or apprenticeship initiatives with CSIIP to leverage the dollars and reach of the program.

4. **Successful Program Support -** Employers are already utilizing programs like V3 and SkillBridge. HRWC should continue encouraging employers to engage with these assets as it builds the talent pathways program.

Virginia Values Veterans (V3), SkillBridge, and regional colleges and universities are current avenues that employers seek out for workforce support. New workforce initiatives should utilize the resources of the V3 program, SkillBridge, and regional higher education institutions to ensure successful implementation. An example of this support could be in the form of collaborating with V3 or SkillBridge to market new initiatives like a fast-track program for an information technology fundamentals certificate.

5. Small Advisory Group – Made up of employers and regional partners aimed at streamlining engagement, building regional cooperation, and supporting further growth in both clusters.

   Employers who participated in the focus group sessions indicated their interest in remaining actively involved with workforce planning for both clusters. The aerospace and unmanned systems cluster is smaller in number of employees in the region compared to the data analytics, cybersecurity, and modeling & simulation cluster. However, there is interest from a small number of employers to engage with HRWC on future initiatives for talent pathways. Data collected in the qualitative focus group and employer surveys indicate that much of the defense work conducted within the aerospace and unmanned systems cluster has direct overlaps with data analytics, cybersecurity, and modeling & simulation.

   Employers in the aerospace and unmanned systems cluster noted that the ability of the region to support data science and cybersecurity will impact the growth potential of this cluster. Many employers in the focus group and surveys also noted the growth in unmanned submersible vehicle manufacturing as a catalyst for the Hampton Roads economy. With the overlap in skills needed in the region, including aerospace and unmanned systems within the cluster of data analytics, cybersecurity, and modeling & simulation would help build a more diverse collaborative of employers with a higher likelihood of sustained impact. **Cybersecurity, in particular, presents a shared need, well-defined skillset, and possibility for a quick win to build trust between employers and HRWC**. Such a collaboration would also help to streamline multiple initiatives to support these clusters from other organizations such as the Hampton Roads Alliance and Virginia Economic Development Partnership. A single point of contact on cluster needs is important for reducing employer time burden and building regional cooperation.

   For developing this advisory group, it is important to strive for balance in representation between different industry interests while prioritizing members who would be eager, active participants. The figure below shows a potential structure for the advisory group. It is recommended that the size of the group be limited to 13 representatives or less to keep sessions focused and tactical. Alternatively, a smaller size could also work well.

Figure 5.3

A Potential Small Advisory Group for HRWC Should Seek Balance in Representation and Eager Participants

HRWC Staff

HRWC Chair

HRWC Talent Pathways Program Manager

HRWC Staff (Administrative Role)

Industry Representatives

Data analytics, Cybersecurity, and Modeling & Simulation Company

Data analytics, Cybersecurity, and Modeling & Simulation Company

Unmanned Systems Company

Unmanned Systems Company

NASA, DoD, or other Government Representative

Education Representatives

Four-Year University

Four-Year University

Four-Year University

Community College

Local School District

Source: Chmura

6

APPENDIX

CLUSTER DEFINITIONS AND METHODOLOGY

Workforce needs for the aerospace and unmanned systems cluster and the data analytics, cybersecurity, and modeling & simulation cluster can be viewed from the dimensions of industry, occupation, and training. From an industry dimension, the cluster definitions refer to the set of firms that design and provide services for consumers and other employers. From an occupation dimension, the clusters refer to the group of professions whose primary responsibilities are working with and developing key technologies and applications. From a training dimension, the cluster refers to the key academic programs that prepare and train relevant occupations.

A critical first step in assessing the clusters in the Hampton Roads region ("the region") is to define the relevant industries and key occupations of each cluster. By nature, it is easier to define the aerospace and unmanned systems cluster at the industry level first and then derive the occupations that are employed in this cluster. On the other hand, it is more natural to think about data analytics, cybersecurity, and modeling & simulation as a cluster of information technology occupations. Since many of these technologies can be applied in a wide range of industries, such as manufacturing, defense, health care, and logistics, it is not straightforward to summarize clusters by North American Industry Classification System (NAICS) codes.

Chmura took the following approach based on its Real-Time Intelligence (RTI) in JobsEQ to solve the problems outlined above. The approach uses keyword searches of full-text online job advertisements in the Hampton Roads region to identify workforce needs. The Standard Occupation Classification (SOC) code taxonomies and employers identified in these online ads then form the basis for SOC code and NAICS code classifications to examine broad trends. This approach is similar to a firm survey approach that has been used in previous reports on the modeling & simulation industry. The figure below summarizes the keyword approach using Chmura's Real-Time Intelligence (RTI) in JobsEQ.

Figure 6.1

Online Job Ad Search Approach to Define Clusters

Source: Chmura and JobsEQ

DATA ANALYTICS, CYBERSECURITY, AND MODELING & SIMULATION

Technology jobs tend to cut across nearly every industry, especially as technology advances and becomes more widely adopted. For this reason, technology trends are commonly examined at the occupation or skill level rather than at the industry level. For example, cybersecurity occupations are generally captured in the information security analysts (15-1212) SOC code. Any firm that stores sensitive data or has an online presence will have a need for cybersecurity, either provided in-house or as a third-party service. Therefore, the cluster will consist of providers of cybersecurity services as well users of cybersecurity.[34]

Data analysis may be performed in firms by dedicated professionals (such as data analysts in health care, banking, and data centers) or as just one part of day-to-day tasks in other roles (such as managerial positions, finance, human resources, etc.). In contrast to the description of data analytics used in the GO Virginia Region 5 Growth and Diversification Plan, which is entirely industry-based, this report focuses primarily on roles dedicated to data analysis which often require an understanding of statistics and data analysis software.[35]

Modeling & simulation refers to the process of developing a model and then applying simulation to extract information from the model. Visualization is often used to enhance the user's ability to understand, interpret, and interact with the data associated with this process. In applications, modeling & simulation may be used to investigate the behavior of a model under various conditions within and exceeding design boundaries, as well as for training individuals to operate or maintain the system represented by the model. Modern applications include artificial intelligence and/or machine learning, FinTech, and Manufacturing Tech software. Searching for the specific combination of modeling & simulation identifies organizations that develop these tools and technologies, provide services, or use modeling & simulation services or products.

The tables below show the estimated employment and sample key occupations, employers, and job titles from searching online job ads using a combination of industry keywords and filters to remove false positives.[36]

Table 6.1

Total job ads in the last 12 months account for almost half of estimated employment

SECTOR	TOTAL JOB ADS LAST 12 MONTHS	ESTIMATED EMPLOYMENT
Cybersecurity	3,742	6,461
Data Analytics	659	1,352
Modeling & Simulation	1,130	4,276
Data Analytics, Cybersecurity, and Modeling & Simulation	**5,531**	**12,089**

Source: Chmura's JobsEQ, RTI, online job ads active between October 2022 and October 2023.

[34] The employer inventory will consist of only the provider of the service.

[35] GO Virginia Region 5's Growth and Diversification Plan restricts the entire data analytics, cybersecurity, and modeling & simulation cluster to the following NAICS industries:

- 541611, administrative management and general management consulting services
- 541612, human resources consulting services
- 541613, marketing consulting services
- 541618, other management consulting services
- 541720, research and development in the social sciences and humanities

[36] For example: sales or warehouse ads that may have matching keywords (like "data modeling") in the company description but refer to jobs not relevant to the cluster.

Figure 6.2

Data Analytics, Cybersecurity, and Modeling & Simulation Includes a Variety of Industries from Defense to Telecommunications or Healthcare

Sample Occupations

- Information Security Analysts
- Network and Computer Systems Administrators
- Software Developers
- Data Scientists
- Operations Research Analysts
- Logisticians
- Computer and Information Research Scientists

Sample Employers

- Leidos
- Booz Allen
- Oasis Systems
- SAIC
- Cox Enterprises
- Sentara Healthcare
- HII Mission Technologies
- Valiant Integrated Services

Sample Job Titles

- Cyber Security Engineer
- Desktop Support Technician
- Data Analyst
- Financial Data Analyst
- Supply Chain Data Analyst
- Systems Engineer
- Wargaming Analyst

Source: Chmura

AEROSPACE AND UNMANNED SYSTEMS

The aerospace and unmanned systems cluster is generally well-defined by NAICS codes, but these definitions may not include work being performed as a subset of the primary work in firms classified in a different industry (such as ship building). Specifically, the following NAICS codes provide a starting point for defining the cluster:

- 3364, aerospace products and parts manufacturing
- 3345, navigational, measuring, electromedical, and control instruments manufacturing
- 9271, space research and technology
- 92811, national security
- 336611, ship building and repairing[37]

These codes are helpful in examining industry trends driving workforce needs but are broader than the specific cluster being examined. For example, while NAICS code 336611 comprises "unmanned and robotic watercraft manufacturing in shipyards", it includes also "fishing boat, commercial, building" and "oil and gas offshore floating platform manufacturing".

Another approach is to compile a list of employers in this cluster directly. Firm-specific information is not typically available, but organization names can be used to filter online job ads to examine workforce needs. Employer inventories are available from state and local economic development offices. For example, the third quarter 2020 issue of the Virginia Economic Review includes a list of aerospace, aviation, and unmanned systems employers in the Hampton Roads region.[38] This approach has the additional advantage of including occupations needed by employers even if the job title does not specifically state aerospace or unmanned systems. This approach uncovers job ads not only for aerospace engineers, but also for occupations such as general maintenance and repair workers, machinists, and software developers.

The table on the next page summarizes the results of searching online job ads using a combination of industry keywords, filters for terms used only in the company description, and employer names.

[37] Except for 336611, this list of NAICS codes is included in the GO Virginia Region 5 Growth and Diversification Plans. In those reports, ship building and repairing is considered a separate cluster. It is included here to capture unmanned and robotic watercraft.

[38] "Aerospace, Aviation, and Unmanned Systems, Transportation Innovation in Virginia," Virginia Economic Review, third quarter 2020, https://issuu.com/vedpvirginia/docs/vedp_q320_v19_4print?fr=sNDdmMzE3MDE3MTA.

Table 6.1

Total job ads in the last 12 months account for almost half of estimated employment

SECTOR	TOTAL JOB ADS LAST 12 MONTHS	ESTIMATED EMPLOYMENT[39]
Unmanned Systems	230	505
Aerospace	476	1,730
Aerospace and Unmanned Systems	**706**	**2,235**

Source: Chmura's JobsEQ, RTI, online job ads active between October 2022 and October 2023.

The list of total job ads posted by companies in the cluster will serve as the starting point to identify the key occupations that are needed to support the cluster's growth. Chmura utilizes the following methods to narrow the initial list down to the strategic occupations:

- Occupations with the largest gap between demand and availability in the labor shed (the area or region from which an employment center draws its commuting workers)
- Occupations with the strongest expected growth
- Feedback from the stakeholder focus groups about most-needed skill/occupation

The figure below presents some examples of these strategic occupations, as well as sample employers and job titles.

Figure 6.3

Aerospace and Unmanned Systems Range in Experience Needs for Analysts, Technicians, and Engineers

Sample Occupations

- Aerospace Engineers
- Maintenance and Repair Workers
- Aircraft Mechanics and Service Technicians
- Computer and Information Systems Managers
- Information Security Analysts
- Machinists
- Electrical Engineers

Sample Employers

- Howmet Aerospace
- DroneUp
- VSE Corporation
- Mazella Companies
- Eagle Technologies
- Aery Aviation
- NASA
- Old Dominion University

Sample Job Titles

- Flight Safety Analyst
- Aerospace Engineer
- Warehouse Specialist
- Electronics Maintenance Technician
- ISR (Intelligence, Surveillance, and Reconnaissance) Mission Scheduler
- Software Test Engineer

Source: Chmura

[39] Cluster-estimated employment equals total occupational employment multiplied by the share of projected total occupational employment in the cluster. The latter is computed as the ratio of the cluster's job ads for a specific occupation to the total job ads for that occupation in Hampton Roads.

Table 6.3

Total job ads in the last 12 months account for almost half of estimated employment

SECTOR	KEYWORDS
Cybersecurity	(cybersecurity OR "cyber security") AND -title.text:(sales OR writer OR warehouse) AND (title.text:cyber OR title.text:security OR title.text:"Network Engineer" OR title.text:"Systems Engineer" OR title.text:technician OR title.text:analyst OR title.text:manager)
Modeling & Simulation	("modeling and simulation" OR "modeling & simulation") OR “artificial intelligence” or “machine learning”
Data Analytics	"data science" OR title.text("Data Analyst")
Unmanned Systems	unmanned AND -"unmanned systems, ISR" AND -"unmanned client sites" AND -"largest family of unmanned" AND -"final offer letter may include any geographic location"
Aerospace	company.text:(Aery OR Mazzella OR Calspan OR "Eagle Technologies" OR DroneUp OR ATAC OR Aeronyde OR Howmet OR VSE) OR title.text:Aerospace

Source: Chmura

IDENTIFYING KEY OCCUPATIONS

Workforce needs for the aerospace and unmanned systems cluster and the data analytics, cybersecurity, and modeling & simulation cluster can be viewed from the dimensions of industry, occupation, and training. From an industry dimension, the cluster definitions refer to the set of firms that design and provide services for consumers and other employers. From an occupation dimension, the clusters refer to the group of professions whose primary responsibilities are working with and developing key technologies and applications. From a training dimension, the cluster refers to academic programs that prepare and train individuals for relevant occupations.

A critical first step in assessing the clusters in the Hampton Roads region (“the region”) is to define the relevant industries and key occupations of each cluster. Chmura leverages its Real-Time Intelligence (RTI) in JobsEQ to define these occupations. The approach uses keyword searches of full-text online job advertisements in the Hampton Roads region to identify workforce needs. The Standard Occupation Classification (SOC) code taxonomies and employers identified in these online ads then form the basis for SOC code classifications to examine trends. This approach is similar to the firm survey approach that has been used in previous reports on the modeling & simulation industry.

Key occupations identified in this research are summarized on the following pages.

Table 6.4

Top Key Occupations in Cybersecurity, Data Analytics, and Modeling & Simulation Cluster in Hampton Roads

COMPUTER AND MATHEMATICAL	ENGINEERING	BUSINESS AND FINANCIAL	OTHER
Information Security Analysts	Electrical Engineers	Management Analysts	Computer Science Teachers, Postsecondary
Network and Computer Systems Administrators	Electronics Engineers, Except Computer	Business Operations Specialists, All Other	Intelligence Analysts
Operations Research Analysts	Electrical and Electronic Engineering Technologists and Technicians	Training and Development Specialists	Welders, Cutters, Solderers, and Brazers
Computer User Support Specialists	Mechanical Engineers	Accountants and Auditors	Maintenance and Repair Workers, General
Software Developers	Industrial Engineers	Financial and Investment Analysts	First-Line Supervisors of Office and Administrative Support Workers
Computer Systems Engineers/Architects	Aerospace Engineers	Logistics Analysts	First-Line Supervisors of Mechanics, Installers, and Repairers
Computer and Information Research Scientists	Electro-Mechanical and Mechatronics Technologists and Technicians	Market Research Analysts and Marketing Specialists	Electricians
Computer Systems Analysts	Marine Engineers and Naval Architects	Human Resources Specialists	Occupational Health and Safety Specialists
Information Security Engineers	Electrical and Electronics Drafters	Logisticians	Machinists
Information Technology Project Managers	Materials Engineers	Search Marketing Strategists	

Source: Chmura

Table 6.5

Top Key Occupations in Aerospace and Unmanned Systems Cluster in Hampton Roads

ENGINEERING	PRODUCTION AND MAINTENANCE	COMPUTER AND MATHEMATICAL	OTHER
Aerospace Engineers	Aircraft Mechanics and Service Technicians	Network and Computer Systems Administrators	Computer and Information Systems Managers
Mechanical Engineers	Maintenance and Repair Workers, General	Operations Research Analysts	Industrial Production Manage
Electronics Engineers, Except Computer	First-Line Supervisors of Mechanics, Installers, and Repairers	Software Developers	Business Operations Specialists
Electro-Mechanical and Mechatronics Technologists and Technicians	First-Line Supervisors of Production and Operating Workers	Information Security Analysts	Stockers and Order Fillers
Industrial Engineers	Machinists	Computer Systems Engineers/Architects	Commercial Pilots
Electrical Engineers	Inspectors, Testers, Sorters, Samplers, and Weighers	Computer Systems Analysts	Plumbers, Pipefitters, and Steamfitters
Electrical and Electronic Engineering Technologists and Technicians	Welders, Cutters, Solderers, and Brazers	Computer User Support Specialists	Intelligence Analysts
Health and Safety Engineers, Except Mining Safety Engineers and Inspectors	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	Computer and Information Research Scientists	Quality Control Analyst
Manufacturing Engineers	Avionics Technicians	Information Technology Project Managers	Airfield Operations Specialists
Mechanical Drafters	Pourers and Casters, Metal	Geographic Information Systems Technologists and Technicians	Logisticians

Source: Chmura