

# Washington State Information & Communication Technology Defense Export Market Research

## Discussion Draft

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Prepared for:



Prepared by:



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**President and CEO**

Chris Mefford

**Lead Analysts**

Spencer Cohen, PhD

Eric Viola

Sam Kaplan, Gittes Global

Nelson Dong, Dorsey & Whitney LLP

Larry Ward, Dorsey & Whitney LLP

**Analysts**

Michaela Jellicoe

Katy Nally

Sudarshan Sampath

Alexandra Streamer

Community Attributes Inc.

1411 Fourth Avenue, Suite 1401

Seattle, Washington 98101

[www.communityattributes.com](http://www.communityattributes.com)

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# **EXECUTIVE SUMMARY**

## **Background and Purpose**

The information & communication technology (ICT) defense sector in Washington is an important contributor to the state economy, bridging defense activities with one of Washington's leading global industries. In fiscal year 2015, there were 199 unique ICT prime contractors in Washington. These companies were awarded contracts worth more than \$315 million in fiscal year 2015, providing the Department of Defense and Coast Guard everything from custom software services to ICT hardware.

Washington's ICT defense contractors perform work in several core areas, notably:

- Cloud services and software
- Supercomputers
- Wireless services
- Navigational systems
- Electronic security systems
- Electronic warfare and cyber security
- Hardware and components

Despite the robust nature of the ICT defense sector, future possible changes in federal spending may spur these businesses to shift more of their attention and business to other non-DOD clients. One method for hedging against these possible shifts in funding is the expansion into overseas markets, both for defense and civilian work.

The Washington State Department of Commerce (Commerce) has requested this report to assess overseas exporting opportunities for Washington-based ICT defense contractors. This report includes a review of defense activities in Washington, global trends in the ICT sector (defense and civilian), potential market opportunities, and a set of recommended strategies for Commerce to implement to help these firms diversify abroad.

Exporting entails numerous challenges, including regulatory/export controls, economies of scale needed to expand overseas, and important information gaps on where opportunities might exist. This report outlines many of these challenges and provide a strategic framework for Commerce to help defense contractors expand their business into overseas markets. Recommendations take into account key trends and considerations specific to information and communication technology businesses in Washington engaged in defense contracting.

## Key Findings

Research findings presented in this report include industry-wide trends and market conditions shaping ICT export opportunities. These findings are summarized below.

### Industry Trends and Baseline Conditions

- **ICT defense contracting is dominated by a few large firms that already export.** Of all ICT defense contracts awarded to Washington ICT businesses in fiscal year 2015, Microsoft contracts totaled 57.7%. Microsoft is already a large exporter active in many markets. Several other contractors, including Cray Inc. (\$34.9 million in defense contracts), New Cingular Wireless Services (\$22.9 million in contracts), and Amazon Web Services (\$138,000 in contracts) are also already major exporters. These companies already have global operations and are equipped to identify and explore export market opportunities.
- **Opportunities to assist smaller firms.** The companies that would most benefit from Commerce assistance include smaller firms engaged specialty software development services, cyber and physical security hardware and services, and ICT hardware and components manufacturers. These companies tend to be fairly small and many lack the internal resources needed to identify and pursue export opportunities.
- **General, cross-applicable, civilian nature of many ICT defense products and services.** Many of the products and services sold by Washington state ICT firms are not highly specific to defense, making these products exportable to the commercial sector. An important exception to this general theme is the increased information security needs of the DOD and Coast Guard: All software and hardware utilized by federal government agencies must meet or exceed Federal Information Processing Standards, which are typically more stringent security guidelines than companies would usually employ for commercial work.

### Key Markets for Future ICT Growth

The most promising markets for defense ICT firms are in China, Germany, Japan, Australia, India, and Poland. Some of these large markets, notably China, entail significant market barriers and challenges, e.g., intellectual property protection and state support for domestic companies.

- **China** is an important, growing export opportunity for Washington ICT defense contractors, especially in the cloud computing, software, and semiconductor manufacturing areas. However, intellectual property concerns and domestic competition pose significant challenges.

- **Germany** represents a potential market for information security defense contractors to implement new solutions in the German market.
- **Japan** has relatively low barriers to entry, although the country does have domestic ICT companies that could compete with potential Washington exporters. Japan is a growing market for cloud services as well as ICT hardware and components. Strong IP protection in Japan makes the market more attractive. Washington has extensive historic trade and cultural linkages with Japan. Japan will also—pending U.S. ratification of the Trans-Pacific Partnership—become a free trade partner with the U.S.
- **Australia** is a strong market for cloud services. The country has strong IP protection, a trade-focused regulatory environment, infrastructure that is ready for cloud services, and significant broadband coverage. Australia is also a free trade partner with the U.S. The Australian government is reportedly targeting 93% broadband coverage by 2021, further supporting growth in cloud services.
- **India.** In recent years India has begun to grow as a market for ICT software and services, beyond the country's history of providing offshoring services. A major part of this growth is increased readiness and demand for cloud services.
- **Poland** has demonstrated market growth in the avionics subfield of ICT products. ICT firms providing navigational equipment and avionics products may be able to support the Polish aerospace industry.

## Strategies for Supporting ICT Defense Contractors

Opportunity/Theme	Key Findings/Considerations	Strategy	Type of Assistance
Industry-wide	Companies need more information on current and future trends in global defense spending.	<b>Expand the Washington Military &amp; Defense Economic Impact Tool</b> to include current information on ICT defense trends. The WMA can be broadened to serve the information gathering needs of aerospace defense contractors in Washington by providing regular newsfeeds and content published on the site as well as sent via SMS and email to registered subscribers.	Education and training/market research
	Companies need support understanding defense regulations and require related technical assistance.	<b>Technical support.</b> Consider hiring a position to focus on technical outreach in the defense market. This position would act as an ombudsman for ICT (and other targeted sectors) by liaising with technical contacts at DOD and related agencies, and by acting as a traffic cop to connect companies to the right resources and contacts.	Technical assistance
	Many firms remain unaware of the services offered by the Washington State Department of Commerce.	<b>Disseminate information.</b> Build out and update an information and communication technology sector section of the Washington State Department of Commerce website with information and data on target markets, regulations, financing information, trends, and contact information for the sector lead.	Education and training
Overseas market opportunities	The Asia Pacific region is a major and fast-growing market for cybersecurity, and one with which Washington has strong economic and cultural ties.	<b>Bring a delegation to one of Singapore's cybersecurity trade shows.</b> These trade shows, with the assistance and facilitation of the Washington State Department of Commerce, can act as an entrée for the Asia Pacific market.	Market research

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## **INTRODUCTION**

### **Background and Purpose**

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However, despite the robust nature of the ICT defense sector, future possible changes in federal spending may spur these businesses to shift more of their attention and business to other non-DOD clients. One method for hedging against these possible shifts in funding is the expansion into overseas markets, both for defense and civilian work.

The Washington State Department of Commerce (Commerce) has requested this report to assess overseas exporting opportunities for Washington-based ICT defense contractors. This report includes a review of defense activities in Washington, global trends in the ICT sector (defense and civilian), potential market opportunities, and a set of recommended strategies for Commerce to implement to help these firms diversify abroad.

Exporting entails numerous challenges, including regulatory/export controls, economies of scale needed to expand overseas, and important information gaps on where opportunities might exist. This report will help address many of these challenges and provide a strategic framework for Commerce to help defense contractors expand their business into overseas markets. Recommendations address key trends and considerations specific to information and communication technology businesses in Washington engaged in defense contracting.

### **Methods**

This project has required a hybrid research methodology, leveraging a wide spectrum sources and materials. These include:

- Existing federal and private sector research reports
- News articles
- Exporting and defense contractor data
- Industry forecasts
- Military spending data, sourced from national government budget reports and the Stockholm International Peace Research Institute, among other sources

- Interviews with: 1) existing exporters in the ICT sector; 2) defense ICT contractors; 3) government and policy officials, including in the Department of Defense and U.S. Foreign Commercial Service; and 4) industry experts

## **Method for developing recommendations**

Recommendations are focused on addressing market opportunities specific to defense ICT activities and contractors in Washington.

Variables considered include: 1) characteristics unique to defense contractors, including size and ability to scale to foreign sales; domestic factors, such as regulatory considerations and pull of the domestic U.S. market over international markets; 3) foreign government factors, including state policies biased to indigenous industries; 4) industry and technology factors, such as the exportability of certain products and services; 5) macroeconomic conditions; 6) regional and geopolitical factors; and 7) considerations specific to defense versus civilian opportunities.

Recommendations were further refined based on existing resources and capacity at Commerce. These include education and training, technical and regulatory assistance, market research, and advocacy support. A more detailed discussion of how recommendations were developed can be found in the **Appendix**.

## **Organization of Report**

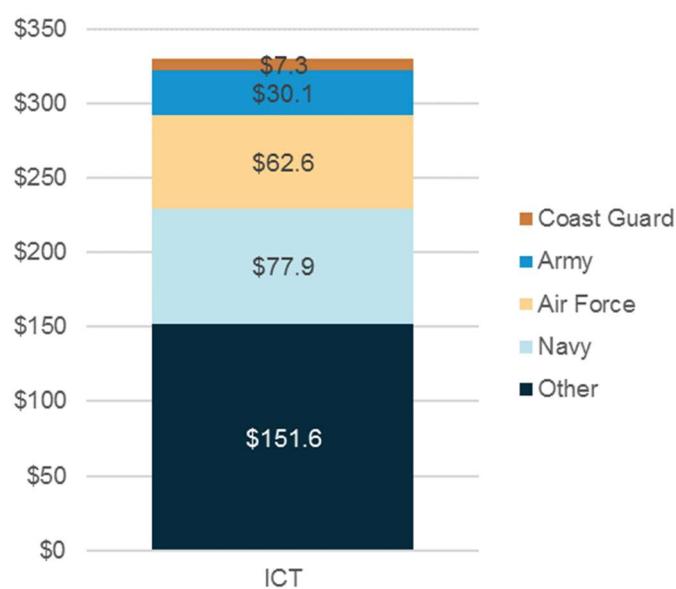
- **ICT Defense Spending in Washington.** An overview of leading ICT subsectors and contractors in Washington.
- **Key Industry Trends and Global Considerations.** Factors and trends shaping opportunities and challenges for ICT defense contractors, including domestic and overseas barriers.
- **Exporting and Competitiveness Factors.** Strengths and weaknesses of Washington ICT defense contractors in overseas markets.
- **Market Opportunities.** Country and region-specific opportunities for defense contractors, based on the matching of current, resident capabilities and overseas demand and market conditions.
- **Recommended Strategies.** Actionable strategies the Washington State Department of Commerce can undertake to support ICT defense contractor exports.

## DEFENSE CONTRACTORS IN WASHINGTON

In fiscal year 2015, there were 199 unique ICT prime contractors in Washington. These companies were awarded contracts worth more than \$315 million in fiscal year 2015, providing the Department of Defense and Coast Guard everything from custom software services to ICT hardware. (U.S. Office of Management and Budget, 2016)

The majority of ICT defense contracts in 2015 were awarded by agencies within the Department of Defense. These include the Defense Information Systems Agency (DISA), which awarded Washington firms \$137.7 million in contracts in 2015. Together with the Defense Logistics Agency, which awarded contracts worth \$11.9 million in 2015, these two agencies compose the bulk of the "Other" category in **Exhibit 1** below. The Navy, Air Force, Army, and Coast Guard also contracted Washington defense companies for ICT products and services in 2015, though to a lesser extent than DISA. (**Exhibit 1**)

**Exhibit 1. Defense ICT Contracts Awarded to Washington State Firms, by Branch of Defense Department, Millions of Dollars**



Source: Office of Management and Budget, 2016; Community Attributes Inc., 2016.

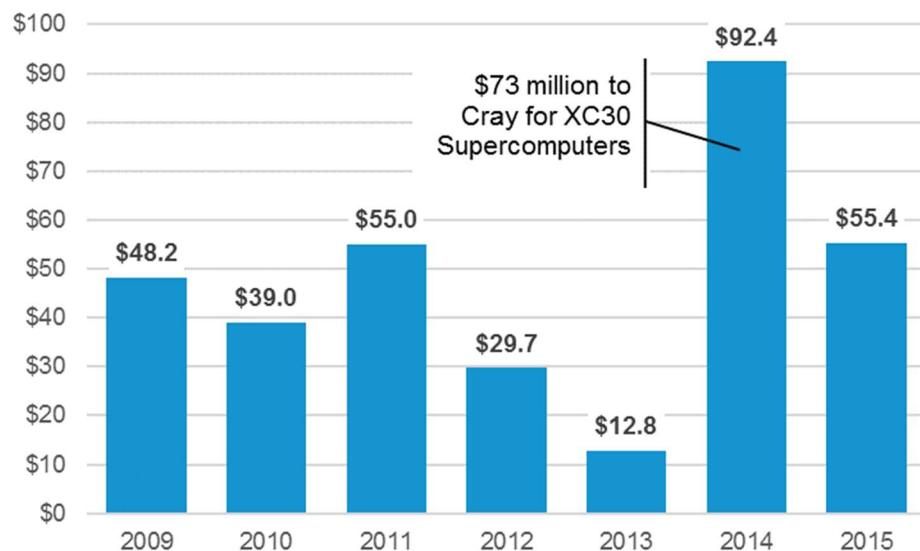
## Contracts by Type of Service or Technology

One of the largest categories of ICT contracts is automatic data processing software and products. This category covers every product offering from computer software to personal computers. In 2015, contracts worth \$55.4 million were made with Washington contractors (**Exhibit 2**).

In recent years, contracts from the Department of Defense or Coast Guard for Washington ICT companies in this category have fluctuated significantly. This is because purchases in this category of products are typically small and recurring, with a few very large but infrequent contracts.

For example, the large jump from 2013 to 2014 illustrated in **Exhibit 2** is due to a series of purchases made by the Department of Defense to Cray Inc., a Washington-based supercomputer manufacturer. The DOD awarded more than \$73 million for several of the company's XC30-series supercomputers. These machines are massive parallel processing computers designed for adaptive supercomputing with scalability in mind. This scalability can be very important for customers like the DOD who may need to add new units to the parallel system in the future for added processing power. (Cray, Inc., 2016)

**Exhibit 2. Automatic Data Processing Software and Products Contracts Awarded to Washington State Firms, Fiscal Years 2009-2015, Millions of 2015 Dollars**

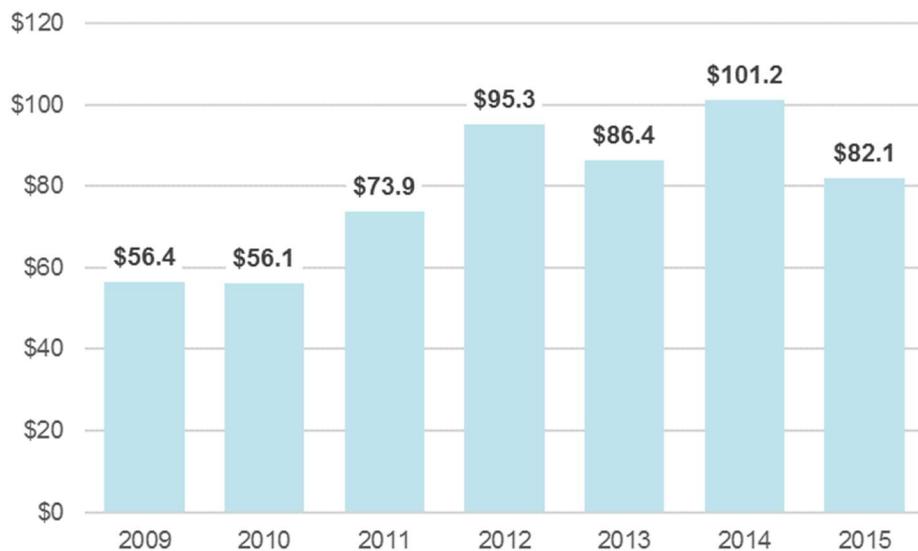


Sources: Office of Management and Budget, 2016; Federal Reserve Bank of St. Louis, 2016.

Services are an important aspect of the ICT sector. For defense contractors in Washington, services related to automatic data processing software and hardware in fiscal year 2015 totaled \$82.1 million. These contracts have been more consistent over the past seven years than contracts for software and hardware sales in support of this subsector. This is primarily due to the relatively high share of recurring service contracts in the telecommunications space.

For instance, in 2015, 25% of contract value in this category went to New Cingular Wireless for wireless services. From 2009 to 2015, that share ranged from 15% to 25%, showing that wireless services contracts with the company have been relatively consistent over time. (**Exhibit 3**)

**Exhibit 3. Automatic Data Processing and Telecommunications Services Contracts Awarded to Washington State Firms, Fiscal Years 2009-2015, Millions of 2015 Dollars**



Sources: Office of Management and Budget, 2016; Federal Reserve Bank of St. Louis, 2016.

The Defense Logistics Agency, Defense Microelectronic Activity, and Defense Advanced Research Projects Agency funded a large share of contracts made with Washington ICT companies. The bulk of purchases from these agencies included information technology hardware, telecommunications equipment, and information systems. (Office of Management and Budget, 2016)

The Air Force was another major customer for Washington's ICT contractors in 2015. The aerospace and ICT sectors are closely linked, and aerospace ICT is vital to reliable aircraft components. Electronic information panels and displays, navigational equipment, mapping equipment, and imaging systems represent some of the largest purchases made by the Air Force from Washington's ICT defense contractors. The Army, Navy, and Coast Guard, also contracted the state's ICT companies for goods and services, especially software and ICT equipment like telephone, radio, and intercom systems. (Office of Management and Budget, 2016)

Defense Information Systems Agency (DISA), which provides information infrastructure support for national defense, was another source of ICT contracts for Washington firms. DISA monitors and supports products and services related to computing and service hosting, network defense, and a variety of enterprise services that connect the U.S. military and government. In fiscal year 2015, DISA awarded Washington-based companies more than \$100 million in ICT contracts. (Defense Information Systems Agency, 2016).

Microsoft, one of the world's largest software producers, signed a comprehensive software contract with the Department of Defense in 2013. This blanket purchase agreement covers software that will be used by roughly three-quarters of all DOD personnel. In the past, software contracting was done by individual agencies: Army, Navy, and Airforce, for example, each had separate contracts with Microsoft. By contracting together, the DOD was able to save money while further integrating information systems. (Office of Management and Budget, 2016)

Encryption is a key differentiator between civilian and defense dual-use ICT activities. There are several programs and services, such as Microsoft Office software or cloud computing, that have applications for both civilian and military purposes. Under FIPS, the platforms, servers, or networks used for defense activities have a significant level of data encryption that is heightened from the civilian-use baseline. The stringency of encryption necessitated by various FIPS differs depending on the nature of the data processed or stored by particular products and services. (National Institute of Standards and Technology, 2002)

## **ICT Contracts by Subsector**

Washington's ICT defense contractors can be split into seven broad categories: cloud services and software, supercomputers, wireless services, navigational systems, electronic security systems, electronic warfare and cyber security, and hardware and components. The section below provides examples of these activities.

### **Cloud Services and Software**

Driven by cost reduction, efficiencies, and security reasons, the DOD began moving its data to the cloud in early 2015. Leading firms nationwide in this space include:

- Microsoft
- Amazon
- Plateau Software

Washington firms, including F5, Amazon Web Services, and Microsoft's Azure, have all received contracts for cloud services (U.S. Office of Management and Budget, 2016). Two programs, FedRAMP and the

Federal Data Center Consolidation Initiative (FDCCI), are integral to the DOD's cloud transition. The former offers a government-wide approach to security assessment, while the latter focuses on reducing the number of federal data centers by optimizing, consolidating, or closing existing facilities (Defense Information Systems Agency, 2016).

**Microsoft** received the largest ICT DOD contract in fiscal year 2015 with a value of \$195 million (Office of Management and Budget, 2016). This is part of a multi-year deal between Microsoft and the Department of Defense. Historically, the Navy, Army, Air Force, and smaller agencies have contracted with Microsoft separately. Under the new contract arrangement, Microsoft provides unified software options to the DOD at a discounted rate.

Microsoft's cloud computing company, Azure, has a platform designed specifically for government use. Under the 2015 contract, Microsoft will provide Azure Government for Air Force use. Azure Government was built to be a highly secure platform meant for continuous communication and document sharing between government entities. Additionally, the Air Force will have access to the Office suite and secure Outlook email and calendar services (Microsoft, 2016).

Microsoft is currently the only cloud services provider to have both FedRAMP (Federal Risk and Authorization Management Program) High and DISA (Defense Information Systems Agency) Level 4 and 5 authorizations. The former allows a cloud provider to host sensitive data at the High Impact Level, meaning information or communications that are extremely confidential. DISA level 5 clearance is one level shy of hosting classified data, but includes high-sensitivity data on national security systems. Azure is currently working to develop a DOD-only cloud that will be hosted in isolated and secure Azure Government data centers. Microsoft estimates availability of these centers and services for late 2016 (Microsoft, 2016).

In February 2016, the Department of Defense committed to immediately upgrade 4 million units to Microsoft Windows 10. The U.S. Secretary of Defense directed all DOD agencies to begin deployment of Windows 10 throughout their respective organizations within the next year. This upgrade is necessary to improve the Department's cybersecurity, and streamline the IT operating environment and associated costs. Windows 10 met stringent security criterion, including protection against Mobile Device Fundamentals Common Criteria, and qualified for the Unified Capabilities Approved Products List (Microsoft, 2016).

DOD agencies have begun using a cloud platform developed by **Amazon Web Services** to process, store, and transfer DOD data. Amazon Web Services recently obtained provisional authorization from the Defense Information Systems Agency to offer their cloud services to DOD

customers. In fiscal year 2015, DOD customers made contracts worth more than \$136,000 with Amazon Web Services for cloud services. Amazon developed key security features to meet the high level of security essential to the DOD, including data encryption, access management, and the option for users to design and build their own security controls on Amazon's existing platform. (Amazon Web Services, 2016; Office of Management and Budget, 2016)

Another example of cloud computing services is **Plateau Software**, with more than 15 years of experience with DOD projects, and all products have been reviewed and certified by the DOD. The company builds software related to environmental compliance, energy, sustainability, and environmental management systems (EMS) (Plateau Software, 2016).

Between 2008 and 2015, Plateau was awarded more than \$24 million in DOD contracts to directly support the Army's Environmental Protection and Sustainability program (Office of Management and Budget, 2016). This program ensures compliance with local, state, and federal environmental laws as well as standards for waste disposal. For example, Plateau's Assessment Manager software is a field audit program that allows the user to input measurements for pollution generated from operations. When the program detects non-compliance on a particular pollutant or regulation, it guides the user through remediation measures (Plateau Software, 2016).

## **Supercomputers**

**Cray Inc.**, a Washington supercomputer manufacturer headquartered in Seattle, sells advanced Automated Data Processing (ADP) equipment to the Army, Navy, and Federal Acquisition Service within the Department of Defense. The Department of Defense's High Performance Computing Modernization Program was enacted to empower DOD engineers and researchers with the most advanced technology available. The DOD uses supercomputers for applications like helicopter rotor thrust performance analysis, global network analysis, computational climate modeling, modeling, and space and astrophysics, among many others.

Between 2008 and 2015 Cray was the recipient of more than \$100 million in DoD contracts for supercomputing services. In 2015, the firm was awarded a \$35 million contract—the largest DoD contract Cray had ever received—for two of the company's supercomputers in addition to two of its data storage systems (Office of Management and Budget, 2016). The contract was awarded through the DoD's High Performance Computing Modernization Program (HPCMP), which has a three-pronged initiative to provide supercomputers, a national research network, and computational science experts for Defense laboratories and test centers. Within the 2014 calendar year, the HPCMP purchased over \$150 million of supercomputers for bases and research centers all over the country.

The four Cray products mentioned above more than doubled the supercomputing capacity of the Navy DOD Supercomputing Resource Center in Mississippi where the supercomputers and storage systems were installed. The Cray products will be used to generate high-resolution, coastal-ocean circulation and wave-model oceanography products for worldwide Navy and DOD operations (Cray, Inc., 2014).

## Wireless Services

Several Washington-based companies and subsidiaries receive DOD contracts for wireless services. Four notable examples are:

- New Cingular Wireless Services
- T-Mobile
- Twisted Pair Solutions
- Intermec Technologies Corporation

**New Cingular Wireless Services**, which operates as AT&T Wireless, and T-Mobile were both recipients of contracts for mobile phone services. The former provided \$245 million worth of contractual services to the DOD between 2008 and 2015. Similarly, **T-Mobile** received DOD contracts totaling \$106 million during the same timeframe (Office of Management and Budget, 2016).

**Twisted Pair Solutions** is a wholly-owned subsidiary of Motorola Solutions, and was acquired in early 2014. The Seattle-based startup was founded in 1999, and specializes in dispatch communications with desktop, mobile, and web interfaces. Its WAVE communications platform works seamlessly between land mobile radios, desktop computers, private branch exchange switchboards, and other systems, providing teams with secure and effective communication through voice, text, and data. The WAVE system operates in real time, regardless of network carrier or device. For example, WAVE allows a user of a desktop computer and another user of a landline to securely exchange messages without delay (Cook, 2014).

Twisted Pair Solutions's communication security features and standards attracted the DOD's attention before Motorola purchased Twisted Pair Solutions. Between 2008 and the beginning of 2014, Twisted Pair was the recipient of 12 DOD contracts, with a total value of about \$950,000 (Office of Management and Budget, 2016). WAVE was placed on the DOD Unified Capabilities Approved Products List (UC APL) in 2014. The UC APL is the sole approving authority of DOD communication equipment, and qualifying products must adhere to stringent security standards (Reuters, 2014). Twisted Pair was awarded its highest-value DOD contract worth almost \$14 million in mid-2015 for the widespread implementation of the WAVE platform throughout DOD operations (Office of Management and Budget, 2016).

**Intermec Technologies Corporation**, a subsidiary of Honeywell Sensing and Productivity Solutions, provides clients with custom-engineered sensors, controls, and productivity solutions built around high performance data collection hardware. Intermec's products serve clients in a variety of sectors, including aerospace, healthcare, industrial manufacturing, and retail. The firm's physical products range from wearable scanners and mobile computers to OEM scanners to customized software (Honeywell, 2016).

In fiscal year 2015, Intermec was awarded a \$1.1 million contract for handheld computers (Office of Management and Budget, 2016). The U.S. Military is one of the largest users of wireless handheld computers—DOD personnel utilize the devices to inventory equipment, record inspection and maintenance data, and manage shipments. Intermec specializes in preserving the highest levels of cybersecurity found in desktop DOD operations, and integrating the wireless handhelds into the local operations network so data can be exchanged freely throughout the system. Intermec recognizes the high level of security on Microsoft's operating systems, and utilizes Windows Mobile on its handheld devices (Intermec Technologies Corporation, 2014).

## **Navigational Systems**

Navigational technology is increasingly reliant on advanced information technology. Importantly, many of the technologies in this space have application across other DOD contractor sectors, such as maritime and aerospace.

Notable companies in this space include:

- **Kongsberg Underwater Technology**, which has a location in Lynnwood. In fiscal year 2015 the company received more than \$3.1 million in prime contracts with the DOD.
- **Edmo Distributors**, operating from its location in Spokane, sells aircraft radar equipment to the Department of Defense (Office of Management and Budget, 2016).
- **Honeywell** is a multi-national aerospace and avionics company with operations in Redmond specializing in integrated aerospace navigation, communication, and surveillance systems. The company overlays geospatial information systems (GIS), navigation, and inertial data in order to provide air traffic controllers and pilots with precise positional information. This technology also informs the pilot's on-board systems to provide weather, traffic, and terrain information, allowing for enhanced situational awareness by decreasing pilot workload (Honeywell, 2016). The company received a \$47 million DOD contract in 2015 for navigational equipment (Office of Management and Budget, 2016).

## **Electronic Security Systems**

Security systems DOD contractors include systems design and integration and suppliers. Two notable companies in this space are:

- Evergreen Fire Alarms and Security
- Absco Solutions

**Evergreen Fire Alarms and Security**, a Tacoma-based company, specializes in safety and security systems for government, commercial, and industrial entities. Evergreen provides clients with fire alarm, mass notification, intrusion detection, access control, and CCTV systems. Additionally, the firm handles the maintenance and administration services of the systems post-installation. Since its founding in 2000, the company has expanded its service reach in Alaska, Arkansas, and California in addition to its Washington operations (Evergreen Fire and Security, 2016).

Since 2008, Evergreen has been awarded \$98.1 million in primary DOD contracts as well as \$38.4 million in subcontracts (Office of Management and Budget, 2016). In 2011, the security company received prime contract designation for a five-year, \$250 million maximum value contract for physical security and base protection services in an automated control systems environment. This contract has indefinite delivery indefinite quantity designation (up to the maximum value of the contract), and Evergreen's services are available to the majority of non-DOD federal government agencies (Homeland Security Today, 2011).

**Absco Solutions** is a security system supplier located in Lynnwood. The company sells, installs, and manages access control, fire safety, security, and video surveillance systems for clients across the state. The company has provided solutions for retail businesses, colleges and universities, and government entities. The U.S. Navy, Washington State National Guard, and Border Patrol have all used Absco solutions for safety and security systems. (Absco Solutions, 2016)

## **Electronic Warfare and Cyber Security**

Long-time defense contractor **Raytheon Company**, through its facility in Keyport, WA, specializes in missile defense, command and control systems, precision weaponry, and cybersecurity related to electronic warfare. The large multinational firm performs torpedo-related support services through its facility in Keyport. This includes engineering services, as well as support for the torpedoes' advanced computer systems.

Between 2008 and 2015, the company was the recipient of DOD contracts with a total prime value of \$51.9 million, and a total sub value of \$9.1 million (Office of Management and Budget, 2016). Roughly 90% of Raytheon's revenues were generated from military contracts. The

company has a significant national presence—its 2016 Q1 net sales totaled \$5.8 billion—but it is largely barred from international market growth under EAR and ITAR. (Raytheon Company, 2016)

## **Hardware and Components**

There are a large number of contractors in Washington that provide ICT hardware and components to the Department of Defense and Coast Guard. Many of the contractors already listed also sold ICT hardware and components, including **Raytheon** and **Honeywell**. Honeywell also manufactures metal used for parts in semiconductor manufacturing. Other contractors who sold ICT hardware and components to the DOD and Coast Guard include:

- **AR Kalmus** sells RF amplifier modules and systems
- **American Power Systems**, a company that manufactures batteries for telecommunication applications
- **Astronic Advanced Electronic Systems**, a Redmond-based contractor that produces aircraft safety equipment, avionics, enhanced vision systems, and antenna systems

## **KEY INDUSTRY TRENDS AND GLOBAL CONSIDERATIONS**

Current and future global trends in the ICT industry, specifically in the subsectors where Washington has unique concentrations, will shape exporting opportunities for these firms. Industry and global considerations are discussed below.

### **Cyber Security**

While the U.S. is positioned to expand its cloud computing services to other nations, many foreign buyers have expressed concerns about data security—especially when overseas companies don't have local servers. Some governments have begun to institute requirements for cloud companies to store user data on domestic servers, which can increase costs and create inefficiencies.

In order to assuage privacy concerns and comply with data localization rules, it may benefit cloud services companies to implement regional servers near substantial overseas customer bases. The primary challenge for U.S. semiconductor companies is the lack of enforcement of intellectual property rights. Counterfeit semiconductors are prolific in several Asian nations, especially China. (International Trade Administration, 2016)

## **Global Sources of ICT Demand**

### **Cyber Security**

Worldwide spending on information security is forecasted to reach \$170 billion by 2020, increasing at a compound annual growth rate (CAGR) of 9.8% from 2015 to 2020. Major growth areas include cloud security, mobile security, threat intelligence, and security analytics. In particular, the Asia-Pacific mobile security market is forecasted to expand rapidly from 2015 to 2020, with a forecasted CAGR of nearly 43% due to increased mobile market growth combined with increased security needs. Additionally, India has grown as a market in recent years, doubling the size of its cyber security market from 2014 to 2015, increasing from \$500 million to \$1 billion. (Forbes, 2015)

The United States is currently the largest exporter of cyber security products. Israel is the second-largest exporter, and exported \$6 billion in 2014. In 2013, Israeli cyber security companies exported \$3 billion, and the increase from 2013 to 2014 surpassed Israeli defense contracting, an important landmark for the nation's security sector. (Forbes, 2015)

The global information security and cyber security sector is growing and experiencing more demand for skilled workers than it can currently meet. A 2015 white paper produced by Frost & Sullivan (2015) in partnership with Cyber 360, Booz Allen Hamilton, and NRI Secure Technologies estimated that the global information security workforce gap is widening. Sixty-two percent (62%) of the study's survey respondents reported having too few information security professionals in 2014 compared to 56% in 2013. The paper presents two key drivers of demand: new, evasive cyber threats that are increasing in sophistication and persistence; and companies' IT footprints are getting larger, which necessitates security solutions at an unprecedented scale. (Frost and Sullivan, 2016)

At the same time, the diversity of information security concerns is increasing in tandem with increased threat techniques. Companies have to consider application vulnerabilities, malware, configuration mistakes, mobile devices, traditional hacking, faulty network configuration, internal employees, cloud-based services, cyber terrorism, and trusted third parties as potential vectors for cyber-attacks. Phishing remains the top security concern, but malware, insider abuse, and hacking are all important considerations for companies that wish to protect their intellectual property. (Frost and Sullivan, 2016)

In addition to major global trends in demand for cyber security, there are also important country-specific changes that will influence cyber security needs in the coming years. China in particular has long been a focus of conversation on cyber security. Over the past several years, China has enacted several laws that tighten regulation on companies that export technological equipment and services to China. The Chinese government

says this is to protect national security, while some foreign governments denounce the laws as unfair discrimination against non-Chinese companies.

China has also enacted and proposed new laws to increase domestic information security, like the National Security Law of 2015, that outlaws threats to China's government, economy, and interests in addition to requiring increased information security. The 2015 Counterterrorism Law requires internet service providers to help government authorities decrypt data and provide technical support in terrorism cases. A new draft cybersecurity law would allow the government to cut internet access in public-security emergencies, and will require data localization and cybersecurity tests. Altogether, recently-enacted and proposed laws follow two key themes: increased attention to cyber security, and increased government control over internet access and personal data. (Wall Street Journal, 2016)

## Cloud Services

The global cloud computing market has been quickly expanding as more and more businesses worldwide adopt cloud storage solutions. Another component driving the expanded growth of cloud computing is the even faster growth of software-as-a-service (SaaS), where users access virtual applications hosted on remote servers. More widespread adoption of public cloud services in the long term is also an important force behind the market growth. Between 2013 and 2018, public cloud expenditures are predicted to grow six times as quickly as overall IT spending. A poll of more than 350 companies worldwide indicated 17 of the top 20 enterprise cloud computing services came from companies based in the United States. (International Trade Administration, 2016)

Microsoft predicts that total worldwide public information technology cloud service revenue will reach \$127 billion by 2018. It sees the U.S. as the largest market at 44% of projected revenues, but also specifically notes Japan (4% of forecasted revenue) and Canada (2% of forecasted revenue) as major markets. Microsoft also points to Western Europe as a major source of revenue for cloud services, forecasting 29% of global revenue. (Microsoft, 2015)

International Data Corporation (IDC) forecasts significant growth in the global cloud services sector: 22% compound annual growth from 2014 to 2019. This is largely driven, according to IDC, by public cloud services purchases from the manufacturing industry, which made \$8.6 billion in public cloud services expenditures in 2015, and the finance and professional services sector, which purchased \$6.6 billion in 2015. (IDC, 2016)

## Semiconductors and Semiconductor Manufacturing Equipment

The growing demand for electronic products—including everything from smart phones to network hardware to industrial electronics—is the driving force behind increasing semiconductor demand. As a result, the electronics products market is closely tied to the semiconductor market—the more established the electronics products market is in any particular nation, the more that country will be reliant on semiconductor production.

The world market for semiconductor manufacturing equipment is highly concentrated: five countries—Taiwan, South Korea, China, Japan, and the U.S.—make up 85% of the market. That being said, the markets for semiconductors and the associated manufacturing equipment are open because the majority of markets participate in the WTO Information Technology Agreement, which stipulates that semiconductor products enter the market with duty-free status. (International Trade Administration, 2016)

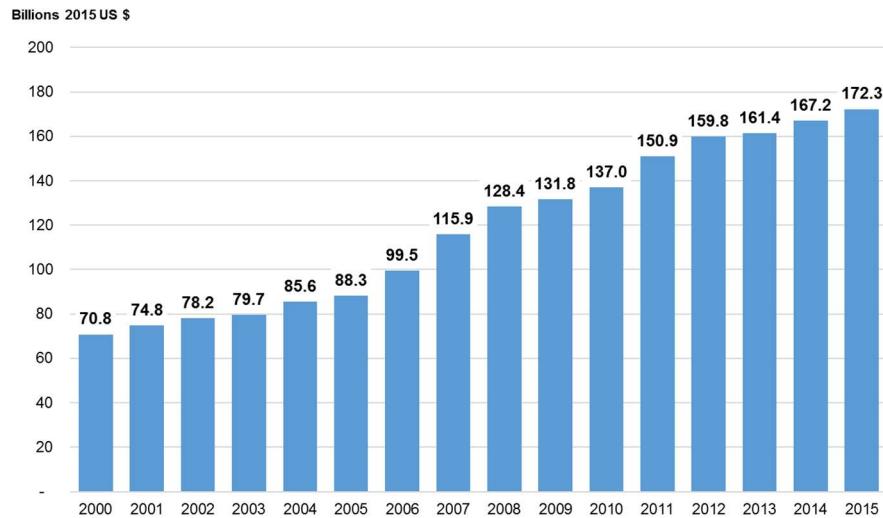
Both the aerospace and ICT sectors play a role in the semiconductor market. Advanced aerospace technologies rely heavily on semiconductor production, and there is the opportunity for crossover between defense-related aerospace ICT, and civilian semiconductor applications. (International Trade Administration, 2016)

## Current U.S. and Washington Export Markets

Current U.S. and Washington ICT market trends provide an important guidepost for assessing where future opportunities may exist for ICT defense contractors in Washington. Markets are reviewed for ICT goods and services, and for current U.S. and Washington

ICT exports can be divided between goods (products) exports and services exports. Goods exports are tracked through U.S. Customs. However, unlike other industry sectors, ICT sales are often in the form of services, such as through licensing revenue generated from software and intellectual property. ICT sales, in the form of hardware, circuit boards, gaming consoles, semiconductors, and other products, thus represent only one component of total ICT sales. Due to the nature of services, they are not easily traceable and reported to the same level of goods. According to the World Bank, in 2015 the U.S. exported \$172.3 billion in ICT services. Adjusted for inflation, U.S. global exports in ICT services have grown 6.1% per year since 2000. (**Exhibit 4**)

**Exhibit 4. U.S. Estimated ICT Services Exports, 2000-2015,  
Billions of 2015 Dollars**



Sources: World Bank Worked Development Indicators, 2016; Federal Reserve Bank of St. Louis, 2016; Community Attributes Inc., 2016.

Based on data from the U.S. Bureau of Economic Analysis, in 2014 the largest U.S. markets for ICT services were the United Kingdom, Brazil, and Canada (**Exhibit 5**).

**Exhibit 5. Top U.S. Markets for Telecommunications,  
Computer, and Information Services**

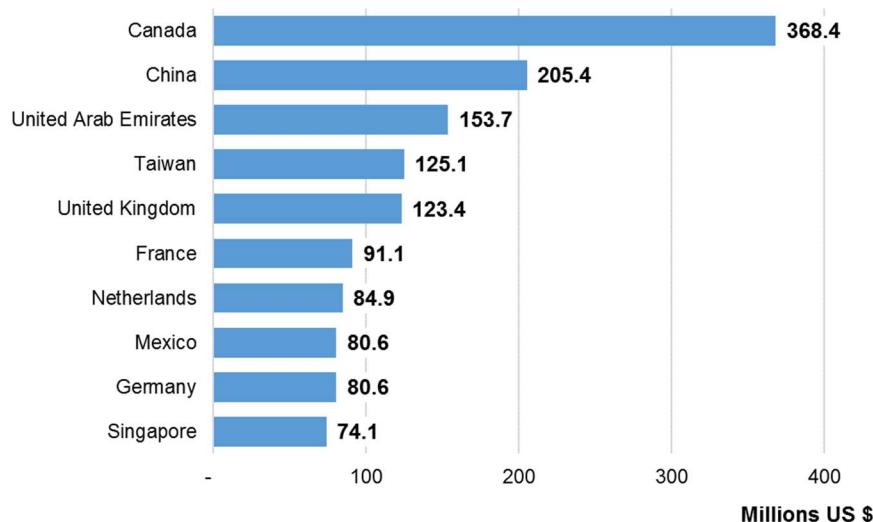
Exports, 2014	
Country	(mils \$)
United Kingdom	4,862
Brazil	4,617
Canada	3,113
Japan	1,567
Switzerland	1,399
Germany	1,308
Argentina	1,286
Australia	1,224
Ireland	1,076
India	1,033

Sources: U.S. Bureau of Economic Analysis, 2016; Community Attributes Inc., 2016.

The export of ICT products can serve as a useful, indirect indicator of overseas demand for all ICT products at the state level. With this in mind,

**Exhibit 6** illustrates the top markets for ICT goods from Washington state in 2015.<sup>1</sup>

### **Exhibit 6. Top Washington State ICT Products Markets, 2015, Millions of Dollars**



Sources: U.S. Census Bureau, 2016; Community Attributes Inc., 2016.

Washington's top ICT export markets reflect broader export trends for the state, with Canada and China as the top two markets. The largest export product category in 2015 was for automatic data processing and magnetic readers (\$348.8 million in sales). Sales of electronic security systems, also a category of ICT defense contracting in Washington, totaled \$2.8 million.

The markets indicate where potential overseas sales opportunities exist for ICT defense contractors.

### **Trans-Pacific Partnership**

While its passage in the U.S. remains incomplete, the Trans-Pacific Partnership (TPP) offers opportunities for market expansion and penetration for many U.S.-based ICT businesses, especially for Washington state firms in cloud computing and software licensing.

According to the U.S. Trade Representative, ensuring a free and open internet and the continued growth of the digital economy are key to the TPP. The U.S. Trade Representative highlights 24 core areas within the TPP that specifically benefit the digital economy; these include rules

<sup>1</sup> The harmonized systems codes selected for inclusion to approximate ICT goods were based on an ICT HS code list published by the United Nations Conference on Trade and Development (2015).

prohibiting customs duties on digital products, strengthening efforts to combat trade secret theft, and enabling cross-border data flows.  
(Washington Council on International Trade, 2016)

Washington software and cloud and computing firms are well positioned to benefit from these new rules, pending final passage of the TPP in the U.S. In 2015, Washington exported an estimated \$2.1 billion in software to TPP member countries (Washington Council on International Trade, 2016).

## ICT in Washington

The majority of ICT activities in Washington are centralized in the Greater Seattle area, represented by King, Kitsap, Pierce, and Snohomish Counties. Microsoft has functioned as the anchor tenant for the regional ICT industry for nearly 40 years. The company employs more than 100,000 people worldwide, with 43,000 workers based in the Puget Sound region (Microsoft, 2016). Many former Microsoft employees have founded successful companies of their own. Well-known firms—including Expedia, Zillow, Valve, RealNetworks, F5, and Index—were all founded by former Microsoft employees (Seattle Trade Alliance, 2015).

Amazon, headquartered in Seattle, is the world's largest online retailer as well as a pioneer of the global cloud computing industry. In 2015, the company disclosed that its Washington workforce was greater than 24,000 employees, which included its global headquarters in Seattle and its warehouse fulfillment centers across the state (Forshee, 2015). Net sales increased 20% to \$89 billion by the end of 2014, compared to \$74.5 billion in 2013 (Amazon, 2015).

Technology transfer is a vital driver of startup talent in Washington. The University of Washington boasts the top rank in national licenses signed for a university, and doubled its annual patent applications in 2013. UW's business incubator, the New Ventures Facility, helped launch 15 ICT startups between 2001 and 2012. (Washington Technology Industry Association, 2015)

Washington's ICT sector is also a global cluster. ICT employment in the greater Seattle area totaled 238,900 workers in 2013, including ICT companies and ICT employees at non-ICT firms. In 2014, some of the greater Seattle region's top exports were ICT goods. This includes electronic instruments (\$829.5 million), semiconductor and electronic components (\$223.0 million), computer and peripheral equipment (\$194.1 million), and communications equipment (\$189.9 millions).

In addition, several of the area's other top exports make extensive use of ICT components, including aerospace and motor vehicles. In 2013, Washington's ICT companies employed 162,900 people throughout the

region, along with an additional 13,700 sole-proprietors and independent contractors. ICT workers in non-ICT companies make up another significant portion of ICT employment, totaling 62,300 workers in 2013. For example, network engineers employed at an accounting firm would count as ICT employment under this definition even though they work in the financial services industry. (Trade Development Alliance of Greater Seattle, 2016; Washington Technology Industry Association, 2015)

## **EXPORTING AND COMPETITIVENESS FACTORS**

### **Defense Contractor Information Security**

All software and hardware utilized by federal government agencies must meet or exceed Federal Information Processing Standards (FIPS), which are outlined by the National Institute of Standards and Technology (NIST). FIPS is a joint set of standards upheld by the U.S. and Canadian governments; European, Latin American, and Asian governments also have similar adherences. As a result, companies manufacturing products with intended use in these countries must acquire FIPS validation if their products process sensitive, cryptographic information (National Institute of Standards and Technology, 2016).

For classified data requiring the highest level of protection, FIPS mandates more extensive encryption algorithms that provide more security than standard code that enciphers and deciphers information. In general, the more encryption required, the more export restrictions applied to a product or service (National Institute of Standards and Technology, 2015).

### **Export Controls**

ICT defense exports are often subject to export controls. These regulations on the overseas sales of ICT products and services help shape potential markets for Washington ICT defense contractors. Details on the rules and specific implications for ICT defense firms are discussed below.

### **International Traffic in Arms Regulations**

The International Traffic in Arms Regulations (ITAR) control the import and export of defense articles and defense services. The U.S. Munitions List (USML) is a list of defense articles and services controlled under ITAR. The USML is divided into 21 categories. USML Category XI (Military Electronics) and USML Category XIII (Materials and Miscellaneous Articles) are the most relevant to the ICT industry. For example, programmable logic devices programmed for defense articles may fall under USML Category XI and intelligence cryptographic software may fall under USML Category XIII.

ITAR has strict licensing requirements and exports of defense articles and defense services to most all countries and in most all circumstances

require an export license from the U.S. State Department's Directorate of Defense Trade Controls (DDTC). Certain articles and services may, however, be exported to Australia, Canada, and the United Kingdom, without DDTC licensing if certain requirements are met. Nevertheless, Washington defense contractors must carefully review ITAR's licensing requirements and exceptions to avoid inadvertently violating ITAR.

Through the Obama Administration's export control reform effort (ECR), the USML has undergone major revisions that have greatly reduced the number of products that fall under ITAR controls. As a result, Washington's ICT industry may see new market opportunities available because DDTC licensing may no longer be required for certain items that previously were under ITAR controls.

Although certain systems and major components have been removed from ITAR controls, the products affected generally have been parts, components, attachments and accessories that were only nominally adapted for military use and that have both military and civilian uses, so called "dual-use items." For example, certain helicopters, small craft, and electronic components that were previously considered ITAR-controlled but that can be used for either civilian or military purposes have shifted from the USML to the Commerce Control List (CCL) of the Export Administration Regulations (EAR).

## **Export Administration Regulations**

The U.S. Commerce Department's Bureau of Industry and Security (BIS) administers and enforces EAR. ICT companies must consider compliance with EAR when providing non-military use products or technology to customers outside of the United States.

The CCL is divided into ten categories. CCL Category 3 (Electronics Design Development and Production), CCL Category 4 (Computers), and CCL Category 5 (Telecommunications and Information Security) are the most relevant to the ICT industry. For example, certain microprocessors may fall under CCL Category 3, certain super computers may fall under CCL Category 4, and a cryptography system employing a symmetric algorithm employing a key length in excess of 56-bits may fall under CCL Category 5. In some cases, a product for export including all of these items may be subject to the licensing requirements under each of the categories.

A special consideration for the ICT industry is that EAR controls software and algorithms in addition to physical products. A key determinant for the application of EAR in regards to software is the presence of data encryption. EAR excludes publicly available software and open code, but includes most software with any level of data encryption

capabilities, even if the majority of software operations are not encrypted (International Trade Association, 2015).

The National Institute of Standards and Technology partnered with the DOD, Intelligence Community, and Committee on National Security Systems in 2009 to begin a three-year effort to create a unified information security system for the entirety of the federal government. This replaced the DOD Information Assurance Certification and Accreditation Process that ensured individual contract companies applied risk management tactics to their information systems (International Trade Association, 2015).

## **Defining Software in ITAR and EAR**

Software has very broad definitions under both EAR and ITAR. The former defines it as “a collection of programs...and a sequence of instructions to carry out a process in, or convertible into, a form executable by an electronic computer.” The latter defines software “to include, but not limited to, the system functional design, logic flow, algorithms, application programs, operating systems and support software for design, implementation, test, operation, diagnosis, and repair.”

All intellectual property including software, is subject to ITAR when activities are defense-related. Information that is deemed freely available, however, is not regulated. ITAR-controlled software includes the following four categories:

1. Military information and security systems and equipment, including cryptographic devices, software, and components designed and modified for that purpose.
2. Instrumentation and navigation systems, equipment, and software.
3. Range instrumentation radars and associated optical/infrared trackers and software.
4. Software that records and processes flight data, enabling determination of vehicle position during its flight plan (National Defense Magazine, 2015).

Unlike ITAR, which requires DDTC licensing for nearly all exports, a potential ICT industry exporter with items controlled on the CCL first would review the CCL to determine the precise Export Control Classification Number (ECCN) that controls the item for export. It is important to note that EAR controls products, design/testing/production equipment, materials, software and technology. Accordingly, the email of detailed blueprints controlled under a specific ECCN might require an export license from the BIS just as an export of the end-item produced using those blueprints.

Many items previously listed on the USML that are now listed on the CCL are assigned ECCNs in the 600 series (e.g., printed circuit boards

originally designed for a military purpose are now covered under ECCN 3A611.g). Items in the ECCN 600 series are generally subject to a policy of denial by the BIS for export to China, Cuba, Iran, North Korea, Sudan, and Syria.

Each ECCN includes a list of the reasons for control. Once the exporter has located the ECCN and the reasons for control, the exporter can then refer to EAR's Commerce Country Chart (Country Chart). The Country Chart provides rows listing all countries of the world and columns listing the various reasons for control. By reviewing the reasons for control and the country, an exporter can determine if a BIS export license is needed. If the reason for control column includes an "X" next to a country, then the exporter must apply to the BIS for an export license to export the item to that particular country unless a license exception is applicable. Each ECCN includes information on special license requirements and any licensing exceptions that apply. When an export license is required, the exporter can apply using the BIS's online system known as "SNAP-R."

A detailed example of an export compliance review can be found in the **Appendix**.

## MARKET OPPORTUNITIES

Finding international market opportunities for Washington's ICT defense contractors involves understanding key global trends, sources of demand, and the core competencies of Washington's ICT defense contractors. Market research reports, news articles, and stakeholder feedback were leveraged to identify specific opportunities.

### Specific Markets

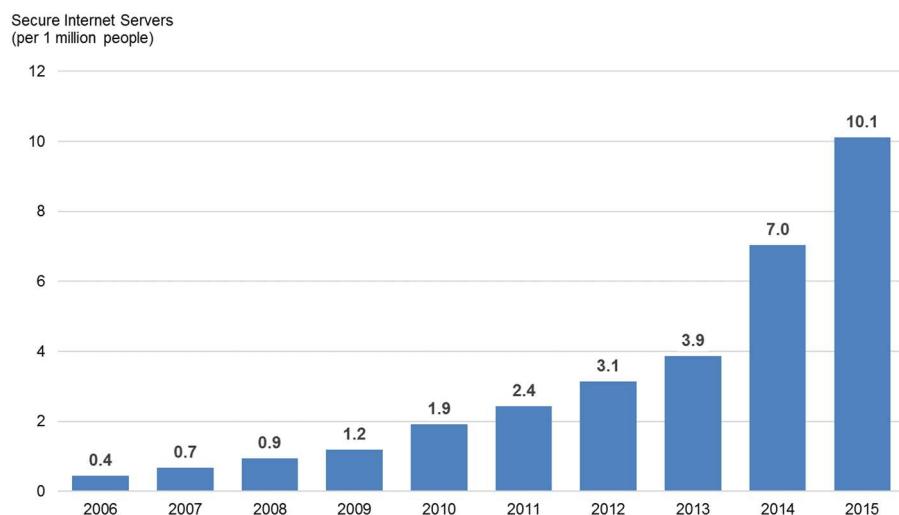
#### China

##### Market Overview

In 2015, Washington exported \$19.5 billion to China, making it one of the state's largest trading partners. The state's software exports to China exceeded \$251 million in 2015, roughly 2% of Washington's total software exports (Washington Trade Development Alliance, 2016; Washington Council on International Trade, 2015). Despite the possible onset of an economic slowdown and local government debt concerns, China's growing middle class poses a potential export market, but the opportunity is tempered by several market barriers.

Based on data published by the World Bank (2016), China's broadband user rate increased 86.9% between 2009 and 2014, reaching 14.4 users per 100 people. Over the same time period, the number of secured internet servers per 1 million people increased more than 7.5 times. (**Exhibit 7**).

### **Exhibit 7. Secure Internet Servers per 1 Million People, China, 2006-2015**



Sources: World Bank, 2016; Community Attributes Inc., 2016.

By 2014 (latest data available), China had already emerged as the U.S.'s 16<sup>th</sup> largest market for ICT services; 2014 also saw 23.9% year-over-year growth in U.S. ICT services exports to China. Washington state ICT goods exported to China reached \$205.4 million in 2015, making it Washington's second largest ICT products overseas market, behind only Canada.

#### Market Barriers

Lack of effective or enforced intellectual property protection can be a major hurdle for software exporters of any kind, including cloud services providers. Cloud computing, software, and semiconductor exporters all face regulatory barriers to market entry in China. (International Trade Administration, 2016).

Effectively doing business in China can also require a relatively large base of cultural knowledge; speaking Chinese and understanding how to navigate the country's business culture are often essential to a successful export arrangement. (International Trade Administration, 2016)

Another barrier to deploying software and cloud services to China are the limitations of infrastructure. While the country is currently undergoing wide scale LTE deployment and other major infrastructure upgrades, broadband access remains relatively low. The country's internet-filtering systems further limit download speeds. Together, these may limit the market for software and cloud services. The World Economic Forum ranked China at 92 out of 143 countries for information technology

infrastructure. (International Trade Administration, 2016; World Economic Forum, 2016)

China has a strong and growing ICT sector. The nation is home to major ICT companies like Alibaba, Tencent, Huawei, and Baidu. These companies are hold market-leading positions in China, and are expanding around the world, potentially challenging future growth in the ICT sector for Washington state firms.

Alibaba is China's fastest-growing e-commerce company, and is expanding into overseas markets. In recent years, the company has expanded to Brazil, Russia, and recently acquired Lazada, a Singapore-based online retailer that also operates in Malaysia, the Philippines, Thailand, and Vietnam, for \$1 billion. The company's annual revenue in 2015 was around \$16 billion, and the company's market cap was \$196 billion. However, the presence of established ICT companies like Alibaba does not preclude collaboration or cooperation. In 2015, Amazon opened a webstore for verified companies on Alibaba's Tmall platform. The website hosts products from Nike and Apple, for example, and ensures Chinese buyers are purchasing authentic products. (Bloomberg Technology, 2016; CNN, 2016; Fortune, 2015)

Tencent is a company focused on mobile gaming, instant messaging, and online services like search engines, online advertising services, and e-commerce. It is similar in size to Alibaba, with a market cap totaling \$194 billion and \$16 billion in annual revenue. Tencent operates around the globe, but the company's major markets are in China, the United States, and Europe. (CNN, 2016; Bloomberg, 2016)

Baidu is China's top internet search company. The site gets more page views than any other website in the county, and the company has already expanded into foreign markets, including Brazil. Baidu logged 663 million monthly active users for mobile search—one of the company's core areas—in March 2016. Baidu also offers enterprise search, news, MP3, and image searches, as well as voice assistance, data storage, and maps. (CNN, 2016; Bloomberg, 2016)

Huawei, the Chinese technology manufacturing company, has an estimated annual revenue of \$61 billion. The company's mobile phones, tablets, and computers are a major part of its business, but it also manufactures components used extensively in other companies' products. Huawei has offices in 100 countries and is a major global exporter. (CNN, 2016; Huawei, 2016)

### Market Assessment

China is a very attractive market for companies that can provide cloud services. Microsoft, Washington's largest ICT company and a major

defense contractor, has already partnered with 21Vianet, a Chinese company, to offer Azure cloud services to the public in China (International Trade Administration, 2016). Azure is a cloud computing platform that allows programmers to build, deploy, and manage applications through Microsoft's global network of data centers (Microsoft, 2016). Amazon Web Services has also recently expanded to China, offering its cloud services the Chinese market. Amazon Web Services provides computing power, database storage, content delivery, and other services through its cloud platform. Cultural and regulatory barriers may prove difficult for small businesses to overcome, but large players have already proven able to penetrate the Chinese market.

## **Germany**

### Market Overview

In 2014, Germany was the U.S.'s sixth-largest export market for ICT services, with more than \$1.3 billion in sales there (U.S. Bureau of Economic Analysis, 2016). The U.S. sold \$3.4 billion in ICT goods in 2015, while Washington state sold \$80.6 million in ICT products—making Germany Washington's 9<sup>th</sup> largest ICT products market (U.S. Census Bureau, 2016).

### Market Barriers

Very few barriers exist for Washington companies that wish to export to Germany. The chief barriers are regulatory complexity, which presents a de facto barrier, and differences between business cultures. Neither of these are insurmountable barriers, however. At the same time, Germany is known for stringent safety and environmental standards. Products that are not up to German safety and environmental standards will not be able to be sold in the country. For potential exporters, altering an existing product line to comply in the German market may be as simple as changing the safety warnings and labels, or as complex as structural changes to the product itself. (International Trade Administration, 2016)

### Market Assessment

Overall, Germany represents a valuable potential market for semiconductors, a subset of ICT products. Very few Washington defense contractors have expertise in this space, and most are wholesalers or parts suppliers. However, the relatively low market barriers presented by Germany make it an attractive market, and one that should not be ignored.

There are also opportunities for information security defense contractors to implement new solutions in the German market. With relatively low market barriers and a recent uptick in demand, the market is a valuable opportunity.

## **Japan**

### Market Overview

Japan is the third-largest economy in the world and an important contributor to the global ICT industry. The nation is the fourth-largest importer of U.S. goods, after Canada, Mexico, and China; the U.S. and Japan already have strong trade links, especially for ICT products. (International Trade Administration, 2016)

### Market Barriers

Barriers to consider include the country's business culture—which can be difficult for foreigners to successfully navigate—and the need for Japanese certifications and labeling requirements. In general, Japan has very low tariffs on imported goods. (International Trade Administration, 2016)

### Market Assessment

With relatively low market barriers and significant opportunities for ICT hardware and components manufacturers and cloud services providers, Japan is a valuable potential market.

## **Australia**

### Market Overview

Australia's open market features limited import restrictions, and the country is an active member of the World Trade Organization, APEC, G20, and other free trade forums. Australia entered into a free trade agreement with China in 2015, expanding its network of bilateral free trade agreements. Notable agreements include those made with ASEAN, New Zealand, Chile, Japan, the Republic of Korea, and the U.S. Australia's GDP has grown between 2.4% and 2.5% for the past three years, and it has a labor force of 12.5 million. (CIA, 2016)

### Market Barriers

Australian economic growth is forecasted to slow in the coming years, with 2.9% anticipated growth between 2016 and 2019. The country's unemployment rate currently at 5.8%. While it has been decreasing in recent years, is still above pre-recession levels. In addition to a slowing economy, Australia has a strong local vendor ecosystem that foreign companies will have to compete with in order to export. (International Trade Administration, 2016)

## **India**

### Market Overview

With 1.3 billion people, India is the second-most populous nation in the world. In 2015, India's GDP totaled \$2.2 trillion, growing 7.3% from

2014. The country's economy is driven by a large agriculture sector (16.1% contribution to GDP), industrial sector (29.5% contribution to GDP), and a growing services sector (54.4% contribution to GDP). (CIA, 2016; World Bank, 2016)

#### Market Barriers

A challenge to consider when assessing the Indian market is the country's internet infrastructure. India has bandwidth constraints, power outages, and low broadband access. The World Economic Forum has ranked India 113 out of 142 countries for availability of international internet bandwidth. The Indian government is aware of these challenges, however, and has begun to address them. Additionally, the Indian regulatory environment for cloud services remains somewhat ambiguous. The country does not have a formal data breach notification law, but at the same time, the country does not have tariffs on software downloads. Doing business with the Indian government is also reportedly difficult. Some businesses will also require that their data be stored domestically, which can be a barrier for cloud services. This is especially common in the financial services and telecommunications sectors. (International Trade Administration, 2016)

## **Poland**

#### Market Opportunities

The aviation industry, and specifically the avionics subsector, is growing in Poland. In 2012, two new regional airports opened in the country. 25.2 million passengers passed through Polish airports in 2013, and that figure is expected to grow 5.5% per year through 2020. Growth in regional airport travel is anticipated because airlines with cheaper flights operate within these smaller airports. Additionally, it is anticipated that Poland's national airline, LOT, will be privatized in the future. It is expected that this will lead to significant updates to the LOT fleet, including the introduction of more advanced GPS and navigational equipment. At present, Polish aerospace manufacturers do not have expertise in the production of avionic navigational technology. This represents an opportunity for Washington defense contractors with expertise in avionics and navigational products. (International Trade Administration, 2016)

## **Major Markets by Subsector**

### **Cloud Services**

#### China

A key Chinese market opportunity is for cloud computing. Private sector evaluations of China's cloud computing market performed by Bain & Company estimated it at \$1.5 billion in 2013, but forecast growth to \$20 billion by 2020 (Bain & Company, 2015). The Chinese government recognizes the importance of cloud computing, and discussed it as a

strategic priority in its most recent five-year plan, which runs from 2016 to 2020 (International Trade Administration, 2016).

Additionally, there may be an opportunity for Washington cloud service providers to offer data storage services in the U.S. This can provide redundancy, making clients' systems more robust.

Key export partners in China for cloud services include small and medium enterprises and some large companies. Large companies, however, may be more likely to have already adopted certain cloud services than their smaller counterparts. (International Trade Administration, 2016)

### Japan

The Japanese market presents a valuable opportunity for Washington's ICT defense contractors, especially cloud services providers. Japan is ranked second for cloud services globally, according to the U.S. Department of Commerce's Top Market Report on cloud computing. The Japanese government has strong intellectual property and cybercrime laws, is committed to universal broadband access, and is a major investor in ICT infrastructure. The World Economic Forum ranked Japan 17 out of 143 countries for its information technology infrastructure in 2015. (World Economic Forum, 2016; International Trade Administration, 2016)

Five of the top six cloud service vendors in Japan are U.S. companies: Amazon Web Services, Google, IBM, Microsoft, and Salesforce. Two of these companies, Amazon Web Services and Microsoft, are also Washington defense contractors. While Washington defense contractors are already actively engaged in the Japanese cloud services market, there is still room for growth: by 2018, IT consulting and analysis firm Gartner predicts that the Asia Pacific and Japan will account for \$11.5 billion in cloud services spending, largely driven by growth in Japan. (International Trade Administration, 2016; Office of Management and Budget, 2016)

### India

Forecasts of cloud services in India are optimistic, anticipating growth in conjunction with several key information technology indicators. In particular, increased internet access, e-commerce, and mobile device usage is expected to foster growing demand for cloud services in India. (International Trade Administration, 2016)

### Australia

Australia has strong IP protection, a trade-friendly regulatory environment, infrastructure that is primed for cloud services, and significant broadband coverage. The Australian government is reportedly targeting 93% broadband coverage by 2021. Currently, the broadband coverage rate is slightly lower than 90%. Market surveys indicate that the

country has significant opportunities for cloud services. State and federal government and private companies are potential trade partners in Australia. (International Trade Administration, 2016)

## ICT Products

### Japan

The Japanese market already imports a large amount of ICT goods: of the nation's top 10 imports by value in 2015, four were for ICT goods. In 2015, Japan imported \$24.7 billion worth of semiconductors, telephones and communications equipment worth \$24.2 billion, and computers worth \$16.3 billion, and audiovisual apparatus worth \$10.0 billion. Many other categories, such as aircraft, medical products, motor vehicles, power generating machines, and scientific and optical instruments, also make intensive use of ICT products and components.

These goods represent opportunities for new exporters to capitalize on an existing, proven market. In particular, ICT hardware and component manufacturers who contract with the Department of Defense and Coast Guard may be well suited to exploring the Japanese market either by exporting their products directly to Japan or by connecting to an existing ICT supply chain. This could involve partnering with existing exporters or producing peripheral or replacement products for the targeted export category. For example, an ICT company that produces processing units for automated external defibrillators could leverage that skill base to sell replacement processing units or leads in the Japanese market. (**Exhibit 8**)

**Exhibit 8. Top Ten Imports by Value, Japan, Billions of Dollars**

Category	2015 Imports (Billions)
Semiconductors	\$24.7
Telephones and Communication	\$24.2
Medical Products	\$24.1
Computers	\$16.3
Scientific and Optical Instruments	\$13.8
Audiovisual Apparatus	\$10.0
Motor Vehicles	\$9.4
Power Generating Machines	\$9.3
Motor Vehicle Parts	\$7.3
Aircraft	\$6.1

Source: Japanese Ministry of Finance, 2016.

### China

The semiconductor market in China offers viable entry points for foreign exporters. As much as 90% of the country's semiconductor demand is met by foreign exporters. China still lacks the necessary technology to

produce equipment for advanced manufacturing, resulting in a reliance on imports to construct foundries as well as assemble and test systems. In 2015, Washington state exported \$20.4 million in semiconductor devices to China, representing a 56.5% year-over-year increase and nearly 500% nominal sales increase since 2012 (U.S. Census Bureau, 2016).

China is largely dependent on imported high-end software products—local software products comprise less than 30% of the market. U.S. companies currently hold strong positions in the Chinese firmware, gaming, automation, digital imaging, storage, and security software subsectors. China accounts for half of the world market for semiconductors—domestic semiconductor production in China only supplies 9% of the country's consumption. (International Trade Administration, 2016)

### Germany

Germany is the fourth-largest manufacturer of electronics products in the world, and the sixth-largest export market for U.S. semiconductor manufacturing equipment. The European semiconductor market continues to decline as the EU prioritizes other subsectors. As a result, Germany will increase its reliance on foreign markets in the long term.

In 2013, Germany imported \$18.1 billion worth of semiconductors, with the U.S. share reaching \$2.3 billion. These values are distorted, however, because many U.S. companies design and manufacture their semiconductors domestically, but export them to third party countries for final assembly and packaging. Therefore, the U.S. share of the Germany semiconductor market is actually much higher, with significant room for growth. (International Trade Administration, 2016)

## Cyber Security

### Germany

In 2015, the German government passed a new law, the IT Security Act (ITSG). The law requires new information security measures be taken for companies that operate critical infrastructure in the energy, IT, telecommunications, transportation, health care, water, food, finance, and insurance sectors. As a result, the country is experiencing increased demand for IT security measures.

Washington defense contractors with significant experience producing software with high information security needs, such as Microsoft and Amazon, can leverage their experience in the German market. The World Economic Forum ranked Germany 13 out of 143 countries for its information technology infrastructure. (International Trade Administration, 2016; World Economic Forum, 2016)

## **ICT Services**

### India

Previously, the Indian market for ICT services was largely dominated by the demand for hardware. In 2012, 72% of U.S. ICT exports to India were hardware-related. Recently, the market for ICT services has grown. U.S. computer and data processing services exports increased by 138% in 2012; database and information services exports increased by 111% in the same year. Between 2006 and 2012, the value of Washington exports to India grew by \$58.7 million, with room for continued expansion.

(Technology CEO Council, 2014)

## **RECOMMENDATIONS AND ACTION STEPS**

### **Industry-wide Strategies**

- **Expand the Washington Military & Defense Economic Impact Tool to include current information on ICT defense trends.** The WMA can be broadened to serve the information gathering needs of ICT defense contractors in Washington by providing regular newsfeeds and content published on the site as well as sent via SMS and email to registered subscribers.
- **Consider hiring a position to focus on technical outreach in the defense market.** This position would act as an ombudsperson for ICT (and other targeted sectors) by liaising with technical contacts at DOD and related agencies, and connecting companies to the right resources and contacts.
- **Disseminate information.** Build out and update an ICT sector section of the Commerce website with information and data on target markets, regulations, financing information, trends, and contact information for the sector lead. A shared knowledge database for information and communication technology defense contractors can also include basic information on exporting, logistics, shipping, customs and more.

### **Market and Sector Specific Strategies**

- **Investigate bringing a delegation to one of Singapore's cybersecurity trade shows.** These trade shows, with the assistance and facilitation of Commerce, can act as an entrée to the Asia Pacific market. Here are three possible trade shows in Singapore:
  - Cyber Security Trade Show
  - Black Hat Asia
  - RSA Asia

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## APPENDIX

### Methodology for Developing Recommendations

The table below delineates key considerations that help shape development of strategy development for the information and communication technology sector.

#### Exhibit A-1. Framework for Developing Strategies for Supporting ICT Defense Contractors

Strategic Considerations	Description	Examples
Firm characteristics	<ul style="list-style-type: none"><li>• Firm size</li><li>• Experience exporting</li></ul>	<ul style="list-style-type: none"><li>• Small firm vs. large firm economies of scale</li><li>• Ability and/or desire to export</li><li>• Resources to invest in exporting effort</li></ul>
Domestic conditions	<ul style="list-style-type: none"><li>• Health of U.S. economy</li><li>• Regulatory issues</li><li>• U.S. government programs supporting exporting</li></ul>	<ul style="list-style-type: none"><li>• Strength of U.S. market versus overseas opportunities</li><li>• ITAR, EAR, FCPA, compliance challenges and access to necessary information</li><li>• U.S. Foreign Military Sales Program and U.S. foreign military aid (e.g., Egypt, Israel)</li><li>• Excess Defense Articles program</li><li>• ITAR exemption status among certain allies, including Australia</li></ul>
Foreign market/government conditions	<ul style="list-style-type: none"><li>• State policies supporting local industries</li><li>• Weak/limited IPR enforcement</li><li>• Cultural barriers</li></ul>	<ul style="list-style-type: none"><li>• Taiwan's recent plan to support more domestic production of maritime vessels</li><li>• China's weak record on IPR protection</li><li>• Offset requirements</li><li>• Relationship building</li><li>• Finding overseas distributors</li><li>• Foreign governments often demand for same hardware as U.S. military.</li></ul>
Firm characteristics	<ul style="list-style-type: none"><li>• Firm size</li><li>• Experience exporting</li></ul>	<ul style="list-style-type: none"><li>• Small firm vs. large firm economies of scale</li><li>• Ability and/or desire to export</li><li>• Resources to invest in exporting effort</li></ul>
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## **A-2. Categories of Assistance and Support from the Washington State Department of Commerce**

Type of Assistance	Examples
Education and Training	<ul style="list-style-type: none"><li>• Seminars on exporting opportunities, how to find market opportunities</li><li>• Seminars on legal and trade barriers and issues</li></ul> <ul style="list-style-type: none"><li>• Trade delegations to learn about new markets, including trips to DC to meet with embassy officials.</li><li>• Add info and links to existing website on resources</li></ul>
Technical and Legal Assistance	<ul style="list-style-type: none"><li>• Proper paperwork</li><li>• Export finance</li><li>• Export control compliance</li></ul>
Market Research	<ul style="list-style-type: none"><li>• Identifying overseas opportunities (defense and civilian)</li><li>• Finding distributors and/or overseas representatives</li><li>• Helping develop connections with the Foreign Military Sales program</li></ul>
Advocacy	<ul style="list-style-type: none"><li>• Helping firms dealing with trade disputes and IPR infringement cases and other barriers</li><li>• Commerce as a first point of contact for defense contractors</li></ul>

## **ICT Defense Contractors**

Washington's ICT defense contractors engage in a wide range of activities. **Exhibit A-3** below outlines the major activities identified among ICT contractors in Washington along with the value of contracts awarded to Washington companies in fiscal year 2015. These categories are not exclusive, and certain contracts can span more than one category. For example, the installation of navigational equipment would cover the first category, ICT Maintenance, Repair, Installation, and Modification as well as Navigational, Mapping, and Imaging Equipment and Instruments.

### **Exhibit A-3. Defense ICT Contracts Awarded to Washington State Firms, Value and Number of Contracts by Subsector**

<b>Category</b>	<b>2015</b>
ICT Maintenance, Repair, Installation, and Modification	\$198,380,197
IT and Telecom	\$110,318,602
Automatic Data Processing Software and Services	\$104,032,146
Telephone, Radio, Intercom, and other Electronic Equipment	\$35,611,769
Hardware and Components	\$7,000,255
Weapon and Military Product Components	\$5,658,933
Electronic Safety Systems	\$4,112,219
Navigational, Mapping, and Imaging Equipment and Instruments	\$1,496,311
ICT Training	\$601,290
Office Supplies and Information Systems	\$219,588
Service and Trade Equipment	\$43,104
Research and Development	\$3,500

Source: Office of Management and Budget, 2016.

## **Export Assessment**

In 2012, Washington's ICT exports had a combined value of \$16.4 billion, representing a 10% CAGR between 2006 and 2012. This translated to \$113,500 in export value per ICT worker (Community Attributes Inc., 2015). Washington's unique combination of top-ranking export volume and export growth rate tells a compelling story about the state's ICT cluster: while California and Texas—the top two ICT exporters at \$62B and \$47.9B, respectively—far outstrip Washington in terms of ICT export value, they have very low export growth rates; Washington may be a distant third, but it is rapidly gaining ground (Technology CEO Council, 2014).

Washington's software publishing industry generated an estimated \$12.5 billion in overseas exports in 2014, almost 56% of statewide services exports. Software exports also accounted for roughly 70% of all Washington ICT exports. In the same year, Washington wireless telecommunications carriers exported \$370 million of services, and computer systems design and related services generated \$289.1 million in services exports (Technology CEO Council, 2014).

## **Current Defense Exporting Activities**

### **Cloud Services and Software**

**Microsoft** has more than 120 office locations worldwide, housing more than 75,000 employees. The company's host of software and cloud computing capabilities are widely utilized in international markets. The majority of its products are available for consumption by all nations with supporting infrastructure that aren't subject to U.S. government restrictions (e.g. Iran, North Korea, Sudan, Syria). Microsoft products

with encryption are marketed and distributed in every country, except the restricted nations mentioned above. Several countries have laws against the use of encryption, but it is generally accepted practice that these laws are not enforced on mass market software and services, such as those offered by Microsoft (Microsoft, 2016).

**Plateau Software** has a strong national presence with two coastal offices—its headquarters in Seattle and its DC-area location. Plateau's clients include the Center for Disease Control, the National Oceanic and Atmospheric Association, and the Joint Munitions Command, among others (Plateau Software, 2016). Its environmental solutions software can be used by both commercial and federal agencies, but it's limited to domestic application. All of Plateau's programmed limits for pollution, waste disposal, energy conservation, and sustainability are adherent to domestic environmental laws. Different nations have completely separate sets of environmental standards, which prohibits export of Plateau's software.

## Supercomputers

**Cray** has a strong international presence with 23 global offices in Australia, Asia, Europe, and North Africa. The company is widely regarded as an expert in the fields of computing, storage, and analytics. One client is Petroleum Geo-Services, a Norwegian marine geophysical company that provides the oil and gas industry with imaging, interpretation, and field evaluation of prospective extraction sites. Petroleum Geo-Services uses Cray's supercomputers and associated data storage to map the earth's subsurface in order to safely identify hydrocarbon sources more efficiently for its customers.

The Korea Meteorological Administration (KMA) also partnered with Cray to perform weather forecasts, which allows for crucial predictions of socioeconomic welfare in areas threatened by natural disasters. KMA's models require a significant amount of computing power—over 700 teraflops<sup>2</sup> during peak performance. Cray's supercomputer and data analytic products power KMA's climate calculations and discoveries. Cray has also done work for the Mongolian National Agency of Meteorology and Environmental Monitoring (NAMEM). Mongolia's economy relies in no small part on farming and livestock, but extreme short-term and long-term weather availability can prove challenging for many farmers. For that reason, NAMEM selected a Cray supercomputer for weather research and forecasting. (Cray, Inc., 2016).

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<sup>2</sup> A teraflop is a measure of a computer's speed. One teraflop represents one trillion floating point operations per second. Floating point calculations are used for heightened precision and accuracy. Because computer memory is limited, numbers cannot be stored with infinite precision regardless of the application of binary or decimal fractions. At some point, the number will need to be cut off or rounded. Increased computing power allows for the carryover of more decimal places, improving the accuracy of calculations.

## Wireless Services

**Twisted Pair's** WAVE and its interoperable push-to-talk features have several non-defense applications, including functionality in the business services and hospitality industries, among many others. For example, businesses already using WAVE can add outside contractors to their established network with temporary licenses. When the contract ends, businesses can quickly deactivate the temporary accounts without compromising security (Motorola Solutions, 2016).

MGM Resorts International recently overhauled their staff communications with Motorola MOTOTRBO radios coupled with WAVE. MGM has over 61,000 employees across the company and its 15 resort properties worldwide. Staff members in different departments and locations are able to communicate swiftly with each other in order to deliver a high quality of service to guests (Motorola Solutions, 2014). Motorola and Twisted Pair provide WAVE to a multitude of customers who operate in a variety of other sectors around the world (Motorola Solutions, 2014).

In 2012, **Intermec Technologies** expanded its foreign operations by opening Intermec Beijing Technology Co. in China. Intermec China enables the company to contract directly with its overseas customers using the local currency. Having a brick-and-mortar location in China also allows the company to employ people directly without the use of a government intermediary. Intermec China's business scope includes handheld device technology, computer software, technical consulting, and the import and export of computer software, hardware, and accessory equipment. Intermec Technologies is a part of Honeywell Scanning and Mobility, and has contracted with the Department of Defense for handheld barcode terminals as well as related software and components. The Department of Defense relies on one of the largest logistics chains in the world, so equipment typically used in warehousing and transportation is among the entity's most common purchases. In 2015, the Department of Defense engaged in more than \$1.0 million in contracts with Intermec. (Intermec Technologies Corporation, 2012).

## Navigational Systems

With more than 1,300 production and sales sites in about 70 different countries, **Honeywell** has a wide-reaching global presence. In 2015, roughly half of the company's sales market was in the U.S., 22% was in Europe, 8% was in South America, and 6% was in China. India and the Middle East also had nominal market shares. 7% of Honeywell's total sales were DOD-related, and 20% were to commercial airlines around the world. More than half of Honeywell's 22,000 engineers are focused on software development (Honeywell, 2016).

Honeywell's aerospace ICT products and services have both defense and civilian applications. Its Weather Information Service utilizes GIS and navigational software to provide pilots, flight crews, and operators with real time weather conditions. Weather Information Service uses radar to track observed precipitation, forecasts vertical convection, cloud top, cloud heights, and clear air turbulence. The software also provides a 3-D rendering of the forecasted direction and speed of winds aloft, or the atmospheric temperature and pressure conditions that contribute to turbulence (Honeywell, 2016).

Another valuable Honeywell software product is GoDirect, which assists pilots with flight planning. GoDirect is a web software that combines access to all of Honeywell's ICT products. Weather Information Service is available with GoDirect, as well as the Health and Usage Monitoring System and Cabin Connectivity Services. The former monitors the status of all of the aircraft drivetrain components, and can alert flight operators of potential issues before they occur. Cabin Connectivity Services has satellite communication capabilities for both the cabin and cockpit, allowing for seamless connectivity in real time. GoDirect is used by commercial airlines around the world (Honeywell, 2016).

## ICT in Washington

Washington's core ICT activities are concentrated in the following six subsectors:

- **ICT Business Services**, including repair services, custom programming, and computer design.
- **Electronic Retail**, representing any form of e-commerce, largely driven by Amazon.
- **Internet Services and Publishing**. Activities in this group include web hosting and data processing.
- **Software**, representing both applications developers and systems software programmers.
- **Telecommunication Services**, including installation, maintenance, and service provision of broadband and mobile utilities and technologies.
- **Manufacturing**. This subsector is broad—representing communications, audio and video, computer peripheral, and photographic equipment manufacturing. Semiconductor manufacturing is also accounted for in this group (Community Attributes, 2015).

Electronic retail is one of the fastest growing activities, largely led by the growth of Amazon. In the fourth quarter of 2015 alone, the company's revenue totaled more than \$29 billion (Amazon, 2015). It should be noted that none of ICT's core activities are found exclusively within the ICT

sector—demand for ICT-related services is pervasive in virtually every industry (Community Attributes Inc., 2015).

The market value of all of Washington's ICT companies totals more than \$1 trillion, and the top ten public ICT firms account for nearly \$600 billion of this total valuation (Washington State Department of Revenue, 2014). Roughly 21% of all public companies in Washington are ICT firms. This is particularly impressive because, aside from Microsoft, almost all of the ICT companies in Washington were founded less than 20 years ago (Office of Financial Management, 2016). In addition to technology giants like Microsoft and Amazon, Washington is home to a wide variety of successful smaller firms. In 2013, the state had an estimated 8,600 ICT employment establishments. More than 90% of these companies employ fewer than 20 workers (Community Attributes Inc., 2015).

Jobs in the ICT sector are high-paying—the median wages for workers in core ICT occupations ranged from \$100,000 to \$140,000 in 2013. In the same year, the statewide sector paid out \$22 billion in wages (Washington State Department of Revenue, 2014). High salaries attract both local and global talent. Between 2004 and 2015, statewide ICT employment grew at a compound annual growth rate of 4.4% per year. In 2015, there were almost 196,000 ICT employees in Washington (Community Attributes Inc., 2015).

## Key Export Markets

The European Union was the largest export market for U.S. ICT hardware, software, and services in 2012 at \$56 billion, accounting for 21% of all U.S. ICT exports. In the same year, Mexico and Canada were the second and third largest export markets at \$39.6 and \$31.8 billion, respectively (Technology CEO Council, 2014).

Washington was the 3<sup>rd</sup> top exporter of ICT products in services in the country in 2012, with exports valued at more than \$16 billion, of which \$5.2 billion went to the E.U. China is also an extremely valuable market for Washington ICT activities. U.S. companies exported a total of \$15.3 billion of ICT exports to China in 2012. Washington exports to China accounted for \$835 million of that total (Technology CEO Council, 2014).

In addition to the ICT cluster's export value and export value growth rate, many companies contribute to the cluster's international reach with locations abroad. Aside from customer service centers and sales centers, some of the larger ICT companies have office locations abroad (**Exhibit A-4**) (Community Attributes Inc., 2015).

## **Exhibit A-4. Washington-based ICT Firms' International Office Locations**

Company	International Office Locations
Avalara	England, India
DocuSign	Australia, England, France
Big Fish Games	Luxembourg
Express Metrix	Australia, United Kingdom
Halcyon Monitoring Solutions, Inc.	Canada
Impinj	China
Microsoft	China, France, Germany, Singapore, Turkey
Raima	England
Valve	Luxembourg

## Example of ICT Defense Export Controls Compliance

As an example, suppose that Company A is interested in selling semiconductor manufacturing equipment, specifically equipment for direct write ion implantation, to Company B in South Korea and also to Company C in Taiwan. Company A would search the CCL Category 3 to determine that the equipment is listed under ECCN 3B001. More specifically, equipment for ion implantation with direct write capability is listed under ECCN 3B001.b.3. ECCN 3B001.b.3 notes that such equipment is controlled for reasons of national security (NS) and anti-terrorism (AT). The ECCN also indicates that on the Country Chart, for NS, column 2 applies, and for AT, column 1 applies (**Exhibit A-5**).

## **Exhibit A-5. ECCN Reasons for Control Entry for 3B001**

## **License Requirements**

*Reason for Control:* NS, AT

### *Control(s)*

*Country Chart*  
(See Supp. No.  
1 to part 738).

NS applies to entire entry

## NS Column 2

AT applies to entire entry

### AT Column 1

Company A can then look at the country entries for Companies B and C on the Country Chart. South Korea does not have an “X” in either the NS or AT columns. *See Exhibit A-6.* Accordingly, Company A likely does not need a BIS license to export the equipment to South Korea. (EAR contains a list of ten general prohibitions that must be reviewed in connection with any international transaction. If one of those prohibitions applies, then a BIS license is required regardless of the determination under the Country Chart analysis.)

However, Taiwan has an “X” under NS. *See Exhibit A-7.* According to the Country Chart, a BIS license may be required to send the equipment to Company C.

### **Exhibit A-6. Commerce Country Chart for South Korea**

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention		Crime Control		Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Kiribati	X	X		X		X	X	X	X	X		X		X		
Korea, North <sup>1</sup>																
Korea, South <sup>3,4</sup>						X		X	X			X		X		
Kosovo	X	X		X	X	X	X	X	X	X		X	X	X		

### **Exhibit A-7. Commerce Country Chart for Taiwan**

Countries	Chemical & Biological Weapons			Nuclear Nonproliferation		National Security		Missile Tech	Regional Stability		Firearms Convention		Crime Control		Anti-Terrorism	
	CB 1	CB 2	CB 3	NP 1	NP 2	NS 1	NS 2	MT 1	RS 1	RS 2	FC 1	CC 1	CC 2	CC 3	AT 1	AT 2
Spain <sup>3</sup>	X					X		X	X							
Sri Lanka	X	X		X		X	X	X	X	X		X		X		
Sudan <sup>1</sup>	X	X		X		X	X	X	X	X		X		X	X	X
Suriname	X	X		X		X	X	X	X	X	X	X		X		
Swaziland	X	X		X		X	X	X	X	X		X		X		
Sweden <sup>3,4</sup>	X					X		X	X			X		X		
Switzerland <sup>3,4</sup>	X					X		X	X			X		X		
Syria																
Taiwan	X	X	X	X		X	X	X	X	X		X		X		
Tajikistan	X	X	X	X		X	X	X	X	X		X	X			

Company A may refer back to the ECCN to see if it qualifies for any license exceptions. *See Exhibit A-8.* The applicable exceptions are for shipments of low value (LVS) and shipments to Country Group B countries (GBS). If the equipment is less than \$500, Company A would not need a BIS license to send it to Company C. However, it is highly doubtful that ion implantation equipment is less than \$500. This leaves license exception GBS. The countries included in Country Group B are listed in Supplement No. 1 of Part 740 of EAR. Taiwan is listed in Country Group B, so Company A likely would not need a BIS license to send the equipment to Company C.

## **Exhibit A-8. ECCN License Exceptions Entry for 3B001**

### **List Based License Exceptions (See Part 740 for a description of all license exceptions)**

*LVS:* \$500

*GBS:* Yes, except a.3 (molecular beam epitaxial growth equipment using gas sources), .e (automatic loading multi-chamber central wafer handling systems *only if connected to equipment controlled by 3B001. a.3, or .f, and .f (lithography equipment).*

*CIV:* Yes for equipment controlled by 3B001.a.1, a.2 and .c.

There are also a number of country-specific and product export regulations under EAR that may apply to other products. For example, certain cryptography equipment and software must be registered with BIS as mass market commodities in order to be released from encryption items (EI) and national security (NS) controls. As referenced above, EAR also has ten general prohibitions. Exports of most items to countries currently embargoed by the U.S. are generally prohibited.

In addition to restrictions on the destination country, U.S. companies exporting controlled products must ensure their products do not pass through certain countries during transit to the final destination. These countries include Armenia, Azerbaijan, Belarus, Cambodia, Cuba, Georgia, Kazakhstan, Kyrgyzstan, Laos, Mongolia, North Korea, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan, and Vietnam.

If a product must pass through one of these countries during transit, a company must apply for a BIS license. Additionally, U.S. companies that import products may need a BIS license to re-export the products if they are modified to have more than a *de minimis* amount of controlled content. For example, if a Washington electronics manufacturer loads EAR controlled software onto a foreign computer or programs a foreign field programmable array (FPGA) with EAR controlled algorithms, the electronics manufacturer may need to apply for a BIS license to re-export the computer or FPGA.

In addition to the CCL, the BIS also maintains lists that designate certain persons, companies, or organizations that are restricted from receiving certain exports. Companies that receive export requests from unfamiliar organizations or individuals should consult these resources as part of their due diligence.