A Strategy to Grow the Fort Bragg Region's Defense & Homeland Security Economy

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FINAL REPORT

Volume Four

Labor Demand: Occupations and Career Paths

Final Report

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A Strategy to Grow the Fort Bragg Region's Defense & Homeland Security Economy

Volume Four – Labor Demand: Occupations and Career Paths

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I. Labor Demand: Occupations and Career Paths

In this chapter we have detailed the key career pathways within the Maintenance and Repair and the Professional Technical Services industrial sectors—the sectors most critical to the BRAC region's economic transformation initiatives—as well as the top occupations within those pathways, and the knowledge, skills, and abilities required for performing these occupations. Equipped with this information, planners will be able to determine the extent to which the region's workforce already has the qualifications needed to acquire and succeed at the region's most import DHS jobs and to identify areas needing improvement.

A. Overview of Labor Demand Model

This section of the report assesses the current and future labor market opportunities in the Fort Bragg region's Defense & Homeland Security industries. We begin by examining the entire economy and then focusing on the D&HS industries—their needs and likely areas of future growth. The analysis contains information of use to those seeking employment in the D&HS industries. It also may help provide a foundation for assessing the capacity of the region's education and training providers to meet the needs of the future.

To measure labor market demand, the study uses a variety of secondary data sources in order to quantify the current and future demand for workers as well as to identify trends in the labor force that might affect their availability. The demand analysis uses a combination of data sets, building on information available from the North Carolina Employment Security Commission's Labor Market Information Labor division supplemented with data from U.S. Bureau of Economic Analysis (BEA) and forecasts from Economic Modeling Specialists, Inc. (EMSI). Unless otherwise stated, employment data are reported as covered employment. As a result, the data include only wage and salary workers covered by the unemployment insurance program. The data, therefore, do not include jobs created through proprietorships, farmers, and those government workers that do not participate in the state's unemployment insurance system.

To determine labor market demand, analysts first assess which industry sectors within the targeted D&HS clusters are growing (or declining) and then focus on a specific set of industries that offer the greatest opportunities. In this case, the team identified those industries tied to the BRAC RTF -targeted industries and their key linked industries, with a particular focus on backward linked (or supplier) industries.

Using a staffing pattern matrix of the individual industries that comprise the primary and the backward linked industries in each value chain, it is possible to identify key occupations in those industries. The present analysis includes a projection of industry job growth (or decline) during the next half decade (including increases or decreases that are likely to occur as a result of BRAC) to determine the trends for individual occupations serving that industry. Those relatively higher wage occupations that are projected to grow represent key focus areas. Occupations in which declines are expected represent another potential target, that is, for worker transition activities.

In addition to data provided through a variety of secondary sources, the consulting team also interviewed personnel from a group of local companies in two different focus groups, an effort designed to validate the quantitative analysis. The report discusses trends that emerged from the data analysis and the company interviews.

For those already working in the targeted occupations, incumbent worker education and training efforts must take into account the ongoing need for upgrading skills to improve productivity. However, much of the focus for the BRAC RTF is on preparing new workers for jobs in targeted growth occupations. After assessing likely worker turnover (due to workers retiring or leaving the regional labor force through migration or career changes) and making a comparison with the number of new-to-entry workers, it is possible to estimate the likely demand for new workers in targeted industries and related occupations. Data from national surveys of employers and other sources can help the analyst identify minimum education and training requirements for these jobs. Analysts also obtained occupational data regarding the minimum education requirements (as well as the knowledge, skills, and abilities that employers demand) using results from surveys produced by the U.S. Bureau of Labor Statistics and its state partners. The O*NET Content Model (http://online.onetcenter.org) describes the mix of knowledge, skills, and abilities required to perform the tasks of each of 812 different occupations.

For those occupations, the consulting team then identified related occupations that require similar education and training. These occupations were identified through both the O*NET dataset as well as the US Department of Education's Career Clusters. Based on these sets of related industries, the team then organized the occupations into potential career pathways and lattices, creating tools to provide guidance on entry points and potential career advancement opportunities.

II. Key Growing Occupations in Targeted Core and Linked Industries

The occupational analysis began by identifying occupations in highest demand, first in the core targeted industry and then in the linked industries (focusing on those that were major suppliers) already located in the region. The following section identifies key occupations for each of the targeted core and linked industries.

A. Research and Development Services

The Fort Bragg region does not currently have significant employment in research and development-related occupations. Two occupations are projected to expand employment: (1) environmental scientists & specialists, including health and (2) medical scientists, except epidemiologists, see Table 1. Both are related to the biological sciences and not directly tied to the activities anticipated for defense-related R&D. Both require advanced degrees. If the Fort Bragg region is successful in attracting all of the contracts, the BRAC-related moves and contracts will require 102 more medical scientists than are currently available in the region. However, it may not be likely that these highly specialized positions would relocate to the region, given Fort Bragg's proximity to major research institutions in the Research Triangle area. In addition, area companies are expected to add four new environmental specialist positions per year through 2013, despite the economic downturn.

Table 1: Key Occupations Related to the R&D Services Value Chain

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level
Linked Occupation	Environmental scientists & specialists, including health	170	190	20	12%	0%	$21.86	Master's degree
Core Occupation	Medical scientists, except epidemiologists	18	120	102	26%	6%	$35.12	Doctoral degree

B. Navigational, Measuring, Electromedical, and Control Instruments Manufacturing

Current projections suggest that regional employment in electronics and instrument-related industries will likely decline slightly unless the region is able to increase employment in this area by attracting new defense contractors to support FORSCOM and USARC. Should BRAC moves boost growth in these industries, this trend would likely help offset job losses anticipated for production workers in the region's other manufacturers. Many of the jobs in this field traditionally have not required formal training beyond high school, with most of the skills learned through customized and on-the-job training (OJT). Long-term OJT involves training of more than one year while short-term OJT typically lasts less than one month. See Table 2 for training requirements for key occupations in the navigational, measuring, electro medical, & control instruments manufacturing industries.

Those occupations requiring the longest periods of training are least likely to be shed as the industry becomes more productive. Future jobs in the field may require some formal post-secondary training, but the development of such training curriculum may need to be done on a customized basis in response to specific needs as they arise.

Table 2: Key Occupations for Navigational, Measuring, Electromedical, and Control Instruments Manufacturing Value Chain

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level*
Core Occupation	Aircraft structure, surfaces, rigging, & systems assemblers	20	16	(4)	(18%)	3%	$18.33	Long-term OJT
Core Occupation	Electromechanical equipment assemblers	45	35	(10)	(23%)	8%	$12.38	Short-term OJT
Core Occupation	Team assemblers	48	38	(10)	(22%)	8%	$11.05	Moderate-term OJT
Core Occupation	Inspectors, testers, sorters, samplers, & weighers	25	18	(7)	(27%)	4%	$11.77	Moderate-term OJT
Core Occupation	Electrical & electronic equipment assemblers	89	60	(29)	(32%)	15%	$12.40	Short-term OJT
Linked Occupations	Extruding & drawing machine setters, operators, & tenders, metal & plastic	199	166	(33)	(17%)		$12.43	Moderate-term OJT
Linked Occupations	First-line supervisors/ managers of production & operating workers	2,342	2,221	(121)	(5%)		$19.41	Work experience in related field

* For on-the-job training (OJT), long-term is typically greater than one year; moderate-term is typically greater than one month but less than one year; and short-term is typically less than one month.

C. Motor and Generator Manufacturing

Occupations in motor and generator production are expected to see minor increases in employment during the next five years, rebounding back to their 2008 levels by 2013. Almost all of these jobs require moderate and short-term training, except machinists and supervisors, both of which require longer term OJT and work experience, see Table 3. Unless the region can attract new companies in this industry, job opportunities will probably result primarily from attrition of existing workers.

Table 3: Key Occupations in the Motor and Generator Manufacturing Value Chain

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level*
Core Occupation	CNC machine tool operators, metal & plastic	29	33	4	13%	3%	$14.18	Moderate-term OJT
Core Occupation	Machinists	21	23	2	8%	2%	$16.30	Long-term OJT
Core Occupation	Maintenance & repair workers, general	25	26	1	3%	2%	$14.58	Moderate-term OJT
Core Occupation	Electromechanical equipment assemblers	44	47	3	6%	4%	$12.38	Short-term OJT
Core Occupation	First-line supervisors/ mgrs of production & operating workers	43	45	2	4%	4%	$19.56	Work experience in related field
Core Occupation	Electrical & electronic equipment assemblers	66	70	4	6%	7%	$12.40	Short-term OJT
Core Occupation	Coil winders, tapers, & finishers	41	41	0	(1%)	4%	$13.92	Short-term OJT
Core Occupation	Inspectors, testers, sorters, samplers, & weighers	51	51	0	1%	5%	$11.77	Moderate-term OJT
Core Occupation	Team assemblers	161	168	7	4%	16%	$11.05	Moderate-term OJT

* For on-the-job training (OJT), long-term is typically greater than one year; moderate-term is typically greater than one month but less than one year; and short-term is typically less than one month.

D. Electronic and Precision Equipment Repair and Maintenance

Over the next half-decade, the Fort Bragg region expects to add jobs in fields related to maintenance and repair. Many of the key positions, such as electrical, industrial, and computer equipment maintenance require post-secondary certifications, as Table 14 shows. In some cases, such as for supervisors and installers, the jobs also require work experience and/or long-term on-the-job experience. To complement the "field installers," the region will also need customer services representatives and clerks to manage client scheduling and billing activities. These administrative support positions tend to require slightly less technical training, and most jobs are available to workers after short- or medium-term OJT.

Table 4: Key Occupations in the Electronic and Precision Equipment Repair and Maintenance Value Chain

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level
Core Occupation	Electrical & electronics repairers, commercial & industrial equipment	71	105	34	48%	7%	$22.57	Post-sec vocational award
Core Occupation	Customer service representatives	44	68	24	55%	5%	$11.95	Moderate-term OJT
Core Occupation	Computer, automated teller, & office machine repairers	78	111	33	42%	8%	$14.73	Post-sec vocational award
Core Occupation	Office clerks, general	59	85	26	44%	6%	$10.16	Short-term OJT
Core Occupation	First-line supervisors/mgrs of mechanics, installers, & repairers	61	87	26	43%	6%	$23.54	Work experience in related field
Core Occupation	Telecommunications equipment installers & repairers, except line installers	62	88	26	42%	6%	$20.91	Long-term OJT
Core Occupation	Bookkeeping, accounting, & auditing clerks	24	34	10	40%	2%	$13.08	Moderate-term OJT
Core Occupation	Shipping, receiving, & traffic clerks	26	38	12	48%	3%	$11.79	Short-term OJT
Core Occupation	General & operations mgrs	30	41	11	38%	3%	$37.46	Degree plus work experience
Core Occupation	Computer support specialists	18	27	9	48%	2%	$18.08	Associate's degree
Core Occupation	Sales reps, wholesale & MFG, except technical & scientific products	21	30	9	41%	2%	$19.04	Moderate-term OJT
Core Occupation	First-line supervisors/mgrs of office & admin support workers	19	28	9	46%	2%	$18.10	Work experience in related field
Core Occupation	Maintenance & repair workers, general	17	26	9	51%	2%	$14.58	Moderate-term OJT
Core Occupation	Helpers--Installation, maintenance, & repair workers	17	26	9	51%	2%	$10.37	Short-term OJT
Core Occupation	Team assemblers	19	28	9	46%	2%	$11.05	Moderate-term OJT
Core Occupation	Inspectors, testers, sorters, samplers, & weighers	31	424	11	37%	3%	$11.77	Moderate-term OJT
Core Occupation	Secretaries, except legal, medical, & executive	27	37	10	39%	3%	$11.77	Moderate-term OJT
Core Occupation	Electronic home entertainment equipment installers & repairers	38	51	13	35%	4%	$14.51	Post-sec vocational award

* For on-the-job training (OJT), long-term is typically greater than one year; moderate-term is typically greater than one month but less than one year; and short-term is typically less than one month.

E. Management Consulting Services

Growth in the Fort Bragg region's consulting activities is expected to create new jobs in a variety of linked industries, especially administrative and financial services. The jobs include office clerks, bookkeepers, and administrative assistants, all requiring short- and moderate-term job training, as Table 15 shows. Of course, the highest paying in-demand jobs will include management and financial analysts (including accountants), all requiring baccalaureate degrees. Some of these jobs will also require experience.

Table 5: Key Occupations in the Management Consulting Services Value Chain

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level
Linked Occupation	Office clerks, general	6,625	6,999	374	6%	6%	$9.84	Short-term OJT
Linked Occupation	Executive secretaries & administrative assistants	3,126	3,387	261	8%	4%	$14.01	Moderate-term OJT
Linked Occupation	Bookkeeping, accounting, & auditing clerks	4,914	5,173	259	5%	7%	$13.32	Moderate-term OJT
Core Occupation	Management analysts	109	238	129	118%	7%	$28.68	Degree plus work experience
Core Occupation	Customer service representatives	91	207	116	128%	6%	$11.95	Moderate-term OJT
Linked Occupation	Accountants & auditors	2,460	2,625	165	7%	10%	$18.29	Bachelor's degree
Core Occupation	Executive secretaries & administrative assistants	74	165	91	123%	5%	$15.38	Moderate-term OJT
Core Occupation	Office clerks, general	93	196	103	111%	6%	$10.16	Short-term OJT
Core Occupation	Business operation specialists, all other	55	118	63	114%	3%	$27.24	Bachelor's degree
Core Occupation	Secretaries, except legal, medical, & executive	68	138	70	103%	4%	$11.77	Moderate-term OJT
Core Occupation	General & operations mgrs	62	131	69	112%	4%	$37.46	Degree plus work experience
Core Occupation	Bookkeeping, accounting, & auditing clerks	47	102	55	116%	3%	$13.08	Moderate-term OJT
Core Occupation	Accountants & auditors	28	66	38	136%	2%	$23.44	Bachelor's degree
Core Occupation	Environmental scientists & specialists, including health	33	71	38	115%	2%	$21.90	Master's degree
Core Occupation	Employment, recruitment, & placement specialists	31	68	37	120%	2%	$18.95	Bachelor's degree

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level
Core Occupation	First-line supervisors/ mgrs of office & administrative support workers	38	75	37	98%	2%	$18.10	Work experience in related field
Core Occupation	Sales representatives, services, all other	23	46	23	98%	1%	$16.97	Moderate-term OJT
Core Occupation	Demonstrators & product promoters	24	59	35	146%	2%	$11.92	Moderate-term OJT
Core Occupation	Receptionists & information clerks	26	61	35	135%	2%	$9.77	Short-term OJT
Core Occupation	Logisticians	20	42	22	108%	1%	$24.27	Bachelor's degree
Core Occupation	Maintenance & repair workers, general	23	45	22	94%	1%	$14.58	Moderate-term OJT
Core Occupation	Laborers & freight, stock, & material movers, hand	31	65	34	110%	2%	$9.40	Short-term OJT
Core Occupation	Training & development specialists	21	42	21	98%	1%	$21.49	Bachelor's degree
Core Occupation	Network systems & data communications analysts	12	33	21	171%	1%	$25.32	Bachelor's degree
Core Occupation	Registered nurses	18	38	20	109%	1%	$25.29	Associate's degree
Core Occupation	Sales representatives, wholesale & MFG, except technical & scientific products	20	40	20	98%	1%	$19.04	Moderate-term OJT
Core Occupation	Interviewers, except eligibility & loan	18	38	20	109%	1%	$11.58	Short-term OJT
Core Occupation	Computer systems analysts	14	33	19	133%	1%	$28.55	Bachelor's degree
Core Occupation	Inspectors, testers, sorters, samplers, & weighers	19	38	19	98%	1%	$11.77	Moderate-term OJT
Core Occupation	Computer support specialists	15	33	18	117%	1%	$18.08	Associate's degree

* For on-the-job training (OJT), long-term is typically greater than one year; moderate-term is typically greater than one month but less than one year; and short-term is typically less than one month.

F. Computer Systems Design/Custom Computer Services

Most of the growth jobs related to computer systems design or services require two or four year degrees. Network and computer systems analysts or administrators typically require at least a four year B.A. degree, as Table 6 shows. Those occupations are expected to add more than 70 jobs per year in the Fort Bragg region during the next five years, despite the current downturn. BRAC-related moves could accelerate this demand. For those jobs in the field that require an associate's degree, including computer support specialists, the growth is likely to be slower. Even so, the region will likely be adding about 80 related jobs per year by 2013.

Table 6: Key Occupations in the Computer Systems Design/Custom Computer Services Value Chain

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level
Linked Occupation	Network systems & data communications analysts (SOC 15-1081)	405	539	134	33%	3%	$25.32	Bachelor's degree
Linked Occupation	Computer systems analysts (SOC 15-1051)	419	540	121	29%	5%	$25.66	Bachelor's degree
Linked Occupation	Computer specialists, all other (SOC 15-1099)	509	663	154	30%	9%	$30.40	Associate's degree
Linked Occupation	Computer support specialists (SOC 15-1041)	706	839	133	19%	7%	$17.17	Associate's degree
Linked Occupation	Network & computer systems administrators (SOC 15-1071)	406	504	98	24%	4%	$27.66	Bachelor's degree
Core Occupation	Computer specialists, all other	138	263	125	90%	9%	$32.68	Associate's degree
Linked Occupation	Computer software engineers, applications (SOC 15-1031)	155	211	56	36%	2%	$29.31	Bachelor's degree
Linked Occupation	Computer software engineers, systems software (SOC 15-1032)	198	261	63	32%	3%	$41.06	Bachelor's degree
Core Occupation	Customer service representatives	91	179	88	97%	6%	$11.95	Moderate-term OJT
Core Occupation	Computer systems analysts	79	153	74	94%	5%	$28.55	Bachelor's degree
Core Occupation	Computer support specialists	114	205	91	80%	7%	$18.08	Associate's degree
Core Occupation	Network systems & data communications analysts	53	108	55	104%	3%	$25.32	Bachelor's degree
Core Occupation	Office clerks, general	69	126	57	83%	4%	$10.16	Short-term OJT
Core Occupation	Network & computer systems administrators	57	113	56	99%	4%	$27.66	Bachelor's degree
Linked Occupation	Computer programmers (SOC 15-1021)	308	362	54	18%	4%	$28.65	Bachelor's degree
Core Occupation	General & operations mgrs	68	120	52	77%	4%	$37.46	Degree plus work experience
Core Occupation	Computer software engineers, applications	37	70	33	90%	2%	$39.39	Bachelor's degree
Core Occupation	Computer software engineers, systems software	44	85	41	94%	3%	$41.06	Bachelor's degree
Core Occupation	Executive secretaries & administrative assistants	43	84	41	96%	3%	$15.38	Moderate-term OJT
Core Occupation	Business operation specialists, all other	31	61	30	97%	2%	$27.24	Bachelor's degree

Relationship to Target Industry	Description	2008 Jobs	2013 Jobs	Change	% Change	% of Industry	Hourly Earnings	Education Level
Core Occupation	Sales representatives, services, all other	29	58	29	100%	2%	$16.97	Moderate-term OJT
Core Occupation	Computer & information systems mgrs	33	61	28	85%	2%	$40.22	Degree plus work experience
Core Occupation	Computer programmers	68	114	46	68%	4%	$38.63	Bachelor's degree
Core Occupation	Bookkeeping, accounting, & auditing clerks	33	61	28	85%	2%	$13.08	Moderate-term OJT
Core Occupation	Training & development specialists	25	52	27	109%	2%	$21.49	Bachelor's degree
Core Occupation	Accountants & auditors	24	42	18	75%	1%	$23.44	Bachelor's degree
Core Occupation	Sales representatives, wholesale & MFG, technical & scientific products	27	53	26	97%	2%	$22.03	Moderate-term OJT
Core Occupation	Sales mgrs	21	37	16	77%	1%	$33.13	Degree plus work experience
Core Occupation	Management analysts	22	38	16	73%	1%	$28.68	Degree plus work experience
Core Occupation	First-line supervisors/ mgrs of office & administrative support workers	26	51	25	97%	2%	$18.10	Work experience in related field
Core Occupation	Secretaries, except legal, medical, & executive	27	52	25	93%	2%	$11.77	Moderate-term OJT
Core Occupation	Database administrators	17	32	15	89%	1%	$30.83	Bachelor's degree
Core Occupation	Sales representatives, wholesale & MFG, except technical & scientific products	20	35	15	75%	1%	$19.04	Moderate-term OJT
Core Occupation	Receptionists & information clerks	20	35	15	75%	1%	$9.77	Short-term OJT

The consulting team selected these industries for analysis because they seemed to offer the greatest potential for economic growth as well as opportunities for area workers to succeed. The report will now examine these occupations in greater depth to understand their linkages with potential career opportunities as well as to explore different ways that workers might enter these occupations. The following discussion examines the highest demand careers identified in this section in terms of the career opportunities they can offer individuals living in the Fort Bragg region.

III. Career Pathway Opportunities in Core and Linked D&HS Industries

There are a number of ways to examine occupational opportunities and the demand for workers. One way involves exploring how occupations tie together to create alternative career pathways. The National Association of State Directors of Career Technical Education Consortium (NASDCTEc) created the career clusters framework to formally define a number of career clusters and related career pathways. This approach provides a method for linking occupations by educational attainment requirements. It affords potential workers the opportunity to see where they can enter certain fields and the opportunities available to them as they grow in skills, experience, and education.

G. Advanced Manufacturing Career Pathways

Workers in manufacturing industries can participate in a number of potential pathway options related to the manufacturing activities targeted for the Fort Bragg region. Three unique career pathways appear to offer particular opportunities in the region: (1) the production design, operations, and maintenance pathway; (2) precision process technologies pathway; and (3) the electromechanical installation and maintenance pathway.

1. Production Design, Operations, and Maintenance

The production design, operations, and maintenance career pathway has positions involving all levels of skill and education. Positions vary from those requiring short-term, on-the-job training up to a degree plus work experience. The hierarchy reflects the possibility of rising beyond the entry level with the right amount of work experience, and the Fort Bragg region has this capacity within this career pathway. There are several opportunities for individuals seeking employment in the manufacturing sector. These include maintenance and repair workers at the entry level, and industrial engineers for those with access to obtaining a bachelor's degree.

The maintenance and repair worker positions are available with a moderate level of on-the-job training, from one month to one year of training. These positions pay about $14/hour. This rate is below the regional average of $17.70/hour, but these positions may lead to higher paying jobs, such as industrial machinery mechanic positions. Long-term, on-the-job training, meaning one year or more, is required for advancing, to pay in the area of $15/hour. Once again, these occupations typically require work experience in addition to formal education. An industrial machinery mechanic can grow into an industrial production manager position. These are advanced positions paying around $35/hour, more than double the regional average, producing 17 new job openings each year in this region. Purchasing agents represent a similar position within this career pathway, with advancement depending more on work experience than formal education. Approximately 11 of these positions open up annually in the Fort Bragg region and pay in the range of $22/hour. At the top of this career pathway is the industrial engineer position. This job requires a bachelor's degree but it may possibly be reached from success at the industrial production manager position. Generally there are 11 positions open annually in the region paying around $29/hour.

2. Precision Process Technology

The precision process technology pathway is not well represented in the Fort Bragg region. These positions exist at all levels of the skill/education spectrum and are highly skilled and technology-oriented. The one position represented in this region is that of first line supervisors, which requires work experience in a related industry. Within the region, there are approximately 23 new positions open every year, paying over $19/hour, above the regional average of $17.70/hour.

3. Electromechanical Installation and Maintenance Pathway

The electromechanical installation and maintenance pathway involves positions of a highly technical nature, but also requires a 'hands-on' approach, using a combination of on-the-job training and work experience. When combined with vocational certificates and associate's degrees, advanced positions within this pathway can be accessible to workers. Within the Fort Bragg region, the specific positions represented are telecommunications equipment installation and repair, which requires only long-term on-the-job training of a year or more. To rise to the next level, work experience and/or vocational certification are necessary. These positions include security and fire alarm systems installers, commercial electrical/electronics installation and repair, and computer installation and repair. Pay ranges from $11.00 an hour for computer installation and repair to $14.16 per hour for security and fire alarm installers. For commercial workers, pay ranges from $18.84 per hour for telecommunications equipment installers and repair technicians to $22.50 per hour for commercial electrical and electronics installation and repair technicians. While average wages for supervisors and managers are relatively lower, this is likely due to the fact that this occupation includes a broader category of managers involved not only in overseeing electromechanical installation and maintenance but also supervisors and managers of other types of installation/maintenance activities. In fact, managers for these skilled labor positions are likely paid much higher than the median for the occupation, which represents only a small portion of the available supervisor and manager positions within the region.

H. STEM Career Pathways

Several technical careers involve occupations related to science, technology, engineering, or math (STEM) pathway options. Two career pathways appear to offer significant opportunities in the Fort Bragg region. Those include (1) professional engineering and (2) science and mathematics.

1. Professional Engineering Pathway

The Fort Bragg region has several key programs for workers interested in pursuing STEM occupations. These range from computer support specialists at the lower level to general and operations managers at the top. Training requirements begin with an associate's degree and move up to a bachelor's degree plus experience.

The entry-level position in the professional engineering pathway is the computer support specialist. This position generally requires an associate's degree and has wages of around

$17/hour, very close to the regional average wage of $17.70/hour. In the Fort Bragg region, there are approximately 36 of these positions open annually. It is possible to move up to the next level through work experience. However, earning a bachelor's degree creates greater opportunities. Degree-dependent positions include network systems and data communication analysts, computer systems analysts, and network and computer systems analysts. These positions pay $21/hour to $25/hour and have a number of openings annually. Related to this pathway are civil engineer positions. These require a bachelor's degree with salaries in the $28/hour range. At the top of this pathway is the general and operations manager position. These positions are open to all with a degree and experience and have the highest pay level of any position in this pathway, $34/hour.

2. Science and Mathematics Pathway

Another direction for those seeking to pursue STEM-related occupations is the science and mathematics pathway. Positions vary from research-related positions requiring advanced graduate degrees down to positions that need only moderate levels of on-the-job training. The lower level positions are more technically-oriented support positions.

In the immediate Fort Bragg region, none of the lower level positions are readily available to new entrants in the workforce. The least amount of training/education required is a bachelor's degree. These positions include chemists and computer programmers. Salaries are generally in the $26/hour to $28/hour range. However, very few of these positions open up annually. Once in these positions, it is possible to move up to the top tier of STEM employment, including medical scientists and post-secondary teachers, both of which pay in the $33/hour range. Regionally, there are approximately 236 openings annually for post-secondary teachers and 14 for medical scientists.

I. Business Management & Administration Career Pathways

Business management and administration offers four potential career pathways, building on a variety of occupations. Those pathways include financial, management, and accounting; business analysis; administration and information; and human resources.

1. Business Financial, Management, and Accounting

The business financial, management, and accounting career pathway has great potential in the region in terms of opportunity. There are plenty of job opportunities that require moderate levels of on-the-job training with a fair number of annual openings. The entry-level salaries, however, are relatively low. Even so, there is room for growth based simply on work experience and or a bachelor's degree with work experience.

In the immediate Fort Bragg region, the most common positions requiring moderate levels of on-the-job training are customer service reps, billing and posting clerks, and machine operators. The pay for these positions is in the $11/hour to $12/hour range, below the regional average of $17.70/hour. However, there are generally several hundred of these positions open annually. Once established, it is possible for these workers to move up to first-line supervisory positions

based on work experience alone. Paying approximately $16/hour, there are almost 100 of these supervisory jobs open annually. Acquiring a bachelor's degree would open up accounting and auditing positions in the region. These pay more than $17/hour and can lead directly to the top-level positions in this category that require a degree plus work experience: management analysts, financial managers, and even chief executive positions. Pay rates for top level job holders is in the $18/hour to $25/hour range.

2. Business Analysis Pathway

Business analysis is a pathway with little to offer anyone without a four-year college degree. Minimum requirements are a bachelor's degree on up to a master's degree. However, employees can reach the top level in this pathway with a degree plus experience. Entry level positions in the Fort Bragg region are computer systems analysts and, from there, it is possible to move up to general and operations manager and management analyst positions.

Computer systems analyst positions in this region require a bachelor's degree, and their earnings average about $25/hour. Annually there are about 26 openings in this job description. Beyond the entry level, it is possible to move into general and operations managerial and management analyst positions with a bachelor's degree plus work experience. These positions have 93 and 52 openings annually within the region and pay anywhere from $18/hour for management analysts to $34/hour for general and operations managers.

3. Administrative and Information Support

Administrative and information support is another pathway that provides a number of positions in the Fort Bragg region and requires only short-term, on-the-job training. With work experience, candidates can attain upper level positions; and can reach the top level of this pathway with an associate's degree. An entire section of this pathway, however, is not represented in the area. Those jobs, requiring a post-secondary vocational award, include legal secretaries, court reporters, desktop publishers, and medical transcriptionists.

Positions requiring only short-term on-the-job training include receptionists and information clerks; stock clerks and order fillers; and shipping, receiving, and traffic clerks. Although plentiful, these positions pay relatively low salaries: $9/hour to $12/hour. From these positions, however, it is possible to move into an executive secretary or administrative assistant position with only a moderate level of on-the-job training. Also represented in the area are medical assistants. These jobs typically require a moderate level of on-the-job training. At this level of training and experience, wages of $11/hour to $14/hour can be expected. At the top of this pathway, paralegal and legal assistant positions require an associates' degree and pay around $15/hour.

4. Human Resources

Although the human resources pathway is not well represented in the Fort Bragg region by the range of potential jobs, one of the positions in this pathway offers a relatively large number of annual openings. The "managers" position in the human resources category has 139 openings

annually, including jobs related to this pathway as well as several other career pathways in technical fields. The lack of a large number of positions limits upward mobility in this pathway. Nonetheless, this is an accessible position requiring work related experience in the field. Although the number of positions is plentiful, the average salary is $12/hour, well below the regional average of $17.70/hour.

Once one earns a bachelor's degree level, however, the number of available positions and the salary picture improve considerably. There are three positions well represented in the area: computer systems analysts, training and development specialists, and training specialists for human resources. Eighteen positions open annually for training specialists for human resources; 23 open for training and development specialists.

Computer systems analyst positions account for about 26 new job openings annually. Salaries are $20/hour for training and development and training specialists for human resources; $25/hour for computer systems analysts. Computer systems analysts are *stand alone* positions—for which natural upward progression is limited in the Fort Bragg Region without significant education or training.

J. Information Technology Pathways

Distinct from business management activities, six information technology career pathways provide potential opportunities for defense and homeland security workers. These include network systems; information support services; interactive media; programming & software development; protective & security services; and audio & video technologies.

1. Network Systems

The number of potential positions in the network systems pathway is small, only five openings per year. However, the Fort Bragg region is well represented by four of those positions. All have salaries at or above the regional average of $17.70.

At the entry level, computer support specialist positions require an associate's degree and offer a natural stepping stone toward computer systems analyst positions requiring experience and a bachelor's degree. There are, on average, 36 new openings annually for this position. Salaries are $17/hour, right at the regional average.

At the bachelor's degree level are three positions: (1) computer systems analysts, (2) network and computer system administration, and (3) network systems and data communication analysts. The salaries for these jobs are well above the regional average. Network systems and data communication analysts earn on average $21/hour, while computer systems analysts, network and computer system administrators earn $25/hour. These positions generally have 22 to 30 job openings, respectively, each year.

2. Information Support Services

This information support services pathway is somewhat limited as only one position out of a potential 13 exists in the Fort Bragg region. Computer specialist represents the most commonly available position in this pathway. These positions typically require at least an associate's degree, and about 28 job slots open in the region each year. Wages, however, are $30/hour, well above the regional average of $17.70/hour. Potential upward mobility for this position is limited, given the small number of advancement opportunities this pathway presents, making this a standalone position in the region.

3. Interactive Media

Interactive media is another pathway not well represented in the Fort Bragg region. The one position that is represented requires a bachelor's degree. Network and computer system administrators are stand alone positions because of the lack of advancement positions in the pathway. However, it should be recognized that these jobs offer only limited upward career mobility. Nonetheless, these positions pay well above the regional average, $25/hour as opposed to $17.70/hour. New job openings total about 22 every year.

4. Programming and Software Development

The jobs in the programming and software development career pathway are rather widely represented in the Fort Bragg region. There are five potential occupations related to this pathway, all of which require an associate's or bachelor's degree. The wages, overall, are well above average.

At the associate's degree level is the computer support specialist. This position offers about 36 new openings every year and pays right at the regional average, $17/hour. There is a natural upward progression for computer support specialists to the higher level jobs in this pathway: computer systems analysts, network and computer system administration, network systems and data communication analysts, and computer programmers. Of these, computer programmers have the highest pay rate, $28/hour. However, there are on average only 11 position openings every year. Computer systems analysts and network and computer system administrators earn $25/hour. These jobs see 26 and 22 new positions open up every year, respectively. Network systems and data communication analysts earn on average $21/hour and have the highest number of openings for jobs requiring a bachelor's degree or higher.

5. Security and Protective Services

The security and protective services career pathway represents a wide variety of positions within a relatively small number of positions. These short-term, on-the-job-training, entry-level, low-skill careers jobs typically pay well below the regional average of $17.70/hour. However, the pathway has jobs ranging to those requiring a professional degree and offering pay far higher than the regional average. In most of the short-term, on-the-job-training positions, there is limited room for upward mobility without strong postsecondary educational experience.

The basic positions in the pathway are security guards and lifeguards/ski patrol personnel. The former earn $12/hour while the latter earn close to minimum wage. Both sets of positions pay well below the regional average. On average 74 new security guard positions and 22 new lifeguard and ski patrol positions open annually.

Private detectives and investigators are stand alone positions. The earning potential here is $15/hour, which is below the regional average. There are approximately 16 new openings every year. Network and computer system administrators are required to have a bachelor's degree. These positions pay $25/hour and produce about 22 new openings annually.

6. Audio and Video Technologies

This audio and video technologies career pathway has previously had very little representation in the Fort Bragg region. Only one position in this pathway exists regionally, computer support specialists, and that position is common to several career pathways in the information technology cluster of occupations. Approximately 36 positions open up annually and the salary is approximately the regional average, $17/hour with the regional average being $17.70/hour. Due to the limited development of this pathway in the area, there does not appear to be room for computer support specialists to advance without competing for limited jobs or the creation of new ones within the industries that offer these opportunities.

K. Education and Training Pathways

Growth in the traditional education sectors of K-12 and postsecondary—combined with an increased emphasis on adult training—is creating opportunities in two different career pathways. One of those relates to teaching and instruction while the other relates to the broad array of other services that support education and training.

1. Teaching/Training

From short-term on-the-job-training positions to those requiring doctoral degrees, there are ample opportunities within this pathway for a sizeable number of employees. Work experience alone can be the sole requirement for advancement for many positions in this pathway. However, the top level positions require a degree or a degree plus experience. Only the top position, postsecondary teachers, requires a doctoral degree. It must be pointed out however, that these positions, although accessible, have wages well below the regional average. Only the degreed positions have salaries above that average.

At the start of this career pathway are three positions requiring short-term on-the-job-training: teacher assistants, child care workers, and recreation workers. The numbers of positions open annually at this level range from 240 for child care workers to 23 for recreation workers. Teacher assistants earn around $11/hour, well below the regional average of $17.70/hour. However, this position has a fair amount of upward mobility, particularly if it is possible for a candidate to acquire a bachelor's degree. From teacher assistant, one can move up to pre-school teacher, which requires vocational certification and pays $8/hour.

Obtaining a bachelor's degree allows one to move into an elementary school teacher position paying $23/hour, significantly above the regional average, and then on to elementary school education administration. Child care and recreation workers are able to move up to coaching/scout positions (requiring only long-term on-the-job training) paying around $15/hour and from there to fitness trainers and aerobics instructors (requiring a vocational certificate and paying approximately $9/hour).

Degreed positions include elementary school teachers, as described above, middle school teachers, and secondary school teachers. The number of openings for these positions range annually from 87 for secondary school teachers to 160 for elementary school teachers. The pay is $23/hour for elementary and secondary school teachers and $25/hour for middle school teachers. All three of these positions can lead to school education administration, described above, or secondary vocational education teachers, requiring a degree plus experience. There are approximately 13 preschool administration openings every year, for positions paying approximately $13/hour. Secondary vocational teachers see about 16 openings per year, with salaries around $26/hour. At the top of this career pathway are the postsecondary teachers. Although there on average 236 openings every year, this is a position requiring a doctoral degree. The pay however, is almost $34/hour, about double the regional average of $17.70/hour.

2. Support Services

The support services career pathway is well-represented in the Fort Bragg region. However, the entry-level requirement for one of these positions is a bachelor's degree. Other positions require as much as a doctoral degree. Bachelor's degree positions are teachers and instructors; and child, family and school social workers. These positions have pay scales in the range of $16/hour to $21/hour with approximately 150 openings every year. In both cases, it is possible to move into the mid-tier position of educational, vocational, or school counselor. The rate of pay for this position is $18/hour but only 25 positions open annually. The other mid-tier position represented in the area is speech-language pathologist, which requires a master's degree and is highly specialized. Only 15 positions are open annually but the pay is approximately $26/hour. At the top level of this pathway are clinical, counseling, and school psychologists, which are doctoral degree positions. These latter positions pay relatively low considering the educational requirements, $19/hour, and there are only about 17 openings in the area per year.

L. Agriculture, Food and Natural Resources Pathways

The agriculture and food sector is particularly important to several counties in the region, but significant D&HS-related expansion is expected largely in the power generation sector. The career pathway offering the greatest potential for new job creation is related to occupations serving power, structural, and technical systems. Welding and computer systems design are particularly noteworthy

1. Power, Structural, and Technical Systems

This power, structural, and technical systems pathway encompasses a wide variety of position requiring an equally wide variety of education and experience. The requirements range begins

with moderate-term on-the-job-training and culminates with positions requiring doctoral degrees. Only four of the positions, however, exist in the Fort Bragg region. The core positions require long-term on-the-job-training. Welders, cutters, solderers, and brazers earn just under the regional average, $16/hour. On average, only about 12 of these positions open up annually in the region. To provide opportunities for lower-level workers to move ahead, it would be necessary for an influx of heavy equipment positions and similar jobs to move into the area. At the associate's degree level, computer support specialists earn $17/hour, approximating the regional average of $17.70/hour. Over the course of a year, as many as 36 positions become available. These positions may provide a foundation for advancing to a computer system analyst position. Another natural progression might be advancement into database administration, but this position is not well-represented in the Fort Bragg region.

The next step in this pathway is the computer systems analyst position, requiring a bachelor's degree. At $25/hour, these workers earn well above the regional average, but only about 26 of these positions come available every year.

M. Architecture and Construction Pathway

With significant construction underway at Fort Bragg, the region offers opportunities in related occupations. One career pathway that appears to offer opportunity for career growth is in occupations supporting design and pre-construction activities.

1. Design/Pre-construction

The design/pre-construction pathway is another that has the potential for a wide variety of positions requiring a range of education and experience, but is not well represented in this region. In the region, only three of the ten potential positions in the pathway offer a substantial number of job opportunities each year. The positions that do exist begin with construction and bidding inspectors. This position requires only work experience in a related field. However, with only 11 potential openings

The pathway contains two positions—civil engineers and computer programmers—that require bachelor's degrees. These positions provide 12 and 11 new job openings, respectively, every year. At $28/hour, however, wages are well above the regional average. It is possible for a construction and building inspector to move into a civil engineer position with the acquisition of a bachelor's degree.

IV. Top Defense and Homeland Security Occupations

Thus far in this chapter we have identified over 100 occupations and numerous career pathways as being important to the targeted DHS industries. The present section prioritizes 1) the occupations within each of the Professional and Technical services and Manufacturing and Repair Industry groupings and 2) the KSAs required for each of these occupations.

N. Manufacturing and Repair Knowledge, Skills, and Abilities

This subsection prioritizes the manufacturing and repair occupations that have higher wages and require a more advanced set of KSAs. It is important to note that the expected demand for these jobs—absent any concerted effort to aggressively recruit DHS manufacturing- and repair-related businesses—is expected to decline.

The most highly rated Manufacturing and Repair industry occupations are found within the Production Design, Operations and Maintenance, and Electro-mechanical Installation and Maintenance sub-paths of the Advanced Manufacturing Pathway discussed earlier. These occupations include:

- Electro-mechanical equipment assemblers
- Team assemblers
- Inspectors and testers
- Computer numerically controlled (CNC) equipment operators
- General maintenance and repair workers
- Aircraft components assemblers
- Machinists

None of these jobs require postsecondary degrees, but all require on-the-job training to develop specialized skills. Following is a discussion of the knowledge, skills, and abilities (KSAs) required for each of these critical manufacturing and repair occupations.

Electromechanical equipment assemblers can typically qualify for their jobs with short-term on-the-job training. Workers' success in this occupational category depends to a great degree on their having advanced knowledge in telecommunications, safety, and engineering technologies. Skills required of electromechanical equipment assemblers include a facility for assimilating information, instructing, and coordination. In addition, these jobs normally require finger dexterity.

Team assemblers must have an intermediate level of knowledge of production and mechanical processes. For all other key tasks—tasks such as quality control and equipment selection—workers need only moderate levels of knowledge. Team assemblers must have the ability to assimilate information and give instruction, especially on mechanical equipment, and they must have good oral comprehension abilities. These jobs require one to twelve months of on-the-job training.

Inspectors and testers must possess more advanced KSAs. They need advanced knowledge of production processes and must also have superior aptitudes for tasks like quality control and operations monitoring. They must be able to read and listen well and must possess the ability to

assimilate information and articulate it to others. Inspecting and testing jobs require anywhere from one to twelve months of on-the-job training.

CNC equipment operators must be highly knowledgeable about telecommunications and media-based communications, especially where these are related to information technologies. Operators must have advanced skills in a number of areas: assimilating information—both written and orally presented) and instructing; critical thinking and troubleshooting; equipment maintenance and selection; mathematical calculation; operation monitoring and control; and quality control analysis. Jobs in this category also require superior manual dexterity, control, precision, and quick reaction times; auditory sensitivity; and superior vision and depth perception. These jobs require one to twelve months of on-the-job training.

Maintenance workers represent another of the region's major Manufacturing and Repair occupational categories. These workers must have expert knowledge of telecommunications plus advanced knowledge of foreign languages, mechanics, and engineering technologies. Maintenance workers also need advanced skill levels in a variety of areas: information assimilation—both written and orally presented; instruction; coordination; critical thinking and troubleshooting; equipment maintenance, repair, selection, and installation; and operations monitoring and analysis. Successful maintenance workers must also have advanced abilities in extent flexibility, inductive reasoning, information ordering, multi-limb coordination, oral expression, problem sensitivity, and visualization. Maintenance jobs require one to twelve months of on-the-job training. With increased training, maintenance workers can qualify as industrial machinery mechanics and industrial production managers. Those who acquire an appropriate four-year degree can become eligible for industrial engineering positions.

Aircraft components assemblers must satisfy still more demanding KSA requirements. They must possess advanced telecommunications knowledge as well as a superior skill levels in a number of areas: information assimilation (both written and orally presented), instruction, installation, equipment maintenance, and mathematics. The job also requires finger dexterity as well as flexibility and coordination.

Machinists must have expert knowledge in telecommunications and advanced levels of mechanical systems, engineering, technology, communications, and media. Machinists should have advanced-level skills in operations monitoring. To be successful machinists, workers should also have superior close-up vision and muscle control.

O. Professional and Technical Services Knowledge, Skills, and Abilities

As noted earlier, the second of the two industrial sectors—in addition, that is, to Manufacturing and Repair—most involved in the region's economic initiatives will be the Professional Technical Services sector. The fastest growing high-wage jobs in this sector fall into two broad categories: business management and finance and computer networking technologies. The next two sections will describe the KSAs for these two basic types of Professional Technical Services jobs.

1. Professional Technical Services: Business Management and Finance Jobs

Within the business management area, key occupations include:

- Accounting and auditing
- Management analysis
- General operations management

Accountants must have advanced knowledge—knowledge that is most often acquired via a college degree in finance or accounting—of mathematics and clerical functions, computers, finance law, and customer service. They also must be proficient at a long list of skills: writing, speaking, the assimilation of information— both written and orally delivered; critical thinking, problem solving, decision making, mathematical calculation, persuasion and negotiation, social performance, and operations and system analysis. As with all Professional and Technical Services jobs, accountants must have a good command of the English language. Successful accountants must demonstrate advanced capabilities in several areas: number facility and mathematical reasoning, oral comprehension and expression, written expression and comprehension, information ordering, near vision, problem sensitivity, deductive and inductive reasoning, and flexibility of closure.

Auditors, who must be even more expert in finance and business management than accountants, normally acquire much of their professional knowledge from four-year college degree programs. Knowledge of computers, business management, and human resources is critical to their success. Skills in which they must be proficient include writing, reading, listening, critical thinking, speaking, decision making, and monitoring. They must also have speaking ability; a facility with numbers; the ability to comprehend and relate what they read and hear; and an aptitude for organizing information, thinking "out of the box," and solving problems.

Management analyst jobs typically require a college degree (often in business or a related field) and substantial work experience. Management analysts must be much more knowledgeable than most other workers in this sector—knowledgeable about, for example, customer and personal service, administration and management, computers and electronics, personnel and human resources, education and training, sales and marketing, and economics and accounting. Jobs in this occupational category require superior proficiency at a long list of skills: judgment and decision making, monitoring, coordination, reading and oral comprehension, operations analysis, systems evaluation, critical thinking, quality control analysis, information assimilation, instructing, service orientation, time management, writing, financial resource management, operation and control, troubleshooting, equipment maintenance, installation, persuasion, systems analysis, complex problem solving, learning strategies, negotiation, social performance, material resource management, personnel management, equipment selection, mathematical calculation, operation monitoring, repairing, and technology design. Key abilities required of management analysts include oral expression and comprehension, written comprehension and expression, deductive and inductive reasoning, near vision, information organization, and problem solving.

Operations manager positions, which normally pre-suppose a college degree as well as extensive work experience, require advanced knowledge of customer and personal service, administration and management, personnel and human resources, clerical work, mathematics, computers and electronics, economics and accounting, sales and marketing, education and training, production and processing, and psychology. Key skills that workers in these positions must possess in abundance include monitoring, financial resource management, coordination, reading and listening, time management, speaking and persuading, personnel resource management, judgment and decision making, critical thinking, writing, systems analysis and evaluation, complex problem solving, material resource management, systems evaluation, negotiation, social performance, mathematics, and information assimilation. General operations managers must also have superior ability in such areas as deductive and inductive reasoning, original thinking, problem solving, mathematical reasoning, and information organization.

2. Professional Technical Services: Computer and Networking Occupations

Having examined the KSAs required in business management and finance jobs, let's look at those required of computer and networking workers. These include:

- Computer and support specialists
- Computer systems analysts
- Network and computer system analysts
- Network and computer systems administrators
- Computer programmers
- Computer software engineering systems specialists

Computer support specialists, who typically posses an associate's degree or equivalent college experience, should have expert knowledge of computers, customer service, clerical functions, telecommunications, engineering technology, and education and training. Workers in these occupations also need advanced skill levels in reading and listening comprehension, critical thinking, speaking, and instructing. They should also have advanced-level abilities in near vision, deductive and inductive reasoning, information organization, problem solving, written expression, and visualization.

Computer systems analysts typically hold a bachelor's degree—usually in majors such as computer science, software engineering, or related fields—as well as work experience beyond college. Analyst positions require advanced knowledge of computers and electronics, customer and personal service, systems design, education and training, telecommunications, and mathematics. They must possess skills in a number of areas: time management, quality control analysis, information assimilation, decision making, monitoring, reading and listening with comprehension, complex problem solving, critical thinking, troubleshooting, equipment selection, installation, service orientation, learning strategies, operations analysis, systems analysis, instructing, technology design, writing, systems evaluation, mathematics, social

performance, communication and persuasion, operation monitoring, and repair. Workers must be capable of deductive and inductive reasoning and must have good near-distance vision.

Network systems and data communications analysts normally hold bachelor's degrees—usually in majors such as computer science, software engineering, and related fields—and have work experience beyond college. Analysts must be knowledgeable about customer and personal service, computers and electronics, education and training, telecommunications, engineering and technology, and mathematics. They should (1) be expert at such skills as troubleshooting, solving complex problems, and selecting appropriate equipment; (2) have advanced levels of skill in such areas as reading and listening with comprehension, installation, information assimilation, critical thinking, organization, systems analysis, technology design, systems evaluation, decision making, operations analysis, and instruction; and (3) have strong skills in areas such as the management of material resources, equipment maintenance, operation monitoring, learning strategies, writing, time management, quality control analysis, speaking and persuasion, operation and control, monitoring, repairing, managing financial resources, organizing services, mathematics, and social performance. They should also have the ability to reason deductively and inductively, to understand complicated problems, to think originally and flexibly, and to work with numbers.

Network and computer systems administrators typically are expected to have bachelor's degrees as well as previous experience in their field. They must have expert knowledge of computers and electronics as well as advanced knowledge of such areas as telecommunications, clerical work, administration, and management. Workers in these occupations need advanced-level skills in reading comprehension, critical thinking, information assimilation, instructing, decision making, writing, monitoring, speaking, and problem solving. They also need advanced abilities in deductive and inductive reasoning and information organization.

Computer programming positions require bachelor's degrees in relevant fields and an expert level of knowledge in computers and electronics. They also need advanced knowledge of mathematics and customer service. Programmers should possess expert-level skills in critical thinking, information assimilation, programming, operations analysis, and problem solving as well as advanced-level skills in reading and listening comprehension, learning strategies, troubleshooting, technology design, systems analysis, and coordination. Successful programmers are also skillful at equipment selection, giving instructions, mathematics, writing, monitoring, systems evaluation, speaking and persuasion, installation, time management, and social performance. They must have the ability to organize information and think creatively.

Computer software engineers, who also are required to hold bachelor's degrees, need to have expert-level knowledge of computers and electronics as well as advanced-level knowledge of mathematics, engineering and technology, education and training, design, customer and personal service, telecommunications, clerical tools, communications and media, and administration and management. These workers must be able to demonstrate advanced-level skills in problem solving, assimilating information, critical thinking, troubleshooting, reading, technology design, mathematics, programming, systems analysis, operations analysis, decision making, speaking and listening, coordination, time management, writing, quality control analysis, equipment selection, learning strategies, science, systems evaluation, instructing, operation and control,

installation, monitoring, persuasion, social performance, service orientation, and material resource management. They must also be able to reason deductively and inductively.

V. Summary

The preceding subsections have detailed the key career pathways within the Maintenance and Repair and the Professional Technical Services industrial sectors, the top occupations within those pathways, and the knowledge, skills, and abilities required for performing these jobs. Equipped with this information, planners will be able to determine the extent to which the region's workforce already has the relevant qualifications and to identify areas needing improvement.

While regional employers with whom we spoke indicated that there is a sufficient supply of workers qualified to staff currently existing information technology and engineering-related jobs, they report that increases in the demand for such workers would lead to considerable shortages, especially if economic developers attract DoD contractors recruiting to fill these focal jobs. Given these and similar imminent possibilities, it is crucial that the region's postsecondary institutions examine whether they are offering an adequate number of programs designed to turn out workers qualified for positions such as network and systems analysts, network administrators, and computer support specialists. Business management and finance experts—ranging from administrators to financial and business management analysts—will also be needed to support the region's growing consulting and computing industries.

Finally, if the region is to produce a sufficient number of qualified workers, it will need large numbers of appropriately trained teachers at all educational levels. Trained instructors will also be needed to help produce the greater numbers of maintenance and repair specialists that will be needed to meet the increased demand for their services generated by the increased use of DoD mobile and electronics equipment.