

SKILL STANDARDS FOR

**Wireless**

TELECOMMUNICATIONS





# for more information

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# perspectives from professional organizations

The Global Wireless Education Consortium supports the development of Wireless Skills Standards, coordinated through Seattle Central Community College, North Seattle Community College and Bellevue Community College.

These colleges have proven themselves to be extremely forward thinking in preparing the workforce for the future. GWEC is very excited about the outcomes of the skills standards project. The skills standards represent a timely and excellent response to the growing need for preparing skilled wireless workers. All three schools are remarkable in their partnering and understanding of the labor issues that companies face and have responded by working with the companies in their areas to develop comprehensive programs that meet the real workforce needs of the wireless industry. I cannot imagine a better team to develop the Wireless Skills Standards.

GWEC has participated by providing industry experts to help define the skills standards. Our members include Lucent Technologies, Motorola, Ericsson, AT&T Wireless, Nokia, Midwest Wireless, Nortel Networks, Movilnet, Raytheon, Telcom Global Solutions, Verizon Wireless, IEEE, Cingular Wireless, Agilent Technologies and Telcordia Technologies. These companies have provided a wide range of background for all applicable wireless positions and are very supportive of this effort. Because of the global nature of the industry, the skills standards will play an important role in the growing efforts to establish certification of wireless workers. The wireless skill standards will also be very important to GWEC's continuing efforts to serve as a leader in supporting and promoting the preparation of wireless engineers and technicians through development of on-line curriculum and the development of other wireless curriculum utilizing the "Points of Knowledge."

*Misty C. Baker*  
*Executive Director*  
*Global Wireless Education Consortium*

The Washington Chapter of the American Electronics Association support the development of Wireless Skill Standards funded by the Washington State Board for Community and Technical Colleges and coordinated through Seattle Central Community College, North Seattle Community College and Bellevue Community College.

We believe these standards will be a useful tool for both industry and education as we move into this emerging field of technology. There are multiple benefits that can be derived from Skill Standards for the Wireless industry and its educational partners.

*Terry Byington*  
*Executive Director*  
*American Electronics Association*

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a skill standards expert, conducted local focus groups, analyzed, cross referenced and synthesized reports of numerous focus groups conducted by wireless businesses throughout the United States, led brainstorming and discussion/dialogue sessions with the Steering Committee, contacted participants and helped write and prepare the final document. Special recognition and gratitude goes to the industry members of the *Global Wireless Education Consortium*, and to Ms. Misty Baker, Executive Director of the consortium. Their strong support, sustained interest and expert guidance on the project were invaluable in producing the skill standards. The GWEC Points of Knowledge were an integral part of the development of the “technical knowledge” section of

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- AT&T Wireless Services
- Ericsson
- Nortel
- Lucent Technologies
- Motorola
- Verizon Wireless
- Telecordia Technologies
- Nokia

Finally, we sincerely appreciate the time, efforts and insights that all focus group participants, educational leaders, State Board personnel and business, labor and high school partners provided in creating this important work.

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The focus group participants consisted of frontline workers through first line supervisors in the Wireless field in Washington State. They reviewed the data collected from industry sources, verified it for Washington State, and filled in gaps. Their contribution was extremely important to this work.

Ms. Teri Battstone  
Mr. Richard Harrison  
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### INDUSTRY EXPERTS

The following professionals provided outstanding expert consultation to the Project Coordinator regarding Wireless Skill Standards and invaluable insight into the data provided by industry:

Dr. Vasilis Polychronidis, Instructor, Seattle Central Community College

Steve Alarcon, RTAC Operations Manager, Network and Customer Operations  
Wireless Local Technology Group, AT&T

# the wireless skill standards project outcomes

Following are the outcomes of Wireless Telecommunications Skill Standards, as determined by the partnership:

Skill standards needed for wireless telecommunications careers consistent with the current and future needs of the public and business.

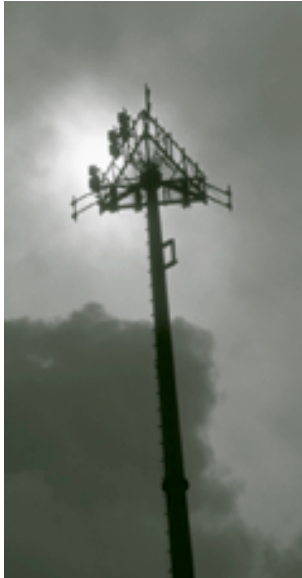
Verification of national standards by Washington State workers.

A report for manufacturers and educators showing the standards and the data that supported those standards.

## NEXT STEPS

The completion of the skill standards represents phase one of this endeavor. The next step is to provide oversight to the development of assessments and a curriculum model based on the skill standards. This is a cooperative and collaborative project with wireless telecommunications employers, labor unions, high schools and colleges throughout the state.

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# executive summary

The wireless telecommunications industry is in the middle of phenomenal growth. As technology advances, especially the Internet, the need for a qualified workforce in this dynamic market will become more critical. According to the results of two research studies conducted by the International Engineering Consortium (IEC) in 1997, the "wireless revolution" is a global phenomenon. No other services will grow as rapidly in either the United States or worldwide. In 1996, there were less than 40,000 cell sites in the U.S. By the end of this year, that number is expected to

grow by 300%. It is estimated that by 2005, the market penetration of wireless products and services will approach or exceed 50%. Meanwhile, the market penetration in Europe, Asia and other parts of the world will probably be closer to 80% by the year 2005. Most recently, the integration of the Internet and wireless telecommunications technology has significantly advanced both the sophistication and the complexity of wireless services, products and operations. The growing convergence of wireless telecommunications, information technology and media technology has resulted in a correspondingly dramatic shift in the type of skill sets required for productive work in the industry. It is estimated that by the year 2005, 350,000 RF (Radio Frequency) engineers, technicians and related personnel will be needed in the U.S. to meet the demand for a qualified workforce for the wireless industry. Likewise, as developments in digital technologies and other new telecommunications technologies escalate, expectations for individuals entering the diverse and dynamic wireless work world will also increase. Workers must be prepared for a new industry (dubbed "Infocom" by the Global Wireless Education Consortium) that links

***"Education  
 is the  
 foundation  
 of the new  
 economy."***

***Larry Borgman,  
 Intel Corporation***

wireless communications, networking, the Internet, E-commerce and M-commerce. Labor has joined business in stressing the importance of the development of skill standards for the wireless industry. The wireless skill standards project fits well with the goal of organized labor to putting qualified individuals to work in high wage/high skill/high demand occupational areas. Jennifer Snyder of the Worker Center/AFL-CIO wrote in her letter of support for the project the following: *"Benefits that can be derived from a set of skill standards developed through our partnership of education, labor and business include more effective training methods and increased communication between industry and education. Especially since this technology reflects a growing sector of our economy, we look forward to Skill Standards for the Wireless industry which includes the worker's voice as a fundamental element of performance skill."* (Excerpt from Jennifer Snyder's support letter accompanying the Wireless Skill Standards Project proposal, dated March 23, 1999)

## NEEDED: SKILLED AND QUALIFIED WORKERS

There are two significant drivers of the new economy: information and knowledge. In fact, it is safe to say that the new economy is an information and knowledge economy. Its future depends, however, not on the technological wonders that may be designed, produced or distributed, but on the skills and ingenuity of its human capital. While the U.S. can boast of its many achievements within this new (information and knowledge) economy in terms of wealth, productivity and global presence, an interesting irony exists. Many work opportunities have been created by the high technology explosion, but severe manpower shortages continue to stymie the advancement of

businesses and industries in achieving maximum performance and in maintaining a competitive edge in both a local and a global economy.

The wireless communications industry, as with other IT industries, is experiencing phenomenal growth, but cannot find a workforce with the unique RF skill sets necessary to fill the work slots. Simply stated, the U.S. is experiencing a *skilled worker* crisis. Many individuals are available for work but lack both the technical and essential basic skills needed for employment in the highly sophisticated and complex work environments of high tech and high tech-related industries. There simply are not enough skilled and qualified workers to meet the needs of industry. Added to the problem of the wireless industry growth is the fact that a significant number of highly skilled workers with substantial tenure in the workplace have reached retirement age. Their exodus from the job market in the next two to three years will dramatically accentuate the skilled/experienced worker supply gap. This situation means that there will be an even more pronounced shortage of qualified workers who are prepared to fill current vacancies or newly-created job openings and who are able to manufacture, produce, implement or develop wireless networks and wireless systems.

### THE GLOBAL WIRELESS EDUCATION CONSORTIUM

No wonder, then, that the task of finding skilled workers for this field has become the number one priority of wireless businesses. The need to address this priority has served as the motivation for wireless companies in the U.S., Canada, Europe and South America to form the *Global Wireless Education Consortium, or GWEC*. GWEC is a collaborative organization representing the wireless industry and higher education. Its mission is: *"To increase worldwide the quality and quantity of technicians, engineers and IT specialists for the providers of wireless technologies."* In the process, the quality of educational programs will be enhanced and the skill level of graduates raised to that which meets global industry standards. The companies have agreed to put aside normal competitiveness to collaborate with each other and to partner with two and four-year educational institutions to ensure a qualified workforce for the wireless industry. In 1997, Jerry Dotson, former AT&T Wireless Executive and co-founder of GWEC, stated, *"There are very few examples of an entire industry—especially one as competitive as wireless—getting together to train the next generation of workers...But we are competing against other emerging fields for a limited talent pool, so we decided we'd better do something a little out of the ordinary."* (Quote taken from an article on Management Strategies in the November 1997 issue of the Wireless magazine).

GWEC was established in 1997 and has grown to a current roster of fourteen industry members, one affiliate and 50 two and four-year educational partners. By working as a consortium, these wireless companies can enhance the investments they are making in local and global educational partnerships by directly affecting curriculum and program development. They can be assured of graduates who are better prepared to enter the workforce; thus reducing on-the-job training time and the level of expenditures needed to make new employees productive. GWEC has emerged as a national model for the kind of *collaborative* liaisons business, labor and education will need to formulate in the 21<sup>st</sup> century to effectively solve the problems of critical shortages in skilled and qualified workers. Through GWEC's initiatives, industry members will draw employees from a consistently larger group of candidates who are trained in *wireless technology*, and who enter the workforce with strong work-related (soft) skills as well as a strong RF foundation. GWEC encourages the establishment of high-quality training programs by: 1) serving as a resource center; 2) by pledging financial support to educational institutions; 3) through active involvement in curriculum development; 4) maintaining a structured internship program; 5) making industry-developed

courseware and learning materials available to educational institutions; 6) sponsoring faculty development and training; and 7) providing first-hand information on current and emerging technology. The consortium helps institutions remain on the cutting edge, thus further assuring the preparation of a workforce with current skills and abilities.

### THE IMPORTANCE OF WIRELESS SKILL STANDARDS

Developing and implementing strong educational programs are essential steps to take toward affirmatively responding to the shortage of qualified workers for the wireless industry. Community and technical colleges have an enviable opportunity to respond quickly and creatively to wireless manpower supply gaps and manpower shortages. Key to this effort, however, is the necessity to identify core skills and knowledge bases for technicians and engineers. Merely training individuals is not a sufficient response to the need for skilled workers. Achieving consistently high levels of quality both in product and in productivity is an imperative in all sectors of the wireless industry. This realization in turn underscores the need for industry-driven standards for the skill development of workers. For Seattle Central Community College, North Seattle Community College, Bellevue Community College and their industry and labor partners, identifying generic skills and requisite and unique wireless skills and abilities through the skill standards process is tantamount to the task of developing educational programs that prepare individuals for the wireless workplace. The wireless skill standards have been developed at a critical time—significant changes in local and global wireless technology require clearly articulated standards for both product and employee performance. The outcome of this process is critical to the ability of companies to hire and retain excellent RF talent in a highly competitive market. Both industry and labor recognize the importance of clearly articulated universal skills as a basis for the preparation of qualified and competent workers for the industry, and they will be the ultimate beneficiaries of the results of the wireless skill standards project.

### BUILDING UPON PRIOR COLLABORATIONS: THE GWEC POINTS OF KNOWLEDGE

The Wireless Skill Standards Project builds upon prior work accomplished through the collaboration of GWEC and two and four-year educational institutions. That collaboration has produced a core set of competencies and areas of knowledge that are endorsed by the wireless industry and that provide a uniform and relevant theoretical context for future curriculum development based on the skill standards.

The Points of Knowledge articulate information and learning experience content for two-year and four-year wireless focused curricula. GWEC realized early on in its developmental stages that schools needed flexibility as well as direction in designing curricula that would be responsive to the needs of the industry yet remain pedagogically sound and meet high academic standards. To address this realization, the theoretical points of knowledge were developed jointly by industry and education representatives. When linked with the skill standards, these two educational elements constitute the primary tools for laying out a blueprint for the development of curriculum and assessment models for wireless education. The Points of Knowledge are divided into the following “knowledge” categories:

- Basic Skills – specific to or within the context of Wireless Communications, i.e., written/verbal communication, computation, computer literacy, business/economic systems, human relations, teamwork, work ethics
- Radio Transmission – RF Theory
- Switch/Basic Data Communications
- Switch/Basic Switching Systems

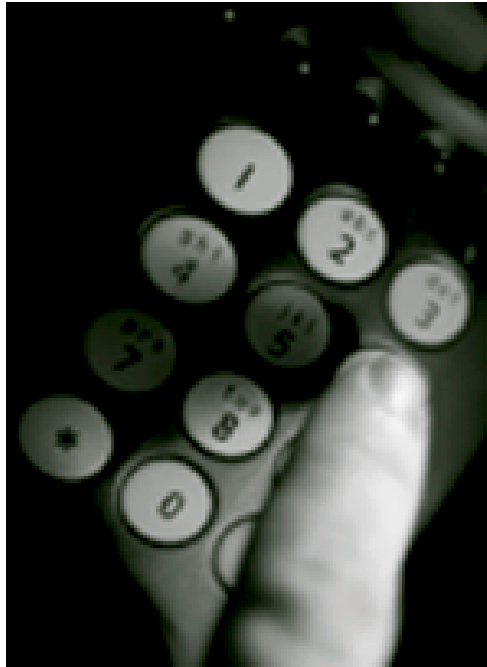
- Transmission and Trunking
- Switch/Basic Telephony Systems
- Switch/Reuse and Planning
- Switch/Basic Data Networks
- Communications Circuit Design
- Air Interface Technologies
- RF Propagation
- Digital Voice Coding
- Microwave Systems
- Power Plant
- Test Tools/Equipment Software
- Regulatory/Standards/Conventions
- Health and Safety
- Electromagnetic Compatibility (EMC)

These categories have further been delineated according to theoretical and/or conceptual depth and breadth appropriate to the two-year or four-year educational level. The Points of Knowledge provide the framework for organizing content around a theoretical foundation that is, in turn, essential to informed, skilled performance on the part of workers. The skill standards, on the other hand, reference those critical tasks and functions expected of workers and that require a high level of application of theories and principles to work performed on the job. The new economy workplace demands workers who not only “know” or “know how-to,” but who can also adroitly translate knowledge and “know-how” into skilled, effective, efficient work performance—performance that in turn meets industry standards and expectations. Through the skill standards process and the development of the Points of Knowledge, industry has played a major role in identifying key theoretical content areas, key tasks and functions of wireless workers and the associated indicators of quality. The outcomes of these two processes constitute a uniquely balanced and creative approach to curriculum/program development and to effective training and preparation of wireless communications technicians.

## A DYNAMIC INDUSTRY

The skill standards outlined in the two occupational concentrations represent the most current thinking of technicians, engineers and other key wireless workers. We realize, however, that technological advancements in wireless telecommunications and in IT in general continue to arrive on the “information horizon” at a dizzying pace. The wireless industry is extremely dynamic. It is important that ongoing changes, improvements and updates be made in any skill standards document in order to maintain currency and responsiveness to the workforce needs of companies. There are new roles and career opportunities for graduates of two-year programs emerging as the industry continues to build its workforce and respond to the demands of a widening and more demanding consumer market. For example, the field of design and development has traditionally utilized graduates of four-year programs. In the near future, however, technicians will carry out many design and development functions. The growing global nature of the wireless communications market points to an eventual demand for highly mobile technicians and engineers who possess skills and knowledge that enable them to pursue careers and job opportunities occurring outside the continental United States. These kinds of developments will mean a “return to the drawing board” to identify new and/or additional occupational clusters and the related skill standards. Higher education institutions and the wireless industry face the constant challenge of preparing individuals for a future that does not yet exist, but will eventually become reality!

These realizations also present a challenge to the skill standards process itself. In light of the dynamic nature of the wireless communications industry, the Wireless Skill Standards Project Steering Committee has stressed the importance of maintaining a broad, flexible, global perspective in the development of skill standards. They see useable skill standards as being those that are linked more closely to functions and market expectations and/or industry protocol rather than to specific job titles. Further, the committee has emphasized the need for frequent and on-going re-examination of occupational clusters, identified tasks and functions, required knowledge and related employability skills—as well as a constant review and evaluation of curriculum.



It is expected that these skill standards will serve as a stimulus for the creative, collaborative development of wireless curricula in secondary and post secondary educational institutions. In fact, Phase II, the design of a model for articulated curriculum and assessment is already underway. Further, it is anticipated that, using the GWEC model as a guide to collaboration, educational institutions, labor and local wireless companies will utilize the skill standards to develop consistent and practical methods of preparing, recruiting and retaining skilled wireless communications workers. The skill standards presented here represent an effective quality mechanism by which institutions can ensure an educated workforce whose skills, knowledge and abilities are appropriately and accurately matched—as well as keep pace with— current and emerging needs of the wireless industry.

Three things are clear: The IT/wireless industry impacts virtually every other business and industry in the new economy. Skilled workers make a difference in the ability of a company to remain productive and competitive. Likewise, a literate, well-educated and highly skilled society makes a difference in the ability of an economy to remain strong and stable over time. The skill standards project represents a timely strategy for recruiting and building a strong wireless workforce that can contribute to both the growth and prosperity of the wireless industry and the growth and prosperity of the new economy.

### TRENDS IN WIRELESS COMMUNICATIONS TECHNOLOGY

Wireless communications has evolved from a hand-held cellular device, used only by an elite segment of the population, to a complex system of voice and data transmission for personal, business and industrial use. It is estimated that there will be one billion mobile consumers by the year 2002. Competition will be fierce among many companies that have a stake in the market. The almost exponential rate of increase in the demand for wireless services and products challenges industries to work together to overcome marketplace, regulatory and technical barriers. Some of these challenges include: 1) intense global competition to capture the same consumer base; 2) complex technological requirements; 3) regulatory requirements and standards that currently vary from nation to nation.

#### ***From Evolution to Revolution***

The evolution of the wireless industry has been relatively short. In less than 30 years, wireless transmission has expanded to include data transmission. Wireless technologies have been able to benefit from the simultaneous increase in network bandwidth and the decrease in hardware costs. Although the U.S. is still behind Europe and Asia in market penetration and in product

development, there is a trend away from the traditional “circuit switching” networks towards “packet switching” networks. The sharp improvement in network capability has facilitated the transmission of significant amounts of data over wireless networks. The evolution from “second generation” networks to “third generation (3G)” networks will mark the beginning of a dominance of data transmission over voice. Users will then be fully able to access data from remote locations. This rapid advance of technology has revolutionized the old “cell phone.” In fact, one could accurately say, “it’s not about phones anymore!”

First, emerging network and client interface standards, such as the Wireless Application Protocol (WAP) and Bluetooth in the U.S., GSM in Europe and iMode in Japan, have enabled software providers to design their offerings with certain platforms in mind. While no consensus has been reached on global standards acceptable to all countries, these standards constitute a perspective from which negotiations on universal standards and applications can proceed. One phenomenon driving technological developments in wireless communications is the increase in the mobility of the workforce, both domestically and globally. As the workforce mobility increases, the demand for a highly developed remote access communication network also increases. Conversely, as wireless communications improves the ability of synchronous/asynchronous communication and transmission of data to occur, the greater the incentive for encouraging and maintaining a highly mobile workforce. Hence, telecommuting, customer service accessed and delivered remotely, and users of cellular phones and PDA's among the population at large and professionals are becoming a way of life in business and industry.

Secondly, many telecommunications (wireline) carriers are actively promoting both low and high-end wireless services in an effort to boost marketability by adding value and differentiating features to their service offerings. As the Internet and web-based technology become more essential for, and integral to, personal and industrial transactions and person-to-person communication, local and long-distance phone services are becoming less profitable. Telecommunication companies have a strong desire to offer specialized, value-added wireless services (all-in-one packages, including Internet connections). Most recently, two companies, AT&T and Verizon have launched such initiatives.

In responding to the explosion of technological advancements in networks and bandwidth, a number of diverse players from information technology and telecommunications industries have merged as well as realigned their offerings to incorporate software applications for wireless communications, the Internet and wireless (RF) technology. This “convergence” of diverse technology providers and producers is still underway. Major players fall into five general categories:

1. Wireless Carriers and Internet Service Providers, such as AT&T, Verizon, WorldCom, OmniSky and GoAmerica.
2. Mobile/wireless device vendors, such as Motorola, Nokia, and Ericsson
3. Software providers, including traditional vendors such as Microsoft and Oracle.
4. Content aggregators, including wireless specialists such as i3 Mobile and Internet pioneers such as Yahoo!
5. Wireless Application Service Providers (WASP's) who encompass companies and consultants that concentrate on broad-based and specific wireless applications and data solutions.

As the interest in web-enabled wireless phones grows, the need for a speedy and reliable wireless communications system that enables the user to access, download and transmit data, access e-

mail and the Internet and/or conduct e-business will continue to push the industry forward at revolutionary speed.

The evolution of the Internet has become the underlying force behind wireless technology, as the market shifts from mainframe and client/server-based computing architectures to Internet-based architectures. The importance of network bandwidth is underscored as this shift takes place. Wireless communications has truly emerged as an “Infocom” industry. Preparing a workforce that is skilled and able to work productively in this dynamic market is an essential strategy for boosting the ability of the wireless industry to remain competitive and on the leading edge of technology, and able to meet the challenges of the wireless communications explosion.



# wireless skill standards project goals, guiding principles and methodology

## GOALS

- Identify voluntary skill standards for Wireless Telecommunications. The standards will serve as benchmarks for entry into wireless telecommunications careers at the technician level.
- Disseminate the results and support their use by educators, businesses, unions, students, workers, and government agencies.

## GUIDING PRINCIPLES

- Experienced workers are the experts in their career field and are best able to identify the work performed and the skills, knowledge, and abilities required to be successful.
- Business, labor and education must work as partners to ensure the link between the work expectations and the curriculum.
- The standards must be consistent with existing civil rights laws and practices.
- Standards must be flexible and portable, and should be updated continuously.
- Skill standards describe the major functions and key activities, as well as the performance indicators, technical knowledge and skills, and employability skills and personal attributes needed to succeed in the workplace.
- Integrated skill standards define work duties and the skills required to perform them in the context of work settings.

The experience of the partners involved in this project holds that the success of any skill standards project is critically linked to the full participation and commitment of all partners.

## IDENTIFICATION OF SKILL STANDARDS: RESEARCH METHODOLOGY

Voluntary skill standards were developed using specific research-based processes. This project followed the process required by the Washington State Board for Community and Technical Colleges (SBCTC) as prescribed in *Skill Standards Guidebook I*, RoseAnn Stevenson, Washington State Board for Community and Technical Colleges, 1996 and through policies and procedures provided by the SBCTC.

The Steering Committee was formed in the fall of 1998, in response to the desire of industry to address the ever-widening shortfall in skilled workers in wireless telecommunications. It was comprised of industry and education representatives. Funds were granted this project by the State Board for Community and Technical Colleges, through Federal School-to-Work funding, to conduct a skill standards study. Funds were awarded to Seattle Central Community College for project management, and the committee began development of standards for wireless telecommunications.

An initial draft of the skill standards (critical work functions, key activities, performance indicators, and occupational and technical knowledge and skills) was created using existing research and skills analyses that were originally created by Wireless Telecommunication companies and organizations. This existing research was reviewed and analyzed by a panel of experts and competent workers and collated into a set of final skill standards.

The project team identified organizations from the steering committee and the Global Wireless Education Consortium (GWEC) to develop a sampling frame and solicit research from small, medium and large companies in the industry. The research data was required to meet certain criteria to be selected. These criteria include:

- The data were developed or updated within the past 18 months.
- The data were professionally developed.
- The data were derived from workers and first line supervisors.
- The data were obtained from high performance workplace organizations.
- The data has been validated within the contributing organization.

The project team gathered existing skill standards, job analyses, needs analyses, skill and knowledge lists, job descriptions and competency models that were developed for the IT-Telecom sector and concentrations. Sources of these data are, for example, content validation studies, skill standards, and training needs analyses performed by members of the steering committee and GWEC such as AT&T, GTE (Verizon), Nokia, and Motorola.

The data was then collated and analyzed by the skill standards expert, Terryll Bailey and placed into the Washington State skill standards format. A Review Panel of subject matter experts was convened to:

- Fill in gaps
- Clarify the organization and structure of the data
- Confirm the accuracy of the data
- Verify the skill standards for wireless telecommunications in Washington State

A structured process was used to guide the review panel through the revision of the draft standards. They were encouraged to edit the draft as they see fit and to edit the research aggressively to avoid “rubber stamping. The process included the following elements:

- Reviewers were facilitated by a professional skill standards focus group leader.
- Participants received an orientation to skill standards. Examples were provided.
- Participants reviewed the draft standards critical work functions, performance indicators, occupational technical skills and academic and employability skills compiled by the skill standards expert. Gaps and inconsistencies noted by the review panel were addressed.

In addition, a survey of SCAN skills and personal qualities for wireless careers was conducted. SCANS (Secretary’s Commission on Achieving Necessary skills) are foundation abilities required of workers in all occupations at varying levels specific to their jobs. Surveys were distributed to and results from the survey were compiled. These results are found on pages 19 and 20.

Because the raw industry data had already been validated, and the purpose of this process was to verify the national data for Washington State, further validation for this state was not necessary. The results of the review panel, surveys and feedback were compiled, and a draft of the document was reviewed by the Steering Committee and GWEC.

# a national context for skill standards

The National Skill Standards Board was established by Congress in 1994 to encourage the creation and adoption of a national system of voluntary skill standards that would enhance the ability of the United States to compete effectively in a global economy. Several voluntary skill standards projects have been developed by various industries in full partnership with education, labor and community-based organizations. The intent is to have voluntary skill standards that are flexible, portable and continuously updated and improved.

## WHAT ARE SKILL STANDARDS?

Skill standards are performance specifications that identify the knowledge, skills and abilities an individual needs to succeed in the workplace. They are critical to improving workforce skills, raising living standards and improving the competitiveness of the U.S. economy. To be effective, skill standards must reflect the consensus of wireless telecommunications professionals.

Skill standards provide measurable benchmarks of skill and performance achievement. They answer two critical questions: What do workers need to know and be able to do to succeed in today's workplace? And, how do we know when workers are performing well? Without this fundamental information, employers do not know whom to hire or where to focus their limited training dollars; employees and new entrants to the workforce do not know what they need to do to improve their performance; and educators do not know how to prepare students for the challenge of the workplace.

Voluntary, industry based skill standards should be:

Responsive to changing work organizations, technologies and market structure.

Benchmarked to world-class levels of industry performance and free from gender, racial or other forms of bias.

Tied to measurable, competency-based outcomes that can be readily assessed.

Inclusive of basic reading, writing and critical thinking skills.

Useful for qualifying new hires and continuously upgrading employees' skills.

Applicable to a wide variety of education and training providers, both work and school-based.

Based on a relatively simple structure to make the system user-friendly.

A cooperative effort among all stakeholders.

Developed independently of any single training/education provider or type of education/training provider.

*National Alliance of Business*

## WHY ARE SKILL STANDARDS IMPORTANT?

In today's workplaces, the only constant is change. Jobs that once were relatively simple now require high performance work processes and enhanced skills. Because skill standards reflect changing workplace realities, they become a tool which can be used by applicants and employees to access greater career opportunities.

National recognition of skill standards in career fields provides a common basis for certifying achievement against those standards, thereby allowing for the portability of skills across geographic areas, companies and careers.

Updating skills and knowledge is now a lifelong endeavor, causing many employers and employees to spend more effort, time and money on education and training. Skill standards provide benchmarks for making education and training decisions, shaping curricula, and directing funds toward highest value education and training investments.

## THE BENEFITS AND USES OF SKILL STANDARDS

Skill standards benefit all the stakeholders — business, labor, educators, government and the community. The success of a skill standards development project and its usefulness to the community is dependent on the full participation and commitment of all stakeholders. These benefits can be used as a benchmark for evaluating the effectiveness of collaborative efforts.

## HOW SKILL STANDARDS BENEFIT EMPLOYERS

Employers can use skill standards to establish personnel qualification requirements. Interviews, performance reviews, and productivity can be evaluated and assessed to a higher degree of accuracy and efficacy. Employers are also able to identify core competencies, workers' abilities to demonstrate competencies and to match competencies to critical work functions and key activities to significantly improve efficiencies and productivity. Performance based skill standards also provide a vehicle for varying degrees of job certain and the ability to structure competency based pay scales. In addition, employers use skill standards to:

- Align personnel qualification requirements with nationally adopted certificates of competence.
- Modify employee training.
- Simplify measurement of employee training effectiveness.
- Assess employee skill levels based on industry standards.
- Match employee skills to the work needed.
- More easily document employee skills, training needs, and performance criteria.
- Improve consumer satisfaction and confidence through better developed evaluation skills of customer contact personnel.
- Improve employee satisfaction and morale by clarifying expectations.
- Improve quality, productivity, time to market and competitiveness.
- Achieve their business goals.
- Partner with education and labor in developing school-to-work initiatives.

## HOW SKILL STANDARDS BENEFIT EDUCATORS

Educators can identify core competencies and assessments based on the skill standards and implement them in their curriculums. Students can then be required to demonstrate competency throughout their coursework. Academia and industry can build a cohesive relationship through a like-minded expectation of student competencies and work readiness. This enhances an instructor's ability to present information consistent with industry's entry level expectations and

needs. In addition, educators use skill standards to:

- Partner with business and labor in developing school-to-work initiatives.
- Provide effective, targeted instruction.
- Develop benchmarks for certificates of competence earned by students.
- Communicate what companies expect of employees.
- Develop new and evaluate existing curriculum and programs based on industry needs.
- Develop assessments to evaluate skills, knowledge and abilities in classrooms and internships.
- Develop a common language on workforce preparation with business and labor.
- Improve relationships with local businesses, labor unions, other educators and agencies.
- Provide students with relevant career education and counseling.

### HOW SKILL STANDARDS BENEFIT LABOR UNIONS

Labor unions can use skill standards to gain support for company-sponsored worker training programs and to identify career paths for workers within companies and industries. Unions can provide this information to union members and develop strategies to improve career mobility and stability.

- Improve member value to company.
- Provide a greater worker voice in the company.
- Link skill standards to increased training and upward career mobility for union members.
- Assist employers to match employee skills to the work needed.
- Develop skills-based training and certification initiatives that complement union apprenticeship programs.
- Communicate effectively with employers about worker training and retraining needs.
- Cooperate with education and industry developing school-to-work initiatives.

### HOW SKILL STANDARDS BENEFIT STUDENTS AND WORKERS

Skill standards assist students in making career choices by providing industry expectations for success in the workplace. In addition, standards-based curriculum and assessments provide students with credentials that certify work-readiness. Work-ready students can anticipate being hired at higher rates of pay and can experience faster advancement in their chosen fields. Workers can accurately assess their skills against those required for career advancement and plan effectively for their career pathways. They can determine the skills and abilities needed for advancement or transfer within industries, and determine the continuous learning and training they need to upgrade their skills. In addition, students and workers can use skill standards to:

- Achieve clarity regarding what they are expected to learn and how to prepare for work.
- Enter and reenter the workforce with better control of their choices of high skilled and high paying jobs.
- Accurately assess business expectations of the skills needed for positions and careers of their choice.
- Improve mobility and portability of their credentials.
- Obtain certification of competence of the skills they gain through experience, school, training or self-study.
- Enhance their performance and achievement by self evaluation against known standards.
- Be active contributors to the activities that make their organizations successful.

## HOW SKILL STANDARDS BENEFIT GOVERNMENT

Government can provide information that will ensure a better skill match between workers and employers and initiate education reform to better educate future members of the workforce. Skill standards better enable agencies to provide options for career and job mobility and link learning to the needs of the workplace. In addition, government can use skill standards to:

- Assist in the development of a highly skilled, high-quality and competitive workforce and industry base.
- Evaluate the effectiveness of publicly funded education and training.
- Increase opportunities for under-represented populations by making public the information that defines the skills required for success and by facilitating the national adoption of those definitions and their use.
- Support the creation of high performance organizations where they improve living standards for all members of the population.
- Facilitate collaboration between educators and industry.
- Communicate the need and basis for education reform to business, education, labor and the community at large both on local and national levels.

# skill standards to curriculum: a continuous development process

It is anticipated that the skill standards generated in this project will be used by its education partners to develop or modify curriculum at the high school and community college level. By providing the necessary input from industry, this skill standards document is a first step in curriculum development. The goal is that it serves the manufacturing industry in particular and is received as an example of what can be done across industries.

In order to keep current with a rapidly changing workplace, standards need to be reevaluated and updated on a regular basis, with full partner participation at each step. New technological developments impact the ways that workers organize and apply their skills, including time management and interpersonal relationships. Increased technological complexity may simplify some of the job tasks but make others more intricate, or make others obsolete. Today's wireless telecommunications workers are asked to acquire a broader range of decision making and customer service skills as well as keeping current with emerging technologies. Ongoing changes like these must be reflected in curriculum in order to meet the needs of industry, where expectations for workers are evolving.

# A Model of Continuous Improvement for Economic Development: Using Skill Standards

## STEP 1: SKILL STANDARDS IDENTIFICATION

- Compile and research existing standards in related jobs and careers
- Conduct focus groups to identify critical work functions and key activities, define key activity performance indicators, and identify technical knowledge, foundation skills and personal qualities.
- Conduct a survey of current workers to determine level of SCANS skills required for the job.
- Develop work-related scenarios to place the skill standards in the context of the work environment.
- Validate the data gathered from the focus group.
- Disseminate skill standards information to involved parties from industry, education and labor for their review and editing.

## STEP 2: ASSESSMENT

- Industry and education collaborate to develop assessments that reflect competent performance as defined by the skill standards.
- A person generates and collects evidence of his or her ability to perform at the levels determined by the skill standards.
- A student, trainee, apprentice, prospective worker or worker seeking additional training is assessed to determine present skill level through direct and indirect evidence.
- Direct evidence includes products and items produced by the person who is assessed.
- Indirect evidence includes supporting information.
- Assessment results meet the criteria of validity, currency, authenticity and sufficiency.
- Demonstration of validity is a tangible item or record of action.
- Demonstration of authenticity shows that the item or specific piece of a team-effort is produced by the individual being assessed.
- Demonstration of sufficiency provides enough evidence to match key tasks and performance criteria of the skill standards.

## STEP 3: CURRICULUM DEVELOPMENT

- Identify necessary competencies based on the skill standards information and assessments.
- Develop program outcomes for specific academic and training programs, including Tech Prep, 2-year and apprenticeship programs.
- Perform gap analysis to determine changes or additions to be made to curriculum.
- Revise existing curriculum to better meet the current and future needs of the industry.
- Develop new curriculum and establish new programs based on these competencies.

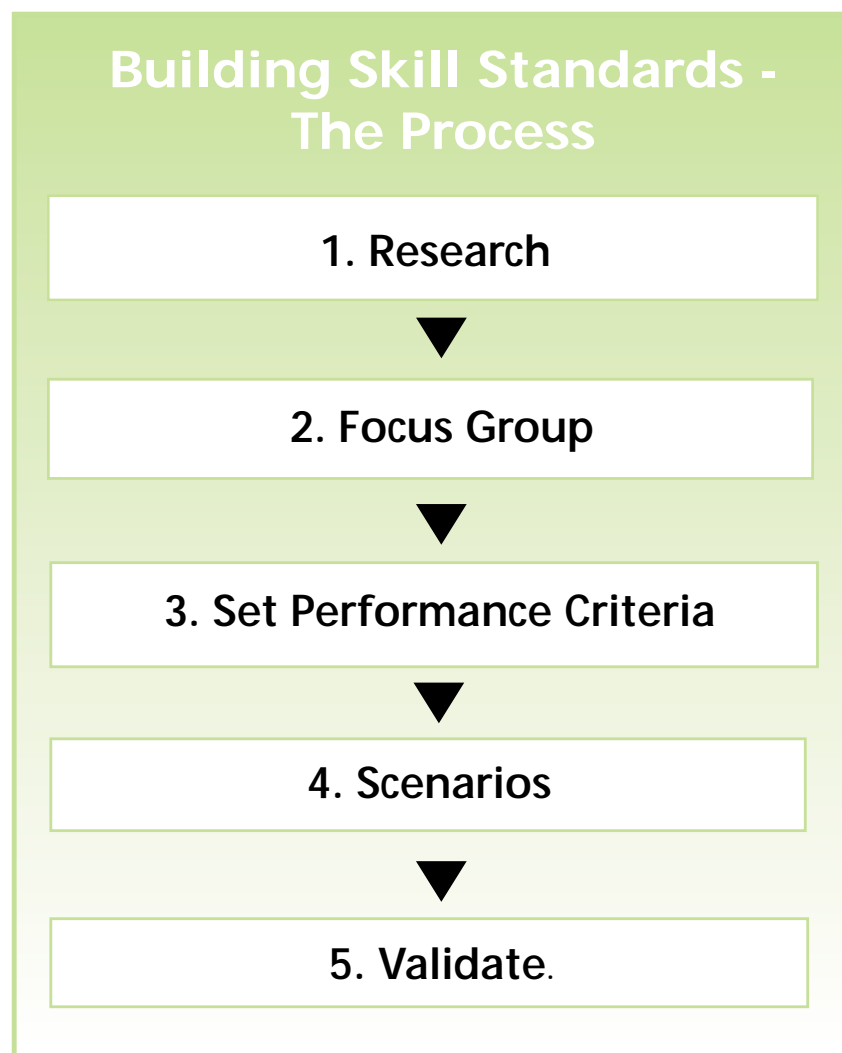
#### STEP 4: ARTICULATION

- Develop models to support the articulation of program outcomes and competencies between academic and training systems.
- Establish articulation agreements between existing programs to ensure portability of skills
- Connect competencies and Certificates of Competence with benchmark documentation to build national portability systems.

#### A CONTINUOUS UPDATING PROCESS

A continuous exercise by all partners of revising and verifying skill standards on a regular basis is necessary. Updating of curriculum and current training methods to meet workplace standards is required for success in national economic development.

Individual workers must have access to clearly stated competency goals and direct access to skill development assistance. With cooperative effort on local and national levels, we can begin to resolve the workforce shortages in the Wireless Telecommunications industry that face us today.



# pyramid of competencies

The Pyramid of Competencies is a depiction of skill standards in three broad skill categories.

## Tier I

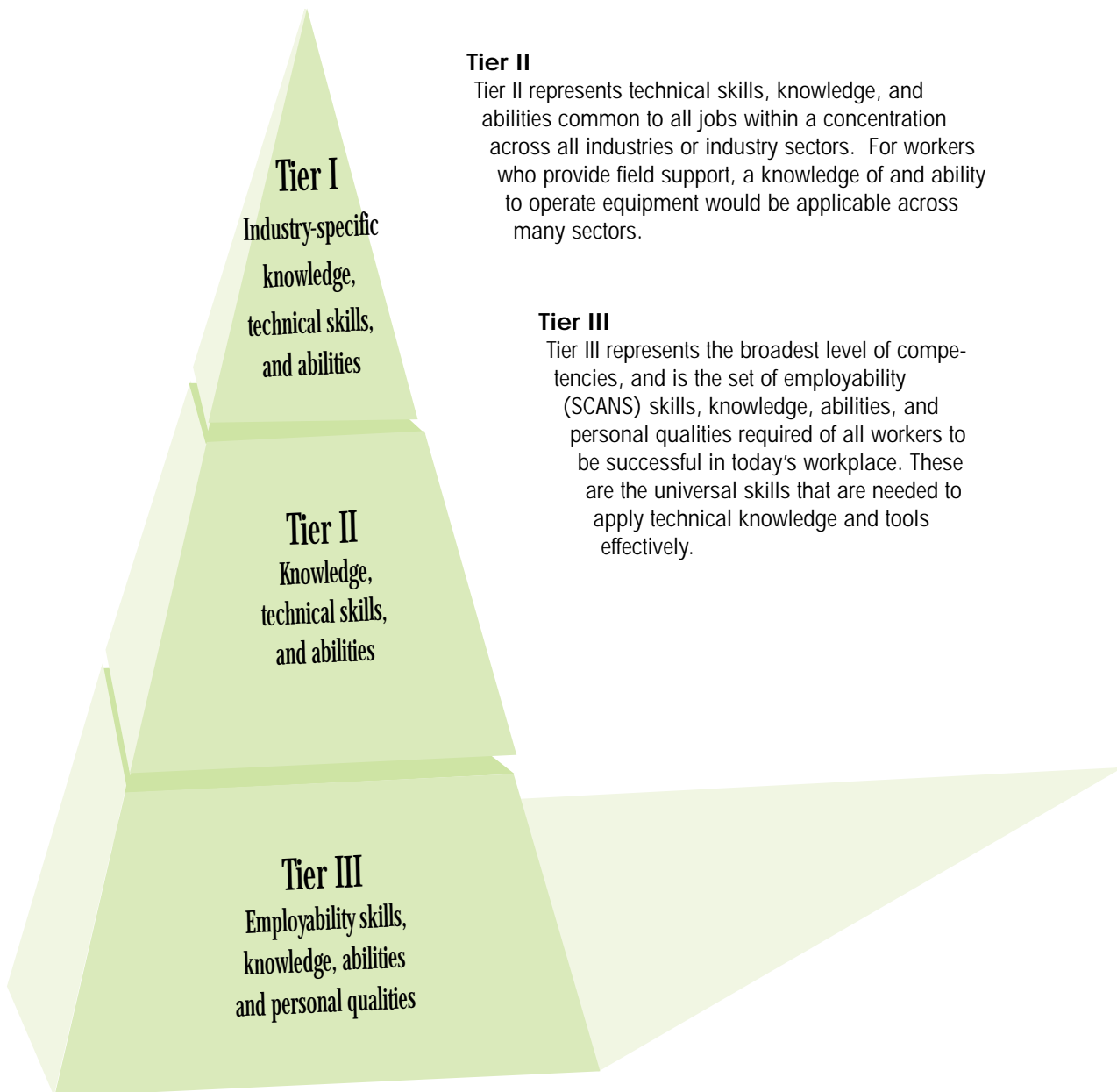
Tier I represents industry-specific technical skills, knowledge, and abilities that are unique to individual jobs or clusters and are the most prone to rapid change. For example, many workers need to upgrade their skills based on sudden market shifts.

## Tier II

Tier II represents technical skills, knowledge, and abilities common to all jobs within a concentration across all industries or industry sectors. For workers who provide field support, a knowledge of and ability to operate equipment would be applicable across many sectors.

## Tier III

Tier III represents the broadest level of competencies, and is the set of employability (SCANS) skills, knowledge, abilities, and personal qualities required of all workers to be successful in today's workplace. These are the universal skills that are needed to apply technical knowledge and tools effectively.



# employability skills: scan profiles

During the data-gathering process of this project, employability skills for wireless telecommunications careers were identified. Employability, or workplace skills are basic academic and foundation skills needed to build more advanced competencies. The foundation skills are based on broad workplace categories, known as SCANS (Secretary's Commission on Achieving Necessary Skills, U.S. Department of Labor). This federal report issued in 1991 identifies 37 foundation and workplace competencies required for work readiness.

SCANS is comprised of a three-part foundation of skills and personal qualities and five workplace competencies needed for successful job performance in today's workforce: Professionals currently working in the field were asked to identify the level of difficulty for each of the 37 SCAN skills which is most required for successful workplace performance in each cluster. The information in the charts on the following pages was compiled by taking a weighted average of the responses across the cluster. This summary information provides a general view of the key workplace skills deemed relevant and necessary for the front line worker in wireless telecommunications as well as providing the foundation for the employability skills within the skill standards.

### ***Basic skills***

Reading  
 Writing  
 Arithmetic  
 Mathematics  
 Listening  
 Speaking

### ***Personal qualities***

Responsibility  
 Self-Worth  
 Sociability  
 Self-management  
 Integrity / Honesty

### ***Thinking skills***

Creative Thinking  
 Decision Making  
 Problem Solving  
 Visualization  
 Knows / Learns  
 Reasoning

### ***Workplace competencies***

Utilizing Resources  
 Interpersonal Skills  
 Utilizing Information  
 Using Systems  
 Using Technology

The *ADVANCE™ Workplace Standards Skill Inventory* from Advance Educational Spectrums, Inc., was used to capture industry views on foundation skills for wireless telecommunication workers. Industry professionals ranked the SCANS skill levels required for wireless telecommunications. The information in the chart on the following pages was created by taking the average of the profiles across the clusters. This summary information provides a general view of the key foundation skills deemed relevant and necessary for the front line wireless telecommunications worker.

**SAMPLE SURVEY QUESTIONS ADAPTED FROM THE ADVANCE EDUCATION SEPCTRUMS JOB PROFILER**

<b><i>Applies creative thinking</i></b>	<b>Level I</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Makes connections between old and new</li> <li>• Recognizes patterns/relationships</li> </ul>	<b>Level II</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Paraphrases/summarizes/generalize existing ideas</li> <li>• Utilizes brainstorming techniques</li> </ul>	<b>Level III</b> <input checked="" type="checkbox"/> <ul style="list-style-type: none"> <li>• Develop creative solutions</li> <li>• Applies creative solutions to new situations</li> </ul>	<b>Level IV</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Generates unique solutions</li> <li>• Formulates new ideas/plans/approaches</li> <li>• Organizes new process/procedures</li> </ul>	<b>Level V</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Judges/validates creativity</li> </ul>
<b><i>Applies decision making strategies</i></b>	<b>Level I</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Understands decision making process</li> <li>• Recalls basic rules/principles</li> <li>• Identifies goals and constraints</li> </ul>	<b>Level II</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Applies rules/principles to situations</li> <li>• Gather information</li> </ul>	<b>Level III</b> <input checked="" type="checkbox"/> <ul style="list-style-type: none"> <li>• Analyzes situations/information</li> <li>• Considers risks/implications</li> <li>• Compiles multiple viewpoints</li> </ul>	<b>Level IV</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Generates alternative solutions</li> <li>• Evaluates alternative solutions</li> <li>• Formulates plan of action</li> </ul>	<b>Level V</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Judges consistency/precedence</li> <li>• Justifies purpose/result</li> <li>• Sets decision making parameters</li> </ul>
<b><i>Recognizes and solves problems</i></b>	<b>Level I</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Identifies the problem</li> </ul>	<b>Level II</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Understands the complaint/discrepancy</li> <li>• Appropriately refers complaint/discrepancy</li> </ul>	<b>Level III</b> <input checked="" type="checkbox"/> <ul style="list-style-type: none"> <li>• Examines information/data</li> <li>• Analyzes possible causes/reasons</li> <li>• Recommends action plan</li> </ul>	<b>Level IV</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Generates/evaluates solutions</li> <li>• Devises/implements plan of action</li> </ul>	<b>Level V</b> <input type="checkbox"/> <ul style="list-style-type: none"> <li>• Evaluates/adjusts plan of action</li> <li>• Judges effectiveness/efficiency of solution</li> </ul>

Foundation Skills and Personal Qualities	0	1	2	3	4	5	Critical Competencies
<b>Basic Skills</b>							
Demonstrates Effective Reading Strategies							<i>Identifies relevant details, facts, specifications; Interprets and summarizes</i>
Demonstrates Effective Writing Strategies							<i>Composes and edits documents for appropriate audience and purpose</i>
Applies Arithmetic Processes							<i>Converts numerical data and predicts arithmetic results</i>
Applies Mathematics Processes							<i>Summarizes and translates mathematical data</i>
Demonstrates Effective Listening Skills							<i>Interprets, clarifies, and influences communication</i>
Demonstrates Effective Speaking Skills							<i>Presents complex ideas and information and actively participates in discussion</i>
<b>Thinking Skills</b>							
Applies Creative Thinking/Generates Ideas							<i>Develops and applies creative solutions to new situations</i>
Applies Decision Making Strategies							<i>Analyzes situation and considers risks, implications, and multiple viewpoints</i>
Recognizes and Solves Problems							<i>Examines information, analyzes possible causes, generates/evaluates solutions</i>
Demonstrates Visualization							<i>Analyzes relationship between parts/whole and process/procedure</i>
Knows How to Learn							<i>Investigates new learning techniques and manipulates learning tools</i>
Applies Reasoning Skills							<i>Analyzes logic/principle and examines information for relevance and accuracy</i>
<b>Personal Qualities</b>							
Demonstrates Responsibility							<i>Monitors performance standards, follows up on assigned tasks</i>
Demonstrates Belief in Self Worth							<i>Accepts responsibility for own behavior and understands impact on others</i>
Demonstrates Sociability in Groups							<i>Modifies behavior to environment and shows empathy for others</i>
Demonstrates Self-Management							<i>Sets and adjusts goals, and demonstrates commitment to self improvement</i>
Demonstrates Integrity/Honesty							<i>Demonstrates honesty, trustworthiness and commitment to personal and social improvement and recommends ethical course of action</i>

Foundation Skills and Personal Qualities	0	1	2	3	4	5	Critical Competencies
<b>Management of Time &amp; Resources</b> Manages Time							<i>Prepares schedule and prioritizes, monitors, and adjusts tasks</i>
Manages Money							<i>(Does not apply)</i>
Manages Materials/Facilities							<i>Acquires/distributes supplies and equipment</i>
Manages Human Resources							<i>Recognizes job tasks</i>
<b>Management &amp; Use of Information</b> Acquires/Evaluates Information							<i>Integrates multiple items of data and contrasts conflicting data</i>
Organizes/Maintains Information							<i>Analyzes organization of information and transfers information between formats</i>
Interprets/Communicates Information							<i>Interprets information, prepares basic summaries and reports and summarizes, analyzes and integrates information</i>
Uses Computers to Process Information							<i>Manipulates, integrates and modifies information; uses networks</i>
<b>Interpersonal Skills</b> Participates as Team Member							<i>Works to improve team skills and encourages/supports team members</i>
Teaches Others							<i>Conducts task-specific training and coaches others to apply related concepts</i>
Serves Customers							<i>Analyzes customer needs and demonstrates commitment to customer</i>
Exhibits Leadership							<i>Understands and adheres to standards; demonstrates commitment to excellence</i>
Negotiates Agreements							<i>Understands negotiations process and identifies conflicts</i>
Works with Diversity							<i>Demonstrates awareness of diversity</i>
<b>Understanding &amp; Management of Systems</b> Understands System							<i>Understands system organization and follows processes and procedures</i>
Monitors/Corrects System Performance							<i>Adjusts and monitors system operation and troubleshoots system malfunction/failure</i>
Improves/Designs Systems							<i>Suggests system modifications and improvements</i>
<b>Use of Technology</b> Selects Appropriate Technology							<i>Understands requirements of the task and technological results</i>
Applies Technology to Task							<i>Understands operation/interaction and manipulates technology for desired results.</i>
Maintains/Troubleshoots Technology							<i>Identifies, corrects and troubleshoots malfunctions and failures and evaluates performance of technology</i>

# definition of terms

Each chart in the following skill standards templates contain the following components:

## CONCENTRATIONS

An occupation cluster is a specialty within an occupation. **“Deployment and Implementation”** and **“Operations and Maintenance”** are the concentrations within wireless telecommunications.

## CRITICAL WORK FUNCTIONS

Critical work functions represent the general areas of responsibility for the front line worker in Wireless Telecommunications. The functions tell us what must be done to achieve the key purpose of an occupation cluster.

## ACADEMIC AND EMPLOYABILITY KNOWLEDGE AND SKILLS

Employability skills are basic academic and personal skills that are needed to build more advanced competencies. They are competencies required by all workers in order to obtain meaningful work and participate in the modern workforce. They are described more fully on page 17 and charted on pages 19 to 20.

## KEY ACTIVITIES

Key activities are the tasks related to the functional area of the career cluster and performed by workers in a given occupation. They are made up of work activities which are measurable and observable, and which result in a decision, product or service.

## PERFORMANCE INDICATORS

Performance indicators are specific behavioral evidence of a worker’s achievement of skills, knowledge and tasks. The question answered is: “How do we know when this key activity is performed well?” Performance indicators provide the standard of performance required to produce the necessary outcomes of key activities.

## TECHNICAL SKILLS, KNOWLEDGE, ABILITIES AND TOOLS

Technical skills, knowledge and abilities are those areas of expertise which workers must have in order to perform a given occupational task with excellence. A collection of skills, knowledge, abilities and tools make up competencies. For the Wireless Telecommunications Skill Standards, the GWEC Points of Knowledge have been integrated into the component.

Skills refer to proficiency in an applied activity. This activity could be physical, mental or interpersonal in nature.

Knowledge is a particular set of information.

Abilities are broad human characteristics that result from natural talent, training, or experience.

Tools are materials, equipment and implements a worker must be able to use competently to meet the requirements of the job.



# deployment & implementation

## TYPICAL JOB DESCRIPTION FOR DEPLOYMENT AND IMPLEMENTATION

Individuals who work in the area of Deployment and Implementation are at the heart of the work in the wireless telecommunications industry. They integrate new cells and features, install, monitor and test new switches and transport equipment. They install, wire and troubleshoot large complex telecommunications equipment. In addition, they perform installation functions and component testing on switching, transmission, power, wireless and data equipment in central office-like environments.

Troubleshooting is a major function of their work. Creative thinking, and the ability to work on a team are important skills possessed by these individuals. Safety is a vital part of the work. Both in terms of personal safety and the safety of co-workers, individuals take on a conscientious responsibility for ensuring that the work environment is safe.

## SAMPLE JOB TITLES

- Integration Testing Technician
- Network Technician
- Switch Installer
- Field Engineer
- Switch Technician
- Installer
- Associate Tester

**CONCENTRATION:  
 DEPLOYMENT AND IMPLEMENTATION**

JANUARY 12, 2001

CRITICAL WORK FUNCTIONS	Key Activities						
<b>A. Install switches</b>	A1 Perform pre-arrival activities	A2 Perform start up activities	A3 Assemble and install cabinets	A4 Install cabling	A5 Perform exit activities		
<b>B. Grow switches</b>	B1 Coordinate with customer	B2 Perform site preparation	B3 Install hardware	B4 Test hardware	B5 Perform exit activities		
<b>C. Install and maintain power</b>	C1 Prepare site	C2 Remove existing equipment	C3 Install grounding systems	C4 Install power plant	C5 Install batteries	C6 Maintain system reliability	C7 Perform exit activities
<b>D. Deploy networks</b>	D1 Perform circuit, high capacity microwave and fiber provisioning	D2 Deploy and maintain microcells	D3 Perform network fault management				
<b>E. Coordinate with work team</b>	E1 Provide mentoring to new employees	E2 Receive training from vendors	E3 Coordinate work flow with team members and other departments	E4 Engage in career development activities			
<b>F. Perform troubleshooting</b>	F1 Analyze problem and research solutions	F2 Identify, test and implement solutions	F3 Coordinate system resolution with available resources	F4 Communicate technical solutions and implementation processes	F5 Document equipment and software problems and resolutions		

**Concentration: Deployment and Implementation**  
**Critical Work Functions: A. Install Switches**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A1.</b> Perform pre-arrival activities</p>	<ul style="list-style-type: none"> <li>• Documentation is carefully verified.</li> <li>• All required tools for the job are assembled and shipped to job site.</li> <li>• ESD equipment is properly verified.</li> <li>• Departure checklist is reviewed and completed.</li> <li>• Specialty tools / services are obtained in accordance with company procedures.</li> <li>• Tools and materials are accurately inventoried.</li> <li>• Non functioning tools are accurately identified and procedures regarding non functioning tools and equipment are followed.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of required documentation.</li> <li>• Knowledge of customer forms requirements, approvals and procedures.</li> <li>• Knowledge of tools and their functions and knowledge of required tools, their location and tool shipping procedures.</li> <li>• Knowledge of ESD equipment and verification procedures.</li> <li>• Knowledge of specialty tools/ services and how to obtain them.</li> <li>• Knowledge of tool certification requirements and calibration procedures.</li> <li>• Knowledge of procedures for non-functioning tools and equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies relevant details, facts, specifications and follows set of instructions.</li> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Evaluates performance of technology.</li> </ul>
<p><b>A2.</b> Perform start-up activities</p>	<ul style="list-style-type: none"> <li>• Environmental conditions, especially power and HVAC are correctly verified.</li> <li>• Site-specific documentation is correctly verified.</li> <li>• Demarcation points are accurately determined.</li> <li>• Customer site standards are meticulously followed.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of environmental conditions and verification procedures.</li> <li>• Knowledge of power and HVAC.</li> <li>• Knowledge of site-specific documentation.</li> <li>• Ability to determine demarcation points.</li> <li>• Knowledge of site standards.</li> </ul>	<ul style="list-style-type: none"> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Interprets and clarifies communication.</li> <li>• Summarizes and translates mathematical data.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Demonstrates trustworthiness and accepts responsibility for own behavior.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: A. Install Switches**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>A3</b> <b>Assemble &amp; install cabinets</b>	<ul style="list-style-type: none"> <li>• Earthquake bracing is installed and thoroughly verified.</li> <li>• Cable ways are properly installed and equipped cabinets are properly installed.</li> <li>• Isolation testing is correctly performed.</li> <li>• Assembly is completed in a timely manner and all quality criteria are met including plumb and level.</li> <li>• ESD (Electro-Static Discharge) precautions are meticulously observed.</li> <li>• Magazine assemblies are properly installed and verified in accordance with company procedures.</li> <li>• Magazines and shelves are properly grounded and grounding is verified in accordance with company procedures.</li> <li>• Transmission equipment and all peripherals are properly installed.</li> <li>• All assembly and installation procedures are in accordance with MOP's (Methods of Procedure).</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of earthquake bracing installation and verification procedures.</li> <li>• Ability to install cable ways and equipped cabinets.</li> <li>• Ability to perform insulation testing.</li> <li>• Knowledge of quality criteria for assembly.</li> <li>• Knowledge of ESD precautions.</li> <li>• Ability to install and ground magazine assemblies and shelves.</li> <li>• Knowledge of installation and grounding verification procedures.</li> <li>• Ability to install equipment including peripherals.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Understands decision making process analyzes situation / information and considers risks / implications.</li> </ul>
<b>A4</b> <b>Install cabling</b>	<ul style="list-style-type: none"> <li>• Internal cable sets and external cables are properly installed.</li> <li>• Installation is thoroughly verified.</li> <li>• Alarm panel cabling is properly installed.</li> <li>• I/O cabling is properly installed.</li> <li>• External alarm cable connectors are correctly built.</li> <li>• Alarm panel cabling is thoroughly tested.</li> <li>• Functionality testing on alarms is properly performed.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to install internal cable sets, external cables, alarm panel cabling and I/O cabling.</li> <li>• Knowledge of installation verification procedures.</li> <li>• Ability to build external alarm cable connectors.</li> <li>• Knowledge of alarm panel cabling testing procedures.</li> <li>• Knowledge of functionality testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Applies processes to new information and transfers information between formats.</li> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: A. Install Switches**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A5</b>            Perform exit activities</p>	<ul style="list-style-type: none"> <li>• Documentation is performed in accordance with company procedures and all modifications are documented in the “as-built” documents.</li> <li>• Documentation is input into database, filed or distributed to correct parties.</li> <li>• Acceptance testing is performed in accordance with company and customer policies and procedures and contractual arrangements.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of documentation input, filing and/or distribution procedures.</li> <li>• Knowledge of power supply testing procedures.</li> <li>• Knowledge of acceptance testing procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> <li>• Records information accurately and summarizes/paraphrases information.</li> <li>• Applies appropriate principles to situation and utilizes previous training/ experience to predict outcomes.</li> <li>• Follows procedures and pays attention to details.</li> <li>• problem solving.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: B. Grow Switches**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>B1.</b> Coordinate with customer	<ul style="list-style-type: none"> <li>• All customer approvals are obtained in accordance with company procedures.</li> <li>• Detailed method of procedures is thoroughly reviews to ensure they are understood.</li> <li>• Workspace is defined and verified.</li> <li>• Timing of work is coordinated with customer and completion times are met in accordance with the contract.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of company procedures regarding customer approvals.</li> <li>• Knowledge of method of procedures.</li> <li>• Knowledge of work space requirements.</li> <li>• Knowledge of reporting requirements.</li> <li>• Ability to relate to customer needs.</li> </ul>	<ul style="list-style-type: none"> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> </ul>
<b>B2.</b> Perform site preparation	<ul style="list-style-type: none"> <li>• Workspace is prepared in accordance with company procedures and safety protocols.</li> <li>• Inventory is received in accordance with company procedures.</li> <li>• Material discrepancies are documented and reported in accordance with company procedures.</li> <li>• Floor plan is thoroughly reviewed.</li> <li>• Live equipment is properly marked and all safety procedures are followed.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of safety protocols and company procedures.</li> <li>• Knowledge of inventory requirements.</li> <li>• Knowledge of documentation and reporting procedures.</li> <li>• Knowledge of live equipment marking procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Applies appropriate principles to situation and utilizes previous training / experience to predict outcomes.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Understands decision making process analyzes situation / information and considers risks / implications.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: B. Grow Switches**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>B3.</b> Install hardware	<ul style="list-style-type: none"> <li>• Cabinet, peripheral equipment and power / grounding are properly installed.</li> <li>• Cabling and wiring are correctly installed.</li> <li>• Cabinets are completely equipped.</li> <li>• Final assembly is properly performed.</li> <li>• Product change notices are correctly completed and distributed to appropriate parties.</li> <li>• Voice / data and interconnect rearrangements are properly performed.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to install cabinet, peripheral equipment and power / grounding.</li> <li>• Knowledge of cabling and wiring installation procedures.</li> <li>• Knowledge of cabinet equipping requirements.</li> <li>• Knowledge of product change notices.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Records information accurately and summarizes and paraphrases information.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> </ul>
<b>B4.</b> Test hardware	<ul style="list-style-type: none"> <li>• Designations are correctly verified.</li> <li>• Strapping and terminations are properly completed and documented.</li> <li>• Power is properly verified.</li> <li>• Data translations are correctly loaded.</li> <li>• Peripheral equipment is correctly tested.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of designations.</li> <li>• Ability to complete strapping and terminations.</li> <li>• Ability to verify power.</li> <li>• Ability to load data translations.</li> <li>• Knowledge of testing procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands decision making process, analyzes situation / information and considers risks / implications.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Summarizes and translates mathematical data.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: B. Grow Switches**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>B5.</b> Perform exit activities</p>	<ul style="list-style-type: none"> <li>• Documentation is performed in accordance with company procedures and all modifications are documented in the “as-built” documents.</li> <li>• Documentation is input into database, filed or distributed to correct parties.</li> <li>• Acceptance testing is performed in accordance with company and customer policies and procedures and contractual arrangements.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of documentation input, filing and / or distribution procedures.</li> <li>• Knowledge of power supply testing procedures.</li> <li>• Knowledge of acceptance testing procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Applies processes to new information and transfers information between formats.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> <li>• Understands decision making process analyzes situation / information and considers risks / implications.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: C. Install and Maintain Power**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>C1.</b> Prepare site</p>	<ul style="list-style-type: none"> <li>• Site readiness is correctly determined.</li> <li>• Floor plan is properly verified.</li> <li>• General MOP (Method of Operation) is thoroughly reviewed.</li> <li>• Safety inspection is thoroughly performed.</li> <li>• Environmental and AC requirements are accurately verified.</li> <li>• Ground resistance is correctly verified.</li> <li>• Materials and spares are correctly inventoried and discrepancies are reported in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of site readiness.</li> <li>• Knowledge of general MOP.</li> <li>• Knowledge of safety requirements and safety inspection procedures.</li> <li>• Knowledge of environmental and AC requirements.</li> <li>• Knowledge of ground resistance requirements.</li> <li>• Knowledge of materials required and inventory and discrepancy procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Applies appropriate principles to situation and utilizes previous training / experience to predict outcomes.</li> <li>• Demonstrates trustworthiness and accepts responsibility for own behavior.</li> </ul>
<p><b>C2.</b> Remove existing equipment</p>	<ul style="list-style-type: none"> <li>• Removal of existing equipment is coordinated with customer.</li> <li>• Cables are properly removed.</li> <li>• Equipment is properly disposed of in accordance with all company procedures and all applicable laws and regulations.</li> <li>• Facilities are properly restored in a timely manner.</li> <li>• Drawings are correctly red lined.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of equipment and cable removal procedures.</li> <li>• Knowledge of disposal procedures and all applicable laws and regulations.</li> <li>• Ability to restore facilities.</li> <li>• Ability to red line drawings.</li> </ul>	<ul style="list-style-type: none"> <li>• Translates blueprints, drawings, diagrams, applies appropriate principles to situation and utilizes previous training / experience to predict outcomes.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Interprets and clarifies communication.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: C. Install and Maintain Power**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>C3.</b>  <b>Install grounding systems</b></p>	<ul style="list-style-type: none"> <li>• Ground bars and grounding conductors are properly installed.</li> <li>• Frame ground is properly installed.</li> <li>• Inverter outlet grounding is correctly verified.</li> <li>• Single point grounding and ground system components are correctly installed and verified.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to install ground bars, grounding conductors, frame ground.</li> <li>• Knowledge of installation and verification procedures for inverter outlet grounding, single point grounding and ground system components.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Evaluates performance of technology.</li> <li>• Summarizes and translates mathematical data.</li> </ul>
<p><b>C4.</b>  <b>Install power plant</b></p>	<ul style="list-style-type: none"> <li>• Required tools and equipment are gathered and on hand and all safety procedures are followed and grounding personal protective gear is worn.</li> <li>• Detailed MOP is thoroughly reviewed.</li> <li>• Earthquake bracing, cabinets, bus bars, power plant ground, cables, and inverter receptacles are properly installed.</li> <li>• Isolation, installation performance and acceptance testing are properly performed.</li> <li>• All spares are thoroughly tested.</li> <li>• Cables are properly terminated and central unit is correctly programmed.</li> <li>• Practicality of equipment layout and cable routing is thoroughly evaluated.</li> <li>• Incoming power is provided in accordance with company procedures.</li> <li>• Cabinets are completely equipped.</li> <li>• Drawings are correctly red lined.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of tools required for power plant installation and of safety equipment and procedures.</li> <li>• Knowledge of earthquake mechanics, cabinets, bus bars, power plant ground, cables, and inverter receptacles and their installation procedures.</li> <li>• Knowledge of isolation, installation performance and acceptance testing protocols.</li> <li>• Ability to test spares and terminate cables.</li> <li>• Knowledge of equipment layout and cable routing options.</li> <li>• Knowledge of incoming power.</li> <li>• Knowledge of cabinet equipping.</li> <li>• Ability to prepare detailed MOP.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Translates blueprints, drawings, diagrams, applies appropriate principles to situation and utilizes previous training / experience to predict outcomes.</li> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: C. Install and Maintain Power**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>C5.</b> Install batteries	<ul style="list-style-type: none"> <li>• Safety equipment is accurately verified.</li> <li>• Battery disconnects are correctly installed.</li> <li>• Battery strings are properly installed.</li> <li>• Earthquake bracing is properly installed.</li> <li>• Permits are correctly verified.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of safety equipment and safety protocols.</li> <li>• Ability to install battery disconnects and strings.</li> <li>• Knowledge of earthquake bracing.</li> <li>• Knowledge of permit requirements.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Identifies relevant details, facts, specifications and follows set of instructions.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> </ul>
<b>C6.</b> Maintain system reliability	<ul style="list-style-type: none"> <li>• Grounding system and isolated ground are inspected in accordance with company procedures and all applicable laws and regulations.</li> <li>• Power system, battery capacity, power alarm and backup generator tests are performed.</li> <li>• Surge suppression is accurately verified.</li> <li>• Preventive maintenance is performed on battery plant.</li> <li>• Supply capacity and AC power quality are accurately verified.</li> <li>• Fire stopping is properly verified.</li> <li>• Troubleshooting of system is performed in accordance with manufacturers specifications and company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of grounding system and isolated ground inspection procedures.</li> <li>• Knowledge of testing procedures for power system battery capacity, power alarm and backup generator.</li> <li>• Ability to verify surge suppression.</li> <li>• Knowledge of preventive maintenance procedures and schedules for battery plant.</li> <li>• Ability to verify supply capacity, AC power quality and fire stopping.</li> <li>• Knowledge of manufacturers specifications and company procedures for troubleshooting.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction/ failure and analyzes system operation.</li> <li>• Suggests system modifications/ improvements and determines system components to be improved.</li> <li>• Identifies the problem, analyzes possible causes/ reasons, generates / evaluates solutions and devises/ implement plan of action.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Understands decision making process analyzes situation / information and considers risks / implications.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: C. Install and Maintain Power</b>			
<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>C7.</b> <b>Perform exit activities</b>	<ul style="list-style-type: none"> <li>• Documentation is performed in accordance with company procedures and all modifications are documented in the “as-built” documents.</li> <li>• Documentation is input into database, filed or distributed to correct parties.</li> <li>• Acceptance and / or functionality testing is performed in accordance with company and customer policies and procedures and contractual arrangements.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of documentation input, filing and / or distribution procedures.</li> <li>• Knowledge of power supply testing procedures.</li> <li>• Knowledge of acceptance and functionality testing procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifies relevant details, facts, specifications and follows set of instructions.</li> <li>• Records information accurately and summarizes/ paraphrases information.</li> <li>• Applies appropriate principles to situation and utilizes previous training / experience to predict outcomes.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: D. Deploy Networks</b>			
KEY ACTIVITY	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>D1.</b> <b>Perform circuit, high capacity microwave and fiber provisioning</b>	<ul style="list-style-type: none"> <li>Interface to switch is properly maintained.</li> <li>Functionality, performance and / or acceptance testing are properly performed</li> <li>Alarm generation capability is correctly verified.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge performance and functionality testing criteria and procedures.</li> <li>Knowledge of switch interface maintenance.</li> <li>Ability to perform acceptance testing.</li> </ul>	<ul style="list-style-type: none"> <li>Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Evaluates performance of technology.</li> <li>Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> <li>Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> </ul>
<b>D2.</b> <b>Deploy and maintain microcells</b>	<ul style="list-style-type: none"> <li>Earthquake bracing is installed and thoroughly verified.</li> <li>Cable ways are properly installed.</li> <li>Equipped cabinets are properly installed.</li> <li>Isolation testing is correctly performed.</li> <li>Assembly is completed in a timely manner and all quality criteria are met including plumb and level.</li> <li>ESD precautions are meticulously observed.</li> <li>Magazine assemblies and shelves are properly installed and verified in accordance with company procedures.</li> <li>Transmission equipment and all peripherals are properly installed.</li> <li>All assembly and installation procedures are in accordance with MOP's (Methods of Procedure).</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of earthquake bracing installation and verification procedures.</li> <li>Ability to install cable ways and equipped cabinets.</li> <li>Ability to perform insulation testing.</li> <li>Knowledge of quality criteria for assembly.</li> <li>Knowledge of ESD precautions.</li> <li>Ability to install and ground magazine assemblies and shelves.</li> <li>Knowledge of installation and grounding verification procedures.</li> <li>Ability to install equipment including peripherals.</li> </ul>	<ul style="list-style-type: none"> <li>Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Evaluates performance of technology.</li> <li>Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>Suggests system modifications / improvements and determines system components to be improved.</li> <li>Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: D. Deploy Networks</b>			
<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>D3.</b> <b>Perform network fault management</b>	<ul style="list-style-type: none"> <li>• Configuration management is properly performed.</li> <li>• Required performance management reports are accurately generated.</li> <li>• Alarm analysis and resolution are performed in accordance with company procedures.</li> <li>• Circuit activity is properly monitored.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of configuration and database management techniques.</li> <li>• Knowledge of required performance management reports.</li> <li>• Ability to perform alarm analysis and resolution.</li> <li>• Ability to monitor circuit activity.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Evaluates performance of technology.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Suggests system modifications / improvements and determines system components to be improved.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: E. Coordinate with Work Team</b>			
KEY ACTIVITY	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>E1.</b> Provide mentoring to new employees	<ul style="list-style-type: none"> <li>• Skill development and information are provided to new employees as required.</li> <li>• Appropriate approaches are used.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of new employee skill development and information.</li> <li>• Knowledge of training approaches.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> <li>• Models proper performance / attitudes, conducts task specific training and coaches others to apply related concepts.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>
<b>E2.</b> Receive training from vendors	<ul style="list-style-type: none"> <li>• Training with vendors is scheduled as needed.</li> <li>• All documentation is completed in accordance with company procedures.</li> <li>• Training is applied on the job effectively and in a timely manner.</li> <li>• Training sessions are attended on time and with full participation.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of vendor training requirements.</li> <li>• Knowledge of vendor training documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands learning process, interprets and applies new knowledge and experience, analyzes application of learning tools and investigates and manipulates learning tools and techniques.</li> <li>• Accepts constructive criticism, sets well defined/ realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors/ adjusts task sequence.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Applies appropriate principles to situation, utilizes previous training/ experience to predict outcomes and uses imagination to visualize events, outcomes.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: E. Coordinate with Work Team</b>			
<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>E3.</b> <b>Coordinate work flow with team members and other departments</b>	<ul style="list-style-type: none"> <li>• Communication with team members and other departments is timely, complete and covers all required topics.</li> <li>• Team meetings are attended on time and with active participation.</li> <li>• Team and department goals and timelines are met.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of topics to cover with team members and other departments.</li> <li>• Knowledge of team goals and timelines.</li> <li>• Knowledge of industry terminology and jargon.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understand own impact on others.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: E. Coordinate with Work Team**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>E4. Engage in career development activities</b></p>	<ul style="list-style-type: none"> <li>• Continuous learning is engaged to meet changes in workplace technology and processes.</li> <li>• Training needs are self-identified and followed up on.</li> <li>• Team interactions promote team and individual learning.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of changes in workplace technology and processes.</li> <li>• Knowledge of career training needs.</li> </ul>	<ul style="list-style-type: none"> <li>• Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understand own impact on others.</li> <li>• Accepts constructive criticism, sets well defined/ realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Understands learning process, interprets and applies new knowledge and experience, analyzes application of learning tools and investigates and manipulates learning tools and techniques.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> </ul>

**Concentration: Deployment and Implementation**  
**Critical Work Functions: F. Perform Troubleshooting**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>F1. Analyze problems and research solutions</b></p>	<ul style="list-style-type: none"> <li>• Problem is identified correctly.</li> <li>• Problem causes are properly isolated.</li> <li>• Solutions are thoroughly researched and tested.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of troubleshooting methods.</li> <li>• Knowledge of sources of relevant technical data.</li> <li>• Ability to prioritize possible solutions based on technical criteria.</li> <li>• Knowledge of networks and components including translation problems and knowledge of point codes, HLR and STP.</li> <li>• Knowledge of WOS, WOSII, IS-41/ANSI-D, ISUP, CNI/LNB, SMS, OAA, AWS roaming, non AWS roaming, international roaming and long distance problems.</li> <li>• Knowledge of local telco, phone equipment, authentication and incoming call problems.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Suggests system modifications / improvements and determines system components to be improved.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: F. Perform Troubleshooting</b>			
KEY ACTIVITY	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>F2.</b> Identify, test and implement solutions	<ul style="list-style-type: none"> <li>Solutions are clearly defined with possible impact to system.</li> <li>Solutions are selected based on technical benefits and cost effectiveness.</li> <li>Solutions are tested in a complete and realistic manner.</li> <li>Test scenarios are representative of actual use and environment.</li> <li>Test process results in permanent solution to problem reported or diagnosed.</li> <li>Change management policies and procedures are followed.</li> <li>Changes are communicated to appropriate individuals and departments effectively and in a timely manner.</li> <li>Implementation is conducted with minimum disruption to users.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of test instruments and methods.</li> <li>Knowledge of systematic methods of solving technical problems.</li> <li>Ability to replace components when appropriate.</li> <li>Ability to remove, repair, or replace modules and subassemblies as appropriate.</li> <li>Knowledge of applications and diagnostic programs.</li> <li>Knowledge of change management policies and procedures and personnel and departments affected by changes.</li> <li>Knowledge of relevant indicators of system performance.</li> </ul>	<ul style="list-style-type: none"> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>Identifies the problem, analyzes possible causes/ reasons, generates / evaluates solutions and devises/implement plan of action.</li> <li>Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>Suggests system modifications/ improvements and determines system components to be improved.</li> <li>Analyzes customer needs and demonstrates commitment to customer.</li> <li>Presents complex ideas/ information and poses critical questions.</li> </ul>
<b>F3.</b> Coordinate system resolution with available resources	<ul style="list-style-type: none"> <li>Relevant and available technical resources are identified.</li> <li>Technical expertise is sought when appropriate.</li> <li>Problems are escalated or referred to another group when appropriate.</li> <li>Resources are requested through appropriate channels and procedures, and organized to optimize use and results.</li> <li>Resolutions are coordinated with all appropriate departments, companies and individuals.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of relevant technical data.</li> <li>Knowledge of resolution processes.</li> <li>Knowledge of relevant physical inventory access and control procedures.</li> <li>Knowledge of departments, companies and individuals requirements for coordination activities.</li> </ul>	<ul style="list-style-type: none"> <li>Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>Suggests system modifications / improvements and determines system components to be improved.</li> <li>Understands the system organization and follows procedures.</li> <li>Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>Interprets and clarifies and influences communication.</li> </ul>

<b>Concentration: Deployment and Implementation</b> <b>Critical Work Functions: F. Perform Troubleshooting</b>			
<b>KEY ACTIVITY</b>	<b>Performance Indicators</b> <i>How do we know when the task is performed well?</i>	<b>Technical Knowledge</b> <i>Skills, Abilities, Tools</i>	<b>Academic &amp; Employability Knowledge and Skills</b> <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>F4. Communicate technical solutions and implementation processes</b>	<ul style="list-style-type: none"> <li>• Technical solutions and implementation processes are communicated in a timely manner.</li> <li>• Technical solutions and implementation processes are communicated in a form understandable to users.</li> <li>• User concerns are considered and addressed in the communication process.</li> <li>• Communication is clear, accurate and targeted appropriately.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of technical communications processes.</li> <li>• Ability to translate technical language into lay terminology when necessary.</li> <li>• Knowledge of customer relations techniques.</li> <li>• Ability to communicate appropriately to different audiences and organizational levels.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Presents complex ideas/ information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Models proper performance / attitudes, conducts task specific training and coaches others to apply related concepts.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>
<b>F5. Document equipment and software problems and resolutions</b>	<ul style="list-style-type: none"> <li>• Documentation is clear and accurate.</li> <li>• Documentation follows organization format and procedures.</li> <li>• Hardware and software problems are clearly identified.</li> <li>• Resolutions are documented to the appropriate level of detail.</li> <li>• Documentation is organized for most efficient access by other users.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of documentation tools.</li> <li>• Knowledge of technical presentation tools.</li> <li>• Knowledge of technical terms.</li> <li>• Knowledge of documentation processes and procedures.</li> <li>• Ability to organize and present technical information in a logical and consistent manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately and summarizes/paraphrases information and creates original documents.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Understands the system organization and follows procedures.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>

# deployment & implementation scenarios

## ROUTINE SCENARIO: DAILY ACTIVITIES

The Technician working in deployment and implementation builds, grows and monitors networks. These are very different activities, and are all performed on a daily basis. When the Technician working in a network operations center comes on shift, he or she interfaces with those coming off shift to understand what has been happening. Any ongoing events are handed off at that time. The Technician uses the systems available to him or her to audit the elements they are managing in order to make sure that everything is operating well. Any work orders to change configuration, activate features or functionalities are completed throughout the day. All ongoing activities are handed off at the end of the shift.

Primary Functions and Tasks Involved in This Scenario:

- A. Install switches
  - A2. Perform start up activities.
  - A3. Assemble and install cabinets.
  - A4. Install cabling.
  
- B. Grow switches
  - B3. Install hardware.
  - B4. Test hardware.
  
- D. Deploy networks
  - D3. Perform network fault management.
  
- E. Coordinate with work team
  - E3. Coordinate work flow with team members and other departments.

## CRISIS SCENARIO: ALARMS

The Technician works with an element management system (EMS), which is a computer program that receives information about system elements and shows how they are working. The EMS will send an alarm if one or more elements are not working.

When the EMS goes down, the Technician must act rapidly. The first step is to call the help desk, which opens a trouble ticket and dispatches a work order to system administration to solve the problem. Once the system comes back up, the Technician can resume normal work activity.

- E. Coordinate with work team
  - E3. Coordinate work flow with team members and other departments.
  
- F. Perform troubleshooting
  - F1. Analyze problem and research solutions.

- F3. Coordinate system resolution with available resources.
- F4. Communication technical solutions and implementation processes.

### LONG TERM SCENARIO: CONTINUING EDUCATION

In the Wireless Telecommunication environment, the Technician must keep current on technology. Usually this takes the form of self study, done on personal time, and uncompensated. The Technician may utilize on line study, visit industry web sites, read industry journals or seek to obtain additional vendor training.

- E. Coordinate with work team
  - E2. Receive training from vendors.
  - E3. Engage in career development activities.



# operations & maintenance

## TYPICAL JOB DESCRIPTION FOR MAINTENANCE AND OPERATIONS

Individuals who work in the area of Operations and Maintenance implement, conduct and coordinate the smooth operation, repair, maintenance and expansion of all systems operated. They perform routine preventive maintenance schedules on network equipment. They log and track network activities and provide technical assistance and information to internal/external customers. They support network equipment expansions and upgrades.

These individuals may work in an office or in the field. They operate, maintain and repair all components of the cellular system in and around the assigned area of responsibility. They troubleshoot and resolve customer complaints concerning technical problems with the system and respond to system failures and correct and restore systems in a timely fashion. In the field, they operate the cell sites in a given geographical area and are responsible for the installation and maintenance of any network microwave links.

Strong communication and teamwork skills are required along with a problem solving and a background in RF technology.

## SAMPLE JOB TITLES

- Cell-Site Technician
- Field Technician
- Switch Technician / Switch Maintenance Technician
- Network Technician
- NOC Technician
- Corrective Maintenance Technician
- MSC Technician
- WNCC Specialist
- NACN Technician
- Customer Service Support

**CONCENTRATION:  
 OPERATIONS AND MAINTENANCE**

NOVEMBER 17, 2000

CRITICAL WORK FUNCTIONS	Key Activities					
<b>A. Perform reactive and preventive maintenance</b>	A1 Perform routine system activities	A2 Perform preventive maintenance	A3 Maintain facilities	A4 Document maintenance	A5 Maintain security	A6 Execute long-range solutions
<b>B. Perform troubleshooting</b>	B1 Analyze problems	B2 Identify, test and implement solutions	B3 Communicate technical solutions and implementation processes	B4 Document equipment and software problems and resolutions	B5 Perform reactive maintenance	B6 Identify problems
<b>C. Provide support</b>	C1 Support new technologies/products	C2 Collaborate with vendors	C3 Provides status updates	C4 Provide technical assistance to internal customers	C5 Provide support to other / partner markets	
<b>D. Manage network and cell site growth</b>	D1 Install equipment and new sites	D2 Perform testing	D3 Reconfigure existing equipment	D4 Work with TELCO personnel	D5 Perform system provisioning	D6 Inventory equipment
<b>E. Manage professional development</b>	E1 Participate in certificate program	E2 Keep current on industry trends, technology and jargon	E3 Provide training to new hires & current employees	E4 Attend vendor training		
<b>F. Perform administrative functions</b>	F1 Inventory equipment	F2 Maintain databases	F3 Write reports	F4 Maintain records and complete necessary paperwork	F5 Research and reconcile billing	
<b>G. Manage roaming</b>	G1 Manage roaming information	G2 Conduct testing	G3 Resolve roaming issues	G4 Add and delete roaming agreements		

**Concentration: Operations and Maintenance**  
**Critical Work Functions: A. Perform Preventive and Reactive Maintenance**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A1. Perform routine system activities</b></p>	<ul style="list-style-type: none"> <li>• Database backups are performed in accordance with company procedures and schedule.</li> <li>• Power system tests are performed.</li> <li>• Surge and fire suppression devices are accurately verified.</li> <li>• Tests are performed according to plan and schedule and test results are documented completely and communicated as appropriate.</li> <li>• Transmission routines are performed in accordance with company procedures.</li> <li>• Applicable systems / equipment are checked using appropriate procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of database backups—ECP, 5ESS, DACs, OMP.</li> <li>• Knowledge of company procedures, backup schedule and documentation and labeling procedures.</li> <li>• Ability to restore data and test status for conformance.</li> <li>• Knowledge of generator systems and verification procedures and ability to check power plant status.</li> <li>• Knowledge of grounding system and isolated ground inspection procedures.</li> <li>• Knowledge of testing procedures for power system battery capacity, power alarm and backup generator and ability to verify surge suppression and supply capacity, AC power quality and fire stopping.</li> <li>• Knowledge of preventive maintenance procedures and schedules for battery plant.</li> <li>• Knowledge of manufacturers specifications and company procedures for troubleshooting.</li> <li>• Knowledge of audio trunk testing, lamp tests and generator tests, channel testing and testing methodologies and procedures and ability to make test calls.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> </ul>

OPERATIONS AND MAINTENANCE

**Concentration: Operations and Maintenance**  
**Critical Work Functions: A. Perform Preventive and Reactive Maintenance**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A2. Perform preventive maintenance</b></p>	<ul style="list-style-type: none"> <li>• Power systems are properly inspected and maintained according to specifications.</li> <li>• Equipment is inspected and serviced in accordance with company procedures and manufacturers specifications and performance logs are checked and carefully evaluated.</li> <li>• Magnetic tape units are thoroughly cleaned.</li> <li>• Routing is audited on a regular basis in accordance with company procedures.</li> <li>• Trunk utilization is accurately audited.</li> <li>• Filters are changed in accordance with maintenance schedule and company procedures.</li> <li>• Troubles are referred to appropriate departments or personnel and maintenance is documented in accordance with company procedures.</li> <li>• System is tested to ensure it is working properly and test results are evaluated according to specifications.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of systems, vehicles, test equipment, system integrity, RBS, nodes, and ERI equipment, and MSC interface equipment.</li> <li>• Knowledge of OMP, 5ESS, ECP and Octel performance logs.</li> <li>• Knowledge of ECP and 5ESS diagnostics.</li> <li>• Knowledge of ECP, OMP and Octel disk space requirements.</li> <li>• Knowledge of switch, ECP, OMP, DACs, Brite Voice, and air conditioning 5ESS filters.</li> <li>• Knowledge of antennas.</li> <li>• Knowledge of routing.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Evaluates performance of technology.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: A. Perform Preventive and Reactive Maintenance**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A3. Maintain facilities</b></p>	<ul style="list-style-type: none"> <li>• Facility vendor list is accurately updated and vendor maintenance is properly scheduled in accordance with company and vendor procedures.</li> <li>• Facility environmental conditions are carefully monitored and defective lights are replaced immediately.</li> <li>• Fire suppression systems are inspected on schedule and in accordance with company procedures and all safety procedures are followed.</li> <li>• Work areas are cleaned and organized.</li> <li>• Power plant is inspected on a regular basis in accordance with company procedures.</li> <li>• Maintenance reports are filled out and filed in accordance with company procedures.</li> <li>• Alarms are handled and verified in accordance with company procedures.</li> <li>• Cell sites are properly regroomed in accordance with company procedures.</li> <li>• T-coders are decommissioned, regroomed and programmed, T-coder hardware is provisioned and T-coder phys/log connectivity is implemented.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to clean switch room.</li> <li>• Knowledge of facility vendor list and vendor maintenance scheduling.</li> <li>• Knowledge of facility environmental conditions monitoring procedures and a ability to replace defective lights.</li> <li>• Knowledge of safety procedures and ability to inspect fire suppression systems.</li> <li>• Knowledge of power plant equipment and inspections.</li> <li>• Knowledge of maintenance reports and submittal procedures.</li> <li>• Ability to verify and handle alarms.</li> <li>• Ability to visually inspect all equipment.</li> <li>• Knowledge of T coders.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Evaluates performance of technology.</li> <li>• Monitors system performance, troubleshoots malfunction/failure and analyzes system operation.</li> <li>• Identifies the problem, analyzes possible causes/reasons, generates/evaluates solutions and devises/ implement plan of action.</li> <li>• Translates blueprints, drawings, diagrams, applies appropriate principles to situation and utilizes previous training/ experience to predict outcomes.</li> </ul>

OPERATIONS AND MAINTENANCE

**Concentration: Operations and Maintenance**  
**Critical Work Functions: A. Perform Preventive and Reactive Maintenance**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A4. Document maintenance</b></p>	<ul style="list-style-type: none"> <li>• All checks and measures are accurately recorded.</li> <li>• Actions taken are completely documented.</li> <li>• Methods for maintenance are completely documented.</li> <li>• Site visit log is accurately and legibly completed.</li> <li>• Existing conditions of the equipment are accurately described.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of the equipment, hardware and software being maintained.</li> <li>• Knowledge of the hardware, software and tools used for maintenance.</li> <li>• Knowledge of documentation procedures and terminology.</li> </ul>	<ul style="list-style-type: none"> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> <li>• Identifies relevant details, facts, specifications and follows set of instructions.</li> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Understands decision making process, analyzes situation / information and considers risks / implications.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: A. Perform Preventive and Reactive Maintenance**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>A5.</b> Maintain security</p>	<ul style="list-style-type: none"> <li>• Ports are operational accurately verified.</li> <li>• Backup media is secure in accordance with company specifications.</li> <li>• Users are added and updated in accordance with company procedures.</li> <li>• Security requirements are monitored, implemented and enforced in accordance with company procedures.</li> <li>• Remote access is properly verified in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of ports and verification procedures.</li> <li>• Knowledge of backup media and security procedures.</li> <li>• Ability to add users.</li> <li>• Knowledge of company procedures.</li> <li>• Knowledge of security requirements and the ability to monitor, implement and enforce them.</li> <li>• Ability to verify remote access.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> <li>• Responds assertively, defends own viewpoints, accepts responsibility for own behavior and understand own impact on others.</li> <li>• Demonstrates trustworthiness and accepts responsibility for own behavior.</li> </ul>
<p><b>A6</b> Execute long range solutions</p>	<ul style="list-style-type: none"> <li>• Implementation is conducted according to plan.</li> <li>• Problems are identified and resolved in a timely and effective manner.</li> <li>• System performance is verified after implementation and compared against specifications.</li> <li>• Implementation is conducted with minimum disruption to users.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to plan according to resource constraints and requirements.</li> <li>• Knowledge of technical specifications.</li> <li>• Knowledge of relevant indicators of system performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Accepts constructive criticism, sets well defined, realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Analyzes and interprets technical data.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: B. Perform Troubleshooting**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>B1.</b> Analyze problems</p>	<ul style="list-style-type: none"> <li>• Problem is identified correctly.</li> <li>• Problem causes are properly isolated.</li> <li>• Solutions are thoroughly researched.</li> <li>• Solutions relevant to problems and academic/employability are practical.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of troubleshooting methods.</li> <li>• Knowledge of sources of relevant technical data.</li> <li>• Ability to prioritize possible solutions based on technical criteria.</li> <li>• Knowledge of ERU and other translation problems and knowledge of point codes in HLR and STP.</li> <li>• Knowledge of WOS, WOSII, IS-41/ANSI-D, ISUP, CNI/LNB, SMS, 3-way calling, MWI, call forwarding, call waiting, OAA, AWS roaming, non AWS roaming, international roaming and long distance problems.</li> <li>• Knowledge of local telco , phone equipment, authentication and incoming call problems.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Suggests system modifications / improvements and determines system components to be improved.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: B. Perform Troubleshooting**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>B2.</b>            Identify, test and implement solutions</p>	<ul style="list-style-type: none"> <li>• Solutions are clearly defined with possible impact to system.</li> <li>• Solutions are selected based on technical benefits and cost effectiveness.</li> <li>• Solutions are tested in a complete and realistic manner.</li> <li>• Test scenarios are representative of actual use and environment.</li> <li>• System resolution is coordinated with available resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of test instruments.</li> <li>• Knowledge of test methods.</li> <li>• Knowledge of systematic methods of solving technical problems.</li> <li>• Ability to replace components when appropriate.</li> <li>• Ability to remove, repair, or replace modules and subassemblies as appropriate.</li> <li>• Knowledge of applications and diagnostic programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Suggests system modifications / improvements and determines system components to be improved.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Presents complex ideas / information and poses critical questions.</li> </ul>
<p><b>B3.</b>            Communicate technical solutions and implementation processes</p>	<ul style="list-style-type: none"> <li>• Technical solutions and implementation processes are communicated in a timely manner and understandable form to a target audience.</li> <li>• User concerns are considered and addressed in the communication process.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of technical communications processes.</li> <li>• Ability to translate technical language into lay terminology when necessary.</li> <li>• Knowledge of customer relations techniques.</li> <li>• Ability to communicate appropriately to different audiences and organizational levels.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Models proper performance and attitudes, conducts task specific training and coaches others to apply related concepts.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: B. Perform Troubleshooting**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>B4.</b>  <b>Document equipment and software problems and resolutions</b></p>	<ul style="list-style-type: none"> <li>• Documentation is clear and accurate.</li> <li>• Documentation follows organization format and procedures.</li> <li>• Hardware and software problems are clearly identified.</li> <li>• Resolutions are documented to the appropriate level of detail.</li> <li>• Documentation is organized for most efficient access by other users.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of documentation tools.</li> <li>• Knowledge of technical presentation tools.</li> <li>• Knowledge of technical terms.</li> <li>• Knowledge of documentation processes and procedures.</li> <li>• Ability to organize and present technical information in a logical and consistent manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately and summarizes / paraphrases information and creates original documents.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Understands the system organization and follows procedures.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>
<p><b>B5.</b>  <b>Perform reactive maintenance</b></p>	<ul style="list-style-type: none"> <li>• Troubles are referred to appropriate departments or personnel accordance with company procedures.</li> <li>• Error codes are acted upon in accordance with company procedures.</li> <li>• When troubles are found they are isolated, faults are analyzed to determine cause and corrective actions are taken.</li> <li>• Hardware is replaced in accordance with company procedures.</li> <li>• Database recovery is performed in accordance with company procedures.</li> <li>• Diagnostics are properly initiated in accordance with company procedures.</li> <li>• Maintenance is documented in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of ECP, 5ESS, OMP/HA-OMP, DACs, Octel, peripheral, and Acculink hardware.</li> <li>• Knowledge of audio trunk testing and test call procedures.</li> <li>• Knowledge of trouble referral procedures.</li> <li>• Knowledge of modification procedures for message class routing and national and local switch translations.</li> <li>• Ability to isolate troubles, identify faults and take corrective actions.</li> <li>• Knowledge of hardware replacement procedures.</li> <li>• Ability to perform database recovery.</li> <li>• Knowledge of company procedures for sign-off on diagnostics and documenting maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Evaluates performance of technology.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: B. Perform Troubleshooting**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>B6. Identify problems</b></p>	<ul style="list-style-type: none"> <li>• Problems are accurately identified.</li> <li>• Impact of problems is accurately assessed.</li> <li>• Alarming is read, monitored and accurately interpreted in accordance with company procedures.</li> <li>• Problems are reported to appropriate personnel effectively and in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of normal operation and behavior of equipment.</li> <li>• Ability to discern problems.</li> <li>• Knowledge of alarming and ability to monitor and interpret alarming.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Understands the system organization and follows procedures.</li> <li>• Understands decision making process, analyzes situation / information and considers risks / implications.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> </ul>

OPERATIONS AND MAINTENANCE

**Concentration: Operations and Maintenance**  
**Critical Work Functions: C. Provide Support**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>C1.</b>  <b>Support new technologies/products</b></p>	<ul style="list-style-type: none"> <li>• New technologies are properly implemented.</li> <li>• System modifications are made in accordance with company procedures.</li> <li>• New processes and procedures are developed as required and are properly communicated and documented.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of new technologies and hardware and software implementation procedures.</li> <li>• Ability to make system modifications.</li> <li>• Ability to develop new processes and procedures and Knowledge of documentation protocols.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Suggests system modifications / improvements and determines system components to be improved.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> </ul>
<p><b>C2.</b>  <b>Collaborate with vendors</b></p>	<ul style="list-style-type: none"> <li>• Needs of vendor are accurately identified and needs of company are accurately communicated to vendor.</li> <li>• Vendor requests are responded to in a timely manner and availability of personnel to vendor is maintained.</li> <li>• Problem solving occurs on a mutual and collaborative basis.</li> <li>• Confidentiality is maintained in accordance with company and customer policies and procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of vendor's equipment.</li> <li>• Knowledge of company and customer policies regarding confidentiality.</li> </ul>	<ul style="list-style-type: none"> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Demonstrates trustworthiness and accepts responsibility for own behavior.</li> <li>• Interprets, summarizes, integrates and analyzes information; prepares basic summaries and reports.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: C. Provide Support**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>C3.</b> Provide status updates</p>	<ul style="list-style-type: none"> <li>• Status reports are provided to all appropriate personnel.</li> <li>• Quality measure reports are generated in a timely manner and in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of status reports.</li> <li>• Knowledge of quality measure reports.</li> <li>• Knowledge of company procedures regarding updates.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the system organization and follows procedures.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> <li>• Follows procedures and pays attention to details.</li> </ul>

OPERATIONS AND MAINTENANCE

**Concentration: Operations and Maintenance**  
**Critical Work Functions: C. Provide Support**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>C4. Provide technical assistance to internal customers</b></p>	<ul style="list-style-type: none"> <li>• Technical information is effectively communicated with other departments.</li> <li>• Cooperation and team skills are effectively utilized in work group relationships.</li> <li>• Problems are accurately determined and appropriate actions are taken to resolve issues.</li> <li>• Company is professionally represented in a positive manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to interpret records and assess arrangement of facilities</li> <li>• Knowledge of company procedures, equipment, materials and processes and the ability to locate information on equipment, materials and processes.</li> <li>• Knowledge of the organizational structure and departmental functions.</li> </ul>	<ul style="list-style-type: none"> <li>• Models proper performance / attitudes, conducts task specific training and coaches others to apply related concepts.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Identifies the problem, analyzes possible causes and reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Accepts constructive criticism, sets well defined, realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: C. Provide Support**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>C5.</b>            Provide support to other/partner markets</p>	<ul style="list-style-type: none"> <li>Needs of other/partner markets are accurately identified and needs of company are accurately communicated to other/partner markets.</li> <li>Other/partner markets requests are responded to in a timely manner and availability of personnel to other/partner markets is maintained.</li> <li>Problem solving occurs on a mutual and collaborative basis.</li> <li>Confidentiality is maintained in accordance with company and customer policies and procedures.</li> </ul>	<ul style="list-style-type: none"> <li>Knowledge of partner markets.</li> <li>Knowledge of company and customer policies regarding confidentiality.</li> </ul>	<ul style="list-style-type: none"> <li>Analyzes customer needs and demonstrates commitment to customer.</li> <li>Demonstrates creative thinking process while problem solving, develops and applies creative solutions to new and existing situations.</li> <li>Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>Interprets and clarifies communication.</li> <li>Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: D. Manage Network and Cell Site Growth**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>D1.</b> Install equipment and new sites</p>	<ul style="list-style-type: none"> <li>• Support equipment is properly added and removed.</li> <li>• Equipment and applications are installed/upgraded and configured according to specifications.</li> <li>• Equipment and applications are tested using appropriate tools and procedures.</li> <li>• Software and hardware compatibility issues are identified and resolved.</li> <li>• Layout, configuration and changes are properly documented.</li> <li>• Cell site trunk groups are created as appropriate.</li> <li>• Cell site is properly sectorized in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to install vocoders, microwave hops, equipment and applications.</li> <li>• Ability to add and remove voice channels and support equipment.</li> <li>• Ability to upgrade and configure equipment and applications.</li> <li>• Knowledge of equipment and applications testing tools and procedures.</li> <li>• Ability to resolve software compatibility issues.</li> <li>• Knowledge of documentation procedures for layout, configuration and changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Records information accurately and summarizes information.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> </ul>
<p><b>D2.</b> Perform testing</p>	<ul style="list-style-type: none"> <li>• Span acceptance is properly performed in accordance with company procedures.</li> <li>• Switch trunk and span testing are properly performed in accordance with company procedures to minimize customer impact.</li> <li>• Completion of testing is properly documented.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to perform T1-T3 span acceptance.</li> <li>• Ability to perform switch trunk and DS3/T3 testing.</li> <li>• Knowledge of company procedures for testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands decision making process, analyzes situation / information and considers risks / implications.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> <li>• Summarizes and translates mathematical data.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: D. Manage Network and Cell Site Growth**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>D3.</b>            Reconfigure existing equipment</p>	<ul style="list-style-type: none"> <li>• All company procedures are carefully followed.</li> <li>• Reconfiguration is completed in a timeframe that does not disrupt customers.</li> <li>• Changes are verified by coworker or supervisor and are checked to ensure that they were properly implemented.</li> <li>• Reconfiguration is communicated to appropriate personnel effectively and in a timely manner.</li> <li>• All personal safety equipment is worn and all safety procedures are followed.</li> <li>• Changes are properly documented in accordance with company procedures.</li> <li>• Cell site trunk and network members are grown in accordance with company procedures.</li> <li>• Facilities are grown in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of company procedures.</li> <li>• Knowledge of reconfiguration procedures.</li> <li>• Knowledge of personal safety equipment and safety procedures.</li> <li>• Knowledge of documentation procedures.</li> <li>• Knowledge of T-coder decommissioning, hardware, regrooming, programming and phys/log connectivity.</li> <li>• Ability to grow and degrow cell sites and to sectorize and regroom cell sites.</li> <li>• Knowledge of ECP, OMP and 5ESS software updates.</li> <li>• Knowledge of ECP and 5ESS memory growth.</li> <li>• Knowledge of ECP, DACs and 5ESS retrofits.</li> <li>• Knowledge of ECP and 5ESS CNI ring nodes.</li> <li>• Knowledge of vocoders, ECP, 5ESS and TTY and of 5ESS digital trunk line units.</li> <li>• Knowledge of DACs system growth.</li> <li>• Knowledge of trunk groups and ring nodes.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrates trustworthiness and accepts responsibility for own behavior.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Understands decision making process, analyzes situation / information and considers risks / implications.</li> </ul>
<p><b>D4.</b>            Work with TELCO personnel</p>	<ul style="list-style-type: none"> <li>• Needs of company are accurately communicated to TELCO personnel.</li> <li>• TELCO personnel requests are responded to in a timely manner and availability of personnel to TELCO is maintained.</li> <li>• Communications with TELCO personnel are accurately recorded.</li> <li>• Issues with TELCO are followed up to ensure they have been properly handled.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of company needs.</li> <li>• Knowledge of TELCO issues and how to resolve them.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognizes job tasks and distributes work assignments.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> <li>• Accepts constructive criticism, sets well defined, realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: D. Manage Network and Cell Site Growth**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>D5.</b> Perform system provisioning</p>	<ul style="list-style-type: none"> <li>• DSX hardware is provisioned in accordance with company procedures.</li> <li>• Cell site trunk groups are created as appropriate.</li> <li>• Software is updated as required to support growth.</li> <li>• Retrofits are properly performed in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of DSX hardware provisioning procedures.</li> <li>• Knowledge of trunk groups and ring nodes.</li> <li>• Knowledge of ECP, OMP and 5ESS software updates.</li> <li>• Knowledge of T-coder decommissioning, hardware, regrooming, programming and phys/log connectivity.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the requirements of the task &amp; technological results and analyzes task / technology relationship.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Evaluates performance of technology.</li> <li>• Demonstrates initiative, monitors performance standards and follow up on assigned tasks.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> </ul>
<p><b>D6.</b> Inventory equipment</p>	<ul style="list-style-type: none"> <li>• Inventory is completed within required timeframe with minimum interference to operations.</li> <li>• Inventory recounts are minimal.</li> <li>• Inventory corrections are accurate and minimal.</li> <li>• Inventory is carried out safely.</li> <li>• Inventory is recorded in correct unit of measure.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of inventory timeframes and the ability to complete it with minimum interference with operations.</li> <li>• Ability to take inventory with minimal recounts and corrections.</li> <li>• Knowledge of safety procedures.</li> <li>• Knowledge of units of measure for inventory.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Summarizes and translates mathematical data.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Follows procedures and pays attention to details.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: E. Manage Professional Development**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>E1. Participate in certificate program</b></p>	<ul style="list-style-type: none"> <li>• Certifications are performed by the manufacturer of equipment or appropriate third party.</li> <li>• New requirements are identified and communicated appropriately.</li> <li>• Documentation is accurate and available to appropriate personnel.</li> <li>• Training requirements for certifications are identified.</li> <li>• Technical and professional certifications are kept current.</li> <li>• Trainings for certification are attended as required.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of industry certifications.</li> <li>• Knowledge of certification documentation procedures.</li> <li>• Knowledge of training requirements and opportunities for certification.</li> </ul>	<ul style="list-style-type: none"> <li>• Accepts constructive criticism, sets well defined realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Applies processes to new information and transfers information between formats.</li> <li>• Adheres to standards, demonstrates commitment to excellence and leads by example.</li> </ul>

OPERATIONS AND MAINTENANCE

**Concentration: Operations and Maintenance**  
**Critical Work Functions: E. Manage Professional Development**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>E2.</b>            Keep current on industry trends, technology and jargon</p>	<ul style="list-style-type: none"> <li>• On- and off-the-job training opportunities are used effectively.</li> <li>• Need for technology skill and knowledge upgrade is accurately assessed.</li> <li>• Relevant technical manuals, journals and subscriptions are read to obtain current technical information.</li> <li>• Mandatory training is attended according to schedule.</li> <li>• The internet is accessed to obtain current technical information.</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to access appropriate training from the company, and professional organizations.</li> <li>• Knowledge of training formats and opportunities in broadband telecommunications.</li> <li>• Ability to evaluate one's skills against current job specifications.</li> <li>• Knowledge of company procedures, and where applicable, labor-management negotiated agreements on training.</li> <li>• Knowledge of Internet services and applications</li> <li>• Knowledge of operational procedures.</li> <li>• Knowledge of appropriate training procedures.</li> <li>• Knowledge of organization legal policies and ethical practices.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands learning process, interprets and applies new knowledge and experience, analyzes application of learning tools and investigates and manipulates learning tools and techniques.</li> <li>• Translates blueprints, drawings, diagrams, applies appropriate principles to situation and utilizes previous training / experience to predict outcomes.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Applies processes to new information and transfers information between formats.</li> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> </ul>
<p><b>E3.</b>            Provide training to new hires and current employees</p>	<ul style="list-style-type: none"> <li>• Employee records document that training has been delivered.</li> <li>• Training schedules are developed.</li> <li>• Evaluations indicate worker understanding of the training materials.</li> <li>• Test results and certification achieved indicated effective training.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of employee training documentation.</li> <li>• Knowledge of new-hire and current employee training schedules.</li> <li>• Knowledge of the topic being taught.</li> </ul>	<ul style="list-style-type: none"> <li>• Recognizes differences, respects the rights of others, and responsibly challenges discriminatory practices / procedures.</li> <li>• Models proper performance and attitudes, conducts task specific training and coaches others to apply related concepts.</li> <li>• Presents complex ideas / information and poses critical questions.</li> <li>• Interprets and clarifies communication.</li> <li>• Takes active interest in and willingly helps others, modifies behavior to environment and shows empathy for others.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: E. Manage Professional Development**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p>E4. Attend vendor training</p>	<ul style="list-style-type: none"> <li>• Training processes are participated in fully.</li> <li>• Notes and knowledge gained are communicated to coworkers as appropriate.</li> <li>• Training attendance is accurately documented in accordance with company procedures.</li> <li>• Feedback is provided to trainer, HR, supervisor or other appropriate personnel effectively and in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of vendor training requirements.</li> <li>• Knowledge of vendor training documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands learning process, interprets and applies new knowledge and experience, analyzes application of learning tools and investigates learning tools and manipulates learning tools and techniques.</li> <li>• Accepts constructive criticism, sets well defined, realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Assists and encourages team members, works to improve team skills and demonstrates commitment.</li> <li>• Applies appropriate principles to situation, utilizes previous training / experience to predict outcomes and uses imagination to visualize events, outcomes.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: F. Perform Administrative Functions**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>F1.</b> <b>Inventory equipment</b>	<ul style="list-style-type: none"> <li>• Inventory is completed within required timeframe with minimum interference to operations.</li> <li>• Inventory recounts are minimal.</li> <li>• Inventory corrections are accurate and minimal.</li> <li>• Inventory is carried out safely.</li> <li>• Inventory is recorded in correct unit of measure.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of inventory timeframes and the ability to complete it with minimum interference with operations.</li> <li>• Ability to take inventory with minimal recounts and corrections.</li> <li>• Knowledge of safety procedures.</li> <li>• Knowledge of units of measure for inventory.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquires supplies and equipment and uses materials in a safe and efficient manner.</li> <li>• Summarizes and translates mathematical data.</li> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> <li>• Records information accurately and summarizes / paraphrases information.</li> <li>• Follows procedures and pays attention to details.</li> </ul>
<b>F2.</b> <b>Maintain databases</b>	<ul style="list-style-type: none"> <li>• Monitoring plan is implemented according to company specifications.</li> <li>• Monitoring data is thoroughly analyzed and all troubles are reported.</li> <li>• Backup and recovery is managed in accordance with company procedures.</li> <li>• Maintenance plan for regular integrity checks is implemented according to specifications.</li> <li>• Software upgrades and fixes are effectively applied.</li> <li>• Database maintenance is properly documented.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of monitoring plans.</li> <li>• Ability to analyze monitoring data.</li> <li>• Ability to perform backup and recovery.</li> <li>• Ability to implement maintenance plan for integrity checks.</li> <li>• Ability to apply software upgrades and fixes.</li> <li>• Knowledge of company procedures regarding administration and enforcement of standards.</li> <li>• Knowledge of database maintenance documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> <li>• Monitors system performance, troubleshoots malfunction or failure and analyzes system operation.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: F. Perform Administrative Functions**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<b>F3.</b> <b>Write reports</b>	<ul style="list-style-type: none"> <li>• Report interpretations are consistent with analysis results.</li> <li>• Reports are completed in a timely manner.</li> <li>• Report is formatted in accordance with company policy and/or project parameters.</li> <li>• Information is complete and accurate and written with proper grammar and syntax.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of and ability to perform technical writing.</li> <li>• Understanding of goals of the report and discern the appropriate information to accomplish the goals.</li> <li>• Knowledge of acronyms and technical jargon.</li> <li>• Knowledge of company policy regarding report formats.</li> </ul>	<ul style="list-style-type: none"> <li>• Writes clearly with proper grammar syntax, punctuation.</li> <li>• Uses word processing equipment and programs including spread sheet, data base, and statistical analysis software.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Interprets, summarizes, integrates and analyzes information; prepares basic summaries and reports.</li> </ul>
<b>F4.</b> <b>Maintain records and complete necessary paperwork</b>	<ul style="list-style-type: none"> <li>• Billing logs are accurately maintained in accordance with company procedures.</li> <li>• Time reporting requirements are followed and work operations are accurately classified to appropriate account codes.</li> <li>• Necessary data is correctly recorded to ensure system accuracy.</li> <li>• Appropriate billing is correctly applied and all pertinent information is entered.</li> <li>• Applicable certifications, union memberships and licenses are up-to-date and displayed as required.</li> <li>• Records are accurately maintained.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of company, and, where applicable, labor-management negotiated reporting requirements and procedures</li> <li>• Ability to perform time reporting and account coding.</li> <li>• Knowledge of correct coding, formatting and/or forms in relation to tasks performed</li> <li>• Knowledge of certifications.</li> </ul>	<ul style="list-style-type: none"> <li>• Uses computer to store, retrieve and edit records.</li> <li>• Accepts constructive criticism, sets well defined, realistic goals, demonstrates commitment to self improvement, and analyzes and adjusts goals.</li> <li>• Understands learning process, interprets and applies new knowledge and experience, analyzes application of learning tools and investigates and manipulates learning tools and techniques.</li> <li>• Records information accurately and summarizes / paraphrases information.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: F. Perform Administrative Functions**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p>F5.            Research and reconcile billing.</p>	<ul style="list-style-type: none"> <li>• Reconciliation is completed in a detailed manner with zero errors.</li> <li>• Reconciliation is properly documented in accordance with company procedures.</li> <li>• Payment process is started to ensure that payment is received by vendor in a timely manner.</li> <li>• Disputes are documented in accordance with company procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of billing.</li> <li>• Knowledge of documentation procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Performs basic computations and measurements, converts numerical data and predicts arithmetic results.</li> <li>• Starts on time, efficiently manages time, prioritizes daily tasks, and monitors / adjusts task sequence.</li> <li>• Interprets, summarizes, integrates and analyzes information; prepares basic summaries and reports.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Selects data relevant to the task, predicts outcomes, analyzes data, integrates multiple items of data and contrasts conflicting data.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: G. Manage Roaming**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>G1.</b>  <b>Manage roaming information</b></p>	<ul style="list-style-type: none"> <li>• Accurate and up to date records are maintained in order to ensure system integrity.</li> <li>• Database of point codes, MSCID and ESID—pointers to other company pieces of equipment is accurately maintained and up to date.</li> <li>• Point codes are used to determine how to direct messaging to our equipment.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of network information and how networks work together.</li> <li>• Knowledge of signaling transfer points, what they do.</li> <li>• Knowledge of the difference between MF and SS7 signaling.</li> <li>• How to read IS 41 messaging.</li> <li>• Knowledge of record keeping procedures.</li> <li>• Knowledge of point codes and how to apply them.</li> </ul>	<ul style="list-style-type: none"> <li>• Records information accurately and summarizes and paraphrases information.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Understands technology applications, manipulates technology for desired results and analyzes technology output.</li> <li>• Utilizes integrated / multiple software, locates and retrieves stored information, manipulates information, integrates multiple platforms, utilizes networks and modifies information.</li> </ul>
<p><b>G2.</b>  <b>Conduct testing</b></p>	<ul style="list-style-type: none"> <li>• New switches or HLR's are tested to ensure that their point codes, MSCID and ESID are working.</li> <li>• Testing protocols are properly followed according to company procedures.</li> <li>• Test results and location are accurately recorded and filed according to company procedures.</li> <li>• All malfunctions are properly followed up according to company procedure.</li> <li>• Messaging software is properly utilized to determine malfunctions, and information is forwarded to appropriate personnel in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of network information and how networks work together.</li> <li>• Knowledge of signaling transfer points, what they do.</li> <li>• Knowledge of the difference between MF and SS7 signaling.</li> <li>• How to read IS 41 messaging.</li> <li>• Knowledge of switches, HLR's, point codes, MSCID and ESID.</li> <li>• Knowledge of testing protocols.</li> <li>• Knowledge of messaging software.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the system organization and follows procedures.</li> <li>• Evaluates performance of technology.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> </ul>

**Concentration: Operations and Maintenance**  
**Critical Work Functions: G. Manage Roaming**

KEY ACTIVITY	Performance Indicators <i>How do we know when the task is performed well?</i>	Technical Knowledge <i>Skills, Abilities, Tools</i>	Academic & Employability Knowledge and Skills <i>SCANS Skills, Academic Knowledge and Skills</i>
<p><b>G3.</b> Resolve roaming issues</p>	<ul style="list-style-type: none"> <li>• Contact is established and maintained with carriers in accordance with company procedures.</li> <li>• Roaming databases are monitored to ensure that information is accurate and all corrections are forwarded to appropriate personnel for updating in a timely manner.</li> <li>• Messaging software is properly utilized to determine malfunctions, and information is forwarded to appropriate personnel in a timely manner.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of network information and how networks work together.</li> <li>• Knowledge of signaling transfer points, what they do.</li> <li>• Knowledge of the difference between MF and SS7 signaling.</li> <li>• Ability to maintain contact with carriers.</li> <li>• Knowledge of messaging software.</li> <li>• Knowledge of roaming databases.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the system organization and follows procedures.</li> <li>• Monitors system performance, troubleshoots malfunction / failure and analyzes system operation.</li> <li>• Evaluates performance of technology.</li> <li>• Extracts information, uses logic to draw conclusions, analyzes principles and examines information for relevance and accuracy.</li> <li>• Identifies the problem, analyzes possible causes / reasons, generates / evaluates solutions and devises / implement plan of action.</li> </ul>
<p><b>G4.</b> Add and delete roaming agreements</p>	<ul style="list-style-type: none"> <li>• Information is distributed to appropriate parties to data fill necessary forms.</li> <li>• Contact list is accurate and kept current.</li> <li>• Agreements are tracked to maintain current information on dollar amounts, who agreements are with, and acceptance or denial of applications with justifications.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of network information and how networks work together.</li> <li>• Knowledge of signaling transfer points, what they do.</li> <li>• Knowledge of the difference between MF and SS7 signaling.</li> <li>• Knowledge of roaming agreements.</li> </ul>	<ul style="list-style-type: none"> <li>• Understands the system organization and follows procedures.</li> <li>• Follows procedures and pays attention to details.</li> <li>• Analyzes customer needs and demonstrates commitment to customer.</li> <li>• Demonstrates trustworthiness and accepts responsibility for own behavior.</li> </ul>

# operations & maintenance scenarios

## ROUTINE SCENARIO: WORK ORDER

Upon arriving at work the Technician goes to central dispatch where he receives a work order to install a new cell site. He proceeds to the site. The equipment has already been located and is in place. He is responsible for performing all the connections for power, communication lines and antennas from the tower to the base. He is also responsible for powering the unit up, and following the start-up procedures. Once the unit is checked out and powered up, it is synchronized with the central office to ensure the base is functioning and communicating with the central office location. When he is complete, he checks in with the on-site supervisor for approvals.

- D. Manage network and cell site growth
  - D1. Install equipment and new sites
  - D2. Perform testing
  
- F. Perform administrative functions
  - F4. Maintain records and complete necessary paperwork.

## CRISIS SCENARIO: ALARM

The network operations center monitors the performance and status of the network systems including bases, switches and network. An alarm is triggered, alerting the operator that there is trouble at one of the bases. The operator generates a work order for central dispatch indicating that a Technician is required. The Technician receives a work order to go out to the base and verify, troubleshoot or repair the problem. Upon arriving at the base, the Technician follows protocols to identify the problem, troubleshoot and repair. He discovers that the entire base is not getting power, and he finds it requires an electrician to repair the equipment. He escalates the problem, following company procedures and contacts dispatch, indicating they need to send an electrician. This is a vital base, and an electrician is available. So the Technician waits until the electrician arrives and fixes the power. Once the base is powered, the Technician performs all resets and runs testing protocols to ensure the base is operating properly. He documents all of his steps as required.

- B. Perform troubleshooting
  - B1. Analyze problems.
  - B2. Identify, test and implement solutions.
  - B3. Communicate technical solutions and implementation processes.
  - B4. Document equipment and software problems and resolutions.
  - B5. Identify problems.
  
- F. Perform administrative functions
  - F4. Maintain records and complete necessary paperwork.

## LONG TERM: PROFESSIONAL DEVELOPMENT

The Technician has taken responsibility for his/her own career development. It is vital that s/he stays current regarding new technologies. The company provides internal training on new technology, and s/he takes advantage of opportunities provided within the company. In addition, the local community college offers courses in wireless telecommunications, and s/he attends

classes in fundamentals of RF technology. S/he also attends courses in management, as s/he aspires to move into a supervisory role.

- E. Manager professional development
  - E1. Participate in certificate program.
  - E2. Keep current on industry trends, technology and jargon.
  - E4. Attend vendor training.



# assessment & certification: a vital connection

Skill standards, while useful on their own, are just one part of a much larger equation. Skill standards establish the standard of competent performance, but they do not tell a person whether he or she has succeeded in meeting that standard.



For this reason, developing skill standards does not end with their publication. Washington State is also working to develop voluntary assessments and certifications which will make it possible for students, workers and any person to determine their strengths and weaknesses based on the standards and to earn certification that documents their ability to perform work competently as established by the skill standards.

In today's fast-moving technological economy, the necessity for assessments and certification is crucial. The demand for both technical and employability skills is escalating as work becomes more complex. The workforce is more mobile, with workers moving freely between jobs and industries, requiring that workers are able to communicate their qualifications to potential employers. As technology changes, workers must keep up with technological

change through continuous learning and worker retraining, and need to be able to prove they have kept pace. All of these mean more training and education for individuals and the ability to show evidence that this training translates to performance on the job.

Voluntary assessments and certifications based on skill standards will help us address all those needs because of the guiding principles upon which skill standards development are based, and because of the stakeholders whose needs skill standards are designed to meet: employers, educators, workers, students, and government.

The first step toward a state-wide system of assessments and certifications is the development of assessments which measure an individual's ability to perform work competently as defined by the skill standards. Once these assessments are developed, curriculum can be assessed to determine that all necessary topics and practicums sufficiently cover the items in the assessment. Once any gaps are identified, learning activities and content adjustments can be made, and post-summative assessments can be administered. Finally, it is critical that industry is involved every step of the way, and that standards are continuously reviewed and updated. The diagram below provides a summary of this process.

## Assessment Strategies

Upon completion of the development of skill standards, performance assessment can be created to assess to the criteria identified. Sample assessments and standards may be distributed to instructors and curriculum developers who will be educated on the skill standards elements.

Assessments based on the skill standards may include pre-and post-evaluations of the student to measure skill progression and also track the success rate of obtaining certification. where applicable.

Within a skill standards or competency-based system, assessment is the generation and collection of evidence of performance which can be matched to specified explicit standards which reflect expectations of performance in the workplace. There are two main forms of evidence:

- Evidence of actual performance;
- Evidence of underpinning knowledge, skills and abilities.

The types of evidence may vary and will include:

- Direct evidence (products and items produced by the performer);
- Indirect evidence (supporting evidence and information about the performer).

Evidence can be collected in a wide variety of educational or business settings. To a large extent, this will be determined by the range of opportunities which are available for demonstration. Often it is difficult to actually perform the task in the authentic work setting. In this case, evidence generated during an educational course or an in-house training session can be collected by individuals and added to their overall portfolios.

By requesting that the student or trainee produce tangible results in the form of take-away products (videos, tapes, paper and electronic products), the participant will have created real evidence which can be shown to human resource personnel, hiring managers, supervisors or assessors. When assessing these products, the trained assessor will seek:

- Validity
- Currency
- Authenticity
- Sufficiency

Therefore, when designing skill standards based assessment for an educational course or training session, the assessment process and results will meet four criteria:

### **VALIDITY:**

The assessment instrument/process clearly relates to the relevant standards.

### **CURRENCY:**

The assessment instrument/process calls for a demonstration of the current standards in the industry.

**AUTHENTICITY:**

The assessment results are produced by the individual being assessed; it is their own work. Team activities will be useful to demonstrate the skills and abilities to work effectively with others, not necessarily the total end results. The individual can, if possible, identify his or her part of the team project to demonstrate evidence of their own results.

**SUFFICIENCY:**

Enough evidence is collected to match the key task and the performance criteria included in the skill standards.

When designing / revising the curriculum for wireless telecommunications, students will be assisted in generating high-quality evidence of performance or of underpinning skills, knowledge and abilities which will help them to be successfully assessed as fully competent.

Adapted from the *Skill Standards Volume 2: Assessment*, 1999, Washington State Board for Community and Technical Colleges, and *Designing Competency-Based Training*, Shirley Fletcher, 1991, Pfiffer & Company, p 86-88.



## Assessment Design

Type of Authentic Assessment	Description of Authentic Assessment Strategies
<b>Project</b>	<ul style="list-style-type: none"> <li>• Hands-on demonstration of knowledge, skills and attitudes that reveals a student's ability to plan, organize and create a product or an event.</li> <li>• Documentation of process of development from initial steps to final presentation.</li> </ul>
<b>Portfolio</b>	<ul style="list-style-type: none"> <li>• Collection of pieces of evidence of a student's knowledge, skills and attitudes.</li> <li>• Showcase of best work, work in progress.</li> <li>• Record of student's progress over time.</li> <li>• Content selection by student in collaboration with the teacher.</li> <li>• Centerpiece for parent conferences.</li> </ul>
<b>On-Demand Demonstrations</b>	<ul style="list-style-type: none"> <li>• Hands-on performance by a student, which illustrates levels of knowledge, skills and attitudes.</li> <li>• Typically involve a "real life" problem or situation to solve.</li> <li>• Focus on the application of knowledge and skills learned in one situation as it connects to a new and different one.</li> </ul>
<b>Case Studies</b>	<ul style="list-style-type: none"> <li>• Analysis of events and individuals in light of established criteria.</li> <li>• Synthesis of evidence to support generalizations based on individual cases.</li> </ul>
<b>Paper/Pencil Tests</b>	<ul style="list-style-type: none"> <li>• Multiple-choice, essay, true-false questions that rely on extended responses to further clarify a student's understanding of the knowledge being assessed.</li> <li>• Graphic representations that reveal a student's understanding of connections among ideas.</li> </ul>
<b>Structured Observation</b>	<ul style="list-style-type: none"> <li>• Observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.</li> </ul>
<b>Scenarios</b>	<ul style="list-style-type: none"> <li>• A problematic or challenging situation presented in the context of a technical area.</li> <li>• Required study to analyze or evaluate a situation.</li> <li>• Apply relevant knowledge or skills.</li> <li>• Prepare and justify a reasonable solution.</li> </ul>
<b>Critical Incident</b>	<ul style="list-style-type: none"> <li>• An interview where the assessee is asked to describe past experiences which demonstrate a skill standards.</li> </ul>

**From:** Center for Occupational Research and Development, November 1996 and *Skill Standards Volume 2: Assessment*, 1999, Washington State Board for Community and Technical Colleges.

# references

Built To Work, National Skill Standards Board, 2000.

National Skill Standards Board web site: [www.nssb.org](http://www.nssb.org)

Points of Knowledge, GWEC, 2000.

Skill Standards Guidebook Volumes I and II, Washington State Board for Community and Technical Colleges. Reprinted June, 1999.

Workforce Demand Study, Northwest Policy Center, University of Washington, 2000.

## FOR MORE INFORMATION

Web references: [www.nssb.org](http://www.nssb.org)  
[www.gwec.org](http://www.gwec.org)

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