Southwest Alaska Long-haul Microwave and Optical Network (SALMONet) Job Opportunity Evaluation

Prepared for

Bristol Bay Native Association

by

information insights

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Executive Summary

As Bristol Bay prepares for broadband installation throughout the region, a group of tribal governments, a telephone cooperative, and Alaska Tribal Broadband (ATB) have created the consortium known as SALMONet or the Southwest Alaska Long-haul Microwave and Optical Network in the northern Lake Iliamna region. This network was created with the goal to construct and operate fiber and microwave broadband within the region to provide 300Mbps speed with unlimited data capacity for under $100/month. To be able to meet these goals SALMONet would deliver the 100 Gbps of dedicated internet access (DIA) through a network that included a combination of fiber and microwave middle mile and fiber to the home for the last mile.

As the consortium prepares for funding opportunities to support the capital costs of this project, they are also preparing for what the next stage looks like; maintenance. This requires qualified workers in an up-and-coming industry with high demand and many unknowns, especially in rural Alaska.

SALMONet and BBNA wanted to conduct research to figure out what other organizations and industry leaders are doing in regards to workforce, both training and employment, practices for broadband networks within Alaska. This research was conducted via interviews and offered insight to potential training programs to be utilized, as well as structures for employment that have worked on the North Slope. Study participants included the CEO of Arctic Slope Telephone Association Cooperative (ASTAC), the past CEO of Nushagak Electrical and Telephone Cooperative (NETC), and an electrical engineer in Southwest Alaska. Of the interviews conducted, the interview with Arctic Slope Telephone Association Cooperative (ASTAC) served as a case study for this report.

Results

- **Federal Funding:** Without substantial federal funding & support for maintenance and operation costs, the creation of a cooperative like ASTAC, would not be as extensive or successfull. See Appendix C for a breakdown of ASTAC federal funding and sample expenditures for an approximately 70 mile two hop Microwave build between Utqiagvik and Atqasuk.
- **Security:** Cybersecurity expertise is a growing need within the broadband workforce and provides opportunities for career pathways beginning at the installation & maintenance technician level and moving up to more senior level network security positions.
- **External Contractors:** Historically, for organizations like ASTAC, external contractors have been necessary to get initial capital network installation up and running, with later operations, maintenance, and network expansion being performed almost exclusively by local technicians. ASTAC has required all outside contractors to train local, entry level technicians while performing installation work, developing a sustainable transition to local expertise.
- **Community Representatives:** Within ASTAC's model, employing a village representative in each community is essential. This ensures there is someone each resident, tribal, city, and borough council member can contact about their connection. They also employ qualified technicians that generally serve their home community, and a neighboring village, reducing the need for long distance travel, or flying in technicians from out of state that are not familiar with the region.

- **Recruitment:** Within organizations like ASTAC, recruitment for technical positions is often based on a persons' curiosity and interest in tech, troubleshooting, the outdoors, experience working in Yup'ik / Athabaskan / Dena'ina / Alutiiq villages, and dedication to their home community. Instead of requiring individuals to have the necessary technical qualifications prior to employment, they often pursue specific trainings and certifications after they are employed, with the support of their employer. A clear ladder of job mobility from entry level to senior level is highly recommended, with senior level technicians responsible for mentoring those newer to their positions. ASTAC also offers a referral bonus, for technician staff to refer others they know about with similar skill sets, to boost local recruitment efforts.
- **Cross Training:** ASTAC technicians are often trained to work and troubleshoot in several different roles. Where other telecommunications companies may employ an inside plant and outside technician to support their operations and infrastructure, ASTAC trains and employs "combination technicians" that have the skills of both positions.

Recommendations

- **Consider hosting a Tribal Broadband Bootcamp.**[1] This could be an opportunity to collaborate with other regions and tribes to get the necessary and desired number of attendees
- **Collaborate with an in-state education or training institution and telecommunications organization to develop necessary job training.** For example, ASTAC has proposed teaching an "Internet 101" course at Iḷisaġvik College, by bringing over their splice trailer to students how to splice fiber, terminate fiber, and clean fiber, including a safety training on how to climb poles and towers on ASTAC's tower facilities. These courses would be taught by ASTAC's senior level technicians. Fiber Broadband Association's OpTIC Path(™) is another example of a workforce training model. [2]

[1] "What is Tribal Broadband Bootcamp?," Tribal Broadband Bootcamp, 2023, https://www.tribalbroadbandbootcamp.com/
[2] "Broadband Workforce Development Guidebook: Workforce for implementing BEAD and other Broadband Deployment Programs," Fiber Broadband Association, 2023, https://fiberbroadband.org/wp-content/uploads/2023/05/Broadband-Workforce-Development-Guidebook-FBA-and-Cartesian-April-2023.pdf

Methodology

Information Insights, in partnership with Deerstone Consulting and SALMONet leadership, created an outline interview guide to further understand employment and training needs and solutions for the SALMONet broadband network.

The project start up was an orientation of what the consortium is and its goals then transitioned to developing an outreach list with the assistance of Bristol Bay Native Association, Deerstone Consulting, and SALMONet leadership. The outreach list consisted of over twenty people who work in telecommunications, consulting, engineering, tribal government, and at a broadband non-profit who are familiar with the region. Outreach efforts included emails, follow-up emails, and phone calls.

Each interview took place virtually and lasted about an hour with all the questions focused on employment and training for organizations. The interview took 30-60 minutes and asked a variety of questions about the region and then specifics about jobs and training for broadband networks. Three total interviews were conducted with the Arctic Slope Telephone Association Cooperative (ASTAC) offering the most applicable information.

Limitations

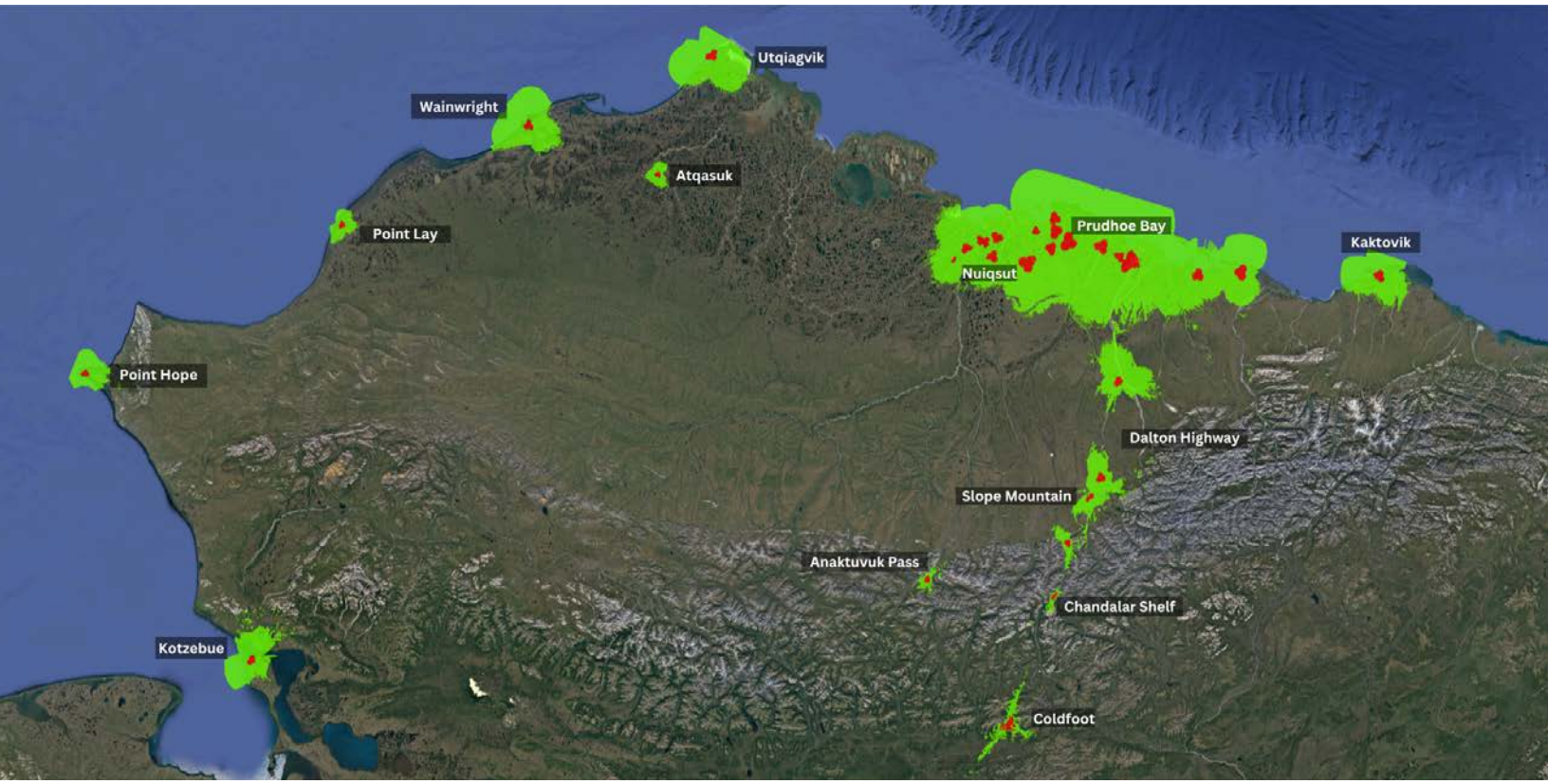
- **Small sample size:** This report involved a small sample size due to limited responses to interview requests. ASTAC's response was converted into a case study for this report and it is important to note that Bristol Bay and the Arctic Slope are culturally, economically, geographically, and seasonally different, making it difficult to take a model from one region and apply it directly to another.
- **Lack of standardized broadband job codes:** The Department of Labor does not currently recognize any specific broadband job codes, making it "nearly impossible to measure worker value, earnings potential, and skills acquisition in these occupations, and … challenging to develop career pathways and related learning curricula to ease transitions into these roles."[3] These jobs tend to be more task oriented, requiring more experiential and "on the job" immersion for workers. The occupations identified below are a best approximation of the credentialing and staffing requirements for the broadband / telecommunications industry and should not be considered comprehensive.

[3] Brady Tavernier and Nicol Turner Lee, "Reimagining the broadband technology workforce," *Brookings Institution*, 2022, https://www.brookings.edu/articles/reimagining-the-technology-workforce-in-broadband-infrastructure

Arctic Slope Telephone Association Cooperative (ASTAC) Case Study

Arctic Slope Telephone Association Cooperative (ASTAC) is a member-owned telephone utility Cooperative providing telecommunications services to the residents of the North Slope region of Alaska. The Cooperative's designated service area is a roadless, remote arctic area of more than 90,000 square miles which is larger than 40 of the 50 states combined. Prior to having local phone service each village was served by only one pay phone. Residents stood in line, sometimes for hours in inclement weather, waiting their turn to use the pay phone.[4]

The Cooperative utility consists of more than 3,500 access lines served by nine central offices located in eight of the region's traditional villages and at the petroleum industry exploration and production complex at Deadhorse-Prudhoe Bay. ASTAC currently employs approximately 74 employees.



[4] Sharon Vollman, "Executive Insights With Jens Laipenieks, CEO/GM of Arctic Slope Telephone Association Cooperative, Inc. (ASTAC)," *ICT Solutions & Education*, 2020, https://www.isemag.com/professional-development-leadership/article/14267202/executive-insights-with-jens-laipenieks-ceogm-of-arctic-slope-telephone-association-cooperative-inc-astac

ASTAC Employment Model

Tiered Approach: ASTAC follows a tiered approach with different levels of positions, including village reps, technicians, and senior techs. Senior techs mentor and guide the village reps and technicians, ensuring knowledge transfer and continuous improvement.

Village Representatives: In an Ideal scenario, ASTAC's CEO expressed that their cooperative would have "a village rep and a qualified technician, scattered throughout these regions, so that they would only have to travel between their home village and a neighboring village" (as opposed to flying in outsiders from out of state), or technicians that have to travel further distances. For example, they have one technician that lived full time in Point Lay and works as a technician in Point Hope and Wainwright.

Technician Training and Skills: ASTAC seeks technicians with a high school diploma or equivalent, preferably with a technological background. Desired certifications include CompTIA Network+ for comprehensive training, as well as installation and troubleshooting certifications for fiber, Ethernet, and IP. Other skills like pole climbing, equipment operation, and problem-solving abilities are essential. The organization emphasized the need for technicians to adapt to modern IP-based systems rather than traditional telephone networks.

Technician Working Conditions & Expected Abilities:

Conditions:

- Both independent and team work environments
- Schedule is often reflective of 10-hour days of a 3 week shift (21/10's) and occasional overtime hours beyond the scheduled 10 hours.
- Intermittent extended hours of employment requiring considerable physical and emotional stamina.
- Site work at ASTAC facilities requires travel by foot, all-terrain vehicle, pick-up truck, aircraft, and various other means of transportation as may be available, in varying and often extreme arctic conditions.

Abilities:

- Can safely use ladders, boom/bucket truck, trenching equipment and other associated telecommunications construction equipment.
- Good verbal and written communication skills.
- The speech, hearing and visual ability to read, write, spell, and communicate clearly using the terminology of the communications industry in the English language.
- Working knowledge of Windows based personal computer equipment, including Microsoft Office Suite
- Physical demands require standing, sitting, stooping, kneeling, walking, the ability to lift at least 50 pounds, and work at heights of 60 ft. or above.
- Positive attitude in a rapidly changing industry.

Career Opportunities: ASTAC's model highlights various career opportunities within the telecom field, such as telecom experts, network technicians, network engineers, and network security technicians. Specializations in areas like cybersecurity can lead to high-demand and well-compensated positions. These key occupations are summarized in Table 1.

Table 1. ASTAC Employment Tiers

		Responsibilities	Training Preferred
Senior Level	**Network Security Technicians**	Identify threats to computer systems and develop firewalls and other security measures to safeguard systems	• *Certificate programs* • *Experience / internal promotion* • *4-year degree in a technical field*
	Network Technicians	Install and troubleshoot internet connections in many different environments with physical cables or wireless frequencies, creating adequate signal strength throughout a location for a client's use.	• *Certificate programs* • *Experience / internal promotion* • *Industry certifications* • *4-year degree in a technical field*
	RF-Wireless Technicians	Troubleshoot and work with a range of RF-enabled devices including cell phone antennas, amplifiers, two-way radios, satellite systems, and internet access points.	• *Certificate programs* • *Industry certifications* • *4-year degree in a technical field*
Mid Level	**Exchange Managers**	Manage, coordinate, and supervise all daily functions and operations including outside plant construction and maintenance, station installation and maintenance, central office construction and maintenance, building and vehicle maintenance, and commercial operations.	• In-house training • 2-or 4-year degree
	Combination (Inside/Outside Plant) Technicians	Construct, operate, and maintain, voice lines, data lines and cellular wireless services, including performing wiring for new and existing subscribers.	• *Apprenticeships* • *Certificate programs* • *In-house training* • *Heavy equipment operation experience*
Entry Level	**Installation & Maintenance Technicians**	Install and maintain all communications services, facilities, and products, including but not limited to terrestrial (buried and aerial) copper and fiber optic, wireless and microwave towers, etc.	• Apprenticeships • CTE • In-house training
	Village Representatives	Responsible for developing, cultivating, and maintaining strong business relationships with both existing and new customers.	• In-house training • High School diploma

Economics of Running a Broadband Network

Capital expenditure (CapEx)	Operational Expenditure (OpEx)
The dollar cost to build the network asset(s) (typically a large, upfront cost) which is depreciated over the useful life of the asset for accounting purposes. This can include material, land, labor for construction and connection, engineering, permitting, upgrades and replacements, and construction equipment.	The day-to-day (ongoing) cost to run and maintain a network to provide services. OpEx can include power, network maintenance, middle mile and/or core internet transit fees (if any), sales and marketing, customer support, rent, and other business operation expenses.

[5]

ASTAC demonstrates the necessity of ongoing OpEx funding with a breakdown of expenditures for an approximately 70 mile Two hop Microwave build between Utqiagvik and Atqasuk. This project provides a total transport of ~5 Gbps of bandwidth.[6]

Table 2. Sample Breakdown of Expenditures

Key Elements and ROM CapEx costs:

Engineering and Permitting	$400,000
3 towers = $1.33M each	$4,000,000
1 remote prime powered mid-point site (twin generators, fuel tank, pad) (4-year life)	$500,000
Microwave Equipment (2 hops, diverse antennas) (5-year life)	$500,000
Power additions (far ends)	$100,000
Total Year 1 CapEx Spend	**$5,500,000**

Annual Operating Expenses, not including middle mile capacity:

Fueling of mid-point site	$120,000
Generator maintenance (Oil changes, filters, failover testing)	$12,000
Tower light testing, licensing, site maintenance, etc.	$3,000
Transport to site for all operations activities	$45,000
Total Annual OpEx cost	**$180,000**

Annual Middle Mile Capacity Annual OpEx Cost:

3Gbps Subsea bandwidth	$5,400,000

20 Year Expenses

20 Year CapEx Spend	**$7,000,000**

[5] "Economics of Broadband Networks: An Overview," *National Telecommunications and Information Association (NTIA)*, 2022, https://broadbandusa.ntia.doc.gov/sites/default/files/2022-03/Economics%20of%20Broadband%20Networks%20PDF.pdf

[6] Tribal Engagement and Best Practices: Arctic Slope Telephone Association Cooperative, Inc. / ASTAC Broadband, LLC," *Arctic Slope Telephone Association Cooperative*, 2022, https://broadbandusa.ntia.doc.gov/sites/default/files/2022-08/Tribal-Programming-and-Local-Coordination-Thomas-Lochner.pdf

20 Year Total OpEX	**$111,600,000**
20 Year OpEx Cost (w/o middle mile)	$3,600,000
20 Year Middle Mile OpEx	$108,000,000

One of the Indigenous Connectivity Institute's 2022 Calls to Action recognizes that, given the high costs of operating networks in rural and remote areas, governments, the private sector, and philanthropic organizations must provide sustainable funding for the ongoing operation of networks, not just upfront capital costs.[7]

ASTAC's recent expansion in the North Slope region has been supported by extensive federal funding, in the form of grants, contracts, and direct payments. Full records can be found at USA Spending.gov.[8]

Table 3. ASTAC Federal Grant Funding

Duration	Grant	Amount
April 2023 - April 2025	US Department of Agriculture's (USDA) Rural Utilities Service (RUS) ReConnect Grant Program - The grant to ASTAC provided the means to expand its terrestrial network in Point Lay and Anaktuvuk Pass by way of Point Hope and the Dalton Highway. Both projects allow for high-speed broadband at or above 100 Mbps in communities currently served by satellite bandwidth, which is prohibitively expensive and has limited capacity and very high latency. As part of the project, ASTAC will also replace copper cabling with fiber optics to roughly 261 homes, businesses, and institutions. Consistent with the goals established by the United States National Broadband Plan and the Arctic Council's Arctic Broadband Initiative, these upgrades provide terrestrial broadband connecting Anaktuvuk Pass to the existing Dalton fiber onto ASTAC's central office in Deadhorse and Point Lay by way of Point Hope.[9]	$31,352,400
July 2022 - July 2024	USDA Rural Utilities Service Distance Learning and Telemedicine Loans and Grants - ReConnect Grant was used to deploy a fiber-to-the-premises network to connect 476 people, 15 businesses and a public school to high-speed internet in North Slope Borough, Alaska. Arctic Slope Telephone Association Cooperative Inc. will make high-speed internet affordable by participating in the FCC's Affordable Connectivity and Lifeline programs. This project will serve the socially vulnerable communities of North Slope Borough and portions of the Anaktuvuk and the Point Lay Alaska Native Village Tribal Areas	$30,970,030

[7] "Indigenous Connectivity Summit: Calls to Action," *Indigenous Connectivity Institute & Connect Humanity*, 2022, https://connecthumanity.fund/wp-content/uploads/2022/12/ICS-Calls-to-Action-Public-1.pdf

[8] "Recipient Profile: ARCTIC SLOPE TELEPHONE ASSOCIATION COOPERATIVE, INC.," *USASpending.gov*, https://www.usaspending.gov/recipient/e7c123fa-6cb7-7bfa-6060-df60822c23a7-P/latest

[9] "Federal Cash Pays for North Slope, Kodiak Island Broadband Expansions," *Alaska Business Magazine*, 2022, https://www.akbizmag.com/industry/telecom-tech/federal-cash-pays-for-north-slope-kodiak-island-broadband-expansions/

Sept 2020 - Sept 2022	USDA Rural Utilities Service Distance Learning and Telemedicine Loans and Grants - ASTAC used this grant to deploy a network connecting 239 people, 28 businesses, a public school and a post office to high-speed broadband in Kaktovik.	$5,376,263
Dec 2019 - Dec 2021	USDA Rural Utilities Service Community Connect Grant - This supplied the final $3Million (out of a $6.5 Million total project) needed to connect Atqasuk with Utqiaġvik using nearly 70 miles of fiber optic cable, with extensions to every home and business in the village. This new fiber connection was made possible through ASTAC's partnership with Quintillion on the Quintillion subsea fiber optic project.[10] The new service is at least 25 megabits per second (Mbps) for residential and business customers. ASTAC will also offer free service to "critical community facilities" for two years, as well as service to a set of computers in the community center for residents to use for free.	$3,000,000
July 2015 - July 2017	USDA Rural Utilities Service Community Connect Grant - Arctic Slope Telephone Association Cooperative, Inc will utilize Community Connect grant funding to provide the Point Hope PFSA with the ability to construct a broadband network to provide broadband services to the residents and businesses with in the PFSA (approximately 700 in total). The types of services to be offered by ASTAC in the PHA PFSA include highspeed Internet, local telephone service and custom calling features, long distance telephone service, and Ethernet transport services. Funding for this project will allow ASTAC to prepare the Point Hope access network for an undersea fiber connection that is planned for 2016/2017. The high-speed Internet service deployed over the FTTH & VDSL equipment with the Point Hope Project will have a superior user experience to other technologies. The speeds will be faster and more reliable when compared to that of traditional DSL or wireless product offerings, with the new FTTH & VDSL system the ability to move from a TDM voice circuit to a VoIP circuit is possible. This provides the possibility for additional IP-based calling features.	$1,418,502

[10] Shady Grove Oliver, "USDA grant will help fund fiber connection to Atqasuk," *The Arctic Sounder*, 2020, http://www.thearcticsounder.com/article/2010usda_grant_will_help_fund_fiber_connection_to

General Broadband Deployment & Operations Occupations

Table 4 maps out the range of occupations necessary for broadband network deployment according to seniority and deployment phase (pre-construction, construction, and post-construction). Many, but not all, of these occupations are housed within local internet service provider (ISP) operations, some pre-construction and construction roles may be subcontracted out to other organizations, while local ISPs provide post-construction operations and maintenance support. Local ISPs may utilize subcontractors for construction tasks when there isn't sufficient volume or duration of work to hire a full-time employee.[11]

Descriptions for each position in this table are provided in the "Detailed Telecommunications Occupation Profiles" section on page 14, and detailed information on common certifications required are provided in the "Detailed Telecommunications Certifications" section on page 20.

Broadband Deployment Occupation "Pathways"

Because broadband deployment occupations tend to be task oriented, rather than reliant on strict technical and educational credentialing, career pathways (both into and out of the telecommunications industry) can be developed by identifying occupations that share similar skill sets. In 2021, Emsi Burning Glass, in partnership with America Achieves, conducted research on the broadband sector and identified pathways into (aka "feeder occupations") and out of (aka "destination occupations" or "next step occupations") high-demand occupations in the broadband sector.[12] Findings are summarized within the "Detailed Telecommunications Occupations Profiles" section on page 14.

Workers within the feeder occupations can be upskilled or reskilled to meet projected demand for broadband industry positions. Table 5 provides an overview of critical education programs and pathways that already exist in Alaska and provide a solid foundation for those looking to pursue careers in any of these fields.

[11] "Broadband Workforce Development Guidebook: Workforce for implementing BEAD and other Broadband Deployment Programs," Fiber Broadband Association, 2023, https://fiberbroadband.org/wp-content/uploads/2023/05/Broadband-Workforce-Development-Guidebook-FBA-and-Cartesian-April-2023.pdf

[12] Emsi Burning Glass, "Feeder Occupations and Next Steps for Broadband Initiatives," *America Achieves*, 2021, https://americaachieves.org/wp-content/uploads/2022/06/Broadband-Feeders-and-Next-Steps-EBG-1.pdf

Table 4. Broadband Network Deployment Occupations

<table>
<tr><th></th><th>Pre-Construction</th><th>Construction</th><th>Post-Construction*</th></tr>
<tr><td rowspan="3">Senior Level</td><td>Cost Estimators</td><td rowspan="3">Safety Specialists</td><td rowspan="3">Network Security Technicians</td></tr>
<tr><td>Land & Pole Surveyors</td></tr>
<tr><td>Project Managers</td></tr>
<tr><td rowspan="4">Mid Level</td><td rowspan="2">Network Designers & Engineers</td><td>Electricians</td><td rowspan="2">Field Maintenance Technicians</td></tr>
<tr><td>First-Line Supervisors of Pole, Anchor, Tower, and Antenna Installers and Repairers</td></tr>
<tr><td rowspan="2">Permitting Officers</td><td rowspan="2">Radio, Cellular, and Tower Equipment Installers and Repairers</td><td rowspan="2">Premise Installation Technicians</td></tr>
<tr><td>Network Designers & Engineers</td></tr>
<tr><td rowspan="3">Entry Level</td><td rowspan="3">Procurement Specialists</td><td>Laborers</td><td rowspan="3">Customer Support Representatives</td></tr>
<tr><td>Quality Inspectors</td></tr>
<tr><td>Telecommunications Line Installers and Repairers</td></tr>
</table>

**Does not include business operations, such as human resources, accounting, marketing, sales, etc.*

Table 5. Critical Education Pathways for Telecommunications Occupations

Program	Provider(s)	Occupation
4+ year degrees		
Occupational Safety and Health	UAA	Safety Specialists
Computer Science	UAA, UAF	Network Security Technicians, Project Managers
Environmental Science / Studies	APU, UAF, UAS, UAA	Permitting Officers
General Computer Engineering	UAA, UAF	Network Designers & Engineers
General Business Administration and Management	UAA, UAF, UAS	Cost Estimators
Mechanical Engineering	UAF, UAA	Cost Estimators
2+ year degrees		
Occupational Safety and Health	UAA	Safety Specialists
General Human Resources Management/Personnel Administration	Alaska Career College	Permitting Officers
Computer Systems Networking and Telecommunications	UAA	Network Designers & Engineers, Network Security Technicians
General Business Administration and Management	Iḷisaġvik College, APU, UAS, UAF	Cost Estimators
Certificates		
Construction Engineering Technology/Technician	Alaska Vocational Technical Center	Cost Estimators
General Business Administration and Management	Alaska Career College, Iḷisaġvik College, UAA	Cost Estimators
Information Science/Studies program	Alaska Vocational Technical Center	Project Managers
Environmental Studies	UAF	Permitting Officers
System, Networking, and LAN/WAN Management	UAA	Network Security Technicians
Building/Property Maintenance	UAF	Field Maintenance Technicians
General Office Occupations and Clerical Services	Iḷisaġvik College	Procurement Specialists

Detailed Telecommunications Occupation Profiles

Entry Level

(High school diploma or equivalent preferred)

Customer Support Representatives

AK Average Annual Wage: **$39,640**

Interact with customers to provide basic or scripted information in response to routine inquiries about products and services. May handle and resolve general complaints. Excludes individuals whose duties are primarily installation, sales, repair, and technical support.[13]

Certifications: None

Construction Laborers

AK Average Annual Wage: **$49,950**

Construction laborers perform tasks involving physical labor at construction sites. May operate hand and power tools of all types: air hammers, earth tampers, cement mixers, small mechanical hoists, surveying and measuring equipment, and a variety of other equipment and instruments. May clean and prepare sites, dig trenches, set braces to support the sides of excavations, erect scaffolding, and clean up rubble, debris, and other waste materials. May assist other craft workers.[14]

Certifications: Heavy Equipment Operation

Procurement Specialists

AK Average Annual Wage: **$81,140**

Procurement specialists compile information and records to draw up purchase orders for procurement of materials and services.[15]

Certifications: None

Quality Inspectors

AK Average Annual Wage: **$64,040**

Inspect, test, sort, sample, or weigh nonagricultural raw materials or processed, machined, fabricated, or assembled parts or products for defects, wear, and deviations from specifications. May use precision measuring instruments and complex test equipment.[16]

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[13] "Customer Service Representatives,"*O*NET Online*, 2023, https://www.onetonline.org/link/summary/43-4051.00
[14] "Construction Laborers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/47-2061.00
[15] "Compliance Officers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/13-1041.00
[16] "Inspectors, Testers, Sorters, Samplers, and Weighers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/51-9061.00

Certifications: Varies

Telecommunications Line Installers and Repairers

AK Average Annual Wage: **$66,990**

Install and repair telecommunications cable, including fiber optics.[17]

Feeder Occupations: Electrician's Assistants, Insulation Workers, Courier/Messengers

Certifications: BICSI Installer 1® Certificate, BICSI Installer 2, Copper® (INSTC®) Certification, BICSI Installer 2®, Optical Fiber (INSTF®) Certification, BICSI Technician® (TECH™) Certification, Cisco Certified Technician Supporting Cisco Routing and Switching Network Devices (RSTECH) v3.0, CFOT® - Certified Fiber Optic Technician, Broadband Premises Expert Technician (BPT), Tower & Pole Climbing

Next Step Occupations: Network/Systems Support Specialists, Electricians, Avionics Technicians, Crane Operators

Mid Level

(Training in vocational schools, related on-the-job experience, or an associate's degree preferred)

Electricians

AK Average Annual Wage: **$80,500**

Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service street lights, intercom systems, or electrical control systems.[18]

Certifications: Varies

Field Maintenance Technicians

AK Average Annual Wage: **$49,040**

Perform work involving the skills of two or more maintenance or craft occupations to keep machines, mechanical equipment, or the structure of a building in repair. Duties may involve pipe fitting; HVAC maintenance; insulating; welding; machining; carpentry; repairing electrical or mechanical equipment; installing, aligning, and balancing new equipment; and repairing buildings, floors, or stairs.[19]

Feeder Occupations: Janitors/Cleaners, Landscaping/Groundskeeping Workers, Laborers/Warehouse Workers

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[17] "Telecommunications Line Installers and Repairers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/49-9052.00

[18] "Electricians," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/47-2111.00

[19] "Maintenance and Repair Workers, General," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/49-9071.00

Certifications: Varies

Next Step Occupations: Building and General Maintenance Technicians, Repair/Service Technicians, Locksmiths, Industrial Mechanics

First-Line Supervisors of Pole, Anchor, Tower, and Antenna Installers and Repairers

AK Average Annual Wage: **$82,400**

Directly supervise and coordinate the activities of mechanics, installers, and repairers. May also advise customers on recommended services. Excludes team or work leaders.

Certifications: BICSI Installer 1® Certificate, BICSI Installer 2®, Optical Fiber (INSTF®) Certification, BICSI Technician® (TECH™) Certification, Cisco Certified Technician Supporting Cisco Routing and Switching Network Devices (RSTECH) v3.0, CFOT® - Certified Fiber Optic Technician, Broadband Premises Expert Technician (BPT), Tower & Pole Climbing

Network Designers & Engineers

AK Average Annual Wage: **$94,690**

Design or configure wired, wireless, and satellite communications systems for voice, video, and data services. Supervise installation, service, and maintenance.[20]

Feeder Occupations: Electrical/Electronic Designer, Electrical and Electronics Technician, Sound Engineering Technicians, Mechatronics Engineers

Certifications: Registered Communications Distribution Designer® (RCDD®), CFOT® - Certified Fiber Optic Technician

Next Step Occupations: Software Developer/Engineers, Hardware Engineers, Engineering Managers, Data Scientists, Business Intelligence Architects/Developers

Permitting Officers

AK Average Annual Wage: **$81,140**

Examine, evaluate, and investigate eligibility for or conformity with laws and regulations governing contract compliance of licenses and permits, and perform other compliance and enforcement inspection and analysis activities not classified elsewhere.[21]

Certifications: None

Premise Installation Technicians

AK Average Annual Wage: **$97,280**

[20] "Telecommunications Engineering Specialists," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/15-1241.01

[21] "Compliance Officers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/13-1041.00

Install, set up, rearrange, or remove switching, distribution, routing, and dialing equipment used in central offices or headends. Service or repair telephone, cable television, Internet, and other communications equipment on customers' property. May install communications equipment or communications wiring in buildings.[22]

Feeder Occupations: Insulation Workers, Television/Satellite Television Installers, Telemarketers

Certifications: BICSI Technician® (TECH™) Certification, Cisco Certified Technician Supporting Cisco Routing and Switching Network Devices (RSTECH) v3.0, CFOT® - Certified Fiber Optic Technician, Broadband Premises Expert Technician (BPT)

Next Step Occupations: Electrical Substation/Relay Repairers, Network/Systems Support Specialists, Electricians, Avionics Technicians

Radio, Cellular, and Tower Equipment Installers and Repairers

AK Average Annual Wage: **$72,110**

Repair, install, or maintain mobile or stationary radio transmitting, broadcasting, and receiving equipment, and two-way radio communications systems used in cellular telecommunications, mobile broadband, ship-to-shore, aircraft-to-ground communications, and radio equipment in service and emergency vehicles. May test and analyze network coverage.[23]

Feeder Occupations: Broadcast Technicians, Tower Climbers/Technicians, Television/Satellite Television Installers

Certifications: Certified Wireless Network Administrator (CWNA), CFOT® - Certified Fiber Optic Technician, Tower & Pole Climbing

Next Step Occupations: Electrical Substation/Relay Repairers, Network/Systems Support Specialists, Electrical and Electronics Technicians, Sound Engineering Technicians

Senior Level

(College degree in a technical field preferred)

Cost Estimators

AK Average Annual Wage: **$85,410**

Prepare cost estimates for product manufacturing, construction projects, or services to aid management in bidding on or determining price of product or service. May specialize according to particular service performed or type of product manufactured.

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[22] "Telecommunications Equipment Installers and Repairers, Except Line Installers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/49-2022.00

[23] "Radio, Cellular, and Tower Equipment Installers and Repairers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/49-2021.00

Certifications: Construction Engineering Technology and/or Business Administration

Land & Pole Surveyors

AK Average Annual Wage: **$82,060**

Make exact measurements and determine property boundaries. Provide data relevant to the shape, contour, gravitation, location, elevation, or dimension of land or land features on or near the earth's surface for engineering, mapmaking, mining, land evaluation, construction, and other purposes.[24]

Feeder Occupations: Television/Satellite Television Installers, Electrician's Assistants, Insulation Workers

Certifications: Varies

Next Step Occupations: Electrical Substation/Relay Repairer, Geographer/GIS Specialists, MRI/CT Technician/Technologists, Ultrasound Technologists/Sonographers

Network Security Technicians

AK Average Annual Wage: **$93,960**

Plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. Assess system vulnerabilities for security risks and propose and implement risk mitigation strategies. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses.[25]

Certifications: BICSI Installer 1® Certificate, BICSI Installer 2, Copper® (INSTC®) Certification, BICSI Installer 2®, Optical Fiber (INSTF®) Certification, Cisco Certified Technician Supporting Cisco Routing and Switching Network Devices (RSTECH) v3.0, CompTIA Network+, CompTIA Security+, GIAC Information Security Fundamentals (GISF), Certified Information Security Manager (CISM), Certified Information Systems Security Professional (CISSP), Systems Security Certified Practitioner (SSCP), JNCIA-Junos, Broadband Premises Expert Technician (BPT)

Project Managers

AK Average Annual Wage: **$99,090**

Plan, initiate, and manage information technology (IT) projects. Lead and guide the work of technical staff. Serve as liaison between business and technical aspects of projects. Plan project stages and assess business implications for each stage. Monitor progress to assure deadlines, standards, and cost targets are met.[26]

Certifications: Registered Telecommunications Project Manager (RTPM), CompTIA Project+, Project Management Professional (PMP), Certified Telecommunications Network Specialist (CTNS), Certified Telecommunications Project Management (CTPM)

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[24] "Surveyors," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/17-1022.00
[25] "Information Security Analysis," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/15-1212.00
[26] "Information Technology Project Managers," *O*NET Online*, 2023, https://www.onetonline.org/link/summary/15-1299.09

Safety Specialists

AK Average Annual Wage: **$86,830**

Review, evaluate, and analyze work environments and design programs and procedures to control, eliminate, and prevent disease or injury caused by chemical, physical, and biological agents or ergonomic factors. May conduct inspections and enforce adherence to laws and regulations governing the health and safety of individuals. May be employed in the public or private sector.

Certifications: Occupational Safety and Health Technology

Detailed Telecommunications Certifications

BICSI[27]

Cabling Installation

BICSI Installer 1® Certificate	**Format:** hybrid
Relevant occupations: Installation & Maintenance Technicians, Network Technicians, and Network Security Technicians	
Demonstrates entry-level knowledge and skills to install information and communications technology (ICT) systems. Validates basic knowledge in the proper and most current methods of installing ICT-related cabling within the confines of a commercial building structure. Skill sets include but are not limited to pulling cable, terminating, and testing copper and coaxial cable.	
Physical Requirements: Must be able to distinguish between different colors, possess manual dexterity to complete fine motor tasks, stand for extended periods of time, climb ladders, and lift and carry items weighing up to 50 lbs. **Prerequisites:** There is no prior ICT industry installation experience requirement for individuals preparing to sit for the Installer 1 exam. It is strongly recommended that examinees: ● Attend IN101: BICSI Installer 1 Training ● Complete at least 50 hours of independent study of BICSI's Information Technology Systems Installation Methods Manual (ITSIMM)	
Total estimated cost (training course, materials, and examination fees): $2,500	

BICSI Installer 2, Copper® (INSTC®) Certification	**Format:** hybrid
Relevant occupations: Installation & Maintenance Technicians, Network Technicians, and Network Security Technicians	
Demonstrates skill at working with structured cabling systems (SCS) and network components. Copper Installers perform duties in compliance with industry best practices, BICSI methodologies, standards, and codes. Copper Installers may work independently, as part of a team, as a team leader, or under the direction of a professional.	
Physical Requirements: Must be able to distinguish between different colors, possess manual dexterity to complete fine motor tasks, stand for extended periods of time, climb ladders, and lift and carry items weighing up to 50 lbs. **Prerequisites:** ● **Option #1** Six months of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an	

[27] Education & Certification," *BICSI*, 2023, https://www.bicsi.org/about-us

apprenticeship program **AND** have passed the BICSI instructor-led, hands-on training Installer 1 certificate program.
- **Option #2** One year of verifiable, full-time equivalent Copper structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** attend and successfully complete BICSI's instructor-led, hands-on training in Copper structured cabling systems (SCS) training*.
- **Option #3** Two years of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprentice- ship program **AND** have completed a minimum of 35 hours of documented continuing education in Copper structured cabling systems which may include training provided by BICSI, manufacturer training, college courses, industry training and/or vendor training.

*Exam approval is contingent upon successful completion of the training course.

Total estimated cost (training course, materials, and examination fees): $3,000

BICSI Installer 2®, Optical Fiber (INSTF®) Certification	**Format:** in person

Relevant occupations: Installation & Maintenance Technicians, Network Technicians, and Network Security Technicians

Demonstrates skill at working with structured cabling systems (SCS) and network components. Optical Fiber Installers perform duties in compliance with industry best practices, BICSI methodologies, standards, and codes. Optical Fiber Installers may work independently, as part of a team, as a team leader, or under the direction of a professional.

Physical Requirements: Must be able to distinguish between different colors, distinguish between copper and optical fiber color codes, possess manual dexterity to complete fine motor tasks and possess fine motor skills, stand for extended periods of time, climb ladders, and lift and carry items weighing up to 50 lbs.

Prerequisites:
- **Option #1** Six months of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** have passed the BICSI Installer 1 certificate program.
- **Option #2** One year of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** attend and successfully complete BICSI's instructor-led, hands-on training in Optical Fiber structured cabling systems (SCS) training*.
- **Option #3** Two years of verifiable, full-time equivalent Optical Fiber structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** have completed a minimum of 35 hours of documented continuing education in Optical Fiber structured cabling systems which may include training provided by BICSI, manufacturer training, college courses, industry training, and/or vendor training.

*Exam approval is contingent

Total estimated cost (training course, materials, and examination fees): $3,200

BICSI Technician® (TECH™) Certification	**Format:** in person
Relevant occupations: Installation & Maintenance Technicians, Network Technicians, Telecommunications Engineering Specialists	
Demonstrates skill at working with complex systems who performs highly technical installations and diagnostic testing on structured cabling systems (SCS) and network components. Technicians must perform duties in a professional manner in accordance with industry best practices. Technicians may work independently, as part of a team, as a team leader, or under the direction of a professional.	
Physical Requirements: Must be able to distinguish between different colors, possess manual dexterity to complete fine motor tasks, stand for extended periods of time, climb ladders, and lift and carry items weighing up to 50 lbs. **Prerequisites:** • **Option #1** One year of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** hold a certificate of course completion for BICSI's instructor-led, hands-on training in Copper and Optical Fiber structured cabling systems (SCS). • **Option #2** Two years of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** attend and successfully complete BICSI's instructor-led, hands-on Technician training in structured cabling systems (SCS) training*. • **Option #3** Three years of verifiable, full-time equivalent structured cabling systems (SCS) field experience which may be obtained on the job, in a trade school, or in an apprenticeship program **AND** have completed a minimum of 35 hours of documented continuing education in Copper and Fiber structured cabling systems which may include training provided by BICSI, manufacturer training, college courses, industry training, and/or vendor training. • **Option #4** Hold the BICSI Installer 2 credential or hold both the BICSI Installer 2, Copper and Installer 2, Optical Fiber credentials. *Exam approval is contingent upon successful completion of the training course.	
Total estimated cost (training course, materials, and examination fees): $3,400	

Communications Distribution Design

Registered Communications Distribution Designer® (RCDD®)	**Format:** in person
Relevant occupations: Network Designers & Engineers	

The gold standard of all BICSI credentials. Demonstrates knowledge in the creation, planning, integration, execution and/or detail-oriented project management of telecommunications and data communications technology.

Physical Requirements: None
Prerequisites:

- **Option #1:** Two years of verifiable full-time work experience in ICT design **AND** a current BICSI certification holder as BICSI TECH™, RTPM®, DCDC® or OSP.
- **Option #2:** Two years of verifiable full-time equivalent work experience in ICT design **AND** completion of two years of higher education course work in ICT. Two years of higher education course work in ICT may include:
  - STEM or trade school
  - Two-year degree
  - ICT and industry-related programs, apprenticeships or certifications
  - Military training equivalent

  Evidence of completion of higher education course work includes:
  - Certificates
  - Diplomas
  - Registrar's documentation
  - Other bona fide documents
- **Option #3: Five years of verifiable ICT experience.**

Total estimated cost (training course, materials, and examination fees): $5,000

Telecommunications Project Management

Registered Telecommunications Project Manager (RTPM)	**Format:** hybrid

Relevant occupations: Telecommunications Project Managers

Demonstrates mastery of knowledge and skills to perform telecommunications project management according to accepted best practices in the ICT industry. Every three-to-five years the Registrations & Credentials Supervision Committee (RCSC) oversees a Job Task Analysis (JTA) of this credentialing program to ensure the program is current, relevant, and held to the highest standard.

Physical Requirements: None
Prerequisites:

- **Option #1** One year of Project Management Experience in ICT* AND hold one of the following current BICSI credentials (RCDD, DCDC, OSP, INSTC, INSTF, TECH).
- **Option #2** Two years of Project Management Experience in ICT.*
- **Option #3** Three years of ICT industry experience** including one year of managing or supervising ICT projects.*
- **Option #4** Hold a current Project Management certification or a degree*** in Project or Construction Management AND one year of ICT industry experience.**

*ICT industry experience includes design or installation of technology pathways, spaces, and infrastructure, consisting of cabling and wireless systems, that support data transfer and data signaling between, and the interconnection of, communication, data processing, data display, or information gathering devices of various systems. These systems can

include audio-visual, telecommunications, safety and security, computer networking, and building automation. **The degree must be from an accredited institution of higher education in the United States or foreign equivalent.
Total estimated cost (training course, materials, and examination fees): $1,000

Certified Wireless Network Professionals[28]

Certified Wireless Network Administrator (CWNA)	**Format:** in person
Relevant occupations: RF-Wireless Technicians	
Demonstrates knowledge of radio frequency (RF) technologies, antenna concepts, wireless LAN hardware and software, network design, installation, and management, wireless standards and organizations, 802.11 network architecture, wireless LAN security, troubleshooting, and how to perform site surveys.	
Physical Requirements: None **Prerequisites:** Certified Wireless Specialist (CWS) and Certified Wireless Technician (CWT) certifications recommended	
Total estimated cost (training course, materials, and examination fees): $700	

Cisco[29]

Cisco Certified Technician Supporting Cisco Routing and Switching Network Devices (RSTECH) v3.0	**Format:** in person or online
Relevant occupations: Installation & Maintenance Technicians, Combination (Inside/Outside Plant) Technicians, Network Technicians, RF-Wireless Technicians, and Network Security Technicians.	
Demonstrates skills required for onsite support and maintenance of Cisco routers, switches, and operating environments. Technicians in this area must be able to identify Cisco router and switch models, accessories, cabling, and interfaces; understand the Cisco IOS Software operating modes and identify commonly found software; and be able to use the Cisco Command Line Interface (CLI) to connect and service products. Achieving CCT Routing and Switching certification is considered the best foundation for supporting other Cisco devices and systems.	
Physical Requirements: None **Prerequisites:** None	

[28] "Certifications," *Certified Wireless Network Professionals*, 2023, https://www.cwnp.com/
[29] "Training & Certifications," *Cisco*, 2023, https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html

Total estimated cost (training course, materials, and examination fees): $500

Cisco CCNA	**Format:** in person or online
Relevant occupations: Entry level network engineers, Help desk technicians, Network administrators, Network support technicians	
Demonstrates skill in networking fundamentals, IP services, security fundamentals, automation and programmability. Designed for agility and versatility, CCNA validates that you have the skills required to manage and optimize today's most advanced networks.	
Physical Requirements: None **Prerequisites:** No formal prerequisites but one or more years of experience implementing and administering Cisco solutions is recommended.	
Total estimated cost (training course, materials, and examination fees): $1,000	

CompTIA[30]

CompTIA A+	**Format:** in person or online
Relevant occupations: Business Analysts, Data Support Technicians, MSP Personnel, IT Server Technicians, IT Specialists, Field Service Technician, IT Support Manager, Technical Support Specialists, Help Desk Technicians	
Demonstrates skill and knowledge of hardware, operating systems, software troubleshooting, networking, troubleshooting, security, mobile devices, virtualization and cloud computing, and operational procedures.	
Physical Requirements: None **Prerequisites:** 9 to 12 months hands-on experience in the lab or field recommended	
Total estimated cost (training course, materials, and examination fees): $500	

CompTIA Network+	**Format:** in person or online
Relevant occupations: Business Analysts, Systems Administrators, MSP Personnel, Data Center Managers, IT Server Technicians, Data Architects, Network Security Specialists, Server Administrators	
Demonstrates skill and knowledge of network fundamentals, infrastructure, troubleshooting, security.	

[30] "Certifications," CompTIA, 2023, https://www.comptia.org/certifications

Physical Requirements: None
Prerequisites: CompTIA A+ Certification and a minimum of 9 to 12 months of hands-on experience working in a junior network administrator/network support technician job role recommended.

Total estimated cost (training course, materials, and examination fees): $900

CompTIA Security+	**Format:** in person or online

Relevant occupations: Network Security Technicians, Business Analysts, Cybersecurity Managers, Software Developers, Systems Administrators, MSP Personnel, Security Consultants

Demonstrates core knowledge required in the cybersecurity field and provides a springboard to intermediate-level cybersecurity jobs. Security+ incorporates best practices in hands-on troubleshooting, ensuring the practical security problem-solving skills required to:

- Assess the security of an organization and recommend and implement appropriate solutions
- Monitor and secure hybrid environments, including cloud, mobile and IoT
- Operate with an awareness of applicable laws and policies, including principles of governance, risk and compliance
- Identify, analyze and respond to security events and incidents

Physical Requirements: None
Prerequisites: CompTIA Network+ and two years of experience in IT administration with a security focus recommended

Total estimated cost (training course, materials, and examination fees): $1,000

CompTIA Project+	**Format:** in person or online

Relevant occupations: Telecommunications Project Managers,
Business Analysts, Project Coordinators, IT Project Managers, IT Support Managers

Covers the methodologies, frameworks and Agile skills necessary to efficiently manage and deliver IT projects while taking new topics like change management and compliance into consideration. CompTIA Project+ is designed for business professionals who coordinate or manage small-to-medium-size projects, inside and outside of IT. The exam certifies the knowledge and skills required to manage the project life cycle, ensure appropriate communication, manage resources, manage stakeholders and maintain project documentation.

Physical Requirements: None
Prerequisites: At least 12 months of cumulative project management experience or equivalent education recommended.

Total estimated cost (training course, materials, and examination fees): $600

Fiber Optic Association[31]

CFOT® - Certified Fiber Optic Technician	**Format:** in person or online
Relevant occupations: Installation & Maintenance Technicians, Network Technicians, RF-Wireless Technicians, Component Manufacturing Technicians, Network Managers, Network Designers & Engineers	
Provides an overview of fiber optic applications and installations, communications systems utilizing fiber optics, fiber optic components appropriate for fiber optic networks, installation of premises and outside plant fiber optic cable, splicing and termination, and testing fiber optic components and cable plants.	
Physical Requirements: Fiber optic techs need the ability to perform relevant tasks, evidenced by showing skills in hands-on tasks. **Prerequisites::** At least two years of relevant field experience is required, including documented experience installing and testing fiber optic networks. Training by employers, manufacturers or vendors of cabling products may be recognized as part of the experience requirements.	
Total estimated cost (training course, materials, and examination fees): $1,000	

GIAC[32]

GIAC Information Security Fundamentals (GISF)	**Format:** in person or online
Relevant occupations: Network Security Technicians	
Demonstrates knowledge of cyber security terminology, the basics of computer networks, security policies, incident response, passwords, and the basics of cryptographic principles.	
Physical Requirements: None **Prerequisites:** None	
Total estimated cost (training course, materials, and examination fees): $7,000	

ISACA[33]

Certified Information Security Manager (CISM)	**Format:** in person

[31] "Certification & Renewal," *The Fiber Optic Association, Inc.*, 2023, https://www.thefoa.org/Certs.htm
[32] "GIAC Information Security Fundamentals," GIAC Certifications, 2023, https://www.giac.org/certifications/information-security-fundamentals-gisf/
[33] "Credentialing: CISM," ISACA, 2023, https://www.isaca.org/credentialing/cism

Relevant occupations: Network Security Technicians
Demonstrates knowledge of information security governance, information security risk management, and incident management.
Physical Requirements: None **Prerequisites:** Five or more years of experience in information security management. Experience waivers are available for a maximum of two years.
Total estimated cost (training course, materials, and examination fees): $1,700

International System Security Certification Consortium (ISC)[2] [34]

Certified Information Systems Security Professional (CISSP)	**Format:** in person
Relevant occupations: Network Security Technicians, Chief Information Security Officers, Chief Information Officers, Directors of Security, IT Directors/Managers, Security Systems Engineers, Security Analysts, Security Managers, Security Auditors, Security Architects, Security Consultants, Network Architects	
Demonstrates knowledge of security and risk management, asset security, security architecture and engineering, communication and network security, identity and access management (IAM), security assessment and testing, security operations, and software development security.	
Physical Requirements: None **Prerequisites:** At least five years of cumulative paid work experience in two or more of the eight domains of the (ISC)2 CISSP Common Body of Knowledge (CBK®).	
Total estimated cost (training course, materials, and examination fees): $1,800	

Systems Security Certified Practitioner (SSCP)	**Format:** in person
Relevant occupations: Network Security Technicians, Network Security Engineers, IT/Systems/Network Administrators, Security Analysts, Systems Engineers, Security Consultants/Specialists, Security Administrators, Systems/Network Analysts, Database Administrators	
Demonstrates knowledge of security operations and administration, access controls, risk identification, monitoring and analysis, incident response and recovery, cryptography, network and communications security, and systems and application security.	
Physical Requirements: None	

[34] "Cybersecurity and IT Security Certifications & Training,"*(ISC)²*, 2023, https://www.isc2.org/

Prerequisites: At least one year of cumulative, paid work experience in one or more of the seven domains of the (ISC)2 SSCP Common Body of Knowledge (CBK®).
Total estimated cost (training course, materials, and examination fees): $500

Juniper Networks[35]

JNCIA-Junos	**Format:** in person
Relevant occupations: Network Security Technicians, RF-Wireless Technicians	
Demonstrates knowledge of networking fundamentals, Junos OS fundamentals, user interfaces, configuration basics, operational monitoring and maintenance, routing fundamentals, and routing policy and firewall filters.	
Physical Requirements: None **Prerequisites:** None	
Total estimated cost (training course, materials, and examination fees): $3,000	

Project Management Institute[36]

Project Management Professional (PMP)	**Format:** in person or online
Relevant occupations: Telecommunications Project Managers	
Validates skill in effectively leading and motivating a project team throughout a project, using predictive, agile and hybrid approaches to determine which way of working is best for each project, and highlighting the success of a project and its impact on overall strategic organizational goals.	
Physical Requirements: None **Prerequisites:** Three years of experience in leading or directing projects.	
Total estimated cost (training course, materials, and examination fees): $1,500	

[35] "Certification Tracks," *Juniper Networks*, 2023, https://www.juniper.net/us/en/training/certification/tracks/junos/jncia-junos.html
[36] "Certifications," *Project Management Institute*, 2023, https://www.pmi.org/certifications/project-management-pmp

Society of Cable Telecommunications Engineers (SCTE)[37]

Broadband Premises Expert Technician (BPT)	**Format:** online
Relevant occupations: Installation & Maintenance Technicians, Network Technicians, Network Security Technicians, Broadband Premises Installers / Technicians, Entry-level cable personnel, Customer Service Representatives, Maintenance Technicians, Outside Plant Personnel	
Demonstrates the knowledge, skills and abilities of an experienced field technician who will install and troubleshoot complex cable telecommunications services (video, voice, and (DOCSIS®, PON, Wi-Fi)) at the customer's premises. Validates a strong understanding of technologies deployed in modern intercommunications networks to troubleshoot and install advanced configurations.	
Physical Requirements: None **Prerequisites:** None	
Total estimated cost (training course, materials, and examination fees): $500	

Telecommunications Certification Organization[38]

Certified Telecommunications Network Specialist (CTNS)	**Format:** online
Relevant occupations: Telecommunications Project Managers	
Demonstrates knowledge of broadband converged IP telecommunications, wireless telecommunications, voice over IP (VoIP), the public switched telephone network (PSTN), OSI layer and protocols, LANs, VLANs, wireless and optical ethernet, IP networks, routers, and addresses, and MPLS and carrier networks.	
Physical Requirements: None **Prerequisites:** None	
Total estimated cost (training course, materials, and examination fees): $1,000	

Certified Telecommunications Project Management (CTPM)	**Format:** online
Relevant occupations: Telecommunications Project Managers	

[37] "Broadband Premises Technician v2.0," *SCTE*, 2023, https://www.scte.org/professional-certifications/become-certified/certification-exam-catalog/broadband-premises-technician-v20-online-exam/

[38] "Telecom Certification," *Teracom Training Institute*, 2023, https://www.telecom-certification.org/

Demonstrates knowledge of integration, scope, quality, risk, human resources, time, cost, and communication management in a telecommunications context.
Physical Requirements: None **Prerequisites:** Experience in telecommunications projects within a data center or enterprise network environment is recommended.
Total estimated cost (training course, materials, and examination fees): $1,000

Other Location-Based Credentials (varied providers)

Heavy Equipment Operation	**Format:** in person
Relevant occupations: Combination (Inside/Outside Plant) Technicians	
Demonstrates skill required to operate one or several types of power construction equipment, such as graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move and/or grade dirt, construction components for structures, or to pour concrete or other heavy product. May repair and maintain equipment in addition to other duties.	
Physical Requirements: None **Prerequisites:** Valid driver license required, Commercial Driver License (CDL) recommended	
Total estimated cost (training course, materials, and examination fees): $10,000	

Tower & Pole Climbing	**Format:** in person
Relevant occupations: Installation & Maintenance Technicians, RF-Wireless Technicians	
Demonstrates skill in climbing towers, fixed ladder systems, conducting work at height, the use of arrest lanyards, descending and positioning on ropes and basic rigging for fall protection in alignment with OSHA regulations and ANSI Standards. Validates knowledge of models for conducting safety meetings, job hazard assessments, equipment inspections, and emergency action plans.	
Physical Requirements: None **Prerequisites:** None	
Total estimated cost (training course, materials, and examination fees): $1,000 - $3,000	