Shipyard Apprenticeship: a qualitative analysis

Final Report

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Introduction and Project Overview

This is the final report of the NSRP Workforce Development Panel's 2022 –2023 research project, entitled "Shipyard Apprenticeship: a qualitative analysis". The project was approved by the ECB and the ATI Task Order Agreement 2018-447 Task Order 17 stipulating work to be performed from October 19, 2022, through October 16, 2023 (see Appendix A, Schedule of Work). The project's thesis is based on the following assumptions:

1. The shipbuilding industry is experiencing a shortfall in filling both entry- and mid-level positions in shipbuilding trades (welders, pipefitters, etc.) and support functions (design, cost estimating, accuracy control, etc.). Recruiting, growing, and maintaining a skilled workforce is paramount to meeting the ever-growing demands to build, repair and maintain military and commercial vessels.
2. In addition to the industry experiencing challenges filling deckplate positions (welders, pipefitters, trade supervisors, etc.), shipyards are also suffering significant voids in other critical areas such as planning, cost estimating, and accuracy control, just to name a few. Referred to as operational support, many individuals serving in these positions have typically transitioned from deckplate positions, often having acquired the post-secondary education or equivalencies required to be highly successful in these roles. The challenge of recruiting, hiring, and retaining individuals for the deckplate positions mentioned above has also negatively impacted the ability to feed operational support areas with well-trained, experienced people.
3. In the past, attrition rates for the shipbuilding workforce stayed at manageable rates. Companies could successfully train new personnel using the "over-the-shoulder" training method by leveraging the abundance of experienced individuals who remained in the workforce. Today, however, coupled with a national perception of manufacturing decline or less desirability, individuals are exiting the shipbuilding industry at higher rates. As a result, it is critical for shipyards to attract, prepare, and strategically place individuals who possess the skills, knowledge and pride of workmanship which have traditionally distinguished the shipbuilding craftsperson. To do this, many shipyards employ an apprenticeship or apprenticeship-like approach. In some cases, companies use an intensive training program; in others, it's a robust professional development program. In

either case, the mission is to take a select group of high potential individuals and develop in them the core leadership principles, along with the character and technical competence that is required to fully meet the challenges of a shipbuilding career.

4. Individual shipyards typically sponsor and pay for apprenticeship programs and, as a result, must maintain a keen focus on the cost to benefit ratio. This includes whether or not to offer an apprenticeship, as well as determining the infrastructure, human resources, and various support systems needed to run an effective apprentice program. How are apprentices supervised? What coaching or mentorship opportunities have maximum value? What related instruction and educational coursework is required to compliment the on-the job training, while also meeting state and national standards to be "registered" with the Department of Labor? These questions and others, including an honest discussion regarding the expected return on investment, are all reasonable questions shipyards contemplate before starting, maintaining, or expanding an apprenticeship program.

Concept Description: To aid shipyards and other NSRP organizations sponsoring apprenticeship programs, this proposed research sought to learn and share current practices relating to shipbuilding apprenticeship programs. Principal to the project will be coordinating and funding a ***national multi-day conference***. Funding was be provided for the five participating shipyards for their time and travel as they extract, study, synthesize and share best practices; issues needing further study; and problems needing future resources. The project will also collaborate heavily with the American Apprenticeship Round Table (www.aart-us.org). Finally, it will share the findings and recommendations with the shipbuilding industry and stakeholders.

The goals/objectives of this project were to:

1. Learn and share current practices related to shipbuilding apprenticeship and industry workforce development programs.
2. Extract, study, synthesize and share best practices; issues needing further study; and problems needing future resources.
3. Develop shipbuilding industry policy and practice recommendations that yield better results.

4. Identify gaps in current and best practices pointing to additional research.
5. Share the findings and recommendations with the shipbuilding industry and stakeholders.

The following methods and procedures were required to accomplish the goals and objectives:

Task 1: Design Survey of Current Practices in Shipbuilding Apprenticeship

- Design survey format and content; select best delivery method(s)
- Develop list of contacts for information gathering

Task 2: Data Gathering

- Conduct surveys and dialogues
- Plan roundtable conference

Task 3: Conduct Roundtable Conference and Follow-Up

- Conduct conference
- Share results of data gathering to date
- Conduct follow-up surveys and local meetings as necessary

Task 4: Compile Results

- Compile and evaluate results of surveys, dialogs and roundtable conference

Task 5: Provide a Final Report

Previous and Current Related Work: The project seeks to align with other recent NSRP projects relating to Surface Preparation (2018), Manufacturing Technician (2019), and Marine Design Training (2019), as well as the more established apprenticeship programs each company has historically offered.

Project Benefits: U.S. shipyards need to consider new strategies for developing a workforce. The apprenticeship model has long been a preferred solution for many shipyards; however, details regarding their existence and internal functions are often unknown. This proposed project

seeks to reveal best practices and make recommendations. This effort is significant because of the need for a more technically educated and prepared shipyard workforce. By sharing best practices and improving knowledge transfer within the community, shipyards already offering apprenticeships will benefit from realizing better ways of conducting internal training programs. Additionally, shipyards not offering programs will be able to make more informed decisions regarding initiating an apprenticeship or an apprenticeship-like program in their organizations.

Deliverables:

- Report on Survey Development and Roundtable Conference (Task 3)
- Final Written Report (Task 5)
- Status Reports – To be submitted quarterly

Review of Apprenticeship in the United States

Producing a citizenry that is workforce-ready is a major objective of our education system in the United States (Symonds, 2011). As described by Symonds, Schwartz, and Ferguson (2011), this preparation includes "preparing all young people with a solid enough foundation of literacy, numeracy, and thinking skills for responsible citizenship, career development, and lifelong learning" (p. 1). As reported by Halpern (2009) the prevailing developmental method used in the United States is one that requires all students to spend a maximum amount of time and energy in a common high school experience, mainly focused on advancing learners to college. Although a college curriculum sometimes reveals a career direction, the learner is not truly expected to participate legitimately in an occupational field until after graduating. Despite intermittent verbiage regarding real world problem solving and partnerships with business and industry, very little interaction occurs between education and a career. Basically, students are expected to go to school for as long as possible, then, and only then, enter a career. They are expected to learn as much as possible about English, science, math, history, etc. while being bulk-rated within the cinderblock building called *school* – whether that be high school, community college, or university. The understanding is that individuals are best prepared in a classroom setting before ever entering, or even thinking about, an occupation. After completing the formal education track – sometimes graduating, more times not – the individual is expected to begin a career. Unfortunately, this model (Figure 1) works well for only a few individuals who can grasp concepts using mostly imagination. The reality is most gain minimally through the formal process (Halpern, 2009) – especially those who are most likely to apply for manufacturing jobs (Weitzman & Harding, 2011).

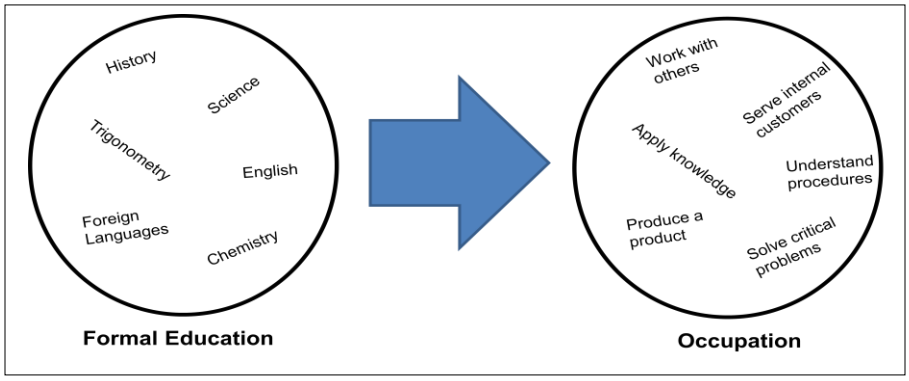

Figure 1: The traditional model of developing a U.S. workforce

At the heart of apprenticeship is *context*. As we grow and develop, we often strive to make connections. Learning – true learning – occurs when connections are made from isolated

knowledge and applied to real situations in life. To most learners, the Pythagorean Theorem, or the trigonometric functions with SOCATOWA have very little meaning without applying them to something real. When academic subjects overlap and apply to something real - something legitimate - a higher level of learning often occurs. Not to fault teachers - teachers in the traditional school setting work diligently to explain connections from the lesson to the real world; however, "explanations" are no substitute for the real thing. Apprenticeship creates conditions where the learner must integrate and use academic and theoretical subject matter in a legitimate occupational setting. Having to negotiate authentic situations on-the-job, apprenticeship enhances learning in a way that traditional schooling cannot begin to match.

Modern apprentice schools in the United States typically reside at the post-secondary level and provide a complementary blend of college-level academic courses and career theory (training) coupled with relevant work experiences in the form of cooperative or full-time employment in an occupational area (Lerman, 2022). The three areas work together and complement each other in ways that develop and benefit both employee and employer (Figure 2). Although many apprenticeships exist in traditional trades such as construction and manufacturing, newer industries such as biotechnology, geospatial technology, healthcare, and information technology are becoming popular (Gonzalez, 2010). Apprenticeships offer participants a paycheck while taking courses and being trained for an occupation. Lave & Wenger (1991) suggest the power of apprenticeship stems from learners participating in authentic occupation where legitimate situations arise requiring real problem solving. When this happens, the learner gains a contextual understanding that truly provides the significant benefits associated with combining related academics, occupational theory, and on the job training.

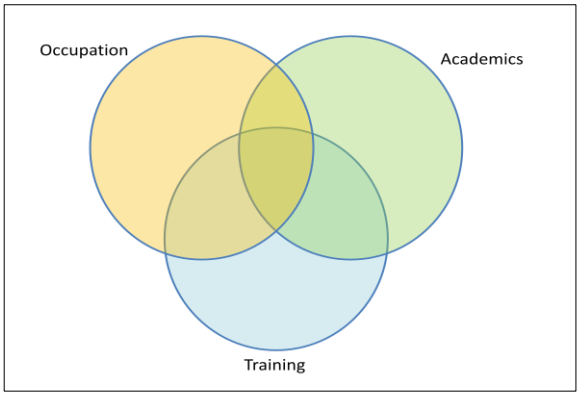

Figure 2: The apprenticeship model of development

Theoretical Concept

Legitimate peripheral participation is a theoretical concept used to explain the phenomenon behind the apprenticeship model of development. Drawing on Albert Bandura's interpretation of social learning

theory, Lave and Wenger (1991) described learning to be *situational*. They expressed that authentic learning occurs more as individuals join legitimate communities of practice. Having to perform in legitimate situations, learning takes on a more constructive nature and personal discoveries motivate the learner to seek even more knowledge. Lave and Wenger argued that real communities provide legitimate feedback and offer the strongest potential in driving learners' understanding and motivation. As the learner grows and develops within the community, he or she gains self-worth and a since of legitimacy within the community, ultimately affecting self-efficacy and the desire to advance throughout the community.

Apprenticeship is a developmental model that provides legitimate peripheral participation. Through strong partnerships between higher education and business and industry, apprenticeship offers an integrated curriculum through hands-on, real-world situations. It requires *natural* applications of the formal academic disciplines – English, science, math, etc. – as situations arise on the worksite. Apprenticeship provides the contextual learning that most students require.

The Difference in Apprenticeship and Training

Fuller and Unwin (2011) explained that training organizations differ greatly as to expansiveness and restrictiveness regarding access to learning opportunities – whether this be apprenticeships or simple training programs. Their research showed how workplace learning environments dictated the experiential richness provided to the learner. While studying training organizations at various occupational levels, some organizations had structured practices that informed and supported the learner with learning opportunities, while others were lacking. They identified *expansive programs* as those programs that afforded the learner rich and legitimate experiences in work-site learning, formal education from an outside institution, proximity to skilled workers, and an ability to rotate and experience various skill sets within the community. Such actions were identified as apprenticeship or apprenticeship-like programs. On the opposite end of the continuum, Fuller and Unwin further identified *restrictive programs* as those mainly focused on the tasks at hand and concerned only with getting the immediate job done as quickly as possible. Referred to strictly as training programs, little attention was given to the possibilities of learning new skills or passing on expertise.

The expansive-restrictive framework explains the learner's access to support networks, training opportunities, and opportunities for developing expertise, all leading to legitimacy within the community one chooses to practice. However, possibly having greater impact, Fuller and Unwin (2004) pinpointed the labelling process that occurs when a new hire enters the worksite. Apprentices are typically labelled as *worker/learners* as they transition into the workplace and are often given leniency for minor mistakes along the way. In the traditional model of development where individuals spend an ever-growing amount of time tucked away being schooled, new hires are often labelled *workers* and, upon entry to the workplace, are expected to be productive – which they rarely are (Casner-Lotto, 2009). Lave and Wenger's (1991) research on legitimate peripheral participation showed that when a learner perceives him or herself as joining a legitimate community, and that community reciprocates a value of legitimacy back to the learner, he or she has a richer experience and are retained at a higher rate than individuals who are not afforded that legitimacy. Apprenticeship, and the apprentice's label of a *worker/learner,* signals to others at the worksite that he or she is an individual *in transition*. Supervisors and incumbent employees are generally more patient with an apprentice than they are with a new hire that spent most of the time in school prior to entering the workforce. Thus, an expansive apprenticeship can foster a more inviting atmosphere for the new-hire – one that is more likely to support the teaching, guiding, motivating, and caring for the new employee during the critical transition into a long-lasting career (Figure 3).

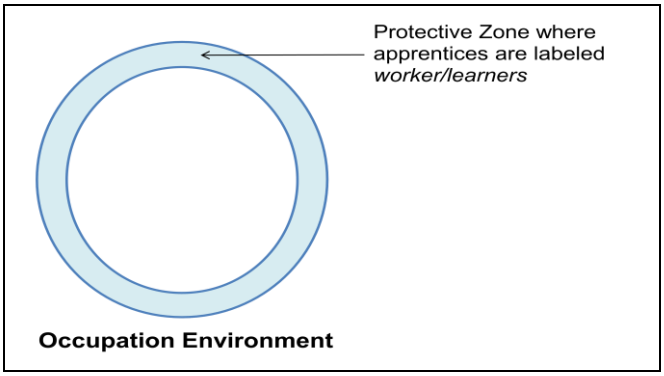

Figure 3: Protective worker/learner zone

<u>Promoting Apprenticeship</u>

Manufacturing has become quite unpopular as a career choice for many Americans (National Academies, 2017), especially among the population of "millennials," the 78 million sons and daughters of the baby boomers who are now entering the labor market (Tolan & Hossain, 2010). Bosman, Strimel and Krauss (2021), in a study to determine how the K-12 system can better advise parents, students, and teachers regarding vocational paths in manufacturing, found that pre-service STEM teachers believe manufacturing is a black box and has poor working conditions. Regarding influence, teachers in the study indicated that the media has considerable

influence on manufacturing perceptions and that educators and schools possess abundant potential to impact manufacturing perceptions. Tran and Mitchell (2010) recognized the brain drain away from manufacturing by stating, "the U.S. has experienced a shift from a manufacturing-based economy to one that overwhelmingly provides services and information" (p. 143). As boomers continue to exit the workforce at exponential rates, business and industry, and particularly manufacturing, are concerned with who is being hired and how new hires transition into the workplace. Attracting and keeping high level thinkers has never been more important for U.S. manufacturing and the Nation.

De Vos and De Hauw (2010) studied millennial career perspectives by focusing on work values, motivation, and expectations. They found that millennials maintain an anticipatory psychological contract upon entering employment in a variety of areas; and if breached, it can have a negative effect on job satisfaction, commitment, job performance, and intention to stay. De Vos and De Hauw explained that new hires determine early, sometimes in the first few days, whether they will persist and remain committed. Today, new hires require a different kind of transition into the workplace – they need an apprenticeship. Often never having held a job, new employees – especially the Millennials – need a system that teaches, guides, motivates, and cares for them during the critical transition into a legitimate occupation, both professionally and personally.

Most companies do not invest in expansive programs like apprenticeships. More often, they conduct restrictive training programs and new hires are expected to absorb knowledge very quickly and be productive soon after being hired. The main responsibility of helping a new hire transition into the work environment is largely left up to the supervisor and more seasoned peer at the worksite where the new hire happens to be placed. While this is a proper approach, these incumbent employees are driven by production demands and are typically overburdened with many other tasks, the least of which includes developing an inexperienced employee. With our traditional system of school-then-work, new hires are expected to be productive workers. Apprenticeship programs, by the nature of their structure, form an environment that gives the necessary attention to the new hire. Additionally, it sends the appropriate signals to the new employee and labels them as *worker/learner* to the more seasoned employees.

Pre-Apprenticeship in the United States

Pre-apprenticeship programs offer a structured curriculum that covers a range of topics, including fundamental technical skills, safety protocols, problem-solving abilities, and workplace communication. Curriculums may vary depending on the specific program but typically include hands-on training and theoretical instruction in areas such as use of tools, machine operation, quality control, blueprint reading, and relevant industry processes. They generally span several weeks to a few months, with varying time commitments. Pre-apprenticeship programs are shorter in duration than formal apprenticeships and can provide a more rapid entry into the job market. They are typically geared towards individuals with little or no previous experience in manufacturing, which includes recent high school graduates, career changers, veterans, and others seeking an entry point into the industry. Some pre-apprenticeship programs may target underrepresented populations to promote diversity and inclusion in manufacturing.

Practical, hands-on training is a crucial component of pre-apprenticeship programs and participants typically gain experience in operating machinery, using tools, and performing tasks relevant to manufacturing occupations. This hands-on experience helps build confidence and familiarity with the processes, tools and equipment used in the manufacturing industry.
Many pre-apprenticeship programs are developed in collaboration with local manufacturers, industry associations, and educational institutions. These partnerships help ensure the training aligns with industry needs and provides participants with requisite skills to enter an apprenticeship and workforce. Some programs offer participants the opportunity to earn industry-recognized certifications that can enhance job prospects and indicate a certain level of competence to potential employers. Job placement assistance is often available, helping graduates secure entry-level positions in manufacturing. Because pre-apprenticeship programs often have solid relationships with local manufacturers, they are typically able to connect participants with employment opportunities. The cost of participating in pre-apprenticeship programs can vary. Some programs are funded by the government, industry associations, or educational institutions, while others may require participants to pay a fee or tuition.

Pre-apprenticeship programs in U.S. manufacturing are valuable tools for addressing workforce development needs, reducing skills gaps, and providing individuals with a pathway to

meaningful and sustainable careers in the manufacturing industry. Pre-apprenticeships help bridge the gap between education and employment, offering a foundation for success in formal apprenticeships and manufacturing jobs.

Review of U.S. Shipbuilding Apprenticeship Programs

Shipbuilding is a vital sector of the U.S. maritime industry that requires a skilled workforce to meet the demands of constructing and maintaining commercial and naval vessels, a salient point that cannot be overstated. According to Limas-Villers (2022), the United States Navy's objective to grow manned and unmanned platforms totaling between 398 and 512 vessels is at present, mostly hopeful since the number of public and private shipyards has significantly declined with respect to experienced personnel. Apprenticeship programs play a crucial role in developing highly trained workers in shipbuilding trades. This section explores the significance of shipbuilding apprenticeships in the United States, discussing their structure, benefits, and the positive impact they have on the industry.

The shipbuilding industry in the United States relies on a skilled workforce that possesses specialized knowledge in various trade areas such as welding, machining, electrical, pipefitting, and more. Apprentice programs serve as a cornerstone in cultivating this workforce by combining hands-on training, theoretical education, and related academic instruction. This study highlights the key aspects of shipbuilding apprenticeships and their contributions to the industry's growth and competitiveness.

Importance of Shipbuilding Apprenticeships:

Shipbuilding apprenticeships address the need for skilled workers in an industry that demands precision, safety, and expertise. By providing structured training and education, these programs offer several benefits:

a. Workforce Development: Apprenticeships nurture a pipeline of skilled workers, ensuring a continuous supply of talent in shipbuilding occupations. They bridge the gap between classroom learning and real-world application, equipping apprentices with the practical skills and knowledge required for shipbuilding operations.

b. Industry-Specific Expertise: Shipbuilding apprenticeships focus on industry-specific crafts, enabling apprentices to gain specialized knowledge directly relevant to the

maritime sector. This targeted training enhances their understanding of shipbuilding processes, safety protocols, and quality standards.

c. Enhanced Productivity: Skilled apprentices contribute to improved productivity and efficiency in shipyards. By mastering their craft, they enhance the overall quality of shipbuilding projects, reducing errors and ensuring timely delivery.

d. Career Advancement: Apprenticeships create pathways for long-term career growth within the shipbuilding industry. By completing an apprenticeship program, individuals acquire a recognized qualification that serves as a foundation for further professional development and advancement opportunities.

Industry Collaboration and Apprenticeship Programs:
Shipbuilding apprenticeship programs thrive through collaboration between shipbuilding companies, educational/training institutions, and government entities. Key stakeholders work together to design, implement, and continuously improve apprenticeship initiatives. Such collaborations ensure that apprenticeships align with industry standards, incorporate the latest technologies, and address evolving workforce needs.

The Value of Trade and Professional Apprenticeships:
In today's dynamic business landscape, talent acquisition and retention have become critical for organizations aiming to maintain a competitive edge. As a company committed to excellence, innovation, and long-term growth, each U.S. Shipbuilder recognizes the immense value of trade and professional apprenticeships. It is important to outline the benefits of apprenticeships and emphasize their significance for our organization's senior leadership.

Developing a Skilled Workforce:
Apprenticeships provide a unique opportunity to cultivate a highly skilled workforce tailored to each U.S. Shipbuilder specific needs. By investing in apprenticeships for trades such as plumbing, electrical work, carpentry, and more, we can bridge the skills gap and equip our workforce with the practical knowledge, technical expertise, and hands-on experience required to

excel in their respective trades. This not only enhances the overall competency level of our workforce but also contributes to increased productivity and efficiency.

Moreover, we recognize the importance of professional apprenticeships for positions like managers and engineers. Offering apprenticeship programs for managerial roles allows us to identify and develop talented individuals who exhibit leadership potential. These programs provide aspiring managers with opportunities to gain practical experience, develop managerial skills, and learn from experienced mentors within our organization. Similarly, professional apprenticeships for engineers provide hands-on training, enabling them to apply theoretical knowledge in real-world scenarios and hone their problem-solving and innovation capabilities.

Nurturing Homegrown Talent:
Implementing both trade and professional apprenticeships allows us to nurture homegrown talent and develop a pipeline of skilled professionals who are aligned with our company culture, values, and long-term objectives. By offering apprenticeship programs, we can attract individuals who are eager to learn and grow within our organization. These apprentices have the potential to become loyal, dedicated employees who deeply understand our company's vision and contribute significantly to our future success.

Apprenticeships create a pathway for individuals to progress from entry-level roles to managerial or engineering positions within our organization. By providing structured training, mentoring, and growth opportunities, we can nurture their potential and cultivate a talent pool that aligns with our goals. This approach not only strengthens our workforce but also fosters a sense of loyalty and commitment among our employees, reducing turnover and building a strong organizational culture.

Cost-Effective Talent Acquisition:
Trade and professional apprenticeships offer a cost-effective solution to talent acquisition compared to traditional recruitment methods. By recruiting apprentices, we can secure highly motivated individuals at a lower cost, while providing them with on-the-job training and professional development. This approach reduces the reliance on external hiring, minimizes

recruitment expenses, and allows us to mold talent according to our specific requirements, resulting in a highly skilled and loyal workforce.

Apprenticeships for managerial and engineering positions enable us to groom individuals with the right skill sets, mindset, and cultural fit for our organization. By investing in their development, we can capitalize on their potential and align their skills and expertise with our company's needs. This reduces the risk of external hires who may take longer to adapt to our organization's culture and strategic objectives, ensuring a seamless transition into key roles.

Building a Culture of Continuous Learning:
Trade and professional apprenticeships instill a culture of continuous learning within our organization. By promoting apprenticeships, we demonstrate our commitment to investing in the growth and development of our employees. This approach encourages senior leadership and the wider workforce to embrace lifelong learning, stay abreast of industry advancements, and adapt to changing market dynamics. Ultimately, this fosters innovation, promotes employee engagement, and positions each U.S. Shipbuilder as an industry leader.

Apprenticeships provide opportunities for managers and engineers to enhance their skills and expand their knowledge base. By offering apprenticeship programs, we encourage senior leadership to actively participate in mentoring and guiding aspiring professionals. This not only facilitates knowledge transfer but also enhances the leadership skills of our senior management team. The collaborative environment created through apprenticeships promotes the exchange of ideas, experiences, and best practices, fostering innovation and driving our company's growth.

Enhancing Employee Engagement and Retention:
Apprenticeship programs have a positive impact on employee engagement and retention rates. By providing a structured learning environment and career progression opportunities, we create a sense of purpose, job satisfaction, and loyalty throughout our workforce. Apprentices who receive valuable training and mentoring are more likely to remain committed to our organization, reducing turnover costs and creating a stable and skilled workforce.

By offering professional apprenticeships, we demonstrate our investment in the career growth and development of our employees. This fosters a sense of loyalty, as individuals recognize the opportunities for advancement within our organization. Managers and engineers who participate in apprenticeships experience personal and professional growth, which leads to higher job satisfaction and increased engagement. Additionally, the mentorship and guidance provided during apprenticeships create strong relationships between senior leadership and apprentices, further boosting employee retention and loyalty.

Conclusion:

Shipbuilding apprenticeship programs form the bedrock of a skilled workforce in the U.S. maritime industry. By providing comprehensive training, combining practical experience with classroom instruction, and promoting industry-specific expertise, these programs contribute to the growth, productivity, and competitiveness of the shipbuilding sector. Recognizing the importance of apprenticeships, stakeholders must continue to support and expand these initiatives to meet the industry's future workforce requirements.

Trade and professional apprenticeships are a strategic investment for each U.S. Shipbuilder. By implementing apprenticeship programs, we can cultivate a highly skilled workforce, nurture homegrown talent, reduce talent acquisition costs, foster a culture of continuous learning, and enhance employee engagement and retention. Embracing apprenticeships positions us as a forward-thinking organization that values professional development and secures a competitive advantage in the market. It is imperative for our senior leadership to recognize the value and potential of trade and professional apprenticeships and support their integration into our talent management strategy.

Methodology

Design Strategy

Using inductive analysis, this qualitative research obtained a thick understanding of the phenomena that shipbuilders and ship repair facilities experience while developing employees through pre-apprenticeships, apprenticeships, and apprenticeship-like programs. It did so by 1) surveying each participating shipyard and collecting preliminary data leading up to the multi-day conference, 2) conducting the multi-day round table discussion and documenting each yard's program description, and 3) conducting several follow-up meetings with each yard for a deeper understanding of their specific program details. An example of the preliminary survey can be found in Appendix C. It focused on "what key information would be value added for the community to know when considering a) to start an apprentice program, b) end a program, or c) expand what they currently offer.

Purposeful sampling was used establishing the criteria for information-rich cases with the sample size of seven – the seven shipyards that committed to participate in the FY2022 NSRP proposal. This research fits the social constructivist paradigm approach in that the researcher will be acting as an advocate for the participants, co-constructing knowledge with them, and giving a voice to their experiences. A solid foundation for this research resides in the phenomenological tradition, where the purpose is to "discover and describe the meaning or essence of participants' lived experiences" (Hays & Singh, 2012, p.50). Observation and interviews with open-ended questions were used to provide the researcher with a deep exploration into the hearts and minds of the participants and a better understanding of this complex social environment.

While this strategy provided a strong, in-depth investigation of phenomena each shipyard experienced in offering an apprenticeship, this researcher recognized that tradeoffs exist in the scope of the study by conducting only one pre-survey, one presentation viewing (at the multi-day event), and subsequent follow-up interviews. However, it is believed by holding the sample size to seven participating shipyards and devoting more time to depth, greater value was realized in understanding the meaning, or the voice, of each phenomenon in lieu of simply having a greater number of participants repeat with the same language.

Analysis Strategies

The research used inductive content analysis to obtain a thick understanding of the phenomena that companies experience while offering their apprenticeship programs. Data was collected from the survey, observation and interviews to refine the research question and identify patterns relating to a particular theory. Each observation and interview were completely transcribed and coded for frequencies and patterns to identify themes. The researcher constantly moved between the research process and findings throughout the study for discovery and verification. Codes and themes were collected, compared, and revised as data was collected and analyzed.

Adding credibility and trustworthiness and reducing the researcher's bias to the study, this research also used triangulation of investigators to strengthen the design and build confidence in its findings. An outside researcher (the Project Lead from BIW) agreed to serve in this capacity. Often referred to as stepwise replication, this project lead assisted with the research in the observation and interview process and was ensured the participant's voices were properly documented and understood by the researcher. Also, adding to the strength of the study's credibility, a 3-member panel of associates from the American Apprenticeship Round Table (AART) was established to peer debrief the study from beginning to end. According to Hays & Singh (2012) this reflective technique provides the accountability needed when the researcher has this much influence over the interpretation of the data.

Summary

Most of the current research on apprenticeship focuses on return on investment from a learner's and government's perspective, and not what companies truly go through when offering apprenticeship. Lacking popular on-boarding programs is the sustained mentorship efforts needed when a newcomer enters an occupation – an element that describes apprenticeship. To aid program developers and policy makers in guiding future apprenticeship models, this study sought to determine shipbuilding program experiences among seven US shipbuilders that offer either pre-apprentice, apprentice, or apprentice-like programs.

Results

Observation Results

The purpose of this study was to extract, study and share current best practices for apprenticeship from seven participating US shipbuilders. To obtain a thick description of the phenomena experienced by each participating shipyard, this study conducted a preliminary review of what each yard determined to be most valuable to know regarding apprenticeship programs in general. Several Delphi iterations were used to reach consensus among the shipyards that generated the following pre-conference questions.

1. What is the purpose of the program? What do we hope to accomplish? What are the expectations for outcomes/competencies?
2. Is "apprenticeship" necessary to serve our needs? Could we accomplish the same thing with a well-managed "training" program?
3. What specific occupations would we want to involve in a training program or apprenticeship?
4. Evaluating OJT progress
5. Considering Related Instruction
6. Defining a probationary period for the program in accordance with 29 CFR part 29
7. What could the hiring process look like?
8. Establishing rates of pay for apprentices and working within a CBA
9. Drafting program standards
10. VA Benefits
11. Drafting necessary MOAs to the labor agreement to make the program work
12. Establishing a regular Apprenticeship Council

From here, the national multi-day roundtable event was conducted April 12, 13, and 14. A representative from each of the seven participating shipyards were in attendance i.e., Bath Iron Works (Maine), Electric Boat (Connecticut), NASSCO (California), Fincantier Marinette Marine (Wisconsin), NNS (Virginia), Ingalls (Mississippi), and Philly Shipyard (Pennsylvania). In

addition to the participating shipyards several related entities were also present and contributed to the process immensely. They included: the Spectrum Group from ATDM, Covalent Works, IACMI – The Composites Institute, Norfolk Naval Shipyard Apprentice Program, NIMS Executive Director, Oberg Industries, OptiMax, Robert C. Byrd Institute, and the US Coast Guard Yard (Baltimore, MD).

Each entity presented a detailed explanation of their program(s) (see Appendices D through K). The sensitizing concept included describing how each shipyard conducted its program(s) e.g., What should the internal workings of the program look like? How are apprentices supervised? What coaching or mentorship opportunities have the maximum value? What related instruction and educational coursework is required to meet state and national standards in order to be "registered" with the Department of Labor? And, most importantly, what's the real return on investment? What do we really look for in an ROI? Should we be offering apprenticeships in general?

The presentation and voice from each participating shipyard were captured and transcribed, and initial coding was developed in a draft observation protocol. What concluded were five "content organizers" that the group agreed would drive the direction of the study from this point forward. The content organizers included the following.

1. <u>Recruiting, Application and Selection:</u>
    - Specific eligibility criteria - minimum age, educational qualifications, and physical fitness standards
    - What does the selection process entail – interviews and assessments. What constitutes a suitable candidate?

2. <u>On-the-Job Training:</u>
    - Hands-on training, working under guidance of experienced professionals

3. <u>Classroom Instruction:</u>
    - Classroom-based theoretical training to supplement the practical learning.
    - Subjects like blueprint reading, technical drawing, mathematics, etc.

4. Mentorship and Guidance:
    - How are you providing mentorship?
    - Experienced professionals provide guidance, support, and industry insights.
    - Help navigate their learning journey, offering valuable advice and assisting in career development

5. Evaluation and Certification:
    - Assessing apprentices' progress in both practical and theoretical areas
    - Does completion lead to a recognized qualification or certification, validating the apprentice's skills and readiness to work independently in their chosen trade.

Apprenticeship Model and a Possible Competency Skills Checklist

Apprenticeship has as its objective the training of skilled professionals versed in all phases and aspects of the identified occupation. As a provider (registered or not), it is recognized that to accomplish this, there should be well-developed on-the-job learning experiences combined with related technical instruction leading to a nationally recognized credential.

Attached below is an example of a one-year experience inclusive of 2000 hours of on-the-job-learning supplemented by the required related instruction (additionally displayed in Appendix B).

_____ APPRENTICESHIP PROGRAM
SCHEDULE OF WORK EXPERIENCE

Apprentices will receive on the job learning/training in the various work areas listed below. The order in which the training is given is to be determined by the flow of work and may not necessarily be in the order listed. The times allotted to these various processes are the estimated time frames in which an average apprentice will learn and become proficient in the skill area. They are intended only as a guide; the apprentice may require more time on one area and less in another. The total term of apprenticeship is indicated below. The columns at the right constitute a record of progress for the apprentice. Each apprentice will be provided with a separate sheet in which to log their hours of experience. When the apprentice has both completed the required hours and attained proficiency in the specific skill area the Supervisor/Mentor will initial the far-right column. Items for which previous credit have been given upon registration into the program should also be initialed. This sheet should be provided to the program office along with documentation of successful completion of related technical instruction when a request for completion of apprenticeship training program is submitted.

OCCUPATION: Basic Manufacturing Technician

SOC: 17-3029.09 **NAICS Code: 336611**
TERM: 2000 hours **RTI Hours: 144 hours**

SKILLS TO BE LEARNED ON THE JOB	Hours Required	Hours Attained	Proficient As of Date	Supervisor Signature
Set up and verify the functionality of safety equipment				
Adhere to all applicable regulations, policies, and procedures for health, safety, and environmental compliance				
Calibrate or adjust equipment to ensure quality production, using tools such as calipers, micrometers, height gauges, protractors, or ring gauges				
Monitor and adjust production processes or equipment for quality and productivity				

Troubleshoot problems with equipment, devices, or products				
Test products or subassemblies for functionality or quality				
Select cleaning materials, tools, or equipment				
Set up and operate production equipment in accordance with current good manufacturing practices and standard operating procedures				
Plan and lay out work to meet production and schedule requirements				
Install new manufacturing equipment				
Start up and shut down processing equipment				
Prepare and assemble materials				
Build product subassemblies or final assemblies				
Maintain inventory of job materials				
Clean production equipment or work areas				
TOTALS	**2000**			

RELATED INSTRUCTION

Each trainee will complete Related Instruction coursework as outlined in the Content Structure below. Intermediary Agencies and/or Employers providing related in-house instruction should utilize instructors trained in teaching techniques and adult learning styles.

The Manufacturing Technician Related Instruction can be adapted for class meetings in any number of ways. The instruction averages 144 hours to complete, however it can be adjusted depending on constraints.

Unit	Topic	Content	Hours
1	Safety	General Safety • Safety in the shipbuilding environment • Emphasis on personal responsibility • Hazard identification and management • Chronic vs. acute hazards • Ergonomics • Electrical and chemical hazards • Care of cords and hoses • PPE & appropriate attire, etc. • Personal Lifting Practices • Safety rules for the M-Tech shop	2
2	OSHA	OSHA 10 • PPE • Job Hazard Analysis • Housekeeping	10
3	Tech Math	Basic Processes • Working with Dimensional Math • Fractions • Basic Geometry Practical Applications • Basic Problem Solving with Math Metrics	12

4	Print Reading	Basics of Print Reading • Introduction to Sketches & Drawings • Locating Information • Basic Terminology • Weld Symbols • 2D & 3D Sketches • Assembly Drawings Practical Applications • Types of Material and Products Used in Construction	12
5	Manufacturing Skills Foundational	Hand Tools: • Hand tool safety, care and use Layout: • Accurate marking of lines and arcs, calculating data from print information • Geometric, layout • Large-scale floor layout using chalk-lines etc. Sawing: • Intro to sawing & saw safety • Types of saws • Cutting principles, saw pitch, set, kerf • Techniques for making accurate cuts. Grinding: • Grinding safety • Angle grinders • Grinding principles, grit, compounds, wheels • Grinding Techniques Drilling: • Drill safety • Types of drills • Drill bits, cutting principles • Techniques for accurate hole making. Air Tools: • Air tool safety • Coupling, uncoupling and care of hoses • Die grinders, cutoff wheels Rigging: • Basic rigging, pinch points • Suspended loads jacking • Bracing push/pull • Mechanical advantage, wedges, etc. • Come-Along jigs & fixtures • Hydraulic Porta-Powers	40
6	Manufacturing Skills	Applied Skills • Coping: Layout and fitting of metal parts using layout tools, saws and grinders • Gusset Plate: Manufacture part from a print using layout tools, saws, grinders etc. • Connector Plate: As above, but with a more complex part. • Drill Gauge: Layout, cut and drill a drill point gauge with attention to accuracy finish.	
7	Hot Work	• PPE/ clothes • 60-amp plasma cutting: plate and flat bar • Stick welding with 7018, 1/8” rod, fillet weld, all positions • Cutting plate and flat bars • Flux-core welding	
8	LEAN Manufacturing		
9	Resume - Interview		

Summary, Conclusions and Recommendations

This researcher was surprised at the level of detail experienced when observing and coding the voice of each participating shipyard. During the observation, many things captured the researcher's attention having utilized the basic observation protocol, i.e., recruiting, related instruction, mentoring techniques, etc. While conducting each presentation and following up with each shipyard, greater depth and quality was captured by voice recordings and transcribing the participants' voices into text. Having performed the study using these methods, this researcher has gained a much deeper understanding of the environment and experiences U.S. shipbuilding companies experience when operating apprenticeship or apprenticeship-like programs.

The purpose of this study was to extract, study and share current best practices for apprenticeship from seven participating U.S. shipbuilders. Qualitative data gathered through this research has revealed the following trends, issues, and solutions.

1. Having access to Master Craftsperson
2. Reduction in large-scale programs
3. Expansion of third-party intermediaries
4. Expansion of Pre-Hire/Third Party Training Programs
5. Expansion of the Pre-Apprenticeship model leading to a full Apprenticeship

<u>Access to Master Craftsperson</u>:

While apprenticeship can be described as a well-organized mentorship program, the best entity providing mentorship on the deck plate is a master craftsperson on the job. Mainly through scaffold instruction, personal or professional, the master craftsperson holds the key to entry and advancement into the work community and ultimately motivation and satisfaction for the apprentice. Through participant voice, it became apparent through the study that program success relies heavily on apprentices working with or having access to a master craftsperson. The theory is that when apprentices have a master craftsperson guiding them on the job, richer experiences happen, leading to greater satisfaction and more motivation. Additionally, this approach also benefits the company in an often-overlooked way in that the master craftsperson

also acts as a “gatekeeper” to the shipbuilding community, ensuring an apprentice progresses to possess the requisite knowledge, skills, and abilities to continually advance in the apprenticeship. In some cases, the apprentice is removed from the program if they are not adequately advancing in their apprenticeship, and thus determined not to be a good fit for the company.

Today, new employees need mentors more than ever. Transitioning through the beginning year(s) of work, or in many cases adulthood, is a very critical time wherein the decisions being made could have lasting and sometimes permanent consequences for the individual and employer. In many cases, mentoring is a term used to describe supervision, and traditional mentorship is known to be a popular program used by companies for employee development. Supporting supervisors acting as mentors or coaches, Liu, Xu, and Weitz (2011) studied three internship programs affiliated with large state universities and noted that effective supervisors acted as mentors and typically assigned challenging tasks, provided proper assistance in accomplishing tasks, and purposely helped mentees build a positive impression of themselves and the organization. In the current study, every participating shipyard reported that mentorship is largely the responsibility of a supervisor at the worksite. Unfortunately, this supervisor is often overburdened and typically driven by production demands that can often take priority over the training and development of a new worker.

Using front-line supervisors as mentors can be a valuable approach if implemented thoughtfully and with an understanding of the potential challenges involved. It can enhance the onboarding process and contribute to the professional development of apprentices, but it requires careful planning and support. This in mind, this study surfaced a host of areas where using front-line supervisors as mentors to apprentices could pose significant challenges.

1. Competing Responsibilities: Front-line supervisors have their own job responsibilities, which can be demanding. Adding mentoring duties can take away time and focus from their primary roles, potentially impacting their job performance.
2. Mentor Training: Not all front-line supervisors are naturally good mentors. They may need training on effective mentoring techniques, which requires additional resources and time.

3. Conflict of Interest: Front-line supervisors often evaluate employee performance and make decisions about promotions, raises, and disciplinary actions. There can be a conflict of interest if the supervisor is also the mentor, as it may affect their objectivity and fairness in performance assessments.
4. Inconsistent Mentor Quality: The quality of mentoring can vary from one supervisor to another. Some mentors may be more effective and supportive than others, leading to inconsistencies in the experience and learning outcomes.
5. Availability: Front-line supervisors may not always be available when apprentices need guidance or support, especially during peak work hours or when supervisors have competing priorities.
6. Mentor Burnout: Taking on mentoring responsibilities in addition to their regular work can lead to mentor burnout. This can result in decreased mentor effectiveness and job satisfaction.
7. Skill Mismatch: Not all front-line supervisors have the necessary mentoring skills or interpersonal skills to effectively guide and support apprentices.
8. Lack of Diversity: Using only front-line supervisors as mentors may limit the diversity of perspectives and experiences available to apprentices. Diverse mentorship can be valuable for fostering a more inclusive and equitable work environment.
9. Limited Scope: Supervisors may focus primarily on job-related tasks and may not provide holistic guidance on soft skills, career development, or company culture, which can be critical for the apprentice's success.
10. Retention Concerns: If an apprentice does not have positive experiences with their supervisor as a mentor, it could lead to decreased job satisfaction and higher turnover rates.

To address these issues, the study offers the following recommendations:

1. Provide Mentor Training: Offer mentorship training to front-line supervisors to equip them with the necessary skills to be effective mentors. Adequate time, including that of the supervisor receiving the training, should be allocated for the training.

2. Establish Clear Expectations: Clearly define the mentor's role, responsibilities, and limitations to prevent conflicts of interest and set expectations for both mentors and apprentices.
3. Monitor and Evaluate Mentoring Efforts: Regularly assess the effectiveness of mentorship programs and address any issues or inconsistencies in mentor quality.
4. Expand mentoring options: Consider diversifying the mentoring pool by including employees from other levels or departments to provide a broader range of perspectives.
5. Balance Workloads: Ensure mentoring responsibilities are balanced with front-line supervisors' normal workloads to mitigate burnout and maintain high-quality mentoring.
6. Implement Feedback Mechanisms: Create mechanisms for apprentices to provide feedback on their mentorship experiences and use that feedback to make improvements.

Additionally, as the findings of this study determined that differences existed in program success between those apprentices having access to a supervisor that acts as a structured mentor, this study recommends program leaders concentrate on how their apprentices are being supervised. Further research should be conducted to determine best practices for mentoring apprentices in all areas of their apprenticeship. Do some supervisors act more aggressively than others in identifying if an apprentice is worthy of continuing in the program? If so, is this by design, is more mentor training required, or does the supervisor lack the skills or temperament to serve as a mentor? What might be the benefits of such an internal component?

Reduction and Changes to Large-Scale Programs:

Every shipyard expressed some level of reduction with their traditional apprenticeship programs that contained a robust college degree in the process. NASSCO in San Diego for instance dropped their program entirely and moved to a well-defined Trade Training on-boarding program. Electric Boat in Groton, CT also dropped all apprenticeships in the early 2000's; however, the company now offers a smaller duration apprenticeship. In lieu of including a post-secondary academic degree component, the company offers extensive trade training as their related instruction element. In recent years, Newport News Shipbuilding became certified by The State Council of Higher Education for Virginia to operate in Virginia. In achieving that certification, the school now serves as its own two-year degree-granting institution. Specifically,

the school now offers Associate of Applied Science (AAS) degrees in 26 shipbuilding disciplines.

The reduction of company-sponsored apprenticeship programs in the United States shipbuilding arena can have several implications and consequences. Apprenticeship programs are vital for our industry, as they provide a structured pathway for individuals to gain valuable skills and experience. This study posed several potential issues associated with the reduction and changes to such programs.

1. Skills Gap: Reduction in apprenticeship programs can exacerbate the existing skills gap in the workforce. As older skilled workers retire, there may not be enough trained replacements to fill their roles, leading to a shortage of qualified workers in specific industries.
2. Limited Career Opportunities: Apprenticeships often serve as a valuable entry point into various industries and occupations in the company for which the apprentice is working. The decline of these programs may limit the career opportunities available to individuals, particularly those who don't pursue traditional four-year degrees.
3. Wage Stagnation: Apprenticeship programs often lead to well-paying jobs with career growth potential. A reduction in these programs may contribute to wage stagnation or even a decrease in earnings for those without access to alternative educational and training pathways.
4. Industry Competitiveness: A reduction in skilled labor can affect the competitiveness of U.S. industries. As companies struggle to find qualified workers, it can hinder their ability to innovate and maintain productivity.
5. Economic Impact: Skilled workers play a crucial role in economic development. The decline of apprenticeships can have a negative impact on local and national economies by reducing workforce productivity and innovation.
6. Diversity and Inclusion: Apprenticeship programs can be a pathway for underrepresented groups to enter certain industries. Their decline may hinder diversity and inclusion efforts within these fields.

7. Education Costs: With fewer apprenticeship opportunities, individuals may turn to traditional higher education, which can be expensive and may result in student loan debt. This could have long-term financial consequences for individuals.
8. Innovation and Technological Advancement: Skilled workers often contribute to technological innovation. The reduction of apprenticeships can slow down the pace of innovation in various industries.
9. Loss of Institutional Knowledge: Many apprenticeship programs involve the transfer of skills and knowledge from experienced workers to newer employees. The decline in these programs may result in the loss of valuable institutional knowledge.
10. Decline in Loyalty: Reduction or changes to apprentice programs can be perceived as a decline in a company's intention and commitment to invest in its people. Consequently, the loyalty that robust apprentice programs inherently produces can be diminished, which can negatively impact retention, commitment, and culture.

In addressing the reduction of shipyard-sponsored apprenticeship programs, policymakers, businesses, and educational institutions should consider the following strategies:

1. Incentives: Offer incentives to encourage shipyards to establish and maintain apprenticeship programs, such as tax credits or grants.
2. Collaboration: Promote collaboration between shipyards and educational institutions to develop and maintain robust apprenticeship programs.
3. Public Awareness: Increase public awareness of the value of shipbuilding apprenticeships as a viable, long-term career path.
4. Modernization: Modernize shipbuilding apprenticeship programs to adapt to changing industries and technology, which should consider the need for advanced skills and education.
5. Diversity Initiatives: Ensure apprenticeship programs are accessible to individuals from diverse backgrounds and underrepresented groups.
6. Increased Government Support: Governments can provide funding and resources to expand apprenticeship opportunities.

In summary, the reduction of company-sponsored apprenticeship programs can have wide-reaching negative consequences. Increased support and collaboration between industry, educational institutions, and government, as well as continuing to modernize apprentice programs and educate the public concerning the value of apprentice programs is needed going forward. Addressing the issue is critical to meet the workforce needs of the United States and ensure economic growth and individual prosperity.

Expansion of Third-Party Intermediaries:

U.S. manufacturing has seen a surge in third party providers acting as intermediaries for the Department of Labor's Registered Apprenticeship Program. Intermediaries started becoming a buzzword about a decade ago, and for the most part, the DOL (and other entities) have found it easier to funnel support monies to the intermediaries rather than private employers. Companies are starting to catch on to the funding flow, and many non-shipbuilding manufacturing companies allow a third party to handle most of its compliance regarding apprenticeship. One such intermediary that is currently partnered with one of the study's participating shipyards is the American Apprenticeship Round Table (AART).

The AART offers a range of services, including apprenticeship program development, regulatory compliance, talent sourcing, training coordination, and program evaluation. Their team possesses years of experience in Shipbuilding Apprenticeship, as most of their consultants (Navigators) are veteran apprenticeship managers from many defense shipbuilders in the country.

In 2020, the American Apprenticeship Round Table established a relationship with one of the shipyards participating in this study, to pilot test the *intermediary* approach in the shipbuilding sector. In doing so, the AART formally registered itself as an "intermediary sponsor" through the Department of Labor and listed the shipyard as the employer. The AART, acting as the sponsoring agent, began identifying training needs and possible providers for the employer. The first provider identified was a local community college in the participating shipyard's area. The college had been receiving state funding to offer a 120-hour manufacturing training program that was available to the public. Together, the company and AART recruited a diverse slate of "pre-hire" candidates desiring employment with the shipyard but lacking the requisite entry-level

skills. Each candidate applied to an open posting on the company's website. "Provisional Offers" were made to each candidate and official offers were contingent on individuals successfully completing the training and passing a background check and medical physical during the on-boarding process.

The company hired and on-boarded 41 individuals, all of whom were also registered by the AART as apprentices with the state's Department of Labor. As employees of the company and registered apprentices, the trainees then (1) completed a minimum of 160 additional hours of specialized on-boarding trade training with the employer; (2) completed 6,000 hours of on-the job learning with the employer; and (3) participated in strategic mentorship sessions with an AART Navigator throughout the 6000-hour experience. Tracking the retention rates of the participants post-hire revealed valuable data. After the first year, 93% were still with the company; two-years post hire, 87% remained; and three-years post hire, 82% persisted and were still employed with the company. While the company did not provide retention rates for its general hire population, it did indicate retention rates of individuals included in this pilot were significantly greater than the company's general hire population.

In general, research indicates that employee retention rates and overall skill levels significantly increase when trainees work towards and complete an industry-recognized certification through a registered apprenticeship. New hires, in their pursuit of completing a nationally recognized credential, typically "stay" working for the employer for the duration of the program. However, the benefits continue even after apprentices complete the program. Newport News Shipbuilding performed longitudinal research in 2015 that revealed greater than 85% of its apprentice graduates are still with the company ten years post-completion. That's a significant return-on-investment that companies need to recognize in their financial models.

Expansion of Pre-Hire/Third-Party Training Providers:

In similar fashion to the intermediaries described above, companies are seeing grant dollars flow to third-party training providers and are slowly identifying ways to "accept" the pre-hire training model as a viable option. This approach uses third-party training providers to prepare individuals "pre-hire", or stated differently, before they start working for a prospective company.

The trend today is for companies to maintain constant communication with their local third-party training providers, educating them as to what content needs to be included in the training. In some cases this results in companies offering up their internal trainers to serve as adjunct instructors for the pre-hire training.

Using third-party, pre-hire training can present several issues and challenges for both employers and job seekers. These entities, often external organizations or service providers are brought in to provide training and assessment services for prospective employers. Below are some of the issues and concerns this research found associated with this practice:

1. Quality and Consistency: Employers may have concerns about the quality and consistency of training provided by third-party entities. If the training is not commensurate with the company's standards, it can result in a mismatch between the skills of candidates and the actual job requirements.
2. Lack of Alignment: The training provider may not fully understand the specific needs and culture of the employer, resulting in training that is not aligned with the company's goals and values.
3. Increased Cost: Engaging a third-party training provider can be costly. Employers may have to pay fees for their services. If the training is inadequate, it can lead to increased hiring costs as employees may require additional training after onboarding as employees.
4. Limited Customization: Pre-hire training providers often offer standardized training programs that may not be easily customized to the unique needs of the employer, or a specific job role needed by the company.
5. Data Privacy and Security: Sharing candidate information and assessment data with third parties can raise data privacy and security concerns. Employers must ensure that sensitive candidate data or personal identifiable information (PII) is handled in a secure manner and compliant with data protection regulations.
6. Lack of Control: Employers may have limited control over the training process when using a third-party training provider. This challenge can result in a lack of transparency and an inability of providers to make real-time adjustments to the training, which may be needed to support emerging knowledge, skills and abilities required for a particular job role.

7. Accessibility and Inclusivity: Third-party training providers may not offer training that is accessible and inclusive for all candidates, potentially leading to issues of discrimination or bias in the hiring process.
8. Consistency in Evaluation: The assessment and evaluation processes conducted by the training provider may lack consistency, leading to variations in candidate evaluations. This can be construed as or lead to unfair hiring practices.
9. Legal and Ethical Concerns: Employers should be aware of potential legal and ethical infractions when using third-party training providers, especially if the intermediaries engage in discriminatory practices, use biased assessment tools, or breach privacy regulations.
10. Transition Challenges: Transitioning from the training environment provided by the training provider to the workplace may pose challenges for new employees, potentially impacting their on-the-job performance and level of satisfaction.

To mitigate these issues, employers should carefully vet third-party intermediaries, establish clear communication and expectations, monitor the quality of training, and ensure that the training aligns with the company's needs and values. They should also prioritize data privacy and security and take appropriate measures to address any potential biases in the hiring process. Ultimately, the decision to use third-party pre-hire training intermediaries should be made with consideration of the employer’s specific needs and risks.

Conversely, there are significant advantages for shipbuilders to invest in third-party training. These advantages contribute to a more skilled and efficient workforce, better safety records, and increased competitiveness in the industry. The following is a list of the specific positives the study identified when using a third-party provider.

1. Skill Development: Pre-hire training equips job seekers with the specific technical and operational skills needed for manufacturing roles. This makes them more attractive candidates for employers and reduces the time and resources required for on-the-job training.
2. Improve Safety: Manufacturing environments can be dangerous, requiring individuals to work with heavy machinery and hazardous materials, and in confined spaces or from elevated heights. Pre-hire training ensures that workers understand safety protocols, can

select and properly don the required personal protective equipment (PPE), thereby reducing the risk of accidents and injuries, and improve overall workplace safety.

3. Increased Productivity: A well-trained workforce is more productive and efficient. Employees who receive pre-hire training are better prepared to operate tools and machinery, follow manufacturing processes, and perform in a manner that produces products that meet quality standards. This results in increased output and greater first-time quality.
4. Reduced Turnover: Adequate training can improve job satisfaction and confidence among employees, reducing turnover rates. When workers are confident in their abilities to produce good quality work in a timely manner, they are more satisfied and less likely to leave their positions prematurely, whether for voluntary or involuntary reasons.
5. Customization: Training programs can be tailored to the specific needs of a manufacturing company, ensuring that employees are well-versed in the company's unique processes and products. This leads to more streamlined and efficient operations.
6. Competitiveness: In the fast-paced world of manufacturing, staying competitive is essential. Pre-hire training allows workers to adapt quickly to new technologies and processes, ensuring the company remains at the forefront of industry best practices and advancements.
7. Adaptability: Manufacturing is constantly evolving with the introduction of automation, robotics, and Industry 4.0 technologies. Pre-hire training prepares workers to adapt to these changes, operate cutting edge equipment, and embrace technological advancements.
8. Workforce Development: Investing in pre-hire training contributes to the development of a skilled workforce in the U.S. manufacturing sector. This not only benefits individual companies but also helps address skills shortages and enhances the overall quality of the shipbuilding industry’s labor pool.
9. Compliance: Company’s must align with various regulations, industry standards, and customer requirements. Pre-hire training ensures employees are knowledgeable of and comply with the rules, policies, procedures, and guidelines to reduce the risk of legal issues and potential fines.
10. Employee Satisfaction: Well-trained employees tend to be more satisfied with their jobs because they feel competent and capable. This can lead to a positive work environment, higher morale, and better employee engagement and retention.

11. Cost Savings: While there is an initial investment in pre-hire training, it can lead to significant cost savings in the long run. Reduced turnover, increased productivity, and lower injury rates can all contribute to cost reductions for manufacturing companies.
12. Improved Quality: Pre-hire training can lead to improved first-time quality. Well-trained employees are more likely to produce products that meet or exceed quality standards, which reduces defects and waste.

In summary, pre-hire training in U.S. manufacturing offers a range of advantages, from improved safety and higher productivity, to increased competitiveness and employee satisfaction. These benefits are essential for the growth and success of manufacturing companies in the United States.

Expansion of the Pre-Apprenticeship model leading to a full Apprenticeship:

To expand apprenticeship, the DOL recently developed a way to "register" a pre-hire training program as a pre-apprenticeship where if documented properly, is designed to lead directly into a fully registered apprenticeship program. When the pre-apprentice is registered as such, the company can count the hours towards both the related instruction (144 hours/year), and the OJT hours (total program hours). In many cases, the company is also able to reduce the amount of additional training needed once onboarding new employees.

Pre-apprenticeship programs in the United States manufacturing sector serve as a valuable bridge between individuals seeking a career in manufacturing and employers looking to develop a skilled workforce. These programs are designed to prepare individuals for formal apprenticeships or entry-level positions in manufacturing by providing them with foundational knowledge and skills. The aim is to prepare individuals for the demands of modern manufacturing jobs. Focusing on equipping participants with the foundational knowledge and skills needed for success in an apprenticeship or entry-level manufacturing position, the primary goals being to reduce skills gaps, enhance employability, increase diversity in the manufacturing workforce, and create a pool of candidates ready to contribute effectively to the industry.

Expanding pre-apprenticeship programs will lead to apprenticeships in the United States, providing a valuable pathway for individuals to gain the skills and experience necessary for successful careers. Pre-apprenticeships are also a bridge between education and the workforce, helping prepare individuals to meet the requirements needed for specific industries and trades. In addition to revealing greater understanding of the naval shipbuilding and repair sector of the Defense Industrial Base (DIB) and how pre-apprenticeship could be incorporated in a positive way, this research also investigated the facilities in Danville, Virginia known as the Accelerated Training in Defense Manufacturing (ATDM).

Workforce and manufacturing shortfalls are particularly acute in the naval shipbuilding and repair sector of the DIB impacting material readiness of the current fleet; major maintenance and overhaul availability; and new construction. The "1 COLUMBIA + 2 VIRGINIA" construction cadence beginning in FY26 will further stress the Submarine Industrial Base (SIB). The ATDM and the Navy Additive Manufacturing Center of Excellence (AM COE), co-located on the campus of the Institute for Advance Learning and Research (IALR) in Danville, Virginia have been established to address these challenges. These projects are moving forward under the direction of the Industrial Base Analysis and Sustainment Program Office (IBAS) in the Office of the Secretary of Defense (OSD) and Navy's Program Executive Office (PEO) Strategic Submarines.

ATDM trains workers in the critical manufacturing skills needed to establish a steady and sustainable flow of workers for the SIB and DIB to fill critical skills gaps and manpower shortages. The AM COE's mission is to enable the introduction of additive manufacturing into naval shipbuilding and repair supply chains to increase manufacturing capacity to produce submarine components. The overall program is a pilot project to test and evaluate a prototype training platform for rapidly training skilled workers in key areas for employment in the defense industry. The project is funded through the CORNERSTONE OTA National Imperative for Industrial Skills initiative launched in early 2020 by the Industrial Base Analysis and Sustainment Program Office under the Undersecretary of Defense for Acquisition and Sustainment. ATDM was developed as a public-private consortium between DoD, The Institute for Advanced Learning and Research (IALR), Danville Community College (DCC), Phillips

Corporation, and The Spectrum Group in consultation with the defense industry. IALR, which is a political subdivision of the Commonwealth of Virginia, serves as the lead organization for program implementation.

Training takes place in Danville, Virginia, and the programs are designed to help motivated students make an immediate impact in the SIB. Whether individuals are seeking a career change or just starting their educational journey, ATDM markets themselves as a perfect fit. They offer classes designed to give trainees the credentials needed for a career in any of these in-demand, great-paying fields — in just a few months. Program areas include Additive Manufacturing, CNC Machining, Non-Destructive Test, Quality Control, and Welding.

The programs are designed to prepare trainees for a new career in just 16 weeks. There is no standing around and waiting for a turn on equipment at ATDM. Instead, trainees have immediate access to training resources and instructors throughout their training. ATDM workspaces and resources are some of the bests in the nation, with tens of millions of dollars invested in state-of-the-art, professional-grade equipment. Additionally, their small class sizes provide individualized attention for an optimal learning experience.

The program has very little "fluff" built into the curriculum. Every arc struck in welding, every part produced on a CNC machine, every inspection programed on a coordinate measuring machine, every part produced on additive manufacturing equipment, or every magnetic particle test performed has a specific purpose. The entire 16-week curriculum is designed to give trainees the skills directly requested or required by the industry. Every trainee is engaged in simulated manufacturing projects tailored to support specific SIB and/or DIB needs.

Shipyards can partner with the ATDM in the following ways:

1. Send current employees (incumbent workers) to the ATDM facility for upskilling
2. Send contingent pre-hires to ATDM with the expectation they must complete the program for their trade/vocation area prior to being hired by the sponsoring company
3. Recruit students who have independently enrolled and successfully completed one of the programs at the ATDM facility.

Currently, tuition is covered at no cost to the student or employer. Housing is also available at no cost to the students via scholarship. The high-quality facilities, equipment, training, and faculty distinguish ATDM as a solution with tremendous potential. However, shipyards are finding it difficult to leverage a reliable model to meet their individual needs. This challenge will be discussed further in the Reflections section below.

Reflections

Stemming from common themes that surfaced throughout the roundtable discussion and "reach-back" investigations, the study gathered deeper understanding into each participating shipyard's reflections on the findings.

Access to Master Craftsperson:

Researchers expected to hear about the master craftsperson teaching, guiding, and caring for apprentices, leading to greater motivation on the part of the apprentice. One is more productive when he or she is trained and motivated properly. Scaffolding properly executed by someone valued within the community of practice allows for positive interactions that cause the learner to feel welcomed into and part of the community. The master craftsperson model of apprenticeship has been shown to offer more potential for success. However, after conducting observations and interviews, apprentice motivation, satisfaction, and success may have more to do with how the work community perceives the apprentice versus simple interactions with a master craftsperson. This, of course, could still hinge on the actions and interactions of the master craftsperson, but may be more complex than this study has revealed. However, this does not diminish the positive impact the master craftsman has on the knowledge, skills, and abilities acquired by the apprentice during OJT, and the individual mentorship opportunities that help apprentices understand "what it takes" to be holistically successful. As discussed in the results, interactions did occur reinforcing the original theory that having a master craftsperson improves the experiences of apprentices in the work-related component of an apprenticeship. However, other themes such as apprentices learning the "tricks-of-the-trade" and the power of belonging to a work community have been shown to be important in motivating apprentices to learn and be eager to excel in an apprenticeship. Further research should investigate the effects of participation and what Lave and Wenger (1991) describe as legitimate peripheral participation (LPP). In their model, apprentices become members of the work community by initially participating in simple but real tasks that are nonetheless productive and necessary for the goal of the community. As a participant matures and gains more knowledge and skill, their participation becomes more central to the community, and they feel more legitimate in the work community. More observations and interviews with apprentices and the master craftsperson may reveal a

deeper understanding of the experiences of apprentices while serving in the work component of their apprenticeship.

Reduction of Large-Scale Programs:

Every shipyard expressed some level of change in what they are offering towards the *related instruction* component of their programs. About half of participating shipyards reported they had offered at least some college coursework leading to an associate degree (in two cases a full associate degree) as their related academic instruction component. This suggests their stated purpose was more in line with that of a professional development program. The intent was to supply a continuous pool of highly motivated and educated individuals with foundational deckplate knowledge, ready to take on the challenges that leadership positions present. Apprentices attaining post-secondary education degrees served their companies well, as identified by many examples where their mid- to senior-level leadership teams were occupied by individuals who started out as apprentices many years prior.

In the past decade however, many of the shipyards in this study reported they have reduced or dropped the academic requirement altogether from their program. Instead, they have opted to offer entry-level trade training – something like their existing on-boarding and reach-back training program they were already performing in-house, only now more robust. Based on their feedback, the changes in related academics were attributable to budget reductions, entry-level candidate preparedness, or a fundamental change in direction for their apprentice programs. In one case, one of the participating shipyards became their own two-year degree granting institution.

Interestingly however, roundtable discussions did not indicate significant concerns over these changes to the academic component of study participants' apprentice programs. While most shipyards reported reducing or eliminating entirely the college accredited academics as their related instruction component, they are still investing significantly in trade training. Their intent is to accelerate time to talent for as many new hires as possible. For those apprentices that excel and aspire for more, two shipyards are still offering opportunities for a limited number of apprentices to complete two-year applied science associate degrees, or higher. In some cases,

shipyards are offering this opportunity to fewer apprentices than in the past. Also relevant to this discussion is that several shipyards still offer tuition reimbursement for qualifying degree programs or professional certifications.

Expansion of Third-Party Intermediaries:

Third party intermediaries are typically consultancy groups, dedicated to providing comprehensive apprenticeship consulting services to organizations across various industries. Their mission is to bridge the gap between employers and potential apprentices by offering tailored solutions that align with business goals and support the growth and development of a skilled workforce. With a team of experienced professionals and a strong network of industry partners, their aim is to become a trusted advisor in the apprenticeship space.

While the manufacturing sector overall has seen a surge in third-party intermediaries acting as apprenticeship sponsors, this concept has largely remained foreign to most shipyards. Fincantieri Marinette Marine and Bath Iron Works were the only two shipyards participating in the study who experimented with the third-party concept. Each yard reported advantages in flexibility and expertise in resources residing with the intermediary as reasons for doing so. In addition to helping design and develop a program, the intermediary also handled all regulatory compliance, talent sourcing, training coordination and program evaluation. They assisted in navigating the complex regulatory landscape surrounding apprenticeships, providing guidance on compliance with regional and national and regulations, including apprenticeship standards, funding schemes, and reporting requirements. The intermediary also helped identify and attract potential apprentices by leveraging their extensive network and recruitment expertise. It facilitated the delivery of trade training from a variety of third-party training providers in the shipyard's local area. Lastly, the intermediary conducted a thorough evaluation of the apprenticeship programs, providing the company with valuable insights into their effectiveness.

Expansion of Pre-Hire/Third-Party Training Providers:

All shipyards reported they are focusing on pre-hire "pathways" programs to successfully meet their demands for hiring competent employees. Their main effort continues to be working with local community colleges, adult education entities, one-stops, and career and technical education

(CTE) schools to affect the third-party curriculums and training content by making them align more with their company's needs. Their hope is to experience more prepared individuals applying to open company postings after having completed the training.

One shipyard reported significant success with preparedness and company retention with its efforts in this area. Specifically, the employer developed a 120-hour training manual in general manufacturing for its local community college to teach to the public. The training provides shipbuilding industry entry-level production craft training and enhances workforce excellence for shipyard craft technicians. It targets new hires as well as the general public, and includes curriculum topics such as: shipbuilding basics, introduction to hand and power tools, basic blueprint reading, technical math and measurements, safety and lean training, as well as plasma cutting and tack welding. The program culminates in the attendee earning a certificate from the community college that distinguishes the person as a knowledgeable and competent shipyard production craft mechanic.

All shipyards agreed there is great potential value in having the ATDM serve as a third-party training provider to combat the workforce shortfalls that continue to plague our sector of the Defense Industrial Base. The ATDM currently has a goal to train 1000 individuals annually in critical manufacturing skills, which can help establish a steady, sustainable flow of workers into the SIB/DIB. However, because the training takes place in Danville, Virginia, every shipyard participating in the study expressed difficulty in understanding how they could possibly take full advantage of the model.

Most shipyards indicated that sending incumbent workers to the ATDM facility is an unlikely option. Union issues, traveling to Danville, Virginia, and providing hourly wage with fringes for the incumbent worker for 4-months makes this option very unattractive. Additionally, when attempting to recruit from the ATDM existing population, every shipyard reported to having difficulty. While all shipyards continue participating in the Job Fairs facilitated by the ATDM, many report only having minimal success hiring candidates after making them an offer. They indicated that, while the trainees are very prepared upon graduating the ATDM, they almost always are from another area of the country (e.g., Florida, Texas, California), and usually get a

local offer from a good company in their hometowns. While graduates of ATDM interview with several shipyards, and almost always receive multiple offers, they infrequently follow through with the on-boarding process. The greatest long-term potential, according to each of the participating shipyards, is sending conditional pre-hires to the ATDM, with the expectation they must complete the program prior to receiving employment. When a shipyard implements this option, they have experienced a 100% success rate – meaning the individual returns to the sponsoring company, begins working, and is determined to be well-prepared to meet the requisite demands of the company.

Expansion of the Pre-Apprenticeship model leading to a full Apprenticeship:
Only one shipyard reported to have been implementing a pre-apprenticeship leading to a fully registered apprenticeship with their company. Starting in 2019, and under previous NSRP Grants, this shipyard developed three curriculum guides (i.e., Manufacturing Technician Training, Marine Design Training, and Surface Coat & Painting Training). The scope and sequence of each course includes 120 hours of training with a capstone project. Multiple U.S. shipyards participated in developing course content, and each guide was scrubbed and cleared for public use. Each guide contains a curriculum foundation with goals, objectives, and daily lesson plans including detailed step-by-step recommendations on how to deliver the instruction, which allows the content to be taught by any third-party training provider – such as a local community college.

Partnering with its local community college to offer the courses based on its hiring needs, this shipyard registered each of the offerings as pre-apprenticeships with the Department of Labor. Through a memorandum of agreement, the company interviews and considers hiring all graduates of the three-week training (classified as a pre-apprenticeship). If hired, the trainee then enters the company and is registered into a one-year apprenticeship. The program is fully registered with the state's Apprenticeship Program at the DOL.

This program is essentially cost free to the company. The community college partners with its workforce systems, and they capture the creative funding streams from the state's Department of Labor – allowing the college to offer the training to the public at no charge. The community

college recruits and delivers the training, and the company simply hires whoever it desires from the program. Consequently, the company gains a higher volume of prepared individuals applying to its open positions. In some instances, the new-hire may accelerate through (or skip entirely) the on-boarding process, since the three-week course contains much of the information found in the company's post-hire on-boarding training – providing the company additional cost savings.

An additional benefit comes in retention. In comparing the employees hired using the traditional process to those hired using the pre-apprentice/one-year apprenticeship approach, the population of those hired using the latter were retained by the company at significantly higher rates, two years after being hired/on-boarded. One possible explanation of the differing retention rates may be attributed to being labeled an apprentice. It is theorized here that when an individual enters an organized development program (i.e., an apprenticeship), he or she often puts forth a conscious effort to persist and finish the program. This contrasts with traditionally hired individuals, where there is no apparent obligatory commitment to stay with the company. Individuals remaining with a company for a year or greater are significantly more likely to remain employed at the company. Understanding the company's investment in and intent to further develop apprentices for future opportunities, provides individuals the motivation needed to persist, complete the program, and seek growth/advancement opportunities with their current employer.

This same shipyard has recently registered the ATDM as a Pre-Apprenticeship and plans to pilot test the program delivered by the ATDM as a pre-apprenticeship leading to a fully registered apprenticeship in early 2024. Like the approach currently used with its local community college, the shipyard will recruit a set of diverse candidates who possess high potential but lack the basic skills for employment with the company. Candidates will be referred to the ATDM with a provisional offer of employment, contingent on them successfully completing the ATDM program. Once the trainee graduates, the company will on-board the graduate and register them into its newly formed three-year apprenticeship with its state. Normally, the company would be required to provide approximately 450 hours of related instruction while in the apprenticeship. However, individuals having received 600 hours of training during their pre-apprenticeship with the ATDM will have satisfied the related instruction requirement for an apprenticeship.

Additionally, under normal circumstances, each apprentice would need to serve three years (or 6000 hours) to complete the apprenticeship program's OJT component. Since the ATDM is registered as a Pre-Apprenticeship, the apprentice will now only need to serve 5400 hours of OJT to satisfy program requirements.

Technology Transfer Activities

The project team attended numerous technology transfer activities to make the communities aware of the efforts being taken to produce curriculum that addresses the needs associated with today's shipyard industry. These events also allowed the team to solicit feedback and information from other U.S. Shipyards regarding their current apprenticeship and training programs. Presenting at these events was very beneficial in the success of this project and the interest in using the final product when released. A summary of the events the project presented is listed below.

Technology Transfer

10/17/2022	Benchmarked The Apprentice School at Newport News Ship and Norfolk Naval's academic program. Shared project and potential outcomes. Generated involvement from the Naval Yards perspective. Also visited two tech schools in Delaware.
11/2/2022	Attended SHPE national conference in Charlotte, NC. SHPE serves as the country's largest gathering of Hispanic STEM students and professionals. Attended workshops on DE&I techniques and generally discussed apprenticeship and how shipbuilding could help members achieve success.
1/20/2023	A focal point of the study being coordinating a national multi-day conference scheduled for April 12, 13, and 14, a trip was made to meet the AART rep [Vince Warren] to scope out sub-contracting details with both the AART and a conference venue. Also presented a status update to NNS representative.
2/20/2023	Met and presented the project to the team members at NASSCO. After touring their plant and programs, Scott and Mike Jury worked diligently documenting and describing NASSCO's offerings into a draft presentation to be delivered at the April 12 Roundtable meeting. While NASSCO dropped their Registered Apprenticeship program year ago, they currently have several great developmental programs that the team can benefit from – they just are not "registered." Preliminary presentation looks great.

3/27/2023	This was the NSRP All-Panel meeting where all FY23 Panel Project Leads share their statuses of projects with the Workforce Panel community. During this trip, Scott Christman reported the project was approximately 30% complete. Multiple meetings were also held with other participating shipyards that surfaced a set of focus group questions. While a general overview of the Apprenticeship Study was given, the survey will act as a focal point for the upcoming roundtable event.
4/10/2023	This was the pinnacle of the Grant – the actual Round Table Meeting where each participating Shipyard will present their training programs. The 3-day in-person event was held in Newport News Virginia and tours of NNS occurred. Each shipyard presented an overview of their programs followed by deep discussions as to the intricate details into the nuts & bolts.
5/17/2023	Presented the project and its status. Responding to key findings from the national round table event, this visit included benchmarking what ATDM is doing and gaining perspective on how the shipbuilding community can access and utilize the strategy. The program is training pre-hire individuals in the skills we need, and a formal discussion was held with ATDM's senior leadership.
6/19/2023	Attended the 2023 IACMI Members Meeting – another IBAS funded entity working to train future defense manufacturing technicians. Also toured the Manufacturing Demonstration Facility at Oak Ridge National Laboratory.
8/23/2023	Attended an ATDM Job Fair (an IBAS funded training provider) and working with the AART to build out a pilot of a pre-apprenticeship feeder into U.S. shipyards.
10/11/2023	Presented research status at the 2023 ATDM Annual Summit.

Acknowledgements

Name	Organization
Roger Collins	American Apprenticeship Round Table
Vince Warren	American Apprenticeship Round Table
Mike Mahon	ATDM Program Spectrum Group
Troy Simpson	ATDM Program Spectrum Group
Matt Delaney	Covalent Works
Shanice Forgette	Fincantieri Marinette Marine
Jessie Hoppe	Fincantieri Marinette Marine
Amanda Streicher	Fincantieri Marinette Marine
Scott Christman	General Dynamics - Bath Iron Works
William Barber	General Dynamics - Electric Boat
Jessica Key	General Dynamics - Electric Boat
Nancy Martin	General Dynamics - Electric Boat
Mike Jury	General Dynamics - NASSCO
Victoria Godbold	Huntington Ingalls Industries - Ingalls Shipyard
Regina McLean	Huntington Ingalls Industries - Newport News Shipbuilding
Lucinda Curry	Institute for Advanced Composites Manufacturing Information
Joannie Harmon	Institute for Advanced Composites Manufacturing Information
Tony Carter	Naval Shipyard Apprentice Program: Norfolk
Myron Evans	Naval Shipyard Apprentice Program: Norfolk
Colby Tynes	Naval Shipyard Apprentice Program: Norfolk
Ronald Viands	Naval Shipyards
Montez King	NIMS Executive Director
Mark Allen	Oberg Industries
Greg Chambers	Oberg Industries
Jim Van Kouwenburg	OptiMax
Mike Giantomaso	Philly Shipyard
Megan Heileman	Philly Shipyard
Kelly Whitaker	Philly Shipyard
Carol Howerton	Robert C. Byrd Institute
Emily Tharp	US Coast Guard Yards

Appendices

Appendix A: Project Statement of Work (SOW)

Appendix B: Sample Schedule of Work used with State of National DOL

Appendix C: Exploratory Survey: Individual Company Apprenticeship Program

Appendix D: Survey Responses: Individual Company Apprenticeship Programs

Appendix E: Bath Iron Works Company Report/Presentation

Appendix F: Newport News Shipbuilding Company Report/Presentation

Appendix G: Electric Boat Company Report/Presentation

Appendix H: NASSCO Company Report/Presentation

Appendix I: Ingalls Shipbuilding Company Report/Presentation

Appendix J: Philly Shipyard Company Report/Presentation

Appendix K: Accelerated Training for Defense Manufacturing Presentation

Appendix A: Project Statement of Work (SOW)

STATEMENT OF WORK – SUBMITTED BY GENERAL DYNAMICS BATH IRON WORKS

PROJECT TITLE: SHIPBUILDING APPRENTICESHIP: A QUALITATIVE ANALYSIS

PTR

TBD
Selection to be made by Panel Chair per Panel Project Guide

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PROJECT PARTICIPANTS

NASSCO
Fincantier Marinette Marine
General Dynamics Electric Boat
Newport News Shipbuilding
Ingalls Shipbuilding
American Apprenticeship Round Table (AART)

SCOPE

Concept Description:

To aid shipyards and other NSRP organizations sponsoring apprenticeship programs, this project will investigate and share current practices relating to shipbuilding apprenticeship programs. Focal points to the project will include coordinating and funding a national multi-day conference. Funding will be provided for each participating shipyard for their time and travel as they extract, study, synthesize and

share best practices; issues needing further study; and problems needing future resources. The project will also collaborate heavily with the American Apprenticeship Round Table (www.aart-us.org). Finally, it will share the findings and recommendations with the shipbuilding industry and stakeholders.

Goals and Objectives:

6. Learn and share current practices related to shipbuilding apprenticeship and industry workforce development programs.
7. Extract, study, synthesize and share best practices; issues needing further study; and problems needing future resources.
8. Develop shipbuilding industry policy and practice recommendations that can yield better results.
9. Identify gaps in current and best practices pointing to additional research.
10. Share the findings and recommendations with the shipbuilding industry and stakeholders.

TASKS

Task 1: Design Survey of Current Practices in Shipbuilding Apprenticeship

- Design survey format and content; select best delivery method(s)
- Develop list of contacts for information gathering

Task 2: Data Gathering

- Conduct surveys and dialogues
- Plan roundtable conference

Task 3: Conduct Roundtable Conference and Follow-Up

- Conduct conference
- Share results of data gathering to date
- Conduct follow-up surveys and local meetings as necessary

Task 4: Compile Results

- Compile and evaluate results of surveys, dialogs and roundtable conference

Task 5: Provide a Final Report

DELIVERABLES (WITH DUE DATES)

- Report on Survey Development and Roundtable Conference (08/31/2022)
- Final Written Report (02/15/2023)

- Status Reports – To be submitted quarterly (see chart below)

Title	Description	Team Member(s)	Receiver	Due Date
Design Survey	Design format and content; Select delivery method; Identify contact list	BIW AART	BIW	10/3/2022
Quarterly Report - at 3 Months	Create Report of Progress	BIW	ATI	12/15/2022
Data Gather	Conduct survey and dialog; Code and categorize voice from participating shipyards; plan and organize for roundtable discussion	BIW AART	BIW	12/2/2022
Quarterly Report - at 6 Months	Create Report of Progress	BIW	ATI	3/15/2023
Conduct Roundtable Conference	Conduct conference; Share results of data gathering; Conduct follow-up surveys and local meetings as necessary	BIW AART All Shipyards	BIW	4/7/2023
Quarterly Report - at 9 Months	Generate a Report of Findings & Recommendations	BIW	ATI	5/15/2023
Compile Results	Compile and evaluate results of surveys, dialogs and roundtable conference	BIW AART	BIW	6/30/2023
Final Report - at 11 Months	Generate a Report of Findings & Recommendations	BIW	ATI	9/15/2023

TECNOLOGY TRANSFER / IMPLEMENTATION APPROACH

To the greatest extent possible, the project team will make project components accessible to the public, and industry at large, using the following methods.

- Presentations at relevant NSRP technology transfer events
- Project results posted to the NSRP website that can be accessed by authorized recipients
- List implementation approach at participating shipyards (as applicable)
- Provide expected implementation timeline (as applicable)

Appendix B: Sample Schedule of Work used with State of National DOL

_____ APPRENTICESHIP PROGRAM
SCHEDULE OF WORK EXPERIENCE

Apprentices will receive on the job learning/training in the various work areas listed below. The order in which the training is given is to be determined by the flow of work and may not necessarily be in the order listed. The times allotted to these various processes are the estimated time frames in which an average apprentice will learn and become proficient in the skill area. They are intended only as a guide; the apprentice may require more time on one area and less in another. The total term of apprenticeship is indicated below. The columns at the right constitute a record of progress for the apprentice. Each apprentice will be provided with a separate sheet in which to log their hours of experience. When the apprentice has both completed the required hours and attained proficiency in the specific skill area the Supervisor/Mentor will initial the far-right column. Items for which previous credit have been given upon registration into the program should also be initialed. This sheet should be provided to the program office along with documentation of successful completion of related technical instruction when a request for completion of apprenticeship training program is submitted.

OCCUPATION: Basic Manufacturing Technician

SOC: **17-3029.09** **NAICS Code:** **336611**
TERM: **2000 hours** **RTI Hours:** **144 hours**

SKILLS TO BE LEARNED ON THE JOB	Hours Required	Hours Attained	Proficient As of Date	Supervisor Signature
Set up and verify the functionality of safety equipment				
Adhere to all applicable regulations, policies, and procedures for health, safety, and environmental compliance				
Calibrate or adjust equipment to ensure quality production, using tools such as calipers, micrometers, height gauges, protractors, or ring gauges				
Monitor and adjust production processes or equipment for quality and productivity				
Troubleshoot problems with equipment, devices, or products				
Test products or subassemblies for functionality or quality				
Select cleaning materials, tools, or equipment				
Set up and operate production equipment in accordance with current good manufacturing practices and standard operating procedures				
Plan and lay out work to meet production and schedule requirements				
Install new manufacturing equipment				
Start up and shut down processing equipment				
Prepare and assemble materials				

Build product subassemblies or final assemblies				
Maintain inventory of job materials				
Clean production equipment or work areas				
TOTALS	**2000**			

RELATED INSTRUCTION

Each trainee will complete Related Instruction coursework as outlined in the Content Structure below. Intermediary Agencies and/or Employers providing related in-house instruction should utilize instructors trained in teaching techniques and adult learning styles.

The Manufacturing Technician Related Instruction can be adapted for class meetings in any number of ways. The instruction averages 144 hours to complete, however it can be adjusted depending on constraints.

Unit	Topic	Content	Hours
1	Safety	General Safety • Safety in the shipbuilding environment • Emphasis on personal responsibility • Hazard identification and management • Chronic vs. acute hazards • Ergonomics • Electrical and chemical hazards • Care of cords and hoses • PPE & appropriate attire, etc. • Personal Lifting Practices • Safety rules for the M-Tech shop	2
2	OSHA	OSHA 10 • PPE • Job Hazard Analysis • Housekeeping	10
3	Tech Math	Basic Processes • Working with Dimensional Math • Fractions • Basic Geometry Practical Applications • Basic Problem Solving with Math Metrics	12
4	Print Reading	Basics of Print Reading • Introduction to Sketches & Drawings • Locating Information • Basic Terminology • Weld Symbols • 2D & 3D Sketches • Assembly Drawings Practical Applications • Types of Material and Products Used in Construction	12
5	Manufacturing Skills Foundational	Hand Tools: • Hand tool safety, care and use Layout: • Accurate marking of lines and arcs, calculating data from print information • Geometric, layout • Large-scale floor layout using chalk-lines etc. Sawing: • Intro to sawing & saw safety • Types of saws	40

		• Cutting principles, saw pitch, set, kerf • Techniques for making accurate cuts. <u>Grinding:</u> • Grinding safety • Angle grinders • Grinding principles, grit, compounds, wheels • Grinding Techniques <u>Drilling:</u> • Drill safety • Types of drills • Drill bits, cutting principles • Techniques for accurate hole making. <u>Air Tools:</u> • Air tool safety • Coupling, uncoupling and care of hoses • Die grinders, cutoff wheels <u>Rigging:</u> • Basic rigging, pinch points • Suspended loads jacking • Bracing push/pull • Mechanical advantage, wedges, etc. • Come-Along jigs & fixtures • Hydraulic Porta-Powers	
6	Manufacturing Skills	<u>Applied Skills</u> • Coping: Layout and fitting of metal parts using layout tools, saws and grinders • Gusset Plate: Manufacture part from a print using layout tools, saws, grinders etc. • Connector Plate: As above, but with a more complex part. • Drill Gauge: Layout, cut and drill a drill point gauge with attention to accuracy finish.	
7	Hot Work	• PPE/ clothes • 60-amp plasma cutting: plate and flat bar • Stick welding with 7018, 1/8" rod, fillet weld, all positions • Cutting plate and flat bars • Flux-core welding	
8	LEAN Manufacturing		
9	Resume - Interview		

WAGE SCHEDULE

A. Pre-Apprenticeship **B.** Apprentice's starting hourly wage **$** **C.** Journey Worker's Hourly Wage **$**

	Period 1	2	3	4	5
D. Term in Hours	**500**	**500**	**500**	**500**	**Complete**
E. % JW Rate	**75%**	**80%**	**85%**	**90%**	**100%**
F. $ Rate per hour					

Appendix C: Exploratory Survey: Individual Company Apprenticeship Program

A. Company Overview

1. Please select the company/organization you represent in responding to the survey:

   ☐ General Dynamics – Bath Iron Works

   ☐ General Dynamics – NASSCO

   ☐ Huntington Ingalls Industries – Newport News Shipbuilding

   ☐ Fincantieri Marinette Marine

   ☐ Huntington Ingalls Industries – Ingalls Shipbuilding

   ☐ Philly Shipyard

   ☐ General Dynamics – Electric Boat

2. Please provide an overview of your company. This is usually the writeup each company proudly displays on its website under "About Us". It is typically a summary detailing your company's history, management structure, mission statement, location, etc.:

B. Programs of Study – Program information is typically displayed on your website. This information includes the trades/craft areas in which you offer apprenticeships, length of programs, trade descriptions, and any general statements you would like the public to know about the apprentice program at your company.

1. How many apprentice programs of study do you offer at your company/institution?

2. Please provide the "traditional" shipbuilding trades (e.g., Welder, Pipefitter) for which you offer apprenticeships (programs of study), including their program durations.

Program of Study	Duration (Hours)		Program of Study	Duration (Hours)

3. In addition to “traditional” trade apprenticeships (e.g., Welder, Pipefitter), do you offer “non-traditional” apprenticeships (e.g., Production Planner, Marine Designer, etc.)? If so, please provide other apprenticeships offered, including program durations.

Program of Study	Duration (Hours)		Program of Study	Duration (Hours)

4. In addition to shipbuilding trade apprenticeships (e.g., Welder, Pipefitter), do you offer apprenticeships other than trades (e.g., Production Planner, Marine Designer, Metrology Technician, etc.)? If so, please provide other programs offered, including program durations.
5. Please provide the average enrollment for your apprentice program for the last five years:

Year	Average Enrollment		Year	Average Enrollment
2023			2020	
2022			2019	
2021				

6. Please provide additional feedback on programs of study not previously provided above:

C. Recruiting and Selection

1. Rate the effectiveness of methods used to recruit/attract individuals to your Apprentice or Training Program

	Not Effective	Somewhat Effective	Effective	Very Effective	N/A
1. Newspapers / Job Oriented Publications	◯	◯	◯	◯	◯
2. Radio / TV Advertising	◯	◯	◯	◯	◯
3. College / Career Fairs	◯	◯	◯	◯	◯
4. H.S. / Vocational School Relationships	◯	◯	◯	◯	◯
5. H.S. Guidance Couns. / Career Coaches	◯	◯	◯	◯	◯
6. Current / Former Employee Referrals	◯	◯	◯	◯	◯
7. Union Halls / Relationships	◯	◯	◯	◯	◯
8. Company Website	◯	◯	◯	◯	◯
9. Company Hosted Job Fairs	◯	◯	◯	◯	◯
10. Public Display (Buses / Billboards, etc.)	◯	◯	◯	◯	◯
11. Workforce Dev Boards / Organizations	◯	◯	◯	◯	◯

Please provide specific details for the effective and very effective methods indicated above (e.g. percentage of your apprentices who came to your program based on the recruiting method; resources required to implement, etc.:

2. Please provide any additional feedback on your recruiting methods and practices not already mentioned above:
3. Please indicate below all the information/methods/processes used to support the vetting/selecting of individuals for your apprentice or workforce development programs:

Information/Method/Process	Yes/No
Interview (single interviewer)	
Interview (more than one interviewer or panel)	
2nd Interview	
High School Transcripts	
Post-Secondary (College/University) Transcripts	
Post-Secondary (Trade-Related/Training) Transcripts	
Certifications	
Pre-Offer/Employment Testing	
Personal/Work References	
Related Work Experience (e.g. summer employment as a plumber's helper)	
Non-Related Work Experience (e.g. summer employment at McDonalds)	
Military Service	
Other:	

4. If applicable, please provide the Pre-Offer/Employment Testing instruments your company/institution is currently using and/or has previously used to vet/select candidates for your apprentice program. Please explain each instrument, as applicable:
5. If you previously used Pre-Offer/Employment Testing instruments, please provide reasons you no longer use these instruments (e.g. did not provide an acceptable return on investment; was not an indicator of individual performance or success in our programs; etc.)
6. Please provide any additional feedback not previously mentioned on the information, methods, processes, and instruments used in the vetting and selection processes for your apprentice programs:
7. Do you hire/start for your programs using a cohort (group) approach? If so, please indicate your typical cohort sizes (# of starts):

Less than 5	
5 to 10	
11 to 15	
16 to 20	
Greater than 20	
N/A	

8. What is the frequency you typically start individuals/cohorts in your apprentice programs?

Weekly	
Monthly	
Quarterly	
Annually	

Other (please specify):

9. Please rate the level of preparedness for individuals entering your apprentice program over the past three years:

   a. Individuals with High School Diploma or General Education Development (GED)

	Not Prepared	Somewhat Prepared	Prepared	Very Prepared	N/A
1. Trade Knowledge, Skills & Abilities • Use of hand/power tools • Trade Math (fractions, rule reading, layout, etc.) • Understanding Workplace Safety • Comprehend and follow oral and written work instructions	○	○	○	○	○
2. Academic Knowledge & Skills: • Reading Comprehension • Math – algebraic functions • Writing – express clear and accurate info in written form	○	○	○	○	○
3. Employability Knowledge & Skills • Decision-Making • Problem Solving • Technology User Basics • Oral Communication • Social Skills	○	○	○	○	○

   b. Individuals who completed one or more postsecondary degrees (AS, BS, etc.)

	Not Prepared	Somewhat Prepared	Prepared	Very Prepared	N/A
2. Trade Knowledge, Skills & Abilities • Use of hand/power tools • Trade Math (fractions, rule reading, layout, etc.) • Understanding Workplace Safety • Comprehend and follow oral and written work instructions	○	○	○	○	○
4. Academic Knowledge & Skills: • Reading Comprehension • Math – algebraic functions • Writing – express clear and accurate info in written form	○	○	○	○	○
5. Employability Knowledge & Skills • Decision-Making • Problem Solving • Technology User Basics • Oral Communication • Social Skills	○	○	○	○	○

c. Individuals who completed one or more postsecondary workforce/trades training certificate programs (ex: certificate program offered through a local community college)

	Not Prepared	Somewhat Prepared	Prepared	Very Prepared	N/A
3. Trade Knowledge, Skills & Abilities • Use of hand/power tools • Trade Math (fractions, rule reading, layout, etc.) • Understanding Workplace Safety • Comprehend and follow oral and written work instructions	○	○	○	○	○
6. Academic Knowledge & Skills: • Reading Comprehension • Math – algebraic functions • Writing – express clear and accurate info in written form	○	○	○	○	○
7. Employability Knowledge & Skills • Decision-Making • Problem Solving • Technology User Basics • Oral Communication • Social Skills	○	○	○	○	○

d. Individuals with previous military service (at least one enlistment)

	Not Prepared	Somewhat Prepared	Prepared	Very Prepared	N/A
4. Trade Knowledge, Skills & Abilities • Use of hand/power tools • Trade Math (fractions, rule reading, layout, etc.) • Understanding Workplace Safety • Comprehend and follow oral and written work instructions	○	○	○	○	○
8. Academic Knowledge & Skills: • Reading Comprehension • Math – algebraic functions • Writing – express clear and accurate info in written form	○	○	○	○	○
9. Employability Knowledge & Skills • Decision-Making • Problem Solving • Technology User Basics • Oral Communication • Social Skills	○	○	○	○	○

10. How much does the post-hire performance and success of individuals in your apprentice program influence your selection/hiring decisions with respect to their background, previous experience, level of preparedness, etc.? Please explain:
11. Do you have a Human Resource team specifically dedicated to performing admission functions for your apprentice program, or do you utilize the same HR team that recruits, interviews, and hires for general/other employment for the company? Please explain:
12. Please provide any information/feedback, not previously mentioned above, pertaining to the recruiting and selection of individuals for your apprentice program:

D. Classroom Instruction - Academic and Trade Related (Theory)

Apprenticeships include classroom-based academic and trade theory instruction to supplement apprentices' practical skills learning and development. This component covers subjects like mathematics, technical drawing, blueprint reading, and other relevant subject matter essential for understanding shipbuilding processes and operations.

1. Please provide the following information for each area of study or course delivered in your academic curriculum.

Areas of Study/Courses	# of Semester Hours (Credits)	Is Class Delivered at Business or Community College?	Is Class Instruction Provided by Business or Community College Instructors/Professors)?
General Education (History, Psychology, etc.)			
Algebra			
Geometry			
Trigonometry			
English (Composition)			
Physics			
Chemistry			
Strength of Materials			
Metallurgy			
Mechanical Drawing			
AutoCAD (other design software)			
Industrial Safety			
Leadership			
Other:			
Other:			

Academic Preparedness

2. Does your academic program include post-hire testing (ex: mathematics, English) prior to apprentices being enrolled in academic classes, to determine apprentices' level of academic preparedness? Please explain below, including subject areas where testing is administered, whether the testing is required or voluntary, etc.:
3. Whether your program does or does not include post-hire testing to determine level of academic preparedness, does your program provide remediation courses (prior to individuals starting required academic classes)? Please explain, including whether remediation is mandatory or optional, consequences for not successfully completing remediation courses, etc.:

Academic Requirements

4. What are the minimum academic requirements to remain in and/or complete your apprentice program (e.g. maintain minimum GPA of 2.0, complete all courses with a "C" or better, etc.)? Please explain:
5. What is the "probation" process for individuals not meeting the minimum academic requirements of your program (e.g. given a semester to improve performance to meet minimum academic requirements; retesting opportunities are provided to allow individuals to improve performance to meet minimum academic requirements; etc.) Please explain:
6. What "extra help" or tutoring resources does your program provide for apprentices enrolled in required academic classes? Please explain:

Trade Related Education Curriculum (TREC) or Trade Theory:

7. Please provide TREC information for each trade apprenticeship you offer:

Traditional Apprenticeships / Programs of Study (e.g., Welder, Pipefitter)	# of Semester Hours (Credits)	Is TREC Delivered at Business and/or Community College?	Is TREC Instruction Provided by Business and/or Community College Instructors

8. Please provide TREC information for each non-trade apprenticeship you offer:

Non-Traditional Apprenticeships / Programs of Study (Production Planner, Marine Designer, etc.)	# of Semester Hours (Credits)	Is TREC Delivered at Business and/or Community College?	Is TREC Instruction Provided by Business and/or Community College Instructors

E. On-the-Job Training (OJT)

Apprentices receive hands-on training and perform production work under the guidance of experienced supervisors and managers. This practical experience allows apprentices to develop knowledge and skills in their chosen trade while becoming familiar with shipbuilding processes and safety protocols. Please provide as much detail as possible for the items below:

1. Does your apprentice program use “Trade Galleries” (i.e. designated non-production space or locations) to train individuals in the fundamentals of their trade? Please provide details below regarding this approach, or other non-production training approaches your company uses to prepare apprentices or trainees for performing production work in their trade:
2. Do your apprentices have OJT rotations on various products, product lines, and shops, or is their OJT limited to one type of product/product line? Please explain:

3. Does the OJT component of your apprentice or training program have dedicated craft/training instructors embedded in the production environment, or do apprentices and trainees work directly for production supervisors? Please explain:
4. Is the craft/trade training component of your program time or competency based with respect to reaching specific milestones or program completion?

   ☐ Time Based

   ☐ Competency Based

   ☐ Both Time and Competency Based

   Please provide additional details related to program completion requirements and methods for determining if requirements have been met:
5. Please provide any additional details pertaining to the OJT component of your apprentice program not previously mentioned above:

F. Mentoring and Guidance

Apprentices often benefit from mentorship programs where experienced professionals provide guidance, support, and industry insights. Mentors help apprentices navigate their learning journey, offering valuable advice and assisting in career development. Please provide as much detail as possible for the items below:

1. Please explain the mentorship resources and opportunities provided to your apprentices. Your feedback may include, for example, formal and informal mentorship opportunities/resources; identified benefits of mentorship (e.g. apprentice feedback from internal surveys regarding mentorship); and peer mentoring programs:
2. Student Services Resources – Postsecondary institutions typically provide students with advisors, career guidance resources, and in- and post-program workshops such as résumé writing. Please explain any Student Services type functions or guidance resources provided to apprentices in your program:
3. Please provide any additional information not previously mentioned pertaining to the mentoring and guidance of apprentices in your program:

G. Evaluation and Certification

Regular evaluations assess apprentices' progress in both practical and theoretical components of their training. Successful completion of an apprenticeship program leads to a recognized qualification or certification, validating apprentices' skills and readiness to work independently in their chosen trade.

1. Please indicate below how often are apprentices formally evaluated with respect to their practical and theoretical training? Note: Formal evaluations are typically defined as documentation that is included in an apprentice's record and can include their performance during non-production and on-the job training; assigned production projects/tasks to demonstrate proficiency, etc.:

Daily			Quarterly	
Weekly			Bi-Annually	
Monthly			Annually	

Please provide additional details concerning the evaluation and assessment of apprentices' practical and theoretical performance and proficiency:

2. Do apprentices completing your program receive any state or nationally recognized qualifications, certifications, credentials, etc.? Please provide specific details:

Appendix D: Survey Responses – Individual Company Apprenticeship Programs

Bath Iron Works – Survey Responses

Company Overview:

General Dynamics, Bath Iron Works (BIW) is a full-service shipyard specializing in the design, building and support of complex surface combatants for the U.S. Navy. BIW's rich history reflects a continuous pattern of innovation, new technology and process improvements. BIW employs more than 6,800 shipbuilders from 16 counties in Maine, offers competitive wages and benefits, provides more than $350 million in payroll each year, procures goods and products from approximately 296 different Maine businesses, indirectly supports thousands of additional jobs in Maine, and has invested $700 million in BIW Facilities since 1996.

Since 1950, the BIW Apprentice School has produced over 1,300 graduates in support of the operational needs of BIW. Every day, our apprentices push new boundaries of achievement and explore new opportunities in a very complex and challenging workplace.

Apprentice Program(s) Overview:

Apprenticeship at BIW offers several layers of programing with multiple on- and off-ramps for the individual – starting pre-hire and continuing throughout the entire career with the company.

BIW currently has sixteen (16) four-year apprenticeship programs and two (2) one-year programs registered with the Maine Department of Labor.

Basic Programs	Advanced Optional Programs	Pre-Hire Pathway
Ship Carpenter	Surveyor	Design
Marine Electrician	Planning	Manufacturing Tech
Shipfitter	Front Line Supervision	
Machinist	Purchasing/Buyer	
Outside Machinist	Marine Design	

Tinsmith Pipefitter Welder Insulator Preservation Technician Stage Builder		
Enrollment = 85 apprentices		Enrollment = 170 apprentices

Four-year program:

Since 1950, the BIW Apprentice School has produced over 1,500 graduates in support of its operational needs. This program combines both academic and on-the-job training that, upon completion, provides an Associate of Science degree from the prestigious college – Maine Maritime Academy. In addition to a college education, one will also receive a Certificate of Apprenticeship from the State of Maine and a diploma signifying graduation from the BIW Apprentice Program. Apprenticeships begin in a trade related occupation through one of any sixteen Basic programs. Besides basic trade related occupations, the school also offers optional advanced programs in surveying, planning, supervision, purchasing, and marine design. These programs are offered on a competitive basis to apprentices who meet established performance standards in required academic and trade-related work. Average enrollment consistently stands at 85 individuals at any given time.

The school's mission is to provide the company with a continuous supply of journeypersons who possess the skills, knowledge and pride of workmanship which have traditionally distinguished the shipbuilding craftsman. OJT and Related Instruction are extensive and come at a significant cost. However, the company proudly funds the program as it is the primary internal effort contributing to the future leadership of the company. Graduates of this program typically zig zag throughout the company with an upward trajectory that surpasses the traditional college graduate. These programs have resulted in increased skills and education level, higher wages, job security and a portable credential for graduate apprentices.

One-Year Program:

This is a one-year mentorship program that BIW registered as an apprenticeship with the state of Maine.

As the industry is experiencing a shortfall in entry-level qualified applicants, BIW partners with several local third-party training providers in hopes that they will better prepare pre-hired individuals for easier entry into our company. Starting in 2019, and under previous NSRP Grants, BIW developed three curriculum guides i.e., Manufacturing Technician Training, Marine Design Training, and Surface Coat & Painting Training. The scope and sequence of each course includes 120 hours of training and includes a capstone project. Multiple US shipyards participated in the development and each guide was scrubbed and cleared for public use. Each guide contains a curriculum foundation with goals/objectives and daily lesson plans including step-by-step suggestions on how to deliver the instruction, allowing the material to be taught by any 3rd party training provider – such as a local community college.

BIW partners with its local community college to offer courses based on its hiring needs. It registered each of the training programs as pre-apprenticeships with the state DOL. Through an MOU, the company interviews and considers hiring all graduates of the 3-week training (classified as a pre-apprenticeship). If hired, the trainee then enters the company and is registered as a 1-year apprentice. The program is fully registered with the Maine Apprenticeship Program at the DOL.

This program is virtually cost-free to the company. The community college partners with its workforce systems and can capture the creative funding streams from the state's Department of Labor – allowing them to offer the training to the public at no cost. They recruit and deliver the training and the company simply hires whoever it desires from the program. In the end, the company gains a higher number of prepared individuals applying to its open positions. In some instances, the new-hire can speed through, or skip entirely, the on-boarding process as the 3-week course contains much of the data found in the company's post-hire on-boarding training – providing the company with cost savings.

An additional benefit comes in retention. In comparing the employees hired traditionally to those hired through the pre-apprentice/1-year apprenticeship, the population of those hired through the pre-apprentice scheme were retained by the company at significantly higher rates 2-years after being hired. One possible explanation of the differing retention rates may be attributed to the "labeling" of being an apprentice. It is theorized here that when an individual enters an organized development program, i.e., an apprenticeship, he or she often puts forth a conscious effort to stay and finish the program. This contrasts with the traditionally hired individual, where there is no apparent obligatory commitment to stay. It being common knowledge that once an individual stays with a company for a year or more, the likelihood of leaving significantly diminishes. Simply carrying the label of an apprentice provides the individual with the motivation needed to get them through the hard spots.

Recruiting and Selection:

BIW understands the importance of recruiting a diverse set of applicants for its workforce and has active engagement with Maine Career Centers, Maine Career Technical Schools, SMCC, Jobs for Maine Graduates and Penobscot Job Corps for all trade positions at BIW. In addition, BIW has a dedicated recruitment team that works directly with veteran organizations and is an active participant in the Maine Hire-A-Vet Campaign. BIW has received awards from the Employer Support for Guard and Reserve, and the US Department of Labor Platinum Medallion.

Besides recruiting through the agencies listed above, BIW posts a requisition (job posting) year-round on its internal career board as well as Indeed and Monster. Leaving the posting "live" year-round and advertising nationally has allowed for a higher quality applicant pool.

To be considered for any apprenticeship, applicants must:

- Be at least 18 years of age at the time of hire
- Have a high school education or equivalent (GED)
- Demonstrate college readiness in reading, writing, and mathematics. College readiness is currently measured through the ACCUPLACER test administered through most community colleges. Information regarding the test is explained below.

- Be able to meet the physical requirements of the job (e.g. able to use hand tools, pneumatic tools and able to wear a respirator)

The 1-year apprenticeship program has a low threshold for competitive entry to employment. However, the 4-year program is highly competitive, and applicants are screened in a multitude of ways. To be considered, all applicants must 1) submit scores from the ACCUPLACER (a placement test that most U.S. community colleges use), 2) submit all high school and college transcripts, and 3) undergo a first- and second-round interview.

On-the-Job Training:

Apprentices are first and foremost employees of the company. Serving in one of the sixteen craft-related occupations, apprentices add value to our product line in everything they do. One factor that makes this program so unique is its mentorship opportunities. While on-the-job, apprentices are assigned to a front-line supervisor (FLS). Each FLS, typically a master craftsperson and an apprentice grad him or herself, supervises the apprentice on the job and acts as a mentor as they work to build the product alongside all other employees. Each FLS was selected among peers to serve in this capacity based on an ability to guide and motivate as a mentor. Although these FLS's look and operate as supervisors on the shop floor, because they also serve the school, they are uniquely allowed to devote the strong focus toward the development of the apprentice. Besides the daily one-on-one guidance and transition assistance to the occupational community, the FLS evaluates and provides official performance feedback to the apprentice through a quarterly craft evaluation. In all, these FLS's provide a valuable element of mentorship that so many new apprentices need to properly transition into a career.

Classroom Instruction:

The academic curriculum meets the rigorous requirements of Maine Maritime Academy. College level classes are generally held onsite during the apprentice's regular paid work hours – "yes, apprentices are paid while taking classes." A normal academic load is about eight hours of classroom instruction per week. Tuition, books, and fees are paid by the company. When students are not in the academic setting (the remaining work week), they receive craft training and serve in essential areas within their trade. Regardless of the trade, all apprentices are

required to complete a STEM-related core academic curriculum consisting of 60 credits of instruction in the subject matter areas of technical mathematics, drafting, physical science; and technical communications. All academic courses are listed in the Maine Maritime Academy Catalog and consist of the following:

Course Number	Course Name	Credits
BIW MS105	Mathematics I	3
BIW MS205	Mathematics II	3
BIW EG120	Mechanical Drawing I	3
BIW EG250	Mechanical Drawing II	3
BIW CS201	Introduction to Computing	2
BIW NA151	Ship Building Process	4
BIW EG106	Confined Space Safety	1
BIW EG280	Basic Electricity	2
BIW PS103	Physics I	3
BIW MA200	Labor History	2
BIW ET206	Mechanics I	3
BIW ET306	Mechanics II	2
BIW ET230	Strength of Materials	3
BIW ET235	Material Properties and Testing I	3
BIW HC110	Business Communications	3
BIW HC113	Oral Communications Skills	3
BIW MA230	Organizational Behavior	3
BIW PS203	Physics II	3
BIW OJT	On the Job Training	12
	Total	61 credits

Mentorship and Guidance:

In addition to the mentorship provided by a craft's FLS (as described above), the BIW Apprentice School (the 4-year apprenticeship) has the look and feel of a traditional college, as it

offers a full range of extracurricular activities. The school has fielded varsity athletics in intercollegiate competitions since 2019. While wrestling is the only varsity sport sanctioned by the NCWA, the School hopes to bring on golf and men's and women's basketball in the near future. Student body input and involvement in planning, implementing, and helping to finance extracurricular activities are provided through the Apprentice Student Association (ASA), which is directed by an elected student council. Through this organization, apprentices organize and participate in intermural sports including competitive action in track & field, cycling, basketball, skiing, golf, softball and volleyball. The ASA also organizes and performs community service activities, including sponsorship of the local Special Olympics and social events. The camaraderie is infectious and provides a very positive workplace/school environment.

Evaluation and Certification:

All apprentices received the same level of work-related evaluation and measured equally regardless of individual type of supervision. While serving their work-related component at the jobsite, each apprentice is evaluated and measured monthly using the Work-Related Evaluation Form (displayed below).

The program combines both academic and on-the-job training that upon completion, provides individuals with coursework leading to an Associate of Science degree (all academics on-the-clock). In addition to an A.S. degree, graduates of the program receive a Certificate of Apprenticeship from the State of Maine and a diploma signifying graduation from the prestigious BIW Apprentice Program.

APPRENTICE EVALUATION FORM

		Evaluation Period:			
Name:		Term:		DEPT:	

Please indicate the type of work performed by the apprentice during the month by selecting from the drop down list for each category

Location:			
Pipe Size(s)	Material Type(s)	Joint Type(s)	Type of Work

Additional Comments (Type of Work):

Please select from the drop down list under each question for the response that best fits the apprentices performance in each category for each half of the month.

Technical Knowledge and Comprehension

1st HALF	1.) At what level would you rate the apprentice on technical knowledge of the trade?	
-0.8	Decisions are sometimes faulty and unsound.	Decisions are sometimes faulty and unsound.
	2.) How well does the apprentice understand job requirements and processes?	
2nd HALF	Demonstrates competency in basic methods, processes and procedures of the t	Demonstrates competency in basic methods, processes and procedures of the tr
-0.8	3.) What level of supervision is needed for the apprentice to accomplish assigned tasks?	
	Requires occasional supervision	Requires occasional supervision

Quantity of Work

1st HALF	1.) At what level would you rate the apprentice on his/her ability to meet production schedules and targets?	
0.0	Meets production schedules and targets.	Meets production schedules and targets.
2nd HALF	2.) Does the apprentice use his/her time so that assigned tasks are completed in a timely manner?	
0.0	Completes a reasonable amount of work in a timely manner	Completes a reasonable amount of work in a timely manner

Quality of Work

1st HALF	1.) What level would you rate the apprentice on workmanship?	
0.8	Workmanship satisfactory.	Workmanship satisfactory.
	2.) At what level would you rate the apprentice for accuracy?	
2nd HALF	Accuracy is usually within allowable tolerances.	Accuracy is within allowable tolerances.
1.7	3.) At what level would you rate the apprentice for mistakes and rework required?	
	Errors and rework kept to a minimum	Errors and rework kept to a minimum

Leadership and Initiative

1st HALF	1.) At what level would you rate the apprentice on his/her willingness to accept/seek responsibility?	
0.8	Takes charge of assignments and resolves problems and discrepancies independ	Takes charge of assignments and resolves problems and discrepancies independe
	2.) When given goals/assignments, does the apprentice perform as expected?	
2nd HALF	Follows through on assignments to satisfactory completion of goals.	Follows through on assignments to satisfactory completion of goals.
0.8	3.) What level of guidance is required to get the apprentice to complete assigned tasks?	
	Performs at an acceptable rate with time will improve	Performs at an acceptable rate with time will improve

Conduct

1st HALF	1.) How would you rate the apprentice on his/her ability to comply with company attendance policy?	
	Rarely late or absent; plans most occurrences.	Rarely late or absent; plans most occurrences.
1.3	2.) Does the apprentice follow all shipyard safety policies and procedures?	
	Follows procedures; wears proper protective equipment; uses correct, appropria	Follows procedures; wears proper protective equipment; uses correct, appropria
2nd HALF	3.) Is the apprentice where he/she is supposed to be and doing what he/she is assigned to do?	
	Works without close supervision; eager to learn / grasp new tasks; pleasant to v	Works without close supervision; eager to learn / grasp new tasks; pleasant to w
1.3	4.) How conscientious is the apprentice with care and handling of the tools and equipment?	
	Rarely has lost or damaged tools/equipment	Rarely has lost or damaged tools/equipment

Additional comments:

Supervisor		Date		GRADE	83
Craft Instructor		Date			

Newport News Shipbuilding – Survey Responses

Company Overview:

Since 1886, the ships built at Newport News Shipbuilding, like the American Shipbuilders who built them, have served our nation in peace and war, in times of adversity and times of abundance. HII's legacy of "Always Good Ships" includes the design, construction, overhaul and repair of hundreds of ships for the U.S. Navy and commercial customers. Today, NNS, a division of HII, is the nation's sole designer, builder and refueler of nuclear-powered aircraft carriers and one of only two shipyards capable of designing and building nuclear-powered submarines, leveraging our unique expertise in nuclear propulsion, naval design, and manufacturing. NNS provides fleet services support for our Navy ships worldwide.

Apprentice Program(s) Overview

The Apprentice School at Newport News Shipbuilding was founded in 1919 and is the preeminent apprenticeship program in the nation. The school offers four-, five-, and eight-year apprenticeships in nineteen shipbuilding disciplines and eight advanced programs of study. The Apprentice School is accredited by the Commission of the Council on Occupational Education and registered with the Virginia Apprenticeship Council and offers apprentices the opportunity to earn college credit, receive competitive pay and benefits, and learn a trade. The school is committed to fostering apprentices' development of craftsmanship, scholarship and leadership. Apprentices complete 1,000 hours of course work in the Trade Related Education Curriculum (TREC) and World Class Shipbuilder Curriculum (WCSC). The curricula complement on-the-job training with a strong foundation in shipbuilding discipline theory and prepare apprentices to further their education.

Programs of Study (Trades) – Four-Year Programs:

Shipfitters	Insulator
Heavy Metal Fabricator	Painter-Coatings Specialist
Welder	Rigger
Electrician (Shipboard)	Pipefitter
Sheet Metal Worker	Outside Machinist (Shipboard)

Inside Machinist	Millwright
Molder	Maintenance Pipefitter
Patternmaker	Heating and A/C Worker
Maintenance Electrician	Non-Destructive Tester

Programs of Study (Advanced/Optional) – Four-, Five-, and Eight-Year Programs:

Advanced Shipyard Operations	Nuclear Test Technician
Cost Estimator	Production Planner
Marine Designer	Supply Chain Specialist
Metrology Technician	Marine Engineer

The Apprentice School also offers two pre-apprenticeship opportunities for high school students to prepare for a future career. The vision is to encourage, empower and recruit the next generation of shipbuilders by improving their job readiness skills to become high performance craftspeople in the shipbuilding trades.

Youth Builders Pre-Apprenticeship Program:
Youth Builders is a high-quality workforce readiness program that is currently open to 11th and 12th graders and is designed to prepare individuals for entry and success in a registered apprenticeship program or a shipbuilding career. Benefits include:

- Improved job readiness
- Resume building experiences
- Waived Apprentice School application fee ($45)
- Enhanced pathway to paid apprenticeship

Who Can Participate in Youth Builders: The Youth Builders program is currently open to 11th and 12th graders at all public high schools throughout Hampton Roads that have an interest in shipbuilding careers. Minimum Requirements for Admission to the Youth Builders Program:

- GPA of 2.0 or higher (with grade of C or better in math and science classes)
- Have taken or are on track to take Algebra I, Geometry, and Algebra II by their junior year of high school

- Submitted high school transcript
- Completed application including meeting the essay requirements

Areas of emphasis for pre-apprenticeship programs include:

- Workplace Learning - Real world trade experiences and activities
- Math Enrichment - Student-centered math enrichment
- Builder “Shop Talk” - In-depth conversations about the day and the life of an apprentice

Apprentice-X Pre-Apprenticeship Program:

The Apprentice X Dual-Enrollment Pre-Apprenticeship Program is for 11th and 12th graders and offered by The Apprentice School, a degree granting and accredited institution with over 100 years of history with Newport News Shipbuilding. This enrichment opportunity allows high school pre-apprentices to participate in The Apprentice School’s World Class Shipbuilder Curriculum (WCSC) via virtual classes during a portion of the school day. The WCSC academic curriculum makes available the latest techniques and information enabling students to be the best in their craft.

Program participants gain a head start to The Apprentice School’s WCSC academic curriculum and concurrently satisfy required high school credit. The program provides a potential pipeline to registered apprenticeship with The Apprentice School or any maritime/career pathway. Individuals who successfully complete Apprentice X will have a competitive edge when applying to The Apprentice School. In addition, The Apprentice School is currently in discussions with Virginia Peninsula Community College and Tidewater Community College regarding the acceptance of several transferrable credits to give pre-apprentices even more options for their post high school education paths.

Program Benefits:

- Dual-enrollment program expanding from Youth Builders
- Debt-free education
- Internal career pathway
- Virtual courses completed while in high school
- Transfer credits

Who Can Participate:

- Rising juniors and seniors with a minimum GPA of 2.5
- Strong achievers in math and science
- Have completed or are on track to complete Algebra 1, Geometry, Algebra 2, or advanced math with a “B” or higher
- Interested in maritime industry and trades
- Participating school districts may have further requirements for eligibility

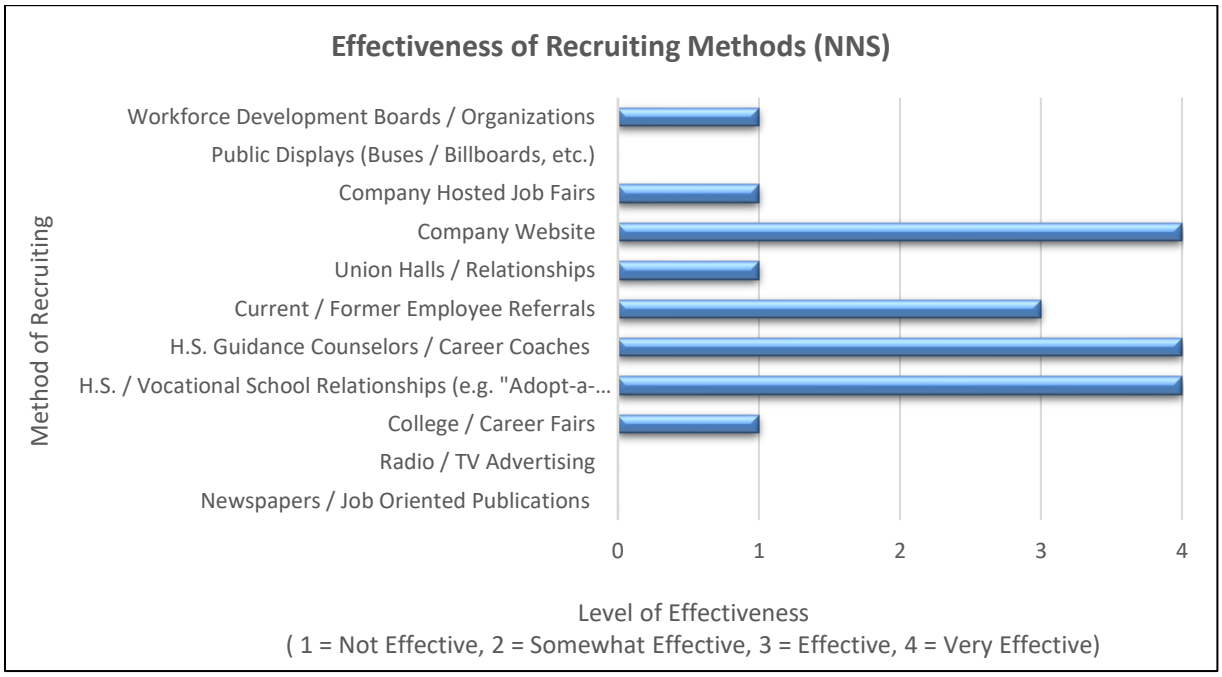
Recruiting and Selection

The recruitment, selection, employment, and training of apprentices are based on bona fide occupational requirements and are done without discrimination because of race, color, religion, national origin, sex, age or disability. The company takes affirmative action to provide equal opportunity in apprenticeship and operates the program as required under Title 29 of the Code of Federal Regulations, Part 30, and the Virginia State Plan.

The Apprentice School at Newport News Shipbuilding uses several methods to recruit individuals for its apprentice program. Very effective methods of recruiting for the program include high school/vocational school relationships (e.g. "Adopt-a-School"); high school guidance counselors and career coaches; and The Apprentice School’s and company’s website. Referrals from current and former employees have been determined to be an effective method of recruiting candidates for The Apprentice School. Somewhat effective methods of recruiting individuals for the program include college and career fairs; union halls and relationships; company hosted job fairs; and workforce development boards and organizations.

Other non-conventional recruiting methods/strategies that have yielded positive results for The Apprentice School include the following:

- In-house/guidance counselor events
- Fostering Opportunities Resulting in Workforce and Research Diversity (FORWARD) targeting high school students
- Special recruiting event targeting females
- Offering additional female collegiate-level sports at The Apprentice School



The Apprentice School uses the following information/methods/processes to support the vetting and selecting of individuals for their apprentice program:

- Interviewer (single interviewer)
- High School Transcripts
- Post-Secondary (College/University) Transcripts
- Post-Secondary (Trade-Related/Training) Transcripts
- Certifications
- Personal/Work References
- Certifications
- Related Work Experience (e.g. summer employment as a plumber's helper)
- Non-Related Work Experience (e.g. summer employment at McDonald's)
- Military Service

The following are the minimum requirements to be considered for an apprenticeship:

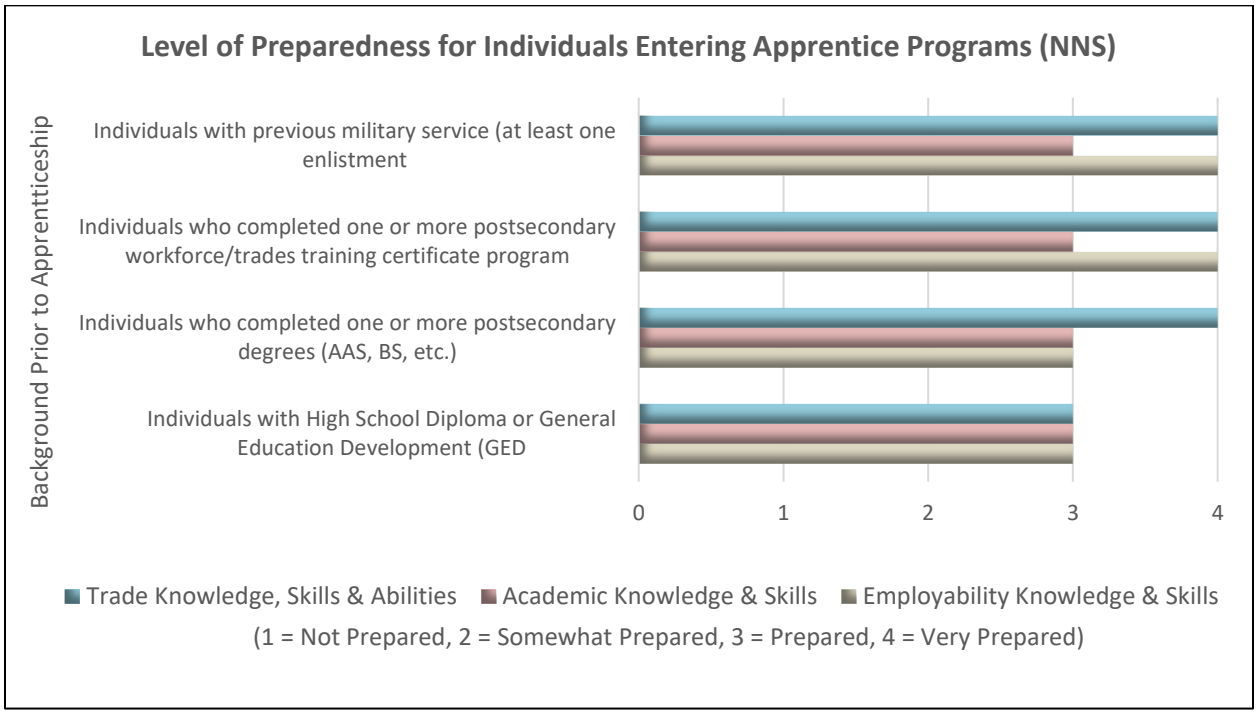
- Be at least 18 years of age (Current high school seniors may apply for early admission before reaching age 18)

- Have a high school education with a passing grade in at least four of the following courses:
    - Algebra I
    - Geometry
    - Algebra II
    - Mechanical/Drawing
    - Vocational/Technical Education or Computer Science
    - Advanced Mathematics
    - Chemistry
    - Physics
    - Principles of Technology
- Be physically able to perform the essential duties of the shipbuilding discipline requested or assigned
- Be able to obtain the proper security clearance
- Due to the nature of the work performed at Newport News Shipbuilding, U.S. citizenship is required
- Applicants will be subject to a U.S. government security investigation and must meet eligibility requirements for access to classified information
- Current employees of Newport News Shipbuilding:
    - Must have good attendance and job performance records
    - May participate in Night School courses, free of charge, in order to attain minimum requirements to be considered
    - Should apply online as internal candidates
- Meeting the specified minimum requirements does not ensure selection

The level of preparedness of individuals entering an apprenticeship varies based on their background prior to entering an apprenticeship. The chart below indicates that:

- Individuals entering their apprenticeship with a high school diploma or GED only were estimated to be prepared in the three areas of trade knowledge, skills, and abilities; academic knowledge and skills; and employability knowledge and skills.

- While individuals who completed one or more postsecondary degrees were rated at the same level of preparedness as high school or GED completers in the areas of academic and employability knowledge and skills, they were considered very prepared in their trade knowledge, skills, and abilities.
- Individuals who completed one or more postsecondary workforce/trades training certificate programs, or had previous military experience, were both deemed very prepared in their trade knowledge, skills and abilities and employability knowledge and skills.



The Apprentice School has its own admissions staff that recruits, interviews and hires individuals for the programs of study offered by the school. The staff is also responsible for the onboarding of new apprentices, which includes ensuring all required human resource documentation is collected/verified and employment forms are completed.

<u>On-the-Job Training:</u>

The Apprentice School uses “Trade Galleries”, or dedicated non-production areas, for training apprentices in the fundamental knowledge and skills required for their trade. Many of the

programs of study couple the gallery training with TREC to connect the theoretical and practical components of an apprenticeship. In some trade galleries, apprentices also perform production work in support of company contracts. Most apprentices entering their apprenticeship are assigned to production work following their initial orientation and training in trade fundamentals.

Depending on their specific trade, apprentices' OJT includes job rotations through various programs and areas throughout the company. As an example, pipefitter apprentices begin their apprenticeship in a trade gallery, which includes completing at least two of the required TREC courses, tack weld training, and practical training in the fundamentals of the trade. From there, apprentices will serve a three-to-four-month rotation in one of the pipe manufacturing shops to apply their acquired knowledge and skills in performing production work. Pipefitter apprentices will then serve six-to nine-month rotations on various programs to include Carrier New Construction, Carrier Overhaul, Virgnia Class Submarines, etc.

While all apprentices are assigned to a craft instructor who is an employee of the company and member of The Apprentice School's faculty, they may or may not work directly for the craft instructor. Apprentices will sometimes be directly assigned to a production foreman while working in one or more of the rotations previously mentioned. The craft instructor, however, is responsible for completing the formal monthly OJT evaluation for the apprentice (i.e. grading the apprentice). The production foreman contributes to the evaluation by providing feedback to the craft instructor concerning the apprentice's performance. In other rotations, apprentices may be assigned directly to a craft instructor, who is also assigned to a particular program (ex: Carrier New Construction), The craft instructor has production responsibilities, as well as training and evaluation responsibilities for apprentices assigned to them.

<u>Classroom Instruction:</u>

The Apprentice School's related academic instruction is delivered at Newport News Shipbuilding by full-time instructors who are employees of the company. All apprentices are required to successfully complete the following academic courses, known as the school's World-Class Shipbuilder Curriculum (WCSC):

QUARTER 1		
Course No.	Course Title	Credits
MATH 111	Mathematics I (General Education)	4.5
COMM 111	Communications I (General Education)	4.5
HIST 111	History (General Education)	4.5
		13.5
QUARTER 2		
Course No.	Course Title	Credits
MATH 112	Mathematics II (General Education)	4.5
DRAFT 111	Drafting (Technical Core)	4.5
SHCN 111	Ship Construction I (Technical Core)	3.5
		12.5
QUARTER 3		
Course No.	Course Title	Credits
SHCN 222	Ship Construction II (Technical Core)	3.5
PHYS 221	Physical Science I (General Education)	4.5
SITE 211	Digital Shipbuilding & Tech (Technical Core)	1.0
PSYC 221	Psychology (General Education)	4.0
		13.0
QUARTER 4		
Course No.	Course Title	Credits
MECH 222	Mechanics (Technical Core)	4.5
PHYS 222	Physical Science II (General Education)	4.5
BUSI 222	Business Operations & Leadership (Technical Core)	4.5
		13.5
	Total WCSC Credits	52.5

The Apprentice School does not conduct post-hire testing to determine apprentices' level of academic preparedness to start WCSC. However, the school does offer a voluntary math remediation course that can be taken in advance of an apprentice starting their WCSC. This course is voluntary and performance in the course does not have any bearing on the apprentice starting WCSC.

Trade-Related Education Curriculum TREC is delivered at the company by full-time craft instructors who are employees of Newport News Shipbuilding and members of The Apprentice School faculty. All apprentices are required to successfully complete the TREC associated with

their trade/program of study. As an example, below is the TREC for the Coatings Specialist apprenticeship. NOTE: Courses X33C 135, 136 and 137 are the OJT component of the Coatings Specialist apprenticeship

Course No.	Course Title	Credits
X33C 111	Paint & Surface Preparation	5.5
X33C 112	Blueprint Reading for Painters	1.0
X33C 135	Surface Preparation	12.0
X33C 136	Coating and Finishing	10.0
X33C 137	Inspection & Instrumentation	10.0

Apprentices taking WCSC and/or TREC courses will be placed on academic probation if an individual class average is less than 69.50 at any time during the final four class sessions of the course, and during the extension week (11th week following a 10-week quarter). Probation status will continue until the apprentice has a final passing average in class or classes for which they were placed on probation. The manager, Academics, or their designee will administer the probation process and status of apprentices.

Academic instructor support hours are normally from 6:00-7:00am, during lunch breaks, and after 3:30pm, which is the end of apprentices' typical work shift. There is typically two instructors available Monday-Thursday 3:30pm-6:00pm to assist apprentices. Apprentices are responsible for contacting instructors concerning tutoring or extra help for hours other than those mentioned above. The company's Night School program also provides an instructional staff member for apprentices to have additional support throughout the week and on weekends.

Mentorship and Guidance:

The Apprentice School ensures interaction between apprentices and faculty and among apprentices. In addition to quality interaction in the classroom environment, academic and craft instructors communicate with apprentices using Moodle, the school's Learning Management System. Moodle provides instructors and apprentices with a platform to exchange information about assignments, course performance, course content, supplemental resources, academic

probation status, and other issues pertaining to apprentices' course participation. The faculty provides timely, quality feedback on a daily and weekly basis to apprentices regarding their knowledge and skill development, conduct, leadership, and overall performance.

Lead craft instructors are credentialed and qualified to advise apprentices concerning all components of their apprenticeship. Leads have responsibility for ensuring programmatic requirements are aligned and being provided in accordance with the school's policies, procedures and guidelines. Along with craft instructors, lead craft instructors serve in an ongoing advisory capacity to apprentices within their areas of responsibility.

The Apprentice School promotes interaction among its apprentices. All apprentices are automatically members of the student association upon starting their program. The mission of the student association to:

- Promote and support student extracurricular activities
- Encourage and develop leadership skills in its members
- Promote and foster an atmosphere of community service and volunteerism

There are several other organizations apprentices may join that provide mentorship, guidance and personal and professional growth opportunities:

- Apprentice Alumni Association – encourages the development of Apprentice School alumni through participation in civic, social, and charitable activities
- Apprentice Jaycees Student Chapter – provides leadership development, business, skills, and personal growth opportunities for apprentices through participation in community service, networking, and social events
- Apprentice School Society of Manufacturing Engineers (SME) – shares knowledge of manufacturing through learning, networking, guided tours, guest speakers, and interaction with parent chapter members
- The Apprentice School Chapter of the Society of Naval Architects and Marine Engineers (SNAME) – advances the disciplines of naval architecture and marine engineering by

sharing information, sponsoring research, and offering educational and career guidance to apprentices

- The Apprentice School Athletic Club – creates social and networking opportunities to sponsor and advance Builder Athletics.

The Apprentice School also has six athletic teams including: baseball, men's basketball, women's basketball, football, golf, and wrestling. In keeping with the excellence of the Apprentice School craft training and academic programs, the goal of the Apprentice School Athletic Program is to:

- Enhance the craft training, academic and leadership development of student-athletes.
- Stimulate a lasting attitude of leadership, discipline, sportsmanship, teamwork, ethical conduct, social responsibility, and integrity
- Promote student-athlete success in the Apprenticeship Program from start to finish and beyond, in an environment that enables continuous learning, professional development, career preparation, the integration of personal and professional commitments, opportunities for advancement, and the attainment of maximum performance.

Evaluation and Certification:

The Apprentice School's programs are both time and competency based. The programs involve a total of 8000 hours each, which includes two main components: academic and trade theory classes (approx. 1000 hours) and craft training (approx. 7000 hours) components. To determine the level of readiness with respect to craft training, apprentices are graded monthly in five areas:

- Technical Knowledge and Comprehension
- Quantity of Work
- Quality of Work
- Leadership and Initiative
- Conduct

During and upon completion of each job rotation, craft instructors document knowledge, skills and abilities apprentices have demonstrated during the rotation. Specifically, instructors use trade skills inventories and task evaluation forms to document whether apprentices assisted others, worked independently, or directed others with respect to the trade skills performed during the job rotation. For each program of study, specific knowledge, skills, and abilities have been identified as required for apprentices to successfully complete their program.

State and federal certification and licensure are not requirements for employment with Newport News Shipbuilding. Apprentices, who are also employees of the company, must meet certain qualifications and certifications that are required to complete an apprenticeship within their respective trades. All certification courses, practical exams, and tests are administered by Newport News Shipbuilding personnel.

The Apprentice School has registered standards of apprenticeship on file with the Virginia Department of Labor and Industry. The Commonwealth of Virginia issued certification of completion of apprenticeship is required prior to conferring all our degrees. The Apprentice School is accredited by the Commission of the Council on Occupational Education. Apprentices completing an apprenticeship at The Apprentice School receive a certificate of completion of apprenticeship from the Commonwealth of Virginia and an Associate of Applied Science Maritime Technology degree in their program of study.

Electric Boat – Survey Responses

Company Overview:

Established in 1899, Electric Boat has established standards of excellence in the design, construction, and lifecycle support of submarines for the U.S. Navy. Primary operations are the shipyard in Groton, CT, the automated hull-fabrication and outfitting facility in Quonset Point, RI, and an engineering building in New London, CT. The current workforce is more than 21,000 employees.

Apprentice Program(s) Overview:

The apprentice program is meant to be a long-term investment in valuable human resources, designed to supply a well-trained work force. The combination of on-the-job training and related instruction offered through the apprenticeship programs has proven a reliable teaching and learning model. The apprentice programs train an active employee in one of the many skilled disciplines in the company in either a shipyard trade or a design discipline. Shipyard Apprenticeship Programs are 3 or 4 years in length while the Design Apprenticeship Program is 4 years. Electric Boat apprenticeship programs are listed below:

- RI (Quonset Point Facility, 3 years): Machining, Electrical, Pipefitting, and Welding Apprenticeships

- CT (Groton Shipyard, 3 years unless otherwise specified): Shipfitter, Welder, Electrical, Sheetmetal, Carpentry, Paint, Inside Machinist (4 years), Outside Machinist, Pipefitter Apprenticeships

- CT (Design, 4 years): Mechanical, Electrical, Arrangements, Piping, and Structural Designer Apprenticeships

Recruiting and Selection

Electric Boat apprenticeship programs are for current employees with at least six months of experience at Electric Boat. Internal communications systems are used to solicited for

applications to the apprenticeship programs, and applicants are vetted through EB and Union leadership and complete an interview. Applicants must have a high school diploma or GED and be in good standing with Electric Boat HR to be considered.

Classroom Instruction:

Three Rivers Community College in Connecticut provides classroom instruction for our Groton Shipyard and Design apprenticeship programs. The Groton Shipyard also completes classroom training via Electric Boat's Workforce Development organization. Community College of Rhode Island provides classroom instruction for our Quonset Point apprenticeship programs. Classes needed for each program are regularly maintained and evaluated.

Mentorship and Guidance:

Apprentices benefit from mentorship and guidance from EB and Union leadership during their OJT rotations.

Evaluation and Certification:

Apprentices are evaluated on their performance in their classes at Three Rivers Community College and/or Community College of Rhode Island and during OJT. Apprentices must receive a C or better in their classes, maintain a work record with no performance issue, and complete all OJT hours and rotations to continue in their respective programs.

NASSCO – Survey Responses:

Company Overview:

General Dynamics NASSCO has been designing and building ships in San Diego's industrial corridor since 1960 and is the only full-service shipyard on the West Coast of the United States. Today, General Dynamics NASSCO has locations on both the West and East Coasts. The company specializes in the design and construction of auxiliary and support ships for the U.S. Navy and oil tankers and dry cargo carriers for commercial markets. It is also a major provider of repair services for the U.S. Navy's global force for good, with capabilities in San Diego, Norfolk, Mayport, and Bremerton.

General Dynamics NASSCO is one of three shipyards in the Marine Systems group of General Dynamics Corporation (NYSE: GD). General Dynamics, headquartered in Falls Church, Virginia, is a market leader in business aviation; land and expeditionary combat systems, armaments, and munitions; shipbuilding and marine systems; and information systems and technologies.

Our main shipyard is located on San Diego Bay, which has a channel depth of 35 feet. To reach NASSCO, ships pass under the Coronado Bridge, which has a vertical clearance of 195 feet. The shipyard encompasses 86 acres of land and 47 acres of water and offers:

- Two inclined building ways, 950-feet long and 108-feet wide
- Eight fully serviced berths ranging from 600' to 1,000'
- 1,000' long x 174' wide graving dock with a lift capacity of 30,000 long tons
- Nine whirley/portal cranes with individual lift capacities of 300 tons and multi-crane lifts of 620 tons
- 820' long x 136' wide NASVEA certified floating drydock with a lift capacity of 35,000 long tons
- Six production workshops and ten assembly areas
- Two blast cells and five paint cells for indoor prep and coating of hull blocks (52'x52'x30′)

Apprentice Program(s) Overview:

NASSCO does not have an apprenticeship program; however, we it does provide comprehensive training programs for several trades:

Shipfitter	Painter/Coatings Specialist
Welder	Rigger
Electrician (Shipboard)	Pipefitter
Sheet Metal Worker	Outside Machinist (Shipboard)

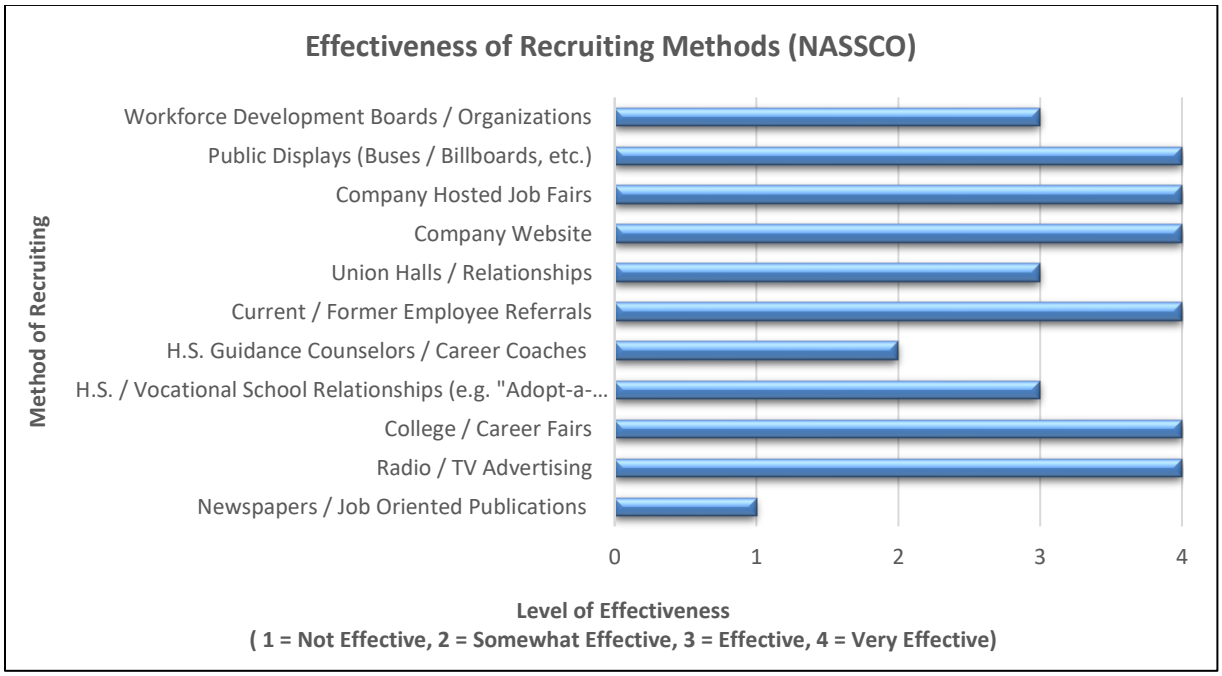
Although NASSCO does not have a formal apprenticeship program like others in the industry, it has an extensive Professional Development Program (PDP) that contributes to the profitability of the company. The PDP is open to both internal and external applicants. The program involves a one-to-two-year rotation throughout various organizations within the company including but not limited to engineering, production, and management. The program provides employees with a holistic view of the different disciplines of the company's shipbuilding, design and repair operations, while establishing strong relations throughout the company and preparing participants for their future career path. The mission of the Program is to provide a corps of talented leaders who possess a working understanding of NASSCO's processes, goals and visions, while harnessing their capabilities to accelerate the success of the company and its employees.

NASSCO offers comprehensive training for several trades, such as shipfitters, welders, electricians, pipe fitters, and outside machinists. The training program is designed to develop those with little to no trade skills to the journeyman level. Initial training is approximately two months. Upon completion, graduates are promoted to trainee positions and assigned to production. From this point, it will take two years to reach the journeyman level. Trainees will receive promotions every six months after completing the required training courses as well as 960 production hours.

Recruiting and Selection:

NASSCO uses several methods to recruit individuals for its training programs. Very effective methods of recruiting include radio and television advertising; college and career fairs; current

and formal employee referrals; the company's website; company hosted job fairs; and public displays such as advertisements on buses and billboards. Established relationships with secondary and post-secondary schools; union halls; and workforce development boards and organizations are effective methods of recruiting for NASSCO. High school guidance counselors and career coaches are only somewhat effective, while advertising in newspapers and job-oriented publications has proven to be an ineffective method of recruiting candidates for training programs at the company. Additional resources for recruiting that have been effective for NASSCO include LinkedIn, ZipRecruiter®, Indeed, Handshake, various machinist websites, state websites, and post-secondary technical schools.



NASSCO utilizes panel and second interviews as methods to vet candidates for selection into their training programs. Additionally, the types of information the company considers when reviewing and selecting candidates includes related work experience (e.g. summer employment as a plumber's helper), military service/background, and personal and work references provided by candidates.

On-the-Job Training:

NASSCO has two training locations within the shipyard: Welding School and Trades Academy. Formal training from start to finish is completed at these training locations in the company. Each location has embedded classrooms and labs that emulate the production environment. There are no structured OJT rotations for trainees. Instead, all formal training is delivered by dedicated craft instructors at the Welding School and Trades Academy. When students graduate, they are transferred to production where they will work directly for production supervisors. Transitioning to the production environment means graduates will initially work closely with an experienced journeyman, who has received mentor training and will serve as the graduate's mentor.

Training is divided into trade development levels that must be completed for individuals to be promoted to a journeyman level in their trade: New Hire, Trainee D, Trainee C, Trainee B, and Trainee A. To successfully advance through each level, trainees must complete six months, 960 production hours, and complete all required courses. Each New Hire receives approximately two months of intensive training, which consists of classroom training and lab practice. Each course and lab activity are formally assessed. Toward the end of new hire training, students are assigned a capstone project, which simulates a production task. After completing New Hire training, employees are promoted to the trainee levels previously mentioned.

At each of the four trainee levels (D, C, B and A), specific courses, which include trade theory and practical training, must be successfully completed to advance through each level. Successful course completion is based on a brief knowledge assessment and inspection of a completed lab project. Each trainee must successfully complete a summative evaluation, which assesses a trainee's knowledge and practical skills at the end of the two-year training program to be promoted to journeyman. This evaluation is important for understanding the retention of concepts covered during the two-year program, and the application and integration of knowledge and skills acquired during training and through production experience.

Classroom Instruction:

NASSCO's training program includes the following related academic classroom instruction: Metallurgy, Mechanical Drawing (manual), AutoCAD, Industrial Safety, and Leadership. There

is no post-hire testing to determine an individual's "academic preparedness" in advance of starting their training program. While the program does not provide formal remediation instruction, the training department works closely with the trainees by conducting follow-up at the workplace to identify and resolve any performance gaps.

NASSCO students attend two months of classroom training prior to entering the production environment. The training is designed to employ a crawl, walk, and run approach in that knowledge and skills are progressively developed throughout the training period. Students receive a mixture of classroom instruction and lab practice. Based on the training design, most of the classroom instruction is delivered early in the training program. Curricula starts with an intensive safety training program in which students receive safety content, apply work area hazard identification skills in a lab, and then complete knowledge testing. Following safety training, students attend the following courses: Math and Measure, Hand and Power Tools, Ship Terminology and Configuration, and Blueprints. Students then complete trade-specific courses. For example, pipefitters will complete courses in pipe construction and quality, piping system cleanliness, pipe parts, flange make-up, spool installation, and torquing flanges. Trainees will continue to attend trade-specific training over the next two years until they advance to a journeyman level.

Mentorship and Guidance:

Experienced journeymen are selected to serve as mentors for trainees, Prior to becoming a mentor, journeymen must complete 12-week mentor training. The mentor training includes classroom training and weekly meetings to provide updates and discuss issues with the mentor program coordinator and peer mentor candidates.

Mentors are embedded in each production crew. As much as practicable, mentors and mentees are assigned to work near one another. Mentoring occurs throughout the day, which depends on the technical complexity of the mentee's assigned tasks and his/her knowledge and familiarity with the task/work being performed. As the mentee increases proficiency, the mentor tapers off on their instruction and coaching to increase the mentee's autonomy and acknowledge their self-sufficiency.

Evaluation and Certification:

Students and trainees are evaluated formatively for each class they attend. Formative assessments consist of the following: knowledge assessment (paper-based testing), skill assessment (e.g., torch cutting, fillet welding), and/or application assessment (e.g., assembly of a piping system). Summative assessments typically occur at two levels. The first summative assessment is conducted at the end of the initial training. For example, shipfitters apply all skills learned during the two-month training to construct a sub-assembly, which is like a small section of the ship built in production. To construct this sub-assembly, the student must apply torch cutting skills, welding skills, blueprint reading, and fitting skills. The second summative assessment is conducted prior to a trainee being promoted to a journeyman level. This assessment includes a test of knowledge and application of their knowledge and skills to complete a practical project. As an example, shipfitters must construct a sub-assembly in a specified time with an acceptable level of quality.

Ingalls Shipbuilding – Survey Responses:

Company Overview:

In 1938, Ingalls Shipbuilding Corporation was founded by Robert Ingersoll Ingalls Sr. (1882–1951), on the East Bank of the Pascagoula River in Mississippi. It started building commercial ships until the 1950s, when Ingalls started bidding on Navy work.

Today, Ingalls Shipbuilding, a division of HII, has pioneered the development and production of technologically advanced, highly capable warships for the surface Navy fleet, U.S. Coast Guard, U.S. Marine Corps, and foreign and commercial customers.

Apprentice Program(s) Overview:

Since 1952, the Apprentice School has produced more than 4,000 graduates in support of Ingalls' operational needs. The program offers 15 specialized craft apprenticeship programs comprises of comprehensive three- to four-year curriculum for students interested in shipbuilding careers. Our graduates have held many types of positions from pipe welders to senior executives. Our faculty and staff deliver instructions for our programs and course offerings that enable apprentices to gain not only the skills, knowledge, and pride of workmanship, but also the educational foundation and personal qualities needed to fully meet the challenges of a shipbuilding career.

Focus on Values: Citizenship, Scholarship, Leadership, Craftsmanship

Programs:

Carpenters
Electricians
Maintenance Electrician
Inside Machinists
Outside Machinists
Insulators
Joiners
Painters
Quality Inspectors
Riggers
Sheetmetal
Shipfitters
Welders
Pipe Welders
Pipefitters

Recruiting and Selection:

Ingalls Shipbuilding currently recruits from the HII website: https://hii.com/careers/
Ingalls Shipbuilding is an equal opportunity employer and offers equal opportunities in employment to all applicants and employees without regard to an individual's protected status, including ethnicity, race, color, religion, sex, age, sexual orientation, national origin, marital status, parental status, ancestry, disability, gender identity, veteran status, genetic information, or any other protected status. Apprentices are selected and hired to the program as vacancies occur. On-the-job training and courses begin immediately after hire. Academic course work begins within the first six months of apprenticeship.

Requirements

1. Be at least 18 years of age
2. Submit High School Transcript or GED Transcript with test scores
3. State issued Driver's License or ID
4. Military Discharge Papers (DD214) if you have ever served active duty in the Armed Services
5. Be physically able to perform the essential duties of the shipbuilding discipline requested or assigned
6. Be able to obtain the proper security clearance and be a United States person.

On-the-Job Training:

The Ingalls Apprentice Program offers on-the-job training for all apprentices, which includes initial theory-based and hands-on training to prepare an apprentice for the job; job rotations to acquire practical skill and knowledge based on the job task; and one-on-one job instruction while on the deckplate.

Classroom Instruction:

Training at the Ingalls Apprentice School is designed to provide an opportunity for shipbuilders to master one of the crafts of shipbuilding. The regular indentured apprentice programs consist of a theory-based and hands-on curriculum, in conjunction with on-the-job training. Following successful completion of the program, the apprentice is promoted to the status of journeyman.

Mississippi Gulf Coast Community College, in partnership with Ingalls Apprentice School, works to meet the training needs of apprentices as outlined by the Bureau of Apprenticeship Training of the U.S. Department of Labor. A person who has completed an approved apprenticeship program may receive credit towards the Associate of Applied Science in Occupational Education (AASOE) degree. Other requirements for the AASOE degree are outlined under "Graduation information" on the MGCCC website.

Mentorship and Guidance:

Ingalls Shipbuilding is invested in the core development journey of each apprentice. All apprentices receive guidance and support through a variety of approaches, including one-on-one meetings, focus groups and classroom-led discussions. There are numerous resources for apprentices to utilize while completing their program.

Evaluation and Certification:

Ingalls Apprentice School provides continuous formal and informal feedback to each apprentice to assess their progress through practical training while on the deckplate. Once an apprentice completes the apprenticeship program, the apprentice is considered a journeyman and receives a Department of Labor certificate of completion.

Fincantieri Marinette Marine – Survey Responses:

Company Overview:

Fincantieri Marinette Marine (FMM) was founded in 1942 along the Menominee River in Marinette, Wisconsin to help meet America's growing naval construction demand. From modest beginnings with a contract to build five wooden barges, FMM has grown into a world-class shipbuilder, having designed and constructed more than 1,500 vessels. Fincantieri Marine Group consists of three Wisconsin shipyards in Marinette, Sturgeon Bay, and Green Bay, and is the U.S. subsidiary of Fincantieri, one of the world's largest shipbuilders. Established in the late 1700s, Fincantieri has been legendary in designing and building military vessels, highly specialized support vessels, ferries, cruise ships, and mega yachts.

FMM boasts some of the best engineering and naval architecture minds in the industry; a skilled, safe, and motivated workforce; and a management team keenly focused on building quality vessels. Our company is internationally recognized for innovative and highly efficient modular, subassembly and assembly-line manufacturing techniques. Sophistication in construction methods has allowed FMM to build some of the most technologically advanced vessels in the world. Its portfolio includes U.S. Navy Littoral Combat Ships, the improved Navy Lighterage System, mine countermeasure vessels and ocean tugs, as well as U.S. Coast Guard icebreakers, buoy tenders and response vessels. Because our record consistently demonstrates delivering products ahead of schedule and within contracted costs, FMM has a long-standing relationship with the United States Navy and United States Coast Guard.

Apprentice Program(s) Overview:

FMM currently offers a welding apprentice program that consists of 18 months, totaling 3,100 hours, of which 447 hours are paid related-instruction and 2,653 hours of on-the-job training. The company is also offering a new Industrial Shipbuilding Apprenticeship program that provides an opportunity to acquire industry-recognized credentials and college academic credits. The apprenticeship includes the following components: Set-up, operate, and control production equipment; improve manufacturing processes and schedules to meet production requirements;

efficiently and safely manage raw materials and consumables; and understand manufacturing as a business system that integrates multiple disciplines, processes, and stakeholders.

Recruiting and Selection:

FMM uses four main methods of recruiting candidates for their apprentice program that they consider to be effective approaches: Newspapers and job-oriented publications; radio and television advertising; the company website; and company hosted job fairs. In addition, FMM uses single interviews, high school transcripts, and pre-offer/employment testing to vet and select individuals for apprenticeship.

REQUIREMENTS

High School Diploma or GED Equivalent.

1. Must be able to use hand tools (i.e., torque wrench, drills, and inspection tools).
2. Ability to read tape measure, pressure gauge, level, and square.
3. Knowledge of basic computer skills and Microsoft Office programs.
4. This facility requires special access, and therefore, all candidates must be U.S. citizens at least 18 years of age.
5. Applicants must complete the TABE test with minimum scores as follows: Reading 6.0 and Math 6.0

FMM uses the Test of Adult Basic Education (TABE) to evaluate apprentice program applicants' skill levels and aptitudes in reading and mathematics. The minimum TABE test score required to be considered for an apprenticeship is 6.0 for each test component (reading and mathematics). Also, the company does not use pre-offer/employment testing for vetting/hiring in other areas of the company, only for the apprentice program.

On-the-Job Training:

FMM does not use "Trade Galleries" (i.e. designated non-production space or locations) for any of their trade-related training. Any formal training takes place at the local Technical College. All apprentices' OJT consists of progressing through all the Stages of Construction (SOC), which

starts on the panel line in the shop. FMM apprentices' OJT does not have dedicated craft/training instructors embedded in the production environment. Instead, they have 20 leadmen, all of whom have successfully completed a "Train the Trainer" program, that assist apprentices with their OJT. Apprentices are formally evaluated quarterly with respect to their OJT.

The craft/trade training component of apprenticeship is both time and competency based at FMM. Craft/Trade training programs consist of 18 months (3,100 hours):

- Manufacturing Skill Standards Council (MSSC) trade-related instruction: 447 hours
    - Introduction to Marine Welding: 160 hours
    - Welding Skills Development Semi Auto: 200 hours
    - Trade-specific Math: 16 hours:
    - Communication for Apprentices: 21 hours
    - OSHA 10: 32 hours
    - Transition to Trainer: 10 hours
- On-the-Job Training: 2,653 hours
    - Adhere to safety procedures
        - Wear appropriate personal protective equipment
        - Maintain a safe work area
        - Minimize potential hazards
        - Follow applicable OSHA or employer safety regulations
        - Adhere to employer's emergency/hazard response procedures
        - Understand and demonstrate hot work permit process
        - Demonstrate ability to perform SLAM operations
        - Adhere to all safety procedures
        - Adhere to fall protection procedures e.g. ladders and scaffolds
        - Signal crane operators to move work parts
    - Set up welding equipment
        - Select and assemble tooling, fixtures, and equipment according to the operational method sheet
        - Install tooling

    - Verify tooling offsets
    - Perform ergonomic set-up, such as proper work heights, weight limits, lifting techniques, appropriate lighting, etc.
    - Interpret visual controls accurately
    - Perform drop test setup
    - Perform parameter setup
    - Adjust set-up as needed
- Operate welding equipment
    - Regulate flow of gas and air to obtain desired flame
    - Preheat work pieces using torch
    - Melt metal parts together
    - Straighten work pieces
    - Bend work pieces
    - Fuse parts together
    - Seal tension points
    - Build up work pieces
    - Dismantle metal assemblies
    - Adjust equipment during operations as needed
    - Shut down equipment
    - Disassemble equipment
    - Clean equipment
- Produce quality product
    - Adhere to job specifications
    - Adhere to production schedule
    - Apply cost of quality principles to jobs and manufacturing processes
    - Apply quality training to job duties and work processes
    - Verify product quality
    - Document work and results

- Interpret production specifications
    - Identify employer production documents
    - Identify production requirements using employer production documents
- Inspect work
    - Examine work piece for defects
    - Measure work piece
    - Ensure conformance with specifications
- Demonstrate knowledge of routine equipment maintenance
    - Inspect equipment
    - Demonstrate mechanical problem-solving abilities
    - Apply preventative maintenance practices effectively
    - Communicate malfunctions to maintenance personnel
- Demonstrate knowledge of inventory and material processes
    - Demonstrate awareness of employer's process for materials management
    - Demonstrate awareness of employer's process flow
- Demonstrate knowledge of trends and the current state of the business
    - Apply basic business terms to manufacturing related work processes
    - Explain and identify competition and potential opportunities
    - Relate the occupation and its responsibilities to keeping jobs in Wisconsin
- Demonstrate continuous improvement
    - Demonstrate knowledge of business motives and strategies for continuous improvement
    - Participate in continuous improvement.

Classroom Instruction:

The FMM apprentice program does not include academic classes. Formal trade-related training is delivered at the local technical college, which would include the MSSC trade-related instruction previously mentioned.

Mentorship and Guidance:

While the FMM apprentice program does not include a formal mentorship component, it does include 20 lead persons, as previously mentioned, whose job it is to both execute production work while also assisting apprentices with their OJT. Included in that relationship would inherently be the sharing of trade experiences, career path discussions, and personal life challenges and experiences.

Evaluation and Certification:

FMM apprentices receive formal and informal feedback and evaluations quarterly and on an ongoing basis, respectively regarding their progress through the apprentice program. However, individuals completing the program do not receive any state or nationally recognized qualifications, certifications, credentials

Philly Shipyard – Survey Responses:

Company Description:

Philly Shipyard is a leading U.S. shipbuilder that is presently pursuing a mix of commercial and government work. It possesses a state-of-the-art shipbuilding facility and has earned a reputation as a preferred provider of ocean-going merchant vessels with a track record of delivering quality ships, having delivered around 50% of all large ocean-going U.S. Jones Act commercial ships since 2000.

Apprentice Program(s):

In 2004, Philly Shipyard, Inc. (PSI) established an apprenticeship program to develop the next generation of shipyard skilled workers and leaders. This 39-month time-based competency program takes candidates with little or no experience and trains them to be multi-skilled employees that can perform successfully in a competitive market and participate in the future success of Philly Shipyard.

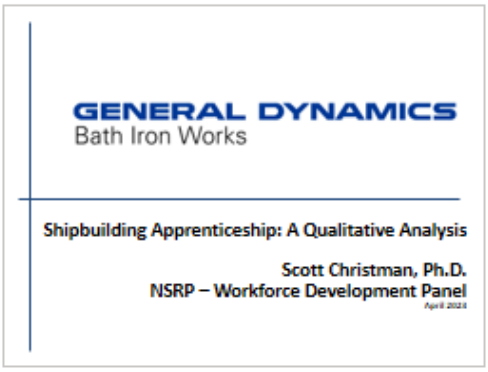
The program consists of classroom training plus time performing the duties of their trade, for example through scheduled job rotations. Classroom training includes both lessons in a classroom setting and an independent learning environment. The program is accredited by the State of Pennsylvania and 100% of the cost of related instruction is paid for by PSI.

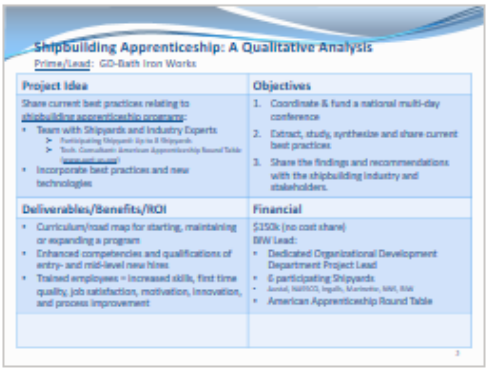
Recruiting and Selection Process:

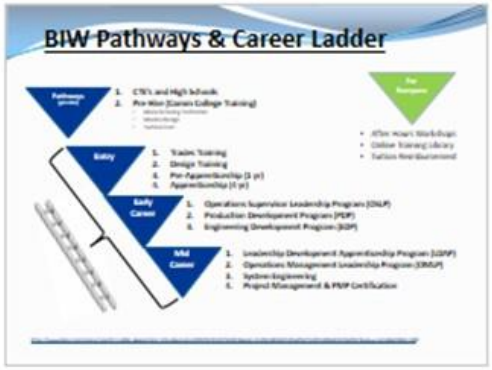
2023 Recruitment Windows - Our application window opens four times per year, so please check back in soon or reach out to our Apprentice Recruiter. As an apprentice, you're a full-time employee from day one, getting paid to learn trade skills and earning college credits without incurring any student debt. For the first 12 weeks, the class will work on-site in the Production areas for immediate immersion into the shipyard's work environment and activities. At the end of 12 weeks, apprentices will report to the Training Academy to begin classroom training and hands-on lessons to obtain their certifications.

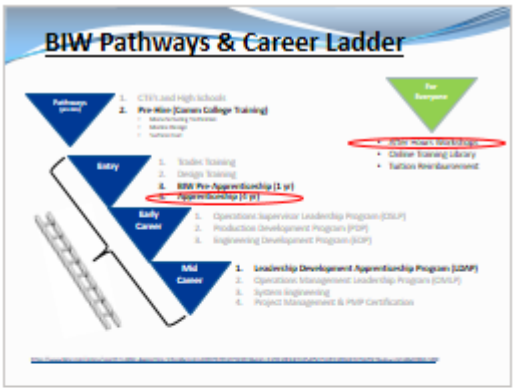
Upon completion at the Training Academy, apprentices re-join production to begin work on ship construction. All apprentices are required to attend and complete a mix of classroom and online training throughout the duration of the program.

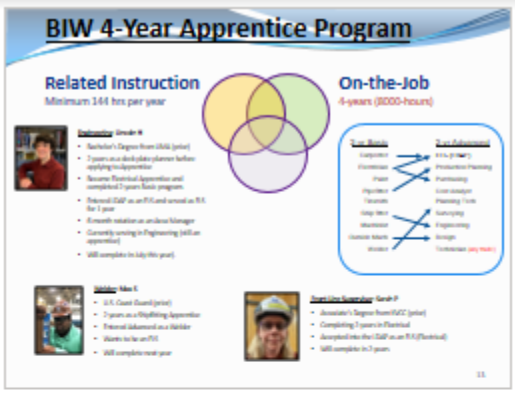
Appendix E: Bath Iron Works Company Report/Presentation

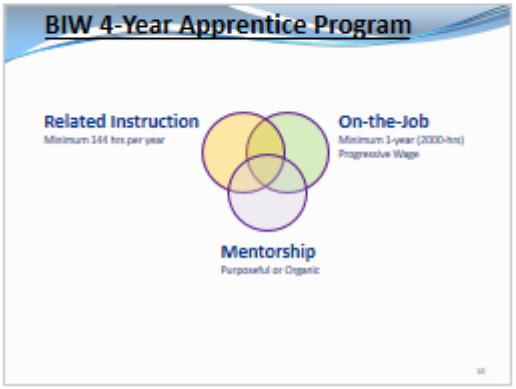


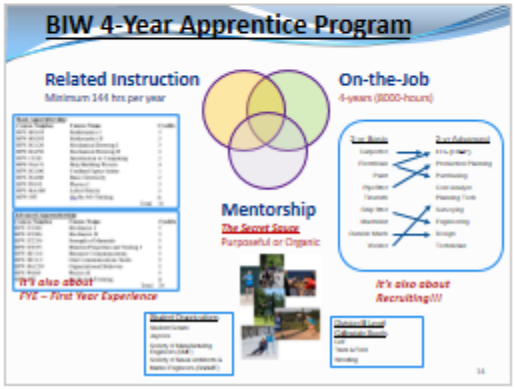


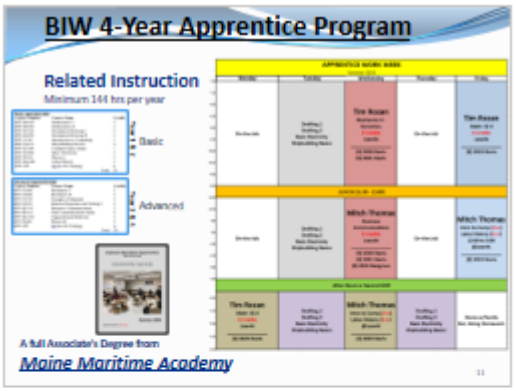


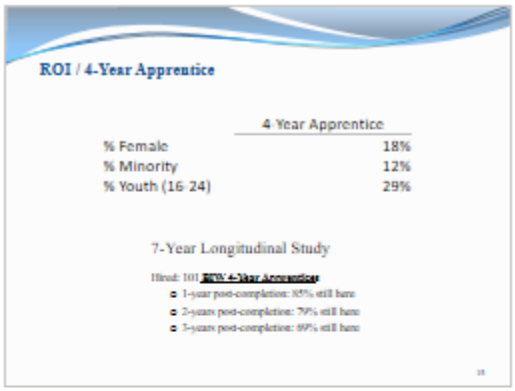

BIW Pathways & Career Ladder
Pathways (pre-hire)
1. CTE/Local High Schools
2. Pre-Hire (Career College Training)
Entry
1. Trades Training
2. Design Training
3. BIW Pre-Apprenticeship (1 yr)
Apprenticeship (4 yr)
Early Career
1. Operations Supervisor Leadership Program (OSLP)
2. Production Development Program (PDP)
3. Engineering Development Program (EDP)
Mid Career
1. Leadership Development Apprenticeship Program (LDAP)
2. Operations Management Leadership Program (OMLP)
3. Systems Engineering
4. Project Management & PMP Certification
For Everyone
Online Training Library
Tuition Reimbursement

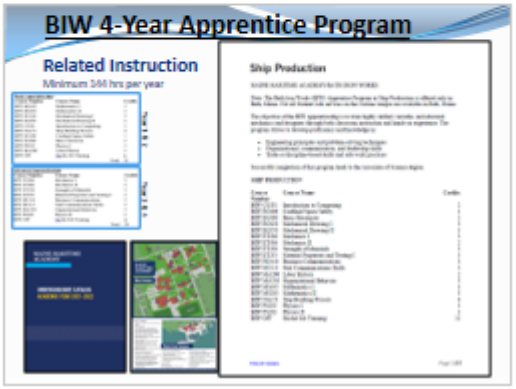

BIW 4-Year Apprentice Program
Related Instruction
Minimum 144 hrs per year
On-the-Job
4-years (8000-hours)


BIW 4-Year Apprentice Program
Related Instruction
Minimum 144 hrs per year
On-the-Job
Minimum 1-year (2000-hrs)
Progressive Wage
Mentorship
Purposeful or Organic


BIW 4-Year Apprentice Program
Related Instruction
Minimum 144 hrs per year
On-the-Job
4-years (8000-hours)
Mentorship
The Secret Sauce
Purposeful or Organic
It's also about
FYE – First Year Experience
It's also about
Recruiting!!!


BIW 4-Year Apprentice Program
Related Instruction
Minimum 144 hrs per year
Basic
Advanced
A full Associate's Degree from
Maine Maritime Academy


ROI / 4-Year Apprentice
4 Year Apprentice
% Female 18%
% Minority 12%
% Youth (16-24) 29%
7-Year Longitudinal Study
1-year post-completion: 85% still here
2-years post-completion: 79% still here
3-years post-completion: 69% still here


BIW 4-Year Apprentice Program
Related Instruction
Minimum 144 hrs per year
Ship Production


Apprenticeship Case Study / 4-Year Apprentice
Program Purpose
Apprentice-able occupations
Evaluating CUT programs
Considering Related Instruction
Probationary period (29 CFR part 29)
Recruiting & hiring
Progressive Wage Scale
Program standards
VA Benefits
MOA's
Joint Committees (JAC or ASC)

4-Year Apprentice
Program purpose, expectation and outcomes

Mission

1. **Recruit**, develop and **meaningfully place** men and women for careers in shipbuilding.
2. Provide a continuous supply of journey-workers who possess the skills, knowledge and pride which have traditionally distinguished the shipbuilder artesian.
3. Develop core leadership principles in all future leaders along with the character and technical competence that is required to fully meet the challenges of a shipbuilding career.

17

4-Year Apprentice
Specific occupations & Evaluating OJT progress

21

4-Year Apprentice
Program purpose, expectation and outcomes

4-Year Apprentice
Considering Related Instruction & Probationary period (2 CFR §200.32)

Probation Period
Same as Company = 500 hours

32

4-Year Apprentice
Is "Registered Apprenticeship" necessary?

Mid- to Large Companies – Your on-boarding program fits the description…

Q – should you register it?

"If funding is involved" - YES

A quick word about "who" we admit
(and a Return on Investment)

Dylan, James H.
U.S. Army, B.S. and M.S. Yale
Currently a Shipfitter Apprentice
Wants to be a Vice President in 10-years

4-Year Apprentice
Recruiting, Applying & Hiring

Interview in-line with a Professional Position

Application Process

1. On-Boarding Process: Hired in w/general employment (4-8 week New Employee Orientation and Training)
3. Apprenticeship Agreement – Signed at MIG

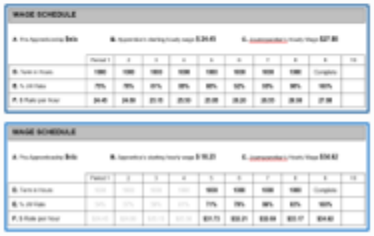
4-Year Apprentice
Specific occupations & Evaluating OJT progress

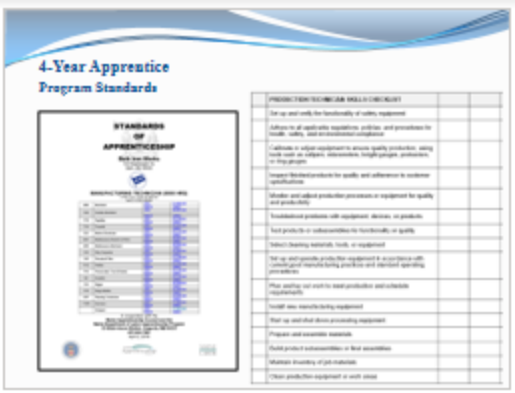
All Occupations are Apprentice-able

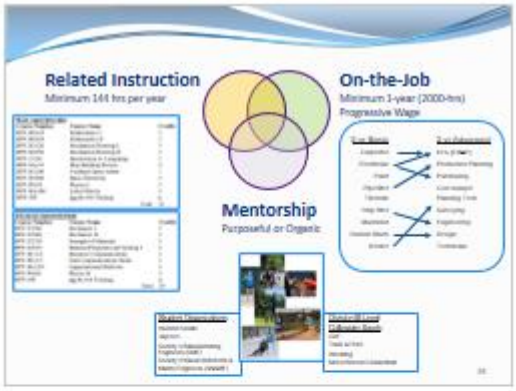
Quarterly Shop Grade: Academic Credit: **52-132 (12 credits)**

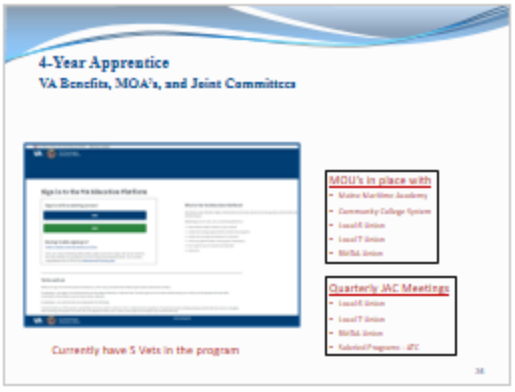
1. Technical Knowledge
2. Quantity of Work
3. Quality of Work
4. Leadership & Initiative
5. Conduct

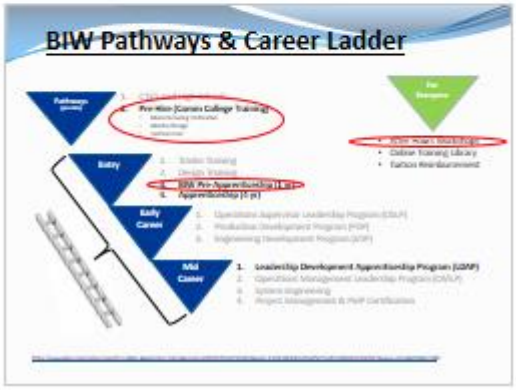
4-Year Apprentice
Progressive Wage

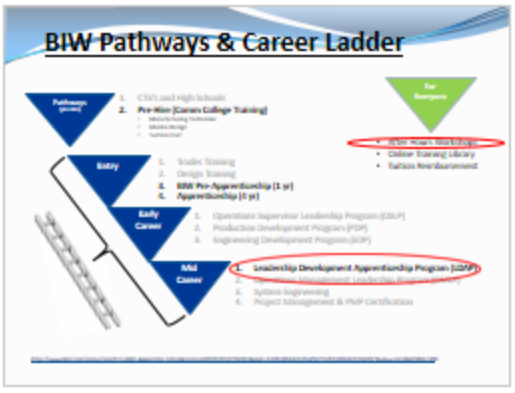


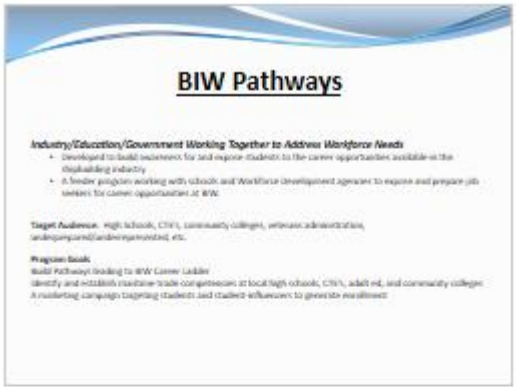

4-Year Apprentice
Program Standards

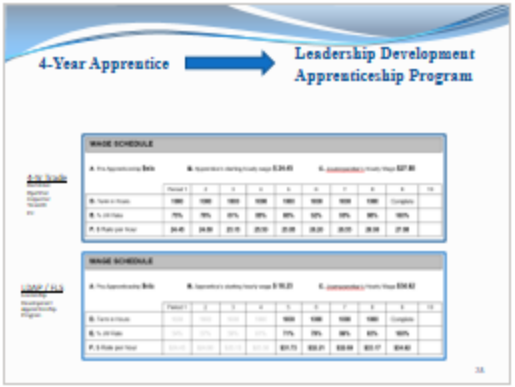

Related Instruction
Minimum 144 hrs per year
On-the-Job
Minimum 1-year (2000-hrs)
Progressive Wage
Mentorship
Purposeful or Organic


4-Year Apprentice
VA Benefits, MOA's, and Joint Committees
MOU's in place with
Quarterly JAC Meetings
Currently have 5 Vets in the program


BIW Pathways & Career Ladder


BIW Pathways & Career Ladder

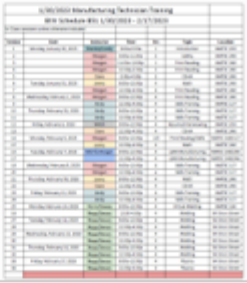

BIW Pathways


4-Year Apprentice
Leadership Development Apprenticeship Program


BIW Pathways
WELDING ACADEMY
MANUFACTURING TECHNICIAN TRAINING
MARINE DESIGN TRAINING

The SMCC Pre-Hire Training

A pre-hire 3-week training class that SMCC conducts to the public

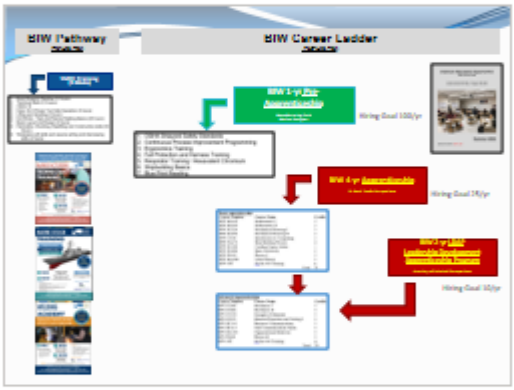


BIW Pathways & Career Ladder

Career Ladder

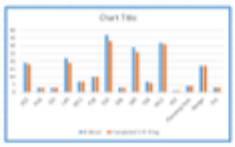
BIW (1-Yr) Pre-Apprenticeship

A 1-year mentorship program that BIW chooses to call a Pre-Apprenticeship. It's a program where anyone hired from the community college's 3-week Training, becomes registered as pre-apprentices with the DOL, then mentored as an apprentice throughout entire first year of employment.



The BIW Pre-Apprentice Program

- Like 1st year: 93% of them were still here
- Like 2nd Year: 87% of them were still here
- Like 3rd Year: 82% of them were still here



Shipbuilding Apprenticeship: A Qualitative Analysis

Prime/Lead: GD-Bath Iron Works

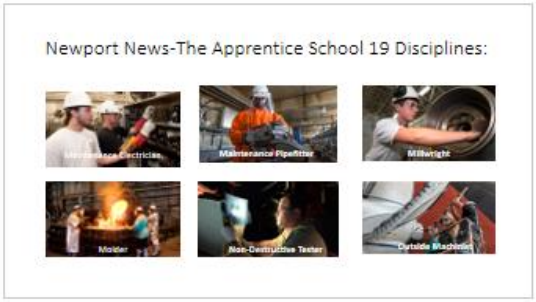
Questions?

Mentorship: The Secret Sauce

1. One-Year Program
2. 3rd Party Sponsor (not us)
3. No added costs
4. Everything is pre-hire and/or off-hours
5. Significantly higher retention rates
6. Enhanced Recruiting capability
7. Great feeder program for other programs

Results: Significantly higher retention rates

Appendix F: Newport News Shipbuilding Company Report/Presentation



Newport News-The Apprentice School 19 Disciplines:

Newport News-The Apprentice School 19 Disciplines

Advanced Disciplines

Advanced Disciplines

Facts:

- Over 11,000 graduates
- Alumni (3256) make up 17% of NNS workforce
- Alumni make up:
  - 38% of Production Foremen
  - 58% of General Foremen
  - 44% of the total Production Management team

SCHEV Approval Announcement

- I am pleased to announce, The Apprentice School completed its first State Council of Higher Education for Virginia (SCHEV) audit with no findings of non compliance and no items of concern to report. SCHEV awarded The Apprentice School full certification to operate as an institution of higher education and to award Associate of Applied Science Degrees in July 2020.

Focused Leadership Development

IMPACT & RETENTION

- Leadership Academy of our company
- Apprentice graduates make up 13.5% of NNS workforce
- 75% still employed with company 10 years after graduation
- Each apprentice will graduate with an Associate of Applied Science Degree in Maritime Technology
- 46% of the Production Management Team are Apprentice graduates

What's New?
The Pre-Apprenticeship Program

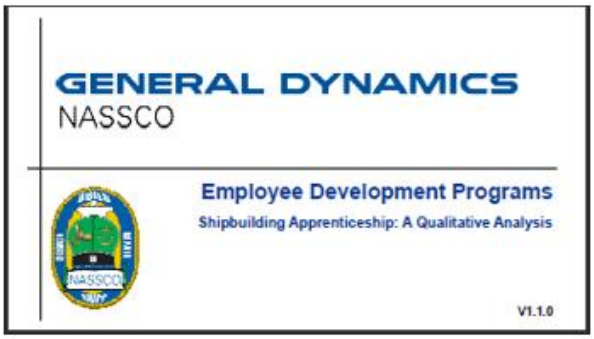
Apprentice Accelerated
- (Apprentice X)
- World Class Curriculum Delivered in the classroom during class hours
- Workplace learning
- Transfer Credit
  - To A-School and Local community colleges
  - Credit toward graduation requirements

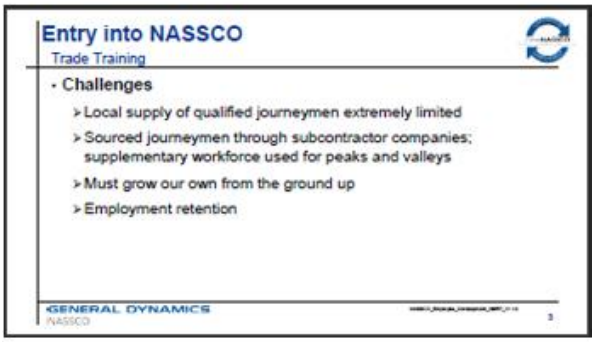
Youth Builders
- High school juniors and seniors
- Workplace exposure
- Builder Shop Talk
- Math Enrichment
- Math 111

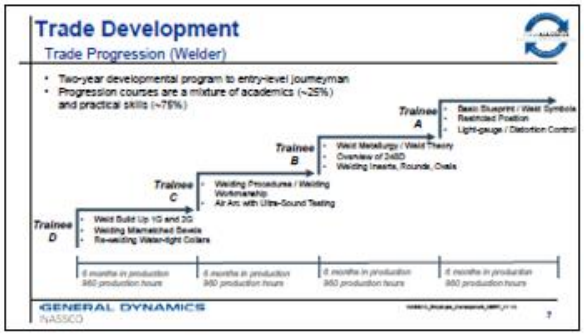
- No commitment
- Admission
- Fee Waiver

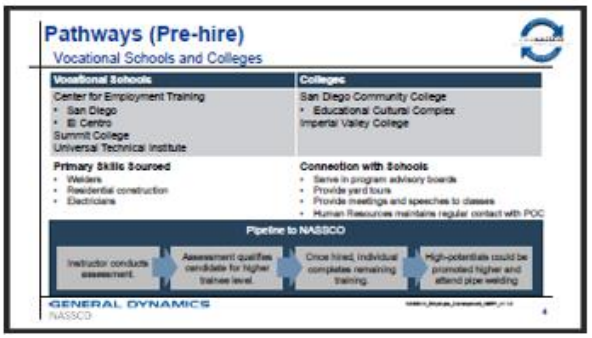
The Newport News Shipbuilding Apprentice School

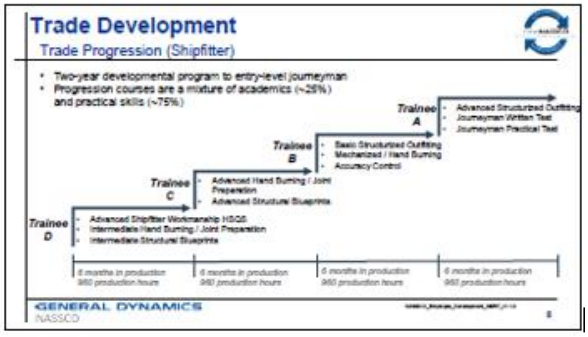
Appendix G: NASSCO Company Report/Presentation











Trade Development

Accelerated Advancement

- Some trainees were able to exceed expectations.
- Created a system to advance high-potential employees earlier than the required six months
- Trainee must be endorsed by his/her supervisor and superintendent (trade manager) and meet the following requirements:
  - No performance or attendance warnings
  - May not exceed a certain number of attendance points
  - High biweekly performance ratings

GENERAL DYNAMICS NASSCO

Journeyman Development

Advanced Abilities: Assessments

Classes are not enough; one must demonstrate proficiency.

Two areas in which employees could demonstrate proficiency:

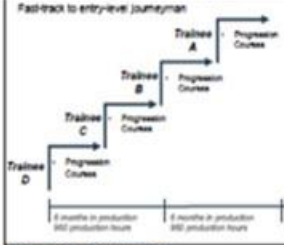
Laboratory	Production
	

GENERAL DYNAMICS NASSCO

Trade Development

Accelerated Advancement Program

Fast-track to entry-level journeyman



GENERAL DYNAMICS NASSCO

Professional Development

Leadership Development

Professional Development Program	New Leader Onboarding	Emerging Leader Program	Ops Supervisor Development Program
• External candidates – recent college graduates • Internal candidates • Approximately 16 months of rotations throughout the company. • Most promote to entry-level manager positions.	• Intended for new supervisors. • Covers compliance requirements and basic leadership skills.	• Intended for experienced leaders and supervisors.	• Operations Principles and Practices • Safe Supervisor Training • Fundamentals of Supervision • Improving the Business • Area and Trade Specific technical skills

GENERAL DYNAMICS NASSCO

Journeyman Development

Entry-Level to Advanced Abilities

Ability is Based on Four Levels		
Two is Average	**Three is Advanced**	**Four is Cross-Trade**
Employee possesses all minimum journeyman requirements.	Employee acquired additional training, certifications, and skills that are beyond base journeyman requirements.	Welder has the capability to perform fitting at a journeyman shipfitter level.
~85% of population	~10% of population	~5% of population

Some employees promote to an entirely different position:

- Welder to pipe welder or code welder
- Electrician to electrical tech

GENERAL DYNAMICS NASSCO

Professional Development

Leadership Development

Professional Development Program
- Dept./Ship Manager
- Area Manager
- Engineer
- Supply Chain
- Planning

Operations Development
- Superintendent
- SOC Manager
- Asst. Manager
- General Supervisor
- Production Supervisor

Production Associate — **Production Supervisor**

External candidates (recent college graduates) | Primarily internal (nearly all are promoted from within)

Internal candidates (experience/education) | Promote from laborer to working foreman

GENERAL DYNAMICS NASSCO

Journeyman Development

Entry-Level to Advanced Abilities

Advanced Abilities (General Process Flow)

Determine which training to attend (based on list) → Attend training after-hours → Demonstrate ability to perform proficiently → Completion entered into LMS. Continue to accrue points.

Welder	Pipefitter	Electrician
• VT Inspector • FCAW Advanced Ceramic • SMAW Code (2 sides) • Buggo Mechanized Welder • Sub-arc Welding • Robotic Welding • Tower Crane	• TIG Welder (CUNI) • TIG Welder (Stainless) • Pipe System Operator • Silver Braze • Class One Fit-Up • Motor Operated Valve Spec. • Crane Operator	• T1 309 SS Welding • Explosion Proof • Fiber Optic • High Density • Light-gauge Welding • Crane Operator • Mentor/Instructor

GENERAL DYNAMICS NASSCO

Professional Development

Additional Resources

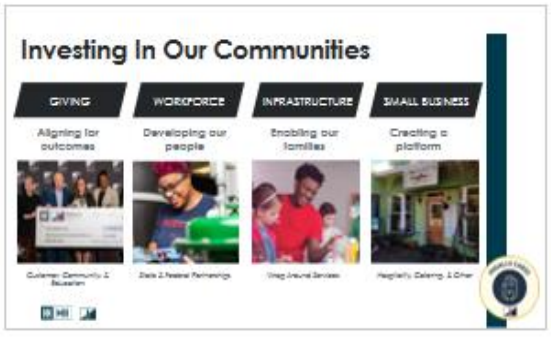
Developmental Resources Available to all Employees

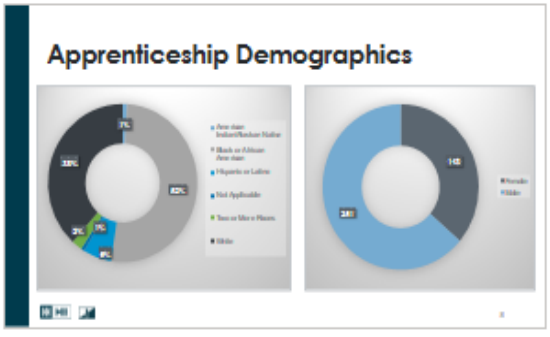
Tuition Reimbursement Program	LinkedIn Learning

• Financial assistance for tuition and books
• Reimbursement amount depends on degree level (higher reimburse amount for undergraduate degrees)
• **Degrees:**
  • Business administration
  • Engineering
  • Supply chain management
  • Information technology
• **Certifications:**
  • Project Management Professional
  • Six Sigma
	• Video-based courses that are deployed via learning management system
	• Completions are tracked on employee's learning history
	• **Course types:**
	  • Leadership
	  • Business
	  • Information technology
	  • Education
	  • MS Office
	  • Additive manufacturing
	  • Human resources

GENERAL DYNAMICS NASSCO

Appendix H: Ingalls Shipbuilding Company Report/Presentation





Future Workforce

Generating Pride in Shipbuilding

- Modeled after high school athletic scholarship signing events
- 22 students signed job offers with 150 family and friends present
- Opportunity for Ingalls and the community to publically celebrate student achievement and to showcase the benefits of Ingalls employment and a manufacturing trade skills career
- Excellent response from the community and from internal stakeholders

Facebook post from parent of new hire:
Tonight was a proud parent moment. Our son had his sign in night for Ingalls. Your work ethics, determination and just being a good person shined through

Talent Development Labs

Ingalls Shipbuilding partners with three local high school CTE programs in efforts to improve technical skills, curriculum, and life skills needed for future career success

Life Skills ⟹ Monthly workshops and visits ⟹ **Champion Visits**

Topics:
- Career prep
- Budgeting and paycheck
- How to apply for a job
- Ethical decision making
- Investments and benefits

Topics:
- Instructor skills with teachers
- Student trade skills building
- Reinforcement of life skills

Workforce Development: $100 Million/Year Investments

Current Workforce
- Leadership Development
- Tuition Reimbursement
- Apprentice Schools

College Programs
- HII Scholarship Fund Post-Secondary Scholarships
- Seabee Memorial Scholarship Support
- Professional Internships
- Diversity Conferences

Pre-K to 12 Programs
- HII Scholarship Fund, School Readiness Scholarships
- Maritime Training Academy
- STEM Teacher Workshops
- Shipbuilder Academy
- Future Shipbuilder Discovery Day
- Middle School STEM Mentorship

Veterans
- Veteran and Spouse Hiring Initiatives
- Veterans Employee Resource Team

Appendix J: Philly Shipyard Company Report/Presentation

Apprentice Program Structure - continued

For the first 12 weeks, the class works on-site in Production departments for immediate immersion into the shipyard's working environment and activities.

At the end of 12 weeks, apprentices report to the PSI Training Academy to begin classroom training and hands-on lessons to obtain their certifications.

Upon completing the Training Academy rotation, apprentices rejoin Production to begin on the job training.

All apprentices are required to attend and complete a mix of classroom and online training throughout the duration of the program.

October 2023: Apprentice welder #8 is ready to rejoin production after completing 12 weeks at the Training Academy

Still Interested? Here's how to apply!

1. Visit https://www.phillyshipyard.com/jobs/apprentice-program/
2. Submit a completed application, which includes:
   - A copy of a High School Diploma or GED Equivalent
   - Two letters of recommendation
3. Submit a $60 money order and schedule a time to take the Ramsay Mechanical Aptitude Test.
4. Score 70% or above combined on the Ramsay Mechanical Aptitude Test.
5. Schedule an interview.
6. If offered a position, attend Onboarding Day session and complete all necessary next steps.

Important application dates!	
Applications close	March 3rd
Aptitude test	March 17th
Interviews	Week of April 3rd
Onboarding and offer day	April 10th
Start Date	May 1st

Curriculum

- Combination of classroom and online instruction
- Minimum requirement of 144 hours each year
- Graduates are awarded 22 college credits to apply toward a Technical Studies Degree (valued at approximately $10,000). These credits can be applied toward an Associate's Degree.
- Former apprentices have continued their education and obtained various degrees like Electrical Engineering and Project Management

PENN FOSTER | COLLEGIATE CONSORTIUM FOR WORKFORCE + ECONOMIC DEVELOPMENT | Delaware County Community College

Company benefits

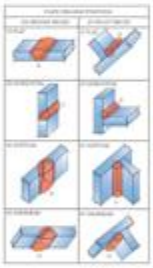
Apprentice Benefits

- Medical, Dental and Vision coverage, with medical plans starting at $10 per pay period
- Flexible benefit plans for un-reimbursed medical costs, dependent care costs and transportation expenses
- 401k savings plan with company match (through Vanguard)
- Union pension
- Longevity bonus
- Vacation time – apprentices begin accruing 1 week of vacation to use it after completion of 1040 work hours
- Personal time – apprentices receive 40 hours of personal time in the first year
- Uniform allowance

Wage increases

Apprenticeship programs have percentage pay increases throughout the entire program length based off of safety, attendance, grades, and performance reviews.

ABS Certifications



Philly Shipyard instructors work with apprentices to hone their skills and learn about various aspects of the shipbuilding industry. Apprentices also practice the skills needed to obtain the following ABS Certifications: Outfitter and Shipbuilder.

Company benefits

Paid holidays

HOLIDAY	DAY OBSERVED	
New Year's Day	Monday	January 2, 2023
Good Friday	Friday	April 7, 2023
Memorial Day	Monday	May 29, 2023
Independence Day	Tuesday	July 4, 2023
Labor Day	Monday	September 4, 2023
Thanksgiving #1	Thursday	November 23, 2023
Thanksgiving #2	Friday	November 24, 2023
Christmas	Monday	December 25, 2023

Paid Shutdown Weeks

After 6 months of employment, apprentices are eligible for a paid shutdown week between Christmas and New Years Day.

After 1 year of employment, apprentices are eligible for both the 4th of July and Christmas shutdown.

Do you have what it takes?

What you'll need to succeed as an apprentice:

1. Reliable transportation and childcare
2. Consistent attendance
3. Ability to do hands-on work
4. Work outside in heat or cold weather
5. Report to work before 8am (in most positions)
6. Flexibility for shift changes
7. Ability to be clean shaven for respirator fit and use

Potential shift schedules include:

1st Shift: Monday - Thursday, 6:00am - 4:30pm
2nd Shift: Monday - Thursday, 3:00pm - 1:30am
3rd Shift: Monday - Friday, 11:00pm - 7:30am

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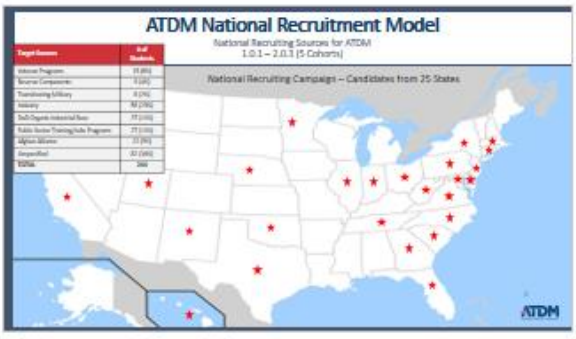
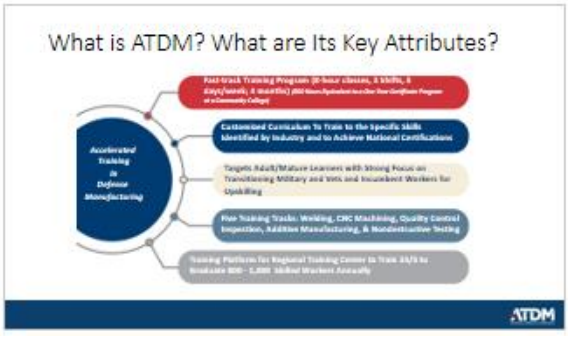
Appendix K: Accelerated Training for Defense Manufacturing Presentation





Industry Partnership Program Initiative

- Industry "call to action" to scale ATDM to FOC by FY25
- Intended to increase ATDM awareness across the SIB overall and put in place 500 – 1,000 "working partnerships" with companies for recruitment and job placement
- Establishes pathways to enable:
  - Upskill training for incumbent workers
  - Training of candidates for employment and new hires
  - Identification of training industry-specific training needs for curriculum customization
  - Calibration of the demand signal for jobs
  - Monitor retention of ATDM graduates in maritime manufacturing jobs

ATDM

Afghan Allies – Expanding the Labor Pool

- Afghan students are an integral part of ATDM in all 5 Skills
- Afghan graduates are value-added employees in SIB/DIB companies today
- SIB/DIB Job Placement to exceed 80% by end of ATDM 2.0
- Afghan Allies are 13.7% of total ATDM student output

ATDM

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