



**Pennsylvania
College of Technology**
A Penn State Affiliate

***A Collaborative Approach to Expanding Nondestructive
Testing Education Within a Welding Program***

Year Two Evaluation Report – March 2022

National Science Foundation ATE Award Number 2000831

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**PREFERRED PROGRAM
EVALUATIONS**
"Unlocking Program Potential"

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List of Acronyms and Initialisms

*20NDT – A Collaborative Approach to Expanding Nondestructive Testing Education
Within a Welding Program*

A.A.S. – Associate of Applied Science

ABET – Accreditation Board for Engineering & Technology

ASNT – American Society for Nondestructive Testing

HPO – High Priority Occupation

MT – Magnetic Particle Testing

NDT – Nondestructive testing

NWI – National Welding Institute

PAUT – Phased Array Ultrasonic Testing

PCT – Pennsylvania College of Technology

PRM – Public Relations and Marketing

RT – Radiographic Testing

UT – Ultrasonic Testing

VT – Visual Testing

EXECUTIVE SUMMARY

The findings, recommendations, and commendations that comprise this second annual evaluation report are based on grant-related activities and accomplishments occurring between April 2021 and March 2022. The goals, objectives, and working framework of Pennsylvania College of Technology's (PCT's) "A Collaborative Approach to Expanding Nondestructive Testing Education Within a Welding Program" (referred to as *20NDT*) are detailed herein.

The project is being implemented under the leadership of Mr. Michael Nau, P.I., and two Co-P.I.s, Dr. Bradley Webb and Mr. James Colton. The project team remains committed to the success of this initiative, and all stakeholders expressed confidence that the buy-in of college administrators has been secured. The college continues its contractual relationship with the Naval Welding Institute (NWI). In partnership with PCT, the team at NWI has developed the curriculum, lecture materials, test banks, and labs for the college's new NDT academic credentials in accordance with American Society for Nondestructive Testing (ASNT) requirements.

The Radiographic Testing (RT) and Ultrasonic Testing (UT) competency credentials were officially approved by the college in spring 2021 and became available to students beginning in fall 2021. The RT competency credential requires a total of five courses (including a radiation safety course) totaling 15 credit hours. The UT competency credential requires a total of four courses totaling 13 credit hours. These competency credentials are structured so that each one can be completed in a single semester (among full-time students). They are standalone academic programs expected to appeal to incumbent workers looking to upskill or reskill.

The new NDT A.A.S degree was officially approved in December 2021. The NDT curriculum focuses on discontinuity, defects, and processes of NDT. The NDT A.A.S. degree requires a total of 69 credit hours. Internships for NDT degree-seeking students will be strongly encouraged, and as the degree program evolves, may become a requirement for graduation. Students who complete the requirements of the NDT A.A.S. degree will have accrued the requisite number of classroom hours for ASNT Level II certification in RT, UT, and Visual Testing (VT). The courses will be held in the NDT classroom and lab, which are part of the college's state-of-the-art welding facility. The lab is outfitted with the latest equipment for the students to hone their technical skills.

All three of these NDT academic credentials have become part of the college's digital program catalogue. Other institutions offering a similar degree do not have as robust of a welding component in their NDT programs, and this distinction makes the academic credentials to be offered by PCT attractive to both students and employers. The degree program at PCT features two welding courses and additional courses that embed NDT students with welders in the lab.

In year two of *20NDT*, Dr. Webb secured approval from PCT to create the NDT Industry Advisory Committee. The first meeting of this newly formed committee occurred in October 2021. The committee members offered valuable input on the NDT curriculum and course sequence, and their suggested revisions were incorporated into two courses and the degree framework.

The earlier limitations on in-person marketing and recruiting stemming from COVID-19 have begun to lift, making it possible for the project team and college admissions representatives to engage with students once again at open houses, career fairs, and group tours of the welding lab. The project team worked closely with Public Relations and Marketing (PRM) at PCT on all print and digital marketing materials: handbills, featured advertisements on digital platforms, and outreach to companies in the region. Every prospective student of the college's welding program received an email about the new NDT degree program. The new degree may also be attractive to students considering other degree pathways at the college, such as machining, diesel technology, and aviation.

The faculty members were in agreement that increasing high school student awareness about this discipline is a critical first step in promoting the new NDT academic credentials. One opportunity for beginning to build a pipeline of students interested in studying NDT is to leverage "Penn College Now," the college's dual enrollment initiative. In year two of *20NDT*, an NDT module was added to the stick welding course for dual enrollment students, and the project team is working to incorporate NDT modules into additional courses offered at 12 high schools in the region.

The two-day NDT summer camp will be held on campus in July 2022. The NDT summer camp is designed to attract underrepresented high school students for an immersive residential experience. NWI is serving as a liaison between high schools in the greater Philadelphia area and PCT to recruit 30 students for the summer camp. Participants will be exposed to the topics of RT, UT, Magnetic Particle Testing (MT), Phased Array Ultrasonic Testing (PAUT), and welding through a series of eight concurrent workshops.

PROJECT DESCRIPTION

In May 2020, PCT was awarded a three-year National Science Foundation Advanced Technological Education (NSF ATE) grant in the amount of \$599,816 to support *20NDT*. The project aims to address the growing unmet need for skilled technicians in NDT who are qualified to secure our nation's critical infrastructure. PCT is already regarded as a leader in welding and NDT instruction, and this ATE grant will increase the institution's capacity to train traditional and non-traditional students to become NDT specialists.

As originally proposed, over the course of the project's first two years, *20NDT* would develop a new A.A.S. degree program and two specialized competency credentials in RT and UT. The project's objectives include: 1) develop curricula for RT and UT that lead to fulfillment of ASNT Level II classroom requirements; 2) align the two competency credentials and A.A.S. degree program to create flexible academic pathways for students; 3) enhance student learning with new equipment for teaching RT and UT, and 4) recruit and enroll high school students and incumbent workers in new pathways to earning NDT credentials.

20NDT represents a unique opportunity to build a pipeline of graduates with the theoretical knowledge and technical skills to succeed in the field. As *20NDT* evolves over its three-year performance period, it has the potential to serve as a model for career and educational pathways in NDT worthy of replication at other institutions. The project is supported by a practical evaluation designed to assess the significance of the initiative on the advancement of student engagement, scholarship, and workforce readiness in NDT, and the capacity-building of the college and its community stakeholders.

A recent expansion at the college culminated in a 55,000-square-foot welding facility featuring a designated NDT classroom and lab. In year one of *20NDT*, several significant equipment purchases were made in support of the new NDT academic programs. The college acquired seven Olympus PAUT units, a digital x-ray bed, and a dummy radiographic source. An in-person training on the new PAUT units was conducted by Olympus in year two of *20NDT*.

METHODOLOGY

The external evaluation of *20NDT* is intended to satisfy NSF ATE's requirement that all funded projects conduct a thorough assessment of their activities and outcomes. The evaluation is being led by Blake Urbach, Principal Consultant of Preferred Program Evaluations. The evaluator is prepared to draw from a combination of qualitative and quantitative data sources that provide an in-depth examination of project implementation and management processes, and inform mid-course correction throughout the performance period. These include: project records, artifacts, and activity logs; curriculum/frameworks; institutional records of enrollment, performance, and completion; one-on-one interviews with a cross-section of internal and external stakeholders; student focus groups; site visits to PCT, and a series of surveys for students, summer camp participants, faculty, and industry partners.

The evaluation will aid PCT in measuring the impact – projected and unanticipated – on: 1) designing and adopting an industry-approved curriculum mapped to ASNT standards; 2) determining effective practices that promote and reinforce student success in the new degree and competency credentials; 3) assessing the fidelity of project activities and processes; 4) identifying constraints encountered that may pose threats to validity within the implementation process; and, 5) reviewing evidence of change among participating students. The evaluation will also assess methods of recruitment and service delivery, characteristics of participants served, growth in faculty confidence and competencies, collaboration with industry partners, and changes in organizational capacity.

Ongoing assessment of the project includes routine correspondence, bi-monthly meetings, ad-hoc monitoring, survey results dashboards, and annual evaluation reports. Strategies employed during the performance period that are shown to have favorable student and faculty outcomes will inform subsequent changes in pedagogy and practice. Findings will be reviewed with the project team and shared with the NDT Industry Advisory Committee, and the parties will strategize the most effective ways to address identified challenges.

The external evaluator's duties and responsibilities include evaluation oversight, alignment of data to project goals, and meaningful reporting on program impact. Using a holistic evaluation design, the evaluator will present a current and complete picture of the project as it takes shape over the three-year performance period. The evaluation is being guided by a series of questions about participants, process, correction, and impact.

Evaluation Questions	
<u>Participants:</u>	Are incoming students and incumbent workers enrolling in the degree and/or certificate programs on par with project outcomes? How have high school students been made aware of the summer camp and dual enrollment opportunities? Are faculty satisfactorily completing train-the-trainer modules?
<u>Process:</u>	In what ways is the project contributing to student engagement in NDT? How has the input of industry partners been used to shape/revise the new curriculum? How have teachers modified their instruction to incorporate NDT simulations using the new equipment?
<u>Correction:</u>	What adjustments were necessary for the promotion of the new program offerings? What corrective actions were taken to ensure students have the requisite knowledge and skills to pass the Level I and II ASNT practice exams?
<u>Impact:</u>	To what extent did the degree and certificate programs produce graduates prepared for employment as NDT technicians? How has the institution's capacity grown as a result of the new program offerings? In what ways have the external stakeholders contributed to the sustainability of this initiative post-funding?

In order to uncover the ways in which the Industry Advisory Committee members envision participating in the college's new NDT academic programs, the external evaluator designed an industry partner survey for administration in fall 2021. The survey findings (shown in the survey results dashboard in Appendix A) yield a better understanding of which representatives – via their companies – are interested in being involved as guest speakers, presenters at a symposium, experiential learning partners, etc.

In fall 2021, one-on-one stakeholder interviews were conducted by the project's external evaluator via Zoom. In spring 2022, a second round of interviews was conducted in-person during the evaluator's two-day site visit to PCT. Stakeholder interviews are valued for generating a candid, in-depth dialogue about project implementation and management processes unobtainable through traditional surveying methods. Participants were asked to respond to a set of questions about curriculum and program design, training, marketing, and collaboration taking place during the second year of 20NDT. The evaluator spoke with a total of five 20NDT stakeholders from PCT and NWI (some of the PCT project team members were interviewed twice).

- Dr. Bradley Webb – Co-P.I., and Dean, School of Engineering Technologies, Pennsylvania College of Technology
- Mr. Michael Nau – P.I., and Welding Instructor, Pennsylvania College of Technology
- Mr. James Colton – Co-P.I., and Assistant Professor of Welding, Pennsylvania College of Technology
- Mr. Mike Hurd – Instructor of NDT and Welding, Pennsylvania College of Technology
- Mr. Kris Jones – Founder and CEO, Naval Welding Institute

PROJECT OBJECTIVES AND OUTCOMES MATRIX

Goals and Objectives	Measures	Data Sources
<p><i>Develop AAS/certificates in NDT</i></p> <ul style="list-style-type: none"> • Fully develop 80 hours for certification in RT and UT ➔ 14 new NDT courses (including a radiation safety course) have been developed and approved • Fully develop courses for PAUT ➔ PAUT curriculum will be finalized in time for the course rollout in fall 2022 • Acquire equipment for RT and PAUT ➔ 7 PAUT units, a digital x-ray bed, and a dummy radiographic source have been purchased for the NDT lab • Create pathways from certificates to A.A.S. to B.S. ➔ The RT and UT competency credentials have been embedded in the A.A.S. degree 	<ul style="list-style-type: none"> • Number of new NDT courses leading to AAS and certificates • Pathways in place to share credits between certificate, A.A.S., and B.S. programs 	<ul style="list-style-type: none"> • Document review • Curriculum/frame-works • Institutional records • Stakeholder interviews • Focus groups
<p><i>Recruit students into the NDT A.A.S. and certificate programs and place graduates in industry positions</i></p> <ul style="list-style-type: none"> • 10 students enroll annually in A.A.S. ➔ The first cohort of A.A.S. students will begin their degree program in fall 2022 • 5 students enroll in each certificate program • 90% of completers are placed in an NDT position 	<ul style="list-style-type: none"> • #, %, demographics of students applying for and enrolling in the A.A.S. and certificate programs • #, % who complete the program requirements and who pass the Level I and II ASNT practice exams • #, % program completers who secure employment in an NDT field • #, %, demographics of summer camp, Philadelphia summer event, and PCNOW participants who enroll in Penn College's NDT programs 	<ul style="list-style-type: none"> • Project records and activity logs • Recruitment event participation • Institutional records • Stakeholder interviews • Student surveys • Focus groups
<p><i>Provide faculty with train-the-trainer opportunities to improve their NDT knowledge</i></p> <ul style="list-style-type: none"> ➔ NWI facilitated a virtual training on RT; Olympus provided training on PAUT; faculty attended training on Eddy current 	<ul style="list-style-type: none"> • Faculty ability to teach the NDT curriculum and use equipment 	<ul style="list-style-type: none"> • Project records and activity logs • Stakeholder interviews • Faculty surveys
<p><i>Disseminate curriculum, lessons learned, instructional best practices</i></p> <ul style="list-style-type: none"> ➔ Materials were shared at the 27th and 28th national (virtual) ATE P.I. Conference 	<ul style="list-style-type: none"> • Dissemination of project results 	<ul style="list-style-type: none"> • Publication and presentation of materials

FINDINGS AND RECOMMENDATIONS

Project Administration and Leadership

When asked how this ATE grant will contribute to STEM student experiences and success, the stakeholders were in consensus that *20NDT* will provide specialized academic and real-world learning opportunities not currently available at the college. With respect to how *20NDT* will benefit the college, the new academic programs are expected to attract FTICs and practitioners looking to upskill and reskill. The college is already regarded as a leader in welding and NDT instruction, and this ATE grant will increase the institution's capacity to train traditional and non-traditional students.

The complement of NDT academic credentials supported by *20NDT* "is really enriching the program offerings of PCT." Mr. Nau reiterated that the NDT workforce is in the same situation as welding. Demand is high but there are simply not enough skilled workers to fill the job vacancies. Students of the NDT program will gain practical experience with the equipment (of several manufacturers) and be very competitive as they enter the job market. Whereas other institutions with NDT degree programs do not provide exposure to the fundamentals of welding, PCT's program graduates will have developed an understanding of each welding process and be able to identify discontinuity in the welding process.

Dr. Webb is the Dean of Engineering Technologies, and he oversees more than 60 academic programs at the college. Dr. Webb is the fiscal agent of this ATE grant and the signatory for expenditure approvals related to *20NDT*. He maintains responsibility for ensuring the fidelity of project-related activities and events on and off campus, marketing the NDT program offerings, building relationships with business and industry, and securing formal approval for the new curriculum and competency credentials.

Mr. Nau and Mr. Colton are the lead faculty of PCT's welding department. Their responsibilities for *20NDT* include the development of course abstracts and outcomes, curriculum revisions, forging relationships with business and industry, and facilitating trainings. They will be instrumental in working with students during the upcoming NDT summer camp for high school students. In 2021, Mr. Nau and Mr. Colton completed Eddy current training and PAUT training in preparation for teaching NDT courses. They have begun to promote the new credentials during career fairs, campus tours, conferences, and professional development engagements.

Mr. Nau expressed the importance of encouraging students early in their degree program to consider what they actually want to pursue as a career. His suggested approach is to consider a broad range of options to start and then hone in on an area of interest. Mr. Nau shared that on many occasions he has worked with students nearing graduation who haven't given much thought to what they would like to do for a living once their degree is in hand.

In year one of *20NDT*, Mr. Mark Hurd was hired to teach some of the new NDT courses developed as part of this ATE grant. Mr. Hurd has been an adjunct at PCT since 2007 and became a full-time faculty member in 2020. He has extensive industry experience and holds ASNT Level II certification in several specialties: PT, UT, RT, and MT.

NDT faculty will provide guidance to NDT students on course selection, internship opportunities, and career goals. Mr. Nau explained that this is an advising role, not a mentoring role. The faculty have access to Starfish, a student success platform for monitoring student progress and connecting students. Faculty will be encouraged to use this tool to identify students who are struggling academically and link them with the appropriate resources.

The faculty members were in agreement that the expectations regarding roles and responsibilities for *20NDT* were clearly communicated. The project team members are working closely with NWI to draft the NDT curriculum, assessments, and labs. The NWI team assisting on this ATE grant include Mr. Jones, Founder and CEO, five ASNT NDT Level III professionals, and two Ph.D. materials engineers. Mr. Jones continues to be satisfied with the partnership between NWI and the college, and expressed that the feedback loop regarding project developments and milestones is satisfactory.

The restrictions surrounding COVID-19 that previously limited in-person engagements, traveling to trainings/conferences, and inviting guests to campus, have been lifted. The faculty members are eager to visit NWI, tour other educational institutions with existing NDT degree programs, participate in professional conferences, and network with colleagues throughout the nation.

The college has several certified welding inspectors on staff but only one, Mr. Hurd, is ASNT certified. Each level of ASNT certification requires a robust number of classroom and lab hours, and these hours must be certified by a Level III examiner. NWI has the ability to certify the NDT students' classroom hours, and in the final year of *20NDT*, the intention is to have at least 10 students achieve ASNT certification with NWI's oversight.

Industry Collaboration

In year two of *20NDT*, the project team partnered with industry to further the college's new NDT credentials by way of exposure, resources, professional development, and content expertise. The John Deere Foundation made a \$10K donation to the college's NDT program in fall 2021. The project team continues its collaboration with WELD-ED, an ATE national center. The college's contractual relationship with NWI for the development of a rigorous and relevant industry-driven curriculum for the new NDT academic credentials has been fruitful. NWI is tasked with aligning the core curriculum to ASNT standards.

Mr. Nau and Mr. Colton attended the ASNT Annual Conference in November 2021 in Phoenix, Arizona. This NDT conference was described as the premier event for making new contacts with academics and practitioners; learning about equipment, software, and platforms, and becoming informed about opportunities for current students and recent graduates. Mr. Nau reported that the ASNT Annual Conference provides an unmatched opportunity to network with industry and secure equipment donations from manufacturers.

Dr. Webb led the charge of assembling the NDT Industry Advisory Committee with seven representatives from the business community. NDT students and alumni of PCT's welding program will also be asked to sit on the committee to offer the student/graduate perspective. The first meeting of the newly formed committee occurred in October 2021. The committee members offered valuable input on the NDT curriculum and course sequence, and their suggested revisions were incorporated into two courses and the degree framework. Dr. Webb is planning to share recent project-related accomplishments with the committee via email during the summer months.

As the NDT degree program evolves in the coming years, the project team intends to leverage its relationships with industry for additional internship opportunities. Per Mr. Nau, the ideal timing for an internship would be between the student's second and third semester in the NDT degree program.

NDT Course and Program Offerings

NWI has provided lecture materials, PowerPoint presentations, test bank, and labs. Mr. Hurd estimates that the curriculum is 25% theory and 75% hands-on instruction. He explained the importance of "pacing the content" for students and reviewing the safety aspects of NDT during each class period. The faculty members have academic freedom to tailor the content and update the course abstracts based on revised learning objectives and emerging trends in NDT. Several faculty members indicated that they have intentionally woven soft skill development into their instruction. Skills such as teamwork, and writing and interpreting reports are required for completing the degree requirements, and will be critical once the student is performing his or her job in the field.

The RT and UT competency credentials were officially approved by the college in spring 2021, and the new A.A.S degree was granted approval in December 2021. Dr. Webb ushered the NDT curriculum through the sequence of approvals: Dean of Curriculum, Registrar, and Curriculum Committee. New NDT courses will be offered in fall 2022. In the event the new RT and UT courses have low enrollment, Dr. Webb is prepared to run these courses with a limited number of NDT students. The courses will be offered face-to-face, and students will spend time in the NDT classroom and lab during each class period.

Mr. Jones expressed confidence that the rigor of the NDT curriculum will prepare students to enter the workforce at the technician level. “We’ve incorporated as much knowledge as possible so the students could be effective wherever they end up professionally.” RT and UT curriculum were described as “the backbone” of the degree program. The RT and UT competency credentials are embedded within the A.A.S. degree program. All three of these NDT academic credentials have become part of the college’s digital program catalogue.

The RT and UT competency credentials are structured so that each one can be completed in a single semester (among full-time students). They are standalone academic programs expected to appeal to incumbent workers looking to upskill or reskill. The RT competency credential requires five courses (including a radiation safety course) totaling 15 credit hours. The UT competency credential requires four courses totaling 13 credit hours. Mr. Jones remarked that with some enhancements, the radiation safety course could be spun off into its own certificate.

RT Competency Credential - New Courses	UT Competency Credential - New Courses
QAL 102 Radiation Safety	QAL 103 Governing Technical Documents for NDT
QAL 103 Governing Technical Documents for NDT	QAL 124 Ultrasonic Testing I
QAL 122 Radiographic Testing I	QAL 126 Ultrasonic Inspection & Recording Practices
QAL 123 Radiographic Inspection & Recording Practices	QAL 224 Ultrasonic Testing II
QAL 222 Radiographic Testing II	

The NDT curriculum has been developed in accordance with ASNT standards. Mr. Nau indicated that the A.A.S. curriculum will focus on discontinuity, defects, and processes of NDT. The NDT A.A.S. degree requires a total of 69 credit hours. A full-time student can complete the degree program in four semesters (see Appendix B for complete curriculum). Each new cohort of students will begin in the fall term; there is not a staggered start date. Students who complete the requirements for the NDT A.A.S. degree will have accrued the requisite number of classroom hours for ASNT Level II certification in RT, UT, and VT. NWI will certify the classroom hours for 10 NDT graduates. ASNT Level II certification requires 80 hours of classroom training and 1,500 lab hours. The project team received confirmation that students may work in pairs on the equipment to earn their ASNT classroom training hours.

Each student will need to accrue his/her industry hours for ASNT certification on the job site. Once this ATE grant has come to an end, the possibility remains for NWI or even a former PCT graduate with Level III certification to proctor the exam. Mr. Nau explained it would be most economical to have an employee of the college with ASNT Level III certification fulfill this role.

Internships for NDT degree-seeking students will be strongly encouraged, and as the degree program evolves, may become a requirement for graduation. Per Mr. Colton, the college has a robust internship process in place, and the project team anticipates structuring the internships for

NDT students after the college's existing model for welding students. The project team intends to leverage business and industry partnerships for (paid and unpaid) NDT internships.

The NDT lab is part of the college's state-of-the-art welding facility, and is designed to offer students real-world experience. The lab is outfitted with the latest equipment for the students to hone their technical skills. The NDT lab can accommodate up to 16 students per class section. There are eight PAUT units available for students (working in pairs), and one demo unit for the faculty member.

Mr. Colton shared that the college anticipates seeking ABET accreditation for its welding program and will likely commit to having its NDT program accredited as well. In order to meet the requirements for accreditation, the college may need to create additional content and assessments that align with the defined standards of quality set forth by ABET.

Marketing, Recruiting, and Outreach

Making prospective and incoming students aware of a brand-new academic program is a challenging undertaking requiring resources, visibility, creativity, and patience. The earlier limitations on in-person marketing and recruiting stemming from COVID-19 have begun to lift, making it possible for the project team and college admissions representatives to engage with students once again at open houses, career fairs, and group tours of the welding lab. Project team members can request release time to attend recruiting engagements at high schools, career and technology centers, and community events.

A collegewide career fair was held on campus in early March 2022. Hundreds of employers were in attendance seeking students and recent alumni for internships, summer positions, and full-time employment. Mr. Nau was pleased to report that the career fair was "NDT heavy."

The NDT program website has been published (<https://www.pct.edu/academics/et/welding-metal-fabrication/non-destructive-testing>) and the NDT degree has been added to the welding and fabrication cluster page (<https://www.pct.edu/academics/et/welding-metal-fabrication>). In February 2022, an article titled "Penn College Adds Non-Destructive Testing Welding Degree" appeared in *PCToday* (see Appendix C).

The editor of ASNT's flagship journal, *Materials Evaluation*, has agreed to run a press release about the college's new NDT degree. The publication's September issue has traditionally focused on NDT education and training. The project team intends to submit an article for publication in *Inspection Trends*, a quarterly periodical designed for materials inspection and testing professionals. Mr. Colton shared that a press release from the American Welding Society is also forthcoming.

The project team worked closely with Public Relations and Marketing (PRM) at PCT on all print and digital marketing materials: handbills, featured advertisements on digital platforms, and outreach to companies in the region. Outreach of this nature remains a collaborative effort insofar as NDT faculty members have the contact list of companies, institutions, and organizations that should receive these marketing materials. Every prospective student of the college's welding program received an email about the new degree NDT program. The incoming class of welding students for fall 2022 is projected to be greater than 100. One faculty member spoke about the possibility of "crosswalking" current welding students into NDT. The new degree may also be attractive to students considering other degree pathways at the college, such as machining, diesel technology, and aviation.

In March 2022, NWI will visit PCT to create interactive videos using equipment in the college's NDT lab. These videos will be useful for train-the-trainer exercises and for use in the classroom. A teacher training event will be held on PCT's campus this summer to attract and educate high school welding and manufacturing instructors across the state. Unlike the virtual trainings and activities conducted in year one of *20NDT*, all of the upcoming engagements are slated to be in-person.

The project team may want to consider promoting the NDT degree at high school STEM clubs, and veteran and workforce development events. Mr. Colton reiterated the value of ensuring the marketing materials indicate that students will graduate from the NDT degree program with ASNT Level II certification. Highlighting the experiential aspects of the program curriculum and the lucrative career prospects in the region and nationwide for NDT specialists are additional marketing talking points.

The faculty members were in agreement that increasing high school student awareness about this discipline is a critical first step in promoting the new NDT academic credentials. Per the interviewees, students have had no exposure to the field of NDT and its associated career pathways. One opportunity for beginning to build a pipeline of students interested in studying NDT is to leverage "Penn College Now," the college's dual enrollment initiative. In year two of *20NDT*, an NDT module was added to the stick welding course for dual enrollment students, and the project team is working to incorporate NDT modules into additional courses offered at 12 high schools in the region.

At the time of this report, eight different welding courses were offered at partner high schools. A total of five PCT faculty members serve as institutional liaisons with the partner high schools. Mr. Colton shared that the liaisons meet twice per year with their high school counterparts. Guest speakers are often brought in to demo a particular skill and stimulate interest in the career opportunities surrounding welding. One faculty member interviewed in spring 2022 noted that the return on investment for dual enrollment is impressive: approximately one-quarter of the students who complete a welding course at a partner high school end up enrolling in PCT's welding program. Mr. Colton remarked that the college has a notable graduation and placement rate for its welding program and anticipates the same for students in NDT.

The NDT faculty intend to establish an ASNT Student Chapter in the coming year. Mr. Colton heads up the SkillsUSA State Welding Fabrication Competition for PCT. Contestants compete in a series of timed exercises to test their ability to use welding tools and execute welding processes. Winners of the state competition will move on to the national contest in June 2022 in Atlanta. This well-respected competition attracts both high school and college students, and is one more outlet for increasing the visibility of the college's new NDT degree.

The two-day NDT summer camp will be held on campus in July 2022. The project team is prepared to bus 30 students from high schools in Philadelphia to the PCT campus for the overnight engagement. The NDT summer camp is designed to attract underrepresented students in tenth through twelfth grade for an immersive experience. NWI is serving as a liaison between the high schools and PCT to recruit students for the summer camp. Participants will be exposed to the topics of RT, UT, MT, PAUT, and welding through a series of eight concurrent workshops. The workshops will be facilitated by the college's NDT and welding faculty. At the time of this report, Dr. Webb noted that the project team was securing the necessary FBI and state clearances in accordance with state and federal child protection laws.

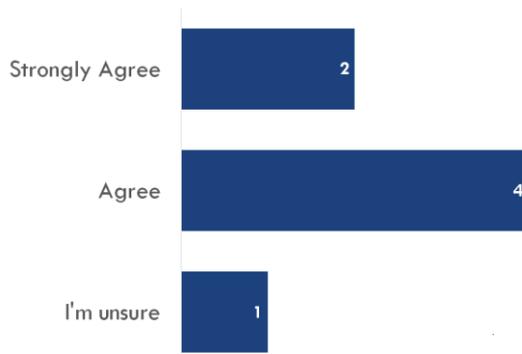
The NDT camp will be held in conjunction with the Thingamajig Fabricators Camp for students interested in manufacturing. Additionally, the college will be hosting a general engineering summer camp, and welding has been included as a two-hour block in the schedule. Students who complete any of these college-sponsored camps are eligible to receive a \$1K annual scholarship to apply to their PCT tuition.

Dr. Webb shared that the project team is looking into the possibility of getting the RT and UT competency credentials, and the new NDT degree program, included as High Priority Occupations (HPOs). HPOs are part of Pennsylvania's industry-driven approach to workforce development. Higher education institutions can petition their local workforce development boards to propose adding an HPO that meets the state's criteria. HPOs are eligible for state subsidies for education, making them advantageous for prospective students with limited financial means, and the educational institutions offering credentials in these recognized career pathways.

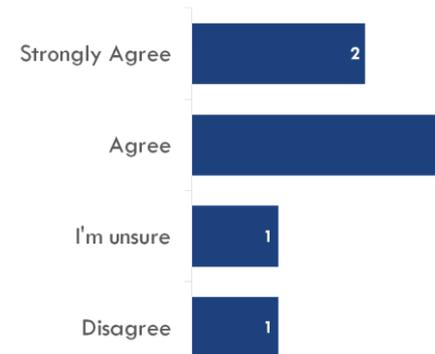
20NDT Industry Partner Survey Dashboard – November 2021

The 20NDT Industry Partner Survey weblink was distributed to the college’s industry partners who had expressed interest in being part of the college’s new NDT program offerings. A total of seven individuals responded to the anonymous survey in September 2021. Their responses will be used to help the college understand how it can best collaborate with industry partners, and to inform the co-curricular activities it can offer students and incumbent workers.

Preference is to hire NDT program graduates whose training has been carried out using the manufacturer-specific equipment we use in our facility.



Preference is to hire NDT program graduates whose training has been agnostic, so long as the skills are transferrable to the equipment we use in our facility.



20NDT Industry Partner Survey Dashboard – November 2021

Your desired level of involvement with the college's new NDT programs



Your company's desired level of involvement with the college's new NDT programs





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Describe the skills (both technical and soft) graduates of an NDT degree program should have in order to be workforce-ready.

“At least have 40hr of classroom training per ASNT-TC-1A. Be IRSSP test ready once the[y] acquire the[ir] field hours.”

“RT experience, certification, UT experience, certification, communication skills”

“Understand the methods and have readiness to practice NDT.”

“Able to pass ASNT type tests”

“NDT theory is important, but taught at many providers. Hands on inspection of a variety of NDT applications is critical so that the student is prepared for real world applications.”

“Advanced knowledge of Radiation Safety Procedures. OSHA 10. Data presentation with standard MS products (should be Excel power users). Inspection methodology with focus on Objectivity and Independence. Data acquisition optimization (sample rate vs processing rate vs file size). Basic computer networking. ISO 9001 awareness. Basic Metallurgy and welding fundamentals. NDE Method and Program fundamentals, similar to scope of ANST LVIII Basic.”

Appendix B – NDT A.A.S. Degree Curriculum

First Semester		Credits
FYE101	First Year Experience	1.0
QAL102	Radiation Safety	2.0
QAL241	Non-Destructive Testing I	3.0
WEL103	Welding for NDT I	3.0
WEL141	Introduction to Welding Inspection	3.0
CSC124	Information, Technology & Society	3.0
MTH181	College Algebra & Trigonometry I	3.0
TOTAL CREDITS		18.0

Second Semester		Credits
WEL104	Welding for NDT II	3.0
QAL122	Radiographic Testing I	4.5
QAL123	Radiographic Inspection & Recording Practices	2.0
QAL222	Radiographic Testing II	4.5
ENL111	English Composition I	3.0
TOTAL CREDITS		17.0

Third Semester		Credits
QAL124	Ultrasonic Testing I	4.5
QAL126	Ultrasonic Inspection & Recording Practices	2.0
QAL224	Ultrasonic Testing II	4.5
QAL103	Governing Technical Documents for NDT	2.0
ENL201	Technical & Professional Communication	3.0
TOTAL CREDITS		16.0

Fourth Semester		Credits
QAL227	Phased Array Ultrasonic Testing I	4.5
QAL228	Phased Array Ultrasonic Testing II	4.5
QAL229	Phased Array Inspection & Recording Practices	2.0
MSC106	Introduction to Metallurgy	4.0
ARP	Core Arts Perspective	3.0
or		
AAP	Core Applied Arts Perspective	3.0
or		
CDP	Core Global & Cultural Diversity Perspective	3.0
or		
HIP	Core Historical Perspective	3.0
or		
SSP	Core Social Science Perspective	3.0
TOTAL CREDITS		18.0

Penn College adds non-destructive testing welding degree

02.17.2022 [ENGINEERING TECHNOLOGIES](#), [FACULTY & STAFF](#), [STUDENTS](#), [WELDING](#)

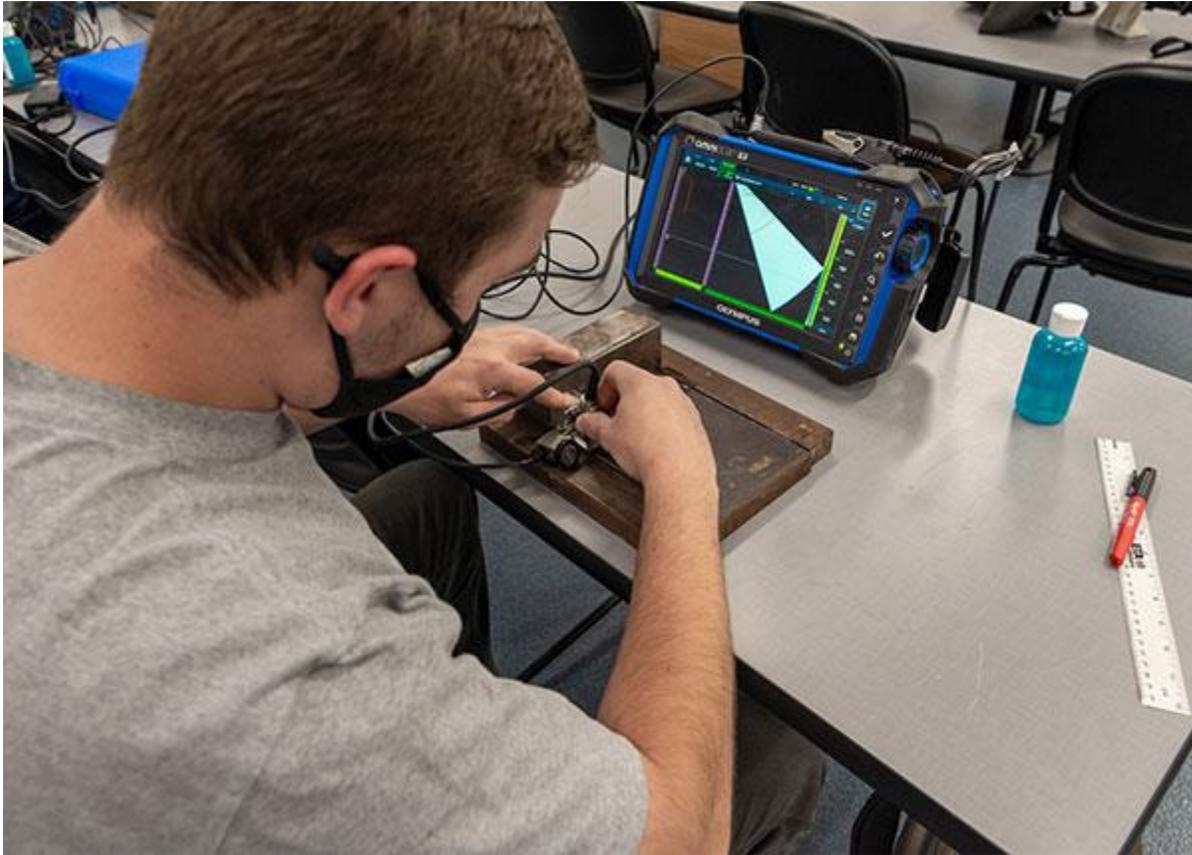
Mark N. Hurd found himself perched about 140 feet above the Hudson River on a cold January day. A steel basket attached to the multijointed arm of a snooper truck stationed on the massive bridge above provided both workspace and sanctuary for the Pennsylvania College of Technology instructor.

For hours, Hurd meticulously employed an ultrasonic testing unit to reveal the quality of butt welds on 10 flanges strengthening the bridge's steel beams. Those girders would soon support about 140,000 vehicles daily, traveling the 3.1 miles connecting South Nyack and Tarrytown, New York, just north of Manhattan.

"It's like being an industrial doctor because many of the testing processes, such as ultrasound and radiography, were originally used in the medical field," Hurd said in describing his work as a quality control inspector at the Tappan Zee Bridge (Governor Mario M. Cuomo Bridge). "I've been in this business for over 30 years, and there's not a week that goes by when I don't learn something new or face a new challenge. That's what keeps it exciting."

Penn College is providing a career pathway to that excitement with an associate degree in non-destructive testing. Offered for the first time this fall, the two-year program will combine hands-on welding experience in the college's 55,000-square-foot lab with exposure to several **NDT** processes, including ultrasonic and radiographic testing.

Appendix C – PCToday News Article (continued)



“We have offered **NDT** classes since the mid-1980s, but we felt a degree was the next logical step in growing the college’s welding program,” explained instructor Michael J. Nau. “Weld inspection, quality assurance and **NDT** go hand-in-hand. Industry is asking for more trained **NDT** professionals.”

Nau and James N. Colton II, assistant professor of welding, developed the new major’s curriculum, as well as two **NDT** competency credentials for current professionals. They were backed by a three-year, \$600,000 National Science Foundation grant devoted to advanced technology education in fields that drive the economy.

“There is a shortage of training programs despite strong industry demand for **NDT** technicians. Our new degree addresses both of those realities,” said Bradley M. Webb, dean of engineering technologies. “It will prepare students for excellent careers rooted in diverse industries like manufacturing, aerospace, construction and aviation.”

NDT professionals help prevent injury or loss of life by ensuring that infrastructure industries meet quality and safety assurance requirements. They do so by employing

Appendix C – PCToday News Article (continued)

various noninvasive technologies to test the soundness of structures, vehicles and vessels.

“All that welding, framing and tubing needs to be inspected. Everything gets inspected,” said Hurd, a certified American Society for Non-Destructive Testing Level II inspector. “You can be an inspector of the raw material before it’s made into a product. You can be an inspector of a product during different stages of its development. You can be an inspector of a product once it’s placed in service to ensure it’s functioning properly.”

Hurd has examined a wide range of material in myriad environments, from the comforts of the manufacturing floor to the frigid Tappan Zee Bridge, which was the largest design-build transportation infrastructure project in U.S. history when it opened in 2017. His employer at the time – High Steel Structures LLC – provided 110,000-plus tons of structural steel for the project.

“It was so cold I had to mix the coupling fluid with RV antifreeze so it didn’t freeze,” he smiled.

During ultrasonic testing, coupling fluid facilitates the transmission of sound waves from a transducer into the sample. The transducer converts the sound waves’ “echo” into electrical energy that is used by a computer to produce an interior image of the sample. In Hurd’s case at the bridge, the images revealed that all the butt welds on the flanges were within code.

“To be a good inspector, you have to have passion for it. It’s a major responsibility. You have to be very conscientious and understand the acceptance standards before you even do an inspection,” said Hurd, who is certified in several **NDT** methods.

Exposure to a variety of testing processes and practical welding experience will be hallmarks of the new **NDT** major at Penn College, according to Nau.

“Certain welding processes have specific flaws associated with them. The students will be able to identify these flaws, evaluate them and pass or fail them using various **NDT** processes,” he said. “Students’ classroom and training hours for each **NDT** process will also count toward their ASNT certification. We feel that this will give students a definite advantage going into industry.”

Anticipated job titles for graduates include **NDT** technician, phased array/UT inspector, quality control technician and assistant radiographer.

“There will be so many avenues and job possibilities,” Hurd said.