

**Eastern Center for Arts and Technology**

**Program Review**

**Final Report**

**WELDING TECHNOLOGY**

**2018**

**Occupational Advisory Committee Members**

Steven Catherman, Sr.	Contractor
John Ferry	Student Representative
Neil Goldberg	Welding Engineer
Jason Hammer	Former Student Representative
Sam Hirlehey	Supplier
Paul Lowry	Contractor
Warren Marley	Foreman
Ray Saccarelli	Welding Engineer
Jason Tucker	Journeyman

**Executive Advisory Committee Representative**

Earl Saurman	Abington Police
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### **Occupational Data Analysis for Welding Trades Program Review**

Data from the O-Net Online occupational data report (51-4121.06) indicates that welders, cutters and welder fitters held approximately 398,000 jobs in 2014. Opportunities for these workers are projected to grow to 2% to 4%, which is slower than average. These numbers are in contrast with the projects from the American Welding Society (AWS) which predict that the U.S. will need approximately 372,664 welding professionals by 2026. Jobs are concentrated in the manufacturing and construction areas; however, advanced manufacturing technology has expanded the opportunities for welders. Many of these opportunities require welders that are highly trained, highly educated and have specific credentials to ensure quality work with new materials in the fields of aerospace, automotive, electronics, oil and gas, and shipbuilding industries.

The median wage for all welders national in 2016 was \$39,390 per year. The rate for welders varies widely as do the specific trades welders work in. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than \$26,800, and the highest 10 percent earned more than \$62,100 (Dept. of Labor, Bureau of Labor Statistics; <https://www.bls.gov/ooh/production/welders-cutters-solderers-and-brazers.htm#tab-5>).

Locally, the manufacturing industry is steady and provides numerous opportunities for welders. The Marcellus shale region is continuing to hire pipe welders at wages that are encouraging tradesmen to relocate to that area for the higher wages paid for that work which in turn has opened up the local jobs to entry level welders. Many local (Montgomery County and Philadelphia area) welding trades related unions are seeing a shortage and are recruiting entry level welders.

### **Program Data Analysis for Welding Trades Program Review**

Data for enrollment and completion did not on average meet the goals although, for the most part, the data was within 10% of the goal and was in line with Eastern averages for all programs. The drop in the completion rate is explained by the new instructor's efficient documentation and assessment of students' ability to adhere to safety rules, students' ability to perform practical skills and students' ability to meet academic standards set forth in the program. The overall expectations and standards for student performance in the program has increased, aligning with what the OAC members believe to be crucial in producing quality welding graduates. The OAC stressed a pertinent need for quality workmanship and work ethic and those expectations are being met within the program now.

Data for attendance, retention, placement and industry certification exceeded the goals set forth by Eastern. Welding attendance increased by 2.1% from the previous year, whereas the overall attendance rate for Eastern dropped from the 15-16 school year to the 16-17 school year. The welding retention rate increased by 9.7% from the previous year, and is overall higher than all the data the program's retention rate had since 2012. The placement rate increased by 15.1% from the 2015 year, and is up 36.3% from the 2014 year. Overall, Eastern's placement rate for 2015 compared to 2016 did not increase. The industry certification rate for the welding program is up 46.2% from 2016 to 2017. From 2015, the rate is up 80%. This is a very significant increase in the amount of students earning welding industry certifications. The overall increase for industry certifications across all programs at Eastern from 2015 to 2017 was 36.6%.

NOCTI scores have been exceptional for the past two years. There was a dip in the scores in 2015 when the new instructor took responsibility of the program; however, since that point, NOCTI scores have been at a 100% advanced rate for both practical and written tests for 2016 and 2017. Eastern's 2017 "competency +" rate was at 88% for the 2017 year and 85.8% for the 2016 year. The welding NOCTI scores far exceed the average for the school. It should be kept in mind that Eastern's welding program is a two-year program while most CTC schools in the area are three years.

NOCTI data from the written portion of the assessment (pre and post-test) reflects that the areas of lowest achievement are Arc Cutting Process, Physical Characteristics and Mechanical Properties of Metals, Oxyfuel Cutting and Shielded Metal Arc Welding. The OAC recommends that emphasis be placed in these areas with the support of audiovisual aids and more hands-on application, particularly in the areas of Arc Cutting and Physical Characteristics and Mechanical Properties of Metals.

### **Program Specific Questions – Welding Technology**

*What are the current and/or new industry certifications available for students in the program?*

Welding certifications for the most part are governed by two separate codifying bodies: ASME (American Society of Mechanical Engineering) and AWS (American Welding Society). AWS is the code that is associated with much of the building industry while ASME is the prevalent governing body in the process industries. Certification in the welding industry has traditionally been the

responsibility of the employer with welders having to certify every time they change employer, add a new process or position, or sometimes even when welding at a new client site. The employer would qualify a procedure and its associated quality assurance, and then the welder would certify to the qualified procedure. In recent years, AWS has begun publishing prequalified procedures, and there are testing labs that will certify welders to those procedures, however; there is no guarantee that an employer will accept these certifications. In fact, most employers continue to recertify newly hired welders at the time of employment. That being said, demonstrating that one has been certified before (even if the employer intends to certify in-house) may make a prospective hire more attractive to that employer and increase their chance of being hired. As of February of 2017, the welding instructor at Eastern is a CWI (Certified Welding Inspector) under the AWS code D1.1 and once a partnership is made with WTTI (Welder Testing and Training Institute), the welding instructor will be able to supervise/facilitate welder qualification tests at Eastern. The partnership is referred to as a RTF (Remote Testing Facility), and it ensures quality control over machine calibration and testing materials, ethics of supervising testing, and both destructive and nondestructive testing of completed test plates. It should be pointed out that this prequalification model exists only under the jurisdiction of AWS and does not exist in ASME.

***Environmental protection is an increasing factor in the planning and conduct of many businesses. What are the consideration that must be addressed in the curriculum to facilitate these concerns? (i.e. OSHA regulations, safety concerns, chemical usage and disposal, and recycling of materials)***

Eastern is currently moving away from thoriated tungsten for GTAW (which are radioactive). The ventilation system in the Eastern weld shop was replaced last school year (2016-2017) and meets requirements for air quality control. Live air respirators and body cooling suits are starting to increase in usage, but primarily as productivity enhancing changes as opposed to requirements, but it does not seem like these measures will be necessary or would improve the training at Eastern. Environmental and safety upgrades have been addressed since the new instructor took over the program in 2015. These include: storing all chemicals in a firesafe chemical cabinet that is in a room that can be locked, acquiring and using an oily waste can to store and discard rags that may be flammable, ventilation upgrades, and a more efficient inventory control of the metals used for welding (i.e., less waste, more efficient material supply/usage control, more recycling).

***Are there any post-secondary opportunities (dual enrollment, articulations) for graduates of the program?***

Eastern does not have any dual enrollment programs, but it does have articulated credit agreements with nine Pennsylvania Colleges (see attachment 1). A student's successful completion of the Eastern Welding Technology program earns three credits at Thaddeus Stevens and up to 18 credits at Northampton County Community College. Eastern also has an agreement with Penn College of Technology to augment graduates training to complete a three year program.

### **Industry Trends**

The welding industry is requiring more of welders than it historically has. Welders must be able read prints, problem-solve, troubleshoot, inspect welds and complete quality control, run multiple welding processes, complete fit-up and layout, fabricate, etc.

The welding OAC stresses that many industry trends concern the process of Gas Tungsten Arc Welding (GTAW). The use of a ER6010 root pass on both pipe and plate applications is being replaced by a GTAW root pass. This means that welders who work predominantly with the Shielded Metal Arc Welding (SMAW) process need to also be proficient with the GTAW process.

The GTAW welding process is seeing the largest increase in advances currently. The use of orbital welders, as well as semi-automatic GTAW processes are becoming popular and very efficient. Historically, GTAW has been a slower and more selective welding process; however, industry advances are making it more attractive to manufacturers. The hot wire TIG (GTAW) process is a further development of mechanized TIG. The high deposition rates are achieved in combination with the first-class quality traditionally expected from TIG processes. This process is in demand for welding with offshore pipeline, cross country pipeline, ship yards, piping fabrications for modules construction and petrochemical industries.

### **Recommendations**

The welding OAC recommends a stress on quality control and welder workmanship. This is needed across all welding processes. The welding industry, more than ever before, demands that a welder be a well-rounded, highly skilled tradesman. This includes the ability to perform precise, high quality welding on nonferrous materials such as stainless steel, aluminum, titanium, etc. The committee recommends the purchase of welding machines that are versatile and that can accommodate these processes. A GMAW machine capable of pulsed spray transfer could be one addition. Nearly all of the welding machines in the shop are large and not portable. The committee would like to see more of a variety

of welding machines, and more current ones at that. Machines are getting smaller and more compact, and an addition of a Millermatic (211) would provide students with an opportunity to use such a machine.

Welders are responsible for more than just “performing the task”; they need to be able to troubleshoot, problem solve, think critically, and work independently while maintaining the highest standard of weld quality assurance. The committee recommends that the welding program begin doing destructive testing on welds as a way for students to participate more authentically and meaningfully in the welding inspection process. The committee recommends that the welding program purchase equipment and supplies to perform macro etching. The committee also recommends that the welding program purchase a coupon bender for the Scotchman Ironworker shear, or a free-standing coupon bender. In addition to these destructive testing methods, the committee recommends that visual inspection testing equipment, such as fillet gauges and weld profile gauges, be purchased and used regularly in the program.

The second recommendation is that of workforce preparedness that specifically addresses fundamental skills such as measuring, competent ability to use industry tools, layout and fit-up, and strong work ethic skills. The welding OAC believes that students graduating from the program should have strong skills regarding use of measuring tools, understanding of dimension tolerance, proficient ability to read blueprints and weld prints, and knowledge of metallurgic properties. The program should be producing students who have a solid concept of skills and traits that employers find desirable, such as punctuality, attitude, ability to follow instructions, desire to succeed, etc. One area of the program that needs to grow is the area of fit-up and layout. The committee would like to see more jig and fixturing, with students both making the jig/fixture, and simply using one that has been set up for them. This would mimic a real shop environment. The purchase of a portable fixturing station is recommended and would allow students to learn how to set up fixtures, as well as help them problem-solve and thinking critically and efficiently.

The third recommendation is to expand opportunities for learning in the areas that need improvement according to NOCTI data. While the task of addressing Arc Cutting has been resolved by the recent purchase of a welder to be used for Carbon Arc Cutting (CAC-A), the Physical Characteristics and Mechanical Properties area needs to be resolved. The OAC recommends more practical activities that can demonstrate the metallurgic properties of metals, including use of milling and lathing processes where applicable. They feel that the metallurgy theory behind

this subject area must be backed up with practical activities that provide exploration and critical thinking. The committee recommends that more tooling be purchased in order to utilize the vertical mill to teach metallurgy. The committee also recommends the purchase of more current diverse equipment. They would like to see the use of a beveling tool in the shop (we currently use a grinder or a oxyfuel cutting track cutter). They also stressed the definite need for more updated welding machines, such as a Miller Dynasty and a Lincoln.

Lastly, the committee recommends that more industry certifications be available to students in the program. Currently, OSHA-10 is the only available certification. It is recommended that other safety certifications, such as S/P2-Welding, be considered. This is a computer based program and the committee recommends that the welding program have better access to technology devices, such as tablets, laptops or computers. The committee also strongly recommends that Eastern partner with WTTI in order to become a Remote Testing Facility (RTF). This would allow the instructor, who is now a CWI (Certified Welding Inspector), to provide an opportunity for students to graduate with an AWS D1.1 certification. Earning this welding certification would provide graduating students with more welding employment opportunities and higher wages.

### **Summary**

Welding technologies are a critical trade in the construction, manufacturing and other industrial employment sectors. In particular, construction and infrastructure projects do not lend themselves to outsourcing and are expected to provide a steady need for welders in the future. The current retirements of a generation of welders coupled with the decreased emphasis in trades education over the last few decades are predicted to result in a shortage of approximately 350,000 welders in the near future. Welding remains a well-paying, viable trade in the foreseeable future. Eastern's welding program effectivity specializes in developing basic practical and soft skills targeting entry level employment.

## Implementation Timeline

### Phase One-2018-2019

Miller Dynasty welder (replacement)

- 280 series with wireless foot control – \$6836.00

Lincoln welder (replacement)

- Invertertec 350 Pro – Factory Model – \$6861.25

Total \$13,697.25

### Phase Two-2019-2020

Beveling tool

- Metabo – \$1800.00

Vertical mill tooling

- Clamping kit – \$160.00
- Collet set – \$150.00
- Vise – \$150.00

Total \$2,260.00

### Phase Three-2020-2021

Dye penetrant testing supplies/equipment

- Magnaflux kit – \$136.00

Macro etch testing supplies/equipment

- Silicone carbide abrasive discs – \$30.00
- Aluminum oxide polish – \$30.00
- Etchant, mild steel – \$170.00
- Etchant, stainless – \$55.00
- Etchant, aluminum – \$60.00
- PPE – 30.00

Visual Inspection supplies/equipment, *Galgage.com*

- Multi purpose welding gauge – \$85.00
- Electronic depth/pit gauge – \$70.00
- Combo welding gauge – \$106.00
- Brim Cam gauge – \$130.00
- Manual pit depth gauge – \$65.00
- Skew T-Fillet gauge – \$140.00
- Weld profile gauge – \$45.00
- 12 piece fillet weld gauge – \$85.00
- WTPS Gauge – \$70.00
- Mag light – \$35.00

Scotchman Ironworker punch set (attachment)  
- Deluxe punch and die package – \$1500.00

Scotchman Ironworker coupon bender (attachment)  
- \$1686.00

Total \$4,528.00

**Program Review Total: \$20,485.25**

Eastern Center for Arts and Technology

WELDING TECHNOLOGY

Program Review Implementation Status

October 2018

ITEM	DUE DATE	STATUS
Miller Dynasty welder (replacement) 280 series with wireless foot control	2018-19	
Lincoln welder (replacement) Invertertec 350 Pro-Factory Model	2018-19	
Beveling tool-Metabo	2019-20	
Vertical mill tooling-Clamping kit, Collet set and Vise	2019-20	
Dye penetrant testing supplies/equipment-Magnaflux kit	2020-21	
Macro etch testing supplies/equipment -Silicone carbide abrasive discs -Aluminum oxide polish -Etchant, mild steel -Etchant, stainless -Etchant, aluminum -PPE	2020-21	
Visual Inspection supplies/Equipment, <i>Galgage.com</i> -Multi purpose welding gauge -Electronic depth/pit gauge -Combo welding gauge -Brim Cam gauge -Manual pit depth gauge -Skew T-Fillet gauge -Weld profile gauge -12 piece fillet weld gauge -WTPS Gauge -Mag light	2020-21	
Scotchman Ironworker punch set -Deluxe punch and die package	2020-21	
Scotchman Ironworker coupon bender	2020-21	