

STATE OF THE WELDING INDUSTRY REPORT:  
**EXECUTIVE SUMMARY**



 **Weld-Ed**

National Center for Welding Education and Training

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# Briefing Summary on the “National State of the Welding Industry Report”

## *The Welding Industry continues to be a critical component of manufacturing worldwide.*

Durable goods manufacturing industries in which welding is a critical enabling technology account for 90% of total U.S. durable goods value of production<sup>1</sup>. It is an industry that continuously evolves from a technology, processes and materials perspective and one which requires on-going training for its practitioners as well as for those who teach welding at all levels.

In 2007, the American Welding Society and several companies that rely heavily upon welding worked with representatives from Lorain County Community College, Ohio State University and several other community and technical colleges in the U.S. to seek and receive funding for the creation of the National Center for Welding Education and Training from the National Science Foundation’s Advanced Technological Education funds. The four year funding that was awarded established the National Center in the Nord Advanced Technologies Center at Lorain County Community College in Elyria, Ohio. The Center began operations as the “National Weld-Ed Center” in July 2007.

Weld-Ed brings together the American Welding Society (AWS) and other industry partners such as Lockheed Martin and Lincoln Electric, Lorain County Community College, Texas State Technical College – Waco, the Pennsylvania College of Technology, the North Dakota College of Science, Chattanooga State Community and Technical College, Honolulu Community College, Yuba Community College, Illinois Central Community College, the Ohio State University and Weber State University to accomplish its mission.

<sup>1</sup>Welding-Related Expenditures, Investments, and Productivity Measurement in U.S. Manufacturing, Construction and Mining Industries, May 2002, French, Page 7



## Weld-Ed Vision

**Weld-Ed is a national partnership of colleges, universities, professional societies, government, and private industry committed to increasing the number and quality of welding and materials joining technicians to meet industry demand.**

## Weld-Ed Mission

**Weld-Ed strives to improve the quality of education and training services to address the hiring and professional development needs of the welding and materials joining industry.**

# Employment Projections



## The Center's Goals are to:

- **Increase the number of welding technicians to meet the on-going workforce needs**
- **Promote comprehensive reform of welding education and training**
- **Promote and enhance faculty professional development and continuing education for welding educators.**

One of the objectives of the current Weld-Ed NSF ATE funding was to establish a National Skill Panel (NSP) for the Welding Industry that would explore and confirm the urgent needs for welding technicians along a welding career pathway that they helped define. The NSP was composed of welding industry leaders, association representatives from AWS and the National Association of Manufacturers, leaders from the community college movement at the national level, community college leaders, and government representatives.

During the 24 month tenure of the NSP they explored a variety of different options for gathering definitive information regarding the needs of the welding industry as a whole to determine and recommend strategies to address the projected shortage of welding professionals at all levels, especially welding technicians. They commissioned three studies that resulted in publications that were produced by JBS International, Inc. under contract to Weld-Ed. The first was "The Welding Industry: A National Perspective on Workforce Trends and Challenges" (June 2008), the second report was "The Welding Industry: Trends and Challenges in Education and Training (2009)" and the third "The Welding Industry: A Regional Perspective on Workforce Trends and Challenges" (2008). These reports coupled with anecdotal information gathered throughout the Skill Panel process and further data collection through the use of Economic Modeling

Specialists Inc. (EMSI) labor market information software and their staff have resulted in this publication "A National Report on the State of the Welding Industry" that was completed in May 2010 and made available to the general public in September 2010.

This report and its appendices represent the most comprehensive body of data that has ever been produced regarding the U.S. Welding Industry, its history, needs and what the future holds. While AWS has conducted a number of surveys over the past several decades about the industry, none was conducted that quantitatively looked at labor market data from traditional sources, from the industry itself and utilized economic modeling to gather a true picture of where the industry was in 2002, where it currently is in 2010 and where it is projected to be in 2019.

The results of a thorough examination of the labor market needs of the welding industry are somewhat deceptive, as they show a decline in the overall number of welding personnel from the period of 2002-2009. However, during that time there were consistently needs in different regions throughout the U.S. for up to 10% of the overall welding professionals to be replaced, predominantly due to retirements. An analysis of projected data that was gathered through the efforts of the NSP show that between 2009-2019 there will be a need for at least 238,692 new and replacement welding professional across the five existing Key Welding Standard Occupational Codes (SOC). The number may indeed be significantly higher when one considers the need for trained technicians and others who need hands on welding-related job training to successfully function in their respective jobs that do not roll-up into the statistical data for the five key SOC Code welding occupations.

Selected Occupations	Education Level
Materials engineers (SOC 17-2131)	Bachelor's degree
Engineering technicians, except drafters, all other (SOC 17-3029)	Associate's degree
Welders, cutters, solderers, and brazers (SOC 51-4121)	Long-term on-the-job training
Welding, soldering, and brazing machine setters, operators, and tenders (SOC 51-4122)	Moderate-term on-the-job training
Inspectors, testers, sorters, samplers, and weighers (SOC 51-9061)	Moderate-term on-the-job training

## National Occupational Overview

SOC Code	Description	2002 Jobs	2009 Jobs	2013 Jobs	2016 Jobs	2019 Jobs	02-19 New & Rep. Jobs	Current Median Hourly Earnings
17-2131	Materials engineers	24,328	23,395	24,207	24,994	25,837	10,771	\$39.11
17-3029	Engineering technicians, except drafters, all other	70,418	70,840	73,680	75,162	76,513	29,588	\$26.34
51-4121	Welders, cutters, solderers, and brazers	377,059	372,221	398,523	408,581	416,992	173,899	\$16.68
51-4122	Welding, soldering, and brazing machine setters, operators, and tenders	71,805	67,028	71,125	73,045	74,780	27,099	\$17.42
51-9061	Inspectors, testers, sorters, samplers, and weighers	532,889	434,554	431,076	430,593	430,849	161,438	\$15.37

Source: EMSI Complete Employment - 4th Quarter 2009

Between 2002 and 2009 there was a decrease in the workforce of 108,461 workers or 10.08% of the overall workforce. Projections indicate that there will be a rebound between 2009 and 2019 of 56,935 jobs or a 5.88% increase in the workforce during that period. This modest growth is a good overall sign for the industry and reflects a healthy welding industry. The figures for the new and replacement workers from

2002-2019 tells the story of the personnel needs of the welding industry for the five key SOC Codes. During that period, despite the decline from 2002-2009, there is a need for 402,794 new and replacement workers, or 37.42% of the overall workforce. These figures do not take into account any other occupations that require welding skills for workers in those 25 welding classifications that were identified in the first JBS National Report.

# Weld-Ed Regions

Weld-Ed consultants were able to work with team members from Economic Modeling Specialists, Inc. to develop a format for the national, regional and state welding industry reports that were contained in the National State of the Welding Industry Report. To assist the Weld-Ed partner institutions throughout the U.S., EMSI was asked to create regional data sets that were aligned with the U.S. Department of Labor's six regions. The regions are as follows:

**Region 1 – Boston** - CT, ME, MA, NH, NJ, NY, RI, VT, (PR and USVI not in data set)

**Region 2 – Philadelphia** – DE, DC, MD, PA, VA and WV

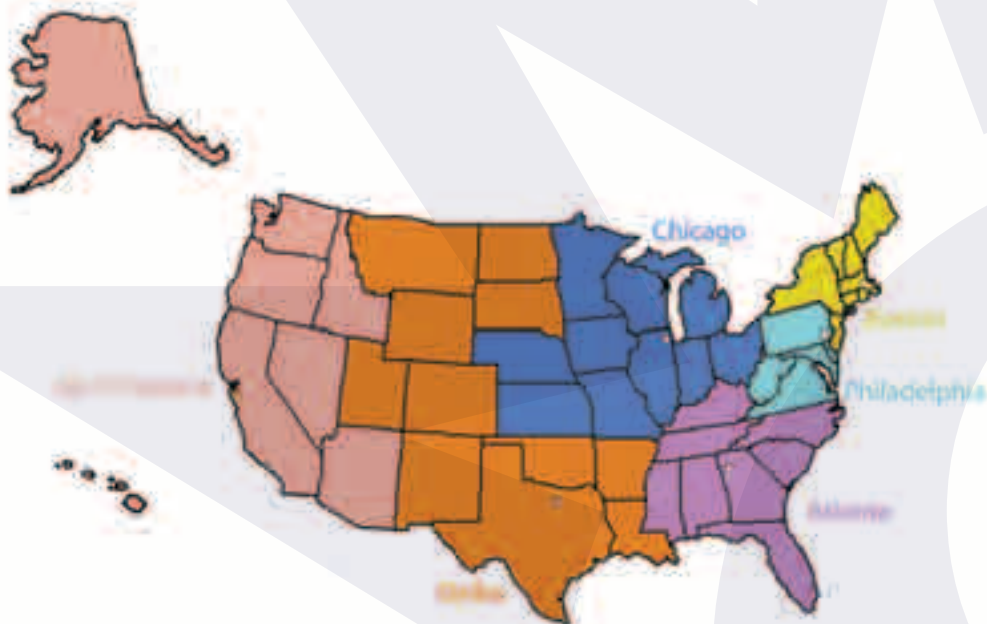
**Region 3 – Atlanta** – AL, FL, GA, KY, MS, NC, SC and TN

**Region 4 – Dallas** – AR, LA, NM, OK, CO, MT, ND, SD, UT, WY and TX

**Region 5 – Chicago** – IL, IN, MI, MN, OH, IA, KS, MO, NE and WI

**Region 6 – San Francisco** – AZ, CA, HI, NV, AK, ID, OR, WA and (Guam not in data set)

The regional data does not depict Puerto Rico, the U.S. Virgin Islands and Guam however the Philadelphia Region does include the District of Columbia.





# Employment Overview by Region - for the Five Key Welding Occupations

Year	Nation	Region 1 Boston	Region 2 Philadelphia	Region 3 Atlanta	Region 4 Dallas	Region 5 Chicago	Region 6 San Francisco
2002	1,076,498	108,194	97,167	205,585	176,784	322,025	166,743
2009	968,037	91,908	87,380	178,507	189,253	266,459	154,531
2013	998,611	89,377	88,521	185,355	206,152	268,454	160,752
2016	1,012,374	88,939	89,403	188,255	212,768	269,233	163,778
2019	1,024,972	88,844	90,329	190,911	218,306	270,039	166,543

Source: EMSI Complete Employment - 4th Quarter 2009

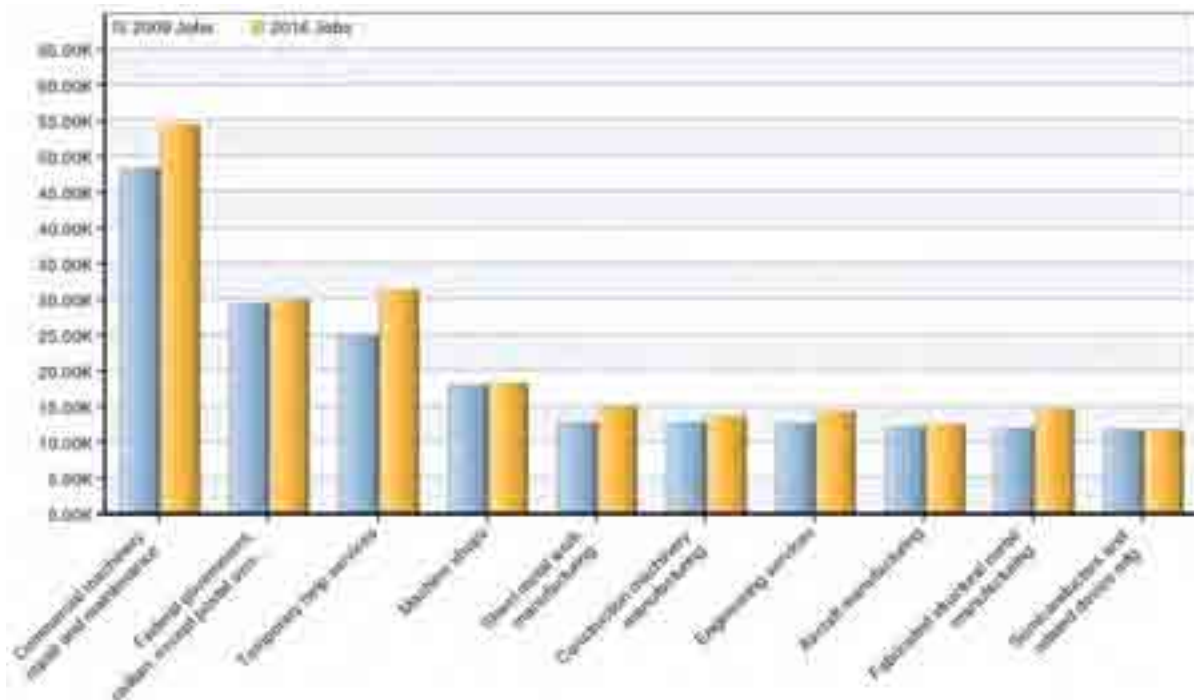
The data provided above shows several regions rebounding from the declines in the welding industry and manufacturing in general during the period from 2002 – 2009.

The projected increase in welding positions in the five key SOC Codes shows that on a national basis more than 50% of the jobs that were lost during that period will return by 2019, with most of the regions recovering at or near that rate. The Dallas Region is the exception as it has steadily grown in the five key areas since 2002 and is projected to grow by 29,000 more jobs between 2009 and 2019.



## Industrial Makeup

Depicts 2009-2016 Jobs Changes for the five key SOC Codes broken down by industry using the North American Industry Classification System Codes.





# Industrial Makeup

Depicts 2009-2016 Jobs Changes for the five key SOC Codes broken down by industry using the North American Industry Classification System Codes.

NAICS Code	Description	2009 Jobs	2016 Jobs	Change	% Change
811310	Commercial machinery repair and maintenance	48,335	54,316	5,981	12%
911000	Federal government, civilian, except postal service	29,359	29,924	565	2%
561320	Temporary help services	25,168	31,217	6,049	24%
332710	Machine shops	18,011	18,285	274	2%
332322	Sheet metal work manufacturing	12,739	15,023	2,284	18%
333120	Construction machinery manufacturing	12,697	13,644	947	7%
541330	Engineering services	12,656	14,288	1,632	13%
336411	Aircraft manufacturing	12,175	12,558	383	3%
332312	Fabricated structural metal manufacturing	11,937	14,672	2,735	23%
334413	Semiconductors and related device mfg.	11,737	11,712	-25	0%
541380	Testing laboratories	11,109	12,650	1,541	14%
336611	Ship building and repairing	10,484	11,991	1,507	14%
333132	Oil and gas field machinery and equipment	10,481	12,729	2,248	21%
333111	Farm machinery and equipment manufacturing	9,996	9,655	-341	-3%
333415	AC, refrigeration, and forced air heating	9,521	10,118	597	6%
326199	All other plastics product manufacturing	9,242	8,485	-757	-8%
336399	All other motor vehicle parts manufacturing	8,439	9,761	1,322	16%
336211	Motor vehicle body manufacturing	8,172	8,063	-109	-1%
930000	Local government	8,076	8,987	911	11%
213112	Support activities for oil and gas operations	7,850	9,686	1,836	23%
332321	Metal window and door manufacturing	7,823	6,846	-977	-12%
920000	State government	7,569	7,795	226	3%
236220	Commercial building construction	7,168	8,172	1,004	14%
561330	Professional employer organizations	6,687	7,093	406	6%
325412	Pharmaceutical preparation manufacturing	6,598	7,203	605	9%
336510	Railroad rolling stock manufacturing	6,554	6,582	28	0%
482110	Rail transportation	6,534	6,646	112	2%
332313	Plate work manufacturing	6,199	7,306	1,107	18%
336111	Automobile manufacturing	6,100	6,470	370	6%
551114	Managing offices	5,721	6,270	549	10%
541710	Physical, engineering and biological research	5,438	6,118	680	13%
332420	Metal tank, heavy gauge, manufacturing	5,413	6,855	1,442	27%
331111	Iron and steel mills	5,371	5,061	-310	-6%
336413	Other aircraft parts and equipment	5,253	5,991	738	14%
334511	Search, detection, and navigation instruments	5,194	5,322	128	2%
423510	Metal merchant wholesalers	4,984	5,559	575	12%
332323	Ornamental and architectural metal work mfg.	4,944	5,917	973	20%

Source: EMSI Complete Employment - 4th Quarter 2009

# Industrial Makeup

Depicts 2009-2016 Jobs Changes for the five key SOC Codes broken down by industry using the North American Industry Classification System Codes.

NAICS Code	Description	2009 Jobs	2016 Jobs	Change	% Change
311615	Poultry processing	4,868	5,113	245	5%
336370	Motor vehicle metal stamping	4,752	4,546	-206	-4%
493110	General warehousing and storage	4,748	5,684	936	20%
336612	Boat building	4,648	4,970	322	7%
339112	Surgical and medical instrument manufacturing	4,549	4,995	446	10%
332999	Miscellaneous fabricated metal product mfg.	4,524	4,789	265	6%
336214	Travel trailer and camper manufacturing	4,365	5,317	952	22%
336412	Aircraft engine and engine parts mfg.	4,340	4,258	-82	-2%
336350	Motor vehicle power train components mfg.	4,322	4,196	-126	-3%
237110	Water and sewer system construction	4,301	4,776	475	11%
332311	Prefabricated metal buildings and components	4,167	5,278	1,111	27%
332410	Power boiler and heat exchanger manufacturing	4,003	4,506	503	13%
336212	Truck trailer manufacturing	3,973	4,301	328	8%
334419	Other electronic component manufacturing	3,895	4,069	174	4%
423830	Industrial machinery merchant wholesalers	3,777	4,115	338	9%
561990	All other support services	3,723	4,411	688	18%
332431	Metal can manufacturing	3,646	3,244	-402	-11%
332116	Metal stamping	3,590	3,299	-291	-8%
541310	Architectural services	3,580	3,978	398	11%
336322	Other motor vehicle electric equipment mfg.	3,559	1,857	-1,702	-48%
339113	Surgical appliance and supplies manufacturing	3,523	3,603	80	2%
561310	Employment placement agencies	3,356	3,979	623	19%
336360	Motor vehicle seating and interior trim mfg.	3,344	3,906	562	17%
333319	Other commercial and service machinery mfg.	3,326	3,628	302	9%
237990	Other heavy construction	3,300	3,889	589	18%
221210	Natural gas distribution	3,290	3,284	-6	0%
213111	Drilling oil and gas wells	3,199	3,873	674	21%
541611	Administrative management consulting services	3,191	4,243	1,052	33%
333999	Miscellaneous general purpose machinery mfg.	3,155	3,307	152	5%
332439	Other metal container manufacturing	3,133	2,266	-867	-28%
311611	Animal, except poultry, slaughtering	3,115	3,200	85	3%
334418	Printed circuit assembly manufacturing	3,113	3,626	513	16%
425120	Wholesale trade agents and brokers	3,084	3,577	493	16%
332813	Electroplating, anodizing, and coloring metal	3,080	2,490	-590	-19%
336312	Gasoline engine and engine parts mfg.	3,041	2,354	-687	-23%
238122	Nonresidential structural steel and precast concrete contractors	2,994	3,692	698	23%

Source: EMSI Complete Employment - 4th Quarter 2009

# Industrial Makeup

Depicts 2009-2016 Jobs Changes for the five key SOC Codes broken down by industry using the North American Industry Classification System Codes.

NAICS Code	Description	2009 Jobs	2016 Jobs	Change	% Change
331511	Iron foundries	2,986	2,225	-761	-25%
812320	Drycleaning and laundry services	2,954	2,549	-405	-14%
423930	Recyclable material merchant wholesalers	2,935	3,215	280	10%
238222	Nonresidential plumbing and HVAC contractors	2,893	3,456	563	19%
333112	Lawn and garden equipment manufacturing	2,873	2,483	-390	-14%
334412	Bare printed circuit board manufacturing	2,837	1,191	-1,646	-58%
336414	Guided missile and space vehicle mfg.	2,831	3,055	224	8%
335314	Relay and industrial control manufacturing	2,780	3,010	230	8%
326211	Tire manufacturing, except retreading	2,758	2,104	-654	-24%
339950	Sign manufacturing	2,728	3,489	761	28%
332912	Fluid power valve and hose fitting mfg.	2,651	2,681	30	1%
333618	Other engine equipment manufacturing	2,593	2,386	-207	-8%
332618	Other fabricated wire product manufacturing	2,592	1,888	-704	-27%
332812	Metal coating and nonprecious engraving	2,564	2,817	253	10%
237120	Oil and gas pipeline construction	2,547	3,199	652	26%
335312	Motor and generator manufacturing	2,547	1,973	-574	-23%
238221	Residential plumbing and HVAC contractors	2,534	2,968	434	17%
238131	Residential framing contractors	2,467	1,862	-605	-25%
336112	Light truck and utility vehicle manufacturing	2,449	2,358	-91	-4%
334220	Broadcast and wireless communications equip.	2,405	2,588	183	8%
238292	Other nonresidential building equipment contractors	2,388	2,506	118	5%
311612	Meat processed from carcasses	2,386	2,569	183	8%
333922	Conveyor and conveying equipment mfg.	2,309	2,118	-191	-8%
333911	Pump and pumping equipment manufacturing	2,304	2,498	194	8%
332991	Ball and roller bearing manufacturing	2,296	2,190	-106	-5%
211111	Crude petroleum and natural gas extraction	2,282	2,542	260	11%
332996	Fabricated pipe and pipe fitting mfg.	2,257	2,602	345	15%
333514	Special tool, die, jig, and fixture mfg.	2,216	2,000	-216	-10%
323110	Commercial lithographic printing	2,138	1,798	-340	-16%
336330	Motor vehicle steering and suspension parts	2,137	1,435	-702	-33%
334513	Industrial process variable instruments	2,131	2,173	42	2%
236210	Industrial building construction	2,125	2,257	132	6%
334510	Electromedical and electrotherapeutic apparatus manufacturing	2,080	2,377	297	14%
336340	Motor vehicle brake system manufacturing	2,026	1,859	-167	-8%
332722	Bolt, nut, screw, rivet, and washer mfg.	2,020	1,845	-175	-9%
339999	All other miscellaneous manufacturing	2,012	2,228	216	11%
311421	Fruit and vegetable canning	2,010	1,916	-94	-5%



# Industrial Makeup

Depicts 2009-2016 Jobs Changes for the five key SOC Codes broken down by industry using the North American Industry Classification System Codes.

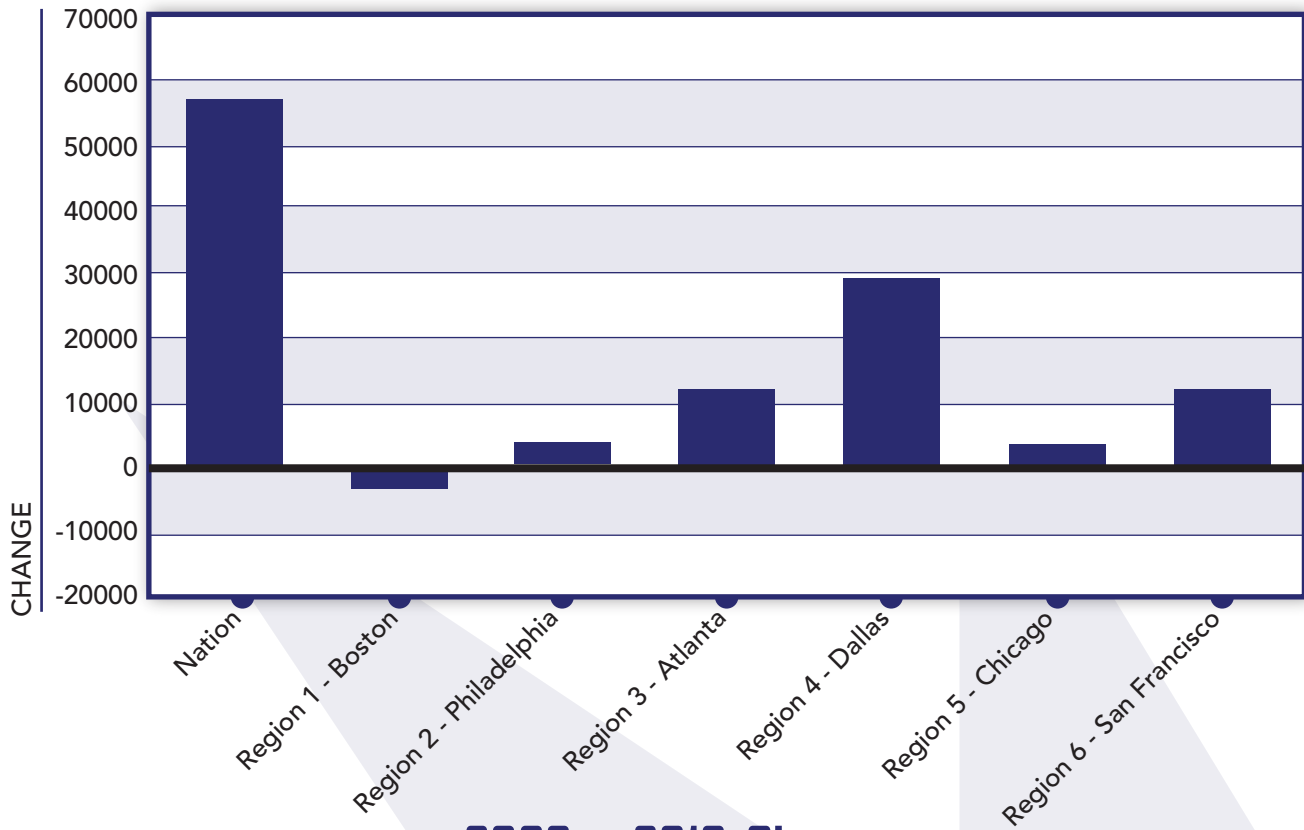
NAICS Code	Description	2009 Jobs	2016 Jobs	Change	% Change
334111	Electronic computer manufacturing	1,974	1,617	-357	-18%
324110	Petroleum refineries	1,972	1,878	-94	-5%
333131	Mining machinery and equipment manufacturing	1,935	1,676	-259	-13%
339116	Dental laboratories	1,906	2,084	178	9%
332721	Precision turned product manufacturing	1,879	1,586	-293	-16%
332911	Industrial valve manufacturing	1,865	2,074	209	11%
327320	Ready-mix concrete manufacturing	1,848	1,987	139	8%
811111	General automotive repair	1,839	2,141	302	16%
327215	Glass product mfg. made of purchased glass	1,839	1,838	-1	0%
337215	Showcases, partitions, shelving, and lockers	1,837	1,558	-279	-15%
811192	Car washes	1,834	2,306	472	26%
335313	Switchgear and switchboard apparatus mfg.	1,824	1,838	14	1%
238912	Nonresidential site preparation contractors	1,818	2,335	517	28%
322211	Corrugated and solid fiber box manufacturing	1,801	1,696	-105	-6%
326291	Rubber product mfg. for mechanical use	1,797	1,247	-550	-31%
331210	Iron, steel pipe and tube from purchase steel	1,792	2,096	304	17%
321113	Sawmills	1,771	1,506	-265	-15%
333924	Industrial truck, trailer, and stacker mfg.	1,763	1,783	20	1%
325211	Plastics material and resin manufacturing	1,763	1,727	-36	-2%
336991	Motorcycle, bicycle, and parts manufacturing	1,749	1,580	-169	-10%
332510	Hardware manufacturing	1,740	1,517	-223	-13%
423990	All other durable goods merchant wholesalers	1,739	2,000	261	15%
333912	Air and gas compressor manufacturing	1,727	1,950	223	13%
332111	Iron and steel forging	1,713	1,726	13	1%
325998	Other miscellaneous chemical product mfg.	1,711	1,684	-27	-2%
339920	Sporting and athletic goods manufacturing	1,711	1,514	-197	-12%
333414	Heating equipment, except warm air furnaces	1,706	1,705	-1	0%
335931	Current-carrying wiring device manufacturing	1,685	1,286	-399	-24%
336213	Motor home manufacturing	1,676	1,635	-41	-2%
311412	Frozen specialty food manufacturing	1,648	1,726	78	5%
221122	Electric power distribution	1,639	1,797	158	10%
221112	Fossil fuel electric power generation	1,624	1,491	-133	-8%
333411	Air purification equipment manufacturing	1,590	1,823	233	15%
336999	All other transportation equipment mfg.	1,586	1,838	252	16%
333996	Fluid power pump and motor manufacturing	1,562	1,569	7	0%
453310	Used merchandise stores	1,552	1,732	180	12%
333298	All other industrial machinery manufacturing	1,537	1,689	152	10%
238152	Nonresidential glass and glazing contractors	1,533	1,977	444	29%

Source: EMSI Complete Employment - 4th Quarter 2009

# 2009-2019 Change

## New Jobs Only - Does Not Include Replacement Openings

For each of the five key SOC Codes by Region.



# 2009 - 2019 Change

## New Jobs Only - Does Not Include Replacement Openings

SOC Code	Description	Nation	Region 1 Boston	Region 2 Philadelphia	Region 3 Atlanta	Region 4 Dallas	Region 5 Chicago	Region 6 San Francisco
51-9061	Inspectors, testers, sorters, samplers, and weighers	44,771	907	1,972	9,470	19,661	6,430	6,332
51-4121	Welders, cutters, solderers, and brazers	7,752	367	486	2,468	2,181	1,307	943
51-4122	Welding, soldering, and brazing machine setters, operators, and tenders	5,673	83	685	838	1,385	1,116	1,566
17-3029	Engineering technicians, except drafters, all other	2,442	124	238	328	757	272	722
17-2131	Materials engineers	(3,705)	(4,545)	(434)	(700)	5,069	(5,545)	2,450
	<b>Total</b>	<b>56,935</b>	<b>(3,064)</b>	<b>2,949</b>	<b>12,404</b>	<b>29,053</b>	<b>3,580</b>	<b>12,012</b>

# Economic Drivers

(global marketplace, increasing foreign competition, global economic downturn, and others)

The welding industry has been experiencing an economic downturn from an employment prospective from 2002-2009 with most Regions (based on packaging of states by U.S. DOL Regions) showing declines. During that period the five key welding SOC Codes showed an employment decline from 1,076,498 workers to 968,037 workers, representing a loss of 108,461 workers or 10.08% of the overall workforce.

During the National Skill Panel (NSP) process there was a great deal of concern about the rapidity of the decline in welding employment from January 2008 through January 2009, nationally as well as in the states where Weld-Ed partner educational institutions were located. Weld-Ed requested that EMSI provide a data run specifically to measure employment declines in the five key SOC Codes during that period nationally as well as in CA, ND, OH, PA, TN and TX. The seasonally adjusted job loss results for that period were: U.S. – 51,130 (5.0%); CA – 4,187 (4.19%); ND – 88 (2.71%); OH – 3,394 (6.15%); PA – 2,349 (4.89%); TN – 1,368 (5.61%); and, TX – 2,602 (2.51%). It should be noted that this special EMSI data run covered the period where the U.S. economy was in its deepest decline and job losses were at their highest level.

Despite the decline the data shows that nationally the five SOC codes will rebound from the 2009 lows to 1,024,972 workers by 2019, which represents an increase of 56,935 workers or a 5.88% increase in workers between 2009 and 2019. This data source can be found in the EMSI National Report Section of this report.

Despite the loss of almost 10% of the workforce as a result of the decline in manufacturing and the severe economic downturn from late 2007 until mid 2009, the industry remains healthy and the need for welders will continue to grow based on a rebound in the economy that is being led by the manufacturing industry during the first quarter of 2010 as well as the need to replace the aging welding workforce over the next decade.

**Demographic Influences (aging of workforce throughout the U.S., impact of rural flight on ability to fill welding positions and training availability, percentage of younger workers seeking employment in welding professions)**

The ability of companies that are involved in the field of welding to find qualified workers regardless of the economy over the past decade has become more and more difficult as the U.S. welding workforce has aged. AWS estimates that the average welding professionals in the U.S. is 56 years of age. This demographic supports the fact that almost 40% of the 1,076,498 people in the welding workforce in the five SOC Codes in 2002 will need to be replaced by 2019.

Another key demographic issue that was known by the welding industry and its talent development pipeline providers was that the ability to recruit young workers into the occupation has been difficult at best. The manufacturing industry as a whole has had difficulty in attracting youth and the welding industry has fared no better in their efforts to recruit youth. In part this is caused by the misperception that manufacturing and welding are dying industries and that there is no future if you chose to work in those fields. There is also the perception from parents, educators, and students that manufacturing and welding both occur in “dark, dank and dirty environments”. Few if any of these naysayer’s have ever seen a modern factory environment or a sterile workforce environment that includes welding. The other dilemma has been trying to overcome the stereotype that many parents instill in their children at an early age, “you are going to college, you are not going to work in an environment where you get your hands dirty”. Often times this attitude is based on the fact that the parent or their parent(s) may have worked in a manufacturing environment in the past.

Urban/suburban flight is also creating great difficulty for employers in rural areas as they try to attract young workers into manufacturing and welding positions. In some parts of the country more than 30% of the youth immediately leave the area after high school completion or successful completion of a GED. This flight makes it extremely difficult for the typical rural area’s talent development providers to recruit enough talent to meet the demands of local industry regardless of sector. Some rural areas of the country are looking



## Economic Drivers Continued...

at creative methods to attract young workers to offset the flight of youth from their areas. These methods have included working with industry to develop viable work experience or internship sites and also possible tax incentives for young workers and their families to move into rural areas.

### **Other Key Factors (impact of stimulus package, extraordinary steps taken by employers to retain critical welding personnel, etc.)**

Despite the economic declines from 2007 through mid 2009, the passage of President Obama's Stimulus package provided hope for the welding industry to begin to stem the decline in welding and welding related jobs and to put many of the laid-off workers back to work. While billions of dollars went toward projects that may have included welding related positions, there was no way to track the actual impact of projects that involved welding on the aggregate total of welding professionals who became re-employed in the field as the result of that funding. An attempt was made to measure the impact of the funding by analyzing which funding streams could have included welding or welding-related jobs. It was estimated that there was up to \$311 billion in funds that were available under the Stimulus initiatives that could have resulted in welding or welding-related employment with many of the projects being infrastructure related.

The question that was asked by the NSP was whether or not the Stimulus funds under the American Reinvestment and Recovery Act (ARRA) would produce enough welding and welding-related positions to offset the losses that had occurred in those areas from late 2007 through mid 2009. It was an important question that unfortunately could not be answered outright and could only be answered based on pure speculation. In the long-term, this question and its answer must continue to be examined in an effort to ascertain the true impact of the ARRA funded projects on the welding field, this will be especially important as it will impact the aggregate total of new and replacement workers that may be needed to fill the projected vacancies in the five welding SOC Codes

that are included in this study.

The ARRA funding was perhaps beneficial to laid-off welding professionals, their employers and the welding field in general, as ARRA provided lengthy extensions of unemployment compensation benefits that may have resulted in some welding professionals not seeking employment outside of their chosen field. During 2010, Congress has approved extensions in unemployment compensations benefits that may further enable laid-off welding personnel to remain available for recall by their previous employers or other employers who employ welding personnel.

During the first quarter of 2010, the manufacturing sector has shown the greatest gains in the U.S. economy and contracts are up, which potentially is a good sign for many of the laid-off workers to return to the welding profession. A March 2010 report from Markit indicated that, "The sharpness of the rebound, reflected in the indexes created by the Institute for Supply Management in the United States and recreated by Markit in other countries, that the American economy is not in-line for a slow recovery, as happened after the two most recent downturns in the early 1990s and early 2000s but a more rapid recovery. That strength was also reflected in the gross national product estimate for the final quarter of 2009, with an annual rate of growth of 5.7%, the fastest of any quarter in more than six years. And earlier this month (March 2010), the U.S. Department of Labor reported that the unemployment rate fell to 9.7% in January. And in March 2010, the U.S. Department added that while the entire economy lost 20,000 jobs, manufacturing employment grew by 11,000 jobs, the first such gain in three years."<sup>5</sup>

<sup>5</sup>New York Times Article, March 21, 2010

# JBS Education, Training Study and Summary

This report, completed in 2009, focused on the education and apprenticeship programs that prepare future workers for welding and/or welding technology occupations. It provides qualitative information about secondary, postsecondary, and apprenticeship programs and quantitative estimates of program enrollees and completers.

**A major finding is the variance in content and length of training required for successful completion of a program of study at secondary and postsecondary institutions. Individual states have curriculum requirement standards that apply to the delivery of Career and Technical Education (CTE), but there is no national standard. This fact supports the need and desirability of developing accreditation standards for welding and welding technology programs.**

Also, given the many different types of welding processes: shielded metal arc welding, gas metal arc welding, gas tungsten arc welding, to name a few, there is no core set of knowledge and skills that define what should be taught in a welding program. Programs vary in the focus and amount of time spent on these subjects.

Another interesting finding from the Internet research and supported by the survey responses is that programs tend to provide students with the training needed to apply welding skills in the dominant industries in the geographic region. This is true for occupationally specific welding programs as well as for instances where welding is taught as part of another broader program. For example, Ohio, a state with high industry concentrations in Fabricated Metals and Machinery Manufacturing, includes welding instruction in the Manufacturing



Technology program.<sup>2</sup> This is especially notable at the secondary level. Of the 603 secondary institutions responding to the survey, 232 indicated that Welding/Welding Technology is taught as a part of another program. Those program titles vary widely, but tend to include agricultural machinery repair, automotive repair, industrial processes, machining and metals, and structural work.<sup>3</sup> Note that enrollment and completer data were not collected for such programs.

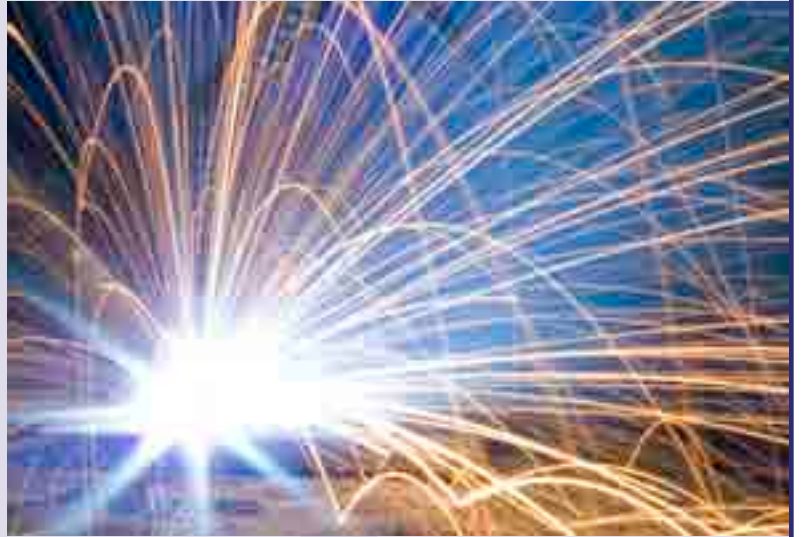
Simple counts of program enrollments and completers do not provide an accurate picture of the supply of workers. When respondents were asked “Will completers of the program be qualified as entry-level Welders, Welding Technicians, Welding Engineers, or Other” 91% of the secondary institutions responded that program completers would qualify as an entry-level welder; 4%, as a welding technician; and 5% responded ‘Other.’ The responses for postsecondary institutions indicated that 84% would qualify as entry-level welder; about 2% welding engineer; 12 % welding technician; and 2 % ‘Other.’ These responses would reduce the total estimated supply accordingly.

Finally, registered apprenticeship programs have a documented history of success in providing skilled workers for the trades. There are very few reported programs in the welding and welding technology fields. Developing registered apprenticeship standards and programs would be a potential strategy for enhancing the numbers of qualified workers.

<sup>2</sup>The Welding Industry: Workforce Trends and Challenges; <http://www.weld-ed.org/NR/rdonlyres/F75C7675-0F14-4492-9969-0F3C63F02AFD/4573/TheWeldingIndustryregionallocalreport.pdf>

<sup>3</sup>See Table 17 in Appendix D for additional detail.

## JBS Education, Training Study and Summary Continued...



The challenges presented to the JBS research team to identify resources of data, collect existing enrollment and completer numbers, and analyze the results are not easily overcome. The findings show that there are no existent sources of data to replicate a process of collecting information about the future supply of workers other than to conduct an annual survey. The AWS School Locator database of institutions provided a valuable resource for the survey effort, but it does not contain a 'universe' of schools. Comparison of the institutions included in the AWS database to the institutions in the Integrated Post Secondary Education Data System (IPEDS) survey and to other sources of information about welding schools showed that the number of institutions by type differed. Additional research to identify and add schools that offer welding instruction to the AWS database would improve future survey efforts.

Data collected through the survey provides a baseline of enrollment and completer information. Annual data collection would provide an ongoing measure of program offerings and outputs. Of the 982 institutions surveyed, 120 secondary schools and 91 postsecondary schools indicate that they no longer offer a welding program. An annual data collection process would be useful to identify new programs as well as programs that are no longer offered.

This report attempts to inform the process undertaken by the Weld-Ed National Skills Panel to identify the education and training programs that prepare welders and welding technicians, and the numbers of students in the welding supply pipeline. The enrollment and completer figures extrapolated from the survey sample provide estimates of program enrollments and completers for PY 2007-2008 at a national level and at the state level for the Weld-Ed partner school regions.



# Next Steps/Recommendations from the JBS Welding Education and Training Research

*The research undertaken to develop this report revealed the challenges in collecting data that presents an accurate picture of the supply of qualified welders.*

Due to variations in education and training programs, the welding industry would benefit from the development of national accreditation standards for Welding/Welding Technology programs. The development of a core set of knowledge and skills used throughout the U.S. would provide confidence that program completers have a set of skills which qualify them to be an entry-level welder.

As the JBS report indicates, there are very few reported apprenticeship programs in Welding/ Welding Technology, though apprenticeship is frequently utilized in occupations which use welding as a skill. Developing registered apprenticeship standards and programs would be a potential strategy for enhancing the numbers of qualified entry-level welders.

Research findings also show that there are no available sources of completer data which compare in value to



the output of an annual survey. An annual survey of secondary and postsecondary schools would provide an ongoing measure of program offerings and outputs which would be especially helpful in identifying new welding programs and schools as well as programs that are no longer offered.

The findings in this document are intended to serve as a resource for educational policy makers, program planners and developers, and career development counselors and facilitators to guide and enhance workforce development activities in the welding industry.

## Identifying the System's Capability and Capacity via the Welding School Locator

In the future the Welding School Locator will become a primary conduit for tracking changes in the talent supply pipeline for welding personnel and for measuring the overall capacity of the system. The locator currently contains more than 3,700 school records. The Welding School Locator site collects data that can be used to aggregate the types of training available on a local, state, regional or national level, the number of students enrolled in the programs,

the number of projected program completers and whether or not the program is directly tied into SENSE Certification Levels I, II or III. The data that is collected will enable AWS and Weld-Ed to monitor the talent development supply pipeline and suggests adjustments to meet the projected industry need in an area as well as the ability to suggest states or regions where employers could recruit students who are due to be completing a program.

# Identifying the Gap between Employer Needs and the Supply Pipeline

By annually updating the EMSI data projections and then comparing those projections to the aggregate data in the Welding School Locator, AWS on behalf of the welding industry and Weld-Ed on behalf of the talent development pipeline can identify gaps that exist between the industry demand and the supply pipeline. Once those gaps are known it will require a joint effort between AWS and Weld-Ed to notify both the industry and the talent development providers about the gap and to recommend changes to remedy that situation(s).

The gaps that are identified will range from undersupply of skilled workers for certain welding related SOC codes to an oversupply in some areas. By monitoring this information closely recommendations can be made to the provider community that may lower or expand capacity to address the needs, alter the curricula or programs that are being offered, and potentially change the technological aspects of the training or the materials that are used in training.

It will be critical to the on-going partnership between AWS and Weld-Ed that the collection and analysis of



the annual comparisons of the supply and demand data be a priority for both organizations and that the information be disseminated widely to the welding industry as well as to the welding talent development providers. An annual survey of secondary and postsecondary schools would provide an ongoing measure of program offerings and outputs which would be especially helpful in identifying new welding programs and schools as well as programs that are no longer offered.

## Issues Impacting Program Enrollment

To ensure that program enrollment continues to grow to address the projected industry needs, it will be critical that a national strategy be developed and implemented to attract future welding personnel of all ages. The attraction strategy that is developed must address youth from K-12, youth in joint vocational school settings, adults who are employed, underemployed, unemployed or looking for new careers and special populations that are a subset of those groups such

as people with disabilities, women, minorities and veterans.

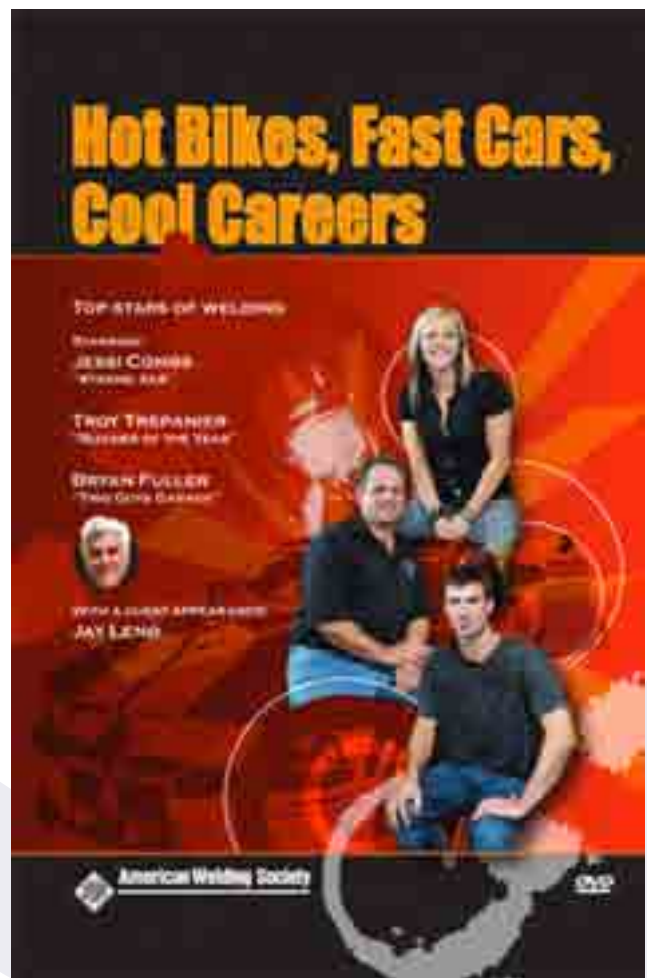
For an attraction strategy to succeed it must also address the misperceptions that exist regarding the welding industry especially among parents, teachers and counselors, in terms of working conditions, the stability of the job market and the health of the welding industry.

# National and Regional Internet and Print Efforts to Attract Students

The recruitment materials that have been developed by AWS over the past several years to attract youth to the welding industry appear to have been successful and have been strongly embraced by the youth who have viewed those materials. The materials include:

## “Hot Bikes, Fast Cars and Cool Careers”

A DVD developed by AWS for use in promoting careers in welding, stars Troy Trepanier, Jessi Combs, and Bryan Fuller who starred together in TLC’s “Overhaulin’”. The three stars of the video have continued to collaborate on cool custom builds and to promote careers in welding. In this video, they share their personal stories about getting into welding bikes, cars and trucks, and why people should consider great career in welding. These three young stars have joined AWS in its mission to recruit young people into the field. Throughout the video they encourage people to take a look at the impact that this fast-growing career can have on their life. The video also includes a guest appearance by TV host Jay Leno who is a motorsports enthusiast and car collector extraordinaire, who gives his own perspectives on why America needs more welders.



## “In Demand Magazine - Careers in Welding”

### An American Welding Society and Weld-Ed Publication Guiding Students to Career Opportunities

This joint publication of AWS and Weld-Ed provides career information to youth and adults who are interested in exploring careers in welding. This magazine offers job profiles, interviews, salary information, educational information and more for interested individuals to consider before choosing a career in the welding field.



## National and Regional Internet and Print Efforts to Attract Students Continued...

### “The Careers in Welding” website

[www.careersinwelding.com](http://www.careersinwelding.com)

The Careers in welding website was developed as part of the Weld-Ed NSF ATE Center contract and is the primary internet attraction tool for individuals who are interested in a career in welding. The site provides career information, industry news, company profiles, welding publications and other information including welding videos. The site targets students, welding professionals who want to upgrade their skills or explore welding career pathways and educators who are interested in promoting welding careers to students, parents and other interested parties.



**“The Invincible Iron Man” comic that was developed by AWS in cooperation with Marvel Comics to promote welding careers to youth**

More than 100,000 copies of this comic book have been distributed to youth in the K-12 setting throughout the U.S. A second version of the comic was released in connection with the second Iron Man feature film in May 2010. This comic has been well received and has successfully promoted welding careers to youth who otherwise may have never considered welding as a vocation or a career opportunity.

# Advancements in Welding

The following information on advancements in welding including application trends and new processes was contributed by David Beneteau, President, CenterLine Welding Products (MI). While a few welding processes form the basis of most welding education, the AWS Master Charts of Welding and Joining Processes currently lists 90 processes and process variations. The Chart of Allied Processes including thermal cutting, gouging and spraying lists an additional 30 process variations. While many perceive the welding industry to be established and static, there is in fact constant change as new processes and equipment are developed to meet the challenges presented by new and novel applications.

## Application Trends

**Some of today's applications trends include:**

**Nuclear Systems Welding** – The welders who build the operating nuclear power plants in the U.S. have retired and there was no demand for replacements. Now, there is a critical need for welders to work on a large number of new and replacement reactor projects.

**Battery Manufacturing** – There are many technical challenges for welders posed by the assembly of the battery systems that will power electric vehicles and store green energy.

**Advanced High Strength Steels (AHSS)** – The manufacturers of steels have created AHSS to enable their customers to provide lighter and stronger recyclable products. These materials have made it necessary to significantly change the process of performing and inspecting welds.



## New Equipment and Processes

**Hybrid Laser/Plasma Arc Welding** – The concurrent application of multiple welding processes is enabling welders to achieve tremendous gains in productivity.

**Remote Laser Welding** – Improvements in laser generation and delivery efficiency coupled with sophisticated beam steering systems have made a whole range of laser applications commercially viable.

**Solid State (e.g. – friction stir, magnetic impulse) Welding** – Solid state welding processes are enabling the efficient joining of materials that cannot readily be joined by melting. The patent for the friction welding process expires in 2010 and there is a tremendous amount of on-going development.

**Stored Energy (e.g. – capacitor discharge) Resistance Welding** – After a hiatus of more than 40 years, electricity costs and sophisticated materials are driving a resurgence of stored energy welders. In these systems the electric charge in the welding machine is released to create the heat to produce a weld.

**Cold Spray** – An entirely new field of solid state coating deposition is in its infancy.

# New Training Technology Impacts and Their Use in Serving Non-Traditional Students

One of the newest education and training technologies that will impact the welding field is the use of welding simulators. These simulator units are portable and can be used to provide training in a traditional classroom/lab setting, as well as in industry settings. The use of these mobile units has also proved highly successful in promoting welding training in "career day" or "job fair" settings. Due to the mobile nature of these units it is also possible to use them in multiple locations within any given day.

All of the simulator units provide a "green training" option for most educational institutions that choose to integrate this technology into their instructional delivery methodology. The simulator also provides an opportunity to deliver training to populations that otherwise may not be able to participate in welding training. For example, incarcerated individuals are often denied the opportunity to participate in welding training due to safety concerns around welding equipment and materials such as rods. The simulator units eliminate the vast majority, if not all of those concerns, and also expand the average amount of instructional time in a correctional facility by eliminating the need for equipment, tool and materials counts that often cut in half the average instructional hour.

The units can also be used to provide training in rural and frontier areas and make training of small groups of students much more economically feasible than trying to run a traditional lab environment. The simulator units can also be used to train military personnel in the field, as well as to deliver welding instruction to military reservists and returning veterans who are in need of a career option or who need to move into a new career due to job loss during their active duty period.

Currently three companies produce virtual simulators: Lincoln Electric's VRTEX 360; 123Certification.com which offers the 123arc.com ARC+ Welding Simulator and ARC PC; and, the Fronius Virtual Welder. All of these systems are computer based and are designed to enable students to practice welding techniques in a simulated environment.

Lincoln Electric's VRTEX 360 is powered by VRSIM and is a virtual reality arc welding trainer that promotes the efficient transfer of welding skills to the welding booth while reducing material waste associated with traditional welding training. The combination of realistic puddle simulation and arc welding sound tied to the



welder's movement provides a realistic hands-on training experience. This technology allows: flexibility (multiple welding processes, a variety of joint configurations and multiple welding positions); innovation (Magnatron and ProFlo technology creating realistic puddle modeling); classroom performance that enables instructors to train welders faster (visual cues give real-time technique feedback, an advanced scoring system for student evaluation, and an instructor cam that allows virtual weld inspection); and the ability to offer Eco friendly training (turns the training program "green" and tracks cost savings with the Weldometer).

The 123Certification.com arc welding simulator is uses two different platforms: the ARC+ Welding Simulator that operates from either a fixed or portable platform with a real welding gun; or, the ARC PC which enables the student to learn to weld from their own PC. ARC+ combines movement capture technology with a treatment of the metallurgy from the most recent scientific publications and with a three-dimensional chart reconstitution with an avant-garde language and platform. It is estimated that the ARC+ will lessen the use of consumables by at least 30%. The ARC PC provides the student with the opportunity to practice welding in a straight line from the convenience of their PC.

Fronius Virtual Welding offers trainees the ability to take virtual course sessions under quasi-realistic conditions without needing any prior knowledge. Beginners learn what welding is about under true-to-life conditions – without any safety risks, and using an ergonomically shaped torch, typical work pieces and adjustable welding parameters. The virtual instructor tells the trainee the optimum welding speed, the tip-to-work distance and the torch tilt angle that should be used. Traffic-light color signals and real-life welding noises give the trainee real-time feedback, showing him where and how he is on-target or deviating from target. The process provides scope for direct, instant correction that allows the welder to learn the craft step-by-step, without being taken out of his depth, while getting a technical feel for the parameter settings.





## Training for Welding Educators and the Need to Attract Welding Professionals to Replacing Retiring Faculty and Instructors

Weld-Ed has been offering professional development activities and courses for community and technical college educators during the summer months since 2007. The delivery of these two week courses has occurred throughout the U.S. at Weld-Ed educational partner sites. In addition, some of the costs for these professional development activities have been covered through the NSF ATE Center grant. Over the course of the next several years, the Weld-Ed Center and its educational partners will continue to offer expanded professional development offerings and will also expand the number of sites where training is offered to community and technical college faculty as well as other educational professionals.

During the last six months of the NSP efforts, discussions began about attempting to identify the

need for replacement faculty and instructors. Over the next year, Weld-Ed and AWS are encouraged to continue a smaller NSP type effort to collect data on the need for replacement educators. This initiative is part of the Weld-Ed NSF ATE Continuation Proposal and has been construed as a key component in efforts to continue to expand and strengthen welding education. The effort will require that Weld-Ed and AWS gain a national understanding about the age, education and skill sets of existing welding educators, collect and analyze that information and then develop strategies to attract new welding educators from either the existing pool of welding professionals or through the attraction of new entrants to the field of welding education.

# The Role of AWS and Weld-Ed in Addressing Future Needs for the Next Generation of Welders

Over the course of the next decade it will be critical to the welding industry that AWS and Weld-Ed continue to work together to address the needs of employers who rely upon welding as a key component of their business. While the work of the NSP has definitively broken down the needs of the industry based on the five SOC Codes, work still needs to be done to gather information about occupations that require welding knowledge and skills but do not fall within the original five SOC Codes that were studied.

At this juncture those positions that require welding skills and knowledge in manufacturing, construction, energy, communications and other sectors present a challenge both in terms of developing training that is specific to the needs of those industries, as well as in insuring that workers that move into those sectors as new or replacement workers have the necessary skills to immediately be productive on the job. The group of new and replacement workers that will be needed to fill these 25 welding-related SOC code positions could dwarf the need for welding professionals in the five key SOC Codes.

These positions could also lead to the movement of welding professionals into less demanding welding-related positions in other sectors that would enable individuals who were contemplating retirement from a full-time welding position due to age or physical factors to remain employed in a less physically demanding job. These assumptions are purely speculative however they point out the need to gain a greater understanding of the needs of welding-related industries and their workers. With that additional knowledge AWS and Weld-Ed could further formulate strategies to address not only the needs of the welding industry but also the welding-related industries and sectors.

In terms of addressing the needs that have been expressed in this report, both AWS and Weld-Ed should jointly chart a course for continuously working together to address the welding industries demand for workers and the talent development supply-side's ability to meet that demand. The funding from

NSF ATE is a critical lynch-pin for this effort to succeed and has enabled the industry and its key educational partners to fully examine the needs of the primary welding industry and gain a better understanding of what the additional needs might be of the secondary welding-related industries/sectors. Both AWS and Weld-Ed are working together to craft a continuation proposal that will be submitted to the National Science Foundation Advanced Technological Education program in the Fall of 2010. This proposal will expand the Weld-Ed Center's work and will enable this strong industry, education and government partnership to carry-out the recommendations contained within this section of the National Report.

## Among the strategies that should be considered by AWS and Weld-Ed are:

- Developing strategic national and regional partnerships to promote careers in welding
- Changing the industry's image and perception
- Expanding the capability and capacity of the welding industry's talent development supply pipeline
- Retraining laid-off workers to enter the welding field
- Training non-traditional populations for the welding field
- Mobilizing resources to maximize training availability
- Strategies for retaining older welding personnel
- Skill upgrading strategies to move welding personnel up the welding career pathway

**Each of these possible strategies are discussed on the following pages in more detail.**

# Developing Strategic National and Regional Partnerships to Promote Welding Careers

While the NSF ATE funded Center represents a partnership between the welding industry, its key professional association, higher education and K-12 education, as well as government agencies, there is a need to further expand the initiative to address the hiring needs of the welding industry. Strategic national partnerships need to be explored with the following government agencies:

- Department of Defense (including all branches of the military and reserve)
- Department of Energy
- Department of Transportation
- Department of Labor (especially the Employment and Training Administration)
- Department of Education
- Department of Commerce
- The National Institute for Standards in Technology

Each of these agencies has a vested interest in the ability of the welding industry to meet critical industry needs ranging from the new electrical grid to investments in transportation infrastructure to retro-fitting of military bases, as well as institutions of higher education and K-12 school districts and their facilities. All of these agencies fund projects that will require contractor's to use high skilled welding personnel or equally skilled welding-related personnel. In addition, many of these agencies fund the training of professionals to enter into high growth, high wage positions that are critical to the U.S. economy, its competitiveness and national defense.

Partnerships with each of these agencies would benefit the agency, those that they serve as well as the welding and welding-related industries on the whole. Working together with many of these industries, AWS and Weld-Ed could help establish a national agenda to ensure that the needs of the welding industry are addressed.



AWS and Weld-Ed should also explore partnership opportunities with organized labor on the national level that would not only benefit the welding industry but could also lead to the collection of necessary data regarding the personnel and training needs of welding-related industries that rely heavily upon unionized workers and are involved in labor-management contracts. The opportunities created by these partnerships could lead to the adoption of AWS certifications, the creation of standardized welding training modules, and the expansion of welding and welding-related apprenticeship programs.

AWS and Weld-Ed have also been working informally with the National Association of Manufacturers, NACFAM and others to explore ways to strengthen the overall talent development supply pipeline to manufacturing in general and welding/welding-related industries. They have also jointly explored funding opportunities that would enable them to jointly promote manufacturing related careers and to change the image of the industry. Formal partnerships would enable this work to ascend to an even higher level of cooperation and the establishment of joint goals that all of the partners could work towards while at the same time perhaps strengthening their respective abilities to achieve their own organizational goals and objectives.



# Changing the Industry's Image and Perception

To successfully change the image of the industry it will take the combined efforts of the industry, AWS, Weld-Ed and several government agencies. It will also require developing new images of the workplace and the importance of the profession. Paraphrasing the words of Gene Lawson, former AWS president, "we must make welding a noble profession once again", especially in the minds of today's youth, their educators and counselors and their parents.

To do that we must clearly show the skill levels required to be a highly qualified welding professional, the possible income levels, the welding career pathway opportunities and the stability of the industry. The data that was initially provided through the JBS International surveys and then through the EMSI National and Regional Reports as well as the State Reports, clearly shows that the industry is stable, will experience some limited growth in certain regions and will need to replace approximately 40% of its workforce between 2002 and 2019 due primarily to retirements.

Attracting youth to "cool occupations" is a large component of the AWS publications and recruitment materials to date, as well as the Weld-Ed strategy. Educators and counselors at the K-12 and community/technical college level must be educated to understand that welding is a noble, stable and high paying occupation with growth potential for its workers. The potential for youth to enroll in welding education and training is directly impacted by their early influencers: parents, teachers, relatives and friends. For us to succeed in recruiting a greater percentage of youth into the industry we must influence the influencers!

AWS, Weld-Ed, the industry, other industry associations such as NAM, and government agencies



need to further increase their individual efforts and also work in collaboration to maximize their resources as they work on changing the perceptions of the industry. An effort must also be made to highlight the emergence of welding as a "green occupation". Several of the welding SOC Codes are now listed among green occupations by the Department of Labor. With the development of the virtual welding technology, welding education now has the ability to become "greener" and that must be promoted to the general public. The movement of more traditional occupations toward "green applications and training" should influence some youth to consider those occupations. The welding industry should clearly place some priority on pointing out its "green aspects and potential" as it will influence youth and their primary influencers.



# Expanding Training Capability and Capacity

Expanding the training capability and capacity of the welding education and training talent development supply pipeline is a top priority of Weld-Ed and AWS. While Weld-Ed focuses predominantly on community and technical colleges across the country, they also impact educators at the K-12, vocational and adult education, and university levels. The focus of Weld-Ed is to work towards standardization of a competency based curriculum model for welding technicians however that also requires working towards some degree of standardization at all educational levels along the defined welding career pathway. These efforts must be continued and strengthened with a great resolve to impact even more community and technical colleges and other education providers at various levels.

Expanding training capability and capacity must also be done scientifically on a state by state or regional basis as well as institution by institution. To scientifically make those programmatic decisions, key decision makers must use strong labor market data and industry need projections, compare that data to the current welding program offerings, examine the capability and capacity of each of those programs and then perform a gap analysis using that data.

They must also establish stronger working relationships with the welding industry and other industries that hire welding-related personnel to better understand the needs of those industries.

It is equally important that relationships be established between the welding education and training programs and the publicly funded workforce development system. The nation's One-Stop System that is funded in large part through the Workforce Investment Act (WIA) of 1998, provides funding to support individual and classroom-sized training in high growth occupations. The five welding SOC Codes that are identified in this report represent high growth occupations. Despite the fact that the industry was

in decline from 2002 through 2009, we know there is a need for substantial numbers of replacement welding personnel nationally, regionally and on a state by state basis. It is up to welding educators and administrators that oversee welding education and training programs across the country to make sure that the One-Stop System in their local areas and the Workforce Investment Boards that oversee their workforce system are aware of the needs of the welding industry and the fact that the industry faces a potential critical shortage of replacement workers.

The local WIA System serves youth ages 14-21 and through its One Stop System at the local level impacts adults (21 and up), dislocated workers, and under employed workers especially those with outdated skills or minimal skills. The local One-Stop System should be a strong source of potential new applicants for welding education and training especially once local industry need has been established. The local workforce system can be a strong advocate for promoting welding careers and training to fill current and future welding positions. To assist the industry in meeting their needs it is critical that both the welding education providers and the workforce system

work together to promote careers in welding and realize the career opportunities that the welding industry presents.

We have tried to provide data and information through this report that can be used by educators at all levels and the workforce system to further substantiate the need for training individuals for careers in welding, for use in expanding their programs, updating those programs and to work towards "green training and applications". Both AWS and Weld-Ed are also working to expand their potential to lend technical assistance expertise to the education and workforce development fields.



# Re-training Laid-off Workers to Enter the Welding Profession

Promoting welding occupations as a viable, stable and well paying profession is a critical component of trying to recruit laid-off workers into training for welding careers. This is a key target population that the welding industry should pursue to address its hiring needs, in partnership with welding education and training providers and the workforce system. Individuals who have already been employed in a manufacturing environment may be hesitant to consider welding occupations based on fear that they will potentially face a lay-off again in the future.

While lay-offs occur for a variety of reasons in industry, based on the supporting data from this report it is apparent that the industry is stable, is projected to grow in parts of the country and is in need of a high level of replacement workers. Welding programs that offer certifications and are tied to AWS certifications will also provide a level of mobility for workers who potentially would face displacement due to economic conditions. One thing that is increasingly clear based on the EMSI data projections that are contained in this report is that skilled welding personnel, especially those with AWS credentials, have the ability to seek and obtain welding employment anywhere in the U.S.



The retraining of dislocated workers who were previously employed in the manufacturing industry or an industry that employed individuals in welding-related occupations are ideal candidates for retraining as welders as they may already possess knowledge, skills and abilities that closely resemble those that are required for welding occupations. A highly successful strategy for expediting training for these individuals is to assess their existing skill sets, compare those skills to the requirements of a welding occupation, identify the skill gap and then train to that skill gap. Welding education and training providers are encouraged to work with their local One-Stop System to further develop these types of strategies for recruiting, assessing and retraining laid-off workers to enter the welding profession.

## Training Non-Traditional Populations for Welding Careers

Women, minorities and people with disabilities are non-traditional groups that represent critical populations that must be recruited for potential careers in welding. Weld-Ed has worked with other NSF ATE Centers across the country in developing materials and "tool kits" to assist programs in promoting training to non-traditional populations. North Dakota State College of Technology has also worked directly with disabled students and has been successful in developing a prototype wheel chair that lifts a person into a standing position that enables them to work as a welder. This

specialized chair has enabled a paraplegic student to pursue his dream of welding training and to obtain competitive employment in the welding field.

Over the next several years Weld-Ed and AWS will be working together to expand their efforts to recruit non-traditional populations for careers in welding and will also expand their efforts to include other NSF ATE Centers and projects in an attempt to market non-traditional employment and careers to non-traditional populations.

# Mobilizing Resources to Maximize Training Availability

As previously mentioned the advent of simulation training has opened new horizons for welding education and training. Through the use of simulators and especially simulators that can be transported across vast rural distances, welding training can be offered anywhere in the U.S. This can also be accomplished in conjunction with distance learning welding training applications including the offering of a national welding or welding technician curricula that is coupled with the simulator for the “hands-on” training aspects.

Unfortunately funding such an endeavor is still costly, though in no way close to the costs associated with creating a traditional welding classroom and lab environment. There is potential for educational

institutions to seek funding for these types of efforts through vocational education funding, the Workforce Investment Act, and potentially new funding streams that have been proposed for the Department of Education by the Obama Administration.

Perhaps another opportunity would be for school districts and community/technical colleges to work together to pool resources to jointly offer welding education or training through distance learning modalities coupled with simulation units. Working together the burden for acquiring simulator units could be offset by multiple institutions. The current pricing structure for a single unit as described earlier in this report is approximately \$46,000.

## Strategies for Retaining Older Welding Personnel

Retraining older workers in the workforce is something that is being considered by employers throughout the U.S. who are projecting worker shortages and are having problems attracting new workers into their industry. Older worker retention strategies were discussed on multiple occasions during the National Skill Panel process and several companies were examining ways to have older workers team with younger workers or other new entrants to the workforce. There were also discussions about retaining older workers by moving them from full-time employment to a status that is less than full-time. The biggest concern that all employers expressed was that our most senior workers are often our most qualified workers and that we can not afford to lose them to permanent retirement.

Another opportunity would be for the employers to work with their local educational institutions to explore options to train many of the older, or soon to be retiring, workers to move into second careers as adjunct welding faculty or instructors. For many of these employers it would be beneficial to enable the welding

professionals to begin their training for these second careers while they were still employed (perhaps even subsidizing their training or providing release time for training). In so doing, the employer is supporting their employee in their post-retirement endeavors and perhaps setting themselves up to offer summer employment opportunities to these future educators as a way to update their industry based skills. In addition, welding professionals who move into the educational field will more than likely also promote employment with their former employer to their future students.

It will be advantageous for Weld-Ed, AWS, the American Association of Community Colleges, NAM and other interested parties to jointly explore strategies for retaining older workers longer in the workplace, for finding less physically demanding occupations within the field for older workers to move into, and for exploring all of the options that may be available to move older workers into adjunct faculty and instructor positions.



# Skill Upgrading Strategies to Move Experienced Welding Personnel up the Welding Career Pathway

There is a definite need for Weld-Ed and AWS to work together to develop a national strategy for employers to work together with their respective educational communities to promote skill upgrading for welding professionals. Some of the most difficult positions for welding employers to fill are those that require higher level skills. At the same time many employers are fearful of providing too much training to their employees for fear that they will leave for higher paying job opportunities with other employers.

The bottom-line is this is a dilemma that every industry or sector faces. Often times the biggest enemy that the industry/sector faces is itself. Fear of losing employees is a natural one for any company president, human resources director or plant manager. However, that fear in actuality is preventing many industries from being able to develop the highly skilled and competitive workforce that they need to compete in today's global economy.

Reality is that if a company is fair to their employees, compensates them for skill upgrading and provides a good working environment, the number of workers that they lose will be substantially lower than employers who provide sub-par treatment to their employees. While the good employer may lose a few employees, the remaining workers know that by taking advantage of additional training they can move up within the company or the industry and are thankful to their employers for creating opportunities.

While this may be construed by some as naïve, the company that takes the risk and upgrades the skills of their workforce, even at the risk of losing some to competitors, will be more prepared to address their human resource needs. They will also be ready to



replace future retiring workers without the disruption that could occur based on the unexpected retirement of a skilled worker without the availability of an equally or better skilled replacement worker. Without taking the risk and upgrading welding professionals along the career pathway, companies put themselves in jeopardy of not being able to remain competitive and have less potential for attracting future replacement workers.

Cost benefit analysis such as those that occurred in some of the AWS earlier research in 2002 holds the key to companies understanding the financial realities of continuously upgrading their workforce versus not upgrading personnel to move up along the welding career pathway. It would be in the best interest of AWS and the welding industry as a whole to further explore the cost and benefits on on-going skill upgrading for welding professionals and publish those findings and related recommendations.



## FINAL WORDS

During the great recession from 2008 through early 2010, anecdotal information received from the participating NSP industry and association representatives revealed that many companies feared that if they laid-off their experienced welding professionals due to economic conditions such as reductions in sales and contracts, that when the economy improved they would never be able to replace those welders. Instead, many of these companies retained the workforce at great cost and assigned them other duties ranging from maintenance to sales, building and grounds, and general office work. These companies realized that to compete once the economy improved that they would need to have a highly skilled and trained workforce that could ramp up production quickly.

Such is the condition of the welding industry as we know it. Issues with the supply pipeline and its ability to produce enough qualified graduates to address the need for new and replacement workers to fill the vacancies left by the high rate of baby boomer retirements are paramount. There also appears to be some reluctance from employers to upgrade the skills of workers along a welding careers pathway for fear that they will lose workers to competing firms that pay higher wages or that offer better fringe benefit packages. To address the pipeline needs we need to not only increase entrants into training but also consistently upgrade the skills of incumbent welding professionals to move into new career opportunities in the industry.

Unfortunately, the inability to recruit large numbers of new entrants into welding training is due in part to the popular misperception that welding is a “dank, dark and dirty occupation”. To overcome that perception, industry, education, the workforce system, government and others must work together to promote the “modern welding environment” and its career pathway opportunities. Nationally we must produce at least another 30,000 welding professionals per year just to address the projected new and replacement worker needs between now and 2019 for the five key SOC occupations. These figures do not include the

other 25 occupations where welding is a portion of the employees’ required skills and abilities. While a statistical analysis was not conducted to gather information about those 25 additional occupations it is estimated that the number of new and replacement workers that would also need some welding skills is at least another 350,000-500,000.

This publication lays the ground work for the welding industry, AWS, higher education, adult and K-12 education, the publicly funded workforce system, government, economic development, and others to enter into a dialogue on the national, state and local level to address the critical needs of the welding industry and its pipeline of future workers. Together they must change the perception of the industry. This need to change the perception was best described by former AWS President Gene Lawson during a 2009 NSP meeting when he said,

**“Welding was considered a noble occupation before and after World War II, that is no longer the case, we must make welding a noble occupation again.”**

**-Gene Lawson, Former AWS President**

Perhaps the simple words of Robert Frost best describe the work that we must all endeavor to undertake to improve the image of the industry, address the pipeline needs and ensure that the industry has enough qualified trained and upgraded welding professionals to address their needs. The words of Frost ring true to our cause: “We have miles to go before we sleep.” Indeed we do.

# Special Thanks to National and Regional Skill Panel Representatives and Others

Without the time and efforts of the dedicated members of the National Skill Panel and the Regional Skills Panels in Ohio, Texas and South Dakota, this report would have just been a dream. Their dedication to improving the welding profession, responding to the needs of employers and promoting educational change was amazing, as was the willingness of their respective employers to allow them to participate in the face-to-face meetings of the skill panels as well as in conference call meetings.

The following individuals were members of the National Skill Panel:

**Gerald Uttrachi**,  
chair, American Welding Society (SC)

**Gene Lawson**,  
co-chair, American Welding Society and ESAB (CA)

**Robert Visdos**,  
facilitator, Workforce Institute, Inc. (OR)

**Patricia Adams**, ENTRON (SC)

**Bruce Albrecht**, Miller Electric (IL)

**Charlie Albright**, The Ohio State University (OH)

**Alan Badeaux**,  
North Point High School and AWS District 3 (MD)

**Chris Bailey**, Lincoln Electric (OH)

**David Beneteau**, Centerline Welding Products (MI)

**Jeanette Carter**,  
Pennsylvania College of Technology (PA)

**Dave Dickinson**, Dickinson Consulting (OH)

**Barbara Derwart, Brian Jones and Laura Putnam**,  
JBS International Inc. assigned to U.S. DOL/ETA (DC)

**Sterling Dolese**,  
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**John Letki**, ESAB (SC)

**Dr. James McKenney**,  
American Association of Community Colleges (DC)

**Jennifer McNelly**,  
Manufacturing Institute an affiliate of the National Association of Manufacturers (DC)

**Stephen Paquette**,  
Stark Development Board (OH)

**Monica Pfarr**, American Welding Society (MI)

**George Rollins**,  
Fluor Corporation (TX)

**Kevin Roossinck**,  
Northrop Grumman Ship Systems (MS)

**Dr. Audrey Smallwood**,  
Alabama Technology Network (representing the NIST MEP Program)

**Kris Stadelman**,  
Seattle-King County Workforce Development Council (WA)

**Mike Trupo**, U.S. Department of Labor/employment and Training Administration (DC)

**Dr. Larry Warford**,  
League for Innovation in the Community College (AZ)

**Frank Wilkins**, Texas State Technical College – Waco (TX)

**Dean Wilson**, AWS and Wilson Industries (CA)

## Special Thanks Continued...

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The National Weld-Ed Center effort is housed at Lorain County Community College in Elyria, Ohio and falls under the leadership of their president, Dr. Roy Church. Through Dr. Church's visionary leadership the college has become a national, regional and state leader in workforce development and designing programs to meet industry needs. Together with his management team including Dr. Karen Wells (Vice President of Instruction and Academic Affairs), Kelly Zelesnik (Dean of Engineering Technology) and Duncan Estep

(Director of the Weld-Ed Center), they have provided guidance and leadership to the entire Weld-Ed effort and have been strong supporters of the National Skill Panel initiative and this report. The Weld-Ed staff including Ramona Anand (Project Manager), Michael Fox (Research Associate), Beth Plas (Staff Assistant), and Ashley Keener (Staff Assistant) have helped throughout the National Skill Panel process including preparing for meetings, disseminating information and gathering information for inclusion in this report. We would be remiss if we did not also acknowledge the hard work and dedication that Ken Smith, the Weld-Ed Center's first Director, put into this National Skill Panel effort. Mr. Smith was an early driving force in ensuring the overall success of the NSP effort.



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# Weld-Ed Regional Center Network

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## COMMUNITY COLLEGES

Lorain County Community College

Chattanooga State Community College

Honolulu Community College

Illinois Central College

North Dakota State College of Science

Texas State Technical College – Waco


Yuba College

## UNIVERSITIES

The Ohio State University

Pennsylvania College of Technology

Weber State University





# Weld-Ed

National Center for Welding Education and Training

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