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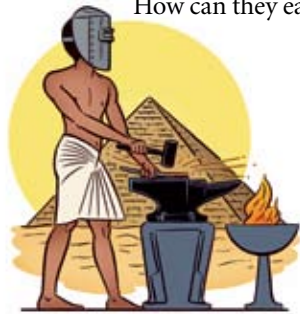


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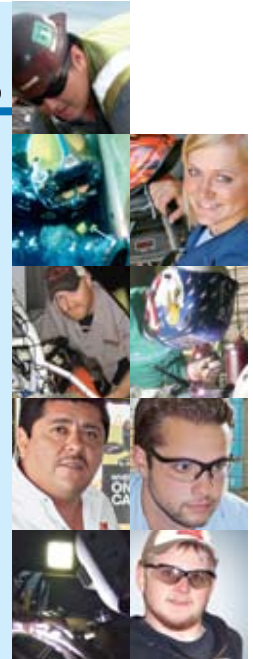
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AMERICAN WELDING SOCIETY

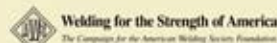
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AMERICAN WELDING SOCIETY FOUNDATION

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Manager, Vicki Pinsky
Corporate Director, Solutions Opportunity Squad, Monica Pfarr
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WELD-ED REGIONAL CENTERS

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Texas State Technical College
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by Pat Toensmeier

Welding is a dynamic industry with a

future

BIG

A CLEVER BRONZE-AGE WORKER WAS thinking outside the box one day 5,500 years ago when he came up with an inspired idea. A great way of making things with the bronze alloys that were being developed then, he reasoned, would be to heat them until they started melting and pound them together with a hammer. By combining heat and pressure in this way, craftsmen could make just about anything that required a strong metal like bronze.

This was the birth of welding, a pro-

cess that has had a major impact on metalworking and product engineering ever since.

Anything made of metal, no matter how big or small, can be welded. Examples are everywhere, from vehicles like cars, trucks and motorcycles to rail cars, ships, aircraft, rockets and space stations. Construction is a huge market, and skyscrapers, bridges and highways would be impossible to build without welding, as would oil and natural-gas pipelines, offshore oil platforms, giant

wind turbines and solar panels. Welders help install and maintain boilers, antipollution systems and other large structures, as well as piping for industrial, commercial and residential facilities. Welding is even used by artists to create sculptures and decorative items.

There is almost no limit to what welding can do, especially since developments in the technology continually improve its accuracy, quality and versatility. Welding is, in fact, an increasingly high-tech skill. Welders are being trained to operate

robots and other automated systems that use powerful lasers, electron beams and sometimes explosives to bond metals. The ability to work with computers and program software is consequently vital to the successful operation of these systems.

Don Howard, a welding specialist at Concurrent Technologies Corp., an engineering firm in Johnstown, Pa., estimates that 20%-25% of U.S. welding is automated and predicts this trend will grow by about 20% in the next few years.

"A lot of very intelligent people are coming into the welding community," says Howard. There is money to be made, he notes, but the industry also offers career paths. "Welding is not just about working on a manufacturing line anymore. Once in the industry, people know they can find a niche."

"These are good times to be in welding," says Patricio Mendez, director of the Canadian Center for Welding and Joining at the University of Edmonton in Alberta, Canada. Mendez notes that students who like designing and building with metal and are interested in fields such as materials engineering, robotics, lasers, computer programming and systems integration will find plenty of career opportunities in welding.

Many students are being introduced to the process with the help of *virtual welding* devices. Edison Welding Institute (EWI) of Columbus, Ohio, and Lincoln Electric of Cleveland, Ohio have developed virtual welding devices that are designed to teach the basics of welding in classrooms. The EWI system uses sensors that duplicate the look and feel of welding. Lincoln's system includes a torch with sensors and a welding mask with special lenses that create realistic images of welding applications.

There are more than 80 welding processes. Most involve a skilled worker using a high-heat torch (2,800-plus degrees Fahrenheit), filler material that

"There are many aspects to welding. When people come in contact with it, they love it."

is usually in wire or stick form (though some welds don't use fillers) to permanently bond metal pieces. Welding can also be used to cut and dismantle objects of all sizes as well as for repairs.

One common process is Gas Metal Arc Welding, or GMAW. In GMAW, an electrode, which is also the filler, is continuously fed through the nozzle of an arc torch. When the welder activates the torch, several operations take place: The electrode begins feeding through the



Jay Eastman an engineer at the Edison Welding Institute operates a laser-weld bonding machine.

nozzle, a direct current is generated that creates an arc when it comes in contact with the workpiece and shielding gases are released around the nozzle to protect the weld from atmospheric gases that could degrade its quality. The arc, whose movement the welder controls, consumes the electrode and fills in the weld joint, which creates the weld.

Other widely used techniques like Gas Tungsten Arc Welding (GTAW) and Shielded Metal Arc Welding (SMAW) are variations of the process. GTAW, for example, is a relatively low-heat method that uses a non-consumable tungsten

electrode. Its low-heat characteristic reduces distortion in thin metals, such as those used in aerospace. SMAW, also called "stick welding," uses a flux-coated consumable electrode ("flux" is a chemical cleaning agent that removes oxidation from the metals to be joined) and is primarily used for repair and steel welding. As the electrode burns, the flux disintegrates, which releases a shielding gas that protects the weld from degradation.

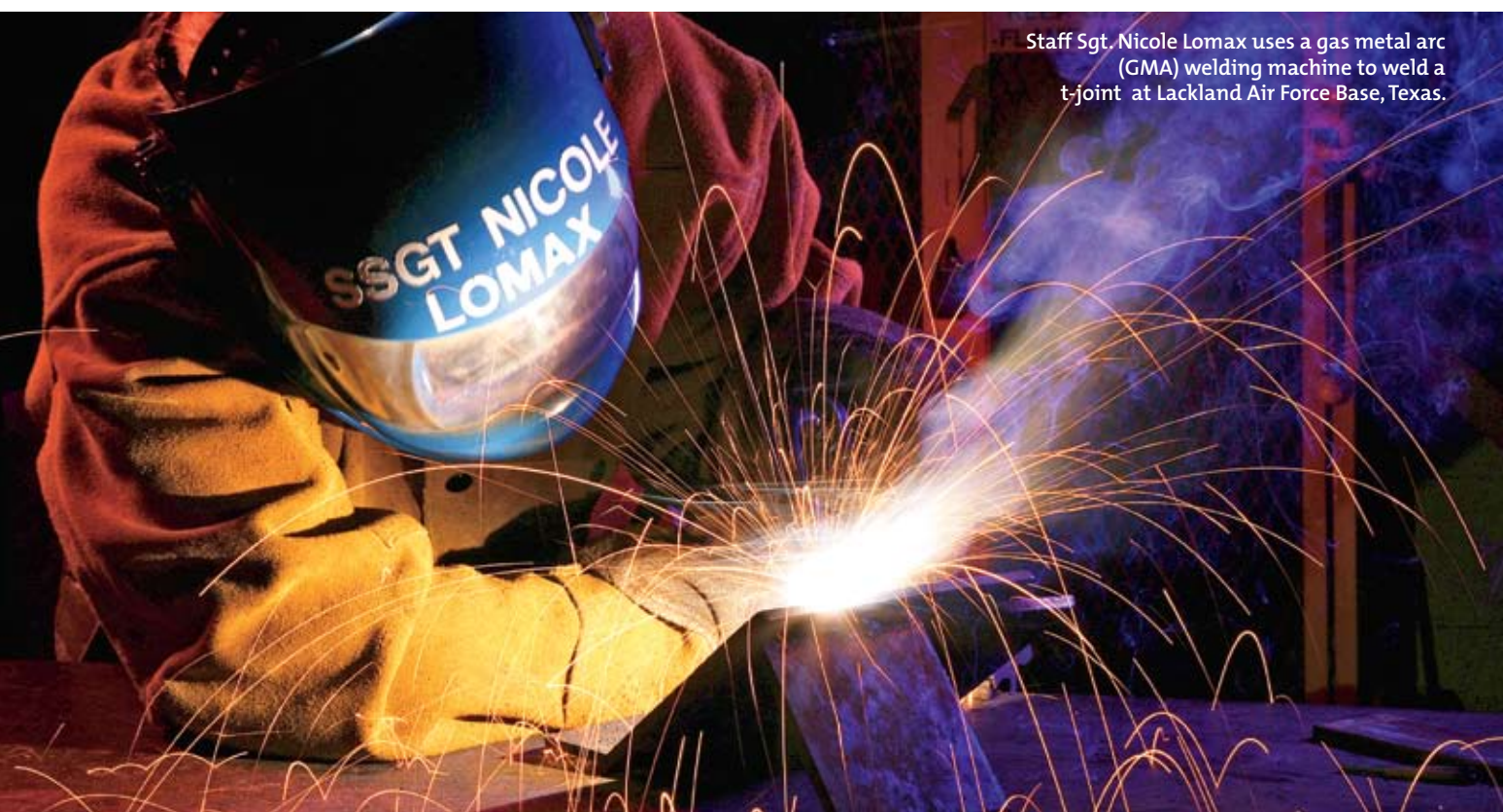
In more advanced welding technologies, lasers are combined with GMAW in a hybrid process to make what one expert calls "scalpel-like cuts" that are up to 1/2-inch deep, narrow and extremely precise. The GMAW part of the process then deposits the filler and melts it with a secondary heat source.

The influence of welding is so broad that many of the product designs and building techniques people take for granted would not be possible without it. With demand for skilled welders rising and the technology of welding becoming more advanced, especially where automation is concerned, students have a unique opportunity to learn a career that can be shaped around their interests.

"There are many aspects to welding," Mendez says. "When people come in contact with it, they love it." *



A mission specialist working on the International Space Station performs extravehicular activities, putting welding to work to connect power, data and cooling cables.



Staff Sgt. Nicole Lomax uses a gas metal arc (GMA) welding machine to weld a t-joint at Lackland Air Force Base, Texas.

PHOTO LEFT COURTESY OF U.S. AIR FORCE; PHOTO TOP RIGHT COURTESY OF EDISON WELDING; PHOTO BOTTOM RIGHT COURTESY OF NASA

Awesome Choices

Amazing Pay

“NO WAY!”

That’s what you’ll say when you hear about the amazing variety of welding jobs that are out there and how much they pay.

You like the idea of working outdoors? Traveling? Getting new skills and moving up in the world? There’s a welding job for you.

The same is true if you want an indoors-only job close to home. Or if you like sales or teaching or science or even research. Or if you want to start your own company.

The starting pay for most welding jobs is pretty basic, especially right out of high school. But, with more experience, the potential to earn two or three times that amount is definitely there.

And making \$100,000 or more isn’t out of the question. But only if you are the best of the best—the Tom Brady or Derek Jeter of welding—and you are willing to work in some far-off spots.

Why is welding such a wide-open gig? It really comes down to this—welding is part of just about everything you see and touch every day: the car you drive, the bridge you drive over, and the school or mall you drive to.

Welding’s also part of making airplanes, ships and all kinds of manufactured products, from lawn mowers to earthmoving equipment.

And then there’s energy. Welding, for instance, plays a huge role in building and maintaining offshore oil rigs. The same goes for pipelines, powerplants and even those big wind turbines.

There are real out-there jobs, too—the kind of jobs you may never think

have a welding angle. Just ask Scott Shriver. Shriver’s the chief fabricator for research and development at Hendrick Motorsports, the team behind NASCAR superstars like Jeff Gordan, Dale Earnhardt Jr. and Jimmie Johnson.

“I got started in welding growing up on a farm,” says Shriver. He helped his dad weld farm equipment “to keep things going.” Then, after Shriver took some welding classes in high school, his instructor said he was great at it and should think about welding as a career.

“I was into racing motorcycles,” Shriver says. “One day a friend of mine

said he wanted to race sprint cars—dirt-track-style cars. I helped him build his first car from the chassis up.” From there, Shriver welded his way to the top of the racing business in just a few years.

Hendrick Motorsports, where Shriver works, does things old-school but with the latest technology. The company builds its cars from the ground up, and Shriver’s involved in how the cars are put together. Especially the welds, which are key.

“I personally get a feeling of satisfaction from doing something that not very

Navy welder



PHOTO LEFT COURTESY U.S. NAVY, PHOTO MIDDLE RIGHT COURTESY OF LINCOLN ELECTRIC, TOP RIGHT COURTESY OF DEREK ARNOLD



Artist



does awesome specialty welding, making cool-looking metal fences, railings and furniture. (Curious? Take a look at his page at www.ghostmine.com).

There are even jobs for welders who like to dive. Welding underwater is part of what a commercial diver does, says

Allen Garber, who is the chief administrative officer at the Commercial Diving Academy in Jacksonville, Florida.

“Commercial divers have to find it, clear it, inspect it and repair it or build it new”—all in diving gear, says Garber.

A lot of that involves

many people can do,” says

Art Cady, who is a master welder and Certified Welding Instructor (CWI), working at the Bechtel Corporation. He’s been welding probably longer than you’ve been alive, and he’s seen the world while doing it. He’s in Chile now and loving it.

What’s Cady worked on? He’s got a long list. “Coal-fired power boilers, nuclear powerplants, a nuclear-waste treatment plant, computer-chip manufacturing plants, liquefied natural-gas plants, refineries, pipelines, gold and copper mines, the cooling system for a Cray supercomputer, office buildings, hospitals... I think that about covers it,” he says with a laugh.

No doubt, Cady has charted his own course in life as a welder. So has Derek Arnold, an artist near Baltimore who uses his welding skills to turn old construction equipment (road-paving machines, stuff like that) into huge sculptures that look and move like dinosaurs. He has also put together a car he says looks like a cross between “The Flintstones” and “Mad Max.”

To help pay the bills, Arnold also

NASCAR welder



welding. It’s challenging work, for sure.

OK, by now you know there is a wide range of jobs out there for welders. Everything from building dinosaur sculptures to building nuclear powerplants.

To put it bluntly, though, a big part of the job satisfaction is making money and a good living.

So what does welding pay? It depends on the kind of welding you do, where you do it, how long you’ve been doing it and how good you are at it.

Starting just out of high school with only basic welding skills, you are looking at \$10, \$12 or \$14 an hour.

Underwater welding also pays well, but it depends on where you’re working. Garber, from the Commercial Diving Academy, says commercial divers doing “inland” work on bridges and powerplants mostly make \$40,000 to \$50,000 a year, but some make \$60,000 or even \$70,000 if they get a lot of overtime.

Work “offshore” on an oil rig, though, and you probably will start out at \$60,000, Garber says. After a few years, you could make \$100,000 or more. “But that’s a different type of career,” he says. On an oil rig, you usually work 12 hours

PAYCHECKS

Your first welding job may not make you rich, but you will do well over time if you work hard, gain experience and update your skills through training.

Here are some examples of the median pay in different welding-related jobs. **Don’t forget, median means that half make more and half make less.**

JOB	MEDIAN* SALARY IN U.S.
Commercial diver	\$47,000
Welding inspector	\$50,000
Welding sales representative	\$50,000
Welding technician	\$55,000
CONSTRUCTION INDUSTRY	
Plumber, pipefitter or steamfitter	\$48,000
Structural metal worker	\$40,000
Welder, cutter, solderer and brazer	\$47,000
Welder, cutter, solderer and brazer aide	\$29,000
MANUFACTURING INDUSTRY	
Sheet-metal worker	\$67,500
Structural metal fabricator and fitter	\$43,500
Welder, cutter, solderer and brazer	\$44,000
SHIPBUILDING INDUSTRY	
Boilermaker	\$47,000
Materials engineer (including welding engineer)	\$84,000
Welder, cutter, solderer and brazer	\$37,500

SOURCE: U.S. BUREAU OF LABOR STATISTICS, WELD-ED (THE NATIONAL CENTER FOR WELDING EDUCATION AND TRAINING)

on, 12 hours off, every day for six weeks, then you come back to dry land for a week. It’s not for everyone.

Generally, “the more types of welding you master the more you can earn,” says Richard Seif. He’s the senior vice president of global marketing at Lincoln Electric, Cleveland, which makes all kinds of welding equipment and offers welding training.

If you have math and science skills, going to college to become a welding engineer just about guarantees good pay—more than \$50,000 a year to start and thousands more a year after that, Seif says.

So where can welding take you in life? It’s really up to you.*

OK, SO YOU'RE THINKING, "I COULD see getting into welding." But you also may be thinking, "How do I make it happen? How do I get from here to there?"

The good news is there are plenty of routes you can take. Of course, like any trip, it depends on where you start.

Some people are almost born into welding. It's part of them. Maybe you grew up on a farm, where there is always something to build or repair. Or maybe your dad does construction, works in a factory or messes around with cars.

For others, like Branden Muehlbrandt, it's a freak thing that gets them hooked on welding.

"I was 13, on a family vacation. I watched a guy repair a dump truck. I thought it was the coolest thing I had ever seen," says Muehlbrandt. Now he trains pipe welders at the Mechanical Trades Institute in Atlanta.

For a lot of people though, welding is something you get your first look at in high school. If that's where you are now, here's what you should do: take every shop course you can in welding and metal fabrication.

You'll learn about the different types of arc welding, like Gas Tungsten Arc Welding (GTAW), frequently referred to as TIG (Tungsten Inert Gas) and Gas Metal Arc Welding (GMAW), frequently referred to as MIG (Metal Inert Gas). There's nothing like hands-on experience with a good instructor to convince you welding is awesome.

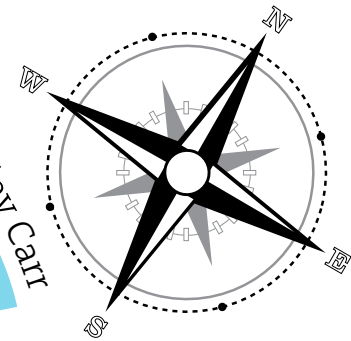
And don't forget about your other high school classes. You've got to have good math skills to do well in any welding job. You don't need to know just addition, subtraction, multiplication and division; you also have to be good at problem solving and know basic geometry.

Science is key, too. After all, when you come down to it, welding is a kind of science. You need a basic understanding of how and why welding actually works before you can do it.

It's also a big plus to be a well-rounded

YOUR WELDING CAREER NAVI SYSTEM

by Housley Carr



person. You'll find out that in just about any welding job you need to work with other people. To be able to talk a problem out. To be part of a team. Being a good student helps with that.

So, if you're in high school and thinking about welding as a career, take whatever shop classes you can. Keep up with your math and science. Be well-rounded.

Also, look for chances to find real work experience with welding. Maybe find a part-time job in an autobody or tractor-repair shop.

Here's something else: Ask your shop teacher about courses you could take at a local or regional career-tech school, or a technical school or a community college. You can also look up schools that offer welding on the School Locator at www.careersinwelding.com.

Muehlbrandt, for instance, took a lot of welding classes in his high school in St. Petersburg, Fla., and ended up as an applied welding technology graduate of the Pinellas Technical Education Center in Clearwater, Fla.

Muehlbrandt or anyone else who's done well in welding will tell you that what got them ahead was a little extra drive. A little ambition. The courses they took in GTA and GMA welding. Perhaps stuff they learned about welding from their first boss.

When you graduate from high school or career-tech school you've got a few options. Get a job that uses the basic welding skills you've got. Or get more welding training at a technical school like the Hobart Institute of Welding Technology in Troy, Ohio.

At a welding school like Hobart,

you'll spend about 20% of your time in the classroom and the other 80% doing hands-on welding, says Martha Baker, the manager of library and Internet services there.

"Some students come to us with no welding knowledge at all," says Baker. Some come with a few welding classes in high school under their belt. Some come from career-tech schools. And some already have been working in welding.

The training at a technical school is geared to where you want to go. For instance, there's a five-month program for guys and girls interested in structural welding and fabrication. And there's a nine-month program for pipe welding.

Something you should know: Technical schools offer financial aid. Some scholarships are out there. And a lot of companies will pay for you to get training. So will a lot of unions.

Cajun Seeger can tell you about that. He's the welding director for United Association Local 72 in Atlanta. Welders who sign on as apprentices there work four days a week, and on the fifth day they go to school—as part of the apprenticeship training program.

"They get paid to learn," says Seeger. And they get college credits for every class they take. When the program's done, Seeger says, they get "journeyman's status and journeyman's pay scale." In other words, even better money. Not a bad deal.

You need two hands to work your way up a ladder, right? Well, you need both experience and training to move up in welding.

And certification. Because employers have to be sure you're qualified to

do what you say you can do.

The American Welding Society offers a wide range of certs, beginning with one that identifies you as a "certified welder." You take a test that shows you can create a sound weld.

AWS also offers certifications for welding supervisors. And welding inspectors. And for robotic arc welding. And welding sales representatives (yeah, there are sales jobs in welding, too).

Here's something you should remember: The more you know how to do in welding, the more you are worth to an employer. Say you're a year or two into your first full-time job. You know how to do arc welding. To get ahead, get to know more about GTA. Take a training course. Or two. Or three. Become an expert.

And go after some training in GMA welding, too. And laser welding. And robotic arc welding.

Step back a second. Remember how there are a lot of different routes to a good career in welding? Another one is going straight from high school to a four-year college. Or going from high school to work and then to college.

There are a lot of great jobs out there for people with welding talent and an engineering degree. Listen to Caleb Roepke.

Roepke's a graduate student in the Department of Metallurgical and Material Science at the Colorado School of Mines' Center for Welding, Joining and Coating Research in Golden, Colorado.

As you might guess from that last sentence, Roepke is neck-deep into the science behind welding.

He got his undergraduate degree in welding and metallurgical engineering from LeTourneau University in Longview, Texas.

(You can major in that field at several

other colleges, too, including Ohio State University in Columbus, Ferris State University in Big Rapids, Michigan, and the Colorado School of Mines in Golden, Colorado.)

"I like engineering, but I really wanted to be in something that's very hands-on," says Roepke. Welding/metallurgical engineering is like that.

Roepke's thesis—the big report he has to write to get his Ph.D.—is about hybrid laser-arc welding. Serious stuff. After school he hopes to land a good-paying research-and-development job with a big company, maybe one that manufactures heavy equipment.

You've probably got the point. No matter where you are in life right now, there are a lot of options out there for you in the field of welding.

There's a pattern to it all though. Getting ahead in welding is all about being open to opportunities. Taking courses. Working hard. Learning on the job from welders who have been doing it for a living. And taking even more courses so you know more, get better and can offer more.

Because the more you know, the more you can offer, and the better your chances are of doing well. And being happier. *

EDUCATIONAL STEPPING STONES

There are a lot of different paths to great welding jobs. Follow the one that's right for you.

IN HIGH SCHOOL...

- Take whatever welding-related courses you can.
- Other shop courses are also a plus.
- Be sure to keep up in math and science.
- Consider a part-time job that involves welding.
- Check into career-tech school opportunities.
- Get involved with your local AWS student chapter.

POSSIBILITIES AFTER GRADUATION...

- Get a full-time welding job that offers further training—**welding helper**.
- Sign up for a welding certification program—**welder**.
- Talk to a local union about apprenticeship opportunities—**union welding apprentice**.

STILL MORE POSSIBILITIES...

- Go after a two-year associates degree in welding—**welding technician**.
- Start your own business—**entrepreneur**.
- Get a four-year bachelor's degree in welding technology or in welding engineering—**welding engineer**.

CERTIFICATION AND APPRENTICESHIP PROGRAMS CAN LEAD TO A VARIETY OF WELDING JOBS IN...

- Construction
- The oil-and-gas business
- The electric power industry
- Robotics
- Shipbuilding
- Manufacturing

AND DON'T FORGET...

- After a four-year college degree, consider going to grad school in welding.
- Think about becoming a welding educator, or an entrepreneur.

ONE FINAL THING...

Experience, training, more training and a good work ethic almost guarantee your success.



There is something for everyone with an interest in the

WELDING INDUSTRY

Job titles range so broadly that
**you are only limited
 by your imagination**

Artist * Boilermaker * **HULL TECHNICIAN** * **MECHANIC**

Pipe Fitter * **PIPE WELDER** * **REINFORCING AND STRUCTURAL IRONWORKER**

RESEARCH SCIENTIST * **ROBOTICS WELDING TECHNICIAN** * Sales Representative

SheetMetal Worker * **UNDERWATER WELDER** * Certified Welder

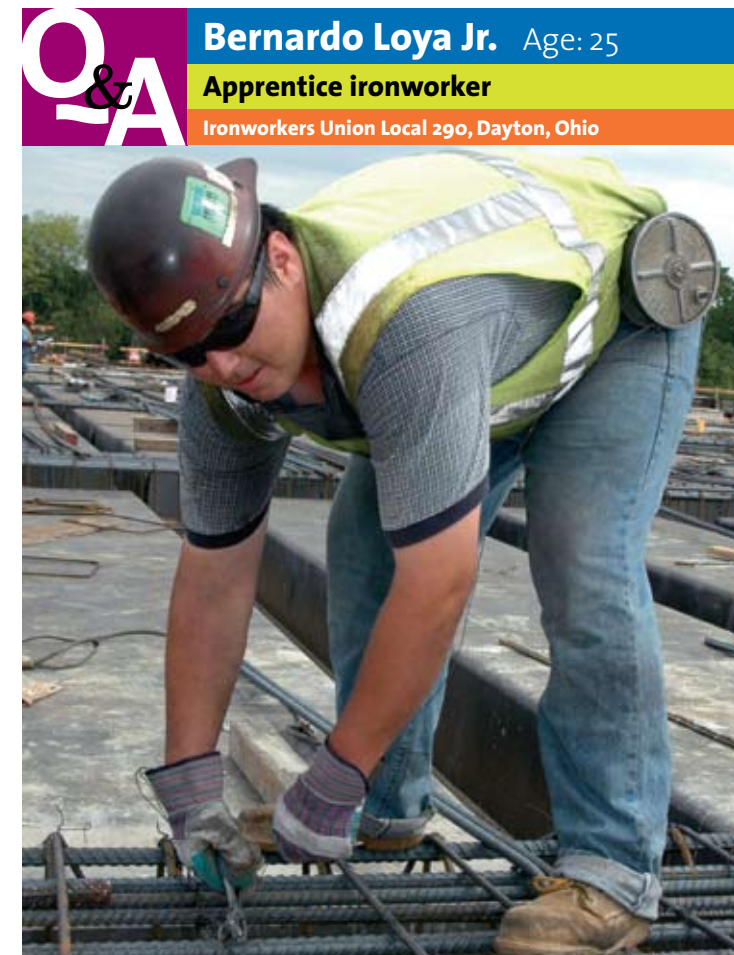
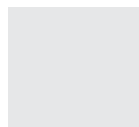
WELDING EDUCATOR * Welding Engineer * Welder-Fitter

Welding Supplies Distributor * Welding Inspector * Welding Machine Operator

Welding Salesperson * **WELDING SHOP OWNER/ENTREPRENEUR** * **WELDING TECHNICIAN**

The **POSSIBILITIES ARE ENDLESS** for careers in the welding industry. There is something for everyone, from hands-on (pipe welder), to education (welding educator) to high-tech (robotics welding technician) to research (research scientist) to entrepreneur (company founder and president) and adventure (underwater welder). Welding careers offer many kinds of work environments. **YOU CAN WORK INDOORS, OUTDOORS, UNDERWATER OR EVEN IN SPACE!** You can weld in construction, manufacturing,

research lab, or in an art studio or you can negotiate deals in a conference room. You can work for a large firm or small start-ups or even explore entrepreneurial opportunities. On the following pages we will detail **10 POPULAR CAREER PATHS** in the welding industry and answer some of your questions. What do the people who have these jobs do? Why are these jobs important? What type of training and education do you need to get these jobs? These stories could help you decide, **"IS THIS JOB FOR ME?"**



Q&A Bernardo Loya Jr. Age: 25

Apprentice ironworker

Ironworkers Union Local 290, Dayton, Ohio

HIGH SCHOOL: Francisco Villa High School, Ascension, Mexico

How did you get interested in your career?

Bernardo: I grew up in Chihuahua, Mexico. My mom wanted me to be a teacher, but I like to work with my hands and build stuff. My dad is an ironworker. In this job you get to do lots of different things.

What kind of training and education did you need to get this job?

Bernardo: The union trains you while you work. I'm a fourth-year apprentice. In nine more weeks I will qualify as a journeyman. Then I can take classes to get other certifications or refresher courses to renew my certifications. The more jobs you are certified to do, the more work opportunities there are.

What's a typical day like in your job?

Bernardo: We work in places like construction sites, steel factories and powerplants. Right now I'm doing maintenance and machine repair on a blast furnace. It's a greasy job. I prefer structural work. The job is outside, you can move around more, and it's quick—in six months you're on to something else.

What do you like most about your job?

Bernardo: I go places no one else goes—like the inside of a blast furnace!

What advice do you have for young people who are considering this career?

Bernardo: Stay in school. That was hard for me because I was working to pay my way through high school in Mexico. Also, study math. That was hard for me, too. I never really liked it, but now I need to know how to calculate things like how much load a crane can lift and at what angle you need to lift it.

COLLEGE: Los Angeles Trade Technical College, Los Angeles, Calif. University of California, Los Angeles (UCLA), Calif. California State University, Long Beach, Calif.
HIGH SCHOOL: Hollywood High School, Los Angeles, Calif. Watts Skills Center, Los Angeles, Calif.

How did you get interested in welding?

Lisa: In high school, I enrolled in the Regional Occupational Program (ROP), which provided high school students with training for various trades on weekends. I saw welding on the list of trades but had no idea what it was. I asked my counselor about it and she said, "I think you put a helmet on and fire shoots out." I said sign me up! I was not sure what welding was when I signed up, but I was hooked the first time I tried it.

What type of experience and training did you need to get your job?

Lisa: Because of the ROP training, I was able to start working as a welder right after graduation. After high school, I worked full time and went to college. I built up my field experience while pursuing my college education.

What advice do you have for young people who are considering this career?

Lisa: Take as many math, English, and computer classes as you can. They will help you, no matter what type of welding career you choose.

What do you like most about your job?

Lisa: Welding educators change lives by equipping and empowering people to achieve fulfilling careers that pay very well. Many of my students tried the corporate world and did not like it but with welding they have found their calling. Another thing I love about my job is that I think of welding as "the second chance profession." At least 10% of my students are convicted felons and were incarcerated. When they learn welding, they have a chance at a new life—they can get good-paying jobs and change their lives forever.



Lisa Legohn

Associate professor of welding

Los Angeles Trade Technical College, Los Angeles, Calif.



Q&A **Wesley Guntharp** Age: 30
Diver/underwater welder
 Miami Diver Inc., Miami, Fla.

COLLEGE: Black River Technical College, Pocahontas, Ark.
Commercial Diving Academy, Jacksonville, Fla.
HIGH SCHOOL: Valley View High School, Jonesboro, Ark.

How did you get interested in your career?

Wesley: I wanted to travel, get away from home and have new experiences in life.

An article on underwater welding sounded interesting. I had never touched a welding machine in my life until I went to technical college, but it turns out I was good at it.

What kind of training and education did you need to get this job?

Wesley: After technical college, where I got my topside welding certificate, I worked as a welder for awhile to gain experience and improve my skills. I also took a recreational diving course to make sure I liked it. Then I enrolled in a commercial diving school.

What do you like most about your job?

Wesley: When I'm in the water welding, it's another world. There's no one down there telling you what to do or looking over your shoulder. I like the freedom and the traveling. My work takes me all over the world. I never know for sure on Monday morning where I might be on Friday. This week I'll be back in Curaçao installing a 55-ton rudder we removed from a ship a few weeks ago so it could be repaired topside. There's always drama and excitement in my job.

Why is your job important?

Wesley: Being able to fix a problem underwater can be an advantage. We often make emergency repairs on cruise ships, for example. We fix the problem while the ship is in port, so the cruise can continue and vacations aren't interrupted.

Q&A **Sara Bingham** Age: 19
Hull technician
 U.S. Navy, Great Lakes, Ill.

COLLEGE: Uintah Basin Applied Technology College, Vernal, Utah
HIGH SCHOOL: Uintah High School, Vernal, Utah

How did you get interested in your career?

Sara: My dad has a metal recycling business. I've been working for him since I was eight years old doing scrap-yard stuff. That experience led me to take welding in high school.

My welding instructor encouraged me to enter competitions. I started locally and last year got all the way to the nationals. Competing pushed me to learn more and taught me how to work under pressure and how to work with others. Competition lets you show what you know, but also what you need to work on.

What kind of training and education did you need to get this job?

Sara: At technical college I did 600 certified hours of welding and learned lots of different processes. I intended to go to college, but when I spent a week on campus I decided it wasn't right for me. The military always interested me, just because I wanted to serve. So I sat down with a recruiter, and it became a question of when, not if, I would go.

What is a typical day like in your job?

Sara: We muster at 6 a.m., go to physical training and then have classes. Those courses have included basic engineering, welding, brazing, mechanics, plumbing and firefighting. The Navy assumes everyone knows nothing, so you start with the basics.

What are your future career plans?

Sara: I enlisted for four years, and I have been assigned to Japan, which was one of my top choices. But it really did not matter where I would be stationed, because wherever I'm stationed it is on a ship that goes everywhere.



Q&A **Justin Stambaugh** Age: 27
Mechanic
 Richard Childress Racing, Welcome, N.C.

COLLEGE: Florence Darlington Technical College, Darlington, S.C.
HIGH SCHOOL: Hannah Pamplico High School, Pamplico, S.C.

How did you get interested in your career?

Tiffany: I've never been book smart, but I've always been good with my hands. I like crafts. In high school I took auto mechanics and could change a brake drum faster than anyone. Even though my dad and uncle are welders, I never thought of being one.

It was my grandmother's idea. She read about the increased demand for welders. At first I dismissed the idea, but I was working in a clothing store then, and I knew I didn't want to do that forever. So I tried a welding class.

What's a typical day like in your job?

Tiffany: I'm working at a powerplant in Maryland right now. Every morning we start with a safety meeting. There are a lot of hazards on a jobsite, a lot going on. You need to be alert and aware, or you can get hurt. After that, we grab our tools and go do our assignment.

What do you like most about your job?

Tiffany: Seeing the end product, knowing I made it, is a big deal to me. The fact that the work is different every day keeps my attention. I like the physical challenge, too. Often you're carrying 25-30 pounds of equipment up steps or scaffolding. You need a lot of strength.

Why is your job important?

Tiffany: I think a lot of people don't realize how many everyday things are welded. I didn't until I started doing it. Now when I go into a restaurant or a store, I'm always noticing the welds everywhere.

COLLEGE: NASCAR Technical Institute, Mooresville, N.C.
HIGH SCHOOL: Francis Scott Key High School, Union Bridge, Md.

What's a typical day like in your job?

Justin: I work in the shop during the week, but on weekends I'm one of seven people on a nationwide pit crew on the NASCAR circuit.

During the week in the shop we rebuild the fleet of cars pretty much from the ground up for the next weekend's race. We change the engine, service the suspension, fix any damage to the chassis and do any welding or fabrication that's necessary.

Why is your job important?

Justin: Pit stops are a critical part of the race. My performance is important to the team.

What do you like most about your job?

Justin: Going to the races every weekend! I love the competition, trying to outperform the other guys as a team.

What kind of training and education did you need to get this job?

Justin: Most of my training was hands-on. Growing up in Pennsylvania, I worked in my dad's auto mechanic shop. I started welding when I was 12 or 13. In high school I studied mechanics at the vocational-technical center. I was always drag racing. After graduation, I headed for North Carolina and found a job building small race cars, which I continued to do while I was going to the NASCAR Technical Institute.

What advice do you have for young people who are considering this career?

Justin: Ninety-nine percent of NASCAR teams are in the Charlotte, N.C., area. Move down there if you can and get started with a minor-league team. It's good experience because the teams are small, so each person has more responsibility.

Q&A **Tiffany Dunlap** Age: 23
Pipe welder
 The Shaw Group, Aquasco, Maryland Project





Guillermo Gallardo Age: 40

President

Complete Welding & Cutting Supplies, Pomona, Calif.



COLLEGE: Riverside Community College, Riverside, Calif.
HIGH SCHOOL: La Zaro Cardenas High School, Tijuana, Mexico

How did you get interested in your career?

Guillermo: Right out of high school I started driving trucks for a welding supply company in California. I did that for four years until I broke a finger rolling a cylinder, and then they put me at the counter. Working in the shop made me want to learn more about welding so I enrolled at Riverside Community College. Eventually I worked my way up to store manager and then an opportunity in sales came up. I found out that's what I do best.

But entrepreneurship is in my genes. At 28, I opened my own store using \$50,000 from a loan against my house. It was just a small shop, but within a few years I could afford to open two more. Five years after I went out on my own, I bought the company I started at, after my old boss died.

Why is your job important?

Guillermo: Nothing is built without welding supplies. Even if it's plastic, it came from a mold, and that has to start with an alloy. Welding is part of every industry. It's one of the last industries that will ever die.

What advice do you have for young people who are considering this career?

Guillermo: They need to stay focused. For 10 years I was making \$10 to \$15 an hour. But I was learning. If anyone had told me I would end up owning my own business, I would have worked for free. The experience and knowledge I gained to start my own business was priceless.

COLLEGE: University of Washington, Seattle, Wash.
HIGH SCHOOL: Entiat High School, Entiat, Wash.

What is a typical day like in your job?

Paul: I lead the welding and forming technology group for commercial airplanes. My focus is friction-stir welding of titanium parts. Friction-stir welding is a solid-state joining process that softens rather than melts metals. I'm also in the shop developing ideas or making test parts.

Why is your job important?

Paul: We facilitate new airplane designs and high-performance structures that allow Boeing to make a better airplane. But the work we do here impacts the state of technology across multiple industries and countries. We explore innovations at the leading edge of research. We're the guys working on new stuff for the future.

What do you like most about your job?

Paul: Being in the shop and playing with the machines. I'm not stuck behind a desk. I get to work with my hands, apply the fundamentals of science in the real world and see the fruits of my labor.

What kind of training and education did you need to get this job?

Paul: An engineering degree in any field gives you the background you need, but mostly you are learning on the job. I've always liked science and math and enjoyed hands-on work: things like shop class in high school and machine class in college. I didn't know what I would end up doing until I was in the middle of my master's program and began working with one of my professors on a stir-welding project. Now I'm pursuing a Ph.D. with support from Boeing's "Learning Together" program, which covers tuition and includes a stipend for books.



Paul Edwards Age: 25

Research engineer

Boeing, Seattle, Wash.



Caleb Hastings Age: 24

Robotics Welder

The Shaw Group, Cliffsides, N.C. Project

COLLEGE: Florence Darlington Technical College, Darlington, S.C.
HIGH SCHOOL: Hartsville High School, Hartsville, S.C.

What is a typical day like in your job?

Caleb: Right now I'm working at the site of a powerplant addition in North Carolina. I'm doing orbital welding using robotics. The job requires 24 hours of welding and two people per shift. I work the night shift. We sit at a computer monitor and control a robotic machine that does the welding. It's almost like playing a video game. But we still have to wear protective gear: long sleeves, safety glasses and other equipment.

How did you get interested in your career?

Caleb: In high school I wasn't very good at math and I didn't like computers much. But I wanted to make good money. I went to a technical college, and the first time I welded I knew it was what I wanted to do.

What kind of training and education did you need to get this job?

Caleb: Years ago a lot of pipe welders were trained on the job. Now most employers want trained people. After technical college I did hand welding in a fabrication shop. Later, I returned to technical college for further training in orbital welding. I use computers now because that's where welding is heading.

What do you like most about your job?

Caleb: I love what I do. Pipe welders are near the top of the project organization. The pay is great. You can work anywhere in the world, and I definitely plan to travel. You're doing something different every day and meeting new people all the time. The sky is the limit. It's an awesome career choice.



Jordan Kay Age: 20

Welding technician

City of Minot, N.D.

COLLEGE: North Dakota State College of Science, Wahpeton, N.D.
HIGH SCHOOL: Minot High School, Minot, N.D.

How did you get interested in your career?

Jordan: I've been in a wheelchair since I was six years old. I first tried welding when I was a kid. I liked the fire and using my hands to make things. I want to do TIG [Tungsten Inert Gas] welding. It's a clean kind of welding that uses a tungsten electrode to heat the metal. It requires a lot of patience and steady hands. I'm pretty good at it.

What kind of training and education did you get?

Jordan: All through high school I took welding classes. In college, I got an associate's degree in welding technology. Several instructors and students helped me build a wheelchair that raises and lowers so I can reach equipment more easily. It looks like a regular wheelchair, but it's pneumatic. Two cylinders under the seat raise it up and down. There are restrictors so it lowers gently. Two legs push down in front so it doesn't roll. Students in the machine class made the parts. I welded them with the help of my lab teacher, Joel Johnson. My fabrication teacher, Jay Schimelfenig, actually designed the chair. We worked out the kinks together.

What advice do you have for young people who are considering this career?

Jordan: Take as much math as you can in high school. I'm terrible at math but I had to take advanced math in college. I wish I had taken more math classes in high school.



Fun Facts

About welding

1 NASCAR—Long before the rubber hits the road, roughly 950 man-hours are spent on welding and fabrication for each race car. Hundreds of parts are hand-cut, welded and machined, from the chassis and suspension to the drivetrain.



2 In 1961, General Motors installed the first industrial robot in history, the Unimate. Featuring a motorized arm that weighed more than two tons, the Unimate performed spot welds by following step-by-step commands stored on a magnetic drum.



3 Which famous comedian has a large antique car and motorcycle collection and employs welders regularly? **Jay Leno!** His large collection includes models from the early 1900s to modern vehicles.



4 Explosion welding is a powerful welding process that can accomplish what many other welding methods can't—it can join nearly every kind of metal together, even the most highly dissimilar ones.



5 Welding in space was first attempted in 1969 by Russian cosmonauts. Today, advances in welding technology have made it essential for projects like the construction of the International Space Station.



6 President Roosevelt, in a letter to Prime Minister Winston Churchill, boasted about the discovery of new welding techniques that enabled America to build ships with a speed unequaled in the history of shipbuilding.



7 The first car made with an entirely plastic body was assembled using ultrasonic welding. Even though plastic cars did not catch on, ultrasonic welding did. Ultrasonic plastic welding is an example of a friction welding process, which creates energy through high-intensity acoustic sounds that cause plastic pieces to vibrate together and form a bond.

8 Did you know that if two pieces of metal touch in space, they become permanently stuck together? This may sound unbelievable, but it is true. Two pieces of metal without any coating on them will form into one piece in the vacuum of space. This doesn't happen on Earth because the atmosphere puts a layer of oxidized material between the surfaces.

9 More than 50% of U.S. products require welding. Do you know which of the following products rely on welding?

- Race cars
- Ships
- Medical devices
- Farm equipment
- Scooters
- Bridges
- Computers
- Oil rigs
- Cell phones
- MP3 players

Answer: All of them.

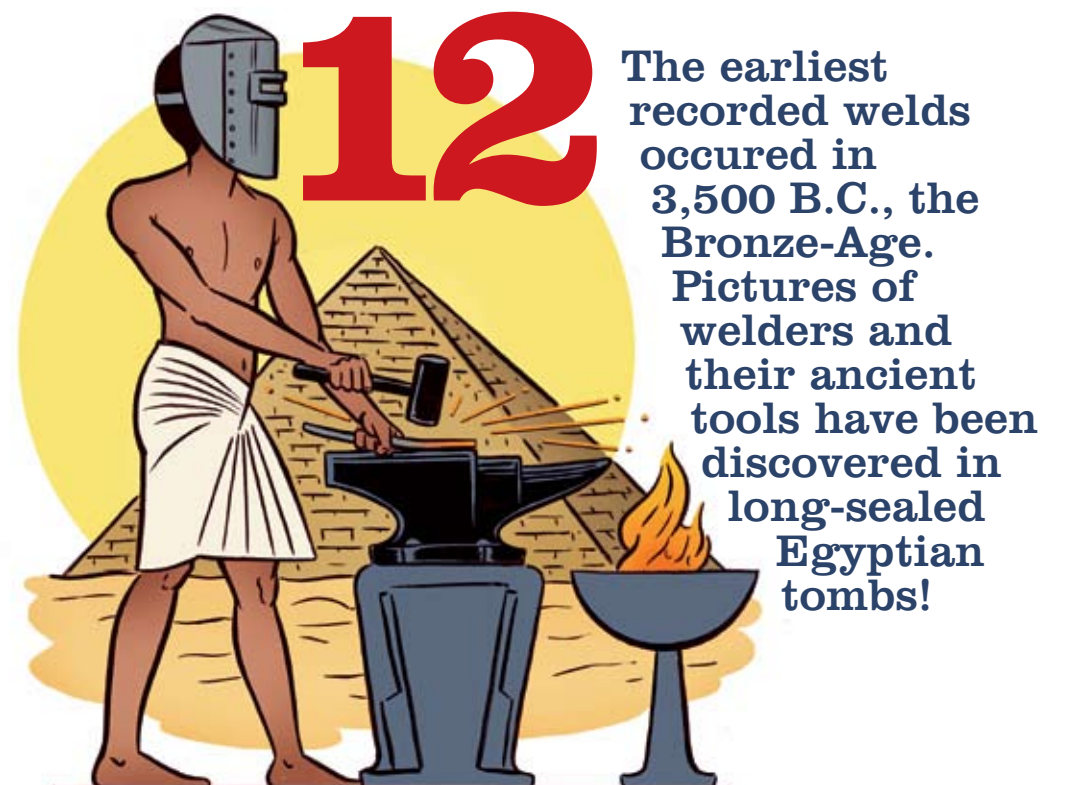


10 What is a “fume plume”? It is the visible column of fume that rises directly from the spot of welding or cutting.

11 The current record for the world's deepest underwater dry weld, which is carried out in a chamber sealed around the structure to be welded, was set by Global Industries in 1990, at 1,075 ft. deep. But that is only half as deep as the world's record wet weld, set by the U.S. Navy in 2005, at 2,000 ft. deep. Wet welding is performed underwater, directly exposed to the watery environment.

JAY LENO: COURTESY OF NBC STUDIOS; UNIMATE COPYRIGHT © 2009 GM CORP. USED WITH PERMISSION, GM MEDIA ARCHIVE

ILLUSTRATIONS: JONATHAN CARLSON



big role

Computers and robots play a

by Pat Toensmeier

THE IMAGE MOST PEOPLE HAVE OF welding is someone in heavy gloves and a mask using an arc torch to join two pieces of metal. But this image, like welding technology, is changing. It won't be long before new welders enter the field trained to work with computers, lasers and robots rather than gloves, masks and torches.

Welding is becoming very high-tech. One reason is that the use of specialty metals in more products requires extremely

Welding is becoming very hi-tech.



An Edison Welding Institute engineer explains the operation of a gas metal arc welding robot equipped with a laser sensor for accuracy.

precise welding capabilities. Another is that companies are looking for ways to increase the productivity and quality of welding. The best way to meet these needs is with automated systems.

As the industry adds automation and other technologies, students interested in welding will have the opportunity to learn advanced processes that improve their skills and expand job prospects.

Experts point to three technologies with a big future: Hybrid/laser Gas Metal Arc Welding (GMAW); friction-stir

welding; and robotics. Each requires students to not only learn welding, but also learn how to set up, program and operate high-tech equipment.

"These are automated technologies that require a high level of training," says Patricio Mendez, director of the Canadian Center for Welding and Joining at the University of Alberta. "These technologies are shifting welding from being entirely a manual skill to one that requires insight and expertise to run sophisticated equipment."

Hybrid/laser GMAW welds thick pieces of metal rapidly and with greater control than manual welding. These systems use high-power lasers that one expert says are about the size of computer servers. The laser makes a thin cut up to 1/2-inch deep, liquefying metal as it moves. The GMAW then deposits filler metal (usually wire) in the groove and melts it with a secondary heat source to create the weld. Process benefits include reduced weld distortion, greater retention of base-metal properties and speed.

Friction-stir welding does not melt metal. It generates frictional heat through a rotating tool bit that penetrates, distorts and softens two pieces of metal that are clamped together on a special machine. The pieces almost immediately fuse together when clamping pressure is applied. Friction-stir welds are called autogenous, which means they

don't use filler metal. One advantage of this is no cracking or deformation as the weld solidifies. The weld also has excellent strength, and fatigue-resistance.

Robotic welding has been used for years by automakers and others. Robots, usually weld flat surfaces laid out in front of them, which limits their use. Work is underway on software and sensors that will permit robots to weld metal shapes placed at all angles. Mendez and his students for example, are trying to improve computer control of robots to broaden the capabilities of welding automation.

"We are trying to invent the machine of tomorrow," Mendez says of the work. "Welding is incredibly exciting because it combines a bit of everything. Welding offers many possibilities and allows lots of room for creative thinking." *



Johnson Space Center's Robonaut (foreground) performing a mock weld.

PHOTO LEFT COURTESY OF EDISON WELDING, PHOTO RIGHT COURTESY OF NASA

Resource Guide

Dozens of professional organizations, government Websites and trade unions exist to help you learn more about careers in welding. Here is a sampling of resources to get you started.

PROFESSIONAL AND INDUSTRY ORGANIZATIONS

American Ceramic Society
(866) 721-3322
www.ceramics.org

American National Standards Institute
(202) 293-8020
www.ansi.org

American Society For Civil Engineers
(800) 548-2723
www.asce.org

American Society For Nondestructive Testing
(614) 274-6003
www.asnt.org

American Society for Quality
(800) 248-1946
www.asq.org

American Society of Mechanical Engineers
(800) 843-2763
www.asme.org

American Society of Safety Engineers
(847) 699-2929
www.asse.org

American Water Works Association
(303) 794-7711
www.awwa.org

American Welding Society
(800) 443-9353
www.aws.org
www.careersinwelding.com
www.jobsinwelding.com

ASM International
(440) 338-5151
www.asminternational.org

Association for Iron and Steel Technology
(724) 814-3000
www.aist.org

Edison Welding Institute
(614) 688-5000
www.ewi.org

Fabricators & Manufacturers Association
(815) 399-8775
www.fmanet.org

Gas and Welding Distributors Association
(215) 564-3484
www.gawda.org

Institute of Electrical and Electronics Engineers
(800) 678-4333
www.ieee.org

Minerals, Metals & Materials Society
(800) 759-4867
www.tms.org

National Association of Manufacturers
(202) 637-3000
www.nam.org

National Center for Welding Education & Training (Weld-Ed)
(866) 529-9353
www.weld-ed.org
www.educatorsinwelding.com

National Council for Advanced Manufacturing
(202) 367-1178
www.nacfam.org

Plumbing, Heating and Cooling Contractors Assn.
(703) 237-8100
www.phccweb.org

Society of Automotive Engineers
(724) 776-4841
www.sae.org



Society of Manufacturing Engineers
(313) 271-1500
www.sme.org

Society of Naval Architects and Marine Engineers
(201) 798-4800
www.sname.org

Society of Petroleum Engineers
(800) 456-6863
www.spe.org

GOVERNMENT AGENCIES

U.S. Department of Labor Employment & Training Administration
(877) 872-5627
www.doleta.gov
www.careervoyages.gov

MANUFACTURING UNIONS

AFL-CIO
www.aflcio.org

AFL-CIO Working for America Institute
(202) 508-3717
www.workingforamerica.org

International Association of Bridge, Structural, Ornamental and Reinforcing Ironworkers
(202) 383-4800
www.ironworkers.org

International Association of Machinists & Aerospace Workers
(301) 967-4500
www.iamaw.org

International Brotherhood of Electrical Workers
(202) 833-7000
www.ibew.org

International Brotherhood of Teamsters
(202) 624-6800
www.teamster.org

International Union of Operating Engineers
(202) 429-9100
www.iuoe.org

National Joint Apprenticeship Training Committee
www.njatc.org

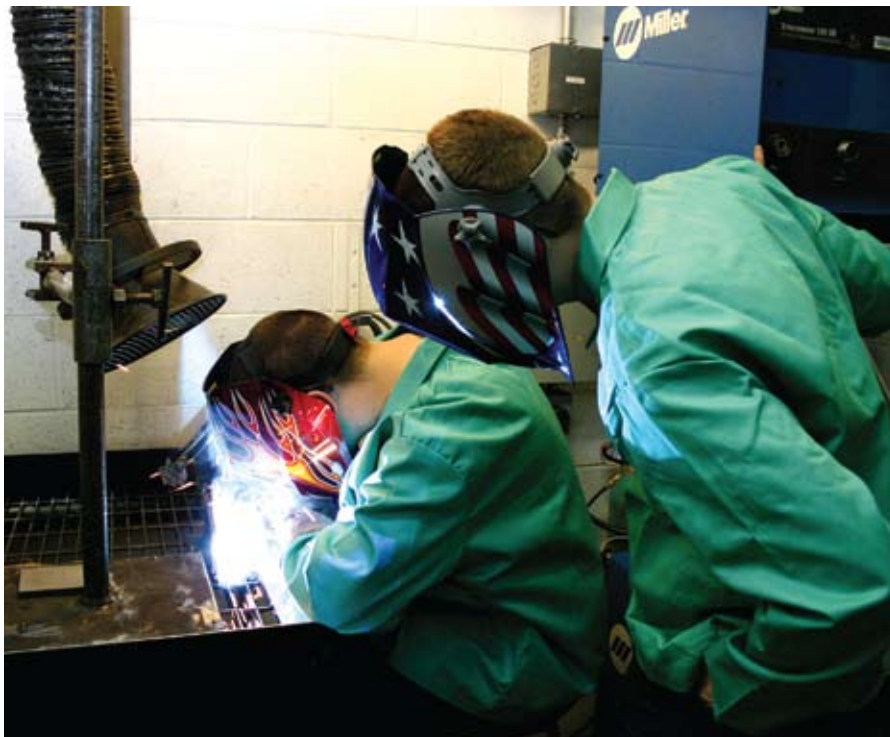
Sheet Metal Workers' International Association
(202) 783-5880
www.smwia.org

United Auto Workers
(313) 926-5000
www.uaw.org

NOTE: Websites are constantly changing, so you should always check by doing a Web search.

Achieving SUCCESS

Tips for Counselors, Teachers and Parents Navigating Students toward Welding Careers



TIPS FOR COUNSELORS

High school students today face some difficult choices about what they want to do with their lives. Amid this information overload, professional counselors can steer students toward careers they may have overlooked. As a career expert, you

can point out the benefits of a future in the growing field of welding.

From spaceships to bridges to nanotechnology, welding is an essential

part of the structure of our world. A new generation of skilled technicians will be required in the future. You can help fill that need by pointing students

in the direction of a rewarding career at all training levels.

Right Fit

The welding industry has something to offer to just about every student. Some may be drawn to the precision of a nanotechnology career. Others may like the adventure of an underwater welding job. Work locations are as varied as the projects. Welders are on location at military bases, at space centers, on construction sites and in university labs, hospitals and auto shops. A growing number of graduates enter the field building cell phones and computers.

You can help future metalworkers decide whether one of the myriad of welding jobs would be a good career fit by asking a series of lifestyle questions like the ones on the U.S. Department of Education's Prepare for My Future Website (www.ed.gov/students/prep/college/consumerinfo/index.html). This is a great place to check out college options to determine what fits a student's financial, family and career goals.

Another free online Career Personality Assessment is offered by Fun-Education (www.funeducation.com). Students rate for accuracy a series of 485 questions such as "Am I the life of the party?" The whole process takes about an hour, and the resulting report gives a range of jobs that may fit the student's personality type.

Asking questions about workplace, salary, along with hobbies and interests, can start a conversation about a career in welding. You can help bridge the gap between possibilities and reality by showing the things they are already doing in their spare time—jewelry making, auto repair or odd construction jobs—that could lead to a profitable career and help them balance their dreams of family, home and stability.

Resources

For more on the future of welding careers, check out the American Welding Society's Welding Technology Roadmap at <http://files.aws.org/research/roadmap.pdf>.

Along with the other resources in this guide, you may want to visit the U.S. Department of Labor Career Voyages Website (www.careervoyages.gov). The Career Changers section is a valuable tool to show students that welders, cutters, solderers and brazers are considered an in-demand occupation. This site is also home to the Career Myths brochure, in the Career Advisors section, which can be a valuable resource in educating students about the opportunities available to them. For instance, one of the myths busted is "No one will hire me because I lack experience, have low grades, and have gaps in my work history." The Occupational Outlook Quarterly encourages students to not only find ways to overcome these challenges, it lays out strategies for informational interviewing to get to the next level.

The U.S. Department of Labor also sponsors www.careeronestop.org, a snapshot of jobs, salaries and search tips that can help paint an accurate picture of life as a welder.

These resources will allow students to make informed decisions about which of the many welding careers may fit their educational and lifestyle goals. Once you show them what is out there, watch the sparks fly. *

TIPS FOR PARENTS

Did your child build elaborate castles out of blocks as a toddler? Did he glue the remote control to the television? Does she like to work on cars? These may be signs your child has a natural instinct for welding. Welders understand that by joining things together, they are creating more useful products

Sharing the Dream

The earlier teens start thinking about what kind of career they would enjoy, the better off they'll be. Just because they change aspirations every six months doesn't mean they aren't dedicated. They are trying on different possibilities to find the right fit. You can help in this process by asking questions and guiding them to resources that will give them answers.

The U.S. Department of Education's Think College Website (www.ed.gov/students/prep/college/thinkcollege/edlite-index.html) can help. It includes basic questions about desired education levels, sources of funding for higher education and tips for picking the right school.

Another way to spend a productive afternoon is at the Vocational Information Center Welding and Metalworking Career Guide (www.khake.com/page29.html). You will find career descriptions, skill requirements, schools and job-market statistics. Or cruise over to Careers in Welding (www.careersinwelding.com) for a sampling of the jobs available.

You can also help your teen get a part-time job or internship. Even if it is unpaid volunteer work, it will help prepare him or her for college and narrow the choices.

Encourage your teen to think big. Opportunities abound regardless of financial background. The AWS Foundation can make dreams reality thanks to a number of scholarships and fellowships offered each year. You can learn more at www.aws.org/w/a/foundation/index.html.

Get Personal

Share your career choices with your teens. Talk about what you do, how you got to where you are and your goals for the future. Take your child to see where you work and why you get up in the morning. You can do this through the national Take Our Daughters and Sons to Work Day (www.daughtersandsonstowork.org) or on your own, informally. Use the experience as an opportunity to ask questions. What do they think about the prospect of doing something similar? What would be more interesting? What are their income and lifestyle goals? What is realistic?

Do you have an interesting career in construction? Volunteer to speak in your teen's classroom or at a career day. Who knows, it just may get you fired up about going to work tomorrow.

Encourage your teens to do the best they can regardless of their educational goals. Whether their future includes college or technical school will depend on the individual student but make sure they get a high school diploma.

Counsel your student to take as many courses in math and science as possible. If your child hasn't caught the "math is fun" bug yet, try finding a summer math camp at www.ams.org/employment/mathcamps.html or check out www.sciserv.org.

Math and science skills will help them in work and everyday life. Teach them to speak and write effectively. Regardless of their career choice, the ability to communicate is essential in today's world. *

TIPS FOR TEACHERS

Teachers can play a vital role in showing students the many opportunities welding opens. An emphasis on collaboration and logical thinking can give students the basic skills needed to pursue a variety of careers. Additional classroom exercises focused on building, following directions and working as a team can also lay a strong foundation.

Regardless of which aspect of the welding industry attracts a student, a grounding in math and science is a great foundation. Employers also value communication, so a well-rounded education can help your students succeed whether they are fabricating medical devices or communications satellites. Shop classes, of course, can be a practical way to open the door to a welding career. For more ideas and resources, check out www.educatorsinwelding.com. It is a great tool for educators and counselors to get additional information on careers in welding, network with fellow educators, and get curriculum and recruiting resources.

Bring a Welder to the Classroom

You can bring the vague idea of a welding career to life by inviting guest speakers from local companies to share stories from their daily lives. Look to local manufacturers, or construction companies for possible speakers. Job fairs and career days are opportunities

IDEAS FOR TEACHERS

A great way to make the idea of a welding career real is to have students create a “dream job” classified ad. After they use the Websites listed in this section, ask them to do some research about welding jobs that fit their interests. Then turn the responses into an ad that fits their skills and career goals perfectly.

- 1 What activities do you like to do? Are they done mostly indoors or outdoors? (Welding workplaces vary from being underwater or at the peak of a skyscraper to an automobile manufacturing plant or the laboratory of a technology campus.)
- 2 What are your favorite school subjects and activities? (Students who have a firm grasp of math, science and communication would do well in a welding career.)
- 3 Do you enjoy working on projects alone or with a large group? (Welders can take pride in their contribution to the team effort of building a bridge or the artistry of creating a unique sculpture on their own.)
- 4 What job holds the most interest for you at this time? (What have you learned about welding through your research?)
- 5 Where do you want to live when you enter the workforce? (Unlike many other careers, welding jobs are available in all states.)

ADAPTED FROM ORIGINAL EXERCISE IN EDUCATION WORLD, WWW.EDUCATIONS-WORLD.COM

for local welders to share their passion.

Internships for teachers can also give you real-world experience. When you come back to class with stories about things you made, it will fire kids up to find a meaningful career.

Resources

Workforce³One (www.workforce3one.org) is a public collaborative that collects the latest resources and strategies to build the workforce of the future. Through podcasts, “Webinars,” white papers and a social networking site, you can learn how to reach students in new ways.

For teachers dedicated to letting kids build their own future, Odyssey of the Mind (www.odysseyofthemind.com)

is a program that teams students up to solve problems. Students build cars, robots and support structures to compete with other teams from all over the world on the basis of originality and teamwork.

Another wonderful hands-on program is SkillsUSA (www.skillsusa.org/compete/contests.shtml). Encourage your students to participate in one of the many Champions at Work programs, which includes a section on welding, that requires students to demonstrate their ability to measure weld replicas, cut accurate holes using oxy-acetylene equipment and even do arc welding. The Educators section has more details about getting involved.

The student chapters of the American Welding Society (www.aws.org) are a wonderful resource for speakers, contests and scholarship opportunities.

America’s Career Resource Network (<http://cte.ed.gov/acrn/teachers/careerexpclassrm.htm>) can make strengthening the link between work and school easier. The story of one teacher’s dedication to showing her students that everyone can succeed is inspiring. *

Surf the Web

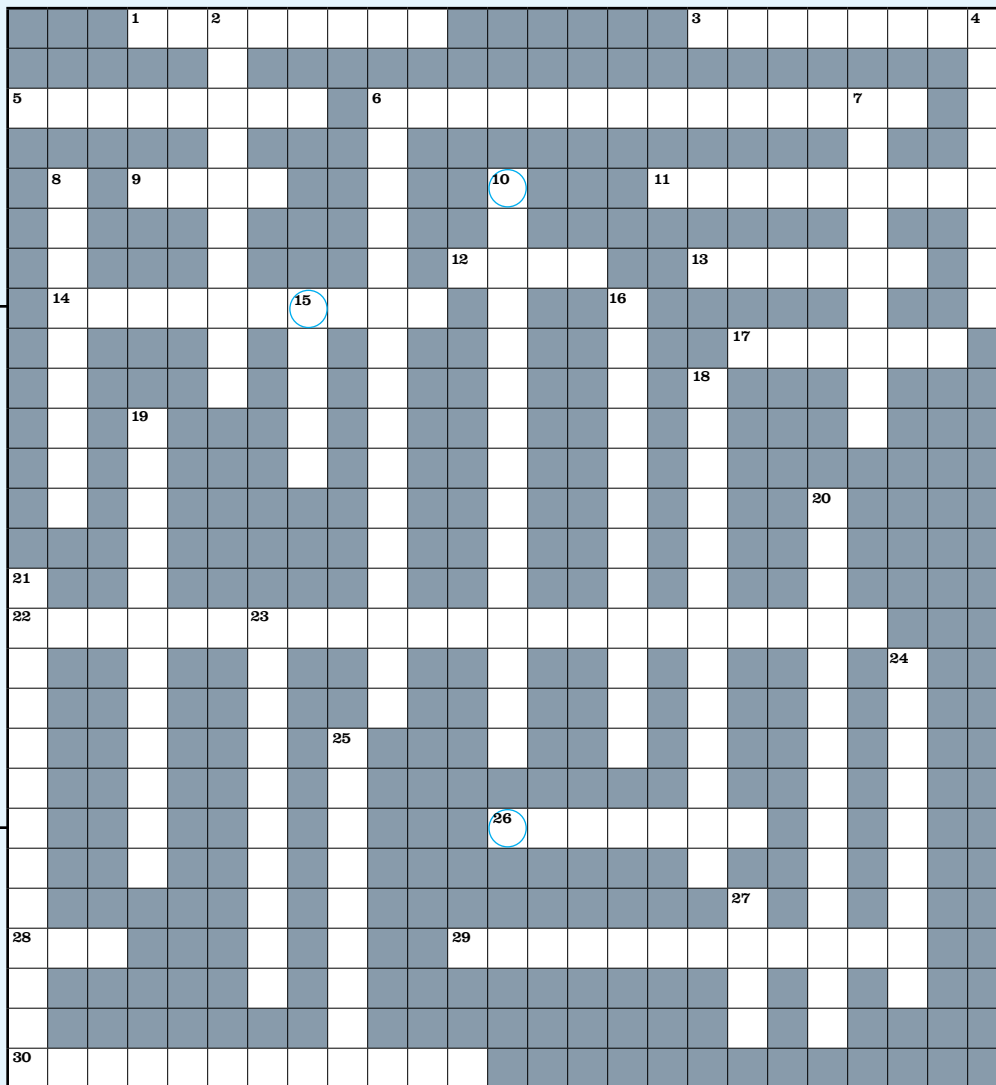
Tell parents they can find lots of career information at the National Center for Welding Education and Training, at www.weld-ed.org. This site provides access to:

- * Different types of careers.
- * The knowledge and skills needed to enter these careers.
- * Information about education and training opportunities needed to prepare for a chosen career.

Another good place to browse with your teen is the American Welding Society’s website, www.aws.org.

WELDING CROSSWORD

Now that you have learned about welding and all the exciting opportunities it offers, let's test your knowledge!



15



10



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ACROSS

- 1 Person who teaches welding
- 3 Where you would work if you worked on an oil rig
- 5 One who runs automatic, mechanized or robotic welding equipment
- 6 Paid on-the-job training and education
- 9 Welding process that uses a non-consumable tungsten electrode
- 11 Powerful welding process that can join almost all metals
- 12 Uses inert gas to shield the weld
- 13 One who performs a manual or semiautomatic welding operation
- 14 Associate's degree in welding/materials joining technology
- 17 Uses blueprint drawings to cut, fit, assemble and tack weld
- 22 Non-profit organization with a goal to advance welding and joining technologies
- 26 Comedian who has large antique car and motorcycle collection
- 28 The arc and molten metal are shielded by a blanket of granular flux
- 29 Industry in which welder builds and repairs ships
- 30 Trade name for SMAW, shielded-metal arc welding

DOWN

- 2 Welding process used on plastics
- 4 Four-year bachelor's degree
- 6 Ways to increase the productivity, quality and economy of welding
- 7 Person who performs non-destructive testing to welds
- 8 When you pass a welding test showing you can do the weld
- 10 Person who welds underwater
- 15 Student who wrote his Ph.D. thesis on hybrid-laser arc welding
- 16 Welding process that uses rotating tool bits
- 18 Industry where welder builds cars and equipment
- 19 Industry where welder works on buildings
- 20 Device designed to teach the basics of welding in the classroom
- 21 Protection for eyes
- 23 No filler material is used for the weld
- 24 When earliest recorded welds occurred
- 25 The metal or alloy to be added in making a TIG weld
- 27 Material that must be kept dry; used to protect weld pool