

# MANUFACTURING TODAY WI



## Manufacturers reached out to Wisconsin Schools



In the early fall of 2013, Wisconsin's Manufacturers reached out to the schools in our state to invite them to explore the world of Manufacturing. They also had a message: "There is a real need for skilled workers in the manufacturing industry. We are looking for employees with a working knowledge of STEM manufacturing principles and how to apply them in a real world setting."

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### And the call was answered!

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This issue of *Manufacturing Today Wisconsin* contains many articles from schools across the state, showcasing their Technology Education programs. Wood, metal, plastics; welding, engineering, assembly and production; 3D printers, CNC machining equipment, metal and inert gas welders; students at these schools are

getting a hands on education in STEM principles.

Through various means these schools are setting a high bar for their students and encouraging them all the way!

We invite you to turn the pages and read about these innovative programs, the efforts that go into them, and the students who are winning with them.





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# Game Changer

## Stoughton High School joins digital fabrication revolution with its Fab Lab



By Shelby Anderson

In Massachusetts a father made a prosthetic hand for his son using a 3D printer, a student in France used a 3D printer to build a digital camera, and NASA has used the technology to build components for rocket engines.

There is a revolution of sorts underway. It's a revolution of "making things" and its taking place across the world and in Wisconsin at Stoughton High School. The high school is fitted with a "Fab Lab." Short for Fabrication Laboratory, the Fab Lab is a phenomenon started by Neil Gershenfeld, director of MIT's Center for Bits and Atoms. There are now more than a hundred of Fab Labs across the world. However, Stoughton High School is one of only a handful housed at a public school. The Fab Lab is a collection of high-tech tools: a 3D printer, two laser cutters, a vinyl cutter, and a large milling machine, or ShopBot, which cuts materials for large-scale products such as furniture. There is also an electronics station where students can build and program microprocessors.

Unlike traditional shop classes where students created projects with handheld or power tools, these machines are controlled and operated through computer numerical control (CNC). Code is entered into a computer and then directions are sent to a machine, like a 3D printer or laser cutter, which produces the product or makes the

cuts or incisions, based on the directions it receives from the computer. Students at Stoughton High School are being trained how to operate the equipment and are beginning to see that the possibilities to design and produce innovative products are endless. "They have the opportunity to create something that doesn't exist, something that they've always wanted, they can create here," said Brian Shimon, Stoughton High School associate principal.

### Building Partnerships

The Stoughton High School Fab Lab got its start when Mike Connor, a retired engineer and now a member of the grant committee at Cummins, a company that designs and manufactures power generation equipment and engines, visited a Minnesota high school that is fitted with a Fab Lab. Connor was impressed and brought the idea to the district. With the help of Connor, Cummins stepped up and offered a \$100,000 matching grant to build a Fab Lab at Stoughton High School. The district was able to collect another \$106,000 on its own. The money is part of a three-year grant that allowed the district to purchase and set-up the equipment.

### Opening the Lab

With the equipment in place, the district needed qualified staff to run the lab. Three teachers at Stoughton High

School – Brad Seehafer, Chris Wiemer, and Francis Kelley – stepped forward and took a semester-long MIT course through live videoconferencing with other Fab Lab leaders from around the world. At the start of this school year, the first Stoughton students officially began classes in the Fab Lab – learning how to use the equipment and getting familiarized with lab philosophies and teaching styles. Wiemer said students are not only learning how to use the high-tech equipment, they're also learning how to apply concepts learning in math, science and technology classes to their projects. "We're teaching that design process, which is useful in a lot of things," Wiemer said. "If students create something and it doesn't work, they don't get docked for it they just go back and work on it some more." Another tenet of the Fab Lab philosophy is collaboration, not only amongst other students in the Stoughton Fab Lab but in other labs. Each Fab Lab in the world can connect to any other lab via a web camera. Through this way, great ideas and projects are shared all over the world.

### Creating Innovators

When asked why the district would want to take on a big project such as the building and development of a Fab Lab, Shimon said it all goes back to the stu-

dents. "The Fab Lab is another way to get students excited about learning and to get them to take high-level math and science courses," Shimon said. "We want to make sure that we're building access to all students," said Liz Menzer, Stoughton school board president. "We have about 25 percent enrolled would be consider non-traditional Fab Lab users. There is an opportunity to really excite and ignite kids in a field where they are eager to learn more." Additionally, projects in the Fab Lab use skills and disciplines from across the curriculum. Students are using science, art, math, and computer programming skills. "It's been really exciting, even if science isn't your thing," Menzer said. "There is a lot of enthusiasm among students and it keeps growing into other areas. This is something that can be a game changer for a school district like Stoughton."

Anderson is editor of Wisconsin School News.

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# Virtual Welding Education: Addressing the Skills Gap through Technology

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Fusion welding entails making sure that welds have complete penetration and are structurally sound. Schools that have welding programs or are looking to add welding programs can use this same definition as a litmus test for their programs — after all, the purpose of welding education is to penetrate students' minds with welding knowledge so that they get a structurally sound education for future welding endeavors.

In today's educational and economic environment, the skills gap is not decreasing although budget cuts, low student enrollment, and high costs of arc welding remain struggles for welding programs. This has left CTE directors and welding instructors needing to find ways to support and defend the benefit of these programs.

As a partner with Career and Technical Education, Realityworks works with

CTE programs to give them hands-on learning tools and to help communicate the importance of CTE. This Eau Claire, Wisconsin-based experiential learning company produced a teachWELD™ Welding Simulator as one resource to help welding programs launch new learning opportunities and bring interest to welding careers.

"The teachWELD Welding Simulator brings virtual reality technology and in-depth welding assessments into the hands of students and instructors in a very affordable way. It is a win-win for all involved," says Realityworks President Timm Boettcher.

In fact, a study published in the Journal of Human Factors titled "Physical and Cognitive Effects of Virtual Reality Integrated Training" tested the use of virtual reality versus traditional, real-time arc welding. The study compared 100 percent traditional welding instruction versus a 50/50

virtual reality welding/traditional welding mix. Results showed that "participants in the 50/50 virtual reality integrated training group performed as well as, and in some cases significantly outperformed, the 100% traditional welding training group"<sup>1</sup>. The study concluded that "virtual reality technology is a valuable tool for the production of skilled welders in a shorter period of time and often with more highly developed skills"<sup>2</sup>.

This hybrid teaching method of using a combination of real arc welding and virtual welding has helped instruct future welding employees in a cost-effective and time-friendly manner. George Karr, a welding instructor at Hollenstein Career and Tech Center in Fort Worth, Texas says, "teachWELD has decreased our consumable and welding costs by about 70 percent for our program." This program has not only seen costs decrease by using this new teaching tool, but has also seen students' technique and welding ability increase, allowing them to become proficient more quickly.

By blending new welding training tools with current teaching practices, students are getting better, faster, and in a very cost-effective manner. The teachWELD Welding Simulator is an exciting new opportunity in education. This classroom tool increases



welding education opportunities and efficiency in student skill development, all while bringing newfound strength to welding programs. TeachWELD is a new and exciting way to bring about fusion to your welding program for years to come.

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# A to Z Machine Co., Excelling in Youth Apprenticeship

Andy Preissner, SPHR  
HR & Safety Manager  
A to Z Machine Company, Inc

A to Z Machine Co., a CNC Machine Shop — Job Shop located in Appleton, WI, like many other machine shops struggled for years with finding the right candidates to fill their skilled trades positions. Instead of sitting on the sidelines with all the information on the Skilled Trades deficit, they took matters into their own hands. The Youth Apprentice program has been wildly successful for A to Z Machine Co.

Beginning in 2010, A to Z Machine Co. started a partnership with Kaukauna High School and Nels Lawrence on the Youth Apprenticeship program. They started with one Youth Apprentice (High School Junior) and added another Youth Apprentice soon thereafter. The company has had 13 total Youth Apprentices go through the program with 3 more currently participating in the program and the students have come from 8 different high schools. Of those 13 who have participated in the program, A to Z

Machine Co. has hired on 6 individuals for full-time positions upon graduation. The Youth Apprentice program provides an excellent opportunity not only to expose high school students to CNC careers and manufacturing, but it is also a great opportunity for A to Z Machine Co. to use a “Try it before you buy it” approach. This level of success is much better than hiring individuals who don’t have experience in the CNC field and trying them out.

“Our initial implementation of the Youth Apprentice program at A to Z Machine was initially rough around the edges, but we have since refined the program and it functions like a well-oiled machine” stated Andy Preissner, HR & Safety Manager. They take a very structured approach in training and exposing our Youth Apprentices to most aspects of CNC Machining. By the time an individual gets through the process it is pretty clear whether or not they would be a good member of the A to Z Machine team. Some individuals have gone on to other careers in manufacturing and



further education, but all have been appreciative of their time and experience in the program.

There was some initial concern as to how accepting the team members would be

of the Youth Apprenticeship program. That concern was quickly put to rest. According to Preissner, “The Youth Apprentices

**Continued on Page 7**

## Dual Enrollment Academy provides skills training to high school students



By Bryan Obst, Trace-A-Matic,  
and Shelly Kuhn, WCTC

A youth pipeline initiative developed by manufacturers, secondary education and post-secondary education is taking root to help fill the state’s need for qualified workers. This spring, the first group of high school students enrolled in Waukesha County Technical College’s Dual Enrollment Academy (DEA) will graduate with basic workplace skills and begin employment immediately or continue honing their skills in college.

### A collaborative effort

Early last year, Trace-A-Matic, a Brookfield-based Computer Numerical Control (CNC) machine shop, approached Waukesha County Technical College (WCTC) in nearby Pewaukee and two area school districts with an idea, said Bryan Obst, corporate recruiter for Trace-A-Matic.

“We wanted to provide students an opportunity to start their post-secondary education

while in high school and be able to start their career in machining upon graduation from high school,” Obst said.

The ensuing discussions resulted in plans for the DEA, a one-year pilot program which offers three high-demand program cohorts – Tool & Die/CNC; Welding/Fabrication; and IT-Networking. Forty students from eight area school districts are currently enrolled in the program. Upon program completion, students earn an industry-recognized “workplace certificate” in one of the three occupations.

“The unique part about this program is that by the time these students graduate from high school in spring, they will have earned an industry-recognized workplace certificate, allowing them to either get a job right away or use the credits they have earned to go on and pursue a college degree,” said Barbara Prindville, Ph.D., president of WCTC.

The Department of Workforce Development (DWD) and Wisconsin Economic Development Corporation (WEDC) each contributed \$77,576 toward the pilot’s instructional costs for the program.

### Students earn dual credit

Each Dual Enrollment Academy co-hort



consists of 8-18 students. Participants must be in 12th grade, with a cumulative GPA of 2.0 or higher, must be on track to graduate from high school and successfully meet WCTC entrance and program requirements.

Students spend a majority of time during

each school day at WCTC participating in the Dual Enrollment Academy program during their first and second semester senior year. They will attain 20-24 credits of course work

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# A to Z Youth Apprenticeship Continued from Page 6



are a critical part of the operations at A to Z Machine Co.” They perform key roles and are held to the same standards as any other team member. “It has gotten to the point where areas are sad to see their current Youth Apprentice move to another area when it comes time although they hear positive feedback about the new individual

coming to their area and they get excited.” The trainers take great pride in passing along their knowledge to the Youth Apprentices instead of keeping it all to himself.

In addition to providing a viable workforce upon graduation, the Youth Apprenticeship program has provided a number of unintended benefits for the

company. Among those include local, state and national recognition, additional area high schools seeking out A to Z Machine to participate in the Youth Apprenticeship program, participating in presentations and sitting on the Governor’s Council on Workforce Reinvestment, attracting the attention of experienced machinists who view A to Z Machine as a forward looking company, and increasing the number of referrals for candidates.

There were some key things A to Z Machine did early on that helped build the program what it is today. Those include spending the time necessary to refine the program to get the best result, creating a Youth Apprenticeship video, and having a Youth Apprentice Parents Night. “We felt it was critical to gain parents buy-in of Youth Apprenticeship program and A to Z Machine” stated Preissner. Without the buy-in and having the potential decision maker involved they could have missed out on potential quality Youth Apprentices. “We instituted this after hearing from multiple Technical Education instructors. I heard from one instructor that a parent told them to quit encouraging their child to go to

machining and that their child was instead headed to college. We had to get the word out about machining and show parents what make our company different” said Preissner. Feedback from the Parents Night has been very positive and it continues to grow year after year.

The Youth Apprenticeship program continues to be a difference maker for A to Z Machine and help them continue their path of growth. In early 2010 A to Z Machine Co. had 75 team members and now they are close to 110. The success of the Youth Apprentice program has been a big part of that.

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## Investing in the Manufacturing Pipeline

### Purple Knight Manufacturing

Beloit Memorial High School's Technology Education program challenges have been similar to many of the programs across the United States. Dilapidated spaces and outdated equipment, with the need to provide relevant and rigorous real world experiences for students we must begin to transform our programs to meet the needs of the 21st Century.

We continuously hear about the United States skilled trades dilemma. The jobs across the country are out there, however we can't meet the demand because of the lack of highly skilled individuals. The Beloit School District has made a commitment to begin challenging students by guiding them to a pipeline of careers that are in high demand.

To do this we have decided to invest in our Career and Technical Education program, specifically in the areas of Manufacturing and Welding. The Beloit School District is fortunate to have a forward thinking Superintendent in Mr.

Steven McNeal, as well as a supportive school board. Through their direction and support we have begun developing a program that will help meet the skilled trade challenges not only locally but also nationally.

Advisory committees have been formed in each of the areas in Career and Technical Education. The manufacturing and welding advisory committees have played a vital role in equipment and curriculum recommendations. The committee concluded that the equipment and spaces were outdated and did not reflect the highly skilled area of today's manufacturing environment. It was at this time that the Beloit School District set out to change the direction and validity of the program.

In December of 2012 the renovation of the Manufacturing and Welding area began. All of the outdated equipment was removed from the space. Items that would no longer be used were auctioned off. Items that would remain were placed



in storage to be returned after the renovation was complete. The plan was to improve the physical environment such as lighting, flooring and also included a new classroom space. With this it was also crucial that the equipment going

back into the area reflected the needs of today's manufacturing and welding careers. Through the advisory committee guidance it was recommended to begin

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## Youth Apprentices of Kaukauna High School



*Nels Lawrence  
CO-OP and Youth Apprenticeship  
instructor since 1996, Technology &  
Engineering  
instructor, Kaukauna High School*

Week after week the skills gap makes the news along with data that documents an aging workforce in the skilled manufacturing trades. In Kaukauna, a Fox Valley high school program provides part of the solution year after year. The steady growth of the machine tool and metal trades in the area means opportunity for the Youth Apprentices of Kaukauna High School. Even during the worst of the economic downturn employers continued to hire 16-18 year old students through the CO-OP and YA program. Graduates of the program are now key employees with

16-17 years' experience. One time student trainees have founded their own machine tool companies and they now hire the next wave of high skill high pay trades people.

The secret of the continued success at KHS is based on a partnership with industry and a careful selection process. Students are eligible to apply for either the 1 or 2 year Youth Apprenticeship. They must be on track for graduation and have good attendance, but one of the keys is that these students are required to have completed a course in a related area such as Machine Tool 1. KHS offers a range of courses in metals, welding, construction, CAD design, engineering, electronics, graphic arts, and automotive. The Wis-

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## Investing in the Manufacturing Pipeline Continued from Page 8

investing in CNC machining equipment. We now have a combination of 12 Haas CNC Vertical Machining Centers and CNC Turning Centers, two of which can also be operated manually. Along with our CNC equipment we now also have 17 Miller MIG welders (Metal Inert Gas) and 17 Miller TIG welders (Tungsten Inert Gas). In August of 2013 the space was ready for students, with minor organizing to be completed throughout the school year.

Our first semester with the new equipment has been a learning experience, with new equipment and tooling also come new challenges. Our instructor Chris Klatt has been a Technology Education teacher for 25 years. He has a background in welding and traditional machining. He has attended training at Haas and will also be taking classes at Blackhawk Technical College to continue to advance his knowledge for himself and his students. We are also in the initial stages of collaboration with the math department. This connection of the two areas will play an important

role as students begin applying math as it relates to STEM (Science, Technology, Engineering, and Math) education.

Also throughout the first semester it has been important to offer different experiences for students. During the month of October (Manufacturing Month) we wanted to begin taking students to facilities so they could see first-hand what manufacturing looks like today. Students were able to visit Forest City Gear, Roscoe Works and Regal Cutting Tools. For many it has opened a new door into a viable and rewarding career. Our investment in manufacturing will provide invaluable learning experiences for students. As we continue to redevelop and improve we have had two high profile Wisconsin officials and many local companies and school districts tour our new manufacturing and welding facility. This recognition has provided validation that we are making the right decisions for our students and our community. We are "Beloit Proud"!



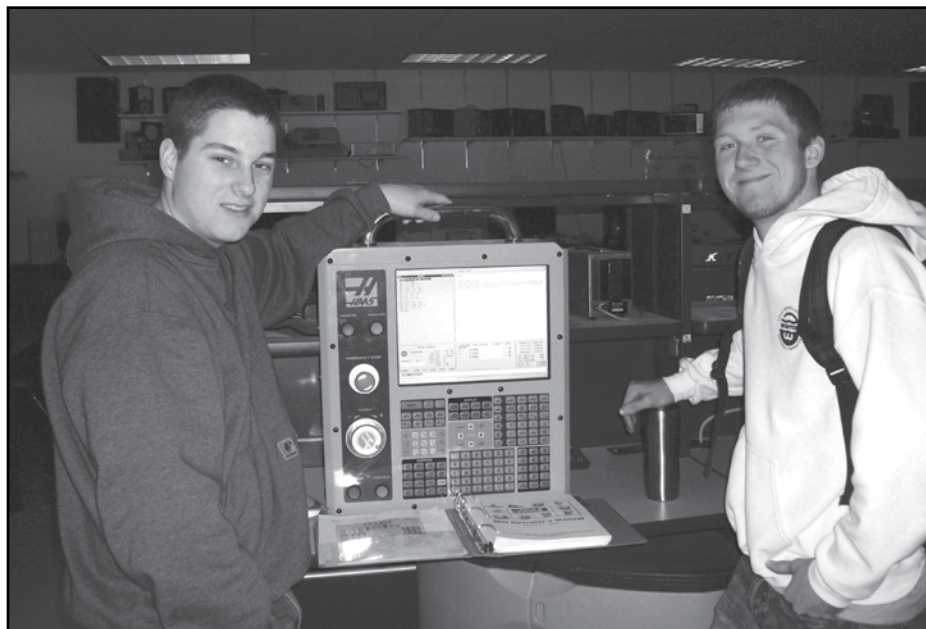
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## Youth Apprentices of Kaukauna High School Continued from Page 8



consin Youth Apprenticeship program requires continued course work that supports the career path during the one to two year apprenticeship period. Employers G&G Machine and Fox Valley Tool & Die have established their own in house pattern that allows students to learn in every area of the facility. Ryan, a senior at KHS, learns on the job and at school he uses a CNC simulator that has an actual control panel for a HAAS CNC machine. His work place however has the MAZAK machines and he trains at school using an on-line subscription to Tooling U. This resource is part of his Youth Apprentice program and is actually used by major corporations, nationwide, to train their employees.

Students are awarded a State of Wis-

consin certificate for completion if they meet the minimum of 450 hours per year and an industry developed set of skills related to a specific career path. While this apprenticeship does not take the place of the registered apprentice program that is available in many trade areas it does put the students on the fast track to become journeymen. Some students have entered a full apprentice program at age 18 and discovered that the average apprentice has been working for several years to qualify for an apprenticeship.

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# It Isn't Just a Shop Anymore!



Marie Collins  
Badger Community Education  
& Career/Tech Ed Coordinator

It isn't just a shop any more. The metals lab at Badger High School is morphing to meet the demands of the workforce as manufacturing jobs move back to the area thanks to a growing economy and a paradigm shift in career and technical education. Since taking over the manufacturing program five years ago, Technology Education Instructor Clint Geissler has been honing his four-year program to better prepare his students for careers in manufacturing and welding.

According to Arnie Oswald, Technology Education Department Chair, instructors strive to keep current with industry trends in preparing students for careers in technology fields, including manufacturing. Oswald credits support from Administration and a School Board that recognizes the need for college and career readiness. In the past, metals classes focused on skills including welding, fabrication and machining. Students are now taking these skills and linking them to the specific skills of the manufacturing process, as well as Common Career & Technical Education Standards. With the implementation of Career Pathways, the program's manufacturing focus includes industry-recognized skills that lead to certifications and help students with job placements and advanced college standing. At the same time, students in the program are connecting their work in the manufacturing labs to core academics, as the certifications clearly link to

math skills.

During the summer of 2012, Geissler enrolled in Manufacturing Skill Standards Council (MSSC) Certified Production Technician training, in order to be qualified to certify his students. Over two summers, he earned the Safety Certificate and the Quality & Measurement Certificate. In the spring of 2013, the first group of Badger High School students earned their MSSC Safety Certificates with a 100% pass-rate. This spring, two classes will test: one to earn each certificate. The goal is that at the conclusion of their 4-year manufacturing program of study, students will have earned both certifications.

Through Badger's four-year curriculum, students begin with the basic skills of welding, machining, print reading and programming CAD/CAM software. As students go through the program, those skills are refined and students are tasked with fine-tuning measurements. Curriculum focuses on small group projects like pedal cars and a clock which is designed using the CNC plasma cutter. By their third year, students are working cooperatively in groups to produce large projects like a mini chopper. "In their groups, students learn the importance of working together, planning, problem-solving, and the importance of attendance," Geissler says, "all skills needed in the manufacturing industry."

Along with large group projects, students continue to work on individual projects each year through which they refine their skills on industry tools including milling machines, lathes, GMAW, SMAW, GTAW, a variety of

cutting tools, and programming CAD/CAM to run the CNC plasma cutter. The focus of the senior year is the MSSC certification, soft skill refinement and planning for life after Badger including college tours, manufacturing tours and career readiness activities like resumes and job applications.

During an era of budget cuts, many area schools have cut Technology Education programs, but not Badger. Principal Bob Kopydlowski doesn't see that happening. The Tech Ed programs of study at Badger are linked to career pathways with advanced college standing and/or industry certifications. This added rigor has not deterred enrollments, and the department supports seven full-time instructors teaching architecture, audio/video technology, automotive, construction/woodworking, engineering, electronics, graphics and manufacturing. Kopydlowski is grateful for the recent increase in involvement at the high school from the manufacturing community in helping to inform and prepare students for future career success.

In October, students participated in the Walworth County Economic Development Alliance's first Manufacturing Day Tours where they visited four area manufacturing facilities. During the business tours, students were able to talk to employees at all levels in the facilities, as well as watch the production process. From concept to completion, students were amazed at the products being manufactured in the big buildings by the highway! An important take-away from the field trip

was students being able to see careers they can step into right after high school, good jobs that provide high wages, benefits and long-term employment opportunities solely with the skills they have attained at Badger. Through on-the-job training, students saw that many of the companies promote from within as well as offer many incentives to employees to continue their education once on-the-job.

Moving forward, the Lake Geneva Economic Development Corporation is facilitating manufacturer visits to the high school to nurture partnerships and potential work-based learning sites for students. A goal of these partnerships is to increase awareness of career opportunities for students here in Wisconsin, and specifically the Lake Geneva/Walworth County area.

Students enrolled are seeing academic growth and potential for high-wage, high-skill jobs. Most importantly, however, Geissler hopes his program instills in his students the necessary skills to become productive, self-sufficient community members once they leave Badger.

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# One Man-ufacturers Scrap Is Another Man-ufacturing Teacher's Treasure



Derek Zabel  
Metals Manufacturing Instructor  
Franklin High School

Manufacturing is a growing program in the Franklin Public Schools with fantastic support from both the district and private industry. In just the last 18 months, working with a few key entities, Joe Carr and David Works, local businesses,

the Franklin Foundation and the school district, we have been able to secure a Haas CNC Mill, a Baileigh 4'x8' Router table, tooling, 24 desktop computers running the necessary software to teach CAD/CAM, and additional material stock. All of these components allow us to transform the curriculum, making it relevant to today's worker and providing students the opportunity to gain both technical skills as well as the soft skills needed to be successful in today's workforce.

One of the concerns expressed by many is that students can't read prints, and lack understanding of how processes work. Part of the answer was to have students create their own prints. As a result, metals students, starting with the first class, are learning to use Autocad's Inventor 3d modeling software. Students create each of their projects in a 3d format and then create their own set of working prints containing material to be used, tolerances, notations, and processes. They then take their prints into the shop and make their parts. This approach has dramatically decreased questions students have about dimensions mainly because they have created those dimensions themselves. They can also visualize



their final product better as they have seen it from every angle on the computer.

STEM is the acronym of the day and Franklin is listening. Currently a program called InRoads is being implemented which aims to develop tomorrow's problem solvers. The Metals program will play a key role in the process, pairing students from the engineering strand with students from the manufacturing strand, so that each grows in an understanding of the others field of study. This is designed to create more capable engineering students and tech savvy manufacturing technicians. One example of this is a project where scrap cutoffs are donated by a local manufacturer. The engineering students must create a product given the size constraints of the stock, and other features that will be machined later. They are then grouped with manufacturing students to work out the processes necessary to complete the final product. Both parties benefit educationally, while learning vital communication skills and contributing to a cross-curricular culture. It's a win for everyone!

All this is done primarily through the use of material and tooling that would have been scrapped by a manufacturer. Several of the shops

in the area have given cutoffs from processes, as well as tooling that is either obsolete, or for them has reached its useable lifespan, but still has some life left in it. This means students are able to use high quality tooling, and the teacher doesn't have to worry about a student starting over a few times until they meet tolerances because after all the goal is for the student to learn how to consistently create products that are accurately made, and that is only achieved through practice. In return, the manufacturer gets the satisfaction of supporting a cause, along with a tax deduction, and students who require less training acquire improved communication skills and basic knowledge of the design process. Currently three students are employed with area shops through a program called YA (Youth Apprenticeship) with several more ready to go, and that number is only anticipated to grow in coming years.

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## Dual Enrollment Academy Continued from Page 6

(dependent on program option); while earning both high school and college credit.

"Guidance counselors, Project Lead the Way and technical education teachers played a huge part in referring qualified students," Obst said. "Many of these students were traditional four-year college or university students with grade point averages up to 3.8."

Students in the Tool & Die/CNC cohort take classes such as Industrial Blueprint Reading, Industrial Math 1 & 2, Machine Tool Operation 1 & 2, CNC Turning Center and CNC Machining Center Operation.

### Industry plays key role

A vital aspect of the DEA is that business and industry are involved throughout the entire process. Industry partners help develop the workplace certificates, provide classroom presentations and offer internships. Trace-A-Matic has gone a step further. The company will offer 10 jobs to Tool & Die students upon completion of the program and an additional stipend based on their GPA.

"Manufacturing is a very rewarding, challenging and lucrative career," Obst said. "It is not the manufacturing of the past working in dark and dirty environments and loading a part and pushing a button – but a career that offers

unlimited growth potential and a comfortable living."

Tool & Die/CNC student Tommy Putnam plans to pursue a bachelor's degree in engineering after he completes the DEA program and graduates from Brookfield East High School. He is interested in "bridging the gap between the design process and manufacturing."

"Learning the hands-on skills is something I really enjoy, and understanding more of what manufacturing is all about in addition to being exposed to the design process," he said. "I've had the opportunity to meet a lot of employers through job fairs – that's one of the biggest things I've gotten out of the program. Now I have contacts from employers who will offer me internships."

Fellow Tool & Die/CNC student Justin Cerny plans to pursue an apprenticeship after he graduates from Waukesha North High School. He also wants to become an engineer. Asked what he would be doing his senior year if it weren't for the DEA, he said, "probably nothing."

"Just doing school and thinking about what I'm going to be doing the rest of my life," Cerny said. "Now I know for sure."







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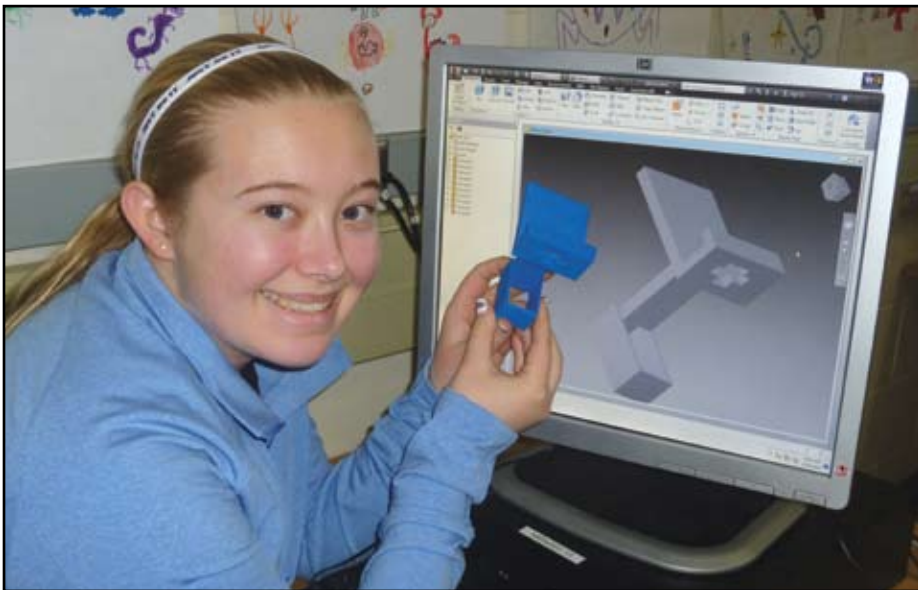
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# A Step Ahead at Northstar Middle School



By Robert J. Beese

I am the technology education teacher at Northstar Middle School in Eau Claire, WI. This year has been really exciting for us with

the introduction of a 3D printer into our classroom. I am currently teaching three classes of Gateway to Technology, which is a curriculum in which we are able to utilize the 3D printer.

During the semester we have the students go through two units:

## Unit 1 Design and Modeling:

- 1.1 What is engineering?
- 1.2 The Design Process
- 1.3 Measurement
- 1.4 Sketching and Dimensioning
- 1.5 Design for Production

## Unit 2 Automation and Robotics:

- 2.1 What is automation and robotics?
- 2.2 Mechanical systems
- 2.3 Automated systems

During unit one, my students learn all about what engineers are and what they do for our world as well as different engineering career paths. After learning about how engineers create the designed world around us, students then transition to the design process. We completely discuss the different steps of the design process, and the students learn how to create their own design briefs to go along with their design challenges. After the students have a handle on the design process, we then

go into our measurement lesson. During this week, we review how a standard and metric ruler are broken down and discuss early forms of measurement (examples: fathom, hand span and cubit) and why we use standardized systems of measurement. The students also learn how to properly use precision measurement instruments, such as dial calipers.

Then next lesson, we go over is sketching and dimensioning. This lesson is very important because the students learn how to properly distinguish between different line types, such as object lines, construction lines, and hidden lines, among others. The students also learn about different types of drawing styles as well, for example, isometric, perspective, and orthographic. We conclude this lesson with properly dimensioning different orthographic drawings and learning about the precedence of lines.

The final lesson in this unit is design for production, and this is where the students learn how to use a 3D modeling program called Autodesk Inventor and apply what they have

Continued on Page 16

# Update: Tiger Manufacturing — Webster, Wisconsin



This school based manufacturing business was featured along with Cardinal Manufacturing in the original issue of Manufacturing Today WI.

Tiger Manufacturing is a thriving enterprise, located within Webster High School, which provides its workers (students) with hands on experience in real world job skills that no textbook could give. This original idea for this business was to build cabinets and cabinet components for paying customers. This continues right into today.

One recent project really emphasized the

partnership between the school and community. It involved cabinets that were built for a local family using pine from the school forest. "This family owns a collision repair business in town. They have been huge supporters of our school and have never said no to anything we have ever asked. We have taken many field trips to their business and they have come to our facility to share their expertise. They have taken students in school to work situations as well as offering to teach the collision repair trade to interested students. I think that this relationship is so important in a success-

ful technology education program." stated Mr. Ward.

When asked "What do the students learn as a result of the class?" Technical Education instructor Roy Ward replied "The biggest thing they learn is how to work together. They learn about taking pride in everything they do and little things matter, each person's role is important. All the parts of the system must work together in unison to be efficient and productive. Standing around and doing nothing makes more work for someone else and will result in a loss of employment. The more you know and can do the more valuable you are. This is knowledge that will benefit them no matter what career path they choose to pursue, but a student that is going down a manufacturing related career path could take Tiger Manufacturing for two years and walk

out ready for a job. If the student has the time in their schedule and the desire to learn every part, they can get what would be comparable to a 2 year degree right here in high school."

Here is a letter that was sent to Roy and his crew at Tiger Manufacturing:

Dear Mr. Ward,

*I would like to take this opportunity to thank you, your students, and the Webster school district for the product Tiger Manufacturing completed and delivered. The complete set of knotty pine kitchen cabinets is beautiful and professionally done!*

*Your hands on approach to teaching vocational career skills, blended with community service have lifelong applications. The business model of student responsibility is a blueprint that should be followed nationwide!*

Sincerely,  
Mike Sperry

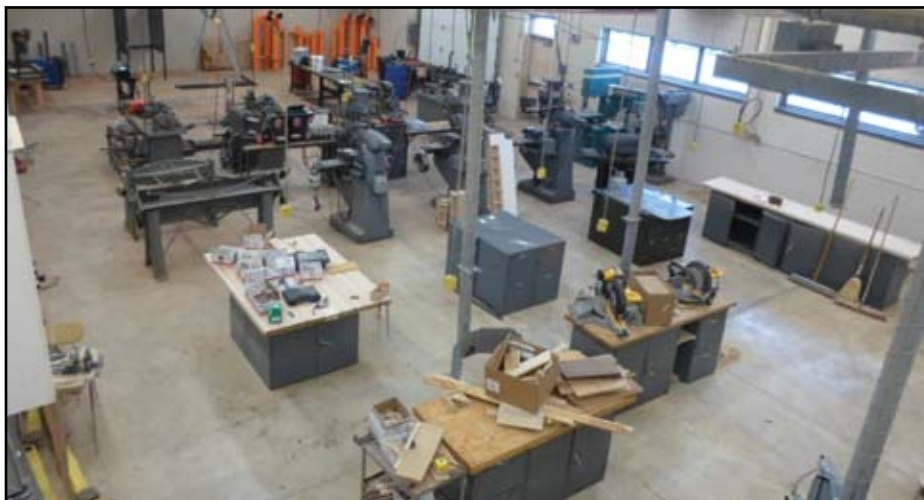


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# Northwoods Manufacturing

## Another student-run business in the making in Wisconsin Schools



Northwoods Manufacturing is a student-run business just getting underway in Hurley, Wisconsin and doing it quickly. One year ago local Industry had a vision for what they would like to see in their local school system.

These industries, like many around Wisconsin, were seeing the skilled labor shortage hit home.

These industries pooled their efforts and approached the school with an idea. This idea

was to start a successful technology education program which trained students to fill jobs in their area. Most of the local industry that approached the school had jobs regularly open for machining, and welding trades.

From the start, the school and the current technology education teacher Roger Peterson were on board. They began doing research on other schools in Wisconsin that have successful technology education programs which targeted skilled trades. They found that school in Eleva-Strum. Teacher Craig Cegielski had found that by creating a student run business, students get the training they need, and the shop gets the updates it needs within a normal school budget. The local industry and school members took a tour of Eleva-Strum and liked what they saw. Soon after, they began to make plans to create a program similar to Cardinal Manufacturing at the Hurley High School.

During their visit of Cardinal Manufacturing, they were brought into contact with student-teacher Jacob Hostettler. After a

short discussion with Jacob at Eleva-Strum, Jacob was soon interviewing for the job at Hurley High School and was hired. With Jacob's previous involvement with Cardinal Manufacturing and Roger Peterson's (Current technology education teacher at Hurley) vision and experience they were soon collaborating for the future of the Hurley High School's Student-run business.

To start, both Hostettler and Peterson cleaned the shop and had small sales to try to raise money for appropriate shop updates. Their vision was to get the shop to a clean and safe working environment so the students of the Hurley High school would start to see a change. Since summer the shop at Hurley High School has seen dramatic improvements due to the support of local industry, dedicated and loyal community members, and school officials.

Hostettler and Peterson are currently in

**Continued on Page 16**

## Update: Cardinal Manufacturing — Eleva Strum, Wisconsin



This school based manufacturing business was featured along with Tiger Manufacturing in the original issue of Manufacturing Today WI.

Cardinal Manufacturing, a student-run machine shop located in Eleva Strum High School, is a glowing example of Tech Ed success. The shop runs like a well-oiled machine and jobs flow in at a steady rate. Students are step up to leadership responsibilities and the younger students are getting excited earlier about Tech Ed class, hoping that they, too, will

make it into the program. This excitement has boosted both attendance and grades across the board. Cardinal Manufacturing students learn not only machine tool technology, but also many elements of entrepreneurship which gives them a working knowledge the of the real business world.

"Students in Cardinal Manufacturing are the cream of the crop." Tech Ed instructor and chief instigator of this innovative program, Craig Cegielski states. "We only take the best.

People wanting to get in need to go through an interview process, just like at a real business, and our admittance is limited."

And like a real job, Cardinal Manufacturing has a profit sharing plan for the students. Last year the business grossed around \$40,000 from the work the students did. Each of the 12 students received their profit share of about \$1000. Typical projects range from a production run of one to 15 parts, and tend to be those small production runs that large companies find too time-consuming.

Responsibility is key. "(These projects) are not just something they're turning in for a grade," Cegielski explains. "They've got the paycheck to work for. If they mess it up, they're the ones in the truck going for more material, they're the ones staying after to get it finished, and in the end they'll have to look that customer in the eye whether they finished his work order or not."

A recent open house raised over \$10,000 in cash for the manufacturing program. About 400 people attending the open house allowed the program to raise about \$6,000 from a raffle. The rest of the money came from direct donations.

Mr. Cegielski says, "Most of the money we received will go toward the construction of new

office space and a conference room. This will provide a professional space for us to meet with customers rather than in the class room. Our current office space will then be converted to an inspection lab. The new space will take us to the next level of professionalism. We are constantly trying to mimic real manufacturers."

Some of the latest equipment added includes:

- New Miller 252 mig Welder
- New Auto Hoist
- CNC 3 Axis BridgePort EZ Track Mill

"It's getting bigger and better and keeps growing every year," says Craig.

"Overall, we are happy with where we are right now, but are excited for our future and everything we can do to make our shop even better!"

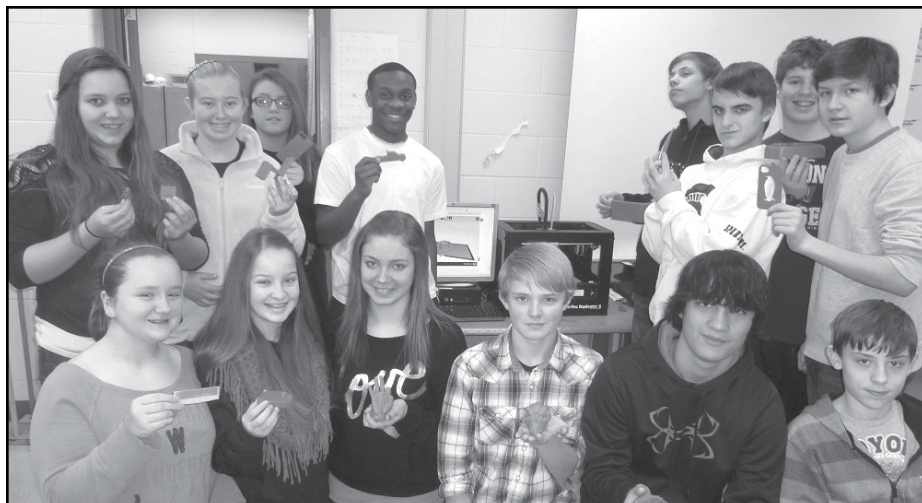
Alexis — Student Marketing Manager, Cardinal Manufacturing

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# Northstar Middle School

Continued from Page 14



learned in the course. In years past, all we were able to do is print out the students 3D designs on paper and use light and shadow to give the picture a sense of depth. Now with the implementation of the 3D printer in our classroom, we are actually able to put something tangible

in our student's hands. They can actually design an invention or innovate a product and then be able to print out a prototype in 3D. The possibilities for our students to manufacture their own prototypes are almost unlimited now.

I have already seen a dramatic increase

in student attention from the 6th and 7th grade when passing my display case with the new 3D designs the 8th graders have created. I have the younger students stopping in my class during passing periods and before and after school asking all sorts of thought-provoking questions about 3D Imaging and Modeling.

During unit two, the students learn all about robotics and automation and how they are used in the field of manufacturing. The first lesson covers robotics and automation together, and the students research a robot of their choice. They learn about how the robots work envelope, the area in which the robot works, to the multi-functionality of its end effectors, the robots hands, and everything in between. During lesson 2.2, we break out Fischertechniks kits and teach the students all about mechanical systems and gear trains. The students have an opportunity to actually build ten different types of mechanical gear trains, for example, bevel gears like a cars differential to rack and pinion, which can be used in steering systems of automobiles when converting

rotary motion to linear motion. All of these different gear trains are built by hand and powered by hand with the use of hand cranks. The final lesson 2.3 covers automated systems. After the students feel comfortable with the mechanical systems, we introduce them to (CIMS) or computer integrated manufacturing systems. We use RoboPro, an icon based programming software in conjunction with a computer interface box, which allows the students to create their own computer controlled assembly line.

In conclusion, my goal for technology education in my classroom is to grant every student the fundamental knowledge to use their skills and know-how in the technology field to help positively contribute to the local, regional, and world community as both an active citizen and as a potential employee.

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## Wrought-Iron Express

### About Us

Florence High School students in the Metals Fabrication courses and Eighth Grade Computer classes are currently working together on a project that involves organizing and operating a non-profit business. Utilizing Wisconsin State standards and teaching across the curriculum helps teach teamwork and skills along with small business fundamentals. Wrought-Iron Express was started by former technology education teacher, Ray Goudreau and Kay McLain (former and current staff). Goals were aligned with curriculum standards in each area.

Students currently in Mr. Randy Evosevich's Metals fabrication class are focusing on the manufacturing processes, estimating product costs, and turning raw materials into finished products. Students will be using advanced fabricating skills such as bending, welding, and finishing, thus creating high-quality wrought-iron products for the consumer. Students will be utilizing skills gained in computers, other such skills as Plasma cutting, MIG welding, Arc welding, Metal lathe, shearing, and many other skills.

Students in Ms. Kay McLain's Eighth Grade Computer class will be focusing on planning and creating a catalog/order form that will appeal to the customer. The point of sale booklets will be



used to educate the community of what the school can bring to consumer.

At the end of the project, students will evaluate and analyze the success of the project. Monies earned will be put back into the business; and used to benefit the community where needed.

There has been a great connection between the school and surrounding businesses in support of this program through the help in organizing, providing leadership and the supply of materials needed to accomplish our goals. We thank all of them.

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## Northwoods Manufacturing

Continued from Page 15

the process of revamping the entire shop with fresh paint and new equipment. Some of the improvements include new miller welders, welding booths, tables, storage areas, updated wood working machines, shop bot CNC router, a Sharp CNC machining center, and other machining equipment. Hostettler said, "With the help from the local industry, school board, the foundation, administration, and other community members, this program just took our five year plan and turned it into one."

Hostettler and Peterson plan to officially get their combined student-run business underway at the beginning of next school year. Their vision for the student-run business shares ties with Cardinal Manufacturing. Students will have to present resumes, cover letters, and interview to get in the class. Afterwards, the students will work for Northwoods Manufacturing, creating any projects local industry and community members bring in. At the end of the class, students will get paid for their time and efforts. Hostettler and Peterson want to make the class a positive learning experience for the students to build interest in manufacturing careers.

There will be two divisions of the company: metals and woods. The students of the Hurley High School will be able to choose a division based on interest. In preparation for next year, Peterson has started selling small turning and other woodworking projects with one of his classes to get the students a taste of what's coming next school year. On the metals side Hostettler has students rebuilding the welding and machining areas of the shop to make them more streamline and efficient for the start of the business.

Future plans for Northwoods Manufacturing include an extensive competency checklist for students to carry with them during and after high school to track their level of skill. Peterson said "Our goal here at Hurley is to create a self-sustaining, up to date shop and get kids to seek jobs related to manufacturing in order to do our part to fill the skilled labor gap."

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# MANUFACTURING MONTH CELEBRATION 2013 IN REVIEW!



# MFG DAY



Above: Terry Hansen, Ultra Tool owner, welcomes guests on Manufacturing Day, October 4, 2013.

Wisconsin's manufacturing heritage stretches back generations, from its roots in heavy-equipment manufacturing and paper-making in the 19th century to today's advanced manufacturers who produce cutting-edge, innovative products.

Manufacturing contributes nearly \$50 billion to Wisconsin's economy and employs nearly 450,000 people. The average wage for a manufacturing worker in Wisconsin is \$52,000, or \$11,000 more

than the average wage for all Wisconsin workers. Manufacturers in Wisconsin are a major contributor to Wisconsin's economy, adding thousands of good-paying manufacturing jobs and creating career opportunities for working families around Wisconsin. Manufacturers have added thousands of openings not only for welders and machinists, but also IT professionals, accountants, and workers in many other rewarding and challenging occupations.



At Left: Derek Dahlgren, vice-president and co-founder of TLX Technologies, shows how solenoids are used in Harley-Davidson Motorcycles to a group of students. The students were some of the almost 200 students that toured the TLX plant in Pewaukee on October 1st, kicking off Manufacturing Month.

"The manufacturing industry is an important part of Wisconsin's economy," said the State Superintendent of the Wisconsin Department of Public Instruction. "Throughout October, not only will we celebrate manufacturing, but we'll also recognize some of the exceptional technical education programs we have in our public high schools that are preparing students for success after graduation."

Watch videos and read news about last year's MFG DAY events at:

**[www.mfgday.com](http://www.mfgday.com)**

***Check Back in September for details for Manufacturing Month: 2014***



# Unique Partnership Builds the Pipeline to Careers in Manufacturing



Manufacturing is Wisconsin's largest economic sector, growing nearly as fast as the state's economy. However, the challenge before manufacturers and educators is creating a pipeline of highly skilled workers to fill the 700,000 vacancies that are anticipated in the next eight years. A recent study by the NEW Manufacturing Alliance in Green Bay, WI found that 60 percent of manufacturers believe they will have difficulty finding talent for their company. To ensure a strong economic outlook, we need to provide our young adults with opportunities to gain valuable knowledge and skills in careers in manufacturing and engineering.

Recognizing our future depends on creating a highly skilled workforce to sustain a successful, vibrant commu-

nity, the Green Bay Area Public School District in partnership with Northeast Wisconsin Technical College (NWTC) and the area business alliance are developing Bay Link Manufacturing, a high-precision manufacturing learning lab designed to provide students with relevant, real world experience in high-tech careers in manufacturing, engineering, marketing and business.

Located at West High School, Bay Link Manufacturing will be a high-end work-based learning program combining a strong academic foundation in manufacturing courses while simultaneously providing students with real world projects presented by local companies in the areas of industrial welding, machine fabrication and metals. Students will also design systems to support accounting,

document control, bidding and purchase orders, production planning, shipping, marketing and communications. Students will continually demonstrate their employability skills and knowledge through real-world relevant work experience. Students involved in the program will be prepared to attend a 2- or 4-year college to pursue on-going education in the field of manufacturing and engineering or may be prepared to enter the world of work in an entry-level position.

The partnership supporting this is unique for three key reasons. First, the Green Bay Area Public School District (GBAPS), NWTC and the business alliance have been equally involved in the design and planning stage from the initial concept phase. Team members representing all three partners visited Cardinal Manufacturing at Eleva-Strum High School in the fall of 2013 and felt confident a similar model was needed in the Green Bay area. To that end, the partnership team went into full-planning

mode to make this exciting new idea a reality. Second, NWTC will provide instructors and college students to work side-by-side with GBAPS teachers and students. NWTC will also provide college-level courses at West High School in the evenings and weekends to support educational opportunities for the residents of the diverse neighborhoods in and around Green Bay's inner-city area. Third, members of our area business alliance are involved in not only an advisory role, but will also become "customers" of Bay Link Manufacturing to support students' skill development in manufacturing careers. They will also mentor our students and teachers.

The name was selected by members of the planning team to denote Green Bay and our location on the "Bay" and the important "link" our partnership will have "linking education and manufacturing," as the tag line in the logo states.

**Continued on Page 19**

## Partners in Manufacturing — NWTC and Bonduel



Did you know that in a recent job market research for the Bonduel area, the 63.2% of the job postings (May, 2012 to April, 2013) were in the manufacturing sector? Similarly, welding certification was the highest in demand during that same timeframe. That is one of the many reasons the School District of Bonduel (SDOB) and Northeast Wisconsin Technical College (NWTC) formed a valuable partnership for our students and community. The goal of this partnership is simple, bring training for manufacturing careers to the doorsteps of community

residents and students.

The partnership began during the 2012-2013 school year when our students began taking courses in NWTC's CNC (Computer Numeric Controlled) Mobile Lab one day a week. Eleven students completed the year-long program and earned college and high school credits for their successful completion of the lab experiences and class work. Five of those students are attending NWTC and are enrolled in the CNC certificate programs.

The impact of this program hit

home with one local family. Entering his senior year, Jarrod Staszak was approaching his graduation with at best, a tentative idea he wanted to attend a technical school but with no clear idea of what programming or training he should pursue. That changed about halfway through his senior year, it became clear to Jarrod that a career in CNC Manufacturing would be a good fit for him. He enjoyed and excelled in the challenge of designing and fabricating products in the CNC Mobile Lab. By spring, Jarrod was enrolled at NWTC and is on pace to successfully complete the CNC Technician program. Without this experience, Jarrod and the other students may have become just another statistic of a student who failed to complete post-secondary training successfully because they did not have the exposure to college coursework and skilled manufacturing training.

The experience of the hands and mind on application proved to be valuable and led the district to explore additional avenues with NWTC. In early

June, NWTC and SDOB agreed to a partnership to create a regional manufacturing center at Bonduel High School that include a remodeled welding lab that is equipped with 8 new Miller welders. NWTC agreed to purchase the nearly \$30,000 worth of equipment in exchange for the district to cover the costs of new welding booths and to host the welding courses for our students and community. Currently students enrolled in our Welding and Manufacturing classes are receiving a technical college credit through transcription (the high school instructor teaches NWTC's curriculum).

The community has also had the opportunity to use the lab by taking a NWTC evening course, Weld Skill Development, which provides instruction for beginners to experts. Community members have clearly been interested in this opportunity as we have had 24 students participate in 3 different evening class sessions. Students have included high school students seeking additional opportunities, a mother and daughter

**Continued on Page 19**



# Bay Link Manufacturing

Continued from Page 18



The logo for was designed by students at Preble High School. Students from all Green Bay High Schools are eligible to enroll.

Students interested in participating will complete an application and interview process prior to participating in the manufacturing learning-lab.

Bay Link Manufacturing will provide the link between education and manufacturing, increasing the students' and the community's awareness, exploration and interest in careers in manufacturing and engineering. The work-based learning lab will be "open for business" on October 1, 2014. All three partners are currently embarking on an endeavor to secure the equip-

ment and financial resources needed to make Bay Link Manufacturing a reality for our students and to ensure a prepared, highly-skilled workforce ready to succeed in our diverse, growing community.

*If you would like more information about Bay Link Manufacturing please contact Lori Peacock, Career and Technical Education Partnerships and Program Coordinator, Green Bay Area Public School District, 200 South Broadway Street, Green Bay, WI 54303. Ms. Peacock can also be reached at lpeacock@gbaps.org or (920) 448-2018.*

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SCHOOL DISTRICT OF  
**BONDUEL**

## NWTC and Bonduel

Continued from Page 18

who took the course to begin a "metal-art" hobby/business, and one community member who sought more technical skill for career advancement. It was heart-warming to know that this course offering could be the key that unlocks the door for a community member to earn more for his/her family.

The future for the partnership includes an expanded offerings to our high school students by adopting additional transcribed coursework. Students and community members will also have the opportunity to earn a NWTC Certificate—Introduction to Metal Inert Gas (MIG) Welding. This certificate would provide trained workers for local

manufacturing or spring board them in earning a NWTC Technical Degree in Welding. Our partnership also is looking to expand into the construction, health care, and information technology fields too.

Thanks to Miller Electric, NWTC, and the staff of SDOB for their continued support of providing opportunities to our students and community.

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# Great! Manufacturing is ~~Good~~ for Wisconsin

Today, manufacturing offers an amazing variety of careers from marketing to engineering. Wisconsin manufacturers welcome the talented graduates of our high schools and technical schools – no matter what their skill and interests, students can find a home that will grow and nurture their career in manufacturing.

## TECHNOLOGY

Manufacturers are inventors – they invent the technology we use every day and are on the cutting edge of applying technology in new ways. A large number of companies are now paperless or are in the process of converting to mobile technology to enhance their processes.

## EXPORTS

American products are in high demand all over the world because they are innovative, high quality and reliable. Wisconsin manufacturers are building their export businesses to tap into this demand and need young visionaries to help build their export markets.

## LEAN MANUFACTURING

Today's plants are high-tech, clean and run like clockwork. This level of efficiency is the result of constant attention by highly-trained, tech-savvy specialists that continually look for better ways to make things using fewer resources and reducing environmental impact.



Buckley Brinkman is the CEO of the Wisconsin Manufacturing Extension Partnership

The WMEP is a private, nonprofit organization committed to the growth and success of Wisconsin manufacturers. The WMEP receives financial support from the Wisconsin Economic Development Corporation and the NIST Hollings Manufacturing Extension Partnership. The WMEP also partners with many public and private organizations to serve Wisconsin manufacturers. Since 1996, the WMEP has helped more than 1,300 Wisconsin manufacturers make nearly \$400 million in improvements in technology, productivity and profits; helping to generate more than \$2 billion in economic impact and creating or saving more than 14,000 manufacturing jobs. Visit [www.wmep.org](http://www.wmep.org).

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# The Skills Gap We Know About, and the Skills Gap We Don't Know About



By Dan Conroy

When it comes to the supply of skilled talent in advanced manufacturing, a few of us have been finding (sick) canaries in the coal mines for a while now. The good news is, that the word is finally getting out about a skills gap in advanced manufacturing. It's still an uphill climb, but it is not unusual to see an article about the scarcity of precision welders, skilled CNC machinists, or engineers. The educational pipelines are far from being full enough, but they are making gains. There is still a lot for all of us to do to promote advanced manufacturing careers.

The skills gap we don't know about is real, and it is coming faster than we realize. The pace and potential of technology is advancing faster than we can capture it. Instead of skilled machinists, we now need super-machinists.

In the depth of the recession, Nexen purchased a Mori Seiki NT mill turn machine. We run lots of parts and small lot sizes, so (reduced)

set up time is critical to us. Having a machine with 2 spindles, a lower turret, a live upper milling head, and a 100 tool magazine offered us more potential for shorter set up times than we ever had before. We did lots of analysis, and we knew we could make this work. The thing is, we didn't know what we didn't know, and that's what this story is about.

What we did know is that we would have to have well educated and skilled machinists assigned to that machine. We knew that there would be a steep learning curve relating to the new technology, and that we would have to very thoughtful about the tooling and the programming. We were both right and successful with all those elements.

What we didn't know is that we would have to "think different". In the early days, we changed the programs every time we ran a part (typically 3 iterations) because we were creating new programs that were similar to how we

would program the old machines. When we came to understand the machine capabilities, we would approach the metal removal very differently. Often times that meant machining the part "backwards", or in an entirely different manner.

We also came to understand that to maximize the efficiency of the equipment, it also meant that we had to give a great deal of thought to the types and configurations of the tooling, the programming/processes, work station layout, and quality/inspection processes. Our approach to scheduling could have a large impact on our setup efficiencies, and the types of parts we loaded into the machine could be a good or a poor fit in regards to overall part cost. Making the most of our new machine meant that we had to optimize everything associated the production of a finished part.

What that meant, was that we were evolving into needing a Super Machinist to make the best use of the new machine tool technology. Certainly they needed to be a skilled CNC

Machinist, but they also had to be a clever Programmer. They needed to have the skills of a Tooling Engineer in order to take advantage of the machine capabilities. They had to have the skills of a Manufacturing Engineer and a LEAN Practitioner in order to optimize processes, and to make improvements for tomorrow.

Our Super Machinist had to have Advanced Quality and Inspection skills, MRP/Scheduling skills, and understand Manufacturing Economics/ROI. Finally, with all the interaction and problem solving that goes along with such a venture, they must be a good Team Player, and play together nice in the sandbox.

We learned all that with the purchase of our first mill turn machine. We are making a \$2M investment and having two more mill turn machines delivered in December. That challenges us to develop our already excellent machinists into super machinists. The technology demands it, and we owe it to our people and to ourselves.



## What is Additive Manufacturing?

Sometimes known as "3-D printing," additive manufacturing uses emerging technologies to fabricate parts by building them up layer-by-layer. It allows rapid transformation from "art" (CAD model) to "part" (manufactured product), and shows great promise for applications as diverse as lightweight aerospace structures and custom biomedical implants.

### How does it work?

Metallic, plastic, ceramic, or composite materials are laid down one thin layer at a time and placed precisely as directed from a digital file. Frequently, the raw materials used are in the form of powders or wires that can be melted and shaped by a laser, in a fashion somewhat akin to welding.

An example application for the medical industry would be the creation of an artificial jawbone. A 3-D computer model of a jawbone

is created based on a person's bone structure, and this model is sliced into many layers. The computer then feeds the information into the additive machine, which could generate the complex bone structure substitute out of metal.

### How does additive manufacturing impact the economy?

Additive manufacturing is largely an emerging technology that shows promise for the defense, energy, aerospace, medical and commercial sectors. Its ability to build up objects directly makes it a good alternative to conventional machining, forging, molding and casting for rapidly making highly customized parts. While additive manufacturing is most attractive for making complex parts in relatively small volumes, it can be used for rapidly making tools and dies used in large volume

manufacturing. The technology also shows promise for creating parts in situ, such as at forward-stationed military bases. Because of its potential, many companies are experimenting with the technology. The field of companies using the technology to make commercial products today is relatively small, but growing, and includes the makers of machine parts and aircraft cabin components.

The expected long-term impact is in highly customized manufacturing, where the technique can be more cost-effective than traditional methods. According to an industry report by Wohlers Associates, by 2015 the sale of additive manufacturing products and services could reach \$3.7 billion worldwide, and by 2019, exceed \$6.5 billion.

The National Network for Manufacturing Innovation (NNMI) is bringing together federal agencies, industry, universities and

community colleges, and the states to invest in industrially relevant manufacturing technologies with broad applications. An interagency team chose additive manufacturing as the focus of the NNMI pilot institute, which will have a physical incubation hub in Youngstown, Ohio. The pilot institute will bring together a regional network of 14 research universities, community colleges, at least 40 industry partners and 10 non-profit organizations and professional societies from Western Pennsylvania, Eastern Ohio and West Virginia, with the goal of building a national presence and network. With a nearly \$40 million match to the \$30 million federal investment, the private sector response is a strong indicator of interest in a successful public-private partnership.

From: [www.commerce.gov/news/fact-sheets/2012/08/15/fact-sheet-additive-manufacturing](http://www.commerce.gov/news/fact-sheets/2012/08/15/fact-sheet-additive-manufacturing)



# Hire My Kids!

By Robin Morgan

Technology and Engineering Department  
John Long Middle School  
Grafton, WI

You should hire my students – today! Bright, engaged, talented; they have it all and when they work together, they can truly make wonderful things happen. No unit of my curriculum proves this truth quite the way that Mass Assembly can, and just the thought of starting this annual process make me giddy with my student's potential.

During Mass Assembly, my students at John Long Middle School in Grafton, Wisconsin, will reverse engineer three specific projects and re-create fifteen to thirty of each to be distributed as gifts of gratitude to the members of the Grafton community who donate their time and expertise for our annual Community Day. As many of the guest speakers have joined us since the beginning of the event eight years ago, we rotate the items so that each of the three speaker groups receives a new item each year and the students have three years accumulate building technique for a single item. Last year, the items selected were a traveling bookshelf, a wooden gumball machine (of course with gumballs), and a lidded-sheet metal box. This year the traveling bookshelf will be retired and replaced with a custom hot-transfer t-shirt.

On the first day of Mass Assembly, the students will walk into the shop to find a single sample of each item for the year, any overruns remaining from viable products in the rotation, and any directions, schematics, or shift notes left behind by the previous eighth grade class. From there, they will have two full shift rota-



tions to decide who will step forward as the foreperson(s) for each shift as well as their steps to complete each item on time and within quality parameters. I do not select the foreman for a shift, though usually there is a student or two, who based on his or her mastery of machines, is the likely choice. You can spot them easily – they are the student who barely has time to work on projects as they are so busy peer teaching, so they come in for recess to work on their own work! Prior to the start of Mass Assembly I often casual drop helpful information about the Mass Assembly items to these students; I know how much work will await these individuals later and good shortcuts help.

Because my full annual eighth grade class is divided into four sections, we run each section as a shift. Foremen from different shifts learn

quickly that if they skimp on details to the shift after their crew, or if they rush blindly forward without checking in with the crew before, the shifts will find themselves re-working and behind. Shift crews are 'paid' in positive and negative points for efficiency, self-sufficiency, safety compliance, and attaining new skills, and miscommunications 'cost' too much to be repeated.

Each shift crew is different, and nowhere is that more evident than in their foreman dynamic. The first year of Mass Assembly, one foreman quickly realized that if he wanted to get through it, he would have to reach out to the other crew leaders. This young man had a complicated individual project he wished to complete, and he couldn't touch it again until the Mass Assembly products were safely to the

customers, so he began rounding up the other forepersons at lunch and walking them through the next set of tasks and problem-solving as a group so that less time was wasted on miscommunication during the shifts. Another leadership set was developed between a young lady known for her velvet-gloved, confident diplomacy and my rather curmudgeonly student aide. He would snarl a command and they would look to her to translate; once translated, all would smoothly comply. It was a strange dynamic to witness, but it certainly worked for their crew. Only once did the leadership selected by the shift truly lead to more comedy than function. A four man group of close friends campaigned to their shift that between them they had all of the leadership skills needed to have success. Dubbed 'the Oligarchy', this crew soon found that true collaborative leadership is not based on a popularity campaign. It took a bit of guidance and a lot of teacher-hosted foreman lunches, but their shift managed to be successful too.

This year's Mass Assembly will roll out in the next two weeks. There is sure to be the usual mayhem, learning curve, and knowledge-gaining moments, but guaranteed, my students are going to succeed in their manufacturing tasks, and they are going to make me proud too; every day.

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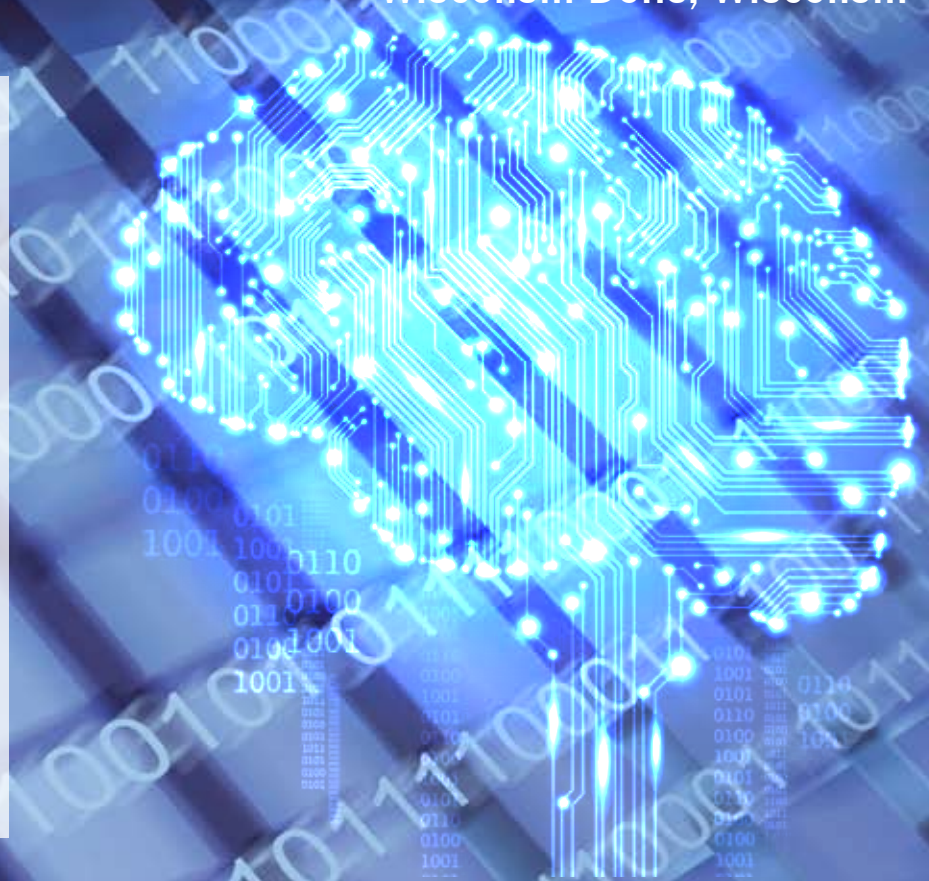
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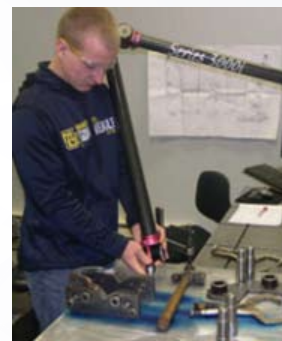
**FEATURED PANEL**

**Direct From the Source: Students Talk About Manufacturing Careers**

Many manufacturers are struggling with how to attract young people to careers in their businesses. This session presents a panel of high school students and young graduates who will share what attracts them to manufacturing and what they find meaningful in their careers.



**Kathryn Liefbrig** is a Junior at Elkhorn Area High School in Elkhorn, Wisconsin. She is currently participating in the series of Project Lead the Way (PLTW) courses at her school.



**Nick Preston** is a Senior at New Holstein High School in New Holstein, Wisconsin. He is also employed at The Amerequip Corporation as a Quality Control Assistant through a Youth Apprenticeship program.



**Ryan Rasmussen** is a senior at Green Bay West High School. Ryan is currently participating in the Youth Apprenticeship program at Lindquist Machine where he works as a welder as well as completes various projects around the business.

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