INTERFACE

SCIENCE
TECHNOLOGY
ENGINEERING
MATH

SkillsUSA. NATIONAL **LEADERSHIP** & **SKILLS** CONFERENCE

SPECIAL FEATURE:
- World's Fastest Supercomputer

Other Highlights:
- "NEW" Partnership
- Project Ideas

Purpose • Pathways • Professionalism

WTEA
EST. 1970

ConsuLab
TRAINING AIDS
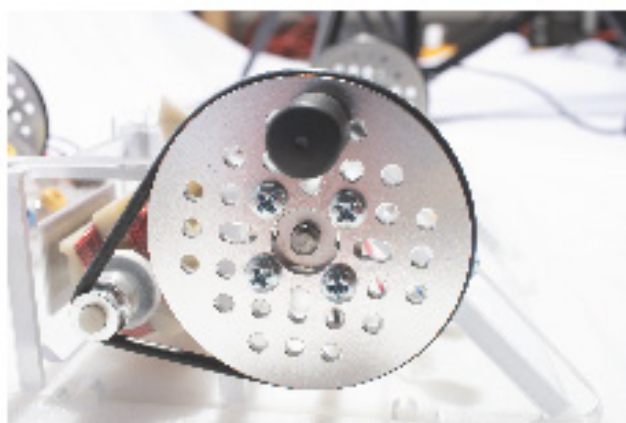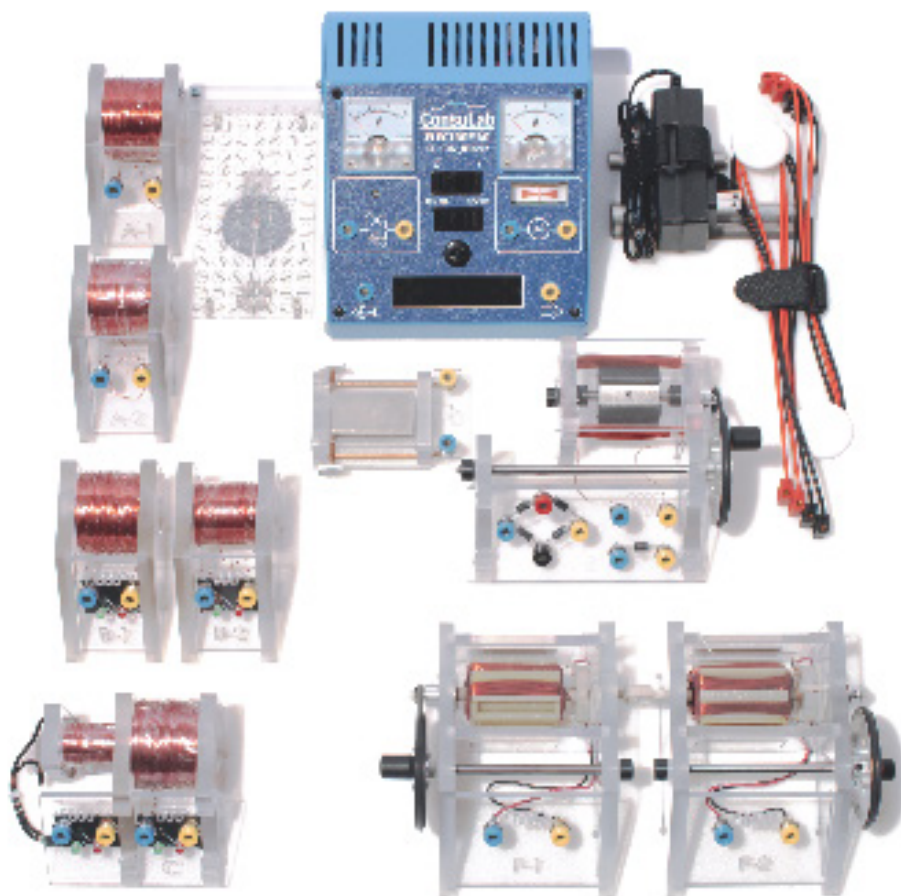
ELECTROMAGNETISM TRAINER CL-1902

Do your students struggle with electricity?

Do you have challenges capturing their attention and getting them interested in how electric motors work?

Do you want to equip them with the skills and knowledge necessary to work on hybrid and electric vehicles?

The ConsuLab CL-1902 Electromagnetism trainer can help challenge your students and keep them engaged.

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2022-2023 WTEA Board of Directors

PRESIDENT - Doug Dimmer
(C) 262-388-0660
ddimmer@cedarburg.k12.wi.us
Cedarburg High School, Cedarburg

V. PRESIDENT - Jesse Domer
(W) 920-262-7500 x6339
(H) 920-219-2922
domerj@watertown.k12.wi.us
Watertown High School

SECRETARY/TREASURER
Michael "Mac" Chopin
(W) 920-478-3633 Ext 4158
(H) 920-478-3881
chopinm@waterloo.k12.wi.us
Waterloo High School

PAST-PRESIDENT
Dave Stroud
(C) 920-217-7439
dstroud@ashwaubenonk12.org
Ashwaubenon High School

EXECUTIVE DIRECTOR
Joe Ciontea
(C) 920-904-2747
joe.ciontea@wtea-wis.org
WTEA Office: P.O. Box 531,
Rhinelander, WI 54501

EXHIBIT COORDINATOR
Tom Barnhart
(W) 920-492-2955 Ext. 2089
(C) 920-615-1939
tb.wtea@gmail.com
Ashwaubenon High School

PROGRAM COORDINATOR
Steven Johnston
(H) 608-689-3033
(W) 608-789-7700 x 3306
sjwtea@gmail.com
Logan High School, LaCrosse

PROJECT SHOWCASE
COORDINATOR
Steve Meyer
(W) 920-735-5668
meyerst@fvtc.edu
Fox Valley Technical Colllege

TECHNICAL COLLEGE
REPRESENTATIVE
Roger Stanford
(W) Phone: 608-785-9100
StanfordR@westerntc.edu
400 7th Street North
Administrative Center 208
La Crosse, WI 54601

DPI REPRESENTATIVE
Jessa Dahmes
(W) 608-261-6334
(C) 715-225-4784
jessa.dahmes@dpi.wi.gov
T & E Education Consultant
Wis. Dept. of Public Instruction
Wis. SkillsUSA State Director

CESA REPRESENTATIVE
Tom Martin
(H) 608-874-4414
(W) 608-822-2154
tmartin@cesa3.org
CESA #3, 1300 Industrial Dr.
Fennimore, WI 53809

ITEEA REPRESENTATIVE
Mason Pautsch
(C) 715-651-1028
mpautsch@wwusd.org
Whitewater High School

WEBMASTER
Michael Beranek
(C) 715-579-2273
webmaster@wtea-wis.org

UNIV. REPRESENTATIVE
Duane Elfering
(W) 608-342-1120
(C) 608-574-7889
elferind@uwplatt.edu
421 Pioneer Tower, 1 Univ. Plaza
Platteville, WI 53818

UNIV. REPRESENTATIVE
Barb Bauer
(W) 715-232-5493
(C) 715-672-5719
bauerb@uwstout.edu
355 Heritage Hall
Menomonie, WI 54751

DISTRICT A DIRECTOR
Emily Fransway
(H) 715-459-4120
(W) 715-684-3321 Ext. 4137
efransway@bwsd.k12.wi.us
Baldwin-Woodville High School

DISTRICT B CO-DIRECTOR
Brian Schiltz
(H) 715-453-2947
(W) 715-453-2106
schiltzb@tomahawk.k12.wi.us
Tomahawk High School

DISTRICT B CO-DIRECTOR
Pete McConnell
(H) 715-536-2691
mcconnell.pete@gmail.com

DISTRICT C DIRECTOR
Brennen Mickelson
(W) 920-755-3329
(C) 920-323-7614
bmickelson@mishicot.k12.wi.us
Mishicot High School

DISTRICT D DIRECTOR
Jon Larson
(W) 920-788-7600
jlarson@littlechute.k12.wi.us
Little Chute High School

DISTRICT E DIRECTOR
Alan Mamerow
(C) 262-957-6022
mameal@hamilton.k12.wi.us
Hamilton School Dist., Sussex

DISTRICT F DIRECTOR
Eric Sutkay
(W) 262-359-8155
(C) 262-945-9374
esutkay@kusd.edu
LakeView Tech. Academy, Kenosha

DISTRICT G DIRECTOR
Stephen Hadfield
(W) 715-884-6412 Ext. 310
HadfiSte@pittsville.k12.wi.us
Pittsville Area School District

DISTRICT H DIRECTOR
Art Pronschinske
(W) 608-943-6312 Ext. 2017
apronschinske@igs.k12.wi.us
Iowa-Grant School District

DIRECTOR AT LARGE
Vacant

DIRECTOR AT LARGE &
AWARDS CHAIR-Matt Schultz
matt.schultz@tlabeloit.com
The Lincoln Academy, Beloit

DIRECTOR AT LARGE
Meghan Walters
((C) 715-581-8482
mwalters@pointschools.net
Stevens Point Area Senior High

DIRECTOR AT LARGE
Anna Vitale
(W) 920-386-8363
(C) 414-803-0082
vitale@dodgeland.k12.wi.us
Dodgeland School District, Juneau

INTERFACE EDITOR
Duane Apel
(C) 262-707-1044
interface.wtea@gmail.com

WTEA
Wisconsin Technology
Education Association
www.wtea-wis.org

PRESIDENT'S MESSAGE

A Quick Welcome Back Message

By Doug Dimmer, WTEA President

Welcome back everyone. I hope your summer went well or as well as it could go. I know my end of the year came skidding in and needed a well-deserved break. In my 22 years of teaching, this past year, I just felt off. I don't know if it was just getting back to a normal schedule or knowing it was the first time in a long time that the students were on a normal schedule and they were off too. Whatever it was, I needed the summer to take a break.

> *"... communication is the key to our success, and I want you to understand, it is my goal to hear everyone out."*

My wife and I had scheduled a trip to Florida, Siesta Key, pretty much the week after school got out. It is a great spot on the gulf side of Florida. Beautiful white sand beaches and gorgeous water. Things were going great the first half. Nice weather, great food and libations when all of a sudden, coming off the beach Wednesday, we get a phone call from our youngest daughter, senior at UW-Madison, that she was in a hit and run accident in Milwaukee which totaled her own car. Of course, what do you do as a parent… cancel the rest of your trip and come home immediately, which was the plan, but since everyone was okay, the kids said to stay and enjoy.

Well, of course, I spent two days on the phone with the insurance and towing companies to get the car, "Rhonda," to the junk yard. That pretty much was the end of our so called "rest and relaxing" time away.

The rest of the summer I did my usual summer job, roofing with colleagues from my former school and painting my house. So here I sit on the first day, taking a break from the summer, refreshed enough to be excited to be back.

So, what's going on with the WTEA and our up and comings? Well, as you might have seen, we had a couple events scheduled for the general population that we had to cancel due to low enrollment. As an executive board we met virtually throughout the summer to con-tinue to communicate possible future events and of course pre-conference information so we can provide you with the latest technology and tools to help you in the classroom and curriculum to support those products and processes.

We have also have been following the news about DPI's review and restructuring of our standards and are looking forward in playing an important role in assisting them with our beliefs and ideals. This process cannot happen without your support, and we acknowledge that everyone should have a say on these points. So, at our fall board meeting, I am going to request that all district leaders have a meeting with their district members within the first quarter of the school year to gather information about what is necessary to continue serving you as a group in our best manner. I will be attending each of these meetings, either in person or virtually, to get a read on what are the most critical areas to improve on, so that we as an organization stay true to our standards and practices. Like I said before, communication is the key to our success, and I want you to understand, it is my goal to hear everyone out.

As mentioned, I said I would keep this short, so I want to honor my word. So, if I have any advice to pass on, it is to continue to do the best you always have done, remember they are just kids, so don't take anything personal or too seriously that they push your way. Please reach out to us if you're in need of any support, guidance or just someone to talk to. I am, and "WE" as the WTEA Board, are always here to help so that "WE" as an organization can continue to grow and lead our students into this evolving world of technology and manufacturing. Stay healthy and enjoy this "Crazy Train" ride we call technology education. Cheers!

2022 Spring General Membership Meeting Summary
By Mac Chopin, WTEA Secretary/Treasurer

General Membership Meeting
- Meeting held in Grand Ballroom, Chula Vista, Mar. 18th, 2022. Approximately 70 people present.
- **Call to Order** – Dave Stroud
- **Approval of 2021 minutes**
- **Board Changes**
  - Jessa Dahmes installed as DPI Rep
  - Steve Meyer installed as Technical College Rep
- **Board Changes** – Executive
  - Doug Dimmer installed as President
  - Jessie Domer installed as vice president
- **Acknowledgment of Service to WTEA**
  - Outgoing Vice President – Bob Morehead
  - Outgoing At-Large – Angie Arneson
  - Outgoing Tech College Rep – Mike Cattelino
  - Outgoing DPI Rep – Kevin Miller
  - Business/Advisory Team Leader – Bryan Albrecht
- **Financial Report** – Joe Ciontea
- **25 Year Awards** – Joe Ciontea
- **Student Ambassador Program** – Matt Schultz
- **Program Coordinator Report** – Steve Johnston
- **No New Business**

- **Acknowledgments** - Dave Stroud
- **Summer Brewers Game** – July 24th at 1:10pm
- **WTEA Summer Tour: Aviation** – June 21-22, 2022
- **Announcements** - Doug Dimmer
  - 54th WTEA Conference – March 8-10, 2023
  - ITEEA Conf. in Minneapolis – April 12-15, 2023
- **Adjournment** of meeting

Post-Conference Board Meeting
- The meeting was held at Chula Vista on March 18th, 2022. There were 19 people present.
- **Call to Order** – Doug Dimmer
- **Brewers Game Committee** was established – Anna Vitale, Tom Barnhart, Joe Ciontea, Dave Stroud, Mason Pautsch, Stephen Hadfield, Eric Sutkay, Brennen Mickelson, Doug Dimmer
- **Conference Report** – Steve Johnston, Joe Ciontea
- **Adjournment** of meeting

For additional information contact any member of the Board of Directors. Complete minutes are available from Mac Chopin at chopinm@waterloo.k12.wi.us

EXECUTIVE DIRECTOR'S MESSAGE
Our Legacy of Teamwork Continues
By Joe Ciontea, WTEA Executive Director

We have records of our association's leadership dating back to 1927. We've always been focused on teamwork. District meetings, Annual Conference & Trade Show, High Tech Weekends, Curriculum Exchange, Weekend Workshops, Beg Borrow & Steal, Train the Trainer, Project Showcase. These are just some of the many ways our association and its membership share their knowledge and expertise with others to make our profession strong in Wisconsin.

As some of you may know, I had a hemorrhagic stroke in May and was rushed out of town to the hospital where I spent two weeks before being released to return home and begin outpatient therapy. I am now pretty much back to normal and have resumed my active lifestyle. Upon being admitted to the hospital, my wife Jaye sent an email to the Board explaining my health situation. Our legacy of teamwork continued. The Board's leadership team immediately connected with each other and took over monitoring and coordinating all association business and activities. They took charge so that I could focus on my health and recovery. Our team is awesome, and I am forever grateful to them and thank them for their support and commitment to me and our association.

We are always seeking new members for the WTEA Board. We are currently looking for members to run for President-Elect and Secretary-Treasurer. We also have some Director positions that need to be filled. Please consider joining the team and help to guide our association into the future. Contact me or any Board member for more information.

I look forward to seeing you next March at the 54th Annual Conference.

NOTE: All purchases and payments made with a credit card will be charged a 3% convenience fee.

WTEA Membership Application & 2023 Conference Registration Form
Membership year runs from September 1st through August 31st

Last Name_____ First Name_____

Home Phone (_____) _____ Local Tech College District _____ # years teaching _____

School Dist. _____ School Name _____

School Address _____

School City _____ State _____ Zip _____ E-mail:_____

Check appropriate boxes below & total amount due. *(To pay fees with a credit card go to the WTEA website)*

Membership Fees: [ ] 3 year membership - $75.00   [ ] 1 year membership - $30.00 $_____

Spring Conference EARLY BIRD Registration (Must be postmarked by December 17, 2022)

    [ ] $140 members   [ ] $170 non-members $_____

Spring Conference Registration (After December 17, 2022):

    [ ] $165 members   [ ] $195 non-members $_____

WTEA Awards Banquet - Wed. Mar. 8th *(Tickets must be purchased in advance)*: [ ] $32 $_____

[ ] Bill my school district - purchase order is attached   [ ] Payment enclosed   **Total $** _____

Send completed form with payment or school purchase order to: **WTEA, P.O. Box 531, Rhinelander, WI 54501**

Phone (920) 904-2747 • E-mail: jc.wtea@gmail.com

If your school uses ACH payment please contact the WTEA for new bank routing. There is a 3% fee added for credit cards.

*Room reservations must be made before 2/21/23 in order to get conference rates!

Room Rates: Tower Jr. Suite - $149 • Two-bedroom Condo - $229 • Three-bedroom Condo - $399

Toll Free Dedicated # for reservations 1-833-621-4953 • Booking ID# i67174 WTEA 2023

Chula Vista will also honor the state rate for single rooms upon request with appropriate documentation.

NOMINATIONS: Officers & Awards

Be Part of the WTEA Team

We are currently accepting nominations for the offices of WTEA President-Elect and Secretary/Treasurer. This is your opportunity to serve your profession in a leadership position. The WTEA Board of Directors works together as a team to plan and coordinate professional development activities, give association awards and promote the advancement of our profession. The Board meets up to four times per year; meetings are held both face to face and virtually, as appropriate. If you have questions please contact any member of the WTEA Board of Directors.

Secretary / Treasurer
(2 year term): Spring 2023 - Spring 2025

President-Elect
4 year term: 2023-2024 as President-Elect, 2024-2026 as President, 2026-2027 as Past-President

Send nominations to WTEA Past-President Dave Stroud: **dstroud@ashwaubenonk12.org**
Nominations accepted until December 9, 2022

*Ballots will be mailed to members approximately February 1st.
If candidates run unopposed, a unanimous ballot is cast by the Board and no paper ballots are mailed.

WTEA Awards Nominations

Each spring at our annual awards banquet, held at the WTEA Spring Conference, the WTEA recognizes technology educators, industry, and technology education programs that have demonstrated outstanding achievement. The WTEA needs your help as educators to identify these worthy teachers, programs, and other professions that deserve recognition.

The WTEA is looking for educators that are going above and beyond in their classroom. The WTEA has a variety of award categories that cover teachers, programs, and examples of classroom excellence. Members are encouraged to visit the WTEA's awards page on the website. There you will find the criteria for each award.

As a profession we need to continue to recognize greatness in our profession! The WTEA Awards Banquet gives us that opportunity.

The awards committee will contact the nominee and request information regarding the nominee's curriculum, achievements, and contributions to Technology Education, along with letters of endorsement.

To nominate a teacher, program or industry visit the awards tab on WTEA website at wtea-wis.org. All nominations must be submitted via the WTEA website. The awards ceremony will be held Wednesday, March 8th, at the Chula Vista Resort as part of our 54th annual Conference.

Notes:
- **Nominations must be received by November 15th** to be considered for recognition the following spring.
- Technology Educators must be a member of the WTEA to be considered for award recognition, unless the award being nominated is "Special Recognition."
- For a detailed description of the awards please visit our website or contact any member of the board of directors.
- If you have any questions please feel free to contact me at this email address: matt.schultz@tlabeloit.com

WTEA AWARDS
Technology Educator of the Year
M.S. Program of the Year
H.S. Program of the Year
Award of Excellence
Inspire Award
Special Recognition Award
Community Service Award

DIRECTOR'S REPORT

How and Why to Recruit Future TEE Teachers from Your Classes

By Duane Elfering - University Rep, UW-Stout Technology Education Program Coordinator

We all know many benefits of Technology and Engineering education. Our courses feed students into so many occupations that make our country great. It's critical we continue to put students into the workforce to feed production lines and better this crippled supply chain. TEE teachers understand students learn better by doing. TEE lessons and activities apply science, math, social studies, and language arts by using technology and engineering to create. There is a sense of pride students gain by creating, building, and engineering projects to solve real-world problems. Add student organizations so students grasp the real meaning of teamwork and communication, and they have the key employability skills employers are looking for.

"So, I ask you to look at your classes and encourage a student or two every semester to become a TEE teacher."

For those that do not know me, I am the new Technology Education Program Coordinator for UW-Platteville. I previously taught Tech Ed for 30 years at Barneveld School District. A former student, William Hodgson, took over the Barneveld program. Stepping into a program that covers all facets of Tech Ed from automotive, metalworking, woodworking, CAD/CAM, fabrication, biotechnology, SkillsUSA and CUSA is a challenge for a one-person department and I'm proud of Will. Changing careers you feel a part of can be difficult, but I was ready for a change and always wanted to move to the post-secondary level.

Here at UW-Platteville, I see so much potential for future TEE educators. I know what you are thinking, why would someone want to become a teacher with the lack of funding, lack of parental support, lack of public perception, and so on. But if you take a moment to focus on the positives, there is much to get excited about: summer vacations, breaks when your children are off from school, always learning and continuing to grow, a great pension plan, the WTEA conference, and most of all, the lives you inspire. Personally, I saw this message so strongly this year at the conference; we teach because we see the difference we make. So, I ask you to look at your classes and encourage a student or two every semester to become a TEE teacher. If they're unsure, tell them your story as to why you became a TEE teacher. Build a bond, and they will watch your enthusiasm and pride in your profession, along with your great teaching, and eventually you'll have inspired a student or more to become a TEE teacher.

At UWP, we've added a couple student organizations. There is now a UWP ChallengeUSA team and a SkillsUSA team, which fall under the Technology Education Association title. These organizations are open to any UWP student. Several students have transferred from engineering to TEE. I simply asked what got them interested in the engineering field and it's been their Tech Ed experience in HS. I then asked if they had considered being that role model to a future student, and a few said yes. Easy recruitment for me! So of course, I'm going to keep the Technology Education Association student organizations open to everyone. We are also in the process of creating a modified Fab Lab. The goal is to have the lab open for students to hangout, build relationships, share ideas, be creative, and make projects. The additional lab time will help students graduate with more hands-on experience and a little machine maintenance skill. We are also working on adding automotive and automation coursework to the program so our future TEE students are more well-rounded and prepared.

I look forward to growing the program at UW-Platteville. With your help, I know we can continue to be the leaders, or teach the leaders, which will solve real-world problems currently hurting this country.

DIRECTOR'S REPORT

A Very Successful Summer CNC Workshop

By Eric Sutkay, District F Director

It's hard to believe that we are back to school. Where did the summer of 2022 go? Most of mine was spent in my kitchen on a remodel project, but I also made time for family, friends, and yes, even a little school-related work. This summer's school-related activities actually started back in January at our winter board meeting. That is when Steven Hadfield informed me that he had been doing a monthly machining workshop at a local CNC manufacturer in his district. Several things crossed my mind as he reported on the things they worked on: tooling, feeds and speeds, work holding, etc. How could I better serve the teachers in my district? Is there a company like Hastreiter Industries in my area that would be willing to put on a similar workshop/training for its local teachers? That is when I approached one of our

> *"...he had been doing a monthly machining workshop at a local CNC manufacturer in his district... If you would like to participate please feel free to reach out."*

district's largest youth apprenticeship employers for yet another favor, teacher training.

Toolamation Services, Inc. has always been a big supporter of youth apprenticeship students for KUSD. Over the past five years we have had at least a dozen students working in their facility. They are a great example of what a youth apprenticeship em-

Garrett, of Toolamation Services, showing instructors how they use their Omega Tool Measuring and Management System

ployer should look like - from the mentorship to the work-based learning, everything seems to align. This seemed like a great opportunity for them to train teachers in the area of CNC and provide them with the skills that an employer might want to see in its future workforce. I proposed the idea of the training as a once a week training opportunity for teachers from the surrounding area to discuss CNC, learn programming, machine setup, work-holding, feeds and speeds, and design. We (Garrett, the machine shop manager, and myself) traveled to four different schools within District F to discuss their equipment, skill needs, tooling needs and general CNC questions to create a framework for this weekly summer training. By the end of May we had some solid plans

Working through Fusion and CAM

and the summer was fast approaching. We had several schools and instructors on board for the training.

Starting in June we met for the first time. We did a shop tour and discussed the skills needed for a student entering an apprenticeship with them. We went through Fusion and talked about how they used it in their machine shop. We discussed some of the skills that students should be aware of when they are entering the workforce. Finally we created some toolpaths, setup and ran a part. There was a lot of good discussion about how this could look in the classroom and what difficulties each person could see themselves running into while presenting to the kids. On our second meeting we were able to make a part for a fixture that was needed for a job they were running. This was a great opportunity for everyone to learn because this was a part that had never been run and the process of working through the CAM and set-

Instructors running their first part

up was all new. We ran the part with success but also had some great conversations about how we might change the setup or order of cuts in the program. Another great learning experience for everyone.

As the summer would progress we only had an opportunity to meet the two times. Since those meetings we have had many discussions about how future trainings might look. We have considered the frequency of the meetings and location. As this school year progresses we are considering training opportunities in different schools around District F. If you would like to participate please feel free to reach out. If you are considering an opportunity like this within your district, I encourage you to reach out to some local manufacturers, they are eager to help, but typically do not know where to start. They are even willing to come to your shop to help with different setups, tooling questions, feeds and speeds or even programming.

Hope everyone has a great year and let's continue educating our future workforce!

54th Annual Technology Education Conference & Trade Show

Tentative Conference Overview

Wednesday, March 8, 2023
5:30 p.m. – 8:30 p.m. Conference Pre-registration
6:45 p.m. – 9:00 p.m. Awards Banquet

Thursday, March 9, 2023
7:30 a.m. – 3:00 p.m. Conference Registration
7:00 a.m. – 9:00 a.m. Project Showcase setup
8:00 a.m. – 4:00 p.m. Trade Show
9:00 a.m. – 3:30 p.m. Project Showcase
8:55 a.m. – 9:05 a.m. General Welcome
9:05 a.m. – 10:00 a.m. 1st General Session
10:15 a.m. – 3:30 p.m. Concurrent Sessions

Thursday, March 9, 2023
7:00 p.m. – 9:00 p.m. President's Reception
Friday, March 10, 2023
7:30 a.m. – 11:30 a.m. Conference Registration
6:45 a.m. – 7:45 a.m. WTEA Breakfast
7:45 a.m. – 8:30 a.m. WTEA Membership
                Meeting
8:45 a.m. – 12:15 p.m. Concurrent Sessions,
        Demonstrations & Project Showcase
12:30 p.m. – 2:00 p.m. 2nd General Session &
                Luncheon
2:15 p.m. – 3:30 p.m. WTEA Board Meeting

Thursday Keynote Speaker:

Mark Glendenning
CEO
Inland

Friday Keynote Speaker:

Mary E. Isbister
Owner
GenMet Corp

Session Topics Include: Project Based Learning, Future of FAB Labs, Multimedia Design, Digital Job Board, Making Traditional bows, Boats, and Boards, Planning/Upgrading Welding Labs, Wood Manufacturing/Drying Lumber, Project Ideas for Your CNC Router, Automotive Info for New Instructors, Opportunities in the Civil Air Patrol, Safety for New Teachers, Build a Hexagon Tree House, Mini Metal Foundry, Engineering 8 Project Ideas, Building High Mileage Vehicles, Project Showcase, SkillsUSA, Middle School Roundtable, New Teacher Boot Camp, and much more!

Chula Vista Resort
4031 River Road, Wisconsin Dells   www.chulavistaresort.com
Toll Free Dedicated # for reservations 1-833-621-4953
Ask for WTEA Conference Rate! See page 5 for details.

DIRECTOR'S REPORT

C2 Makerspace Coming Soon

By Stephen Hadfield, District G Director

In Central Wisconsin, a group of manufacturing businesses, UWSP, MSTC, and area high schools are working collectively to create a makerspace. This is a place where students and community members will have access to high tech equipment and the ability to gain skills needed for future career paths in the areas of manufacturing and engineering. The C2 Makerspace will be housed at the UW-Stevens Point, Marshfield Campus, and is scheduled to open very soon.

The space will have a variety of CNC and fabrication equipment and will be a great resource for students who want to expand their knowledge and skill set after normal school hours. For more information checkout: https://www.c2makerspace.com/

COLLABORATE + CREATE MAKERSPACE

Check Your *Interface* Expiration Date!

Check first line of your address on back cover of this magazine to see when your membership expires.
You may not receive the next important issue of the *Interface* unless your dues are paid beyond 2022.

CRAY RESEARCH - CHIPPEWA FALLS

5 Decades of the Fastest Supercomputer in the World

By Michael Beranek, WTEA Webmaster

This journey started 50 years ago in 1972, in Chippewa Falls, Wisconsin, with the creation of the supercomputer company, Cray Research. Their first supercomputer hit the market in 1976. The CRAY-1, was built for the National Center of Atmospheric Research (NCAR) and remained in service until 1989. The NCAR system was able to reach peak performance speeds of 167 megaflops. What is a megaflop, you might ask? A megaflop is one million operations/calculations per second. Let's compare that to something we all can understand. Today's iPhone operates at about 700 billion operations per second, which means today's iPhone 13 is 4000 times faster than the CRAY-1 which, in 1972, was the fastest supercomputer in the World until 1982. The Cray X-MP then took over the top spot with 941 megaflops until 1985.

> *Today's iPhone operates at about 700 billion operations per second, which means today's iPhone 13 is 4000 times faster than the CRAY-1 which, in 1972, was the fastest supercomputer in the world until 1982*

In 1985, the CRAY-2 took the title as the fastest

1972 Cray-1 sitting in front of tape storage drives

supercomputer in the World, reaching peak speeds of 1.9 gigaflops, which was about 12 times faster than the CRAY-1.

In 1998, the Cray SV1 was the world's first vector supercomputer and took the fastest supercomputer in the world title by breaking the teraflops (one trillion calculations per second) barrier. This system was 8 times faster than the previous system topping the Top 500 list.

In November, 2008, the Cray XT5 system named Jaguar, located at Oak Ridge National Laboratory, broke the next supercomputer barrier, running at speeds over one petaflop, topping the Top 500 fastest supercomputers in the World. Jaguar was made up of 200 cabinets of microprocessors, housing 224,256 computer processing cores (CPU).

Fast Forward to June 2022

Something incredible happened this past summer, marking a milestone which will be forever etched into the history books as one of the most notable computing accomplishments.

Yes, Wisconsin, and more specifically Chippewa Falls, has been at the forefront of supercomputing for the past 50 years but more incredible than that, computing speeds have reached amazing new levels.

In June 2022, computing speeds of 1.1 exaflops (theoretical speeds of 2.0 exaflops possible) were reached by an HPE Cray EX Supercomputer, built in Chippewa Falls for the U.S. Department of Energy's Oak Ridge National Laboratory, and is named Frontier. Frontier, breaking the exascale barrier at 1.1 exaflops, is faster than the next seven most powerful supercomputers in the world combined (based on the Top 500 List, 2022).

Exascale Computing Will Be Remembered As A New Era of Supercomputing Power

Exascale computing means computing at exaflops of performance – more than a quintillion, or 10^{18}, calculations/operations per second. The first Cray supercomputer reached speeds in the megaflops (1 followed by 6 zeros) and today's exaflops systems equals a quintillion (1 followed by 18 zeros), or a million, million, million.

Let's continue to try to put that number into perspective, the Milky Way galaxy is 1 quintillion kilometer wide, and it would take 40 years for one quintillion gallons of water to flow over Niagara Falls. Further, you'd need every single person on earth calculating 24 hours a day for more than four years to do what an exascale supercomputer can do in 1 second. The concept of exascale computing, in sheer numbers, is mind boggling and truly astonishing. This computer will change the world.

Inside ORNL's computer room looking at the HPE Cray EX System, named Frontier.

Supercomputers Keep Bringing the Previously Impossible Within Our Reach

Now, supercomputers have entered a new era. Decades after the introduction of the first petascale (1,000,000,000 megaflops) system to reach 30 petaflops (2011, a Cray XK system named Titan at ORNL), the first computers capable of crunching numbers at exascale levels are now running in the United States.

Traditionally associated with universities and big national laboratories, supercomputers have long been running everyday applications for private industry that range far beyond basic science. Industries such as oil exploration, finance, personalized content delivery, and online advertising are deploying high-performance computing (HPC) systems to manage heavy workloads delivering real-time services.

3-D graphic rendering of HPE Cray EX System, Frontier

What's new and exciting for the exascale era is that artificial intelligence (AI) has arrived. As industries move to incorporate more AI, they are crunching massive amounts of data to teach the systems how to work. Coupling HPC with AI allows industries to train bigger, better, and more accurate models.

The move to exascale computing will position organizations to embark on seemingly limitless searches for answers to "what is", "what if", "what else", and "what could be" questions.

For example:

- Understanding the structure and properties from exabytes of data by zooming into subatomic-scale measurements from microscopes (e.g., Cryo-EM), scattering sources (e.g., CERN), and light sources (e.g., SLAC), and zooming out into a square-kilometer array of telescopes (e.g., SKA@Pawsey) to study events in the distant universe.
- Hypothesizing new atomic structures that could be materials with superconducting properties or drugs with the potential to treat novel and rare diseases.
- Conducting ensemble simulations to predict the path of a hurricane or quantifying the uncertain dynamics of the atmosphere, oceans, land, and human behaviors to climate change.
- Predicting 15 minutes of extreme weather based on 50 years of climate data and 100 years of physics or forecasting the species-leaping transmission of a virus to avoid the next pandemic.

Imagine what exascale computing could do in a lab where researchers are testing out remedies for a disease. These machines have up to 1,000 times more power than the first petascale computers. They can crunch processing time down from weeks to days and from days to minutes and from hours to seconds. They can connect and combine inputs from more sources, create more powerful models, and run more frequent simulations to see what works. Rather than waiting weeks for feedback, teams can determine, whether a potential pharmaceutical compound is worth pursuing in just a few hours.

The Frontier Supercomputer is an HPE Cray EX Liquid-Cooled System, Built in Chippewa Falls, Wisconsin and Includes Some of the World's Most Advanced Technologies From AMD & HPE

The Frontier, which is an HPE Cray EX System.

- Each node contains one optimized third-generation AMD EPYC processor and four AMD Instinct MI250X accelerators for a system-wide total of 9,472 CPUs and 37,888 GPUs. These nodes provide developers with ease of programming for their applications owing to the coherency enabled by the EPYC processors and Instinct accelerators.
- HPE's Slingshot interconnect is the world's only high-performance Ethernet fabric designed for High Performance Computing (HPC) and Artificial Intelligences (AI) solutions. By connecting several core components for improved performance (e.g., CPUs, GPUs, high-performance storage), 90 miles worth of HPE Cray Slingshot networking cables enables larger data-intensive workloads that would otherwise be bandwidth limited and provides higher speed and congestion control to ensure applications run smoothly. Owing to this unique configuration and expanded performance, teams have taken a thoughtful approach to

scaling the interconnect to a massive supercomputer such as Frontier, made up of 74 HPE Cray EX cabinets (each weighing more than 8000lbs), to ensure reliable performance across applications.

- An I/O subsystem from HPE is being brought online this year to support Frontier and the OLCF. The I/O subsystem features an in-system storage layer and Orion, which is a Lustre-based, enhanced center-wide file system. The in-system storage layer will employ compute-node local storage devices connected via PCIe Gen4 links to provide peak read speeds of more than 75 terabytes per second, and more than 15 billion random-read input/output operations per second. The Orion center-wide file system (which is a Cray E-1000 ClusterStor File Systems) will provide around 700 petabytes of storage capacity and peak write speeds of 5 terabytes per second.
- As a next-generation supercomputing system and the world's fastest for open science, Frontier is also liquid cooled. This cooling system promotes a quieter datacenter by removing the need for a noisier, air-cooled system.

This system, named Frontier, is the first of three exascale systems that will be built in Chippewa Falls and will be installed at national labs across United States. The Frontier system is located at Oak Ridge National Lab, the next two systems (Aurora and El Capitan) will be located at Argonne National Labs and Lawrence Livermore National Labs. The Cray Exascale journey started in 2018 with a newly designed supercomputer (code name, Shasta) built from the ground up. It uses a Cray-designed interconnect called Slingshot to provide a High-Speed Network backbone of the systems.

Growing up in Northwest Wisconsin I was always a fan of the supercomputer lore that permeated from Chippewa Falls, along with the ground-breaking work that Seymour Cray was creating. If Seymour Cray was alive today, he would truly be the grandfather of Supercomputing and Chippewa Falls, Wisconsin, would be the birthplace.

Red and blue cooling hoses attached to compute blades are visible inside the cabinet of the Frontier. Each blade houses 4 CPUs or GPUs; each CPU/GPU has at least 64 compute cores, creating an 8,730,112 core massively parallel system.

Terms and Associated Links

FLOPS - https://en.wikipedia.org/wiki/FLOPS
    Megaflop
    Gigaflops
    Teraflops
    Petaflops (petascale computing)
    Exaflops (exascale computing)
Top 500 list - https://www.top500.org/
CPU - https://en.wikipedia.org/wiki/Central_processing_unit
GPUs -https://en.wikipedia.org/wiki/Graphics_processing_unit
High-performance storage - https://en.wikipedia.org/wiki/High_Performance_Storage_System
Byte - https://en.wikipedia.org/wiki/Byte
    Megabytes
    Gigabytes
    Terabytes
    Petabytes
    Exabytes
Cryo-EM - https://cryoem.slac.stanford.edu/what-is-cryo-em
CERN - https://home.cern/
SLAC - https://www6.slac.stanford.edu/
SKA@Pawsey - https://pawsey.org.au/pawsey-and-the-ska/
Argonne National Labs (ANL) - https://www.anl.gov/
Lawrence Livermore National Labs (LLNL) - https://www.llnl.gov/
NCAR - https://en.wikipedia.org/wiki/National_Center_for_Atmospheric_Research
Oak Ridge National Lab (ORNL) - https://www.ornl.gov/
OLCF - https://www.olcf.ornl.gov/
AMD - https://en.wikipedia.org/wiki/Advanced_Micro_Devices
Cray - https://en.wikipedia.org/wiki/Cray
HPE - https://en.wikipedia.org/wiki/Hewlett_Packard_Enterprise
Lustre - https://en.wikipedia.org/wiki/Lustre_(file_system)
PCI - https://en.wikipedia.org/wiki/Peripheral_Component_Interconnect
PCIe - https://en.wikipedia.org/wiki/PCI_Express
High Performance Computing (HPC) - https://en.wikipedia.org/wiki/High-performance_computing
Artificial Intelligences (AI) - https://en.wikipedia.org/wiki/Artificial_intelligence
Ethernet - https://en.wikipedia.org/wiki/Ethernet
I/O subsystem – Input and Output Subsytems - https://en.wkpedia.org/wiki/Input/output
Supercomputer - https://en.wikipedia.org/wiki/Supercomputer

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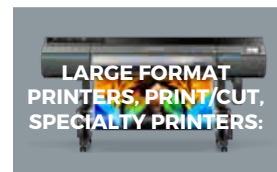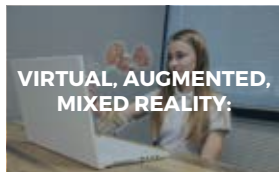
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Adding Electronics to Woodworking
By Michael Chopin, WTEA Secretary / Treasurer

Adding electronics to woodworking projects has never been easier. The use of simple electronics can add a lot to a basic woodworking project and still be very inexpensive. You can also use small coin cell batteries to power single LEDs. While this is not a typical woodworking procedure, it does give students another skill they will carry with them.

The use of 5v USB power for LED lights is very simple and safe to use with students. Making a lighted sign or display is as easy as buying the correct LED jack. While I found some students have all of my students were able to get their very inexpensive, so the project does was also able to make smaller projects on the wood for the projects. Students checking their soldering to make sure everything is correctly hooked up. This builds more troubleshooting skills for my students.

> *"...a great way to differentiate and ...*
> *challenge their skills in the wood shop."*

strip lights and soldering them to a USB trouble using a soldering iron at first, LEDs to light. Most of the parts are not add much to the overall budget. I more interesting, hence I saved money learn about using a multimeter and

A small 3-volt coin cell battery can also be used to power single LEDs. Students designed a small candle that uses a flickering LED to simulate the candle. While the candle is not very bright, it does work will and only required less than $1.50 in parts for each candle. This required only a small amount of soldering. Students also learn basic electronics skills, such as making sure the positive on the battery connects to the correct leg of the LED.

I have found this is a great way to differentiate and allow students to create something that, while based on my criteria, still allows them to challenge their skills in the wood shop. It is something that they can use for many years or give as a gift.

Parts are all cut out of a pine board, 1x4 by 19" long. The thin pieces were re-sawed on the band saw.
Parts: 2 @ 3 ½ x 3 ½ x 3/4", 3 @ 3 ½ x 3 ½ x ¼", and 2 @ 3 ½ x 3 x ¼".

Create a design in the four sides.

Glue the base pieces together. Drill a large hole in the bottom of the base for the electronics. Drill a small hole the diameter of the LED all the way through the base. Drill a small hole in the side of the base for the switch, the holes should intersect.

Insert the LED into the small hole in base. Use hot glue to hold LED in place and create a small candle looking mound of glue on top of base. Glue the rest of the base together.

Insert switch into base of candle.

Components needed for the candle.

Complete all wiring in the base of the candle.

The finished candle being tested.

WTEA Welcomes New Board Member

The WTEA is pleased to announce that Dr. Roger Stanford, President of Western Technical College, has agreed to serve on the WTEA Board of Directors as our WTC Representative.

Dr. Stanford will be replacing Dr. Bryan Albrecht, President of Gateway Technical College, who is retiring after a long tenure on the WTEA Board. We are very grateful to Dr. Albrecht for his time, dedication, and service to our organization, and we wish him the best in his retirement.

Dr. Stanford became President of Western in July 2017, after serving as the Vice President of Academic Affairs at Western for two years. Prior to coming to La Crosse, he had increasing roles of responsibility at Chippewa Valley Technical College (CVTC), most recently as the Vice President of Instruction.

Dr. Stanford's 30-year career in education started when he was a high school marketing instructor and transitioned into higher education when he served as the adjunct professor/facilitator/research advisor for University of Wisconsin-La Crosse and University of Wisconsin-River Falls master's programs.

Additionally, Dr. Stanford is a veteran of the United States Air Force and is a strong advocate for veteran students and programs that support these students on their quest for higher education.

Throughout his career, Dr. Stanford's passion for student success has been a guiding force. We look forward to adding Dr. Stanford's leadership to the WTEA Board.

◄ Mark Your Calendar ►

Real Math & Science Video Premiere
October 11, 2022 ....Green Bay, WI

WTEA Awards Nominations Deadline
Nov. 15, 2022 ....via the WTEA website

ACTE CareerTech VISION 2022
Nov. 30-Dec 3, 2022 .... Las Vegas, NV

WTEA Officer Nominations Deadline
Dec. 9, 2022 ....to Dave Stroud

WTEA Early-Bird Registration Deadline
Dec. 17, 2022 .....WTEA website or U.S. Mail

ITEEA National Conference
April 12-15, 2023..................Minneapolis, MN

SkillsUSA 50th State Conference
April 25-26, 2023 ....Madison, WI

SkillsUSA National Conference
June 19-23, 2023 ....Atlanta, GA

SKILLSUSA NATIONAL CHAMPIONSHIPS
Wisconsin Wins the Automotive Gold Medal
By Brent Kindred, Vice President WATDA Foundation

In April, at the Alliant Energy Center in Madison, Grafton High School's Owen Pryga won the SkillsUSA Wisconsin automotive competition which qualified him for Nationals in Atlanta, Georgia, in June. The Wisconsin Automobile and Truck Dealers (WATDA) Foundation has proudly coordinated this automotive student competition for over 20 years, engaging our dealership network, helping prepare the next generation technician, and sending the state gold medal winner to nationals.

The annual SkillsUSA National Championship had gold medal winning automotive competitors from across the United States working on a wide variety of tasks that tested proficiency on Automotive Service Excellence (ASE) tasks across multiple manufacturers' products. Owen captured the gold medal at Nationals by proving his skills in the areas of Safety, Brakes, Electrical & Electronics, Suspension, Steering, Alignment, Major Engine Repair, Engine Performance and Transmissions. By following the national automotive training standards in his automotive program at Grafton High School, Owen was well prepared for the national event.

The WATDA Foundation is proud of Owen and all that he has accomplished. He demonstrated expertise and professionalism while proving his technical proficiency. Our Foundation's vision is to help produce the most highly skilled transportation technicians for Wisconsin.

Congratulations to all transportation students who competed at nationals!

Wisconsin's Transportation Student Placements from the SkillsUSA National Championships

Automotive Technology
1st Place/Gold Medal: Owen Pryga – Grafton High School
8th Place: Benjamin Black – Fox Valley Technical College

Collision Repair Technology
8th Place: Luke Murphy – Freedom High School
7th Place: Bryce Dunstan – Northeast WI Technical College

Diesel Equipment Technology
15th Place: Jake Anderson – Holmen High School
5th Place: Timothy Beckman – Madison Area Technical College

Motorcycle Technology
2nd Place/Silver Medal: Dominic Blatterman – Spooner High School
4th Place: Isaac Jasmin – Fox Valley Technical College

Power Equipment Technology (Small Engines)
1st Place/Gold Medal: Brian Siegler – Jefferson High School

Automotive Refinishing Technology
5th Place: Emelie Horsens – Northeast WI Technical College

Power Equipment Technology

Motorcycle Service Technology

Automotive Maintenance & Light Repair

SUMMER TEACHER TRAINING

Fox Valley Technical College Facilitates Summer Automation Training

By Steve Meyer, Manager of STEM Education, Fox Valley Technical College

Training Overview

This summer, Fox Valley Technical College (FVTC), along with a partnership from the company Amcor, a global packaging company, facilitated Automation Teacher training events for six different Northeast Wisconsin schools and teachers. The training curriculum and learning experiences were designed and facilitated by Steve Meyer, Manager of STEM Education, at FVTC. Schools that participated in the

Fabricating the bubble gum machine

trainings include Hortonville, New London, Omro, Winneconne, Little Chute, and Clintonville. A total of seven teachers spent time at FVTC learning about the philosophy, concepts, technologies, and pedagogy to implement Automation and Control Technology into their classrooms. Through the partnership with Amcor, the teachers and schools received a stipend and materials and supplies to implement this curriculum into their programs.

Concepts Covered

During this training teachers learned how to systematically teach their students about four areas of Automation and Industry 4.0. Those areas touched on include:

1. Computer Programming and Computational Thinking
2. Control Technology and Systems thinking
3. Electronics and Sensors
4. IoT, Big Data, and Human Interfaces

The concepts and experiences within the curriculum were designed to be stand-alone if need be, but provide continuity and cascading of the content if desired. The projects can be increased

Programming the bubble gum machine

or decreased in complexity for different age levels, course or unit time frames, and teacher/student background experience. Many of the schools will be testing portions of the curriculum throughout this school year.

The Nuts and Bolts

Teachers did various hands-on, minds-on activities just as the students would do in the classroom. While doing these activities, the instructors went through proper pedagogy techniques

and how to provide the proper amount of structure and support to the students to allow for success, yet allow them to also learn through experimentation and forward failure. Ultimately, the teachers fabricated, calibrated, wired, assembled, programmed, tested and troubleshooted a fully automated bubblegum machine. The automated machines did the following:

- Allowed the user to load bubblegum balls, count bubblegum balls as variable, and track the bubblegum ball inventory in the machine at any point from anywhere.
- Dispensed a bubblegum ball after a customer pushed the dispense button.
- Displayed an audio (sounds through a speaker) and visual (blinking LED) when the machine was dispensing.
- Provided real time data on the machine status.
- Gave a visual and audio signal when the bubblegum machine was getting low on inventory and when the machine was empty.
- Sent information to the user wirelessly on their "cellphone" notifying the user if the machine needed to be refilled.

Automated bubble gum machine

Teacher Findings and Observations

Everyone in the training had a great time and learned a lot from each other. They found out that rich and engaging learning experiences in Automation and Control Technology do not have to be expensive and can still replicate the procedures, processes, and ways of thinking used in industry applications. The teachers and schools that participated are now part of a consortium that will provide support and other learning opportunities in the future to continue to develop, improve, and spread sound curriculum and teaching methods in this area.

Future Training Opportunities

More Automation Training sessions will be provided to schools and teachers throughout the state in the future. For more information on these opportunities, please email Steve Meyer at

meyerst@fvtc.edu

Renew Your *Interface* School Subscription

WTEA

Stay informed about technology education in Wisconsin AND receive a discounted rate by taking advantage of the WTEA school (building or district) subscription. The more local technology educators you sign up, the more you save! An individual subscription is $30, but you can sign up six people for only $125 - that's a savings of $55 (*see fee schedule listed below*). And each additional person beyond the initial four is only $15.

How it works:
Complete the form below and list every technology educator in your building. If your department has teachers in more than one building, duplicate the form and provide us with the correct school address for each educator. That way separate buildings in the same school district can be combined to increase your savings. All names listed must be employees of the same dchool district. Tally the fees on the form and send it along with a check or school purchase order to the address on the bottom of the form. **To be eligible for all benefits of this special pricing, school subscriptions should be sent as soon as possible.**

What you get:
Each person receives: a personal copy of the *Interface*, all association mailings and notices, invitations to attend regional technology education meetings and workshops, unlimited access to the WTEA website, discounted admission to the association's annual Technology Education Conference, and eligibility to receive all association awards (educator of the year, program of the year, award of excellence, 25 year award). All mailings will be sent to the school address on the form. This school year subscription will expire the following fall. This form will be published in the *Interface* each fall; it is also available on the WTEA website.

— — — — — **Please type or print all information. Duplicate this form as necessary.** — — — — —

School District _____ School Name _____

School Address _____

School City _____ State _____ Zip _____

Phone (_____) _____ School Fax _____

Local Technical College District (used for regional workshops and meeting invitations) _____

Local Tech. Ed. Contact (Dept. Chair, LVEC, etc.) _____

Email address of local Tech. Ed. contact _____

Name and email	# of years teaching	Fee
1 _____	_____	$30
2 _____	_____	$25
3 _____	_____	$20
4 _____	_____	$20
5 _____	_____	$15

Each additional person is $15 each; names and school address may be attached on a separate sheet.
Please note: The *Interface* is published 3 times per year: fall, winter and spring.
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NORTHEAST WISCONSIN MFG ALLIANCE
"NEW" Partnership Provides Free Videos and More

The Northeast Wisconsin (NEW) Manufacturing Alliance has partnered with WTEA on numerous events and programs over the years. One of those events is the annual Get Real Math & Science Video Premiere at the Meyer Theatre in Green Bay. The free event is always the second Tuesday in October from 5 p.m. – 7 p.m. WTEA has sponsored the networking reception prior to the video debut. Tech ed teachers from throughout the state have attended event.

Ann Franz, executive director for the organization stated, "The concept of the videos came from a math teacher participating in the Alliance's K-12 task force." Franz added, "She was looking for a tool to show students how the curriculum she was teaching is used in the real world." In 2014, five videos were created to answer the questions students often ask, "When am I ever going to use this in the real world?" The free educational videos include a teacher lesson plan and spotlight real-world problems at manufacturing companies. To date, there have been over sixty Get Real Math! Videos created. In 2021, the organization debuted six Get Real Science videos.

Unlike most movie premieres, it is not the stars of videos that are recognized, but rather the educators. At the event, signage stating "Educators are the stars of our community" are displayed and teachers walk down the red carpet to have their pictures taken. There are numerous prizes given away including $500 cash awards to math, science and tech ed departments, along with a Miller Electric welding machine.

Companies featured in the videos include: Alliance Laundry Systems, Ariens, Carnivore Meats, EMT International, Fincantieri Marinette Marine, Georgia-Pacific, KI, Kohler Co., McCain Foods, Nercon, Oshkosh Corp., Pierce Mfg., Plexus, Robinson Inc., Rockline Industries, Sargento Foods and TIDI Products.

To view Fincantieri Marinette Marine's Get Real Math video: "What Does A Sinking Ship Have To Do With Math?": https://newmfgalliance.org/get_real_math_video/what-does-a-sinking-ship-have-to-do-with-math/

The October 4, 2022 Premiere included a special gift for every tech ed teacher in attendance - a special 'tool box' that included safety glasses & gloves, measuring devices, earplugs, calipers and other assorted tools. It was a 'thank you' gift from the organization. Franz stated, "We are so grateful to tech ed teachers that inspire youth every day". She added 'This gift is a small way for our organization to express our thanks to these dedicated educators.

To see the Get Real Math & Science Videos and to register for October NEW Manufacturing Alliance events, go to www.newmfgalliance.org. Contact Ann Franz with questions regarding the events at 920-498-5587 or ann.franz@nwtc.edu.

WTEA STUDENT AMBASSADOR PROGRAM

The WTEA Student Ambassador Program is kicking off its third official year. The program provides students with an opportunity to see what it is like to be a TE Teacher and gives students the opportunity to work with a cooperating teacher mentor. The Student Ambassador Program is an initiative started by the WTEA to help support students who show potential and/or an interest in becoming a Technology Education Teacher.

When students enroll in the program, they work with their cooperating teacher/mentor on a number of amazing opportunities. Students will plan and teach a lesson; students will visit colleges who support a 220 license; students have the opportunity to attend the WTEA Fall Conference; and create a digital portfolio of their experience. These are a few of the many opportunities the Student Ambassador Program provides. At the end of each year the Student Ambassador Program offers scholarships to those who apply. This year I encourage you to reach out to your students and have a conversation about their future. Not all students are interested in becoming a TE teacher, but these conversations will shed light on why they are taking your classes and will help you better serve them.

Visit the Student Ambassador website linked to the WTEA home page. Contact Matt Schultz with any questions. wteasap@wteafoundation.org

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CALL FOR PRESENTERS!
2023 WTEA Conference Theme:
"Purpose • Pathways • Professionalism"
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Presenter form must be submitted by December 1, 2022 by mail, website submission or e-mail.
Submit directly via online form under the Conference & Events tab on the WTEA website.
E-mail: johnston@mwt.net • Phone: 608-689-3033

PROJECT BUILD

Designing, Building, and Testing a Control Line Airplane

By Steve Meyer, Manager of STEM Education, Fox Valley Technical College

Overview

There are certain projects and experiences that you do that have a lasting effect on students for years to come. I was recently talking with a number of students that I had in class 15 years ago. We were reminiscing about all the fun we had in class with various projects, clubs, etc. Ironically, most of the stories were not about anything educational. However, one of the students did bring up a project that he remembered being so fun and how he learned a lot from the experience. The topic area was aviation and the project involved students designing, fabricating, and testing a small electric control line airplane. This article shares some insight into this project and should be enough for you to implement it into your curriculum if you choose. *All the necessary files and information for this project are located in the WTEA Google Drive Folder title Control Line Airplane.*

Background

I have used a version of this project with both middle school students and high school advanced engineering students. Dr. Don Mugan, a former department chair for Technology Education at Valley City State University (VCSU) in North Dakota shared the basis of this activity with me back in the early 2000's. The procedure for each age group is the same, however, there is a lot more mathematics, science, and engineering design involved at the high school level. For the middle school experience, I have a template of an airplane fuselage, wing, and elevator that students trace and cut out of foam insulation on a hot wire cutter. The students glue it together and then add a small DC motor and propeller. I then built a "control stand" using a dimmer switch, 12-volt power supply, a wooden stand, and a 90-degree rotating RC jack. By increasing the dimmer switch, the airplane would start to take off and would fly in a 20-foot diameter circle around the pole. The following article explains the process in more detail.

How it's Made

Middle School Version

For my middle school class, I designed an airplane that I knew would fly (3D rendering above and foam version pictured here). The fuselage was made out of half inch polystyrene insulation. The wings, rudder, and elevator were made out of quarter inch fanfold foam sheathing material. One piece of this will make enough airplanes for years. The students used hardboard templates to cut out the parts with a hot wire cutter and scissors, hot glued the parts together, and then rubber-banded the motor assembly into each airplane. The students had a chance to power up their planes and watch them fly around in circles. *(Full build directions and template files located in WTEA Google Drive folder).*

High School Version

Students in the Advanced Engineering Design class spent an entire month studying aviation technology. Concepts studied included the history of aviation, technological systems, parts and control surfaces of an airplane; the science behind lift, drag, gravity, and thrust; Bernoulli's Principal, airfoil design, etc. Students at this level designed their own airplane, created a 3D model of it, cut out the parts on a laser engraver or CNC milling machine, performed wind tunnel testing, etc. Students even developed a thrust tester to determine the optimum propeller blade to use on their design. After designing and building, they did extensive testing on their planes and gathered data such as amount of lift, scale mph, optimum angle of attack, etc. A reflection presentation and "Science Fair" tri-fold display of their entire design process and results were created.
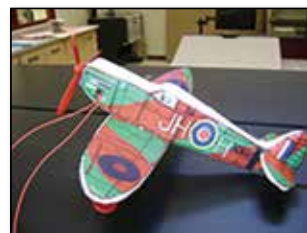
The Control Stand

In the WTEA shared Google folder is a PowerPoint modified from Dr. Mugan's original that has directions on how to make the basic airplane and control stand. I know that companies such as Kelvin have come up with their own PowerPole that you can purchase also. I found that a quick trip to Radioshack and a look through some old electronics supplies was all that

was needed to make a version of Don Mugan's control stand. I chose to use a larger power supply with more amperage and made the control stand a few feet higher. It really helped the heavier planes fly.

Control stand

Test Day…….*So Much Learning*

My favorite part of this activity is how realistic everything is in regards to an engineering simulation. When students hook up their planes and give it some thrust, the plane goes forward and starts to take off. If the angle of attack of the wing is too large or the elevator is tilted down too much, the plane will go straight up in the air and stall out. Students can quickly change the inputs to the system and test again to see the results. We used to test the planes in the gymnasium. If the ceiling fans were on and the planes flew below them, they would flutter up and down…turbulence! I used to always give students the choice of using a 2-blade, 3-blade, or 4-blade propeller. Many students would always go immediately with the 4-blade thinking it would make their planes more powerful. Ironically, or more like scientifically, it did not. The 4-blade propeller required more torque from the electric motor. The torque rating on the electric motor was actually more suitable to produce more thrust using a 3-blade propeller. Once students failed and figured this out themselves, I had them do some propeller testing and take some data using a simple propeller thrust tester. An image is shown below. This is a great way to have students participate in data driven design and make engineering decisions through scientific testing rather than purely trial and error. It was a simple and fun way to teach students this enduring understanding. When students finally got their airplanes tuned in, the majority of them would "fly" very well. Theoretically, if you swing a brick around fast enough it will "fly," however, with the airplanes, you could really tell how much smoother and with less energy they could fly when students had the control surfaces set properly and the planes balanced. The planes required less thrust to produce more lift and could react much quicker to student inputs.

Female and male 90-degree RCA jack to allow wires to spin as plane goes in circles.

Propeller Thrust Tester-students plot voltage vs force.

Tall control stand, propeller tester, and student planes with display stands.

Helpful Hints and Troubleshooting

Below are some things that can help to make this project go smoothly for the students and you as a teacher:

- Use a 12-volt power supply with 2-amp capability so the electric motors run strong.
- Use high speed electric motors - 15,000 rpm or more (model number 850647 from Kelvin works well and costs just over a dollar).
- Use light gauge wire (Ethernet cable stranded wire works well) for the wire to the airplane. Keep it under 10 feet for starters so the wire is not too heavy for the plane.
- Have the students twist the landing gear and motor out at a small angle so the plane flies to the outside of the circle and the wire gets tight.
- Don't allow students to get big eyes and make their planes too large. The weight becomes an issue. A good rule of thumb is to keep the fuselage around 12 inches long.

In Conclusion

As mentioned earlier in the article, this project can be used at the middle or high school level. It will definitely get kids excited about learning. There are so many different concepts, skills, and ways of incorporating standards into this project. If you are looking for an authentic, inexpensive, and very engaging student experience, check it out.

Thank You

I hope you enjoyed and have success with this project. Please visit the shared WTEA Google folder to access a PDF of this document, design portfolios, airplane templates, and project PowerPoints. Please email me at meyerst@fvtc.edu if you need help at all. ***Good luck and keep it STEMY!***

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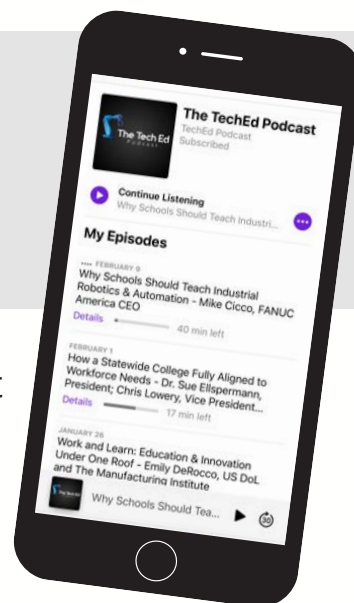
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