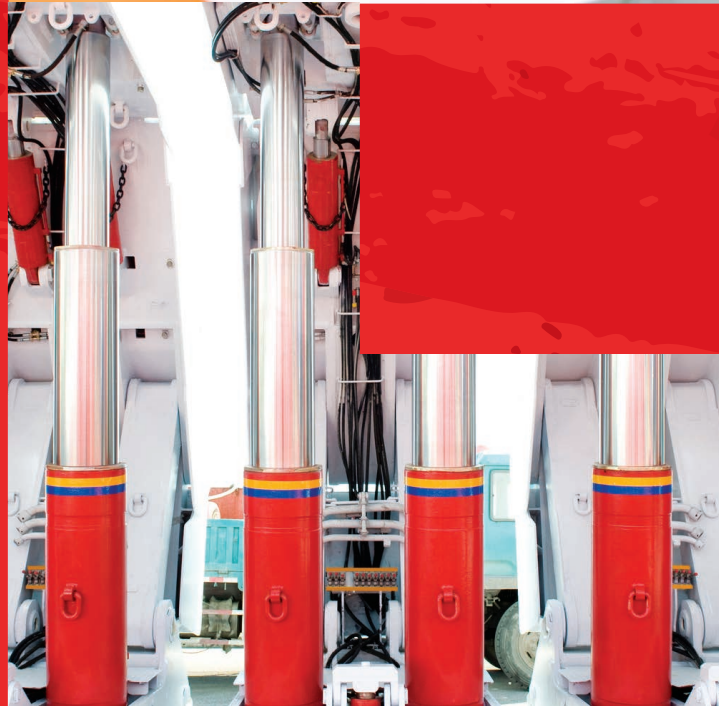




NFPA
Education and
Technology
Foundation

DONOR **IMPACT** REPORT **2023**



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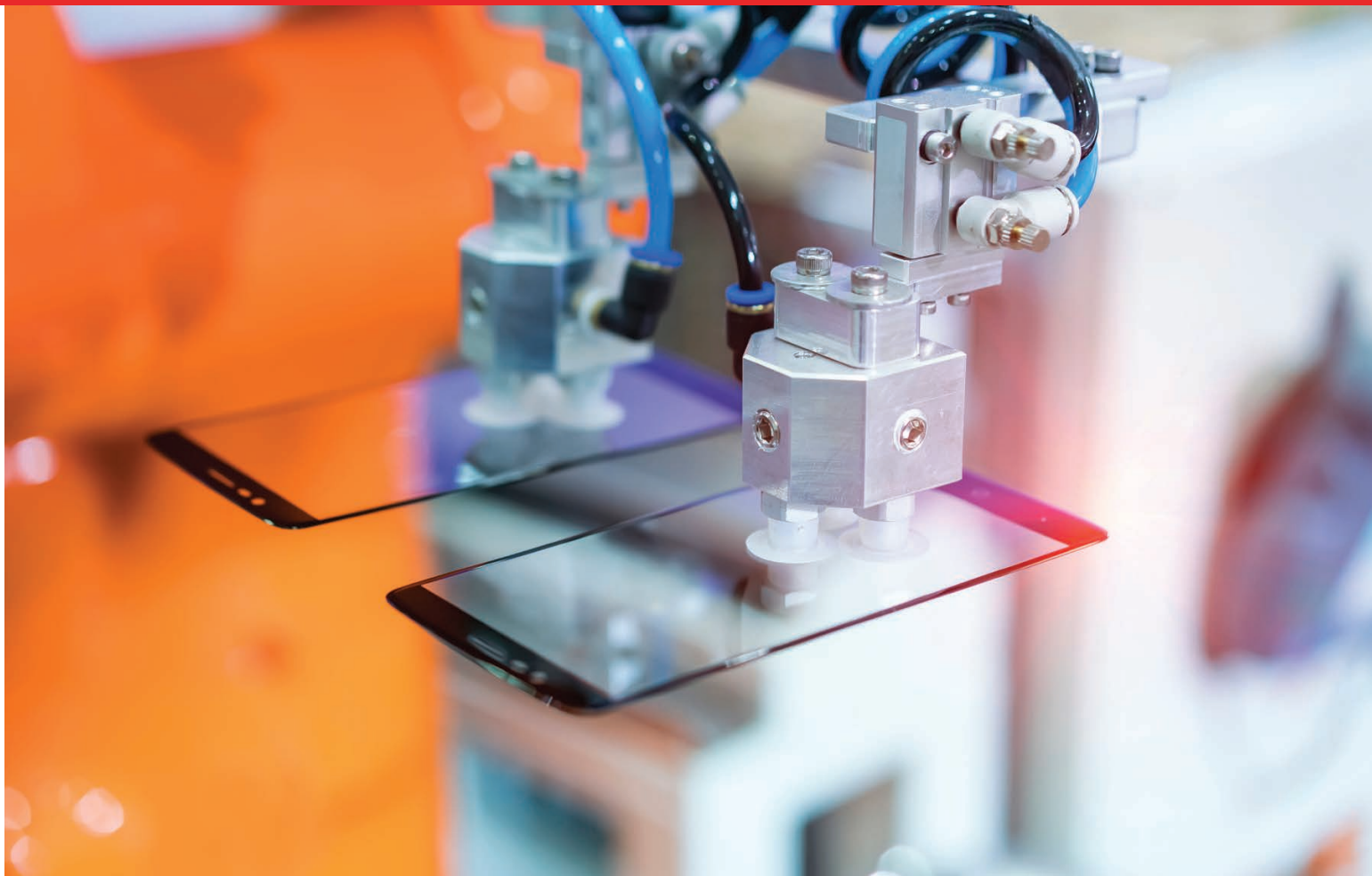
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OUR MISSION

Members of the National Fluid Power Association (NFPA) consistently rank the recruitment of a skilled workforce as among the most challenging issues their companies face. This is likely because not enough technical colleges or universities are teaching hydraulics and pneumatics, nor preparing their students for careers in the fluid power industry.

As a result, NFPA has identified growing the fluid power workforce as one of its primary strategic priorities. It is central to its mission of strengthening the fluid power industry. NFPA seeks to increase the number of technical college and university students educated in fluid power, and to connect them to jobs in our industry.

The NFPA Education and Technology Foundation is a tax-exempt, charitable organization, affiliated with NFPA, that is dedicated to meeting this workforce development need. Through the generous support of our donors, we are impacting the lives of thousands by:

- Creating more educated fluid power technicians, by funding student outreach and education programs, designed to create a pathway into the fluid power industry; and
- Creating more educated fluid power engineers, by funding education and recruitment programs, designed to better engage academic faculty in the teaching of fluid power and connecting their students to fluid power career opportunities.

Because of your support, our programs are helping to change the talent pool available to our industry. More young people are aware of the fluid power industry. More 2-year technical college and 4-year university graduates have specific training in fluid power. More technical colleges and universities have education programs focused on fluid power. And more partnerships between these schools and our industry are increasing access to highly talented candidates.

This is truly our mission—yours and ours—and it is working. Your donations will make sure it works for many years to come.

Best Regards,



Eric Lanke
President/CEO
NFPA Education and Technology Foundation

Your Gifts at Work

Creating More Educated Fluid Power Technicians

To create more fluid power-educated Technical College graduates, the NFPA and the NFPA Foundation conduct a number of education and recruitment programs, designed to create a pathway into the fluid power industry.

We have a series of programs that first introduce fluid power in middle schools, then provide fluid power educational experiences in high schools, then fluid power degrees and certificates at tech schools, and finally connections to jobs in the fluid power industry.

Many of these programs are organized under our Fast Track to Fluid Power initiative, which is a workforce development pathway that connects local technical colleges with industry partners and high school teachers. The network creates awareness and interest in fluid power and leads students along a path that leads to careers in our industry.

Education and Recruitment Programs Building a Pathway into the Fluid Power Industry

Fluid Power Action Challenge

Engages thousands of middle school students in learning about and having fun with fluid power. It raises awareness among students, educators, and parents. Industry partners serve as coaches and judges.

Fast Track High Schools

Equipped with fluid power lab equipment and curriculum, they teach real-world fluid power and generate interest in fluid power careers. Industry partners visit the schools frequently and provide mentorship and career encouragement.

Fluid Power Scholarships

Offered to graduating high school students, and students currently enrolled at technical schools, community colleges, and universities in order to pursue fluid power degrees or certificates. Industry partners serve on the scholarship review committee that makes funding decisions.

Fast Track Technical Colleges

Teach validated core fluid power competencies in a 2-year degree program. Industry partners provide on-going curriculum guidance and student internship opportunities.

There are three Fast Track Hubs running – one in Milwaukee, WI headquartered at Waukesha County Technical College, one in Chicago, IL at Triton College, and one in Warren, MI at Macomb Community College. NFPA members with interest in recruiting students out of these regions join Workforce Engagement Groups which serve as a forum to discuss activities designed to connect NFPA members with the Fast Track to Fluid Power network, giving participating members increased visibility to educational institutions and recruitment opportunities to more successfully engage with students interested in fluid power.



The Fluid Power Action Challenge is a STEM-based competition that challenges middle school or high school students to solve a real-life engineering problem by building a fluid power mechanism made from balsa wood and plastic syringes. The students work in teams to design and build a fluid power mechanism and then compete against other teams in a timed competition to see who can score the most points with their fluid power device.

The Fluid Power Action Challenge has many benefits:

- Actively engages students in learning about fluid power.
- Gives support and resources to teachers for science and technology curriculum.
- Creates a learning environment where math and science are fun.
- Encourages students to practice teamwork, engineering, and problem-solving skills.
- Introduces students to careers in the fluid power industry.

Hundreds of individuals in NFPA member companies and education partner institutions have been involved in mentorship, classroom activities, and events related to the Fluid Power Action Challenge, which have engaged more than 30,300 students to date.

Fluid Power Action Challenge

30,300+ engaged through events and classroom activities

Fluid Power Action Challenge Champions

Thirty-five NFPA member companies and education partners from across the country have been recognized as Fluid Power Action Challenge Champions for their efforts in organizing and executing Fluid Power Action Challenge events in their local communities. In doing so, they have made serious investments of both time and money. They have also helped spread information about our industry and reaped the benefits that come with connecting their organizations to the schools and science classrooms where the industry's future employees are learning fluid power for the first time.

These Fluid Power Action Challenge Champions are:

- Bennett Mills Middle School** - 4 annual events, engaging 180 total students
- Bucher Hydraulics** - 1 event, engaging total 20 students
- Caterpillar** - 5 annual events, engaging 372 total students
- Cleveland Community College** - 6 annual events, engaging 198 total students
- Cooper Middle School** - 3 annual events, engaging 171 total students
- Daman Products Company** - 10 annual events, engaging 904 total students
- Deltrol Fluid Products** - 11 annual events, engaging 2,608 total students
- Dura-Bar** - 2 annual events, engaging 158 total students
- Eisenhower Junior High** - 2 annual events, engaging 36 total students
- Florida Technology Student Association** - 5 annual events, engaging 129 total students
- FORCE America** - 8 annual events, engaging 493 total students
- Georgia Tech University** - 2 annual events, engaging 136 total students
- Gulliver** - 1 annual event, engaging 90 total students
- Husco and Waukesha STEM Academy** - 4 annual events, engaging 332 total students
- Hydroquip** - 1 annual event, engaging 18 total students
- Hydrotech** - 1 annual event, engaging 20 total students
- Jerling Middle School** - 4 annual events, engaging 803 total students

- Komatsu Mining Corp Group** - 4 annual events, engaging 251 total students
- LoneStar Community College** - 3 annual events, engaging 65 total students
- Master Pneumatic** - 8 annual events, engaging 1,250 total students
- Mequon School District** - 1 annual event, engaging 36 total students
- Micromatic** - 1 annual event, engaging 20 total students
- Milwaukee School of Engineering** - 14 annual events, engaging 1,426 total students
- Oak Prairie Middle School** - 2 annual events, engaging 68 students
- Parker Hannifin** - 2 annual events, engaging 44 total students
- Pennsylvania Small Business Education Fund** - 5 annual events, engaging 604 total students
- Price Engineering** - 6 annual events, engaging 881 total students
- Purdue University** - 7 annual events, engaging 373 total students
- Ridgewood High School** - 2 annual events, engaging 325 total students
- SMC Business Councils** - 2 annual events, engaging 224 total students
- Triton Girls Summer Camp** - 2 annual events engaging 80 total students
- Triton College** - 2 annual events, engaging 52 total students
- University of Minnesota** - 5 annual events, engaging 352 total students
- Valley View Junior High School** - 3 annual events, engaging 324 total students
- Wojanis Supply Company** - 10 annual events, engaging 911 total students

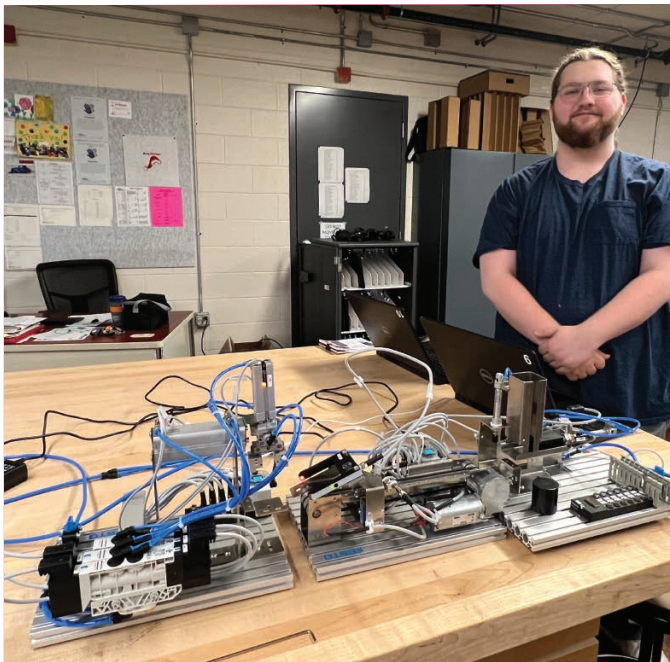
In total, our Fluid Power Action Challenge Champions have organized **150 events** impacting **13,969 students**.

Fast Track High Schools

Students Are Learning About Fluid Power



As each Fast Track to Fluid Power program comes online in communities around the country, the NFPA Foundation provides grants to local high schools so they can purchase fluid power training platforms or participate in professional development training so that they can more effectively teach the fluid power curriculum associated with their chosen training platform, or purchase other materials they may need to offer targeted fluid power education to their students.



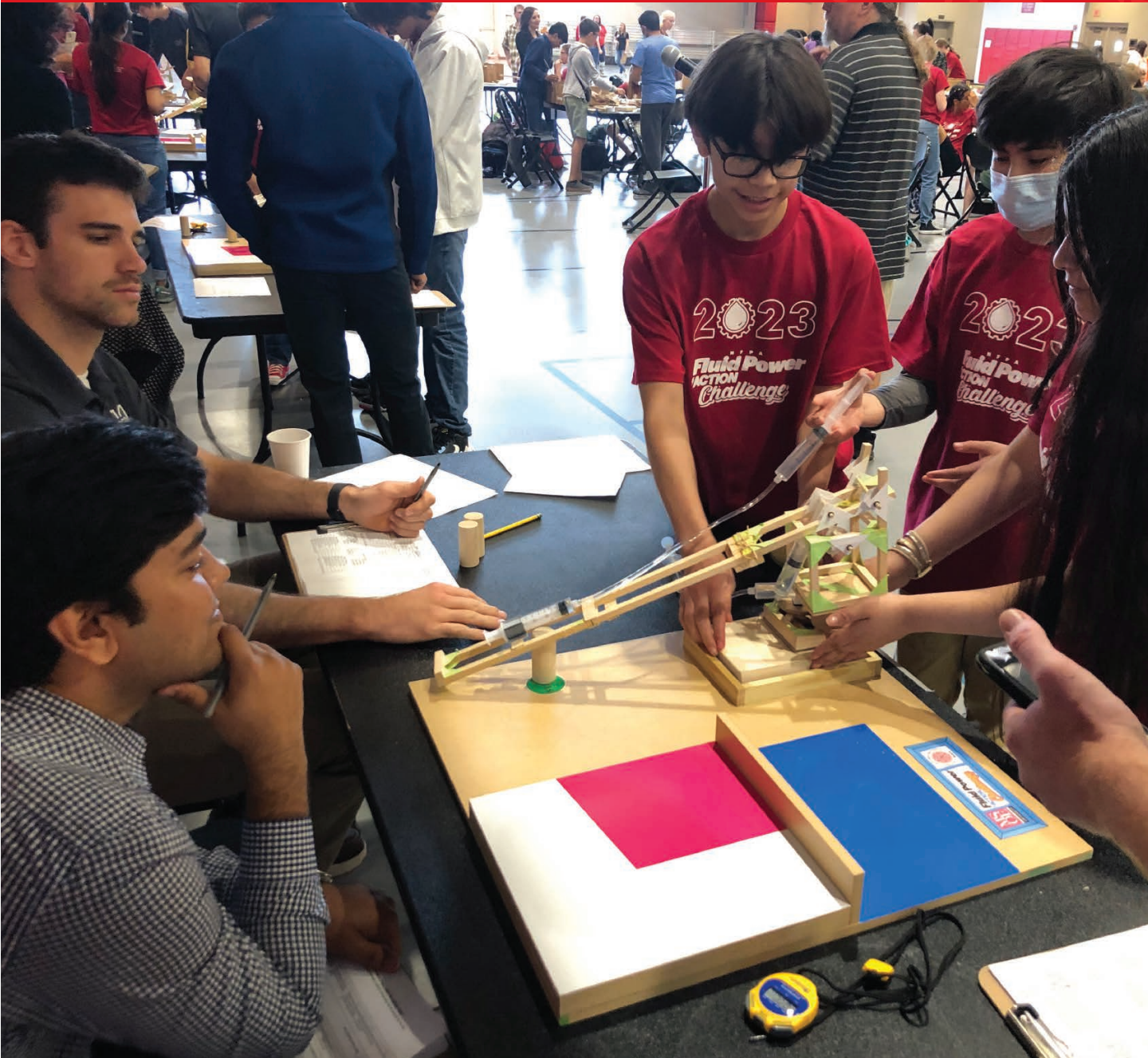
In addition, NFPA members of our industry donor coalition help to support these activities and the growth of future Fast Track networks, by offering mentorship and information on careers in fluid power.

As a result, these high school students have expressed interest in continuing their fluid power education at the Fast Track Technical Colleges following their high school graduation. This is confirmation that the Fast Track pathway is working, leading students into fluid power careers.

Fluid Power Action Challenge Grants

The NFPA Foundation awards middle and high schools grants to facilitate hydraulics and pneumatics curriculum and programming. Grant awards defray the costs related to the educational aspects of the Fluid Power Action Challenge Program—either for the fluid power kits for classroom use or participation in the Fluid Power Action Challenge event.

In total, 266 schools have used Fluid Power Challenge materials in their curricula, exposing 16,448 students to fluid power.



NFPA Scholarships

72 Scholarships Awarded to Further Fluid Power Education

\$2,000 scholarships are offered to graduating high school students, and students currently enrolled at technical schools, community colleges, and universities in order to pursue fluid power degrees or certificates.

Thanks to a transfer of assets from the now-defunct Fluid Power Educational Foundation, and an on-going series of annual gifts from the International Fluid Power Society, the NFPA Foundation has set-up a dedicated scholarship fund that has already awarded 72 \$2,000 scholarships to students interested in studying fluid power at one of our education partner institutions.

2022-23 Fluid Power Scholarship Awardees:

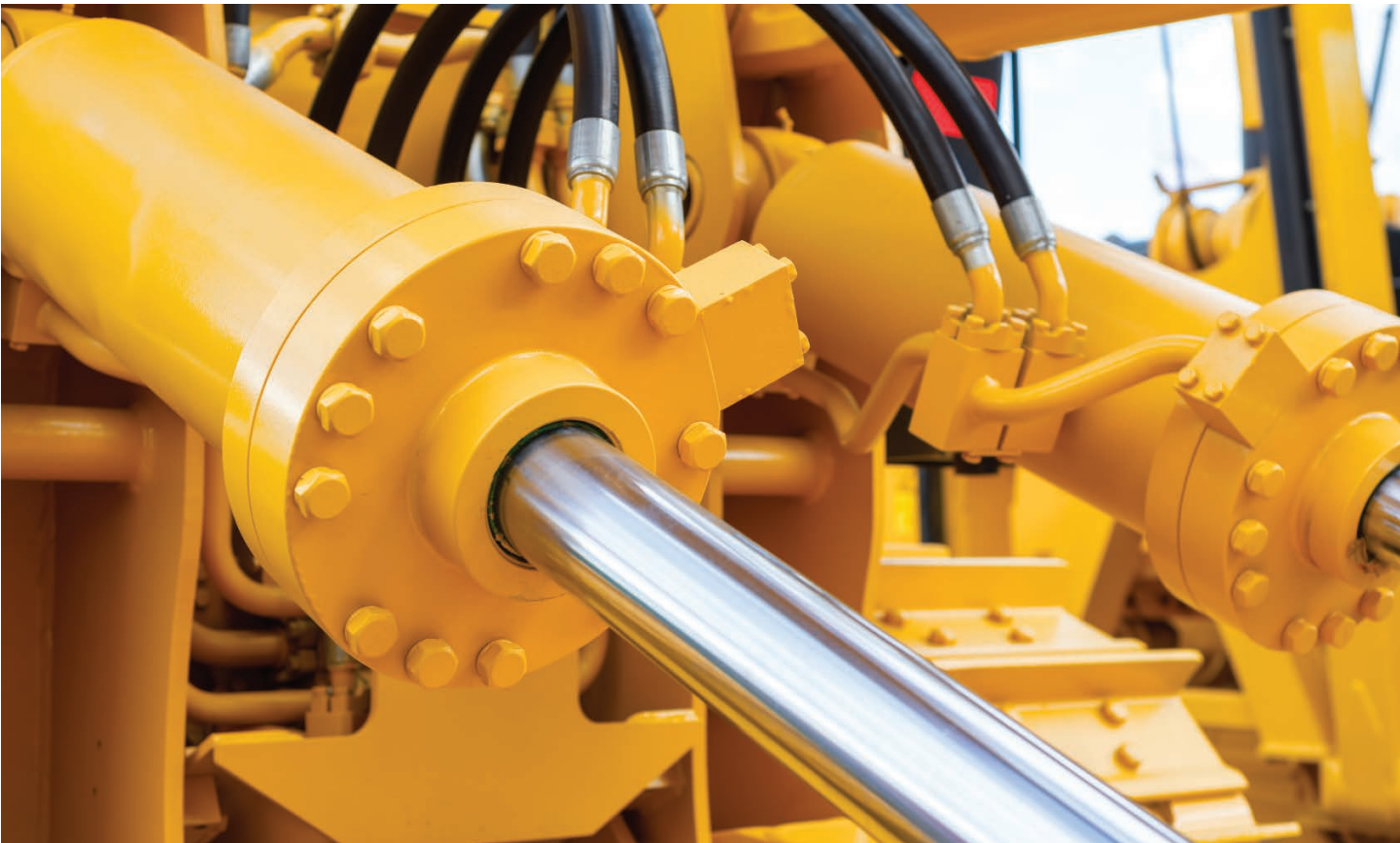
- **Albert Ly**, Triton College
- **Austin Nolley**, Iowa State University
- **Ben Quade**, Iowa State University
- **Brendan McCluskey**, Georgia Institute of Technology (Raymond F. Hanley Memorial Award)
- **Dmitriy Rybalko**, Hennepin Technical College
- **Hugo Garcia**, Moraine Valley Community College
- **Jose Solorio**, Purdue University
- **Michael Glochowsky**, Triton College
- **Nathan Linke**, South Dakota State University

- **Nicholas Zambrano**, University of Southern California
- **Paton Desha**, Chattanooga State TCAT
- **Paul Schlotman**, South Dakota State University
- **Ryan Collins**, Spokane Community College
- **Spencer Burke**, University of Texas at Austin (Robert Mackey Memorial Award)
- **Tatiana Timmons**, Murray State University
- **Thomas Lahr**, Hennepin Technical College
- **Wyatt Morlan**, Spokane Community College
- **Zoe Kulphongpatana**, University of Kansas

Student Testimonial:

“It is an honor to be recognized by the NFPA for my academic achievements. Being selected to receive this scholarship confirms to me that I’ve been chosen for the right career path. This award will enable me to focus better on my studies as I prepare to enter my final year of education. My motivation to succeed in the fluid power industry has gone even higher, and I intend to prove the NFPA made the right choice when they selected me.” – Nathan Maki

Industry partners serve on the scholarship review committee that makes funding decisions.



NFPA Fluid Power Robotics Challenge

The Fluid Power Robotics Challenge aims to bring an awareness of fluid power options in robotics to high school students and stimulate increased use of fluid power products in the FIRST, NRL, and VEX competitions. Each year, one student that uses fluid power in their robot design receives a \$30,000 scholarship – up to \$7,500 a year for up to 4 years of college. The program is increasing the use of fluid power by these students, with FIRST Robotics now reporting that 47 percent of their teams use fluid power. In our seventh year, we received 47 applications for this scholarship.

Robotics Challenge Scholarship winners include:

Colton Seitz, our 2022 recipient, is using his scholarship to pursue a degree in Mechanical Engineering at the University of Alabama. This year he made the Dean’s List, and spends his extracurricular time with the rock climbing club and the Bama IP Commercialization Academy.

Caleb Qiu, our 2021 recipient, is using his scholarship to double major in Biomedical Engineering and Computer Science Engineering at the University of Michigan. He enjoys the research he has been able to do on campus relating to biomedical and mechanical engineering and works as a teaching assistant for the math department.

Matthew Morley, our 2020 recipient, is using his scholarship to pursue a degree in mechanical engineering at Northeastern

University in Boston, Massachusetts. He will be an intern doing robotics research in Pasadena, CA this summer. He is also actively involved in Northeastern’s Aeronautics Club building robots. Matthew attended the 2023 Annual Conference and impressed members with his questions and interest in fluid power.

Noah Santoni, our 2019 recipient, graduated from Case Western Reserve University and is employed as a mechanical engineer in the San Francisco area.

Jacob Barnes, our 2018 recipient, is using his scholarship to study electrical engineering at Cal Poly in San Luis Obispo. He is looking forward to graduating later in 2023.

Spencer Tiegs, our 2017 recipient, graduated from the Milwaukee School of Engineering and is employed as a design engineer in the greater Milwaukee area.

Fast Track Technical Colleges

Connecting Tech School Grads to Fluid Power

Fast Track Technical Colleges are schools with a 2-year degree program validated to teach core fluid power competencies. As determined by NFPA's industry members and NFPA Foundation donors, those core competencies are:

General Fluid Power

1. Read circuit diagrams and understand function of components in fluid power systems
2. Determine and perform calculations to move loads in fluid power systems (e.g., torque, speed, power)
3. Specify and size components for fluid power systems (e.g., pumps, valves, cylinders, hoses, filters, reservoirs, accumulators)
4. Analyze and troubleshoot problems with fluid power systems
5. Program and connect electronic controls for fluid power systems
6. Promote safe working conditions with pressurized systems

General Electrical/Electronics

1. Understand electrical schematics
2. Understand electrical signals come in different form factors
3. Understand basic electrical components (Resistors, capacitors, etc.)
4. Be able to setup and run test equipment (oscilloscopes, digital multi-meters, function generators, power supplies, data acquisition, etc.)
5. Possess IPC-rated soldering skills
6. Be able to design, document, and build test harnesses
7. Be able to troubleshoot issues
8. Be able to write test reports
9. Be able to read industry standards and execute tests to ensure product meets them

Control Systems

1. Understand how electronics and controls are integrated into fluid power systems, and the related benefits
2. Possess basic understanding of C programming language
3. Be able to diagnose vehicle wiring issues relevant to the controls
4. Understand popular communication protocols (i.e., Ethernet, Wifi, CAN, Bluetooth, USB)
5. Experienced in OPCUA protocol for industrial PLCs to communicate
6. Be able to translate electrical signals into usable CAN parameters

Data Acquisition

1. Understand high level vehicle system architecture diagrams to determine where data will come from
2. Be able to translate data collected into meaningful information that users can use to solve problems
3. Have knowledge of data storage architectures and when to use them (i.e., RAM, Flash, Databases)
4. Understand benefits of how data collection, data storage and data presentation can improve vehicle safety, vehicle performance, operator performance and cost of ownership
5. Know how to size data collected into compact data schemas

There are three Fast Track Technical Colleges up and running – one in Milwaukee, WI headquartered at Waukesha County Technical College, one in Chicago, IL at Triton College, and now one in Warren, MI at Macomb Community College. In the 2022-23 school year, the fluid power degree programs at these schools provided advanced-level training to 610 students.

Those students were supported by the coalition of industry partners, who actively engage to provide guidance and feedback to instructors, and also internship and employment opportunities via the Workforce Engagement Groups. In the 2022-23 school year, 32 NFPA members have participated in these groups.



Teaching and Laboratory Grants

Many more 2-year technical colleges are teaching fluid power to their student bodies as a result of our Teaching and Laboratory Grant programs. These grants provide schools with the teaching materials and state-of-the-art teaching laboratories that are needed to embed fluid power into their training curriculum. To date, 8 schools have received Teaching Grants and 9 schools have received Laboratory Grants. As a result of these investments, students at the following schools have more access to fluid power curriculum and hands-on learning.

TEACHING GRANTS

- Central Community College - Grand Island, NE
- Cleveland Community College - Shelby, NC
- Hennepin Technical College - Eden Prairie, MN
- Ivy Tech Community College - Columbus, IN
- Kaskaskia College - Centralia, IL
- Texas State Technical College - Waco, TX
- Triton College - River Grove, IL
- Vernon College - Vernon, TX

LABORATORY GRANTS

- Angelina College - Lufkin, TX
- Central Community College - Grand Island, NE
- Cleveland Community College - Shelby, NC
- Eastern Iowa Community College - Davenport, IA
- Hennepin Technical College - Eden Prairie, MN
- Macomb Community College - Warren, MI
- Marshalltown Community College - Marshalltown, IA
- South Central College - North Mankato, MN
- Triton College - River Grove, IL



Your Gifts at Work

Creating More Educated Fluid Power Engineers

To create more fluid power-educated university engineers, the NFPA and the NFPA Foundation conduct a number of research and education programs, designed to better engage academic faculty in the teaching of fluid power.

Truth be told, there are plenty of engineering students in our nation’s universities. The problem is not getting more kids to study engineering in college, the problem is teaching those kids fluid power when they’re in college.

NFPA’s focus is increasingly on helping academic faculty build more fluid power education into their undergraduate engineering courses. Many of our programs are organized under our Power Partner Universities initiative, which helps connect undergraduate students with fluid power instruction, applied technology opportunities, and industry partners offering rewarding careers.

Research and Education Programs Creating Educated Fluid Power Engineers

Research Supplements

Provide funds to academic faculty with fluid power research grants to facilitate their presentation at and the participation of their graduate students in designated industry conferences and research summits. This helps build the careers of faculty who are and will be in a position to teach fluid power to undergraduate students.

Power Partner Universities

Showcases universities that actively participate in all NFPA fluid power university educational programs. In order to qualify, a university must consistently conduct five major activities:

- **Core Competencies**
Teach the fluid power competencies that our industry members have identified as most important for entry-level engineers in the fluid power industry.
- **Speaker’s Bureau**
Invite an NFPA member to speak, virtually or in-person, on fluid power careers or technology on their campus.
- **Fluid Power Vehicle Challenge**
Design and build a human-powered vehicle that incorporates fluid power. The project easily embeds in the capstone design course of participating universities, teaches hands-on fluid power and connects students to jobs in the fluid power industry.

- **Fluid Power Clubs**
Engage undergraduate engineering students in fluid power education and careers. They organize fluid power study groups and social events, launch student job fairs and resume building workshops, and invite industry professionals to speak with them about career opportunities in fluid power.
- **Industry Connection Events**
Host an event on their campus to introduce fluid power-educated students to companies in the NFPA membership.

This year, NFPA welcomed two new Power Partner universities: Northern Illinois University and Murray State University. They join Purdue University, Milwaukee School of Engineering, and Iowa State University as examples of what high quality fluid power programs look like. When a university is designated as a Power Partner, we continually promote their programs to NFPA members and help support targeted, fluid power specific recruitment events.



Research Supplements

Connecting Academic Faculty to Fluid Power Education

Research Supplements provide funds to academic faculty with fluid power research grants to facilitate their presentation at and the participation of their graduate students in designated industry conferences and research summits. In doing so, the program helps achieve two goals:

- Support an industry/academic forum where research and education topics in fluid power can be explored and acted on for mutual benefit.
- Support the careers of current and future academic faculty who are and who will be in a position to teach fluid power to undergraduate engineering students.

A total of 48 Research Supplements have been awarded. In our 2022-23 fiscal year, we awarded six Research Supplements to the following university faculty members:

IOWA STATE UNIVERSITY

- **Brian Steward** - Off-Highway Vehicle Chassis Dynamometer

MILWAUKEE SCHOOL OF ENGINEERING

- **Paul Michael** - An investigation of varnish formation and removal in a high-pressure piston pump

PURDUE UNIVERSITY

- **Jose Garcia Bravo** - Mixed Reality for Fluid Power Education
- **Farid Breidi** - Simulation and Design of Externally Actuated Digital Pumps

UNIVERSITY OF MINNESOTA

- **Perry Li** - Fully Electric Powered Hydraulic Assisted, Compact Track Loader
- **Zongxuan Sun** - Optimization and Evaluation of Energy Savings for Connected and Autonomous Off-Road Vehicles

These research projects independently represent more than \$3.9 million in funding from a variety of organizations, including the U.S. Department of Energy, the National Science Foundation, the National Institute of Health, and the Center for Compact and Efficient Fluid Power (CCEFP). They are an excellent sample of the growing body of fluid power research being funded by the federal government and other research organizations. The research supplements from the NFPA Foundation offset the cost of travel, allowing each faculty member and one or more of their graduate students to attend and present their research at the CCEFP Summit in Spring 2023.

Research Grants

In addition to our Research Supplements, the NFPA Foundation has also funded individual pre-competitive research projects designed to connect graduate students to the study of fluid power and expand the capabilities of their host institutions to research and teach fluid power.

To date, 7 universities have received 14 of these research grants.

IOWA STATE UNIVERSITY

- Dielectric Spectroscopic Sensor Development for Hydraulic Fluid Contaminant Detection
- An Investigation of Dielectric Spectroscopic Contamination Sensing in a Compressed Air Stream

MARQUETTE UNIVERSITY

- Efficient, Integrated, Freeform Flexible Hydraulic Actuators

MILWAUKEE SCHOOL OF ENGINEERING

- Simulation, Rheology, and Efficiency of Polymer Enhanced Fluids (joint project with the University of California at Merced)

PURDUE UNIVERSITY

- Design, Simulation and Control of Hydraulic System Topographies with Integrated Energy Recovery
- Control and Prognostic of Electro-Hydraulic Machines
- Four-Quadrant Multi-Fluid Pump/Motor
- Investigation of Noise Transmission through Pump Casing

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

- Portable Pneumatically Powered Orthoses

UNIVERSITY OF MINNESOTA

- Free Piston Engine Based Off-Road Vehicles
- Hybrid MEMS Proportional Fluid Control Valve
- Variable AC Hydraulic Pump/Motor (joint project with Vanderbilt University)

VANDERBILT UNIVERSITY

- Pneumatic Exhaust Gas Recovery
- Controlled Stirling Power Unit

Through these research projects, the NFPA Foundation is engaging current and helping to build the careers of future academic faculty who will be in a position to teach fluid power to thousands of undergraduate engineers on their campuses.

Core Competencies

Defining and Delivering Cutting Edge Fluid Power Education

Power Partner Universities are schools with a 4-year degree program validated to teach core fluid power competencies. As determined by NFPA's industry members and NFPA Foundation donors, those core competencies are:

General Fluid Power

1. Understand fluid power benefits and limitations
2. Conceptual and theoretical understanding of fluid power laws and principles (including energy transfer and power efficiency)
3. Understand fluid power components and circuits
4. Understand the impact of fluid properties, i.e., fluid viscosity, on fluid power system efficiency and performance.
5. Understand machine level requirements and translate into fluid power system requirements
6. Apply design, simulation and analysis tools to fluid power components and systems
7. Appropriately size components in fluid power systems
8. Integrate sensing and electronic control functions with fluid power components and systems
9. Cite hands-on experience with fluid power components and systems
10. Inspect, analyze and develop corrective action for product failure

General Electrical/Electronics

1. Understand electrical schematics
2. Understand electrical signals come in different form factors
3. Understand basic electrical components (Resistors, capacitors, etc.)
4. Be able to setup and run test equipment (oscilloscopes, digital multi-meters, function generators, power supplies, data acquisition, etc.)
5. Possess IPC-rated soldering skills
6. Be able to design, document, and build test harnesses
7. Be able to troubleshoot issues
8. Be able to write test reports
9. Be able to read industry standards and execute tests to ensure product meets them

Control Systems

1. Understand how electronics and controls are integrated into fluid power systems, and the related benefits
2. Possess basic understanding of C programming language
3. Be able to diagnose vehicle wiring issues relevant to the controls

4. Understand popular communication protocols (i.e., Ethernet, Wifi, CAN, Bluetooth, USB)
5. Experienced in OPCUA protocol for industrial PLCs to communicate
6. Be able to translate electrical signals into usable CAN parameters

Data Acquisition

1. Understand high level vehicle system architecture diagrams to determine where data will come from
2. Be able to translate data collected into meaningful information that users can use to solve problems
3. Have knowledge of data storage architectures and when to use them (i.e., RAM, Flash, Databases)
4. Understand benefits of how data collection, data storage and data presentation can improve vehicle safety, vehicle performance, operator performance and cost of ownership
5. Know how to size data collected into compact data schemas

There are 5 Power Partner Universities up and running – Iowa State University, the Milwaukee School of Engineering, Murray State University, Northern Illinois University, and Purdue University and they provide advanced-level training to students.



University Fluid Power, Teaching, Laboratory and Curriculum Grants

Many more 4-year universities are teaching fluid power to their student bodies as a result of our multiple grant programs. These grants provide schools with the teaching materials and state-of-the-art teaching laboratories that are needed to embed fluid power into their undergraduate curriculum. To date, 8 schools have received Fluid Power University Grants, 16 schools have received teaching grants, 2 schools have received laboratory grants, and 4 schools have received curriculum grants.

UNIVERSITY FLUID POWER GRANTS

- Ohio University - Athens, OH
- South Dakota State University - Brookings, SD
- Michigan Technological University - Houghton, MI
- Murray State University - Murray, KY
- Purdue University Northwest - Hammond, IN
- University of Kentucky - Lexington, KY
- Milwaukee School of Engineering - Milwaukee, WI
- Purdue University - West Lafayette, IN

TEACHING GRANTS

- Georgia Institute of Technology - Atlanta, GA
- Illinois Institute of Technology - Chicago, IL
- Iowa State University - Ames, IA
- Lawrence Technological University - Southfield, MI
- Marquette University - Milwaukee, WI
- Massachusetts Institute of Technology - Cambridge, MA
- Milwaukee School of Engineering - Milwaukee, WI
- Montana State University - Bozeman, MT
- Purdue University - West Lafayette, IN
- Rochester Institute of Technology - Rochester, NY
- University of Illinois at Chicago - Chicago, IL
- University of Illinois at Urbana-Champaign - Urbana-Champaign, IL
- University of Minnesota - Minneapolis, MN
- Western Michigan University - Kalamazoo, MI
- Western New England University - Springfield, MA
- Worcester Polytechnic Institute - Worcester, MA

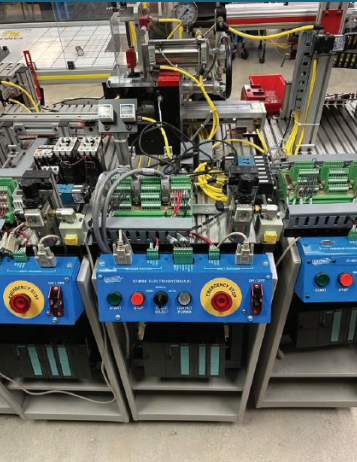
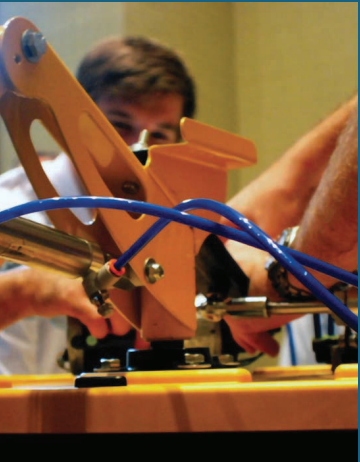
LABORATORY GRANTS

- Milwaukee School of Engineering - Milwaukee, WI
- Western Michigan University - Kalamazoo, MI

CURRICULUM GRANTS

- Lawrence Technological University - Southfield, MI
- Ohio University - Athens, OH
- University of Missouri - Columbia, MO
- Western Michigan University - Kalamazoo, MI

Each grant creates curriculum that facilitates the teaching of fluid power to dozens or hundreds of students on each campus.



Speakers Bureau

Bringing Real-World Experience to the Classroom

The Speaker's Bureau program brings industry professionals to university, technical college, and high school classrooms to help build student awareness of opportunities in the fluid power industry and to foster connections with schools around the country. Instructors tell us that visits from fluid power professionals help students see the real-world applications of the material they are learning in the classroom. What's more, it is an excellent way for companies to increase their name-recognition among potential employees. In the 2022-2023 academic year, 14 companies have spoken to classes at 9 universities.



Fluid Power Vehicle Challenge

23 University Teams Participate in 2022-23



The Fluid Power Vehicle Challenge is a unique engineering design/build competition that embeds in the capstone design course at participating universities. It strives to promote original thinking in a competitive setting by combining two technology platforms that are not normally associated with one another— human - powered vehicles and fluid power.

The first, as exemplified by the bicycle, is recognized as extremely efficient in terms of input vs. output. The second presents more of a challenge in terms of efficiency, especially at low speeds. A fluid powered vehicle, then, presents undergraduate engineers with a familiar yet challenging platform for change. By combining this unlikely pair, the Vehicle Challenge creates an environment that results in uncommon connections and breakthroughs, while supporting learning and the growth of fluid power industry knowledge.

Student teams from 23 universities participated in the seventh year of the NFPA Vehicle Challenge:

- **Arizona State University** - Phoenix, AZ
- **California Polytechnic State University** - San Luis Obispo, CA
- **Cleveland State University** - Cleveland, OH
- **Iowa State University** - Ames, IA
- **Kennesaw State University** - Kennesaw, GA
- **Loyola Marymount University** - Los Angeles, CA
- **Michigan Technological University** - Houghton, MI
- **Milwaukee School of Engineering** - Milwaukee, WI
- **Murray State University** - Murray, KY
- **Northern Illinois University** - DeKalb, IL
- **North Carolina A&T** - Greensboro, NC
- **Ohio University** - Athens, OH
- **Purdue University** - West Lafayette, IN
- **Purdue University Northwest** - Hammond, IN
- **South Dakota State University** - Brookings, SD
- **Texas A&M** - College Station, TX
- **University of Alabama at Birmingham** - Birmingham, AL
- **University of Akron** - Akron, OH
- **University of Cincinnati** - Cincinnati, OH
- **University of Louisiana at Lafayette** - Lafayette, LA
- **University of Utah** - Salt Lake City, UT
- **West Virginia University Institute of Technology** - Beckley, WV
- **Western Michigan University** - Kalamazoo, MI

This year’s program expanded to include a fourth race – the Regen Race – to demonstrate the potential of stored energy and the regenerative braking capabilities of the fluid power system design. Texas A&M and the University of Louisiana at Lafayette took Overall Champion in the events hosted by NORGREN and Danfoss Power Solutions.

This year’s events also highlighted the use of pneumatics and electronics in addition to the traditional hydraulic systems in teams’ designs. The prize for Best Use of Pneumatics, sponsored by NORGREN, was taken home by Murray State University and California Polytechnic State University. The prize for Innovative Use of Electronics, sponsored by IFP Motion Solutions, Inc., was taken home by Purdue University Northwest and Texas A&M with teams from multiple other universities placing competitively in the program’s additional award categories.

Additional support for this year’s program was provided by:

Event Hosts	Founding Sponsor
Danfoss Power Solutions	Parker Hannifin Corporation
NORGREN	
Program Sponsors	Product Suppliers
HYDAC	Danfoss Power Solutions
IFP Motion Solutions, Inc.	Lubrizol
NORGREN	Source Fluid Power
SunSource	VEST, Inc.

Many student participants admitted that the Vehicle Challenge was their only exposure to fluid power in their four-year engineering curriculum, greatly underscoring the need for this program. This year, the Vehicle Challenge again achieved all four of its key objectives:

- Stimulate education in practical hydraulics, pneumatics, and sustainable energy devices for motion control.
- Provide students with experience in real world engineering under a strict timeline of designing, simulating, ordering, building, testing and demonstrating their designs.
- Stimulate innovative thinking for designing and testing potential new technologies or concepts integrated into a vehicle platform.
- Provide an industry recruitment opportunity for high potential engineering seniors by engaging directly with practitioners in the field.



Fluid Power Clubs

Connecting Students to Fluid Power Careers

In 2019, NFPA launched a Fluid Power Club program on university campuses to expose fluid power to a greater number of students to fluid power education and career possibilities. This year, twenty universities have established clubs impacting 170 engineering students across the country. NFPA provides annual funding to support these clubs. Students have been organizing fluid power study groups and social events, launching student job fairs and resume building workshops, collaboration with Vehicle Challenge students and inviting industry professionals to speak with them about career opportunities in fluid power.

FLUID POWER CLUB UNIVERSITIES:

- **Cleveland State University** - Cleveland, OH
- **Iowa State University** - Ames, IA
- **Kennesaw State University** - Kennesaw, GA
- **Loyola Marymount University** - Los Angeles, CA
- **Michigan Technological University** - Houghton, MI
- **Milwaukee School of Engineering** - Milwaukee, WI
- **Murray State University** – Murray, KY
- **North Carolina Agricultural and Technical State University** - Greensboro, NC
- **Northern Illinois University at Rock Valley College** - DeKalb, IL
- **Ohio University** - Athens, OH
- **Purdue University** - West Lafayette, IN
- **Purdue University Northwest** - Hammond, IN
- **South Dakota State University** - Brookings, SD
- **Texas A&M University** - College Station, TX
- **University of Alabama at Birmingham** - Birmingham, AL
- **University of Cincinnati** - Cincinnati, OH
- **University of Louisiana at Lafayette** - Lafayette, LA
- **University of Utah** - Salt Lake City, UT
- **West Virginia University Tech** - Beckley, WV
- **Western Michigan University** - Kalamazoo, MI

Fluid Power Vehicle Challenge Community

The Fluid Power Vehicle Challenge Community is the volunteer structure tasked with mentoring, coaching, and judging the student teams participating in the Vehicle Challenge. Its membership includes major donors to the NFPA Foundation, including those members who are a part of the Pascal Society.

As a result of these interactions, several Vehicle Challenge students have been hired by companies in our industry network, greatly enhancing the value of the program to industry participants.

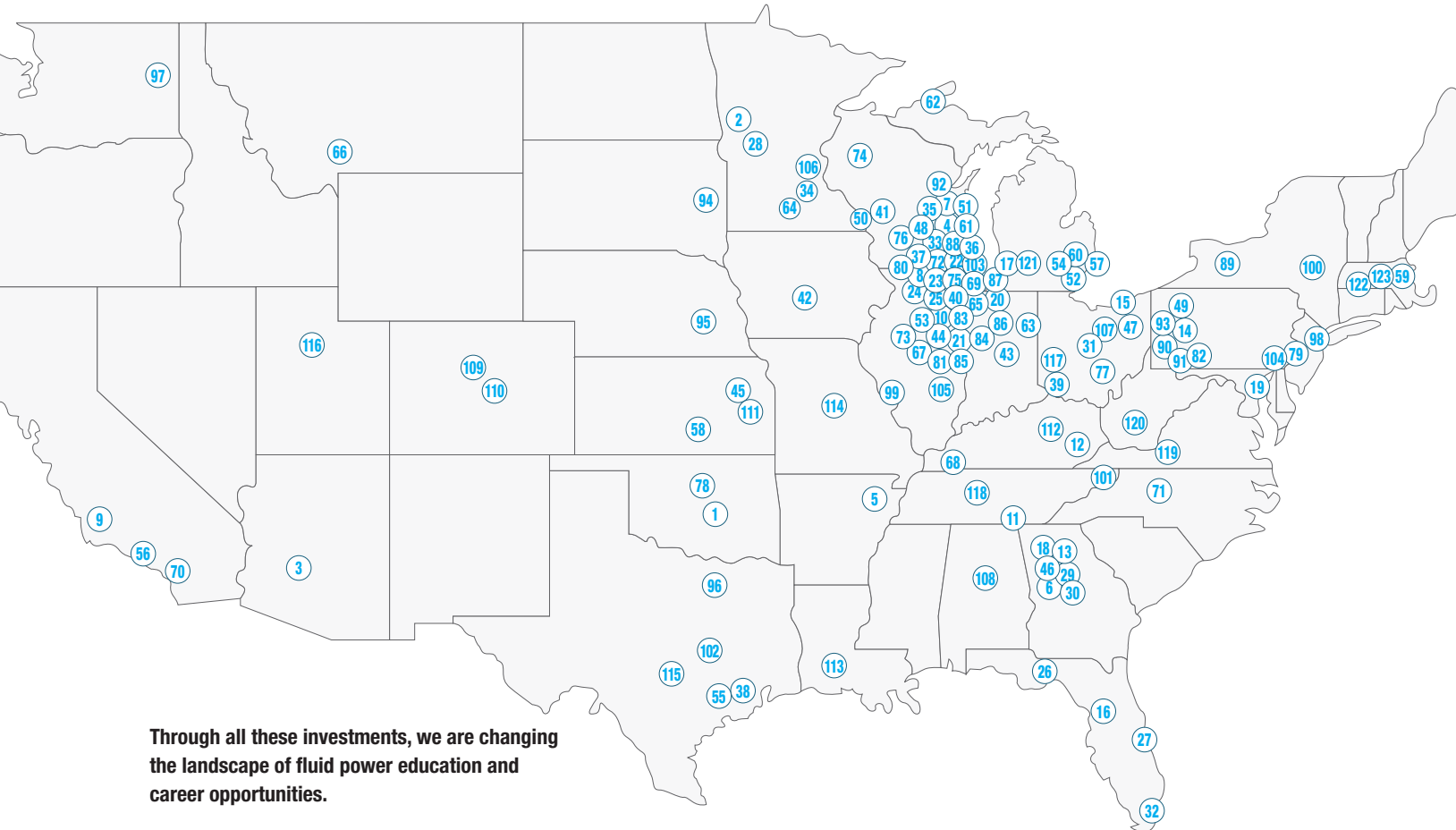
Twenty-six companies participated in the community’s year-long mentoring program, networked with students, provided components or dedicated representatives to act as competition judges during the final event:

- Applied Industrial Technologies
 - ARGO-HYTOS
 - Bucher Hydraulics
- Casappa Corp.
 - Danfoss Power Solutions
 - Deltrol Fluid Products
 - ETS Hydraulics
 - GPM Controls
 - HYDAC
 - HydraForce
 - Hydraulic Controls
 - IFP Motion Solutions, Inc.
 - JARP
 - Kraft Fluid Systems
 - Lubrizol
- Moseys Production Machinists
 - Motion Industries
 - NORGREN
 - Nott Company
 - Parker Hannifin Corporation
 - QCC
 - ROSS Controls
 - Source Fluid Power
 - Sun Hydraulics
 - SunSource
 - Trelleborg Sealing Solutions
 - VEST, Inc.



Impact Map

The NFPA and the NFPA Foundation has had a tremendous impact on students and schools in communities around the country.



Through all these investments, we are changing the landscape of fluid power education and career opportunities.

KEY: ▲ Action Challenge Events or Grants | ● Fast Track Colleges and High Schools | ◆ Schools Educating Fluid Power Scholarship Recipients
★ Schools Receiving Fluid Power Research or Education Grants | ■ Schools with Fluid Power Clubs or Vehicle Challenge Teams

- 1

The Academy of Seminole ▲
- 2

Ashby Public Middle School ▲
- 3

Arizona State University ■
- 4

Arrowhead Union High School ●
- 4

Price Engineering ▲
- 5

Arkansas State University ◆
- 6

Bennett Mills Middle School ▲
- 7

Brookfield Central High School ●
- 8

Bucher Hydraulics ▲
- 9

California Polytechnic State University ◆■
- 10

Caterpillar ▲
- 11

Chattanooga State TCAT ◆
- 12

The Challenger Learning Center ▲
- 13

CircuitRunners Robotics ▲
- 14

Clarion Area School District M.S. & H.S. ▲
- 15

Cleveland Community College ▲
- 15

Cleveland State University ■
- 16

College of Central Florida ◆
- 17

Coloma Community Schools ▲
- 18

Cooper Middle School ▲
- 19

Crofton High School ▲
- 20

Daman Products Company ▲
- 21

Deltrol Fluid Products ▲
- 22

Deltrol / SD54 ▲
- 23

Dundee Middle School ▲
- 24

Dura-Bar ▲
- 24

Woodstock Community School District ▲
- 25

Eisenhower Junior High ▲
- 26

Florida A&M University ◆
- 27

Florida Technology Student Association ▲
- 28

FORCE America ▲
- 29

Georgia Institute of Technology ◆★
- 30

Georgia Tech University ▲
- 31

Gilead Christian School ▲
- 32

Gulliver ▲
- 33

Hamilton High School ●
- 34

Hennepin Technical College ◆
- 35

Homeschool Nashotah ▲
- 36

Humboldt Park School ▲
- 36

Marquette University ★
- 36

Milwaukee College Prep ▲
- 36

MSOE ▲★■
- 36

South Milwaukee High School ▲
- 36

University of Wisconsin Milwaukee ◆
- 37

Horning Middle School ▲
- 37

Husco and Waukesha STEM Academy ▲
- 37

Waukesha County Technical College ●
- 37

Whitman Middle School Wauwatosa ▲
- 38

Hydroquip ▲
- 39

Hydrotech ▲
- 39

University of Cincinnati ■
- 40

Illinois Institute of Technology ★
- 40

Triton College ▲
- 40

STEM Learning Center ▲
- 40

Triton Girls Summer Camp ▲
- 40

University of Illinois at Chicago ★
- 40

Ridgewood High School ●
- 41

Innovations STEM Academy ▲
- 42

Iowa State ◆★■
- 43

Ivy Tech Community College ◆

44

Jerling Middle School ▲

45

Johnson County Community College ◆

46

Kennesaw State University ■

47

Kent State University ◆

48

Kettle Moraine High School ●

49

Komatsu Mining Corp Group ▲

50

La Crescent High School ▲

51

Lake Shore Middle School ▲

51

Mequon School District ▲

52

Lawrence Technological University ★

53

Leyden East High School ●

54

Livingston Christian Schools ▲

55

LoneStar Community College ▲

56

Loyola Marymount University ■

56

University of Southern California ◆

57

Macomb Community College ●

58

Maize Career Academy ▲

59

Massachusetts Institute of Technology ◆★

60

Master Pneumatic ▲

61

Menomonee Falls High School ●

62

Michigan Technological University ★■

63

Micromatic ▲

64

Minnesota State ◆

65

Mitchell Middle School ▲

65

Union Grove High School ▲

66

Montana State University ★

67

Moaine Valley Community College ◆

68

Murray State University ◆★■

69

New Berlin Eisenhower ▲●

69

New Berlin West High School ●

70

Norco College ◆

71

North Carolina Agricultural and Technical State University ■

72

North Shore Middle School ▲

73

Northern Illinois University ■

74

Northern Lakes Regional Academy ▲

75

Oak Prairie Middle School ▲

76

Oconomowoc High School ●

76

Stone Bank School ▲

77

Ohio University ◆★■

78

Oklahoma State University ◆

79

Orchard Friends School ▲

80

Palmyra Eagle Area M.S. & H.S. ▲●

81

Parker Hannifin ▲

82

Pennsylvania Small Business Education Fund ▲

83

Proviso East High School ●

84

Proviso Mathematics and Science Academy ●

85

Proviso West High School ●

86

Purdue University ▲◆★■

87

Purdue University Northwest ◆★■

88

Richmond School ▲

89

Rochester Institute of Technology ★

90

Brentwood Middle School ▲

90

Rosedale Technical College ◆

91

Wojanis Supply Company ▲

92

Sheboygan Central High School ▲

93

SMC Business Councils ▲

94

South Dakota State University ◆★■

95

Southeast Community College ◆

96

Southern Methodist University ◆

97

Spokane Community College ◆

98

Stevens Institute of Technology ◆

99

St. Francis/Holy Ghost Catholic M.S. ▲

100

SUNY Cobleskill ◆

101

Tennessee State University ■

102

Texas A&M University ◆★■

103

Union Ridge Elementary ▲

104

Unionville High School ▲

105

University of Illinois at Urbana ★

106

University of Minnesota ▲◆★

107

University of Akron ■

108

University of Alabama at Birmingham ■

109

University of Colorado Boulder ◆

110

University of Denver ◆■

111

University of Kansas ◆

112

University of Kentucky ★

113

University of Louisiana at Lafayette ■

114

University of Missouri ◆★

115

University of Texas at Austin ◆

116

University of Utah ■

117

Valley View Junior High School ▲

117

Valley View High School ▲

118

Vanderbilt ★

119

Virginia Tech ◆

120

West Virginia University Institute of Technology ▲■

121

Western Michigan University ★■

122

Western New England University ★

123

Worcester Polytechnic Institute ★

Industry Connection Events

The Final Step for Power Partners

Once a university has demonstrated that it teaches the core fluid power competencies, participates in the Fluid Power Vehicle Challenge, has an active Fluid Power Club, and invites industry speakers to campus, there is only one more step to becoming a Power Partner University: hosting an Industry Connection event. Industry Connection events bring member companies to Power Partner universities, virtually or in person, for exclusive networking and recruitment opportunities with students in fluid power degree programs such as Mechanical Engineering, Electrical Engineering, Computer Science and Agricultural Engineering, to name a few. This year, 20 companies have attended industry connection events at some of NFPA's Power Partner universities: Purdue University, the Milwaukee School of Engineering, Murray State University, and Northern Illinois University.



The Pascal Society

The Pascal Society is the NFPA Foundation’s annual giving society that has raised more than \$4.7 million for fluid power outreach, education, and research programs. Pascal Society funds support the full range of Foundation programs highlighted in this report.

To maintain membership in the Pascal Society, a donor must annually contribute an amount at least equal to 50% of their NFPA dues. Pascal Society donors combine their financial and volunteer contributions in one concerted effort, developing the resources, tools, and people needed to meet the future technology and workforce needs of the U.S. fluid power industry.

Pascal Society Donors as of **June 30, 2023**

Companies that have donated MORE THAN 50% of their NFPA dues

- Aladco, LLC
- Bosch Rexroth
- Danfoss Power Solutions
- Deltrol Fluid Products
- Fluidyne Fluid Power
- FORCE America
- Gates Corporation
- Husco
- Hydra-Power Systems
- Kawasaki Precision Machinery
- Linde Hydraulics Corporation
- Main Manufacturing Products
- Micromatic LLC
- Moseys Production Machinists
- Parker Hannifin Corporation
- Trelleborg Sealing Solutions
- Yates Industries

Companies that have donated 50% of their NFPA dues

- Alro Steel Corporation
- Applied Industrial Technologies
- ARGO-HYTOS
- B&B Management Labs
- Bucher Hydraulics
- Caterpillar
- Clippard Instrument Laboratory
- Comer Industries
- Delta Computer Systems
- Engineering Technology Services
- Evonik Oil Additives
- Festo
- Galland Henning Nopak
- GPM Controls LLC
- Helios Technologies
- HYDAC/Schroeder Industries
- Hydraforce
- IC-Fluid Power
- Ifm efector
- IFP Motion Solutions, Inc.
- International Fluid Power Society
- Industrial Hard Chrome
- JEM Technical Marketing Company
- KYB Americas
- MHA Zentgraf Corporation
- Moog, Inc.
- Muncie Power Products
- National Tube Supply Company
- NORGREN
- Nott Company
- OEM Controls
- Poclain Hydraulics
- QCC
- ROSS Controls
- SunSource



Legacy Builders

The NFPA Education and Technology Foundation extends gratitude to the many generous donors who share our mission of meeting the workforce development needs of the U.S. fluid power industry.

The following organizations have achieved Legacy Builder status—cumulative giving of \$25,000 or more—as of our last recognition year, ending **April 30, 2023**.

CLASS OF 2023

- Alro Steel Corporation
- Applied Industrial Technologies
- Industrial Hard Chrome
- Micromatic LLC

CLASS OF 2022

- Hydraforce

CLASS OF 2020

- Daman Products Company
- Kawasaki Precision Machinery
- Muncie Power Products, Inc.
- NORGREN & Bimba
- SunSource

CLASS OF 2019

- Clippard Instrument Laboratory
- Festo
- Hitachi
- Iowa Fluid Power
- OEM Controls
- Trelleborg Sealing Solutions

CLASS OF 2018

- FORCE America
- Husco
- International Fluid Power Society
- QCC

CLASS OF 2017

- Linde Hydraulics
- Lubrizol
- Proportion Air
- Woodward

CLASS OF 2016

- Afton Chemical Corporation
- Bobcat Company
- Chevron
- Donaldson Company
- Evonik Oil Additives USA
- ExxonMobil
- HYDAC / Schroeder Industries
- Hydra-Power Systems
- Hydraquip
- Netshape Technologies
- Poclain Hydraulics

CLASS OF 2015

- CNH Industrial
- Pall Corporation
- Moog, Inc.

CLASS of 2014

- Danfoss Power Solutions
- Eaton
- Gates Corporation
- ROSS Controls

CLASS of 2013

- Bimba Manufacturing Company
- Bosch Rexroth
- Caterpillar
- Deltrol Fluid Products
- Parker Hannifin Corporation

CLASS of 2012

- Enfield Technologies

CLASS of 2010

- Sun Hydraulics

Thank You Donors

The NFPA Education and Technology Foundation extends gratitude to the many generous donors who share our mission of meeting the workforce development needs of the U.S. fluid power industry.



Included in this list of donors are those who have contributed to the Tom Wanke Legacy Fund. Thomas Wanke was a monumental figure in fluid power, active for more than 50 years and influencing generations of fluid power engineers through his work at the Milwaukee School of Engineering, its Fluid Power Institute, and with the National Fluid Power Association.

To honor his memory, and to help ensure that his positive impact on fluid power education continues to be felt, the NFPA Education and Technology Foundation has established the Thomas Wanke Legacy Fund.

Donations will support fluid power scholarships and education activities at universities throughout the United States.

The following individuals and organizations have made a donation in our last recognition year—between **May 1, 2022** and **April 30, 2023**.

COMPANIES

Aladco, LLC
Allied Hydraulic
Alro Steel Corporation
AMETEK APT
Applied Industrial Technologies
ArcelorMittal Tubular Products
ARGO-HYTOS Inc.
AW-Lake Company
B&B Management Labs
Bethann and John Duncan Donor Fund
Bosch Rexroth
Bucher Hydraulics
Cadenas PARTSolutions
Camozzi Pneumatics, Inc.
Casappa Corp.
Caterpillar Inc.
Certified Power/Hydrotech, Inc./Fluid System Components
Charter Dura-Bar, Inc.
CIM-TEK Filtration
Clippard Instrument Laboratory
CNH
Comer Industries, Inc.
Cross Company
Daman Products Company
Danfoss Power Solutions
Delaware Manufacturing Industries Corp.
Delta Computer Systems, Inc.
Deltrol Fluid Products
DGD Fluid Power
Employee Owned Holdings, Inc.
Endeavor Business Media
Engineering Technology Services
eShipping, LLC

Evonik Oil Additives USA, Inc.
Festo
Flodraulic Group, Inc.
Fluid Power Society
Fluid Power Society of Milwaukee
FluiDyne Fluid Power Corporation
FORCE America Inc./ Valve Division
Galland Henning Nopak, Inc.
Gates Corporation
GPM Controls LLC
GS Global Resources
HAWE Hydraulik GmbH & Co KG
Helios Technologies
HPS, Inc.
Husco
HYDAC/ Schroeder Industries
Hydradyne LLC
Hydraforce
Hydra-Power Systems, Inc.
Hydraulex Global
Hydro Electronic Devices, Inc.
IC-Fluid Power
Ifm efector
IFP Motion Solutions, Inc.
Industrial Hard Chrome
JARP Industries, Inc.
JEM Technical Marketing Company
Kawasaki Precision Machinery
Kepner Products Company
KYB Americas Corporation
Linde Hydraulics Corp.
Magnet-Schultz of America, Inc.
Main Manufacturing Products, Inc.
Marmon/Keystone
Master Pneumatic-Detroit, Inc.

MFP Seals
MHA Zentgraf Corporation
Micromatic LLC
Moog, Inc.
Moseys Production Machinists, Inc.
Motion
Muncie Power Products
Nachi America, Inc.
National Tube Supply Company
Niagara LaSalle Corporation
NORGREN
Nott Company
OEM Controls, Inc.
OPS Controls, Inc.
Orange Seal LLC
PMMI
Paquin Company
Parker Hannifin Corp.
Poclain Hydraulics, Inc.
QCC
R&J Cylinder & Machine, Inc.
ROSS Controls
Scanreco, Inc.
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SunSource
The GE Foundation
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Womack Machine Supply Co.
World Wide Fittings Corporation
WTWH Media
Yates Industries, Inc.

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Patsy Baer
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