Our Mission

In a biennial survey, 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 research and education programs, designed to better engage academic faculty in the teaching of fluid power.

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 universities have research facilities and 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 and CEO
NFPA Education and Technology Foundation

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To create more fluid power-educated technical college graduates, the NFPA and the NFPA Foundation conduct a number of student outreach and education 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 in tech schools, and finally connections to jobs in the fluid power industry. Many of these programs are organized under our Fast Tracks 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 careers. Industry partners visit the schools frequently and provide mentorship and career encouragement.

**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 Detroit, MI at Macomb Community College. Local NFPA members 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行动 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 Hubs**

- Milwaukee, WI at Waukesha County Technical College
- Chicago, IL at Triton College
- Detroit, MI at Macomb Community College

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

**Fluid Power Scholarships**

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

**Fluid Power Action Challenge**

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 26,000 students to date.

To our Fluid Power Action Challenge Champions

Thirty-two 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
- Deltrol Fluid Products – 11 annual events, engaging 2,028 total students
- Dura-Bar – 1 annual event, engaging 66 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 – 9 annual events, engaging 429 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
- Hydrotech – 1 annual event, engaging 20 total students
- Hydraquip – 1 annual event, engaging 18 total students
- Jerling Middle School – 4 annual events, engaging 803 total students
- Komatsu Mining Corp Group – 3 annual events, engaging 159 total students
- LoneStar Community College – 3 annual events, engaging 56 total students
- Master Pneumatic – 7 annual events, engaging 1,028 total students
- Mequon School District – 1 annual event, engaging 36 total students
- Micromatic – 1 annual event, engaging 30 total students
- Milwaukee School of Engineering – 13 annual events, engaging 1,302 total students
- Parker Hannifin – 2 annual events, engaging 44 total students
- Pennsylvania Small Business Education Fund – 5 annual events, engaging 604 total students
- Price Engineering – 5 annual events, engaging 716 total students
- Purdue University – 7 annual events, engaging 340 total students
- University of Minnesota – 5 annual events, engaging 352 total students
- Triton Girls Summer Camp – 2 annual events, engaging 60 total students
- Triton College – 2 annual events, engaging 52 total students
- Waojas Supply Company – 10 annual events, engaging 911 total students
- SMC Business Councils – 2 annual events, engaging 224 total students
- Valley View Junior High School – 3 annual events, engaging 324 total students

In total, our Fluid Power Action Challenge Champions have organized 139 events impacting 12,842 students.
As each Fast Track to Fluid Power program comes online in communities around the country, the NFPA Foundation provides grants so area high schools can purchase the fluid power training platforms they need to offer targeted fluid power education to their students.

In its fourth year, the second Fast Track Technical College located at Triton College in River Grove, Illinois has continued to engage students in the area during the COVID-19 pandemic. High schools that are part of that Fast Track network, bringing hands-on fluid power instruction to their students, include:

- Leyden West High School
- Leyden East High School
- Proviso East High School
- Proviso West High School
- Proviso Mathematics and Science Academy
- Ridgewood High School

And, for the fifth year, our first Fast Track Technical College, Waukesha County Technical College (WCTC) in suburban Milwaukee, Wisconsin, continued to engage eight local high schools as part of that Fast Track network during the pandemic. These schools are:

- Menomonee Falls High School
- Arrowhead Union High School
- Brookfield Central High School
- Hamilton High School
- New Berlin Eisenhower Middle-High School
- New Berlin West High School
- Kettle Moraine High School
- Oconomowoc High School

WCTC and Triton, as the affiliated Fast Track Technical Colleges, are providing training to the teachers in their area high schools so that they can more effectively teach the fluid power curriculum associated with their chosen training platforms.

In addition, members of our industry donor coalition, who are helping to support these activities and the growth of future Fast Track networks, are offering mentorship and information on careers in fluid power. Companies in this industry partner network include:

- Deltrol Fluid Products
- Festo
- FORCE America
- Hydraulics
- Husco
- NORGREN
- Poclain Hydraulics
- Price Engineering
- Quality Control Corporation
- SunSource

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, 214 schools have used Fluid Power Challenge materials in their curricula, exposing 13,275 students to fluid power.
Fluid Power Scholarships
78 Scholarships Awarded to Further Fluid Power Education

Fluid Power Scholarships are offered to graduating high school students in order to pursue fluid power degrees or certificates at designated technical colleges and universities. 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 fifty-eight $2,000 scholarships to students interested in studying fluid power at one of our education partner institutions.

2021-22 Fluid Power Scholarship Awardees:
• Ben Quade, Spokane Community College (Raymond F. Hanley Memorial Award)
• Brendan McCluskey, Georgia Institute of Technology
• Dana Nestrick, Triton College
• Michael Glachowsky, Triton College
• Natalie Pecaro, Triton College
• Reagan Lawson, California Polytechnic State University
• Sawyer Newman, Purdue University Northwest
• Seth Leighton, Spokane Community College
• Zoe Kulphongpatana, University of Kansas
• Evan Bartelsen, University of Wisconsin – Milwaukee
• Joleen Nush, Spokane Community College
• Luke Wilie, Iowa State University
• Max Kleesnikov, Moraine Valley Community College

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.

Fluid Power Robotics Challenge
Aims to bring 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 $40,000 scholarship – up to $10,000 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 sixth year, we received 43 applications for this scholarship.

Robotics Challenge Scholarship winners include:
Caleb Qiu, our 2021 recipient, is double majoring in Biomedical Engineering and Computer Science Engineering at the University of Michigan. He particularly enjoys the research he has been able to do on campus relating to biomechanics and mechanical engineering.
Matthew Morley, our 2020 recipient, is using his scholarship to pursue a degree in mechanical engineering at Northeastern University in Boston, Massachusetts. Matthew recently accepted a mechanical engineering coop position where he will work on drones used in agriculture. He is also actively involved in Northeastern’s Aeronautics Club building robots.
Noah Santoni, our 2019 recipient, is using his scholarship to pursue a double major in mechanical and aerospace engineering at Case Western Reserve University. Noah attended the 2020 Annual Meeting and impressed members with his questions and interest in fluid power.
 Jacob Barnes, our 2018 recipient, is using his scholarship to study electrical engineering at Cal Poly in San Luis Obispo and participated in the International Fluid Power Society’s mentorship program the year. This program connects current and prospective fluid power professionals to grow their potential and learn how to navigate the fluid power industry.
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 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 multimeters, 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 diagnosis vehicle wiring issues relevant to the controls
4. Understand popular communication protocols (e.g., 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

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 Detroit, MI at Macomb Community College. In the 2021-22 school year, the fluid power degree programs at these schools provided advanced-level training to 262 students.

Those students were supported by the coalition of industry partners, who actively engage to provide internship and employment opportunities. Companies in this industry coalition include:
- Deltrol Fluid Products
- Festo
- FORCE America
- Husco
- HYDAC
- NORGREN
- Poclain Hydraulics
- Price Engineering
- Quality Control Corporation
- SunSource

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**Teaching and Laboratory Grants**
Many more 2-year technical colleges are teaching fluid power to their student bodies as a result 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:**
- Angelo College - Lubbock, 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
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 fluid power education into their undergraduate engineering 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 Event**
  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: the Milwaukee School of Engineering and Iowa State University. They join Purdue University, our original Power Partner 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 connection events.

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  Host an event on their campus to introduce fluid power-educated students to companies in the NFPA membership.

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**Research Supplements**

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 career 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 42 Research Supplements have been awarded. In our 2021-22 fiscal year, we awarded ten Research Supplements to the following university faculty members:

- **Iowa State University**
  - Brian Steward - Off-Highway Vehicle Chassis Dynamometer
  - Milwaukee School of Engineering
  - Paul Michael - Polymer-Enhanced Fluid Effects on the Dynamic Response of Hydraulic Pumps
  - Purdue University
  - Andrea Vaca - Individual Electro-Hydraulic Drive for Off-Road Vehicles
  - Jose Garcia - Lateral Micro-Drilling Autonomous Robotic System
  - Farid Breidi - Mechanically Actuated Radial Piston Digital Pump/Motor Utilizing Variable Cam
  - Lishi Shang - AI-aided lubricating interface modeling technology for hydrostatic pumps and motors
  - University of Minnesota
  - Perry Li - Hybrid Hydraulic-Electric Architecture for Mobile Machines
  - Kim Stelson - Short-Term Energy Storage System for Hydraulic Hybrid Wind Turbine Transmissions
  - Zongquan Sun - Electrohydraulic System Diagnostics with Recursive Spectral Analysis
  - University of Minnesota
  - Free Piston Engine Based Off-Road Vehicle
  - Hybrid MEMS Proportional Fluid Control Valve
  - Variable AC Hydraulic Pump/Motor (joint project with Vanderbilt University)
  - Vanderbilt University
  - Pneumatic Exhaust Gas Recovery
  - Controlled Stirring Power Unit

These research projects independently represent more than $4.6 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 provide travel support so that each faculty member and one of their graduate students can attend and present their research at a series of designated industry conferences and research summits. In our 2021-22 fiscal year, the designated conferences are the two CCEFP Summits in September 2021 and June 2022.
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, these 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 machine level requirements and translate into fluid power system requirements
5. Apply design, simulation and analysis tools to fluid power components and systems
6. Appropriately size components in fluid power systems
7. Integrate sensing and electronic control functions with fluid power components and systems
8. Cite hands-on experience with fluid power components and systems
9. 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 three Power Partner Universities up and running – Iowa State University, the Milwaukee School of Engineering, and Purdue University. In the 2021-22 school year, the degree programs teaching these competencies at these schools provided 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 body as a result of multiple grant programs. These grants provide school with the teaching materials and state-of-the-art teaching laboratories that are needed to embed fluid power into their undergraduate curriculum. 16 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.
23 University Teams Participate in 2021-22 Fluid Power Vehicle Challenge

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 under-graduate 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 fourth 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
- 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 Denver - Denver, CO
- 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 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 and University of Cincinnati 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:
- Founding Sponsor: Parker Hannifin Corporation
- Product Suppliers: Eaton Corporation, VEST, Inc.
- Source Fluid Power

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.

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, fifteen universities have established clubs impacting 110 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 meeting industry professionals to speak with them about career opportunities in fluid power.

Fluid Power Club Universities:

- Iowa State University - Ames, IA
- Loyola Marymount University - Los Angeles, CA
- Milwaukee School of Engineering - Milwaukee, WI
- Murray State University - Murray, KY
- North Carolina Agricultural and Technical State University - Greensboro, NC
- Northern Illinois University - 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
- Western Michigan University - Kalamazoo, MI
The NFPA and the NFPA Foundation have 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 Arizona State University ▲
2 Armstrong High School ▲
3 Price Engineering ▲
4 Arkansas State University ▲
5 Bennett Mills Middle School ▲
6 Broadview Central High School ▲
7 California Polytechnic State University ▲
8 Caterpillar ▲
9 Chattanooga State TCAT ▲
10 Cleveland State University ▲
11 Cleveland Community College ▲
12 Co-Centric Fluid Products Company ▲
13 Delphi Fluid Products ▲
14 Dura-Bar ▲
15 Eisenhower Junior High ▲
16 Florida A&M University ▲
17 Florida Technology Student Association ▲
18 FORCE America ▲
19 Georgia Institute of Technology ▲
20 Georgia Tech University ▲
21 Gulfw ▲
22 Hamilton High School ▲
23 Hennepin Technical College ▲
24 Home School Resistance ▲
25 Humboldt Park School ▲
26 Marquette University ▲
27 MSOE ▲
28 South Milwaukee High School ▲
29 University of Wisconsin Milwaukee ▲
30 Waukesha County Technical College ▲
31 Whitman Middle School Wauwatosa ▲
32 Hydroquip ▲
33 University of Cincinnati ▲
34 Illinois Institute of Technology ▲
35 Triton College ▲
36 Triton Girls Summer Camp ▲
37 University of Illinois at Chicago ▲
38 Holy Cross High School ▲
39 Innovations STEAM Academy ▲
40 Iowa State ▲
41 Ivy Tech Community College ▲
42 Joliet Community College ▲
43 Johnson County Community College ▲
44 Kent State University ▲
45 Kettle Moraine High School ▲
46 Komatsu Mining Corp Group ▲
47 Lake Shore Middle School ▲
48 Mequon School District ▲
49 Lawrence Technological University ▲
50 Leyden East High School ▲
51 Lincoln Star Community College ▲
52 Loyola Marymount University ▲
53 University of Southern California ▲
54 Macomb Community College ▲
55 Massachusetts Institute of Technology ▲
56 University of California ▲
57 North Carolina Agricultural and Technical State University ▲
58 North Lincoln High School ▲
59 North Mississippi High School ▲
60 Oconomowoc High School ▲
61 Park High School ▲
62 Milwaukee Area Technical College ▲
63 Palmyra Eagle Area M.S. & H.S. ▲
64 Parker Hannifin ▲
65 Minnesota State ▲
66 Mitchell Middle School ▲
67 Union Grove High School ▲
68 University of Minnesota ▲
69 Missouri Valley Community College ▲
70 Murray State University ▲
71 New Berlin Eisenhower ▲
72 New Berlin West High School ▲
73 Norco College ▲
74 North Carolina Agricultural and Technical State University ▲
75 North Mississippi High School ▲
76 North polished High School ▲
77 Northern Illinois University ▲
78 North Western High School ▲
79 Northville High School ▲
80 Ohio University ▲
81 Oklahoma State University ▲
82 Palmyra Eagle Area M.S. & H.S. ▲
83 Parker Hannifin ▲
84 Pennsylvania Small Business Education Fund ▲
85 Proviso East High School ▲
86 Proviso Mathematics and Science Academy ▲
87 Proviso West High School ▲
88 Purdue University ▲
89 Purdue University Northwest ▲
90 Richmond School ▲
91 Rochester Institute of Technology ▲
92 Rosedale Technical College ▲
93 Roswell High School ▲
94 Rutgers University ▲
95 South Dakota State University ▲
96 Springfield Central High School ▲
97 South Mountain Community College ▲
98 South Mississippi Community College ▲
99 Spivey Community College ▲
100 Stevens Institute of Technology ▲
101 SUNY Cobleskill ▲
102 Texas A&M University ▲
103 University of Illinois at Urbana-Champaign ▲
104 University of Alabama at Birmingham ▲
105 University of Alaska Anchorage ▲
106 University of Colorado Boulder ▲
107 University of Denver ▲
108 University of Florida ▲
109 University of Georgia ▲
110 University of Hawaii ▲
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112 University of Illinois at Chicago ▲
113 University of Illinois at Urbana-Champaign ▲
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117 University of Kentucky at Lexington ▲
118 University of Las Vegas ▲
119 University of Colorado at Boulder ▲
120 University of Miami ▲
121 University of Missouri ▲
122 University of North Carolina ▲
123 University of Central Florida ▲
124 University of Southern California ▲
125 University of Texas at Austin ▲
126 University of Utah ▲
127 University of Virginia ▲
128 University of Wisconsin ▲
129 University of Washington ▲
130 University of Wisconsin-Madison ▲
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132 Wisconsin Technical College ▲
133 Waukesha County Technical College ▲
134 Whitman Middle School Wauwatosa ▲
135 Wisconsin State ▲
136 Whitman High School ▲
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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 opportunities with students in fluid power degree programs such as Mechanical Engineering, Electrical Engineering, Computer Science and Agricultural Engineering. To name a few, 28 companies have attended industry connection events at Purdue University, the Milwaukee School of Education, and Iowa State University: NFPA’s Power Partner universities, involving a total of 261 students.

Impact Map
The NFPA and the NFPA Foundation have had a tremendous impact on students and schools in communities around the country.
The Pascal Society

The Pascal Society is the NFPA Foundation's annual giving society that has raised more than $4 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, 2022

Companies that have donated MORE THAN 50% of their NFPA dues
- Bosch Rexroth
- Danfoss
- Deltrol Fluid Products
- Fluorine Fluid Power
- FORZE America
- Gates Corporation
- Helix Technologies
- Husco
- IFP Motion Solutions, Inc.
- Kawasaki Precision Machinery
- Linde Hydraulics Corporation
- Main Manufacturing Products
- Micromatic
- Mosey’s Production Machinists
- Parker Hannifin
- Poclain Hydraulics
- Trelleborg Sealing Solutions
- Yates Industries

Companies that have donated 50% of their NFPA dues
- Akro Steel
- Applied Industrial Technologies
- Bucyrus Hydraulics
- Caterpillar
- Clipper Instrument Laboratory
- Corner Industries
- Delta Computer Systems
- Evonik Oil Additives
- GPM Controls LLC
- HYDAC/Schradera Industries
- Hydroforce
- International Fluid Power Society
- Industrial Hard Chrome
- JARP Industries
- Muncie Power Products
- National Tube Supply Company
- NORGREN
- OEM Controls
- 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, 2022.

CLASS OF 2022
- Hydromax

CLASS OF 2020
- Daman Products Company
- Kawasaki Precision Machinery
- Muncie Power Products, Inc.
- Norgren & Bimba
- SunSource

CLASS OF 2019
- Clipper Instrument Laboratory
- Festo
- Hitachi
- Iowa Fluid Power
- OEM Controls
- Trelleborg Sealing Solutions

CLASS OF 2018
- FORCE America
- Husco
- International Fluid Power Society
- Quality Control Corporation

CLASS OF 2017
- Linde Hydraulics
- Lubricol
- Proportion Air
- Woodward

CLASS OF 2016
- Atlan Chemical Corporation
- Bobcat Company
- Chevron
- Donaldson Company
- Evonik Oil Additives USA
- ExxonMobil
- HYDAC Technology Corporation/Schradera Industries LLC
- Hydra-Power Systems
- Hydraquip
- Netshape Technologies
- Poclain Hydraulics

CLASS OF 2015
- Afton Chemical Corporation
- Bobcat Company
- Caterpillar
- Deltrol Fluid Products
- Parker Hannifin Corporation

CLASS OF 2014
- Danfoss
- Eaton
- Gates
- ROSS Controls

CLASS OF 2013
- Bimba Manufacturing Company
- Bosch Rexroth
- Caterpillar
- Deltrol Fluid Products
- Parker Hannifin Corporation

CLASS OF 2012
- Enfield Technologies
- Sun Hydraulics

CLASS OF 2011
- Horizon Fluid Power Systems
- SunSource

CLASS OF 2010
- Husco
- Trelleborg Sealing Solutions

CLASS OF 2009
- Bimba Manufacturing Company
- Danfoss
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CLASS OF 1982
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- Danfoss
- Eaton
- Gates
- Parker Hannifin Corporation
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.

The following individuals and organizations have made a donation in our last recognition year—between May 1, 2021 and April 30, 2022.

Adams Air & Hydraulics
Alro Steel Corporation
AMETEK APT
Anresco Machine
Applied Industrial Technologies, Inc.
ArcelorMittal Tubular Products
ARGO-HYTOS
AW-Lake Company
Bernhard Biederman
Bosch Rexroth Corporation
Brand Hydraulics
Bucher Hydraulics
Cadenas PARToxutions
Camozzi Pneumatics, Inc.
Caterpillar, Inc.
Certified Power/ Hydrotech, Inc.
Charter Dura Bar
CMF-TEK Filtration
Clippard Instrument Laboratory, Inc.
CMH
Comer Industries, Inc.
Daman Products Company Inc.
Danfoss
Delta Computer Systems, Inc.
Detroit Fluid Products
Diezel Progress
Employee Owned Holdings, Inc.
Endeavor Business Media
Engineering Technology Services
Eric Lanke
eShipping, LLC
Ewonik Oil Additives USA, Inc.
Exotic Automation and Supply
Festo Corporation
Flodraulic Group, Inc.
FORCE America, Inc./Valve Division
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Husco
HYDAC TECHNOLOGY CORPORATION/
Schroeder Industries
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Hydrafork
Hydra-Power Systems, Inc.
Hydrotech Dynamics, Inc.
International Fluid Power Society
JARP Industries, Inc.
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Kepner Products Company
Kevin Coughlin
KP Components Inc.
Linde Hydraulics Corporation
Main Manufacturing Products
Master Pneumatic-Detroit, Inc.
MFP Seals (A Division of Martin Fluid Power)
Micromatic, LLC
Mosey’s Production Machinists, Inc.
Motion
Muncie Power Products, Inc.
Murrelektronik, Inc.
National Tube Supply Company
NORGREN
Nott Company
OEM Controls, Inc.
Paquin Company
Parker Hannifin Corporation
Penair Cylinder Company
Pocklan Hydraulics, Inc.
Power & Motion
Power Systems Inc. Florida
QCC - Quality Control Corporation
QP Hydraulics
R&J Cylinder & Machine, Inc.
ROSS Controls
Scarinci, Inc
Schmalz Inc.
Scott Industrial Systems, Inc.
Sharon Tube Division of Zekelman Industries
SMC Corporation of America
Spectra Premium Corporation
SPX Hydraulic Technologies
Stauff Corporation
Stauchi S.p.A.
SunSource
TraceParts
Trehemborg Sealing Solutions
Ultra Clean Technologies Corporation
V1s Hydraulics North America
Walvoil Fluid Power
World Wide Fittings Corporation
WTWH Media
Yates Industries, Inc.

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