



NFPA
Education and
Technology
Foundation



2020 DONOR IMPACT REPORT

Competition #5
**The
Ghostbusters
(Minnewaska)**

OUR MISSION

In a biennial survey, members of the National Fluid Power Association (NFPA) consistently rank the recruitment of a skilled workforce as the most challenging issue 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:

- 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

2020–21 NFPA Education and Technology Foundation Board of Directors



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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 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 now being organized under our FAMTEN initiative, also known as the Fast Track to Fluid Power. FAMTEN, or "Fast Track," 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.

In total, our Fluid Power Action Challenge Champions have organized

124 EVENTS IMPACTING 11,935 STUDENTS

Outreach and Education 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

Are each 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

A variety of scholarships are 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.

FAST TRACK TECHNICAL COLLEGES

Are schools with a 2-year degree program validated to teach core fluid power competencies. Industry partners provide on-going curriculum guidance and student internship opportunities.

FLUID POWER ACTION CHALLENGE

25,000 + Engaged Through Events and Classroom Activities

The Fluid Power Action Challenge is a competition that challenges middle or high school students to solve an engineering problem using fluid power. The students work in teams to design and build a fluid power mechanism and then compete against other teams in a timed competition.

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 25,000 students to date.

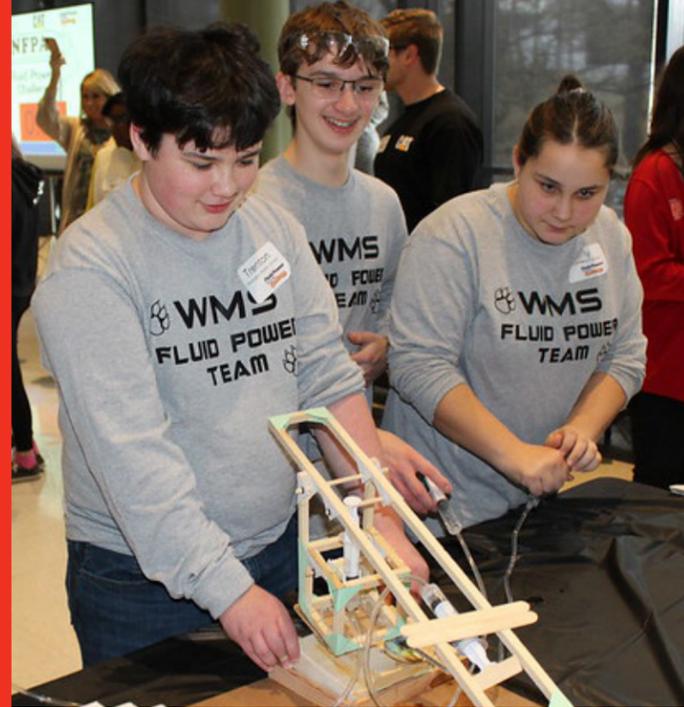
Fluid Power Action Challenge Champions

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 running Fluid Power Action Challenge events in their local communities. In doing so, they have not only made serious investments of both time and money, but 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:

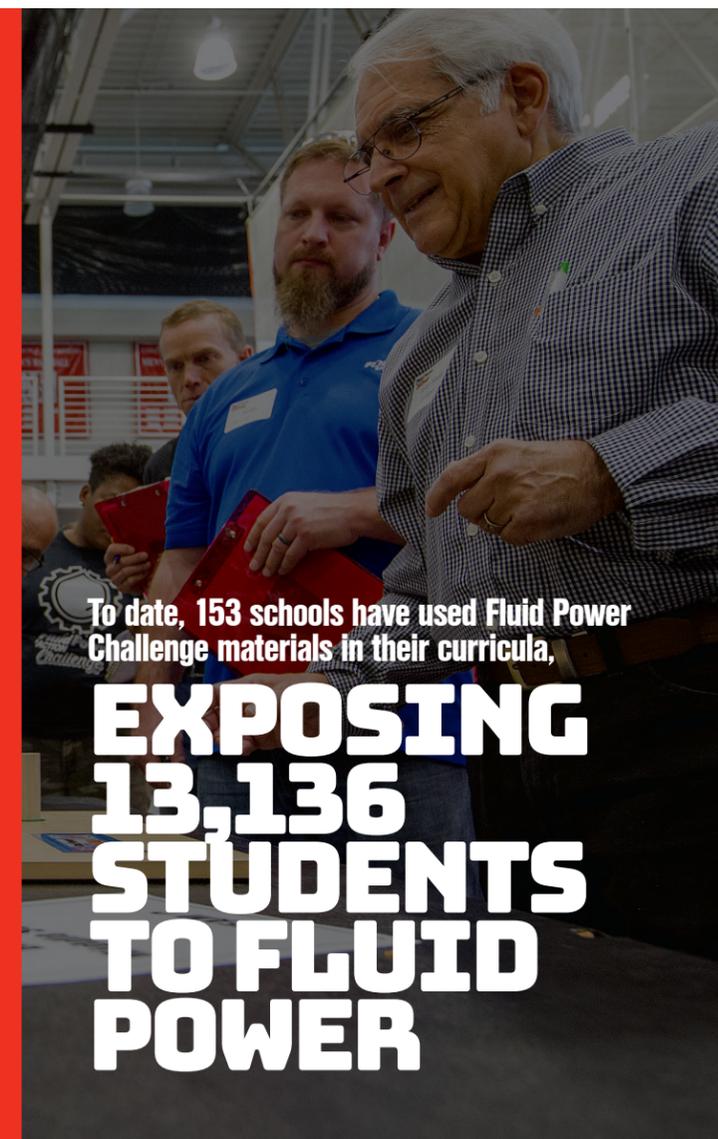
- Bennett Mills Middle School** - 2 annual events, engaging 80 total students
- Caterpillar** - 5 annual events, engaging 372 total students
- Cleveland Community College** - 6 annual events, engaging 198 total students
- Cooper Middle School** - 3 annual events, engaging 171 total students
- Daman Products Company** - 10 annual events, engaging 904 total students
- Deltrol Fluid Products** - 11 annual events, engaging 2,528 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** - 3 annual events, engaging 104 total students
- FORCE America** - 5 annual events, engaging 344 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** - 2 annual events, engaging 96 total students
- LoneStar Community College** - 2 annual events, engaging 56 total students
- Master Pneumatic** - 6 annual events, engaging 804 total students
- Mequon School District** - 1 annual event, engaging 36 total students
- Micromatic** - 1 annual event, engaging 20 total students
- Milwaukee School of Engineering** - 12 annual events, engaging 1,210 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** - 6 annual events, engaging 324 total students
- University of Minnesota** - 5 annual events, engaging 352 total students
- Triton Girls Summer Camp** - 2 annual events, engaging 80 total students
- Wojanis Supply Company** - 10 annual events, engaging 911 total students
- SMC Business Councils** - 2 annual events, engaging 224 total students
- Valley View Junior High School** - 2 annual events, engaging 256 total students





Fluid Power Action Challenge Grants

The NFPA Foundation also awards grants to middle and high schools to facilitate hydraulics and pneumatics instruction. 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 for participation in the Fluid Power Action Challenge event.



To date, 153 schools have used Fluid Power Challenge materials in their curricula.

EXPOSING 13,136 STUDENTS TO FLUID POWER

FAST TRACK HIGH SCHOOLS Students Learning Fluid Power in 10 High Schools

As each “FAMTEN: 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 our 2019-20 fiscal year, the second Fast Track Technical College was established at Triton College in River Grove, Illinois. Triton engaged three local high schools as part of that Fast Track network, bringing hands-on fluid power instruction to their students:

- Ridgewood High School
- Leyden East High School
- Leyden West High School

And, for the second year, our first Fast Track Technical College, Waukesha County Technical College (WCTC) in suburban Milwaukee, Wisconsin, continued to engage seven local high schools as part of that Fast Track network.

- Hamilton High School
- Hartland Arrowhead High School
- Kettle Moraine High School
- Menomonee Falls High School
- New Berlin Eisenhower High School
- New Berlin West 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 platform.

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

- Bimba
- Deltrol Fluid Products
- Festo
- FORCE America
- Husco
- IMI Precision Engineering
- Poclair Hydraulics
- Price Engineering
- Quality Control Corporation
- SunSource

As a result, 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 SCHOLARSHIPS

29 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 twenty-five \$2,000 scholarships to students interested in studying fluid power at one of our education partner institutions.

2019-20 Fluid Power Scholarship Awardees:

- **Maximus Addington**
University of Denver
- **Trevor Burke**
Southern Methodist University
- **Rebekah Clark**
Spokane Community College
- **Wyatt Hoehn**
Ivy Tech Community College
- **William Horning**
SUNY Cobleskill
- **Krystal Horton**
University of Colorado Boulder (Raymond F. Hanley Memorial Award)
- **Nolan Jones**
Spokane Community College
- **Kristen Postiglione**
Stevens Institute of Technology
- **Cole Rickerson**
Texas A&M University
- **Cole Stephan**
Ohio University
- **Haisaane Summers**
Massachusetts Institute of Technology
- **Brett Watson**
Spokane Community College (Robert Mackey Memorial Award)

STUDENT TESTIMONIALS

- "Winning the Fluid Power Scholarship is extremely exciting for me as I have developed great interest in the applications of fluid power. Being awarded this scholarship motivates me to continue looking into different technologies within the fluid power realm that will greatly contribute to my ability to design devices efficiently utilizing the exceptional linear motion technologies." – Krystal Horton
- "I view the Fluid Power Scholarship as a challenge. Since the organization was willing to bet on my educational and career success by offering me a scholarship, I am challenged to put my best effort into my college education and future employment." – William Horning

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

FLUID POWER ROBOTICS CHALLENGE

The Fluid Power Robotics Challenge is a scholarship program that launched with the 2016-17 school year.

In collaboration with FIRST Robotics and the National Robotics League (NRL), each year the NFPA Foundation offers one merit-based scholarship to a high school student using fluid power in their robot design. The scholarship, set at \$10,000 per year for up to four years, may be utilized for an Engineering course of study at any United States tech school/college or university that holds accredited status.

The goal of the Fluid Power Robotics Challenge is to bring an awareness of fluid power options in robotics to high school students and to stimulate increased use of fluid power products in the FIRST and NRL competitions. In our third year, 75 applications were received for our scholarship. FIRST Robotics has reported that the number of teams using fluid power in their robot has increased from 2,035 last year to 2,659 this year, an increase of more than 30%.

Robotics Challenge Scholarship winners include:

- **Matthew Morley**, our 2020 recipient is using his scholarship to pursue a degree in mechanical engineering at Northeastern University in Boston, Massachusetts. Matthew impressed the judges by his knowledge of pneumatics and his sincere interest in the experiences that they had in college. He is looking forward to taking part in Northeastern University's strong co-op program where he will participate in six-month industry-sponsored co-ops.
- **Noah Santori**, 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. He is pursuing a Masters Degree and taking advantage of their 4 + 1 masters program and their "learn by doing" philosophy. Jacob attended the 2019 NFPA Annual Meeting and made many connections with attending members.
- **Spencer Tiegs**, our 2017 recipient, has been very busy since winning his scholarship. Not only is he attending the Milwaukee School of Engineering for mechanical engineering as part of the University Scholars Honors Program, he also continues to coach and mentor FIRST Robotics high school students and is part of the Formula Hybrid team at MSOE. Spencer recently completed an internship at Husco.



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 Tech School Education Committee, those core competencies are:

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

In the second year of operation, the fluid power degree programs at WCTC and Triton College provided advanced-level training to 339 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:

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

TEACHING AND LABORATORY GRANTS

Many more 2-year technical colleges are teaching fluid power to their student bodies as a result of 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, more than 3,400 students are taught fluid power each and every year.

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

As a result of these investments, more than

3,400 STUDENTS ARE TAUGHT FLUID POWER EACH AND EVERY YEAR

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 funded research faculty build more fluid power education into their undergraduate engineering courses. To educate these students in fluid power and produce graduates that are attractive hires for the fluid power industry, we have built a full fluid power curriculum for insertion into these and other core engineering courses.



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.

EDUCATION GRANTS

Allow academic faculty to either develop or acquire the necessary educational tools or resources to teach validated fluid power curriculum in their undergraduate engineering programs.

FLUID POWER VEHICLE CHALLENGE

Is a design/build competition that embeds in the capstone design course of participating universities. It 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.



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 21 Research Supplements have been awarded. In our 2019-20 fiscal year, we awarded eleven Research Supplements to the following university faculty members:

Georgia Institute of Technology

- Michael Varenberg – “Dynamics of Rolling Friction in Soft-Rigid Interface”

Milwaukee School of Engineering

- Paul Michael – “Polymer-Enhanced Fluid Effects on Mechanical Efficiency of Hydraulic Pumps”

Purdue University

- Andrea Vacca – “Individual Electro-Hydraulic Actuators for Off Road Machines”
- Jose Garcia – “Distributed Compact Hydraulic Regenerative Breaking for Heavy Duty Transport Vehicles”

University of Minnesota

- Thomas Chase – “High Efficiency Hydraulic Pump-Motors Employing Partial Stroke Piston Pressurization (PSPP)”
- William Durfee – “Hydraulic Ankle Foot Orthosis for Prescription of Orthoses for Children with CP”
- Perry Li – “Hybrid Hydraulic-Electric Architecture for Mobile Machines”
- Kim Stelson – “Increasing the Efficiency of Wind Turbines through Understanding of Their Transient Responses”
- Zongxuan Sun – “Modeling and Optimization of Trajectory Based HCCI Combustion”
- James Van de Ven – “Efficient, Compact, and Smooth Variable Propulsion Motor”

University of Wisconsin – Madison

- Eric Severson – “Seamless Electric to Hydraulic Conversion”

These research projects independently represent more than \$2.4 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 2019-20 fiscal year, the designated conferences were the October 2019 and May 2020 summits of the CCEFP, and a special Research Symposium presented at IFPE tradeshow in March 2020.

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.

EDUCATION GRANTS

7,500 + Undergraduate Students Taught Fluid Power Each Year

Thanks also to the efforts of our University Education Committee, we've defined the nine fluid power competencies that our member companies are most looking for in entry-level engineers coming out of our nation's universities. Using these competencies as a guide, we have sorted all our curriculum products and placed them online in a curriculum tree. This is providing university faculty who wish to add fluid power to one or more of their undergraduate engineering courses with a quick reference, not only for which competencies industry believe belong in their curriculum, but with the downloadable teaching products that will allow them to quickly and easily incorporate them.

Curriculum Grants allow academic faculty to either develop or acquire the necessary educational tools or resources to teach validated fluid power curriculum in their undergraduate engineering programs. As determined by NFPA's University Education Committee, the validated curriculum is designed to teach at least one of the following core competencies:

- Understand fluid power benefits and limitations
- Conceptual and theoretical understanding of fluid power laws and principles (including energy transfer and power efficiency)
- Understand fluid power components and circuits
- Understand machine level requirements and translate into fluid power system requirements
- Apply design, simulation and analysis tools to fluid power components and systems
- Appropriately size components in fluid power systems
- Integrate sensing and electronic control functions with fluid power components and systems
- Cite hands-on experience with fluid power components and systems
- Inspect, analyze and develop corrective action for product failure

A variety of different funding programs support this model curriculum. To date, 3 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.

FLUID POWER UNIVERSITY GRANTS

- **Murray State University**
Murray, KY
- **Purdue University Northwest**
Hammond, IN
- **University of Kentucky**
Lexington, KY

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

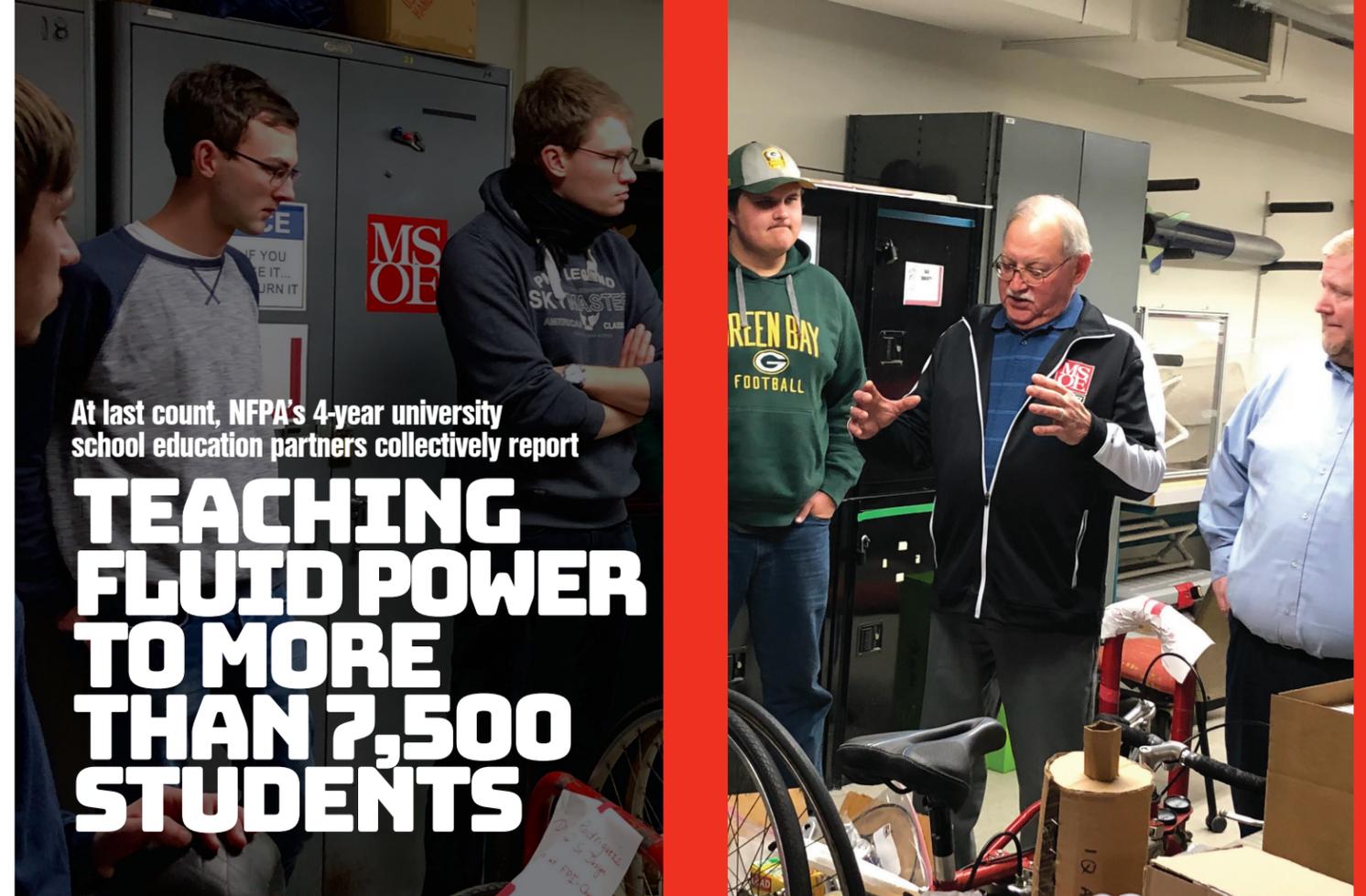
LABORATORY GRANTS

- **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.



At last count, NFPA's 4-year university school education partners collectively report

TEACHING FLUID POWER TO MORE THAN 7,500 STUDENTS



FLUID POWER VEHICLE CHALLENGE

15 University Teams Participate in 2019-20



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 15 universities participated in the fourth year of the NFPA Vehicle Challenge:

- **Arizona State University**
Tempe, AZ
- **California Polytechnic State University**
San Luis Obispo, CA
- **Cleveland State University**
Cleveland, OH
- **Colorado State University**
Fort Collins, CO
- **Iowa State University**
Ames, IA
- **Michigan Technological University**
Houghton, MI
- **Milwaukee School of Engineering**
Milwaukee, WI
- **Murray State University**
Murray, KY
- **Purdue Northwest**
Hammond, IN
- **Purdue University**
West Lafayette, IN
- **University of Akron**
Akron, OH
- **University of Cincinnati**
Cincinnati, OH
- **University of Denver**
Denver, CO
- **West Virginia University Institute of Technology**
Beckley, WV
- **Western Michigan University**
Kalamazoo, MI

The team from Cleveland State University won the overall competition, with teams from multiple universities placing competitively in the program's other award categories, including best presentations, three Judges Choice awards for design, teamwork and use of components, and for the first time, a best use of pneumatics award, sponsored by Bimba.

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

- Bimba Manufacturing (as part of IMI Precision Engineering), event host
- LubeTech, the program's official fluid supplier
- Parker Hannifin
- SunSource/Eaton Corporation/Source Fluid Power, the program's official parts suppliers

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 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 at the Gold and Silver levels 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.

Eighteen companies participated in the community's year-long mentoring program or dedicated representatives to act as competition judges or lead career information sessions during the final event:

- Bimba
- Bosch Rexroth
- Danfoss
- Deltrol Fluid Products
- Eaton
- FORCE America
- Gates
- HAWE Hydraulik
- IFPS
- IMI Precision Engineering
- Iowa Fluid Power
- JM Grimstad
- LubeTech
- Parker Hannifin
- Source Fluid Power
- SunSource
- Trelleborg Sealing Solutions
- Walvoil Fluid Power

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. Nine universities have newly established clubs impacting 98 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:

- **Colorado State University**
Fort Collins, CO
- **Iowa State University**
Ames, IA
- **Milwaukee School of Engineering**
Milwaukee, WI
- **Ohio University**
Athens, OH
- **Purdue University**
West Lafayette, IN
- **Purdue University Northwest**
Hammond, IN
- **University of Cincinnati**
Cincinnati, OH
- **West Virginia University Tech**
Beckley, WV
- **Western Michigan University**
Kalamazoo, MI





THE PASCAL SOCIETY

The Pascal Society is the NFPA Foundation's annual giving society that has raised more than \$3.6 million for fluid power outreach, education, and research programs. Pascal Society funds support the full range of Foundation programs highlighted in this report.

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, 2020**



GOLD DONORS

Danfoss	Iowa Fluid Power
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