

HIGH SCHOOL PATHWAY TO ENGINEERING

Getting Started

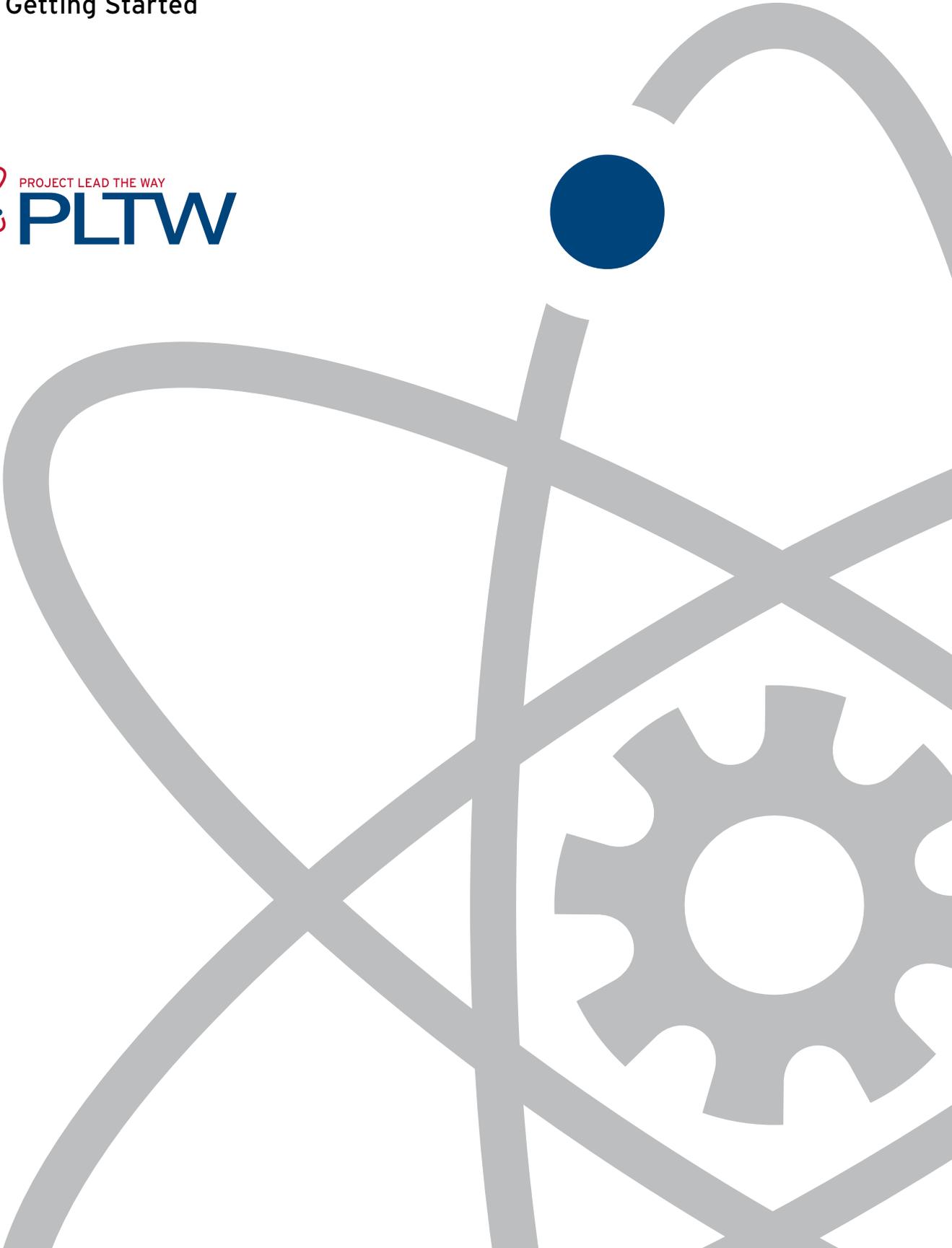
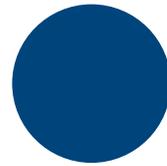


TABLE OF CONTENTS

| | |
|-----------------------------------------|-----------|
| Overview | Page 2 |
| Talking Points | Page 3 |
| Pathway To Engineering Program | Pages 4-5 |
| Administrator and Counselor Information | Pages 6-7 |
| Sample Student Schedule | Page 8 |
| Steps to a Successful Implementation | Page 9 |
| University Affiliates | Page 10 |
| PLTW Partners | Page 11 |

OVERVIEW



SUMMARY & MISSION

PLTW is a national nonprofit organization that partners with middle schools and high schools to implement a curriculum, developed by it and imparted by teachers whom it has trained, that emphasizes hands-on experiences in Science, Technology, Engineering, and Mathematics (STEM) and biomedical sciences in an effort to prepare students for academic and professional success in these disciplines. PLTW aims to encourage an increasingly more diverse group of students to consider careers as scientists, technology experts, engineers, mathematicians, healthcare providers, and researchers in an effort to enable the United States to compete favorably in the global economy.

HISTORY & SCOPE

PLTW began in 1998 in 12 high schools in upstate New York as a program designed to address the shortage of engineering students at the college level. It has grown to a network of more than 3,300 middle and high schools in 50 states and the District of Columbia. In 2007, PLTW added a Biomedical Sciences program, also project-based, to stem an impending shortage of healthcare professionals and researchers.

CURRICULUM

PLTW's approach — using activities-, project-, and problem-based learning (or APPB learning) — centers on hands-on projects that have real-world applications. The curriculum makes mathematics and science relevant and strives to help students understand how the skills they are learning in the classroom may be applied in everyday life.

THREE TRACKS

PLTW Gateway To Technology (GTT) is a middle school program offered in six independent, nine-week units and designed to help students explore math, science, and technology. This activity-oriented program challenges and engages the natural curiosity of middle school students and is taught in conjunction with a rigorous academic curriculum.

PLTW Pathway To Engineering (PTE) is a four-year high school sequence taught in conjunction with traditional math and science courses. PTE's eight courses, including Digital Electronics and Civil Engineering and Architecture, provide students with in-depth, hands-on knowledge of engineering and technology-based careers.

PLTW Biomedical Sciences Program (BMS) introduces high school students to the human body, cell biology, genetics, disease, and other biomedical topics in a sequence of four courses. The program prepares students for the postsecondary education and training necessary for success in a wide variety of positions: physician, nurse, pharmaceutical researcher, technician, etc.

PLTW NETWORK

Teachers and guidance counselors at schools that offer PLTW courses may access a nationwide support network comprised of PLTW staff, master teachers, affiliate directors and state leaders who are Department of Education employees. PLTW has 36 affiliated colleges and universities that provide teacher training. They also offer college credits for some of the courses. Business partners offer grants and internships.

TALKING POINTS



A CHANGING ECONOMY

Postsecondary education and training have become an essential requirement for a steadily increasing percentage of jobs. Two-thirds of America's economic growth in the 1990's resulted from the introduction of new technologies and 60% of the new jobs of the 21st century require postsecondary education, which is held by only one-third of America's workforce.

A SHORTAGE OF ENGINEERS

As the uses of science and technology expand in today's job market, our nation will need a constant supply of engineers graduating from college in order to remain competitive in the world's marketplace. Today, with more than half of the country's engineers and scientists nearing retirement, and with more than half of the students in college engineering programs dropping out before graduation, U.S. technical industries are in need of engineers and technical workers—not just a handful—but more than one million.

HIGH SCHOOL REFORM

Nationally, of 100 ninth graders, only 68 will graduate from high school on time, 38 will directly enter college, 26 are still enrolled in their sophomore year of college, and only 18 graduate from college. The rates for minority students are even lower. Only one-third of America's workforce has a postsecondary education, yet 60% of new jobs in the 21st century require it.

MATHEMATICS, SCIENCE, & PROBLEM SOLVING

According to the latest results from the Program for International Student Assessment, America's 15-year-olds performed below the international average in mathematics literacy and problem solving, placing 27th out of 39 countries.

PLTW'S MISSION

PLTW's mission is to ensure that the United States succeeds in the increasingly high-tech and high-skill global economy by partnering with middle schools and high schools to prepare students to become the most innovative and productive in the world.

STUDENT ENGAGEMENT

PLTW is able to accomplish this mission because it has broken the code on student engagement through hands-on, project-based curriculum in STEM fields. To date, more than 500,000 students in the United States have taken at least one PLTW course.

RESULTS

PLTW alumni are studying engineering and technology at colleges and universities at rates approximately five to ten times the average of all U.S. students. They also have higher retention rates in college engineering, science, and related programs than other students in these areas.

TEACHERS

Teachers play a critical role in PLTW's success with students. Since 1997, PLTW has trained approximately 13,000 teachers to teach its courses. PLTW supports teachers with an ongoing professional development model based upon its curriculum. Its Virtual Academy, a robust online resource to which teachers may turn for guidance, is also available to non-PLTW teachers.

COLLEGES & UNIVERSITIES

PLTW has relationships with more than 100 colleges and universities. Of these, 36 offer credit to students for completion of select PLTW courses.

ECONOMIC STIMULUS

Among the biggest hurdles for new schools is the ability to secure capital for classroom technology. Some states have plans to include PLTW as a "centerpiece" in ARRA Race to the Top applications.

PATHWAY TO ENGINEERING PROGRAM



Pathway To Engineering curriculum is designed as a flexible four-year sequence that will fit into any student schedule and is taught in conjunction with traditional math and science courses. The program is divided into eight rigorous, reality-based courses. Research shows that PLTW students are five times as likely as other students to choose engineering and related disciplines in college and they have a higher retention rate in postsecondary engineering, science, and related programs.

Pathway To Engineering consists of a minimum of four courses. School districts that elect to implement the high school program are required to offer students a minimum of four courses within a period of four school years. The four courses are to include the foundation courses of Introduction to Engineering Design (for New York State, Design and Drawing for Production), Principles Of Engineering, and Digital Electronics.

TIER 1 - FOUNDATION COURSES

INTRODUCTION TO ENGINEERING DESIGN (IED)

In this course, students use 3D solid modeling design software to help them design solutions to solve proposed problems. Students will learn how to document their work and communicate solutions to peers and members of the professional community. This course is designed for 9th or 10th grade students. The major focus of the IED course is to expose students to the design process, research and analysis, teamwork, communication methods, global and human impacts, engineering standards, and technical documentation.

PRINCIPLES OF ENGINEERING (POE)

This survey course of engineering exposes students to some of the major concepts they'll encounter in a postsecondary engineering course of study. Students have an opportunity to investigate engineering and high-tech careers and to develop skills and understanding of course concepts. Students employ engineering and scientific concepts in the solution of engineering design problems. They develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students also learn how to document their work and communicate their solutions to peers and members of the professional community. This course is designed for 10th or 11th grade students.

DIGITAL ELECTRONICS (DE)

This course is the study of electronic circuits that are used to process and control digital signals. Digital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, and high-definition televisions. The major focus of the DE course is to expose students to the design process of combinational and sequential logic design, teamwork, communication methods, engineering standards, and technical documentation. This course is designed for 10th or 11th grade students.

TIER 2 - SPECIALIZATION COURSES

AEROSPACE ENGINEERING (AE)

The major focus of this course is to expose students to the world of aeronautics, flight, and engineering through the fields of aeronautics, aerospace engineering, and related areas of study. Lessons engage students in engineering design problems related to aerospace information systems, astronautics, rocketry, propulsion, the physics of space science, space life sciences, the biology of space science, principles of aeronautics, structures and materials, and systems engineering. Students work in teams utilizing hands-on activities, projects, and problems and are exposed to various situations faced by aerospace engineers. In addition, students use 3D



design software to help design solutions to proposed problems. Students design intelligent vehicles to learn about documenting their project, solving problems, and communicating their solutions to their peers and members of the professional community. This course is designed for 11th or 12th grade students.

**BIOTECHNICAL
ENGINEERING (BE)**

The major focus of this course is to expose students to the diverse fields of biotechnology including biomedical engineering, biomolecular genetics, bioprocess engineering, and agricultural and environmental engineering. Lessons engage students in engineering design problems related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interface, bioprocesses, forensics, and bioethics. Students in this course apply biological and engineering concepts to design materials and processes that directly measure, repair, improve, and extend living systems. The BE course is designed for 11th or 12th grade students.

**CIVIL ENGINEERING &
ARCHITECTURE (CEA)**

The major focus of this course is completing long-term projects that involve the development of property sites. As students learn about various aspects of civil engineering and architecture, they apply what they learn to the design and development of a property. The course provides teachers and students freedom to develop the property as a simulation or to students to model the experiences that civil engineers and architects face. Students work in teams, exploring hands-on activities and projects to learn the characteristics of civil engineering and architecture. In addition, students use 3D design software to help them design solutions to solve major course projects. Students learn about documenting their project, solving problems, and communicating their solutions to their peers and members of the professional community of civil engineering and architecture. This course is designed for 11th, or 12th grade students.

**COMPUTER INTEGRATED
MANUFACTURING (CIM)**

The major focus of this course is to answer questions such as: How are things made? What processes go into creating products? Is the process for making a water bottle the same as it is for a musical instrument? How do assembly lines work? How has automation changed the face of manufacturing? As students find the answers to these questions, they learn about the history of manufacturing, a sampling of manufacturing processes, robotics, and automation. The course is built around several key concepts: computer modeling, Computer Numeric Control (CNC) equipment, Computer Aided Manufacturing (CAM) software, robotics and flexible manufacturing systems. This course is designed for 10th, 11th, or 12th grade students.

TIER 3 - CAPSTONE COURSE

**ENGINEERING DESIGN &
DEVELOPMENT (EDD)**

This capstone course allows students to design a solution to a technical problem of their choosing. They have the chance to eliminate one of the “Don’t you hate it when…” statements of the world. This is an engineering research course in which students will work in teams to research, design, test, and construct a solution to an open-ended engineering problem. The product development lifecycle and a design process are used to guide and help the team to reach a solution to the problem. The team presents and defends their solution to a panel of outside reviewers at the conclusion of the course. The EDD course allows students to apply all the skills and knowledge learned in previous Project Lead The Way courses. The use of 3D design software helps students design solutions to the problem their team has chosen. This course also engages students in time management and teamwork skills, a valuable asset to students in the future. This course is designed for 12th grade students.



ADMINISTRATOR & COUNSELOR INFORMATION

WHO SHOULD TAKE PLTW COURSES?

The high school program should be offered to students who:

- Maintain at least a 75% grade in math and science.
- Show interest in STEM (Science, Technology, Engineering, or Math) career fields.
- Display an aptitude for art and design concepts.
- Enjoy working with computers.
- Learn best in “hands-on” classes.

Students who are taking math courses such as General Math and Consumer Math, exhibiting weak math skills, or demonstrating little interest in science may experience difficulty in the PLTW program.

WHAT ARE SOME SUCCESSFUL METHODS FOR RECRUITMENT?

- Provide teachers and counselors with PLTW promotional materials to distribute to their students.
- Encourage PLTW teachers to attend and present at parent/student orientations and other district/community meetings.
- Set up window displays showing a diverse population of students involved in various types of engineering.
- Provide students the opportunity to explore engineering career fields by utilizing the resources available on the PLTW website.
- Invite parents and students to learn more about the PLTW program through the various promotional materials provided on the PLTW website.
- Involve members of the community by inviting key stakeholders to bring their expertise and guidance to the students and, in the process, enhance their support of the program.
- Use press releases to local newspapers and other media outlets in order to generate community awareness of the PLTW programs.

WHAT IS REQUIRED FOR HIGH SCHOOL CERTIFICATION?

Per the School District Agreement, the district agrees to complete the PLTW Certification process no later than the second year of each high school site’s participation in the program. Schools must undergo recertification every five years.

The certification process recognizes schools which have successfully implemented the PLTW program. It also provides an opportunity for students to apply for college credit for any of the PLTW Pathway To Engineering courses, except for the capstone course, Engineering Design and Development. The process involves three steps: a self-Assessment, a site visit, and a final certification report. ;

WHAT IS A PARTNERSHIP TEAM?

A Partnership Team is an advisory board comprised of teachers, representatives from colleges, business and industry, and other community members. This group supports the PLTW program, addresses issues arising from the implementation of the program, mentors student teams, and speaks to students about engineering and technology.

WHO SHOULD TEACH PLTW COURSES?

The school district shall recommend teachers for participation in the PLTW professional development program. Selected teachers should have a strong math background especially in algebra, geometry, trigonometry, and statistics. Engineering, math, and science teachers are prime candidates to teach PLTW courses. Be sure to check with your State Leader regarding state specific requirements.



WHAT IS A SCHOOL DISTRICT DELEGATE?

Each district office designates its own PLTW School District Delegate to be the liaison between PLTW and the entire district, including all schools implementing a PLTW program. In many districts, the Career and Technical Education (CTE) coordinator also serves as the delegate. The School District Delegate is responsible for the following:

- Verifying the accuracy and completeness of district information in the PLTW database and ensuring that all schools within the district teaching PLTW courses are registered.
- Acting as liaison between PLTW and the district superintendent's office with the processing of the School District Agreement and the school board of education approval process.
- Assisting new teachers in registering with PLTW and enrolling in a Core Training.
- Periodically managing district and school data in the PLTW database to confirm for accuracy.

WHAT IS CORE TRAINING?

Until 2009, training took place exclusively during the summer months and was referred to by PLTW as Summer Training Institute (STI). As 2009 comes to a close, Core Training will take the place of STI as the name of PLTW's professional development division, with STIs continuing to take place during the summer months. Year-round training will allow PLTW to accommodate more teachers and schools. As with STIs, Core Training is offered through our Affiliate Universities. Core Training includes intense training of the PLTW teaching model and course content. Only upon successful completion of Core Training may a teacher instruct that PLTW course. In order to register for a Core Training course, teachers must earn a score of at least 75% on a pre-assessment for that course.

SAMPLE STUDENT SCHEDULE



| GRADE 9 | GRADE 10 | GRADE 11 | GRADE 12 |
|-------------------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| English 9 1 unit | English 10 1 unit | English 11 1 unit | English 12 1 unit |
| Social Studies 9 1 unit | Social Studies 10 1 unit | Social Studies 11 1 unit | Social Studies 12 1 unit |
| Math 9 1 unit | Math 10 1 unit | Math 11 1 unit | Math 12 1 unit |
| Science 9 1 unit | Science 10 1 unit | Science 11 1 unit | Science 12 1 unit |
| Foreign Language 1 unit | Foreign Language 1 unit | Digital Electronics 1 unit | Engineering Design & Development 1 unit |
| Introduction to Engineering Design 1 unit | Principles of Engineering 1 unit | *Computer Integrated Manufacturing *Civil Engineering & Architecture *Biotechnical Engineering *Aerospace Engineering 1 unit | Health .5 unit |
| Physical Education .5 unit | Physical Education .5 unit | Physical Education .5 unit | Physical Education .5 unit |

* Any of these courses may be taken concurrently with Digital Electronics.

STEPS TO A SUCCESSFUL IMPLEMENTATION



FALL 2009

- Visit the PLTW website to learn more about the program.
- Contact your PLTW State Leader with questions or to find out more information.
- Visit schools currently implementing the program.
- For federal funding information, read Education and America's Economic Recovery: Project Lead The Way's Critical Role and Plan for Immediate Action.
- Utilize promotional materials to increase awareness about the program.
- Select a School District Delegate.
- Complete the New Program Online Registration for the school district and schools that will be implementing the PLTW program for 2010-11. Registration will open in September 2009 and will close on March 1, 2010.
- Return School District Agreement signed by the superintendent and approved by the school board, to the PLTW National Office by May 1, 2010.
- Review equipment and supply needs to create a multiyear budget.
- Send school counselors and administrators to a Counselor Conference.

SPRING 2010

- Identify teachers who meet the requirements set by PLTW and are best suited to teach the courses.
- Complete online teacher registration (once the signed school district agreement has been returned).
- Register teachers for Core Training (registration for Summer Training Institutes opens on March 15, 2010).
- Return signed Software Lease Agreement.
- Send purchase order for the appropriate software to the PTLW National Office.
- Purchase supplies and equipment using the PLTW Engineering Purchasing Manual.
- Pay the appropriate participation fee for each school according to the invoice from PLTW.

SUMMER 2010

- Teachers attend the appropriate Summer Training Institute.
- Check to make sure all equipment and supplies have been ordered.
- Load required software on classroom computers.

UNIVERSITY AFFILIATES



Arkansas Tech University
Duke University
Eastern Michigan University
Georgia Southern University
Indiana University Purdue University Indianapolis
Iowa State University
Milwaukee School of Engineering
Missouri University of Science & Technology
NHTI, Concord's Community College
New Mexico State University
Northwestern State University of Louisiana
Oklahoma State University
Old Dominion University
Oregon Institute of Technology
Penn State University
Purdue University
Rochester Institute of Technology
Rowan University
San Diego State University
Seattle University
Sinclair Community College
Stevenson University
University of Colorado at Colorado Springs
University of Illinois
University of Iowa
University of Kentucky
University of Maryland at Baltimore County
University of Minnesota
University of New Haven
University of Nebraska – Lincoln
University of South Carolina
University of Tennessee at Chattanooga
University of Texas at Tyler
West Virginia University
Wichita State University
Worcester Polytechnic Institute

PLTW PARTNERS



BUSINESS PARTNERS

Autodesk
Cengage Learning
Edgecam
Fischertechnik
Intelitek
National Instruments
Stratasys/Dimension

SPONSORS

3M
American Electric Power
Amgen
Cargill
Chevron
Intel
Lockheed Martin
Northrop Grumman
Qualcomm
Rockwell Automation
Rolls-Royce
Sprint
Time Warner Cable

EDUCATION INITIATIVES

Academy of Engineering Collaboration (AOE)
American Society for Engineering Education (ASEE)
Engineering Equity Extension Service (EEES)
Gateway Academy
NASA Goddard Space Flight Center
NASA Dryden Flight Research Center
National Council for Agricultural Education (NCAE)
Society of Manufacturing Engineers Education Foundation (SME-EF)
Southern Regional Education Board (SREB)
U.S. Army

FOUNDATIONS

Ewing Marion Kauffman Foundation
John S. and James L. Knight Foundation
Kern Family Foundation

INDUSTRY ASSOCIATIONS

Aerospace Industries Association/
National Defense Industrial Association

Project Lead The Way, Inc.
Clifton Park, NY

<http://www.pltw.org>

Copyright 2009. All rights reserved

