

SIEMENS

Ingenuity for life

Multiple industries

University of Maryland

Siemens PLM Software solutions advance engineering education and academic competition

Product

NX, Teamcenter, LMS, Femap, Tecnomatix, Fibersim, Star-CCM+

Business challenges

Employers seek student interns and recent college hires with innovative product engineering and manufacturing skills

Retirement of the aging workforce population is creating the loss of key process knowledge and skills

Employers are expecting graduating students to have a greater set of applied technology skills than in the past

Employers are expecting new hires to hit the ground running on the first day

Keys to success

In-kind software grant from Siemens PLM Software that provides students and faculty with access to advanced engineering and manufacturing software

Multidisciplinary student teams have access to leading technology that enables team collaboration

Students and graduates are better prepared to meet the demands of potential employers today and into the future

University of Maryland uses leading PLM technology to empower the next generation of engineers and scientists

Major grant to a preeminent public university

The University of Maryland (UMD) is the state's flagship university and one of the nation's preeminent public research universities. A global leader in research, entrepreneurship and innovation, the university is home to more than 37,000 students, 9,000 faculty and staff, and 250 academic programs. The university is consistently ranked among the nation's top public universities.

In 2013, the university received an in-kind software grant from product lifecycle management (PLM) specialist Siemens PLM Software with a commercial value of more than \$750 million, the largest-ever software grant to a U.S. university at the time. The grant gives students and researchers access to industry-leading PLM technology, including NX™ software for product development, LMS™ solutions for simulation and testing and Teamcenter® software for PLM.

The grant is an important component of a comprehensive partnership with Siemens PLM Software that includes student recruitment, workforce development, research and education, and collaborative activities in



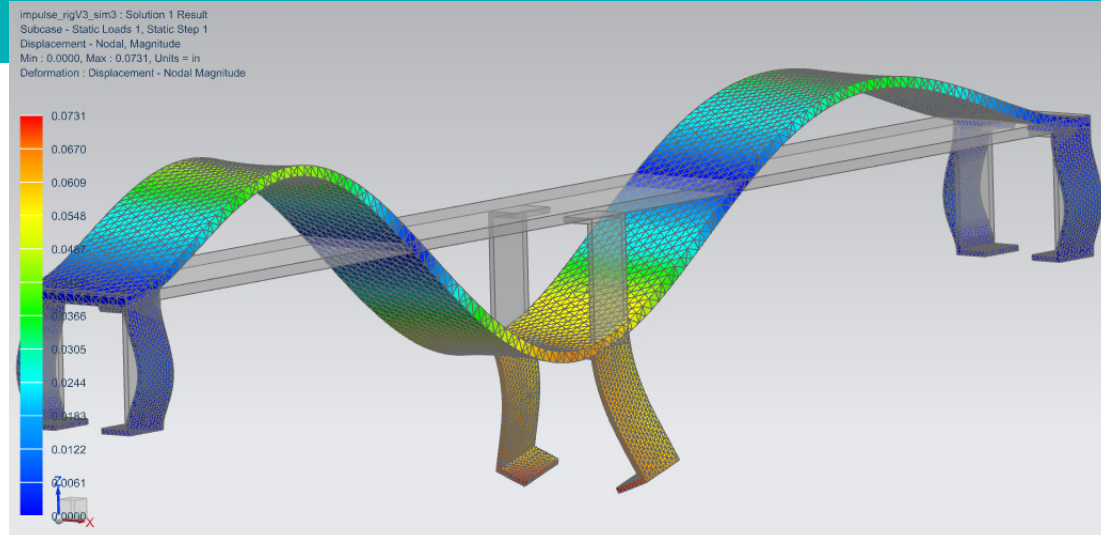
UMDLoop team testing its Hyperloop Pod at SpaceX Competition weekend, January 2017.

Results

Growing use of advanced PLM solutions in curricula

Success of student teams in competitions

Excellent job placement results, with sought-after students quickly landing advanced technology positions



UMDLoop cart for the team's dynamic test rig using NX Simulation.

energy, transportation, neuroimaging, biomedical devices, and fire safety, among other research and development areas.

The A. James Clark School of Engineering at UMD is one of the premier engineering schools in the U.S. Students and faculty of the Clark School use Siemens PLM Software technology in courses, research and competitions related to robotics design, space systems, product engineering, manufacturing, and systems lifecycle analysis.

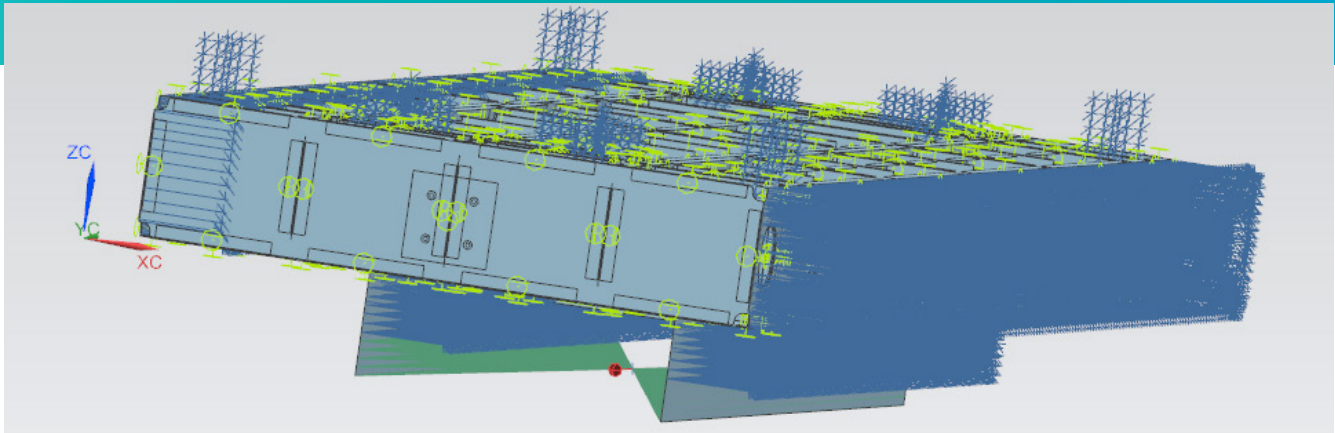
“Our in-kind grant from Siemens PLM Software gives students and faculty access to the same technology that many of our corporate partners depend on every day to develop and manufacture innovative

products in a wide variety of industries, including automotive, aerospace, biotechnology, machinery, shipbuilding, and high-tech/electronics,” says Dr. Darryll Pines, Dean and Farvardin Professor of aerospace engineering at the Clark School. “Access to the software also helps students advance their professional careers after they complete their degrees. We know that graduates with Siemens’ PLM software training are highly sought after by corporate recruiters seeking candidates for advanced technology jobs.”

Training builds proficiency

Siemens PLM Software has provided robust training for UMD faculty, staff and students. This has included week-long and short course instruction; online demos of

UMD integrates NX software into coursework and research labs in the mechanical engineering and aerospace engineering departments, including classes in computer-aided design, finite element analysis, aerospace structures and space systems design.



UMDLoop team's full frame subsystem simulation created using NX.

the Tecnomatix® portfolio, the Fibersim™ portfolio of software for composites engineering, and other modules; in-person demos by Siemens PLM Software expert users; and free Learning Advantage licenses, which provide access to self-paced training in an e-learning portal for the campus community.

PLM in engineering education

UMD integrates NX software into coursework and research labs in the mechanical engineering and aerospace engineering departments, including classes in computer-aided design, finite element analysis, aerospace structures and space systems design.

Students enrolled in aerospace engineering space systems design courses have utilized Siemens PLM Software technology to create award-winning designs, including "200kW/500kW Solar-electric Modular Flexible Kinetic Escort" or SMO-FLaKE, the first runner-up in NASA's 2017 "BIG Idea" Engineering Design Competition. Other designs have taken top honors at NASA's annual RoboOps and Revolutionary Aerospace Systems Concepts-Academic Linkages (RASC-AL) engineering design competitions.

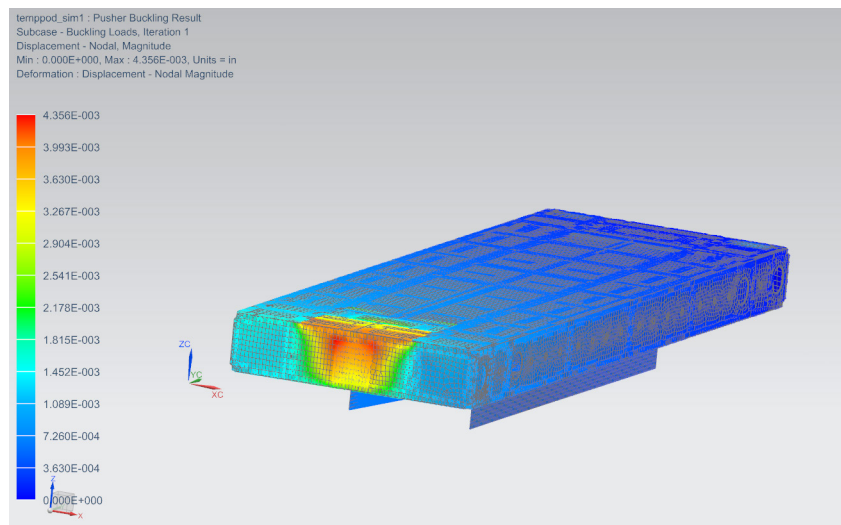
Offered for credit in the Department of Mechanical Engineering, UMD's top-ranked Terps Racing Formula SAE Team uses NX™ software, Teamcenter® software, LMS™ software and Star-CCM+ software to help

develop new automotive designs each school year. The SAE International Formula program is an engineering student design competition providing participants with the opportunity to enhance their engineering design and project management skills by applying learned classroom theories in a challenging real-world competition.

Furthermore, the world-renowned Glenn L. Martin Wind Tunnel utilizes NX and Star-CCM+ software to develop and test student and faculty vehicle designs, furthering UMD's leadership in aerospace education and research.

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Dr. Darryll Pines
Dean and Farvardin Professor
of Aerospace Engineering
A. James Clark School of
Engineering
University of Maryland



UMDLoop team's full frame subsystem simulation after it has been run through the NASTRAN buckling solver.

Advanced technology of Siemens PLM Software supports student competitions

Student groups use the software in co- and extracurricular national and international competitions. Student teams include the Robotics@Maryland Club, competing in the RoboSub competition sponsored by the Association for Unmanned Vehicle Systems International (AUVSI) Foundation and the Office of Naval Research (ONR); the NASA design competition teams; the Terps Racing Formula SAE competition team; and UMDLoop, a team competing in SpaceX Hyperloop pod design competitions.

The UMD Hyperloop team (UMDLoop) used Siemens PLM Software solutions in developing its prototype Hyperloop pod named Prometheus that won the Performance in Operations Award and placed in the top five for overall pod design at the January 2017 SpaceX Hyperloop Pod Competition held in Hawthorne, California. The competition is intended to advance the Hyperloop concept for a new form of transportation in which passenger-carrying pods travel between cities through aboveground tubes at very high speeds.

UMDLoop comprises more than 60 undergraduate students with backgrounds in engineering, physics, computer science and other disciplines who average more than 40 hours per week outside of class to assist with the project. The team joined more than 120 others from around the world to showcase their designs at Hyperloop Design Weekend in January 2016, and was one of only 30 teams selected for the next round of competition in January 2017. The Prometheus design, developed using NX and LMS software, uses only passive magnetic levitation for control and braking. A chainmail braking system distinguishes the design from those of other teams, and an innovative multilink suspension system provides a comfortable ride.

After considering many alternatives, the team settled on the chainmail braking system, which consists of multiple magnetic arrays that can be moved with a pneumatic cylinder toward and away from the track's I-beam to vary the braking force. The suspension system houses the control and levitation system and dampens vibration forces.

“By integrating NX into our team, we have improved our overall design, build and test experience.”

Kyle Kaplan
Team Captain, UMDLoop
University of Maryland

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Solutions/Services

NX

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Star-CCM+

www.siemens.com/mdx

Customer's primary business

The University of Maryland's A. James Clark School of Engineering is one of the premier engineering schools in the U.S., with graduate and undergraduate education programs ranked in or near the top 20 in the U.S. The school, which offers 13 graduate programs and 12 undergraduate programs, including degree and certification programs tailored for working professionals, serves more than 6,000 undergraduate and graduate students annually and is home to one of the most vibrant research programs in the country.

www.eng.umd.edu

Customer location

College Park, Maryland
USA

"NX has been an unbelievably powerful tool for our team," says Kyle Kaplan, team captain of UMDLoop. "It has given us fantastic flexibility in our design through the use of expressions and WAVE geometry linking, while simultaneously being customizable and user-friendly. By integrating NX into our team, we have improved our overall design, build and test experience. NX has given us the tools we need to be a competitive Hyperloop team."

The team made extensive use of NX Nastran® software to simulate the performance of the Prometheus design. In one example, a linear static simulation was conducted on the structural frame of the pod to determine the maximum displacement with load coming from the levitation and control system. The simulation was useful in determining which components of the frame needed more rigidity to operate as safely and efficiently as possible.

Building on the enthusiasm and engineering achievements of this competition, SpaceX will host a second competition weekend during the summer of 2017. The UMD team will be there with a redesigned pod, Nemesis.

Plans for the future

The Clark School of Engineering used the Teamcenter portfolio Rapid Start configuration, which delivers the world's most widely implemented product data management (PDM) solution, preconfigured to utilize the most common industry best practices and the expertise of Siemens PLM Software. It also worked with PLM consultancy Piterion to set up Teamcenter for use by the UMDLoop Team. Going forward, the Clark School will engage Piterion to create a platform tailored to other teams and courses, including the Robotics@Maryland Team and UMD's Department of Energy (DOE) Solar Decathlon Team.

The Clark School also recently requested and received licenses of Femap™ software for use in analysis coursework, and is planning to introduce the Tecnomatix portfolio of digital manufacturing solutions in future mechanical engineering capstone design courses and space systems design courses. The use of Star-CCM+ is also growing at UMD, assisting faculty and students with their computational fluid dynamics analyses.

"NX has been an unbelievably powerful tool for our team."

Kyle Kaplan
Team Captain, UMDLoop
University of Maryland

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