PLM Used by Students to Build F1 Car

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Engineering students use Siemens' PLM software to collaborate with their counterparts around the world to design and build a Formula One racing car

Brigham Young University (BYU) gives engineering students an opportunity that only a few other schools can match – the ability to experience, in the classroom, the kind of global product development collaboration they will encounter after they graduate. This opportunity is made possible by the university’s participation in the Partners for the Advancement of Collaborative Engineering Education (PACE) program, a first-of-its-kind partnership between the corporate and academic sectors that uses commercial product lifecycle management (PLM) software to conceptualize and develop a product, in this case an automobile.

Specifically, students in the PACE program collaborated with their counterparts around the world to design, manufacture and assemble a racecar to Formula One specifications – all in one academic year. The scope of the project is huge: 20 universities, 200 students, 24 faculty, four continents, 16 time zones and seven languages. And the time frame of one year is highly ambitious. “Some would say it’s impossible,” says Dr. C. Greg Jensen, professor, Department of Mechanical Engineering at BYU and coordinator of the project.

And yet it happens, and in addition to the satisfaction of seeing something as concrete as a racecar at the end of the year-long project, students experience the challenges and rewards of the global nature of today’s product development. “The intent is that this is a collaborative project that emulates how a major automotive OEM like General Motors works with its operations all over the world,” explains Jensen. “This way, students learn how to deal with situations they will encounter when they graduate, such as the exchange of engineering and manufacturing information that must bridge cultural and time zone differences.”

Co-sponsors of the PACE program include Siemens PLM Software, General Motors (GM), EDS and Sun Microsystems. Siemens PLM Software’s role has been to enable the global

communication and information management required by the PACE program, which it has done by providing Teamcenter® digital lifecycle management software to participating universities. Siemens also supplies the digital product design solutions, NX™ and Solid Edge® software, to PACE participants.

The design effort

The PACE universities in this project are located in Germany, Korea, Canada, Mexico, India, United States, China, Sweden and Brazil. At the beginning of the academic year, each university receives its assignment from Jensen, which is typically to design and build one of the racecar’s subsystems (such as front or rear suspension, outer shell, exhaust system, brake system, fuel system and so on). All the parts are eventually shipped to BYU where the car is assembled during the summer.

“This works because we build the car virtually in NX,” says Jensen. “That allows us to find interference problems before cutting metal or laying up composites.” The students use the advanced simulation functionality within NX to perform stress and kinematics analyses of their designs. They also use the NX data in other analysis programs such as Fluent (to evaluate the aerodynamics of the outer shell) and ADAMS (to predict how tires ride or how a suspension handles, for example).

The collaboration platform

While NX enables a virtual mockup of the car, the other critical aspect of the PACE project is the collaboration platform, Teamcenter. Because each team’s work must be integrated with that of many others to build the car, students must share and manage their NX models. They must also communicate with each other directly from time to time. This is where Teamcenter comes in. The PACE program relies on Teamcenter’s engineering process management functionality to manage all of the design and analysis data for the project, and uses Teamcenter’s community collaboration capabilities to facilitate communication.

“Teamcenter provides a central repository for information as well as a collaborative work environment where we can share component designs and discuss work in process in real-time via the internet,” Jensen says. “This way, schools don’t incur the costly expense of international telephone and travel.Without the Teamcenter PLM technology, a project of this scope would be cost-prohibitive in the academic sector.”

Using a centralized Teamcenter collaboration system to store ideas and information eliminates some of the challenges posed by the time differences between the various schools’ locations. Students access information when and where they need it. Teamcenter’s ease of use has

been a welcome feature in that regard. “Teamcenter simplified the learning curve of a PLM system by offering a familiar Windows desktop environment,” Jensen notes.

In addition, Teamcenter facilitates information re-use, helping make the ambitious one-year timeframe possible. Jensen points out, “The project is set up so that students design and build a new Formula One car three years in a row. Teamcenter lets us capture lessons learned so that students can benefit from it. There’s less likelihood that a team will follow a dead-end, and they can move more quickly into a final design.”

Over the past two academic years (2006-2007 and 2007-2008), PACE students have designed, analyzed and built two racecars. “GM was amazed at the quantity and quality of virtual design and analyses work done during the first two years of this three-year collaboration project, and they were impressed with how well the finished cars came together,” Jensen says. This year’s racecar is being shipped to Korea for testing at the GM Daewoo facility. During the 2008-2009 academic year, PACE students will use the Teamcenter PLM suite of tools to refine and correct any problems identified by GM Daewoo that would prevent this racecar from qualifying for a November 2009 time trial. Teamcenter will be used to release the new or modified designs to particular PACE schools so their students can make the physical parts or modifications to existing parts for a scheduled reassembly of the final car in the spring/summer of 2009. “This project and its success is a tribute to Siemens’ PLM technologies,” Jensen says.