

Auburn University Formula SAE

Using Solid Edge, Auburn University's Formula SAE Team earns its best finish in an international competition; multiple awards received

Product

Solid Edge

Business challenges

Comprehensive vehicle development

Aggressive deadline

50 percent yearly turnover of design team

Keys to success

Easy-to-use CAD that enables self-teaching

Collaboration between Powertrain and Chassis groups

Results

Space frame reduction of 10 lbs., with 65 percent gain in torsional stiffness

2nd place finish overall in 2013 Formula SAE race in Lincoln, Nebraska

2nd place in Autocross, 3rd place in Acceleration and 4th place in Design

Real-world automotive engineering experience before graduation

Team reduces space frame weight by 10 lbs., with 65 percent gain in torsional stiffness

The unique challenge of FSAE

In addition to a rich history of winning football teams, students at Auburn University can be proud of its success in the automotive sports world, with a best-ever team finish in 2013. The Auburn Formula SAE team combined design, manufacturing, teamwork and ingenuity to place second at the Formula SAE race in Lincoln, Nebraska.

The unique challenge of FSAE is that it is an educational project with a motorsports timeline. The student team has effectively three months to design every part of the

car, and roughly half of Auburn's designers this year are returning freshmen with no computer-aided design (CAD) experience. Every part on the car must be modeled, down to each nut and bolt. Under these time constraints, a significant number of the vehicle's parts must be drawn, analyzed, and then iterated to find the optimum part. Moreover, weight reduction to improve speed is one of the driving forces in achieving a competitive advantage.

Two groups

The car design is handled by two groups. A Powertrain group, led by a chief engineer, has six section leaders in charge of designing specific parts of the car. These sections include engine internals, intake, exhaust, electronics, fluids and drivetrain. The Chassis group, also led by a chief



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Jimmy Gordon
Mechanical Engineering Student
Lead Electronics Designer – FSAE Team
Auburn University



engineer, includes eight sections: frame, suspension kinematics, brake, tire dynamics, structure/wheel sets, wheel research and development (R&D), and ergonomics.

“Data integration, the ability to share information and cross-team collaboration are critical to success,” notes Andrew Rains, a Marketing major in the School of Business at Auburn and the FSAE team captain.

Self-taught

“Roughly half of our designers this year are incoming sophomores with no CAD experience,” says Dr. Peter Jones, Woltosz Professor of Mechanical Engineering and War Eagle Motorsports Faculty Advisor, Auburn University. “Auburn’s needs center around a CAD package that is easy to use and provides significant design flexibility,

so that we can create the complex models that are required. Over the past 10 years, Solid Edge has fit those needs.”

Students, upon entering the program, are expected to learn how to use the design tools on their own. The use of Solid Edge® software makes that easy through an especially user-friendly interface and excellent tutorials. “A prime example of this is my use of the software’s Frame capability,” comments Kurt Wagner, a mechanical engineering student at Auburn and chassis chief engineer on the FSAE team, “With Frame, I was able to use both fully constrained sketches and Express Route to define the paths of the tubes. I created a library of our tubing sizes and rapidly iterated frame tube thickness and placement to optimize the stiffness of the structure.

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In total, we reduced the space frame by 10 pounds (lbs.) while gaining 65 percent torsional stiffness.”

Rains notes, “Solid Edge gave us the CAD resources we needed to develop a highly sophisticated racing machine. The user-friendly interface of Solid Edge made it easy for us to fully engage new team members on the software, while also giving our more experienced team members the tools they needed to lower the car’s center of gravity, and decrease the overall mass.”

Jimmy Gordon, a mechanical engineering student at Auburn and lead electronics designer on the FSAE team, adds, “Using Solid Edge is a straightforward design process, and it’s easy to get your head around. It just makes sense!”

Best finish in an international competition

Auburn Formula SAE returned home from Formula SAE Lincoln bearing a slightly heavier load than when the team departed from Auburn. This time, added weight was a welcome addition. The team captured three trophies, including a very large trophy for Auburn’s best finish in an international competition: second-place overall. Other awards included second-place in Autocross and third-place in Acceleration. The team was also recognized with fourth-place honors in Design, a critical component to its overall success at the competition.

“Our use of Solid Edge, with its user-friendly platform, allows us to easily understand what we’re doing in CAD,” says Rains. “Solid Edge played a huge role in our design success, as it gave us the tools to conceptualize and understand the systems that we’re developing to make the car faster.”

Rains adds, “Even though Auburn was a young team lacking experience, to finish fourth in Design, the most knowledge-heavy event, was huge. I’m so proud of the guys who had to put in a lot of time to gain the insight to be competitive in this domain.”

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Kurt Wagner
Mechanical Engineering Student
Lead Chassis Engineer – FSAE Team
Auburn University

“Solid Edge is a crucial puzzle piece in our design and manufacturing process!”

Andrew Rains
Marketing Student
Team Captain – FSAE Team
Auburn University



The process

There were 80 registered teams for the Lincoln race. After the initial selection process was completed, the Auburn team was chosen as one of the top six teams. These teams were then put through an intensive interview process by industry professionals who questioned individual team members, asking for specifics about the quantitative research behind vehicle strategy, why certain materials were chosen, details about the engineering process, and more.

“The use of Solid Edge contributed to the team’s success by enabling students to make quick design decisions and modifications,” says Rains. “Teams with a good

understanding of the car typically do better because they are able to translate their design ideas into a quantifiable model, realizing engineering initiatives and design ideas that fit their goals. The use of Solid Edge accelerates this process, enabling us to bring innovative concepts to bear that are practical and usable.”

Chip Stallings, a mechanical engineering student at Auburn and lead suspension designer on the FSAE team, notes, “The personal support we receive from Siemens PLM Software is awesome. Solid Edge is simply the standard for all CAD to me.”

The competition

FSAE Lincoln began on a Wednesday in mid-June with the Technical Inspection. The team quickly resolved an unexpected challenge and proceeded to the noise and brake test. The team then completed the Cost, Presentation and Design events. Throughout the competition, the team remained poised and resolved to finish well. Rains points out, “The team realized a

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Chip Stallings
Mechanical Engineering Student
Lead Suspension Designer – FSAE Team
Auburn University

Solutions/Services

Solid Edge
www.siemens.com/solidedge

Customer's primary business

Founded in 1996 and improving every year, Auburn University Formula SAE continues to produce outstanding engineers year after year that achieve success in engineering professionally.
www.eng.auburn.edu/organizations/SAE/AUFSAE/

Customer location

Auburn
Alabama

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series of incredible successes on the track, including a fifth-place finish in the Endurance event, third in the Acceleration event, and an outstanding 2nd place finish in the Autocross event!"

New goals

The 2013-2014 season is now underway, and a new car design has just been completed. Moreover, the Auburn FSAE team has set more aggressive goals for the new season. With excellent software tools in place, strong collaborative dynamics and a great confidence-builder in its last competition, the team is looking forward to racing in the summer of 2014 at an international FSAE competition in Hockenheim, Germany.

The team has been busy transitioning from design to build. Many key activities have already begun or even been completed, including torsion testing of the Yamaha R6 power plant, and checking the strength

of the carbon-fiber A-arms. Both of these tests provide critical information as the car is being built.

Each section leader is now delegating tasks to new team members to allow components to be completed by the set deadlines. Team members are learning critical engineering and leadership skills as they work with others to develop the best parts possible for the 2014 vehicle.

Rains concludes, "We've really enjoyed working with the Siemens PLM Software team and using Solid Edge for various projects. It's been a very beneficial relationship, and we are especially pleased with the brilliant new software release for designing our 2014 racecar. Solid Edge is a crucial puzzle piece in our design and manufacturing process! With Solid Edge, we continue to improve our performance each year."

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