ISTANBUL TECHNICAL UNIVERSITY SOLAR BOAT TEAM

Powering a world-class solar boat design team with SolidWorks solutions

Using SolidWorks Education Edition, SolidWorks Simulation, and SolidWorks Flow Simulation software, the Istanbul Technical University Solar Boat Team has become one of the world's most successful competitive student solar boat teams.

With Turkey's long maritime history, it's only natural that Istanbul Technical University (ITU) would produce one of the world's most successful student solar boat teams. The ITU team has placed among the top three finalists every year that it has competed at the ASME (American Society of Mechanical Engineers) International SOLAR SPLASH®, the world championship of intercollegiate solar/electric boating. The ITU team's innovative designs have garnered special recognition—including the Hottest Looking Boat, Most Commercially Viable Hull, and Design Achievement awards—as well as multiple Outstanding System Design honors.

When Munir Cansin Ozden, an ITU graduate student who is currently working on a propeller project for the Turkish Navy, founded the ITU Solar Boat Team, he was researching model boats for undergraduate naval architecture studies. Ozden led the ITU team to its first SOLAR SPLASH appearance in 2007 and now serves as a graduate advisor. He believes that the competition provides valuable experience for team members from ITU's naval architecture, mechanical engineering, industrial design, and electrical engineering programs.

Ozden recognized that the team would need 3D design and simulation tools to refine design concepts, eliminate costly prototyping, and facilitate communications. The ITU Solar Boat Team standardized on the SolidWorks® Education Edition 3D CAD platform.

"Before we established our team, SolidWorks was not very well known at the university," Ozden recalls. "Today, it has become such an important part of our effort that the first question we ask someone who wants to join the team is: 'How well do you know SolidWorks?' Students see our design and rendering capabilities and want to learn SolidWorks, so we've produced some educational videos to help them become familiar with the program. Additional tutorials and videos are available online. Because SolidWorks is easy to learn and use, it has helped accelerate the contributions of new team members."

In 2011, the team acquired SolidWorks Simulation analysis and SolidWorks Flow Simulation computational fluid dynamics (CFD) analysis software. "We simply don't have the funding to build and test multiple prototypes," Ozden notes. "SolidWorks Simulation enables us to explore innovative design concepts more efficiently and affordably."

Challenge:

Build a solar boat design team—bringing together naval architecture, mechanical engineering, industrial design, and electrical engineering students—to successfully participate in international design competitions.

Solution:

Implement SolidWorks Education Edition design, SolidWorks Simulation analysis, and SolidWorks Flow Simulation computational fluid dynamics (CFD) analysis software to efficiently and cost-effectively develop solar-powered boats.

Results:

- Shortened research and development cycle from 20 months to one month
- Cut prototyping costs by 66 percent
- Accelerated contributions of new team members
- Won multiple competition-related design awards

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Integrating a multidisciplinary effort

The ITU Solar Boat Team is a multidisciplinary effort, requiring the contributions of naval architects, mechanical engineers, industrial designers, and electrical engineers. SolidWorks software plays an important role by providing team members with a common design visualization environment.

"SolidWorks enables team members to fully visualize the design," Ozden stresses. "Weight is a critical design issue. While a mechanical engineer is interested in structural stresses and the positioning of the drivetrain, a naval architect focuses on hydrodynamics—balancing weight for stability and maneuverability—which affects how electrical engineers position solar cells, batteries, circuits, and motors. We all have to work together, and SolidWorks facilitates this process. In one instance, SolidWorks animations allowed us to understand how we could let our batteries slide from side to side with the motion of the boat to improve performance."

Simulating fluids and structures

Using SolidWorks structural and fluid-flow analysis, the ITU Solar Boat Team can quickly and cost-effectively refine design concepts, enabling the team to explore novel hull concepts and introduce design innovations. For example, the hull design on the 2011 boat placed an air cavity under the boat into which the motors pumped air bubbles to create a cushion of air, resulting in less drag and a faster boat.

"We can't afford to build prototypes, so we develop many design concepts," Ozden explains. "We then use simulation tools to select the best concept and refine it. On the air cavity design, we would run a simulation, pinpoint a problem, change the surface geometry, then re-run the simulation. With this iterative process, we were able to improve our design without incurring the cost of building and testing prototypes."

Cutting costs and shortening design cycles

With SolidWorks design and analysis tools, ITU's Solar Boat Team was able to condense what would ordinarily have been a 20-month research and development cycle to create the air-cavity hull design down to just one month. Simulation enabled the team to avoid extensive model production and towing tank tests, and cut boat development costs by 66 percent. Ozden attributes much of these savings to the ability to simulate performance and make design modifications quickly and easily.

"The surfacing tools in SolidWorks are a big advantage," Ozden points out. "It is very easy to generate surfaces in SolidWorks, simulate performance, identify issues (e.g., pressure increases), and modify the surface. There are other surfacing programs but none that let you simulate and modify in a single design environment."

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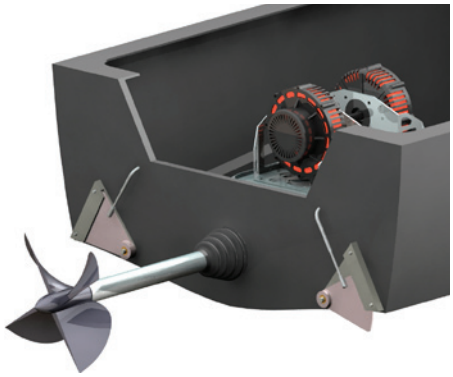
Munir Cansin Ozden
Founder and Graduate Advisor



The combination of SolidWorks surfacing tools and simulation capabilities enables the Istanbul Technical University Solar Boat Team to create innovative boat designs efficiently and cost-effectively.

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