

A Next-Generation Competition Prepares Students to Tackle Today's Challenges

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To help students learn about advanced process technology and to prepare students to tackle grand societal challenges in their careers, the RAPID Manufacturing Institute has launched an exciting undergraduate student competition called ChemE Cube™. Teams of undergraduate students must design, build, and operate a chemical process that solves a real-world problem, utilizing modular chemical process intensification (MCPI) concepts.

What is ChemE Cube? The ChemE Cube competition prepares students for the workforce by providing them with the opportunity to participate in an innovative, team-oriented, hands-on design project to develop a chemical process that fits in a one-foot cube. Students are expected to:

- solve a real-world problem by designing a process using creative chemical engineering solutions
- demonstrate the ability to safely build and operate a complete chemical process (*i.e.*, reaction and/or separation) at a small scale using advanced manufacturing and intensified process technologies.
- calculate and clearly communicate how the process could be numbered-up to meet required product demand and pitch the product/technology to a panel of industry judges
- display a commitment to the competition's core values of teamwork, creativity, innovation, sustainable development, and diversity and inclusion (teams are encouraged to recruit students from a variety of majors and disciplines).

How does the ChemE Cube competition work? Each year, a competition problem statement is released by RAPID, which defines the business objective, required cube output, and process requirements. The release of the problem statement is the kickoff of the competition. Students then have approximately ten months to collaborate with team members from their universities to design, build, and test their cubes.

The in-person competition takes place during the AIChE Annual Student Conference and consists of three elements:

- The Ad — Teams must prepare a three-to-five-minute video prior to the competition that is concise and engaging. The ad should communicate the technical approach and highlight innovative or intensified elements of their process.

- The Pitch — Teams have 20 minutes to pitch their process to a panel of industry judges, similar in style to the TV show *Shark Tank*. The pitch should include elements such as profitability, market analysis, competitive advantage, financing required to bring the technology to market, and the value proposition to the customer — just as a start-up company formed to commercialize the cube's technology would present to potential investors. Judges score the pitch on specific criteria, and each judge has a mock \$1 million to invest in the start-up companies. The team who earns the most investment dollars receives the ChemE Cube Entrepreneur Award.

- The Cube — Each team must run their process in a head-to-head arena against another team. Cubes are judged and scored based on measurable criteria that are defined in the annual problem statement. Potential scoring criteria include weight, energy consumption, throughput, waste generation, and product purity. For example, a cube that weighs less than its competitor might be awarded extra points.

Modular, on-demand water purification. At the 2021 AIChE Annual Student Conference, five teams will compete in the first ChemE Cube competition. Students from North Carolina State Univ., the Univ. of Delaware, Carnegie Mellon Univ., the Univ. of Pittsburgh, and Missouri Univ. of Science and Technology have been working since January to safely design, build, and test cubes that perform modular, on-demand water purification for potential application in regions lacking access to clean drinking water.

This competition focuses specifically on drinking water, as it requires the highest purity and is the most basic need. Each one-foot cube should be able to purify 25 L of surface water per day, meet the relevant drinking water standards, and cost no more than \$1,500 for a first-of-a-kind prototype.

Get involved with ChemE Cube. RAPID is accepting volunteers to serve as cube output analysts, safety inspectors, pitch judges, and poster judges at the pilot competition in Boston on Nov. 8. Faculty or students interested in participating in a future competition can sign up online to receive notifications. In addition, sponsorship opportunities are available for companies interested in helping to prepare the future workforce. To learn more or volunteer, visit www.aiche.org/chemecube or email ChemECube@aiche.org.

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► This prototype ChemE Cube, designed and built by RAPID intern Seth Ricketts, performs a mixing process.

Thanks to former RAPID CTO Paul Yelvington and RAPID intern Seth Ricketts for their significant work in creating the ChemE Cube competition and developing the 2021 competition problem statement.