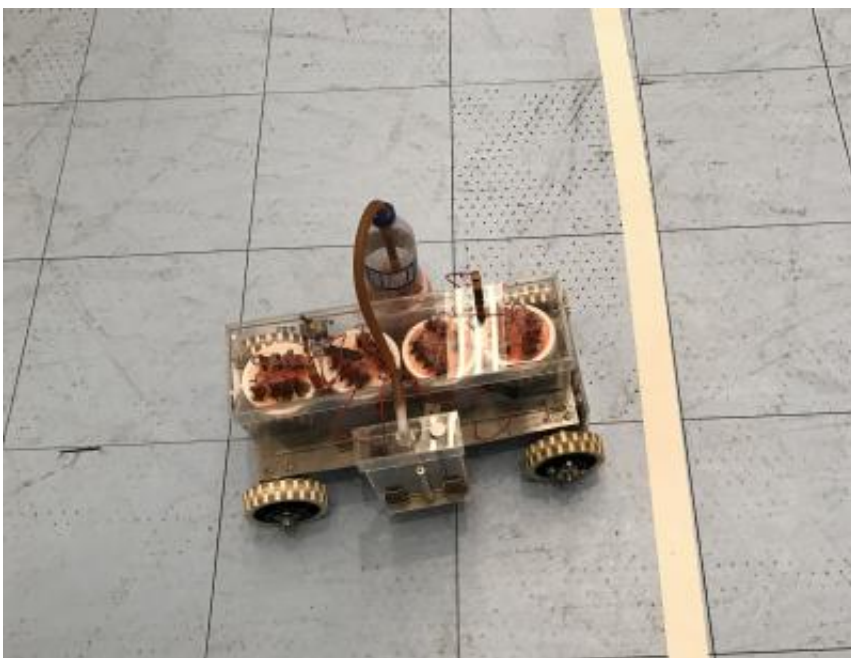


# NJIT's 'Lead Tank' motors to a medal at the Chem-E-Car Championship

December 23 2016, by Tracey Regan

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Credit: New Jersey Institute of Technology

The "Lead Tank," a 25-pound driverless car with an intimidating name and an intricate timing mechanism, made NJIT history by medaling for the first time in the championship round of the Chem-E-Car Competition, held in San Francisco in November. In clinching third place, the shoe-box sized roadster edged out nearly 40 of the best teams from around the world.

As it stopped 14 centimeters shy of perfection - the finish line - its creators gave way to whoops of delight. The team's co-captain, Michelle Vazquez '17, of Santa Fe Springs, Calif., noted that her cell phone recording of the Lead Tank's run began gyrating wildly as the car trundled up to the finish line, a piece of tape stretched across a ballroom floor at the Hilton Hotel at Union Square.

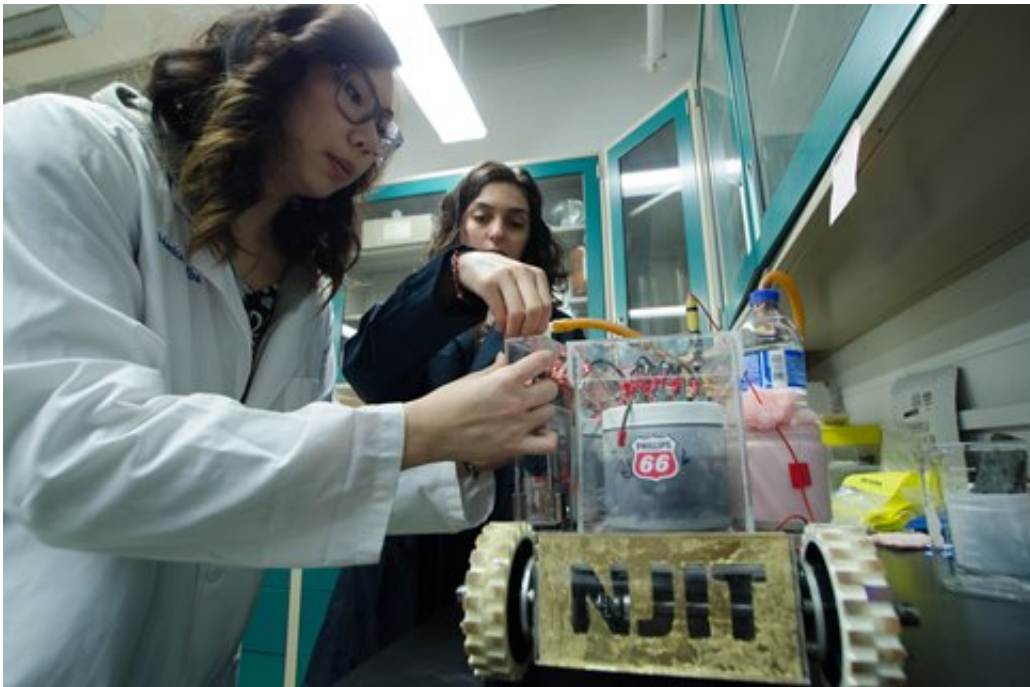
"That's because I was jumping and screaming and waving my arms," she laughed.

The competition, held by the American Institute of Chemical Engineers (AIChE), pitted NJIT's team against top engineering schools, such as Cornell, the University of Michigan, Carnegie-Mellon University and Virginia Tech. Universities in Hong Kong, Poland, Columbia and Korea, among nine international entries this year, all sent their best.

The car that comes closest to the finish line before shutting itself off is proclaimed the winner. Each team gets two attempts.

The Lead Tank, made of transparent Lucite and powered by chemical reactions and complex on-board electrical circuitry, features a lead-acid battery and a strip of magnesium at the core of its timing element, both designed and built in a laboratory in NJIT's Tiernan Hall. Just before the race, the team learned how far the car had to travel - 17.1 meters - and how much water weight it had to carry - 150 milliliters. They set their concentration of [hydrochloric acid](#), which reacts with the magnesium strip timer to dissolve it - breaking the circuit and stopping the car - at exactly the right time.

"It's not about speed, but all about the calculations," Monica Torralba '17, president of NJIT's AIChE student chapter and a member of the team, noted earlier this year. To be precise, the car drives about .23 meters per second.



Credit: New Jersey Institute of Technology

"Our timing mechanism is pretty unique," offered Brody Frees '17, of Hopatcong.

As they've repeated dozens of times, NJIT's team "driver" at the competition pushed down a plunger in the timer box, raising the level of hydrochloric acid so that it would react with the magnesium strip, and turned a switch to start the car, completing the circuit between the battery and the timer, thus supplying power to the motor.

But despite their confidence - and months of practice - the team got off to a harrowing start in the first round. The car shot several meters past the finish line, landing NJIT in 19th place - and a quandary. "It was nerve wracking - we didn't know what went wrong," recalled Thomas Reardon '17, of Lincoln Park. And so they huddled.

"It all came down to a group decision about what change to make to the hydrochloric acid concentration in our timing mechanism," Reardon added. "We decided to make it slightly stronger - one-quarter of a milliliter of hydrochloric acid - so that it would break the magnesium strip earlier."

"This is a difference so small that an error can occur when pouring," commented Nick Gorlewski '17, of Old Bridge, who helped with the calculations.

And then there was the agonizing wait as they watched the 18 teams that had bested them in the first round make their runs. "There was praying - and some tears, mostly internal," revealed co-captain Sohui Park '17, of Little Ferry.

The difference in the degree of competition between the regional and championship round can be summed up in a single centimeter, Reardon said, noting, "The second-place winner, Georgia Tech, finished 13 centimeters from the finish line." KAIST, from South Korea, took first place.



Credit: New Jersey Institute of Technology

What powered the Lead Tank to NJIT history?

Reginald Tomkins, a professor of chemical engineering and a co-adviser of the team along with Angelo Perna, also a chemical engineering professor, cited practice and rigorous self-scrutiny. He noted that the team spent the months between the rounds redesigning elements of the car, including the lead plates in the battery, to make it more efficient and powerful.

But he felt another element played a crucial role - team dynamics.

"There have been years when an individual really takes on the project, but this time there was a good working team," he said of the crew, which

won the Saul K. Fenster Innovation in Design Award at NJIT's 2016 Salute to Engineering Excellence.

Can their successors recreate the magic next year? Optimism is high.

"The new members of the club had lots of hands-on experience. They helped build the battery that won third place," Vazquez said.

Provided by New Jersey Institute of Technology

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