

# Los Angeles Times

## RoboFlops No Match for Teenage Girl

The 17-year-old beats three robotic arms at arm-wrestling in San Diego. Disappointed creators still upbeat about machines' future.

March 8, 2005

By Jia-Rui Chong, Times Staff Writer

SAN DIEGO — It wasn't exactly "Terminator 3: Rise of the Machines."

For the first time, robotic arms powered with plastic muscles took on a human competitor Monday. The 17-year-old high school student who described herself as a "weakling" beat all three robot arms handily.

"I was hoping we could have a win, but that didn't happen," said Yoseph Bar-Cohen, an expert on responsive plastics who organized the challenge. "We need to do a little more homework."

Still, Bar-Cohen, an ebullient physicist from NASA's Jet Propulsion Laboratory in La Cañada Flintridge, could not help but be positive. When he issued the challenge to scientists six years ago to build an artificial arm that could match a human one, he thought that the technology would take 20 years to develop.

"It's incredible how far we've come," he said. "A human being could run faster than the first car. Try that now."



(Robert Lachman / LAT)

The man-versus-machine showdown occurred at a symposium of the International Society for Optical Engineers on "smart structures," held at a San Diego convention center. Three groups, from New Mexico, Virginia and Switzerland, rose to Bar-Cohen's challenge.

The JPL scientist chaired a section of the symposium on "electroactive polymers," which are flexible plastics that change shape when charged electrically. One technique scientists use to move the plastics relies on ions in the material, the physicist said. A

faster method energizes electrons.

Bar-Cohen envisioned myriad uses: lightweight prosthetic arms, heart valves or Mars rovers that could climb over ledges like monkeys.

"You have to ask whether science fiction drives reality, or reality drives science fiction," he said.

The robots' opponent at the symposium, Panna Felsen, is a senior at La Costa Canyon High School in La Costa, Calif., who has participated in student robotics competitions since middle school. The first robot that she and teammates created had stacked cups on top of its body, which was made of Legos.

Before the match, Felsen said that the robots had a good chance of beating her.

"I'm not very strong," she said. But two visitors who held world titles in arm-wrestling stood by to give advice: Lean in with your body, stand on your toes, they said.

She struggled a little against the first robotic arm, which was built by Environmental Robots Inc., an Albuquerque firm. Mohsen Shahinpoor, the company's chief scientist, said the robot's arm was powered by a row of eight ionic polymer muscles. Each consisted of a long, slender core muscle with a flat muscle wrapped like a candy-cane stripe around it.

Since the arm had only a nub for a wrist, Felsen had to adjust her grip. When the match began, she and the robot locked in the middle for a few seconds. Felsen leaned harder into the robot and downed the arm in 24 seconds.

"My arm is kind of tired," she said afterward. "It felt like just a really strong spring or something."

The other matches were quicker. Felsen took four seconds to down an arm made by the materials testing and research group at a Swiss federal laboratory in Dubendorf, Switzerland.

"Arm" was interpreted loosely by this group, which used a large black box (the shoulder), a black rod for the arm and a ball for the hand.

"It's the same movement as arm-wrestling," said group leader Gabor Kovacs. "You do not fight with your arm, you fight with your thorax."

The black box contained about 220 spongy, sausage-shaped muscles. Each used acrylic film wrapped around a metal coil. The energy to activate the coils could electrocute a person if something went wrong, said scientist Lukas Kessler, 26, who put a rubber glove on Felsen's hand.

"I wanted to be 300% sure," he said. "This has 4,000 volts. It's dangerous."

Felsen also had to don safety gear for her third opponent, an arm made by seniors at Virginia Tech as part of their senior project for engineering science and mechanics.

The project used hydrochloric acid to contract synthetic fibers in an acrylic tube. The material came from a textile maker in Japan, who used the fibers to make artificial silk, said Steve Deso, 21. The students baked and boiled the fibers until they had something with the color and consistency of a large snail.

The students threaded fishing line through the muscles to the arm. As a final touch, they painted their contraption in school colors, Chicago maroon and burnt orange.

Felsen slammed their arm to the table in three seconds.

"Well, it's contracted now," said Virginia Tech student Noah Papas, 22, a few minutes after the contest.

Still, he said, "We had a time lag.... It did what it was supposed to do."

When they present their project to the department for their degrees in May, he said, "we hope to get a little more force out of it."

Observers said they were impressed by the demonstration, even if the robots didn't win.

"That was awesome," said Richard Landon, who has worked on robots for movies including "Terminator" and "Artificial Intelligence: A.I."

The puppeteer and self-described "bargain-basement engineer" said he wasn't sure he had anything to take back to his workshop, Stan Winston Studio in Van Nuys. He had come to the conference because he was looking for a motor or other device he could put inside his props.

"The biggest problem is to fit a square motor or an oblong hydraulic into the space a muscle would go," he said. "I'll keep watching."