Solar-Powered Robot Swarm Could Clean Oil

Oil-absorbing nanomaterial on a swarm of robots could clean up spills in record time.

By Alyssa Danigelis | Fri Aug 27, 2010 07:39 AM ET

In the future, a swarm of autonomous robots might be able to handle oil spill cleanup.

That's the idea behind a new solar-powered robot prototype equipped with nanotechnology designed by researchers at MIT. They say that a giant swarm of these robots could be able to clean a Gulf of Mexico size area in one month.

The robots, dubbed "Seaswarm," are being developed at MIT's Senseable City Lab, an initiative that focuses on sensors and handheld electronics in the built environment.

At the start of the summer, the lab’s researchers were asked to present a new design at the international Biennale festival in Venice demonstrating how nanotechnology could make a positive impact 40 years in the future. They came up with a robot that incorporates oil-absorbing nanomaterial created by visiting MIT professor Francesco Stellacci.

“We believe that the efficiency and autonomy of these vehicles will make cleaning up future spills faster, safer and ultimately more successful,” said Assaf Biderman, associate director of the Senseable City Lab and a member of the Seaswarm team.

Currently, oil skimmers usually need to be attached to large fuel-intensive ships, and they have to go ashore for maintenance several times a month. Plus, Biderman said, oil skimmers being used today have not had a design update in decades.

The Seaswarm robot prototype is 16 feet long by 7 feet wide and weighs 35 pounds. Two square solar panels at the head propel the robot along the water's surface. As it moves, a thin and flexible conveyor belt covered in oil-absorbing nanofabric rotates, selectively mops up oil.

“We say these vehicles are autonomous because they provide their own energy, propel themselves along the surface of the ocean and therefore we don’t need humans to collect the oil,” Biderman said. “The oil goes into the head.”

According to the lab, one vehicle has the potential to run for weeks on only 100 watts. One robot has the capacity to remove several gallons per hour, the lab said, and will come with a price tag between $10,000 and $20,000. The robot is also equipped with GPS and wireless communications so that it can convey its coordinates to other robots. If needed, humans could also operate one using a remote control.

The researchers believe that a Seaswarm of between 5,000 and 10,000 autonomous robots working nonstop could cover a Gulf-sized surface area in a month’s time.

“This robot shows how pervasive technology can be used to supercede what people have been able to accomplish on their own,” Biderman said.

The lab is presenting its oil-absorbing robot at the Biennale festival in Venice starting this...
weekend. When they return to MIT, the researchers say they plan to continue working on the prototype, refining it.

Tad Patzek, professor and chair of the Petroleum and Geosystems Engineering Department at the University of Texas at Austin wonders whether advanced robots are the most effective solution to oil spills.

"Collecting oil is a pretty low-tech enterprise," he said. "If you want to deploy hundreds of expensive machines to do that, I'm not so sure that it will scale up." Instead, he suggests that an imperfect, albeit fast-working approach might make a bigger difference.

"Robotic strategies are intriguing, and they create further opportunity to consider responses in the future," said Ron Kendall, director of the Institute of Environmental and Human Health at Texas Tech University and professor of environmental toxicology. Although robots hold promise, Kendall cautions that they could have key limitations.

Kendall said that much of the oil from the Deepwater Horizon spill in the Gulf entered the water column, which would present a serious challenge to robots that stay on the surface. He also compares the surface oil he saw in the Gulf to extremely sticky chocolate mousse. Even nonwoven material developed at Texas Tech that can absorb 40 times its weight in crude oil couldn’t handle the substance.

“This demonstrates the need for new innovation in oil spill cleanup and remediation,” he said.

While the lab currently has no plans to test their robot in the Gulf, they will be entering it into the X Prize Foundation’s new $1.4 million challenge seeking new technologies and methods for oil cleanup.

Lab director Carlo Ratti said that entering was an afterthought. “Winning is not as important as developing a vehicle that works and could be useful for future spills.”