



Photo by Olivia Logan

It's Monday morning, June 27th, inside the David Taylor Model Basin at the Naval Surface Warfare Center's Carderock Division, in Bethesda, Md. The water of the Deep Water Basin is calm, but the environment is chaotic. People hustle by in a blur of wetsuits, air tanks and life jackets. Several submarines bob in the staging area anticipating their chance at a moment of glory. Jim Corry, responsible for controlling the race course start line, climbs up to his perch over the basin and announces, "Sublime: Lock and load!" And with that, the 11th International Submarine Races are officially underway.

The submarine races are a biennial week-long competition that challenges students and independent enthusiasts to design and build a one- or two-person, human-powered submersible and race it on a 100-meter underwater course. This year's event featured 28 submarines from 16 colleges, five high schools, and three independent teams. Over 600 contestants, staff and volunteers came from the United States, Mexico, Oman, France, Canada, Venezuela, and the United Kingdom. Over the course of five days, 282 races took place, working out to an average of one race every five minutes.

Throughout the competition, participants had the opportunity to apply their technical knowledge to practical reality, giving them a better understanding of underwater vehicle hydrodynamic, propulsion and life support systems. The event also helps increase public awareness of the challenges of working in and exploring the underwater world.

"At Carderock, as we like to say, "This is where the fleet begins," said Capt.

# Learning through Competition



# The Eleventh International Submarine Races



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(Opposite, left) Flags of the seven countries that sent teams to the sub races hung above the model basin. (Not shown are the flags of Venezuela and Britain.) (Opposite, right) Members of the Naval Academy team work on their entry at the Academy before taking it to Carderock for the submarine races. (Above) Teams prepare their submarines in the staging area, referred to as “the beach.”

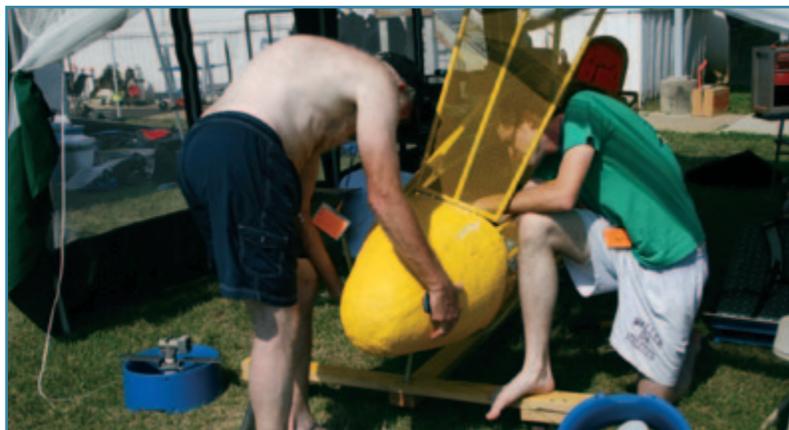
Heidemarie Stefanyshyn-Piper, Carderock’s commander. “Part of hosting these submarine races is that we can get these students interested in math and science, see[ing] a real practical application to what they’re learning in the classroom and putting it to actual use building a piece of hardware—and not just building it, but getting it to complete a goal.” Several Carderock staff members were once contestants in prior sub races, including Dan Dozier, Carderock’s

head liaison for the event, who served as a team mentor and contestant from 1991 to 2007.

“We really want to foster education and growth for our country,” said Jerry Rovner, director of race operations and a former Navy diver. “It may seem simple to build a human-powered machine that goes in a straight line, but...a lot of them don’t do that.” He said students often come to the sub races and learn more in a week than they

did in three years of school. “They see the theoretical, and now they have to make it practical.” One mother wrote an appreciative letter to sub race organizers telling them that her high school-age son “is so excited he now has a career path. He knows exactly what he wants to do.”

Several sub race alums plan to pursue careers in engineering and perhaps even join the Navy. “I can’t think of a better motivating or recruiting event than this one,” said



(Clockwise from top, left) Frank Lang, head timer for the races, uses a bank of television and computer screens to monitor subs on the course; Jim Corry gives instructions to teams from his perch above the deep-water basin; *The Yellow Rose of Texas* team members work on their submarine; An underwater shot of SSH-11, *Mighty Mid*, as it travels down the course. (Photos by Olivia Logan)

Christopher Land, a former nuclear-trained officer on USS *Henry M. Jackson* (SSBN 730) (Gold), who is the advisor for the team from Sussex County Technical School in New Jersey. Land noted that about 85 percent of his students seek engineering degrees, and about 95 percent of them keep their major. Tom Price, a civilian model maker for the U.S. Naval Academy, said being involved in the sub races does transfer to a naval career, although no one from this year's academy team is going into submarines.

Michael D'Alessio, the "pilot," or driver, of the Sussex County Tech sub, is entering Ramapo College of New Jersey this fall to study engineering physics. D'Alessio believes the sub race experience has helped prepare him for higher education. "If we can do this, college kinda seems like a walk in the park."

Preparing for the sub races was certainly no walk in the park. Teams started planning many months before. Land assembled his Suffolk County Tech team in early September 2010. "The process takes between two and three weeks," he said. "I've got a number of exercises I make them go through, and I try to make sure they truly, as much

as they could know, want to follow through on this thing that is not a normal project." Seventeen kids signed on for the long journey to the sub races.

Teams are eligible for nine awards: overall performance, innovation, absolute speed, fastest speed by category (the categories being one-person or two-person, propeller or non-propeller, academic or independent), best use of composites, best design outline, "smooth operator," persistence and resourcefulness, and "best spirit of the races." Awards are given by a group of judges, with the exception of the "best spirit of the races award," which is voted by the submarine teams.

The Sussex County Tech team began the conceptual design process with a tradeoff between innovation and speed. Was it worth more to have a fresh design or a faster sub? "When you really try to mix the two, you have a tough time meeting your goals," Land said. The team chose innovation and decided to model some aspects of their sub on a fish. They consulted Dr. Frank Fish, a biology professor at West Chester University, who advised them to model their sub on

a bluefin tuna because of its short, stout body shape, which would provide room for the pilot to sit in a recumbent position. The students plugged their design concepts into a CAD program and went to work building *Umptysquatch V*, a one-person, non-propeller-driven submarine.

D'Alessio said the team's chemistry was a great help in construction efficiency. "In the morning [teammates] could design something, hand it over to us in the afternoon, and we would start machining it, almost like an assembly line."

The team did not have a chance to test *Umptysquatch V* in the water before the races, so the students said that when it came time to race, it was an accomplishment just to get the sub going. "We're not going very far [down the course]," said Dean Romanelli, who is both the support diver, assisting the sub while on the course, and *Umptysquatch V*'s head designer. "But it's working, which is really cool." Land said the students' faces lit up at the sight of the fishtail motion working for the first time. "They know that, 'Wait a minute...every gear tooth, every pinion, every chain, every shaft, every piece

“They know that, ‘Wait a minute ... every gear tooth, every pinion, every chain, every shaft, every piece of fiberglass, was designed and built by us,’ and it’s only moving forward because of their understanding of physics and engineering.”

— Christopher Land,  
Advisor, Sussex County Technical School



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*The Yellow Rose of Texas*, from Arlington, Texas, was another sub that did not get tested in the water beforehand. In fact, the team still had quite a bit of unfinished business to attend to upon arrival at Carderock. At first sight, the sub’s permeable hull (also referred to as a “screen door on a submarine”) seemed to be part of that unfinished business, but that was not the case. “Everybody else that has a solid hull has to carry all the water that’s in that sub with them. It’s like a car loaded down with a lot of luggage,” explained the team’s leader, Keith Blaylock. “What we’re trying to do is not carry any water with us. Therefore we’re lighter in the water and, hopefully, we’ll be able to utilize the pilot’s power more to moving the sub than just moving the water in the sub.” This novel approach didn’t actually work out as well as the team hoped, but they did earn an honorable mention for innovation.

*Sea Wolf*, from Springstead High School, in Spring Hill, Fla., also received an honorable mention for innovation. According to Zachary Gooch, one of the team’s support divers and pilots, they already had an “excellent sub” with *Sublime*, which was

propeller-driven, so they made *Sea Wolf* to race in the separate, non-propeller-driven category.

But *Sea Wolf* wasn’t living up to her predecessor. “It’s still not entirely in working order,” said Gooch. “We have some buoyancy issues, the chain slips ... there are still some kinks to work out.” Christopher Sarabalis, a Springstead High graduate who came back to assist the team, said that because *Sublime* had always performed so well, the team regarded *Sea Wolf* as somewhat of a “step child.” Yet by the end of the week, *Sea Wolf* made her team proud. She received second place for fastest speed (1.169 knots) in the category of one-person, non-propeller, academic (from a high school or college).

The big winner of the competition was *Talon 1*, a one-person, propeller-driven sub from Florida Atlantic University, in Boca Raton, Fla. *Talon 1* posted the fastest speed from all of the design categories, at 8.614 knots. The team also got the “smooth operator” award in recognition of its efficiency in staging for the race course, racing the course, troubleshooting as necessary, and otherwise preparing for the next run. The team received second place for overall performance.

Not far behind *Talon 1* was SSH-11, *Mighty Mid*, from the U.S. Naval Academy.

(Top) *Umptysquatch V* rests on its trailer outside of the David Taylor Model Basin. (Bottom) Team members bring *Umptysquatch V* to the starting line. (Photos courtesy of Marilyn D’Alessio)

This was the Academy’s first appearance since the races’ inception in 1989. Despite the 22-year hiatus, the team achieved first place in overall performance. *Mighty Mid* also won first place for speed (6.100 knots) in the category of two-person, non-propeller, academic, breaking the previous world record of 5.133 knots held by the École de Technologie Supérieure, of Montreal, Canada. The other submarine teams also selected the Naval Academy to receive the “best spirit of the races” award, which is given to the team that displays “the best gusto, fortitude, support to other teams and overall best spirit.”

While not every sub made it past the finish line and not every team went home with an award, participants said the whole sub race experience was worthwhile. “This is the best ... it couldn’t get better,” said Brian Dubord, a member of the *Umptysquatch V* team. “It’s a learning experience, it’s a life experience, it’s a competition. It’s everything all in one.”

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