

Propagating Undersea Vehicle Expertise

APL-UW Scientists and Engineers Mentor UW Human Powered Sub Team

Narrator: The USS *Pennsylvania* based at Bangor, Washington. Nuclear powered. Governed by the same engineering principles as the human powered “What Sub Dawg” based at the University of Washington — designed, built, and operated by students.

Carol Nishikawa: They let me hop in there and pedal away.

Dominic Forbush: It’s a sprint cycling race underwater.

Narrator: Dominic and Carol are the co-pilots of “What Sub Dawg” — the University of Washington human powered submarine team’s latest entry in international competition. The sub is pedal powered — the latest evolution by the UW team, which was born at the Applied Physics Lab in the late 80’s.

Andy Stewart: The very first human powered submarine was built at the APL and the team was comprised of APL engineers and scientists. Since then, it’s become more of a Mechanical Engineering Department activity. But this last year, I’ve taken on the responsibility of serving as their faculty adviser. So they’ve become again part of the Applied Physics Laboratory.

Narrator: Big.... Or not big.... Many of the operating principles are the same, despite the notable difference in size.

Bentley Altizer: The submarine going into competition this year is a single-person propeller. It’s designed for output power of 800 watts from our pilot. And it has a total internal volume of 0.4 m³. So when it’s underwater flooded, we weigh just over 400 kg. And that’s the mass we have to accelerate in the first 50 m of the race.

Narrator: In 1989, pedal power got the sub up to just under 3 kn. The goal for the 2016 competition...

Altizer: To try to hit our speed goal, which is breaking 7 kn with our male pilot and we’re trying to break 6 kn with our female pilot.

Nishikawa: It’s a little bit cold and wet being inside of the submarine because it’s actually full of water, which is not the first thing people think of when they think of submarines.

Narrator: New this year is a two-person sub built from western red cedar.

Connor Hughes: The two-person submarine is a whole different animal. As you can see, it’s way larger and absolutely beautiful. The cool thing about that is that we get to work with the Northwest School for Wooden Boat Building and kind of tap into this Northwest tradition of wooden boats and the craftsmanship that they bring to their work.”

Narrator: The UW team is feeling good about its chances at this year’s competitions, thanks in large measure to the renewed collaboration between the UW Mechanical Engineering students on the sub team and APL-UW.

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- Altizer:** We haven't been at APL since the early 90s. But getting back to that building and having the presence of the APL engineers around us has been of huge benefit.
- Stewart:** They're actually sitting right alongside APL scientists and engineers — getting that real-time interaction with folks who, you know, are doing real professional activities in ocean engineering on a day-to-day basis.
- Altizer:** Probably the biggest thing I've learned is keep it simple.
- Stewart:** They're exploring some new ways of doing things — some very innovative things and really kind of taking human powered submarines to the next level.

This is APL **The Applied Physics Laboratory at the University of Washington in Seattle.**