Adaptable Monitoring Package – AMP

Eyes and Ears on the Environmental Effects of Marine Energy Conversion

Narrator: New light on a complex challenge: monitoring the environment around marine renewable energy systems – systems that convert the energy of strong underwater currents or waves into electrical power in dynamic and demanding surroundings.

Andy Stewart: You see a lot of energy. So you have moving water. You have big waves. You have significant currents. So those conditions present a lot of challenges and we had to face those challenges in the development of this system.

Narrator: The system is AMP: the Adaptable Monitoring Package developed by a team from the University of Washington's Department of Mechanical Engineering and the UW Applied Physics Laboratory.

Stewart: I would say that the main challenge of developing this system is coming up with a way of rapidly and at a low cost deploying and recovering the Adaptable Monitoring Package. So what you see here is not just the AMP itself, but a deployment system, which consists of a low-cost inspection-class remotely operated vehicle – an ROV – and a custom skid that we developed, designed, and fabricated at the Applied Physics Lab.

So this specialized hardware is developed to be able to bring this system down in close proximity to a marine energy converter and then let it sit on site – maintain on site – for a period of time to conduct monitoring studies.

Brian Polagye: We've been asking environmental questions about marine energy converters for years. It turns out that it's very difficult to deploy the right mix of instrumentation to answer these questions.

So something like the AMP is a tool that allows you to get the information you need in the time you actually need to acquire it.

James Joslin: Initially, the AMP concept came out of a series of brainstorms with people from the Applied Physics Laboratory. We started with optical cameras because that was a system that we knew the regulators wanted. They wanted to be able to capture images of fish in proximity to a tidal turbine and it was a system that didn't exist. And the idea behind having stereo vision is that we can take measurements in 3-D space and if we're trying to determine what type of fish or marine animal that is near a turbine or a converter, the measurement of how big they are is very helpful.

My research has been focused more on the hydrodynamics of the system just because it represents a number of engineering challenges to operate ROVs at a marine energy site given the strong currents we actually might have. This is not a small instrumentation package. So being able to do that with a relatively small ROV is a bit tricky.

Polagye: The whole idea behind the package is that the whole plug and socket hardware, the power that comes to it, the fiber-optic connection that comes to it – that's all custom engineering that we've done. But beyond that point, virtually any instrument that can communicate over serial and Ethernet connection and any instrument that requires power can be plugged into the AMP.

Emma Cotter: I've been working on integrating all of the different instruments in the AMP into one software package that will be able to control the data acquisition for all the different instruments.

Polagye: One of the problems with actually being able to adapt to any scenario is you can end up being flooded with data. So if you're just continually running cameras, you end up with terabytes of data. And so the next step in the process, which is called the intelligent Adaptable Monitoring Package or I-AMP, is to try to network these sensors together.

So one sensor is allowed to trigger another one. So we basically use the lowest bandwidth sensors we can until a target's close and then we switch to high-bandwidth sensors. So we might listen on passive acoustics for a long time and then switch to a multi-beam sonar and then at really close range switch to an optical sonar.

Narrator: On this day's test AMP scored a major first: successfully maneuvering onto its docking station, where AMP needs to be to gather data.

Stewart: Once deployed and on the docking station there is a cable to shore that exports the data that we collect at these marine energy sites. And that real-time monitoring is critical for retiring the risk associated with some of these converter technologies.

Narrator: Work on the AMP is coordinated by the Northwest National Marine Renewable Energy Center or NNMREC.

Stewart: This project has been very exciting. The development of the Adaptable Monitoring Package has really catalyzed the collaboration been the Ocean Engineering Department (at APL-UW) and the (UW) Mechanical Engineering Department and has also helped NNMREC grow.

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