

I. What happened in 2017? Here are our highlights:

1. CalWave and UC Berkeley collaborated to advance our power take-off technology, supported by an **NSF STTR**.
2. CalWave engaged leading experts from **various departments at** Sandia National Laboratories via the **Small Business Vouchers (SBV)** program.
3. CalWave worked closely with marine technology experts from the **University of Washington & the Applied Physics Laboratory** as a sub-awardee under the Naval Facilities Engineering Command Marine and Hydrokinetic Energy Advancement program.
4. **US Department of Energy** awarded CalWave a 3-year, multi-million dollar support package to demonstrate CalWave's award winning technology in open water.
5. **Breakout Labs** supported CalWave with research grant.



II. 2017 conferences, presentations and visits:

Mar - CalWave visits Sandia National Laboratories & the National Renewable Energy Laboratory

Apr - 2017 Waterpower Week in Washington – Annual Conference, IMREC and METS

Jun - International Society of Offshore and Polar Engineers (ISOPE)

Sep - Ocean Renewable Energy Conference XII and NNMREC Annual Meeting - Portland, OR.

Sep - CITRIS Foundry Demo Day: Fall 2017

Sep - Cyclotron road demo day 2017

Oct - Society of Naval Architects and Marine Engineers (SNAME) - NorCal Section - October Meeting

Dec - DOE's Marine Energy Technologies Forum: Distributed and Alternate Applications



It's a time for reflection - CalWave's major milestones till today:

	<p>2014</p> <ul style="list-style-type: none"> • International patent filed by UC Berkeley • Cyclotron Road - Cohort 1 	
<p>15/Q2</p>	<ul style="list-style-type: none"> • Entrance to US Wave Energy Prize <ul style="list-style-type: none"> • Advance to top 20 • Advance to top 9 	
<p>16/Q1</p>	<ul style="list-style-type: none"> • Threshold exceeded – Awarded 	
<p>17/Q1</p>	<ul style="list-style-type: none"> • NSF STTR Phase I • Small Business Voucher (SBV – Sandia) • UW - APL 	
<p>2017-2020</p>	<ul style="list-style-type: none"> • DOE MHK Advancement • Open ocean demonstration 	
<p>17/Q4</p>	<ul style="list-style-type: none"> • Breakout Labs supports CalWave with research grant 	



1. California Wave Power Technologies, LLC Awarded Competitive Grant from the National Science Foundation Small Business Innovation Research Program; Seed Funding for R&D.

Berkeley, CA, December 2, 2016 – California Wave Power Technologies, LLC has been awarded a National Science Foundation (NSF) Small Business Technology Transfer (STTR) to conduct research and development (R&D) work on a component advancement of a Power Conversion Chain for Wave Energy Converter technologies.

Wave energy is produced by converting the energy from waves into electricity. Since 50% of the U.S. population lives within 50 miles of coastlines, energy captured from ocean waves provides a vast potential for clean, renewable electricity to communities and cities. It is estimated that the technically recoverable wave energy resource is approximately 1,170 terawatt hours (TWh) per year, distributed across Alaska, the West Coast, the East Coast, the Gulf of Mexico, Hawaii, and Puerto Rico. Developing just a small fraction of the available wave energy resource could allow for millions of American homes to be powered with this clean, reliable form of energy.

“The National Science Foundation supports small businesses with the most innovative, cutting-edge ideas that have the potential to become great commercial successes and make huge societal impacts,” said Barry Johnson, Director of the NSF’s Division of Industrial Innovation and Partnerships. “We hope that this seed funding will spark solutions to some of the most important challenges of our time across all areas of science and technology.”

“It is an honor for our team to be supported by the National Science Foundation and to further our close and fruitful collaboration with our research partners, the Theoretical and Applied Fluid Dynamics Laboratory and the Department of Structural Engineering, Mechanics and Materials (SEMM), Civil and Environmental Engineering at the University of California, Berkeley.” – Marcus Lehmann, PI

Once a small business is awarded a Phase I SBIR/STTR grant (up to \$225,000), it becomes eligible to apply for a Phase II grant (up to \$750,000). Small businesses with Phase II grants are eligible to receive up to \$500,000 in additional matching funds with qualifying third-party investment or sales.

NSF accepts Phase I proposals from small businesses twice annually in June and December. Small businesses with innovative science and technology solutions, and commercial potential are encouraged to apply. All proposals submitted to the NSF SBIR/STTR program undergo a rigorous merit-based review process.

To learn more about the NSF SBIR/STTR program, visit: www.nsf.gov/SBIR.



SBIR/STTR
SMALL BUSINESS INNOVATION RESEARCH
 SMALL BUSINESS TECHNOLOGY TRANSFER

TAF Lab
Theoretical & Applied Fluid Dynamics Laboratory
Berkeley
UNIVERSITY OF CALIFORNIA

About the National Science Foundation's Small Business Programs: The National Science Foundation (NSF) awards nearly \$190 million annually to startups and small businesses through the Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) program, transforming scientific discovery into products and services with commercial and societal impact. The non-dilutive grants support research and development (R&D) across almost all areas of science and technology helping companies de-risk technology for commercial success. The NSF is an independent federal agency with a budget of about \$7 billion that supports fundamental research and education across all fields of science and engineering.

2. University of Washington Applied Physics Laboratory - Marine and Hydrokinetic Energy Advancement for Naval Facilities

CalWave collaborates with University of Washington Applied Physics Laboratory on technology advancements supported through the Naval Facilities Engineering Command (NAVFAC). Reliable and cost-effective energy conversion technologies have great potential to harness marine and hydrokinetic (MHK) resources to supply significant power and long-term advantage to the US. The objective of this research was to advance all aspects of MHK technology and deployment readiness to enable simple, cost-effective adoption of MHK generation capabilities at naval facilities. The approach is to focus on the development of systems and strategies that maximize MHK resource benefits.



3. CalWave awarded Small Business Vouchers (SBV) for collaboration with Sandia National Laboratories.

On April 20, 2017, CalWave Power Technologies was awarded a voucher from the U.S. Department of Energy, Small Business Vouchers Pilot (SBV) to partner with Sandia National Laboratories to advance wave energy converter (WEC) technologies by broadening device controls beyond the power take-off system.

CalWave Power Technologies was selected in the third round of the Small Business Vouchers (SBV) pilot initiative that facilitates access to US National Labs for American small businesses, enabling them to tap into the intellectual and technical resources they need to overcome critical technology challenges for their energy products.

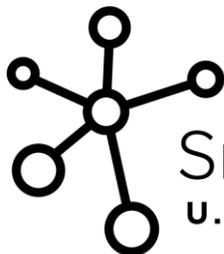
“Our team is excited to work together with leading experts from Sandia National Laboratories that are continuously advancing the state of the art and industry. Leveraging the experience and knowledge of the Advanced WEC Dynamics and Controls program, we will develop and validate control strategies to increase power and reduce cost of WEC devices.

The goal for this collaboration is to apply Sandia’s expertise to the unique features of our technology. These innovations, validated by wave tank tests conducted at MASK as a finalist of the US Wave Energy Prize, enable our solution to operate at high performance while effectively surviving extreme conditions, which are key enabling requirements for the wave energy industry.”

– Thomas Boerner, Lead Hydrodynamics and Controls

Official press release by U.S. Department of Energy (DOE).

Press release by TidalEnergyToday.



Small Business Vouchers Pilot

U.S. DEPARTMENT OF ENERGY

About the Small Business Vouchers Pilot

The U.S. Department of Energy Small Business Vouchers Pilot is a collaborative, national effort that provides funding for U.S. companies to work with National Laboratories. Vouchers range from \$50-\$300K and focus on nine clean energy technologies.

The SBV Pilot is an initiative of the U.S. Department of Energy, DOE’s Office of Energy Efficiency & Renewable Energy, and participating DOE national labs.

4. US Department of Energy awarded CalWave multi-million support to test and validate CalWave's award winning technology in open water.

June 2017, the Energy Department of Energy awarded CalWave a multi-million award to test and validate CalWave's wave energy converter (WEC) technology in open water. The test's goal is to demonstrate wave energy's potential to compete with other forms of energy in the longer term. Through open water testing, CalWave will validate and update estimated costs for a full-scale version of its technology.

From official press release:

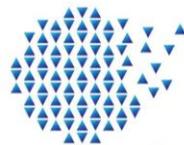
"Research and development in MHK technology will let America develop new water energy resources that can provide reliable electricity close to load— be it a remote village, major city, or distributed application, like forward-operating military bases or subsea data centers," said Alejandro Moreno, director of the Water Power Technologies Office. "MHK also provides an opportunity to develop new energy markets and create jobs." CalWave's vision for 2030 is that wave energy provides 20% of our energy supply.



U.S. DEPARTMENT OF
ENERGY

5. Breakout Labs supports CalWave with research grant

Breakout Labs supports early stage companies as they transition radical scientific discoveries out of the lab and into the market. The foundation backs scientist entrepreneurs working at the intersections of technology, biology, materials, and energy.



Breakout Labs.

II. 2017 conferences, presentations and visits:

Mar - CalWave visits Sandia National Laboratories & the National Renewable Energy Laboratory

CalWave visits the Sandia National Laboratories (SNL) and the National Renewable Energy Laboratory (NREL). Our team was excited to learn more about the latest capabilities and research in ocean energy conducted at these prestigious institutions. Highlights of our visits were both high up in the air - on top of the solar tower test facility at SNL and on top of a research wind turbine at NREL.



Apr - 2017 Waterpower Week in Washington – Annual Conference, IMREC and METS

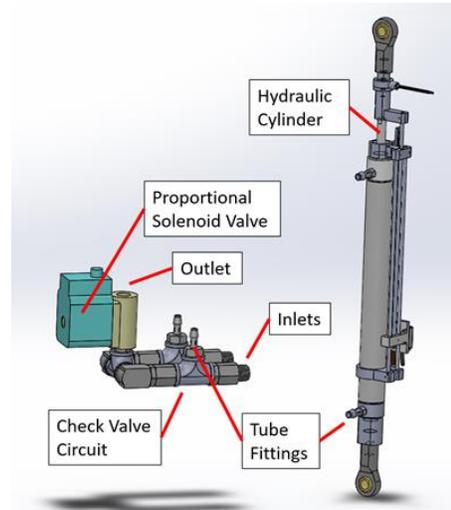
CalWave was invited to present and attend a panel at the IMREC's session: Learning from Colleagues – Inside the Heads of the Wave Energy Prize Finalists

Session details: The U.S. Department of Energy's Wave Energy Prize process identified great concepts from a number of technology developers and has enabled a funding mechanism for moving some of these concepts closer to reality. Listen to and learn from the Wave Energy Prize finalists as they share their specific advice regarding creation of a technology plan and a business plan, and their specific approach to demonstrate technology viability.



Jun - International Society of Offshore and Polar Engineers (ISOPE)

CalWave presented our publication “Model Scale Submerged Hydraulic Power Take-Off with Adjustable Damping for Wave Energy Conversion”. This paper details the custom design, fabrication, and performance of 1:50 and 1:20 scale model PTOs. These PTOs are modeled after hydraulic cylinders and operate fully submerged in the experimental environment, providing adjustable and predominantly linear damping characteristics. PTO control is performed manually at 1:50 scale and remotely at 1:20 scale. Challenges in the implementation and control of these PTOs are discussed and recommendations are made on their future use.



Sep - Ocean Renewable Energy Conference XII and NNMREC Annual Meeting - Portland, OR.

Members of CalWave attended the Ocean Renewable Energy Conference XII to reconnect with collaborators and friends of the ocean energy industry. It was our great honor to also attend this year's Northwest National Marine Renewable Energy Center (NNMREC) annual meeting and learn about the great progress and future plans of the center.



Sep - Cyclotron road demo day 2017

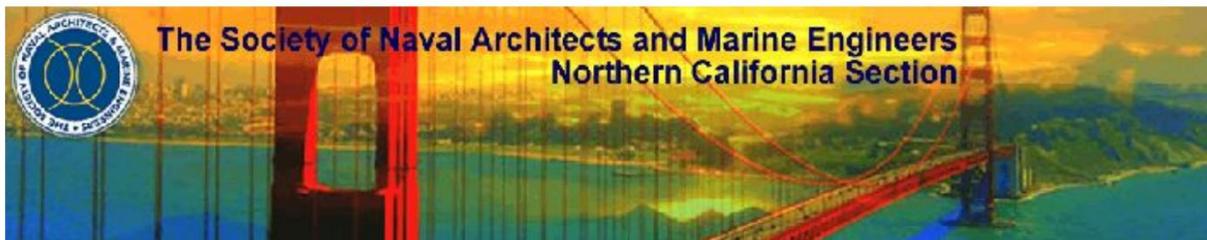
In September, the Cyclotron Road program held its second demo day highlighting the progress of all program companies and alumni to a large public audience with over 200 attendees.

Our team wants to express our special thank you and gratitude for all the help of the program team, collaborators and supporters at LBNL and the entire Cyclotron Road community working towards our shared mission.



Oct - Society of Naval Architects and Marine Engineers (SNAME) - NorCal Section - October Meeting

The Society of Naval Architects and Marine Engineers (SNAME) - NorCal Section invited CalWave to present at the October session. We want to thank Dr. Antoine Peiffer, chair of the Northern California Section for the kind invitation.



NorCal SNAME Meeting – Oct. 11, 2017

Wave Energy Conversion – State of the Art Review and Lessons Learned in Europe and the United States

CalWave Power Technologies Inc.,



Dec - DOE's Marine Energy Technologies Forum: Distributed and Alternate Applications

The Department of Energy invited CalWave to attend The Marine Energy Technologies Forum: Distributed and Alternate Applications.

The forum brought together experts in marine energy and those from ocean industries who might benefit from local, reliable energy from waves and currents. Speakers included marine and hydrokinetic (MHK) technology developers and researchers at the forefront of marine energy generation, representatives from industries and communities where marine energy can offer the greatest economic benefit, and government leaders and regulators. Most importantly, this was an opportunity for all attendees to provide feedback and input into which markets are best suited to the different marine energy technologies, and how devices can be designed and operated to maximize their benefits for each application.

[Link to Forum Topic Notes](#)

[Link to Tidal Energy Today News](#)



Exciting ocean energy news from 2017 we enjoyed reading:

- A new wave in renewables harnesses the power of the ocean:

“The Bureau of Ocean Energy Management in the US estimates that recoverable wave power could supply a third of the nation’s electricity needs”.

- Is a New Approach to Renewables Set to Make Waves?

“On the last day of 2016, Clean Technica reported that the U.S. Department of Energy (DoE) has invested \$40 million to create a utility scale wave energy test site off the coast of Oregon. The Pacific Marine Energy Center South Energy Test Site will be run by Oregon State University’s Northwest National Marine Renewable Energy Center.”

- Department of Energy Announces \$40M Investment in Wave Energy Test Facility

“The Energy Department today announced the award of up to \$40 million, subject to appropriations, to design, permit, and construct an open-water, grid-connected national wave energy testing facility. The facility will be constructed in Newport, Oregon, by the Northwest National Marine Renewable Energy Center at Oregon State University and will support innovations in wave energy technologies capable of harnessing the significant wave energy resources along United States coastlines.”

- Marine and Hydrokinetic [MHK] Technology: Background Information

- WAVE AND TIDAL ENERGY STUDY FINDS NO LONG-TERM DISTURBANCE TO WILDLIFE



Upcoming events you can find us:

- 2018 **Waterpower Week** in Washington, APRIL 30 – MAY 2, 2018 | WASHINGTON D.C.
 - NREL INDUSTRY GROWTH FORUM DENVER COLORADO MAY 3-4, 2018
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Special thank you to our sponsors, partners and supporters!

