



U.S. DEPARTMENT OF ENERGY

WAVES TO WATER

WEBINAR COMPETITOR QUESTION RESPONSES ADAPT STAGE

Provided by the Coastal
Studies Institute

*Accompanying summary provided by Simon
Gore of the U.S. Department of Energy*

Resource Questions

1. Typical wavelength? Tides? Currents?

Response: Available data are provided in the document [Drink Stage Test Site: Jennette's Pier](#) under the heading "Relevant Regional Observations." CSI will update competitors as new observations come online, specifically from Spotter buoys to be deployed at the test sites. The information provided to contestants during the webinar follows below:

Waves:

Jennette's Pier Historical Wave heights from a moored Acoustic Wave and Current Meter at the 11m test berth:

<https://chlthredds.ercd.dren.mil/thredds/catalog/frf/oceanography/waves/awac-jpier-11m/catalog.html>

USACE Army Corps Field Research Facility Regional Waves Information:

<https://chlthredds.ercd.dren.mil/thredds/catalog/frf/oceanography/waves/catalog.html>

Waverider 243 at the 26m isobath ~10 miles offshore of Jennette's Pier:

https://cdip.ucsd.edu/themes/?d2=p70:s:243&zoom=auto&pub_set=public®ions=all&tz=UTC&units=standard

Waverider 192 at the 26m isobath south of Jennette's Pier ~10 miles offshore of Pea Island:

https://cdip.ucsd.edu/themes/?d2=p70:s:192&zoom=auto&pub_set=public®ions=all&tz=UTC&units=standard

Ocean Currents:

The most relevant available currents may be from this AWAC deployed at the Field Research Facility at the same depth as the test site:

<https://chlthredds.ercd.dren.mil/thredds/catalog/frf/oceanography/currents/awac-5m/2009/catalog.html>

Surface currents offshore of the test site from the North Carolina HF Radar network can be found here: <https://dods.ndbc.noaa.gov/thredds/hfradar.html>

and viewed here in near-real time: <https://cordc.ucsd.edu/projects/mapping/maps/>

Winds

Three years of historical met data including winds are located here:

<https://americanmadechallenges.org/wavestowater/docs/JennettesMetData.xlsx>

NOTE: Any party using these wind data must acknowledge WeatherFlow Inc. as the provider

Most accurate tidal information from Field Research Facility tide gauge in Duck:

<https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=8652226&units=metric&bd ate=20220401&edate=20220430&timezone=LST/LDT&clock=12hour&datum=MLLW&interval=hilo&action=monthlychart>

2. Distance from shore of the test site?

Response: Approximately 200M from the shore as described in the document “Drink Stage Test Site: Jennette’s Pier.”

3. Is the depth and tidal range specified in the rules correct? (3.6–6m depth) This is a very high ratio of tidal range to mean depth, almost 1:1. Is it possible to move to deeper water?

Response: Competitors will not be allowed to move to deeper water outside the designated deployment areas. Note that the depth and tidal range is NOT 1:1. There appears to be some confusion about this d/t units, namely the tidal range is ~3.3 feet, while the depth range is from 3.6 to 6 meters. Bathymetry varies widely with season and storm events. CSI will do a survey prior to anchor deployment and attempt to set anchors at similar depths with the depths and ranges provided to competitors. Note that a link to the tide projections for a nearby NOAA station are provided with observation data links in the answer above.

4. Our device can benefit from advanced wave information. Can this be made available, or should we make provision ourselves?

Response: Competitors will not be allowed to deploy their own measuring devices like spotter buoys due to potential complications with deployments, moorings, and other competitors. CSI will provide spotter buoy information from the test site to all competitors. CSI recommends using the CDIP 243 buoy information provided to competitors (30-minute time averaged wave information) to observe trends in the developing wave field.

5. Clarifying question #4: By advance wave information in real time - can we deploy our own spotter buoy upwave for control purposes. WRT your wave rider buoy referred to by CSI, can this provide real time advance information, i.e. is it upwave of the deployment location?

Response: See answer above to question 4.

Deployment Questions

1. Will there be a scoring advantage to devices that require little or no CSI assistance with installation?

Response: CSI will be performing in-water installation of the devices at Jennette’s Pier. There will be no scoring advantage that minimizes CSI assistance; however, we encourage all competitors to reference the minimum requirements and prize metrics in the “Adapt Stage - Waves to Water Prize Rules and Criteria” which describes our metric prize awarded to the team with the simplest and fastest assembly and deployment method.

2. Can we operate right on the shoreline?

Response: No.

3. Will there be any assistants there to help us set up the device, or do we have to bring all our own help?

Response: Teams only will be responsible for device set up on shore, and the Waves to Water Prize Team will plan to identify in the near future a maximum number of team members allowed to assist onsite. Students and the public will only be allowed to be spectators during set up on shore if they are not identified as part of the official team.

4. Will we (competitors) be able to assist in diving operations at Jennets for deployment?

Response: No, refer to CSI / Jennette's limitation as described in the [Drink Stage Test Site: Jennette's Pier](#) resource on HeroX.

5. The depth varies from 3.6m to 5m at the pier. Can the developer choose the exact depth of deployment?

Response: No, we will specify site locations based on CSI / Jennette's input and guidelines, safety precautions, and device attributes. Team will have the opportunity to provide input for consideration.

NOTE: A depth survey will be conducted prior to deploying anchors. CSI will attempt to deploy anchors at the same depth and will report the depths of anchor deployment to competitors approximately 3 months prior to the event.

6. How far from the pier are we allowed to go?

Response: Please see deployment area and other details described in the [Drink Stage Test Site: Jennette's Pier](#) resource on HeroX.

7. Lifting straps provided for spider crane?

Response: CSI will provide lifting straps to competitors for deployment from the Spider Cranes. CSI will require competitors to provide information about device lifting points and orientation in advance, and an image of the device being lifted is preferred.

Anchor Questions

During the ADAPT stage webinar, there were several questions concerning mooring and anchoring that the prize team will plan to answer soon. For now, we are providing more specific details on the common mooring/anchoring system we intend to utilize for the prize at Jennette's. Please see below for information about the intended mooring system. We will provide guidance and clarifications concerning some of the questions around additional or secondary anchoring systems, rigid connections points, multiple connection points, allowable anchor lift and movement, and safety features soon. If your system currently requires additional anchors please consider they will have to fit in the container as specified in the [competition rules document](#).

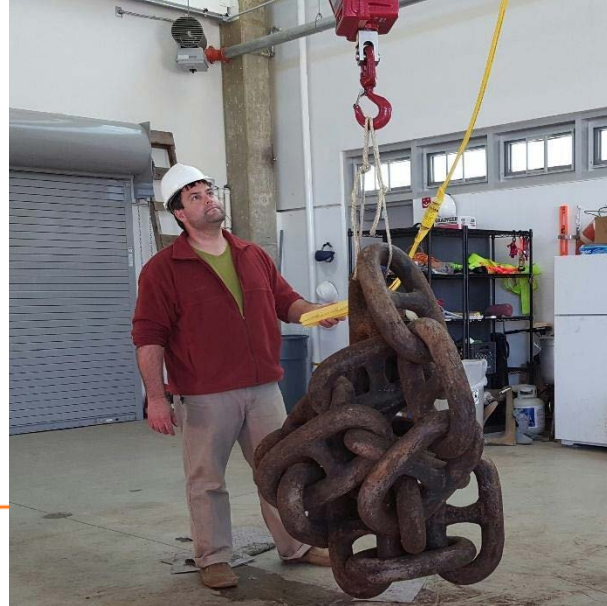
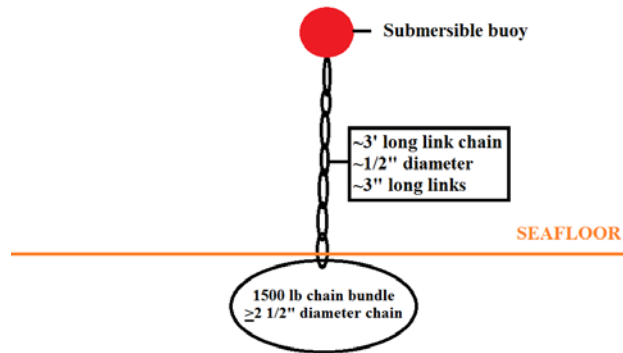
Jennette's Pier Waves to Water Mooring Details

The primary mooring for devices will consist of used ship anchor chain bound tightly to prevent as much movement as possible. The links of this chain will be at least 2 ½ inches in diameter and weigh approximately 18-25 pounds per link.

A 4' length of long link chain will be attached to the chain bundle. The links of this chain will be ~1/2" diameter and 3" long links. The long link chain will allow competitors to attach their device as close to the seafloor as possible anywhere along the length of chain with a single shackle. The top of the chain will have a submersible buoy to keep chain off of the bottom and for location by divers. The submersible buoy can be removed after device is attached. Scouring will bury the bundle under the seafloor prior to the event leaving the long link chain extending out of the seafloor.

Devices may need to share a network of these large moorings on the seafloor if a device needs more than one primary mooring. It is anticipated that every device will need additional anchors to prevent spinning or maintain a primary orientation. Heavy Danforth style anchors will be used for this purpose. Please include appropriate attachment points on device. The orientation of the mooring network will depend upon the needs of the competitors.

**Primary mooring
Jennette's Pier**



- 1. Is sand available from the beach to add ballast to the device?**
Response: Sand cannot be taken from the beach for ballasting. It is against the law to remove sand from the beach in Nags Head.
- 2. Some systems may not need anchors, so providing this weight of anchor "free" will advantage some devices over others. How will this be assessed in the judging?**
Response: There is no scoring advantage to not using the specified anchor system during the DRINK Stage. We will qualitatively assess systems in the ADAPT Stage to understand the feasibility, weight, and design of any anchor/mooring systems.
- 3. The anchor weight is directly related to the ability of some devices to capture wave energy, so providing this provides an advantage for some devices to produce water - how will this be addressed in the judging?**
Response: There is no scoring advantage to not using the specific anchor system during the DRINK Stage. We will qualitatively assess systems in the ADAPT Stage to understand the feasibility, weight, and design of any anchor/mooring systems.
- 4. Can you supply information on the horizontal load capacity of the anchors? For example, to check the design safety under angled mooring lines.**
Response: Competitors should evaluate or analyze additional static or dynamic loads (such as the loading poised in this question) based on the information provided. We will not be providing additional information at this time.
- 5. Will teams be allowed to choose their specific deployment spot at the pier? That is, can we know the water depth ahead of time?**
Response: No, we will specify site locations based on CSI / Jennette's input and guidelines, safety precautions, and device attributes. Team will have the opportunity to provide input for consideration.

6. To be clear, can a device rest on the seabed?

Response: Due to complications with previous deployments at Jennette's that rested on the bottom due to scour and sedimentation, CSI strongly recommends that devices do not rest on the bottom. CSI will review the proposals for devices that rest on the bottom on an individual basis and provide feedback.

7. Does the anchoring cable have to be included in the competitor's standard container, or will it be provided by the Pier?

Response: Yes, include it in the standard container.

8. In the rules it says one point anchoring system. Does it mean the device cannot be fixed to seabed? It must be floating?

Response: CSI believes there is some confusion here – namely there is a *single connection point at each anchor, but multiple anchors may be used*. With respect to having the device rest on the seabed, refer to Anchor question 6.

9. In the earlier document, we were allowed to use some rock as ballast/anchoring. Can we use some sand available at the pier as ballast but not accounted for in the total weight.

Response: Sand at the pier cannot be used due to town regulations. Sand supply cannot be guaranteed at this particular site.

10. Will Danforth anchors mentioned in the recent webinar response document be provide at the pier? If so, can specs on available anchors be provided?

Response: At this time, providing additional anchors is under consideration by the W2W prize team, but we cannot guarantee we will choose this action nor can we provide specific details. Please outline in the ADAPT stage submission any additional anchors or anchoring points your design might require and consider how these additional anchors/moorings are included in the standard shipping container. As noted in the rules document, if you are not planning to solely rely on the standard mooring system: "should competitors seek to have an alternative or additional mooring system (e.g. simple Danforth anchor to control orientation), details will need to be provided to WPTO, NREL, and CSI and approved prior to the DRINK Stage."

11. There is mention of "sharing" a network of the large chain bundle anchors. Will a bundle be provided for each team, or is this saying that more than one device may share a particular bundle?

Response: Similar to the response to the question on additional anchors, the W2W prize team is considering the potential for competitors to share the standard mooring system in order to provide additional mooring points if necessary for a design. However, we will not be able to guarantee or specify sharing a standard mooring (large chain bundle anchor) until the DRINK stage competition. We ask competitors to not assume the ability to share a standard mooring at this time but to specify additional anchoring/mooring as requested in the response above.

12. Can weight be added to that primary anchor (with material we would bring inside the container)?

Response: No, adding weight will complicate the installation of the standard mooring.

13. Is the primary anchor allowed to lift off slightly, as long as it does not leave a defined area?

Response: Please note any designed anchor lift could pose a significant risk to water and/or electrical connections provided for each competitor at their specified test berth. Currently, the prize team is analyzing specifying a minimal allowable anchor lift that will work safely

with provided water and/or electrical connections. Competitors should proceed cautiously and assume only minimal amounts of anchor lift if necessary, however more prudent would be to assume no anchor lift.

- 14. In the official test site information, the anchor will be approximately 1,000 lbs. Is it possible to use the anchor as the ballast weight on the system? That means teams can put the chain bundle (i.e. anchor) on the system to stabilize the system.**

Response: The approximate dry weight of the anchor will be 2000 lbs (See Adapt Stage – Waves to Water Rules and Criteria Revision 1). Systems that utilize the standard mooring as ballast or as an integrated structural component of their system design will be reviewed by CSI for approval. The prize team cannot guarantee these concepts will be approved or considered feasible.

- 15. In the official documents, CSI strongly recommends that devices do not rest on the bottom. Is it possible to design some thin legs and let the system stand on the seabed with minimum contact with the seabed? Compared with the anchor, the contact between the "leg" and seabed will be very small, similar as the legs of a desk.**

Response: The prize team will review these type of proposals but as noted prior does not recommend devices sitting on the seabed considering the nearshore environment at Jennette's Pier, and cannot guarantee these types of designs will be considered feasible for later stages of the competition. The standard anchor is robust to changing seabed conditions and has been previously determined to have acceptable environmental impact. Any new structure contacting the seabed would need additional assessment.

Connection/Integration Questions

- 16. Is the pipeline for pumping water to shore provided?**

Response: CSI will provide the pipeline to pump water to the pier. Water will not be pumped to the shore.

- 17. I think it was in the video, but what is the lifting capacity of the spider cranes?**

Response: See [spider crane reference brochure](#) for specifications that depend on crane extension, lift height, etc.

- 18. If the test site is 50 meters from the pier, then a 50m-long hose will be needed to transport water back to the pier. Does the water hose have to fit into the standard container?**

Response: No, the water hose does not have to fit in competitor containers. The hose will be provided by CSI at the mooring for attachment. Note that hose lengths will be identical for each competitor and will be greater than 50 meters.

- 19. Is it possible to put the water container in the ocean and collect it periodically?**

Response: No, water will need to be pumped to the pier and collected at the pier.

- 20. Is it possible to put the wave energy converter in the ocean but RO module on the pier?**

Response: Yes

- 21. If we put the RO module on the pier, can we adjust or maintain it during the five days testing?**

Response: The prize team will plan to review this request and provide specific timeframes and judging criteria for RO only maintenance if the RO system is sited on the pier.

22. If the water delivery pipe is supplied by CSI, what would be the pressure rating?

Response: Prize team will provide specific information on delivery pipe pressure ratings at a later time.

23. Can the water be collected at the device, or does it have to pump to shore?

Response: No, water will need to be pumped to the pier and collected at the pier.

24. You said the water has to be pumped to shore. Can it be pumped right to the pier spot from which you are working?

Response: Yes, we will specify a location on the pier for each team.

25. Our device produces electricity to run an off-the-shelf desalinators. Can a low voltage cable be run to the point where we power our desalinators?

Response: Yes

26. Can we run electrical wires from test berth to the pier?

Response: Yes

27. A standard electrical connection to pier for WEC (vs. pumping water to pier) is a very important element in our team's design, when will a decision be made on this?

Response: We will plan to provide this information at a later date.

28. Will the water collection location be up on the pier or at sea level? Do we need to generate the pressure/head to pump up to the pier level (20 ft.?)?

Response: Yes, pump to pier deck.

Environmental/Other Questions

1. Can you share any info on Brine discharge requirements at Jennette's?

Response: There are no explicit discharge requirements at Jennette's. Modeling results from the labs suggest that the anticipated production from these technologies are unlikely to trigger any environmental or permitting concerns.

2. What is meant by "be scaled for similar environments"?

Response: We mean the ability for your design to be broadly applicable and deployable across different wave conditions and physical locations, to meet the needs of numerous applications such as disaster relief and/or community water needs.

3. Does "scaled" mean the ability to be different sizes for different sites?

Response: We do not narrowly define the ability for a design to scale. However, in this particular context we'd emphasize some degree of sizing and optimization but within a modular, systematic, and replicable approach.

4. The number of images in the technical narrative is limited to show the different systems of the machine. Technical drawings are not suited for in-report publishing. Is it possible to have a different submission for the numerous technical drawings?

Response: No, we expect all submissions to follow the submission requirements and documentation as described in the [official rules document](#).