### University of Massachusetts Dartmouth

Department of Electrical and Computer Engineering

### Request for Senior Project Form

#### Project Title Ocean Internet of Things: Tidal Height Instrumentation Package for Coastal Tidal Flow\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Requester: Buzzards Bay Coalition,, David Sprogis / David Brown\_/ Sean Leach (PE)\_ ref State DCR David Sprogis (Consultant), [Dsprogis@gmail.com](mailto:Dsprogis@gmail.com)

PE: Supervisor/consulting PE  Sean Leach, PLS,  SITEC   [SLeah@sitec-engineering.com](mailto:SLeah@sitec-engineering.com)

Faculty Advisor: David Brown, [DBrown@UMassD.edu](mailto:DBrown@UMassD.edu) (Faculty Advisor)

#### \_\_\_\_

Phone/EMAIL: \_DSprogis@gmail.com\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### Organization: \_Westport Community\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### Date: 14 August 2019\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(To be completed by UMass Dartmouth)

Team Number: ­­­­\_\_\_\_\_\_\_\_

#### Team Members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Title: Ocean Internet of Things:** Tidal Height Instrumentation Package for Coastal Tidal Flow

**Description:**.

Horseneck State Reservation is home to the largest state beach in Massachusetts and many beautiful hiking, sand dunes, biking trails and fishing that also extend to Gooseberry Neck via a man-made causeway. Tens of thousands of visitors make their way to Horseneck weekly via Route 88 that travels across from Westport Point to the Horseneck. Coastal erosion has taken its toll on this beautiful area due to many factors. For example, the state beach and neighboring campground lost about 8 feet of beachfront after a winter storm and local experts theorize that the man made causeway is blocking natural beach nourishment and replenishment.  Some areas have lost about 50 feet of land over about a decade. Further the beach erosion appears to transport sand/sediment into the opening to the Westport Harbor making navigation more difficult.

This project involved the design, development, and implementation of coastal instrumentation buoys or bottom mounted packages to determine the mean water height in at least four locations (two on each side) at the causeway to Gooseberry Neck with means for transmitting the data to a nearby weather station and WIFI access to Buzzards Bay Coalitions at Horseneck Live Saving Station.

As a baseline, an instrumentation package/prototype has been developed and dropped to obtain preliminary data but divers need to recover the package to obtain the tidal height. A means to improve the sensor package and allow wireless or acoustic data transfer to remove the need to recover the sensor package would be a great improvement. Calculations, signal processing, and data interpretation is also needed to determine/ estimate tidal height differences and estimates of would-be water flow in the Gooseberry Neck with and in the absence of the causeway. Field work is required and those interested in Marine / Ocean / Environmental Engineering is welcomed. The possibility of including a CNE Civil Engineering Senior to help with calibrating tidal heights and sextant surveying is of value.

Students interested in this topic are encouraged to review the link below that describes student-lead teams that are working on battery free Ocean IOT.

<https://blog.hackster.io/battery-free-approach-to-ocean-internet-of-things-df5581ff4a1b>

**Scope:**

Describe the scope of the project. The project should involve at a minimum the following components

* Design and prototyping an ocean/coastal instrumentation package capable of determining water surface height in a tidal/ beach area subject to large wave action.
* A means to obtain the surface height data remotely by suitable methods such as WIFI or Acoustic Modem.
* A means to subsequently send data to a nearby receiver located at the Buzzards Bay / Westport Fishermans Assoc Horseneck Life Saving Station.
* To combine data with local weather station data at the Life Saving Station and upload the data to web.
* Calculations of estimated tidal flow (GPH) that the causeway is blocking from measurements of mean water surface heights on either side of causeway in no less than four locations (preferably goal is three instruments on each side (East and West) of Causeway.

Project:  The project involves establishing insturmenation buoys or moorings as described above.

**Requirements/Specifications:**

At least four but six preferred field tested and implanted instrumentation packages.

**Resources Available for Students:**

List any specific resources you will be able to provide to the student team. This may include site surveys (specify format if possible – e.g. AutoCAD, paper, etc.), traffic data, geotechnical boring logs, existing conditions reports, related design drawings, etc. The list does not need to be exhaustive but should be representative of the type of site specific information that they students may have available to base their designs on. If collection of some or all of this data is envisioned as one of the tasks for the student team, please note it here and/or elsewhere on the form, as appropriate.

Previous state sponsored reports/studies on erosion.

GIS data and mappings.

Causeway construction and remediation, design recommendations

Prototype work on an drop and go instrument made by others.

**Project Specific Deliverables:**

There are four milestones required as part of the course, generally broken down as follows:

* Milestone 1 (Mid Fall Semester): Review exiting prototype and come up with design modification to improve and telemetry data.
* Milestone 2 (End Fall Semester): Site visit. And test tank calibration of water height instrument.
* Milestone 3 (Mid Spring Semester): Design build and test prototype.
* Milestone 4 (End Spring Semester): “100% Design, Build, Test six instrument packages.

Of course, the final product will not be a complete 100% design, ready for construction, and the intent for the spring milestones is to have a midway check point towards the final course design, which may vary by project from a preliminary design to something that is approaching a full design.

Please provide any specific content, relevant to your proposed project, for any or all of these milestones. This may include design drawings, specifications, cost estimates, final reporting requirements, etc. Project titles can/should be changed to be consistent with terminology in specific sub-disciplines.

**Legal:**

If applicable list any legal constraints that may affect students working on the project, including intellectual property or other relevant issues. Do not list permitting requirements or other project requirements here.

TBD

**Special Instructions:**

List any other specific instructions here…

**Cost of Sponsorship:**

TBD. Local Coallitions on Buzzards Bay, Watershed Commission, and other parties.

TBD We will explore possible funds from local Watershed Alliance

**Title:**

# Redesign of Main Street and Oak Street Intersection for the Town of Universityville

**Description:**

EXAMPLE

The existing intersection of Oak Street with Main Street at the center of town has become increasingly congested over the last decade with increased retail and commercial development, as well as residential traffic. In addition, the area has always been prone to flooding during moderate storms, causing impacts not only to traffic, but to nearby properties. This project will involve the development of several solutions to the current and anticipated traffic problems in conjunction with drainage upgrades, and the development of 50% design plans for one of the alternatives.

**Scope:**

The project will require traffic analysis, roadway layout/design, and drainage design. The first phase of the project will involve the development of alternatives to solve the identified issues. The second phase of the project involves the development of design plans and cost estimates. The designs must meet all applicable state and local standards, and be responsive to any appropriate permitting requirements.

**Requirements/Specifications:**

* Traffic and roadway design must meet all applicable state DOT standards, and conform to local bylaws.
* Drainage design must allow for passage of design storm flows without adverse impacts to the roadway or neighboring properties

**Resources Available for Students:**

* Site survey conducted April 2016, in AutoCAD format
* Recent traffic survey data collected by XYZ Engineering Consultants, 2017.

**Project Specific Deliverables:**

* Milestone 1 (Mid Fall Semester): Project History and Background
* Follow course requirements
* Milestone 2 (End Fall Semester): Feasibility Study
* Preliminary design drawings for each alternative.
* Written report detailing alternatives, and economic feasibility.
* Milestone 3 (Mid Spring Semester): 25% Design
* Follow course requirements
* Milestone 4 (End Spring Semester): 50% Design
* Final design drawings, including vertical and horizontal signing, pavement markings, signals, highway lighting, landscaping and erosion sedimentation and pollution control (ESPC) drawings.
* Construction specifications
* Written report explaining the final design, including cost estimates.

**Legal:**

*There are no identified legal constraints.*

**Special Instructions:**

*None*