



## September 2018

On behalf of the Ocean Twilight Zone (OTZ) team, I am pleased to provide an update on **The Audacious project at Woods Hole Oceanographic Institution (WHOI)**. The project has ramped up quickly and we are making good progress in each of the priority areas of **science, technology, and engagement**. We have also established our OTZ **project management** and governance structure, which is my role and responsibility on the project. We will be formalizing the cadence and mechanisms for communicating with you soon.

This is the first in a series of periodic updates about WHOI's OTZ initiative, funded through The Audacious Project. In this newsletter, we highlight major recent accomplishments and milestones, and outline our near-term plans.

Among recent highlights were the successful completions of the OTZ team's first expeditions, the deployment of a new vehicle, and new insights about the abundance of life in the twilight zone. The team's science and engineering successes were extensively documented and generated numerous opportunities for public engagement via earned media, social media, events, and original content.

### Rob Munier

*Vice President for Marine & Facilities Operations*

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# Science

Scientific activity has been focused on preparing for and participating in research cruises that have launched the OTZ field program with a bang. In particular, the August 2018 expedition on the NOAA ship *Henry B. Bigelow* revealed exciting surprises, including preliminary results questioning conventional wisdom about the amount and distribution of animals in the ocean twilight zone. Based on traditional shipboard sonar alone, it had seemed that animals in the twilight zone were concentrated in a few dense layers. But the OTZ project's new *Deep-See* platform and its wide-band sonar systems revealed that there are many more animals at all depths in the twilight zone than previously thought based on shipboard sonar alone. Parallel research on sharks showed that they use massive spiraling eddies as "tunnels" to dive deep into the twilight zone to feed.

## ACCOMPLISHMENTS

- The OTZ team **completed two inaugural project expeditions** involving more than a dozen project participants and scientific collaborators from other universities and federal agencies: a cruise to the Northwest Atlantic aboard the NOAA ship *Henry B. Bigelow* (11–20 Aug. 2018); and two cruises to the North Pacific as part of NASA's EXPORTS expeditions aboard the R/V *Roger Revelle* and R/V *Sally Ride* (10 Aug.–12 Sept. 2018).
- The *Deep-See's* first-ever combination of state-of-the-art camera systems and wide-band sonars **revealed an abundance of animals at all depths** in the twilight zone, highlighting the shortcomings of conventional methods such as single-frequency ship-based sonar and net trawls.
- Shipboard and *Deep-See* sonars also detected a dense layer of animals in deeper water below the twilight zone, but we don't yet know what kinds, or how many.
- Based on initial cruise findings, many twilight zone animals appear to be myctophids, jellies, squid, shrimp, and small drifting crustaceans, and a significant number of twilight zone animals remain at depth and do not migrate to the surface.
- **Satellite-tagging of blue sharks and white sharks** revealed that they use large eddies as warm water tunnels down into the twilight zone, helping them to feed longer in deep, cold waters.
- As part of the NASA-sponsored EXPORTS program, a new OTZ-funded postdoctoral scientist is using chemical tracers to track how much organic carbon is lost from sinking particles when they are eaten by twilight zone animals, **a key factor in the carbon cycle with implications for global climate.**

## NEXT STEPS

- We will **conduct a comprehensive analysis of the large, complex datasets** resulting from these initial OTZ cruises to evaluate and build on preliminary results.
- We will **assess the challenges** encountered on the *Deep-See's* first mission, such as animals' avoidance of the vehicle, and develop strategies to overcome them, such as changing the location of sensors and the color and strobe frequency of lights.
- We are **working with potential scientific collaborators** to explore the possibility of OTZ scientists participating in cruises aboard the Norwegian R/V *Kronprins Haakon* in November and/or February, as well as on several cruises as part of the Northeast U.S. Shelf Long-Term Ecological Research (LTER) program this winter and next summer.
- We will be initiating discussions with OceanX to explore conducting **missions on *Alucia II*.**



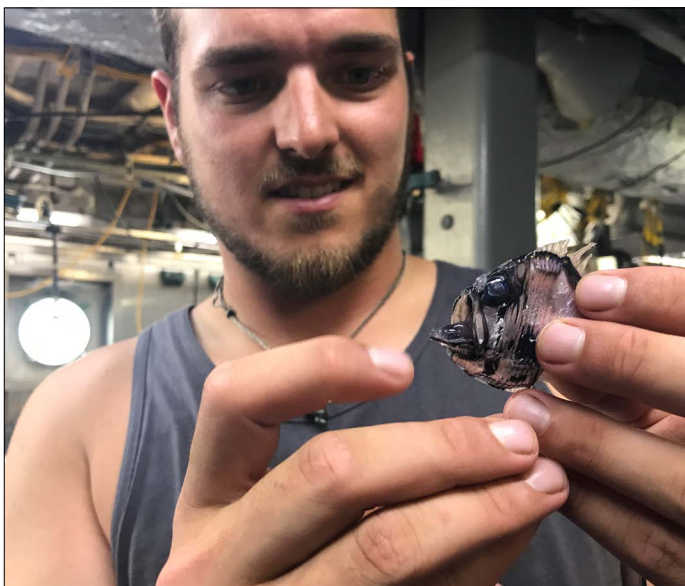
OTZ's first expedition: WHOI mechanical engineer Kaitlyn Tradd directs deck operations on the NOAA research vessel *Henry B. Bigelow* during a recovery of the towed vehicle *Deep-See*.

# Technology

The major focus of technology development activities has been on preparation for and execution of the research cruises undertaken in August. The main outcome of intensive engineering activity since June was the highly successful first at-sea trials of the *Deep-See* vehicle and its on-board camera and sonar systems to assess the amount and diversity of animals in the twilight zone.

## ACCOMPLISHMENTS

- The team undertook and completed intensive engineering efforts to prepare the *Deep-See* vehicle for at-sea trials, including the addition of a tail section and a handling system for towed operations.
- OTZ engineers completed the camera and sonar systems of the *Deep-See*, the first vehicle to integrate this combination of imaging and acoustic sensors. They include wide-band split-beam sonars, a holographic camera system, a large-area stereo camera system, and a twilight zone radiometer (under development).
- **The *Deep-See* was successfully deployed** in the twilight zone of the Northwest Atlantic from the NOAA ship *Henry B. Bigelow*, collecting more than **30 terabytes of data**. Initial analyses suggest that there are many more animals spread throughout and just below the twilight zone than previously thought, and that many animals do not migrate.



The fascination of discovery: Among the abundance of marine life found on the first OTZ science cruise was this silvery hatchetfish.

- **New microchips were developed for use in animal satellite tracking tags** (RAFOS Ocean Acoustic Monitoring (ROAM) tags). These miniaturized chips will make it possible to produce tags that are smaller, less expensive, longer lasting, and better performing than those currently in use, allowing researchers to more effectively track sharks and other large predators that dive into the twilight zone to feed.

## NEXT STEPS

- OTZ engineers will work to eliminate sources of noise that interfered with the *Deep-See*'s sonar systems during sea trials, and to explore the possibility of using red LED lights instead of white to minimize animal avoidance.
- OTZ engineers will continue the **development of another robotic vehicle** designed to explore the twilight zone: the **Mesobot**. This includes completing the vehicle's design, software development, and construction, with the goal of conducting tank tests in WHOI's Coastal Research Center in early 2019 and field tests at MBARI later next spring.
- OTZ is excited to announce a partnership with the University of Rhode Island to **develop tiny disposable sensors** that will be deployed in the twilight zone to assess the properties of sinking particles known as marine snow. The concept is to deploy "swarms" of low cost MINIONS (MINIature IsOpycNal floats), as "eyes in the twilight zone." MINIONS sink into deep water then return to the surface several days later to transmit their data back to researchers at sea or on shore.
- ROAM microchips will be sent to two commercial manufacturers for integration into **satellite tracking tags** which will be **beta-tested** in the winter using ocean gliders as stand-ins for sharks, tunas, and swordfish.
- **The OTZ team and OceanX** will initiate a collaboration on technology that might be incorporated into plans for *Alucia II*.

# Engagement

Engagement activities have focused on building momentum from the launch at TED, while at the same time, developing a long-term approach to educating, motivating and activating key stakeholders. In particular, earned media coverage of the OTZ project has reached more than 100 million people worldwide to date through placements in top-tier outlets. The WHOI Communications Department has continued to provide interim engagement support to the project, including earned media, social media, original content production, website development, events, and strategic partnerships. The objective is to establish a permanent engagement team that could include the soon-to-be-hired program manager and a dedicated specialist or specialists to collaborate with external resources, including media partners, to implement the strategic approach. The team will also be bolstered by the recent appointment of Sam Harp as VP of Advancement and Chief Marketing Officer for WHOI.

## ACCOMPLISHMENTS

- **Strategic planning:** Michael Holland was brought on to the OTZ team in June to develop an engagement strategy for the twilight zone project and to lead the team through the first phase of the project.
- **Media:** ~300 earned mentions with >100 million potential reach worldwide, including coverage in **National Geographic**, **Business Insider**, the **Boston Globe**, and the **Washington Post**, the latter an op-ed by media partner Jim Cameron.
- **Original content:** 17 original OTZ content pieces developed and promoted through WHOI channels, including an **overview video** about the ocean twilight zone; a video about WHOI's **first twilight zone expedition**; and **feature** and **news** articles in *Oceanus* magazine.
- **Lead generation:** A WHOI sweepstakes offering a trip to Woods Hole to meet twilight zone scientists generated 5,000 entries and 3,000 new email subscribers; an ocean twilight zone coloring page generated 2,500 downloads and 1,200 new email subscribers.
- **Media partners:** The OTZ team has collaborated with the **TED and Audacious Project** PR teams to create awareness and increase engagement with the OTZ project, including promotion of Heidi Sosik's TED talk, now at 950,000 views, and the creation of a new ocean twilight zone Facebook group. The team established a partnership with Jim Cameron and Maria Wilhelm for media support and advice on OTZ project engagement activities, the first result of which was the op-ed in the Washington Post on June 8, which coincided with World Ocean Day. WHOI partnered with **Big Wave Productions** to have a videographer document the OTZ team's first cruise with their new vehicle, the *Deep-See*. OTZ scientists participated in NASA's EXPORTS expeditions to the North Pacific and were featured in **NASA** content highlighting their Aug.–Sep. cruises. OTZ team met in August with **OceanX and OceanX Media** to establish a dialogue for collaboration. A meeting was also held at OceanX on September 13 to continue these discussions.
- **Social media:** 40 Facebook posts with a reach of 430,000 and 5,860 reactions; 29 Twitter posts with a reach of 465,000 and 1,890 reactions; and 9 Instagram posts with a reach of 67,000 and 6,060 reactions.
- **E-communications:** 10 OTZ-related emails sent to approximately 17,000 WHOI email subscribers, with an average open rate of 30%.
- **Events:** An April TED Talk by OTZ lead scientist Heidi Sosik; an Ocean Conversation telephone town hall with OTZ team members and 55 current and/or potential WHOI donors; and a presentation by WHOI President Mark Abbott to 150 New York-based WHOI supporters and potential supporters, including the first announcement of initial OTZ cruise results from the Northwestern Atlantic.
- **OTZ website:** 17,000 page views.
- **Visuals:** Video and photos of the first WHOI expedition to the ocean twilight zone with the *Deep-See*, including drone footage of the NOAA ship *Henry B. Bigelow* returning to port and deck operations at sea; holographic, stereo, acoustic, and other imagery of twilight zone animals taken



# More visuals to come

With hundreds of visuals coming from our first expedition, we expect to create more videos to capture the imagination of our followers.

## Engagement continued...

by the *Deep-See*; video and photos of pre-cruise *Deep-See* assembly and testing; 5 video interviews with OTZ team members.

## NEXT STEPS

- **Strategic Planning:** The team will focus on developing a plan for the open data platform, which we believe has the potential to accelerate analysis of scientific data in order to shape public dialogue and policy-making on the sustainable use of the ocean twilight zone. Once deployed, it will also serve as the distribution platform for relevant and stimulating public content.
- **Media:**
  - **BBC:** WHOI is currently in discussions with the BBC to air a week of live shows from WHOI as a follow-up to *Blue Planet II*. BBC producers have indicated that they want the OTZ project to be one of the major research initiatives featured.
  - **CBS This Morning:** WHOI was contacted by CBS to feature the OTZ project on their show; talks are ongoing.
  - **National Geographic:** The team from Big Wave is producing one or more short (1-3 minute) videos that will be published on National Geographic digital platforms.
  - **New York Times:** WHOI has pitched them the story of the first OTZ cruise, along with first media publishing rights of photos taken on the cruise. We expect a response shortly.
  - Members of the OTZ team recently met with eight WHOI Ocean Science Journalism fellows. Several of the fellows, from major publications, have indicated that they plan to write a story about the OTZ project.
  - Michael Holland will be conducting a media training workshop later this fall at WHOI for members of the OTZ team.
- **Original content:** We plan to continue our current production rate of **one to two OTZ-related pieces per week**, to be posted on the **ocean twilight zone website** and promoted across WHOI's outreach channels.
- **Media partners:** Heidi Sosik, Rob Munier, and Michael Holland are meeting with the OceanX Media team on Sept. 18 to discuss opportunities for collaboration.
- **Social media:** In addition to continuing to post OTZ-related news on WHOI's Facebook, Twitter, and Instagram accounts, we are collaborating with the TED/Audacious team to develop an **exclusive Facebook group**, which will offer a select audience the opportunity to receive advance notice of news and events and to interact directly with members of the OTZ science, engineering, and engagement teams, as well as with each other.
- **E-communications:** We are developing a strategy for e-communications and reporting to various audiences, including donors, potential donors, influencers, OTZ email list subscribers, and WHOI email list subscribers.
- **Events:** We are developing a strategy for a series of **OTZ Ocean Science Café** events in select cities across United States.
- **OTZ website:** We are currently **upgrading the Ocean Twilight Zone website**, including moving the news/updates feed to the homepage; developing a technology section; and making other infrastructure changes to include new content and improve discoverability.
- **Visuals:** We will continue to **collect video and photo documentation** of any OTZ participation on 2018-2019 cruises (e.g. aboard the Norwegian *R/V Kronprins Haakon* in November and/or February, or to the Northeast Shelf Long-Term Ecological Research station this winter and next summer); we will take advantage of *Deep-See* holographic, stereo, and acoustic imagery for engagement purposes, as it becomes available; and we will document any engineering milestones for the *Deep-See* and *Mesobot* vehicles to look for unique moments that enable us to tell the story of twilight zone exploration.

# Project Management

The scale and complexity of the OTZ project necessitate effective project management to ensure successful outcomes. The project demands a new model for WHOI, both internally and in relationships with external partners. During this period, effort has been focused on development of an internal organizational structure that is now in place, and on reaching out to external partners to begin the process of defining strategic alliances. The WHOI OTZ team is actively engaged in a search to hire a full time program manager to run the project office.

## ACCOMPLISHMENTS

- **Developed an organizational structure for the OTZ project:** established a science and engineering team with interim engagement support from members of the WHOI Communications Department; established a Steering Committee consisting of OTZ scientists and engineers; established a Leadership Committee to serve as the OTZ board of directors.
- **Initiated the hiring process for an OTZ project manager:** received 37 applications; shortlisted six candidates for an on-site interview; started interviewing candidates.
- **Meetings:** held weekly Steering Committee meetings, also attended by members of the WHOI Communications Department; held monthly Leadership Committee meetings since April 2018; held weekly *Deep-See* engineering sub-team meetings since June 2018; met with the Dalio Family Office and OceanX Media on Aug. 14, 2018, to initiate collaboration.
- **Metrics:** established Year 1 objectives for science, technology, engagement, and project management; created a framework for budget allocation across science, technology, engagement, and project management.
- **Grants:** We are working to complete all of the donor grant agreements. To date we have received \$2.8 million in first-year and one-time funding.
- **Donor communications:** began to develop a plan for communicating and interacting with donors and partners; received feedback from the Dalio Foundation regarding metrics and collaboration with OceanX.

RIGHT: The new sensor platform *Deep-See* weighs about 2,500 pounds and extends 16 feet in length. Designed to be towed from a ship via an electro-optical cable, the *Deep-See* gives researchers a new real-time view of life in the ocean twilight zone hundreds of meters below the surface. Photo by Paul Caiger.

## NEXT STEPS

- **Project organization:** establish a project management office; hire engagement team member(s).
- **Project manager:** complete interviews by Mon. Sept. 17; select a candidate and establish a start date.
- **Meetings:** continue weekly Steering Committee and monthly Leadership Committee meetings; meet with OceanX Media on Sept. 18 in New York City to identify collaboration opportunities.
- **Metrics:** review sample metrics to be provided by OceanX; finalize OTZ metrics; institute metrics with the OTZ project team.
- **Grants:** complete outstanding discussions regarding grant format and execute the final core donor agreement.
- **Donor communications:** complete plan and begin implementation; implement actions to develop more robust OTZ project metrics and OceanX interactions.

