Summary of the Innovations Laboratory Experience

Kendra Daly
University of South Florida

Overview of the planning process to relocate the Pioneer Array during the COVID pandemic

Virtual Innovations Lab I

- Select the coastal region for the relocated Pioneer Array

Virtual Innovations Lab II

- Select the site within the new coastal region
- Recommend array layout, mooring types, instruments, mobile assets and their routes

Timeline

- **December 2020** NSF and the OOI Facilities Board announced the potential relocation of the Pioneer Array and the process for including community input. Knowinnovation was contracted to organize and facilitate the Innovations Labs based on the "science of deliberate creativity" and using their custom collaborative Kistorm platform. Applications requested for participation in Innovations Lab I.

- **January 2021** Virtual Microlab 1. Introduced the goals and the process for the Innovations Lab I. Information on the NES Pioneer Array was provided.

- **March 2021. Virtual Innovations Lab I** (5 days).

- Participants were asked to generate compelling research questions that required the Pioneer Array to make progress (tagging questions on a ‘wall’, speed networking, small interdisciplinary groups); then groups were asked to steward two potential sites that were not their primary interest based on the science drivers. New teams were formed to create ‘pitches’ for eight sites. Feedback to presentations helped to hone concepts. Final presentations were made, and pros and cons of sites discussed.
- The panel made their recommendation to NSF based on:

  - What are key science drivers (Intellectual Merit)?
  - What are the novel aspects?
  - What new outcomes would we expect after the 5-year implementation at this location?
  - List the key logistical barriers and implementation challenges (e.g., hurricanes).
  - What new disciplinary/interdisciplinary opportunities might be facilitated?
  - What are the potential broader impacts for this site?
  - What are the potential opportunities to engage equity and inclusion?

- **April 30, 2021** **NSF announced the decision to re-locate the Pioneer Array to the Mid-Atlantic Bight**

- **May 3, 2021** Applications requested for Innovations Lab II

- **May 12, 2021** Microlab II. Introduced objectives and goals; provided technical considerations for relocation of existing Pioneer Array.

- **June 21-25, 2021** Virtual Innovations Lab II.

  Day 1

  - *Goal: to identify the top science questions and optimal site*
  - Background talks on Pioneer technologies, waterspace management maps (go/no go map), fisheries, wind energy, military, commercial traffic, etc.
  - Participant brainstormed and then voted on the top five key science questions/themes that (1) required the Pioneer Array and (2) could be addressed within the five-year deployment period.

Innovation Lab II (cont.)

- Groups formed to determine the optimal sites within the MAB to address science questions, site characteristics, a general design for the array, and site risks
- Groups presented their locations and designs. There was a plenary discussion. The participants then voted on the top sites/designs that supported the largest number of priority science questions.

<u>Day 2</u>

- *Goal: to select the optimal site*
- A Venn diagram of the top sites was presented. Groups discussed the sites. There was a plenary discussion on the pros and cons of each site/design and participants voted for the final site selection.
- Broader impacts breakout groups and discussion

Day 3

- *Goal: to generate the Backbone Array using the optimal site. Configure the elements, i.e., the placement and types of moorings, and the glider and AUV routes, frequency of repeat lines, etc. What configuration best fit the environment?*
- Participants rotated through different breakout groups and then presented their configurations.
- Group plenary discussed the pros and cons of the configurations and then voted for the optimal one.

Day 4

- *Goal: to use the backbone configuration to (1) determine what measurements from current sensors and instruments should be included and how should they be configured based on the science questions. (2) What additional measurements (sensors) could be added to allow new science investigations.*
- Prepare for final presentations.

Day 5

- Teams made their final innovative pitches with detailed information on the array configuration and sensors needed to address the key science questions.

- These results were critical in providing the basis for redesigning the MAB Pioneer array by the OOI team in time for the deployment in spring 2024.

Science Themes

240 sciences questions, top votes organized into themes

- Dynamics of shelf/slope exchange (wind forcing; frontal instability; Gulf Stream influence, etc.)
- Biogeochemical cycling and transport (carbon, nutrients, and particulates)
- Extreme events (hurricanes and freshwater outflows)
- Ecosystem dynamics (ecology, biodiversity, phenology, invasive species, HABs, plankton, and changes in habitat)
- Complimentary science and technology (e.g. methane, sediments, canyons, bioacoustics, contaminants, etc.)