Ocean Research Advisory Panel

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Biogeochemical Observing Technologies Subgroup

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ORAP Task:

Develop a report to offer an initial set of recommendations to the U.S. Ocean Policy Committee (OPC) about **opportunities to leverage public-private partnerships to advance emerging marine biogeochemical observing technologies and advance national ocean science initiatives**. The report will identify barriers and challenges, recommendations for addressing those challenges, and examples of technologies that are mature for investment.

Report Outline and Objectives:

The report will include discussion on:

1. **Diverse and inclusive stewardship of the ocean**

2. **Key societal needs and research priorities** in marine biogeochemical research

3. Need for **Public Private Partnerships** to address these needs and priorities

4. **Challenges and barriers** to public-private partnerships

5. **Recommendations for addressing these challenges** to advance marine biogeochemical observing technologies

6. **Examples of key emerging technologies for advancing Public Private Partnerships**

Evolution of report since May ORAP meeting

Since the May meeting, the subgroup decided to **narrow the examples of emerging technologies** that would benefit from public-private partnerships to three (3) that align with key societal needs/research priorities and the challenges discussed in the report.

Key Emerging Marine Biogeochemical Technologies:

- **Microfluidics Applications for Ocean Biogeochemistry**
- **Environmental DNA (eDNA)**
- **Advanced Sensors for Carbon Related Chemistry**

Under each “Key Emerging Marine Biogeochemical Technology” the report will discuss:

- Current and Potential Technology Applications, and
- Technology, Market, and Industry Maturity Level

Marine Biogeochemical Research: Societal Needs and Research Priorities

Marine Biogeochemical Research:
Societal Needs and Research Priorities

- Offshore Energy (Including Marine Renewables and Offshore Wind)
- Biodiversity & Sustainable Living Marine Resources
- Climate Adaptation Strategies for Human health and wellbeing
- Pollution (e.g., chemical, plastics)

Challenges and Barriers to Public-Private Partnerships

Challenges and Barriers to Public-Private Partnerships

Improving the Market

It is difficult for private sector actors to consider up-front capital investments in new public-private partnerships in **cases where a sufficiently large and diverse customer market for emerging technology does not exist**.

A sizable, mature, and predictable market is essential to allow up-front industry R&D and commercialization costs to be recouped in a reasonable timeframe and for a path to profitability to be defined.

Challenges and Barriers to Public-Private Partnerships

Enhancing Visibility of US Companies in the Market

US companies that develop and manufacture marine technologies, including those on the cutting edge of biogeochemical sensor, system, and platform development, look to serve customers on a global scale. The ocean technology and innovation landscape is rapidly maturing, with other nations making large ($300M+) and long-term investments to raise the visibility of, maturity, and competitiveness of their domestic private sector to serve the ocean economy. **Current agency efforts to expand market opportunities and visibility for US companies and to encourage exports of nonagricultural US goods and services have not kept up with the rapid expansion of domestic ocean technology clusters and companies.**

Challenges and Barriers to Public-Private Partnerships

Aggregating Government Demand

Government agency demand for marine technologies is large – through direct purchase, platform-as-a-service, and government-owned/contractor-operated (GOCO) and contractor-owned/contractor-operated (COCO) business models – although a uniform set of requirements for technology performance, data production, and information delivery that spans agencies (e.g. US Navy, NOAA, USGS) does not exist. The **absence of an aggregated, consistent, and consolidated set of technology performance requirements, standards, specifications, and use cases** suppresses market maturity, limits the growth of the marketplace to a sufficient size to attract industry investment, and stifles innovation of new approaches, technologies, and applications.

Challenges and Barriers to Public-Private Partnerships
Supporting R&D and Investments in Innovation

The management of and appetite to accept **risk in the development, maturation, and adoption of new technologies** is a limiting factor to innovation and market growth. In the ocean space, government agencies serve as both an investor in the development of technologies (e.g. SBIR/STTR), benefactor for the long-term use of technologies to support research (e.g. IOOS, NSF Division of Ocean Sciences) and customer for ocean research technologies (e.g. Office of Naval Research, NOAA).

Consistent and predictable government involvement in ocean innovation, particularly over time horizons spanning medium- to long-term, can help to mitigate the private sector risk associated with technology innovation and can support continued US R&D excellence.

Challenges and Barriers to Public-Private Partnerships

Evolving an Under Defined Regulatory Framework

For many developing marine technologies, **well defined use cases** supported by a well defined regulatory environment, inclusive of standards, are essential to allow for the evolution of technology development from exploratory research and development to wide-scale market adoption and industry engagement.

In situations where the regulatory environment supports the development and adoption of novel technologies, interagency coordination and alignment is essential to support the predictable and scalable market landscape industry looks to serve. **Absent federal, state, and tribal interagency coordination on defined and accepted use cases for technology, market maturation can be severely constrained.**

Challenges and Barriers to Public-Private Partnerships

Partnership Mechanisms

Development of new partnerships can be hindered by:

- **Lack of awareness of potential funding mechanisms** (especially private funding).
- **Alignment of timescales** - industry requires more rapid progress than government can support.
- **Limited options to develop public/private partnerships** beyond a request for proposals/award.
- **Blended funding not currently allowed** between agencies (co-funded NOPP projects are awarded by each respective agency).
- Inclusion of **public funding alongside private (philanthropic)** is difficult – cannot currently be blended and awards cannot be linked.
- **Risk management agreements** and other legal protections are a consideration.

Recommendations for Addressing Challenges and Barriers to Public-Private Partnerships

Establish and Define Use Cases & Standards

Develop:

- **Interagency technology use cases** (e.g., eDNA) supported by a national catalog of standard protocols and best practices.
- **Consistent data formats, reporting rules, and communication guidelines.**
- **Accreditation procedures** for laboratories and technical staff.
- **Performance-based testing methods** that would undergird the legally robust use of methods while also supporting continuous improvement.

Recommendations for Addressing Challenges and Barriers to Public-Private Partnerships

Convene a White House Summit

Convene a **White House Summit focused on public-private partnerships in the ocean** to include the participation of all relevant Federal agencies, private industry (both established companies and start-ups), members of the academic research community, nonprofit and philanthropic organizations, and representatives of coastal tribal governments. Suggested topics of discussion include:

- ocean observation and characterization;
- offshore energy development and assessment/mitigation of environmental impacts;
- biodiversity;
- environmental DNA and omics;
- ocean climate action (e.g., marine carbon dioxide removal);
- exploration and mapping;
- artificial intelligence and machine learning.

Recommendations for Addressing Challenges and Barriers to Public-Private Partnerships

Offer Incentives to Leverage Industry Infrastructure to Collect Publically-Accessible Measurements

- NOAA cooperation with the National Academy of Sciences to assess the need for and feasibility of an ARPA-O; bolster agency investment in innovation prizes and competitions that lower barriers of entry for startups and small business to advance novel technologies.
- Provide a mechanism for industry to recover the costs of collecting and publicly sharing ocean data via the federal R&D tax credit (26 USC 41).
- Under the provisions of the Build America, Buy America Act (Public Law 117-58) consider federally operated and federally funded ocean observing systems public infrastructure to support secure/stable domestic supply chains for ocean research technologies.

NEXT STEPS

- Seek the involvement of additional ORAP members to draft the report for presentation at the December ORAP meeting.
- Identify additional existing partnership mechanisms that could inform the recommendations to address the challenges and barriers discussed in the report.
- Welcome novel ideas from ORAP members about additional recommendations that are within the purview of the Executive Branch to address.