OCEAN ENTERPRISE INITIATIVE

Dialogues with Industry

Ocean Observing of the Future: Advancements in Sensors and Platforms: Reducing Costs and Increasing Utility

Report Out from Dialogue 2

MTS marine technology society
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Global Ocean Observing System

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

IOOS Integrated Ocean Observing System

**Cover photo: Hydro dam inspection in Idaho Falls using a Seamor Chinook ROV and Voyis stereo camera. Photo by Rick Zaunbrecher & Ryan Wallace.*

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Dialogue Purpose

The Ocean Enterprise Initiative is a global effort that spearheads innovation, thought leadership, and economic development within the Ocean Enterprise. It is led by the Marine Technology Society (MTS), Global Ocean Observing System (GOOS), National Oceanic and Atmospheric Administration (NOAA), Industry (Kongsberg Discovery and L3Harris), and the United States Integrated Ocean Observing System.

The first successful *Dialogues with Industry* (hereafter *Dialogues*) series (September 2022–January 2023) focused on advancing the Ocean Enterprise to achieve key societal, economic, and environmental goals. This initiative resulted in the publication of Dialogues with Industry *Roadmap*. The Ocean Enterprise Initiative carries out the Roadmap's recommendations, focusing on three main goals:

- Improving the Marketplace
- Collaboration to Grow and Impact Change
- Shaping the Future

The *Dialogues* are a signature pillar of the Ocean Enterprise Initiative.

The *Dialogues* series have been co-designed for focused discussions with companies, academia, and government to identify challenges and explore solutions. The series also aims to highlight opportunities for increasing industry involvement, utilizing technologies, and fostering public-private partnerships to mature the Ocean Observing Enterprise. Working together will solve problems faster.

The third *Dialogues* will focus on future ocean observing consisting of three curated dialogues held October – November 2025, specifically targets the market dynamics influencing public-private-academic partnerships and aims to address challenges related to accessibility, cost, and technology integration in future ocean observing systems. A key focus is on defining what constitutes “accessible” and “low-cost” ocean technology, acknowledging the complexity of these terms beyond upfront price, including factors such as operational and maintenance costs and sensor capabilities.

11 Key Takeaways

This dialogue presented a comprehensive discussion on reducing costs and enhancing the utility of ocean technology, and enhancing accessibility, ensuring data quality, and fostering collaboration of ocean observing technologies. The participants emphasized that incremental progress is insufficient, and a fundamental disruption is essential to successfully align technology development, market forces, operational challenges, and community needs. The following main takeaways were summarized from the assembled experts' comments.

1. **Total Cost of Ownership (TCO):** Emphasize cost per profile collected and efficiency to extend deployment, rather than just the technology's price.

2. **Coalition Building:** Forming coalitions to boost order quantity, lower prices for members, and enhance negotiation power. Building stronger ties between science and industry can also maximize quantitative benefits.

3. **Sensors for User and Outcome needs:** Addressing potential misalignments between developers and end-users can result in cost savings. Technologies are often not designed with end users in mind and tend to be over- or under-engineered.

4. **Maintenance & Best Practices:** Enabling global users of technology to maintain, calibrate and service ocean technologies locally (e.g. through modular part replacement) and capture standards and procedures in open-source format.

5. **Public-Private Scaling and Procurement:** Streamlining IP transfer, centralized procurement, and consortium funding for product development.

6. **Service-Based Delivery Models:** Exploring leasing, rental, or subscription options to make access easier for users and ensure consistent revenue for manufacturers.

7. **Market Readiness and Transformative Opportunities:** Accessible/low-cost technologies are well-suited to specific markets to fill a vital gap, particularly in markets with price-sensitive deployment schemes.

8. **Democratizing Data and Data Intelligence:** Ensure data is FAIR (Findable, Accessible, Interoperable, and Reusable), and develop software, dashboards, etc., turning complex datasets into actionable, easy-to-digest information for all.

9 **Trust and Reliability:** Distrust in accessible/low-cost sensors can be mitigated by regular calibration against high-accuracy instruments, validation, and user training. Data quality assurance and adherence to best practices are necessary to build user confidence.

10 **Supply Chain Risk:** Enable global standardization and widely available components to reduce reliance on single sources and the uncertainty around the longevity of start-up companies.

11 **Sensor Development by Non-Profits:** Non-profit organizations are increasingly developing ocean sensors and technologies to fulfill their missions. Their financial flexibility allows them to offer these technologies at lower costs.

Dialogue 2 Description

The second Ocean Observing of the Future dialogue brought together 21 experts from industry, government, non-governmental organizations and academic sectors (see list of the participants in Appendix 1) for a virtual discussion diving deeper into the feasibility of reduced costs for sensors and platforms and associated drawbacks and further identified common barriers of "accessibility" beyond the cost of the platform or sensor itself. In preparation, the participants were provided with the Ocean Observing of the Future Background Paper and the Use Case 2 discussion guide (Appendix 2). The Use Case was divided into three sections: (1) Barriers to reducing the cost of ocean technologies; (2) Addressing the Accessibility Gap - Traditional and Emerging Company Approaches; and (3) Beyond the cost of the ocean technologies - barriers to access and potential solutions. Each section of the Use Case included questions to help participants prepare and to guide the dialogue discussions.

Invited experts from 10 countries joined the discussion, representing the following sectors: Private – 65%; Non-governmental – 20%; Governmental/Intergovernmental – 5%; and Academic – 10%. In addition, approximately 218 individuals from 40 countries joined as observers, providing input primarily via chat.

Hans Van Sumeren, Senior Director, Ocean Enterprise Initiative, Marine Technology Society, moderated the discussion and prompted participants for feedback and recommendations on the sections outlined above. The first two hours of the dialogue focused on discussion among experts, while the moderator integrated comments and questions from observers. During the last thirty minutes, observers engaged in an open question-and-answer session with the experts.

This was the second of three in the Ocean Observing of the Future *Dialogues*. The key takeaways and potential paths forward provide a foundation for Dialogues 3 and are outlined in this synthesis report on a non-attributional basis.

Discussion Synthesis

Section 1: Barriers to Reducing the Cost of Ocean Technologies

The dialogue began by addressing the barriers to reduced sensor and platform costs and their impacts on companies and their operations. The discussion underlined some of the key points made during dialogue 1, especially regarding enhancing accessibility and viewing the price of ocean technology more comprehensively. While companies have applied various strategies to reduce costs, such as enhancing the versatility of infrastructure or increasing sensor capacity on platforms, other components must also be considered. Participants highlighted the need to shift the focus from Capital Expenditure (CAPEX) for ocean technology to Operational Expenditure (OPEX). While the product price and thus CAPEX are affected by competition and volume (the more sensors are purchased, the lower the price), OPEX can be reduced by lowering operational design and data flow costs.

Barriers to Accessibility

Participants stressed that the cost of ocean technology is a minor component in a larger barrier to the total cost of ownership. Often, the cost of ownership is not considered in program funding structures and can often not be sustained, leading to inefficiencies and underutilized equipment. This resulted in a key shift towards more autonomous vehicles and reduced power consumption to enhance deployment durations, decrease the cost per data point, and lower other barriers, such as ship time requirements, which can be associated with enormous costs. In addition, maintenance requirements need to be made more accessible, as this is another critical barrier and often leads to underutilized or abandoned ocean technologies.

Other suggestions included comparison studies between sensor manufacturers to identify sensor reliability and the creation of central procurement systems/groups to bring groups together and place bulk orders, enabling negotiations to lower prices.

Sharing Costs in Development Cycles

Public-private-led projects along the entire readiness pathway, from Research and Development to qualified product status, would allow for mutual knowledge transfer, link ideas, and create the potential for the development of "dual use" technologies suited for a larger market, i.e., platforms capable of taking atmospheric and underwater measurements. These co-designed projects would provide better pathways for transferring intellectual property (IP) from universities to manufacturers and enable universities to access ocean technologies that meet their needs. Allowing for this transfer of knowledge and understanding of need would greatly enhance the articulation and definition of requirements for infrastructure, benefiting both the academic and private sectors, and aid in identifying potential market communities. An identified barrier to

successful IP transfer was the challenge of determining suitable technology transfer rates that are aligned with the actual Ocean Enterprise and Blue Economy market conditions.

Managing Risk

Other arenas to explore are providing a minimum order quantity through funding streams that allow private sector companies to explore lower cost solutions and reducing the risk of a non-existent market or funding the development of an initial prototype before market upscaling (e.g., government, philanthropy). Developing mechanisms for governments to purchase research infrastructure and provide the capacity to maintain such systems, which can be made available to the research/ocean observing community at no cost, could significantly reduce the entry barrier and ensure continuous use of technologies (*South Africa is partially operating under this mechanism*).

Section 2: The Accessibility Gap — Traditional and Emerging Company Approaches

Despite the rapidly expanding need for ocean information, there has been no significant increase in observations over recent years, underscoring the need to identify efficient pathways to expand ocean observing capabilities. Section 2 began with the participants discussing the revolutionary potential of low-cost ocean technologies for the market and its users. Throughout the discussion, participants examined the revolutionary and transformative potential of "accessible/low-cost" technologies, addressed risks to manufacturers, and investigated strategies in this emerging market to address the challenges of democratizing information. The discussion ended with an intervention that stressed the responsibility to share what companies do regarding environmental monitoring with as many people as possible to raise awareness of the importance of environmental data.

Revolutionary vs. Transformative

Expanding on the first session, the participants discussed the potential for accessible ocean technology to revolutionize the market of ocean observing. While discussions were broad and highlighted various aspects of the potential of accessible/low-cost technologies, the idea of revolutionizing the market was deemed not applicable but transformative. Regarding this, it was noted that, from a manufacturer's standpoint, although a reduction in costs could result in a market that is 10x larger, from a revenue standpoint, this would likely yield no net gain. Instead of viewing low-cost technologies as a revolutionary opportunity for the market, the community should see them as a revolutionary opportunity to increase accessibility.

Participants highlighted that accessible/low-cost sensors are truly impactful across various fronts, enabling the development of scaled networks, allowing companies to create broad, multi-use data platforms before upscaling production, and helping identify the target audience. These opportunities allowed initiatives to emerge and new markets to be targeted, e.g., one company works with fishermen globally to deploy sensors on their nets and deliver data critical to this specific need at a low price, allowing a broader community to access these technologies and information that are not usually serviced. The discussion touched on the broadening application of these ocean technologies as a key benefit and on their use to enhance traditional monitoring capabilities. Where monitoring is becoming unsustainable, these technologies can be used to

replace traditional observing platforms with low-cost alternatives, ensuring continued monitoring at a sustainable cost.

The discussion highlighted that the market is mostly primed for low-cost technologies in areas with low deployment costs (e.g., coast, intertidal, estuaries). Lowering deployment costs and increasing the number of available sensors can have a large, direct impact on everyday life and engage a broader constituent base (e.g., non-profits, fisheries, universities, citizen scientists), whereas the open ocean is a less-primed market for these technologies.

Democratization and Data Intelligence

As addressed in various parts of this dialogue series, democratization and data intelligence are a central piece to the transformative nature of accessible/low-cost technologies and beyond. The development of community dashboards and related tools that translate raw data into easily digestible, actionable information for nontraditional users.

Technology Endurance

Endurance is the biggest opportunity for change. It was highlighted that diverse markets are placing greater emphasis on platform longevity and on enabling simultaneous measurement of more parameters, thereby reducing the cost per profile or data point. Currently, the market often views the cost per ocean technology as the primary driver, while the market should be looking at the cost per profile or data point. This reiterates the point of TCO.

Geographical Markets

Participants highlighted that many countries lack access to ships, vehicles, etc., to address local information needs. With the growing desire to research local waters and rising societal needs, this could be an opportunity to expand the market, open access to tools, and tap a new global market that has not been utilized.

Data and Platform Rental Services

The use of higher-cost sensors through rental or service contracts rather than purchase was brought up. Balancing the trade-offs between purchase (procurement, training, deployment, processing, maintenance, etc.) and rental or service contract approaches will be important for identifying which types of sensors or markets would benefit from accessible/low-cost sensor development. Rental of higher-accuracy sensors has been far more beneficial for data collection and does not require CAPEX, storage, or maintenance.

Addressing Trust

Accessible/low-cost technologies face a barrier to preconceived notions regarding reliability and data accuracy. Participants highlighted that companies working with cost-effective sensors must address this heightened scrutiny by undertaking more upfront work, developing detailed protocols, enhancing communication to build trust in the technologies, and adopting a lower failure acceptance rate. Transparency and equitable access, best practices on how to deploy, and service technologies, etc., need to be captured through systems such as the IOC Best Practices system.

In terms of data accuracy, outputs may be comparable to those from more advanced technologies. There are projects that compare various sensor types across different environments to enable data comparison and identify which sensors are suitable for specific application areas. These results and information (especially accessible/low-cost options) are captured and published online.

Supply Chain and Market Risks

The Ocean Enterprise faces compounding risks stemming from sourcing and long-term viability. Geopolitical risks are emerging as regions increasingly implement policies that encourage in-country purchasing, restricting the ability to source globally and to diversify supply chains. This has inherent risks, including market concentration and the potential for a single domestic vendor to dominate the supply chain. A significant operational risk is the discontinuation of key parts, which can stifle projects; therefore, market diversification is essential. Additionally, in some cases, the market is not delivering the specific ocean technologies needed by the user community, leading to the emergence of small companies or universities developing them to meet those needs. In this scheme, by developing accessible/low-cost ocean technology and selling a small batch to the user community, R&D costs are covered, and a gap is filled.

Section 3: Beyond the Cost — Barriers to Access and Potential Solutions

The final segment moved on to discussing potential solutions to increase accessibility beyond cost. The primary access barriers highlighted in this discussion centered on building trust, data accuracy and reliability, deployment barriers, and data and software delivery and maintenance.

Barriers to Access

One critical accessibility barrier mentioned throughout the dialogue series is the ease of deploying and recovering technology. Various mechanisms were suggested as potential solutions, e.g., providing ship time for deployments, collaborating with other entities, increasing the endurance of technologies to reduce the need for deployment and recovery missions, and adopting service-based delivery models.

Beyond these, the need for simplified mission planning tools and easy-to-maintain technologies has been a key recommendation throughout the discussions, allowing entities to maintain, calibrate, and redeploy technologies without additional expenses and cost of ownership. Participants highlighted that CAPEX is usually easier for the research community to fund (purchasing infrastructure); however, operating costs are rarely accounted for. This touches upon a previous point, shifting the focus to TCO. Many factors can ensure that the TCO remains low enough to avoid stifling the adoption of technologies, such as ease of maintenance and extended endurance. Another component raised by the participants is the use of accessible/low-cost ocean technologies that must come with certain assurances, including reliability and endurance, environmental integrity, and the longevity of the provider.

The discussion affirmed that achieving FAIR (findable, accessible, interoperable, reusable) data is a clear pathway to enhance accessibility to a broader user base. This increased accessibility necessitates the parallel development of easy-to-use software (open-source software), dashboards, etc., enabling non-expert users to access and understand the information. While data accessibility is crucial, participants acknowledged that the demand for free and open-source data creates a significant financial and intellectual property burden on private industry. This can be compounded by the user community adopting new technologies and/or data models, placing additional strain on the industry, as investments must be made upfront with no guaranteed returns.

These must be considered when making recommendations, ensuring the approach remains viable for private industry.

Distrust

Participants discussed whether an inherent distrust of data from low-cost technologies exists and whether the correlation between sensor price and performance has become arbitrary. While a higher cost can reflect reduced risk of sensor failure and the necessity for long-lasting durability, this is not guaranteed. Participants stressed that comparison studies and regular testing can help break down distrust in data accuracy, reliability, and the durability of technologies across various environments.

Another factor to consider is the user group responsible for deploying the sensor. Data collected by trained scientists knowledgeable in the deployment and maintenance of sensors carries an inherent level of trust. Conversely, a higher level of distrust may be present for citizen scientists and other non-expert user groups.

Market Subsidies

The discussion highlighted that the cost of an ocean observing technology is often less about its material components and more about the purpose the data is intended to serve; however, this model often relies on market subsidies. This is a space where non-profit organizations are actively subsidizing certain applications and sensor costs, artificially depressing prices to ensure that people and communities can access essential data, effectively decoupling price from accessibility.

Open Session

The open session brought the observers together with the participants to address systemic challenges facing the ocean enterprise, focusing primarily on operational barriers, data practices, and sustainable commercial models.

Discussions emphasized the technical hurdles of maintaining and calibrating technologies. A core solution emphasized by the audience was the need for in-house training and the development of materials to ensure calibrations can be performed internally. This is vital for expanding the market, enabling a larger user base, and reducing the cost of ownership. Separately, a critical barrier in the academic sector is retaining experts, such as technicians, amid continuously decreasing funding.

Data quality, particularly its reusability, was a key focus. Participants stressed the need to adhere to FAIR data principles and to provide metadata and data quality information. For global and strategic purposes, the community is encouraged to review the GOOS EOVs (Essential Ocean Variables) and develop a layered approach, outlining required accuracy levels and application area overviews for the data.

The concept of leasing was explored as a tool to fund the research and development of new sensors. However, participants noted that the success of this model is dependent on the user base. While research operates with CAPEX funding, it lacks OPEX funding, limiting the commercial transaction pathways. For other users, such as engineering groups, OPEX is easier to secure than CAPEX. These diverse funding mechanisms across user groups make it difficult to streamline delivery methods and reliable commercial transactions.

A step forward for the ocean enterprise involves rethinking business-to-business collaborations and factoring in aspects of competition. Dialogues are needed to identify reliable solutions that foster partnerships without stifling the evolution of this enterprise. Finally, participants highlighted that academia may not be the appropriate market for the low-cost technology community, and other users may need to be approached where this technology has a larger and more recognized impact. The primary goal remains to elevate data to a higher level of intelligence across all applications.

Potential Pathways Forward

This is the second of three *Dialogues with Industry* on Ocean Observing of the Future. Below is an initial take on the key issues and potential pathways forward drawn from the second dialogue. The results from all Dialogues will be synthesized in a final summary paper for the series.

- **Total Costs of Ownership:** Organize specialized panels during ocean-focused conferences and create informative resources that shift attention to the Total Cost of Ownership for these technologies. Encourage dialogue and inspire comprehensive analyses of ocean technology ownership costs that go beyond mere technical comparisons.

- **Public-Private Procurement Scaling:** Encourage strategies such as bulk purchasing through consortiums, streamlining product design for specific deployments, investing in co-development, employing modularity for local repair, transitioning to rental or subscription models, and leveraging public-private partnerships to share development risks and costs.

- **Market Maturation and Economic Understanding:** Promote more national and international Ocean Enterprise market studies to realistically assess economic opportunities. This supports adjusting IP/technology transfer rates and identifying cost-effective ocean technology applications.

- **Building Trust in Low-Cost Sensors:** Collaborate on a use case to compare data from low-cost sensors with traditional technologies, evaluating accuracy and applications to increase confidence in their use.

- **Accelerate Technology and IP Transfers:** Address current barriers related to restrictive intellectual property policies and raise awareness at appropriate fora about the impacts.

- **Develop Standardized Production Protocols:** Motivate the application of established quality frameworks as a basis for sensor production, calibration, maintenance and data quality assurance.

Appendix 1: Participants

Sector	Affiliation	Name
Private/For Profit	Silent Returns	Lucas Wissmann
Private/For Profit	Alseamar	Laurent Beguery
Private/For Profit	CatchCam	Chris Lewis
Private/For Profit	Obscape	Paul Groves Jason van Pletzen
Private/For Profit	Richard Brancker Research (RBR)	Greg Johnson
Private/For Profit	Fieldkit	Pete Marchetto
Private/For Profit	Science Applications International Corporate (SAIC)	William Sandberg
Private/For Profit	Teledyne Marine	Clara Hulburt
Private/For Profit	Surfline	Ben Freeston
Private/For Profit	L3Harris	Teresa Pace
Private/For Profit	SubSeaSail	Michael Jones
Private/For Profit	Sofar Ocean	Evan Shapiro
Intergovernmental	South African Environmental Observation Network (SAEON)	Juliet Hermes
Academia	Solutions for Cost-effective Ocean Observation Platform (SCOOP)	Emilie Breviere
Academia	South African Polar Research Infrastructure (SAPRI)	Jethan d'Hotman
Private/Not for Profit	FishEye Collaborative	Marc Dantzker
Private/Not for Profit	EnvLogger	Frenando Lima
Private/Not for Profit	A Liquid Future	Lizzie Murray
Private/Not for Profit	Ocean Discovery League	Katy Croff Bell

Appendix 2: Use Case

Dialogues with Industry — Ocean Observing of the Future | Reducing Costs and Increasing Utility | October 29, 2025

Introduction

There is now worldwide recognition that healthy and safe oceans are fundamental for thriving ecosystems and for resilient global economies. Efforts to advance robust and innovative ocean data collection and dissemination practices, as well as wide-reaching collaborative data sharing and analysis efforts, demand engagement and partnerships among the public, private, and academic sectors.

The Ocean Enterprise Initiative is a global effort that spearheads innovation, thought leadership, and economic development within the Ocean Enterprise. It is led by the Marine Technology Society (MTS), Global Ocean Observing System (GOOS), National Oceanic and Atmospheric Administration (NOAA), and Industry (Kongsberg Discovery and L3Harris). The first successful series of *Dialogues with Industry* explored how to mature the Ocean Enterprise to deliver essential societal, economic, and environmental benefits. The second *Dialogue with Industry* series focused on Harmful Algal blooms, understanding opportunities for sensor and platform development, increasing demand for downstream services, and advancing control mechanisms.

The third series, focusing on Ocean Observing of the Future, consists of three curated dialogues that will be held in October – November 2025. The *Dialogues with Industry* – Ocean Observing of the Future (hereafter *Dialogues*) will explore and define the market dynamics, including barriers and opportunities, for maturing the public/private/academic partnership, capability, and capacity to support the growing societal need for delivery of actionable, fit-for-purpose ocean data, information. The *Dialogues* are less focused on technical and scientific discussions, except as they influence the market dynamics.

This Use Case outlines the scope, format, and proposed discussion topics for Ocean Observing of the Future - Dialogue 1.

Background and Scope

There is a widespread effort to make ocean observing technologies more efficient and accessible through the price itself and other avenues. This dialogue will focus on defining “accessible” and “low-cost” technologies, identifying barriers to accessibility, and exploring how such technologies can complement existing ocean observation platforms to address the growing need for ocean information. A consensus on definitions has not been reached; however, the background paper provides a framework based on significant cost reductions.

The first dialogue assesses advances in technologies and enablers, as well as advancements in infrastructure, that can both reduce the cost of measurement and expand the geographical and temporal deployment of future ocean observations.

Dialogues Outcome

The goal of the *Dialogue* series is to raise awareness and conduct a stock-taking of the trajectory of the global ocean observing community, focusing on services for data delivery and the generation of enhanced predictions and forecasts that are sustainably funded through collaboration between the public and private sectors. The deliverable from Dialogues is a set of actionable recommendations to be acted upon by those globally engaged in future ocean observing across the public, private, and academic sectors.

Format of the *Dialogue* 2

Dialogue 2 is divided into three sections described below. Each section will engage experts from the public, private, and academic sectors to explore challenges and opportunities associated with maturing the commercial market for observing platforms; understanding the influences on demand for these technologies; harmonizing and leveraging of public and commercial observing networks. The facilitator will provide a short review of each section below and then discuss the questions outlined in each section with the participants. The purpose of the questions is to draw out the different perspectives of the participants. The moderator will ask follow-up questions as needed to flesh out the discussion in more detail. Observers will be able to provide their input to the questions via the chat function. The last 30 minutes the observers will be invited to join the discussion.

Section I - What are the barriers/bottlenecks for companies to reduce the cost of ocean technologies?

The cost of ocean technologies and sensors is a critical barrier to access. To effectively address the challenges driving these prices, we must first understand the many factors contributing to their price (including cost of research and development, materials, maintenance, deployments, personnel, shipping, demand, etc.). The dialogue will evaluate the feasibility of reduced cost of sensors and platforms, understand the impacts of such price reductions, and discuss potential solutions to achieve economies of scale that allow for lower prices. The Ocean Enterprise continues to develop new technologies, platforms with a greater capacity for sensor suites and more sophisticated sensors; these are often conducted within research organizations with grand/public funding. It is essential to evaluate opportunities to foster public-private innovation while maintaining open science principles to address the need for improved sensors/platforms. In discussing this topic, both CAPEX and OPEX should be considered. While CAPEX is driven by competitivity, OPEX is often driven by design.

Discussion Topics

1. If market demand remains the same, what strategies could be used to reduce costs and what are the potential impacts? (e.g., reducing customer support, shifting costs to end users, co-investing in development, shifting the business model to rental or subscription models).

2. Beyond lowering costs, what other approaches could make sensors and platforms more accessible?

3. How can public funding be targeted to create opportunities for co-development of sensors/platforms with private sector when a gap is discovered? How can we overcome the hurdle of public funding that often goes to prototypes but does not extend to a product?

5. How can private sector and research institutions/universities best collaborate to address the need for research and development for observing sensors and platforms?

6. If industry does not perceive that the market for accessible/low-cost sensors is large enough to warrant their participation, what are some creative funding/incentives that can accelerate this market space?

7. Can the ocean community define which observations can tolerate reduced sensor accuracy to lower costs?

Section II - Addressing the Accessibility Gap: Traditional and Emerging Company Approaches

Despite the rapidly expanding need for ocean information, there has been no significant growth in observations over recent years creating a pressing need for a paradigm shift. There is a critical need to identify efficient pathways to increase ocean observing capabilities across the globe giving rise to a new market sector of "accessible/low-cost" sensors/platforms. Financial demands, specialized research and development, materials, deployment associated expenses have confined to the collection of ocean information. This dialogue seeks to examine the viability and potential of the new market of "accessible/low-cost" technologies, addressing core assumptions about the link of price and performance, and investigate the strategies of this emerging market to meet the challenges to democratize information. This dialogue will discuss various aspects of the market to evaluate transformative potential.

Discussion Topics

1. Are accessible/low-cost technologies truly revolutionary? If so, how might they disrupt the market, and what differentiates them from existing sensor market?

2. If autonomous platforms already enable affordable/low-cost data (compared to ship campaigns), why has the market or wiliness to pay for the data grown?

3. Where is the market most primed for transformation, and why? (e.g., technological advances, market size, broad applications, or other factors). Is there a "sweet spot" where multiple factors intersect to drive change?

4. What are areas of consideration in your business case when including cost effective technologies (e.g., customer base, market dynamics, risk)?

5. What are the primary risks and how are inherent risks and uncertainties being managed?

Section III - Beyond the cost of the sensor/platform, what are other barriers to access and potential solutions?

As established in the first dialogue, the cost of the sensor/platform is not the sole inhibitor to accessibility, and simply lowering the price does not automatically translate into enhanced accessibility. A set of operational and perceptual barriers influence whether technologies are truly "accessible". This dialogue will investigate the most prominent barriers to democratizing information looking beyond the price of the technologies, but the total cost of ownership (including technology cost, operations, and maintenance). Identifying the most prominent barriers will allow for the development of creative solutions to bridge these gaps and achieve a truly accessible ocean observing system.

Discussion Topics

1. What additional costs should be considered beyond purchase price? (e.g., calibration, durability, power requirements, deployment)

2. What gaps exist that limit broader access to and use of ocean technologies? What is the most prominent barrier?

3. Is there currently a stronger focus on fit-for-purpose sensors rather than versatile systems to increase accessibility?

4. How important are decentralization and local repairability to reduce usage costs and minimize downtime? What are the barriers to their implementation?

5. Is there an inherent distrust with affordable/low-cost solutions?

Appendix 3: Planning Team

Sector	Affiliation	Name
Academia	Stanford University	Collin John-Erik Closek
Integovernmental	GOOS	Patrick Gorringe
Intergovernmental	GOOS	Emma Heslop
Private/Not for Profit	Euro-Mediterranean Center on Climate Change (CMCC) Foundation	Viviana Piermattei
Private/For Profit	Kongsberg Discovery	Peer Fietzek
Private For Profit/Not for Profit	L3Harris/MTS	Donna Kocak
Public	NOAA/GOMO/UCAR	Ann-Christine Zinkann
Public	NOAA/IOOS	Zack Baize
Public	South African Environmental Observations Network (SAEON)	Juliet Hermes
Private/Not for Profit	MTS	Hans VanSumeren
Private/Not for Profit	MTS	Caisey Myers
Private/Not for Profit	MTS	Zdenka Willis
Private/Not for Profit	MTS	Maik Kecinski

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