

The 2022 National Ocean Exploration Forum

# Ocean Exploration: BLUEPRINT

# 2032



University of Texas at Austin  
March 28-30, 2022

## Forum Report

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# EXECUTIVE SUMMARY

The 2022 National Ocean Exploration Forum (Forum), titled *Ocean Exploration: Blueprint 2032*, was held in a hybrid in-person/virtual format from March 28-30, 2022, at the University of Texas at Austin. The event convened representatives from the ocean exploration community to envision community-driven actions that can advance United States (U.S.) national ocean exploration priorities over the next 10 years. Forum discussions were guided by a “blueprint” framework, which was generated by key members of the ocean exploration community and informed by whitepapers commissioned for this event, as well as discussions at the Forum itself. This blueprint captures essential elements of ocean exploration: **how we explore** (*Platforms and Technology, Novel Collaborations and Partnerships, Alliances and a Community of Practice*) and **why we explore** (*Data to Address Societal Needs, Public Engagement and Impact*). Short- and long-term actions were formulated from participants’ discussions at the Forum and synthesized into this blueprint.

“Actions” (detailed throughout this report) are defined as opportunities for the community to make progress on specific activities over the next decade. They are intended to serve as a foundation for further discussions and/or for the community to take ownership of and determine how they can be advanced. “Short-term” refers to activities that can be accomplished in one to five years, while “long-term” refers to activities that can be accomplished in five to 10 years.

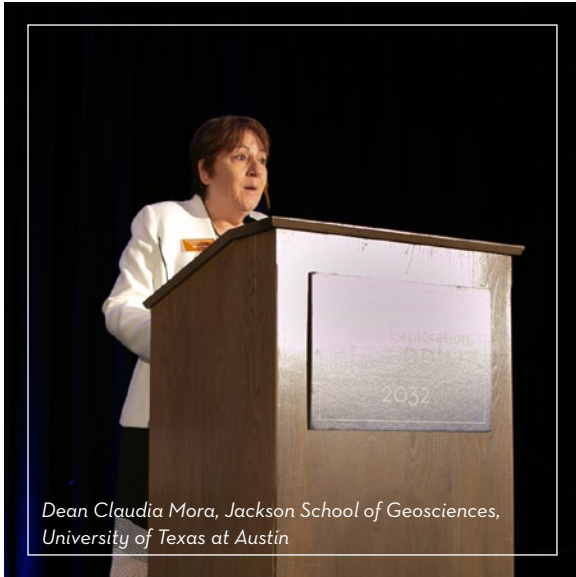
## **Common themes within the identified actions and throughout the Forum discussions included:**

**Storytelling:** Enhancing public engagement in ocean exploration can be achieved through dynamic, inclusive storytelling that is built around common and proven messages determined collectively by the ocean exploration community. Ocean exploration is not just about collecting data, and data alone do not tell stories. The community must work together to enable exploration of the data itself and share the stories they tell.

**Data:** Data must be at the forefront of project and expedition planning, as well as technology development. As the availability of low-cost sensors and cloud computing capabilities for processing large amounts of data increase, investments in a data-first strategy and development of effective public-private partnerships will be required to understand stakeholder information needs and implement systemic policy changes for data accessibility and discoverability. Furthermore, data are often not truly accessible by everyone; full data accessibility and inclusion must be aspired to.

**Equity and Inclusion:** Equity, inclusion, and access in ocean exploration, including to the resulting data, should be an overarching goal of the community and underpin all of its activities. Integration of diverse perspectives and representation at all levels will ensure the long-term success of and engagement in the enterprise. This must not be an afterthought, but an intentional effort throughout ocean exploration planning, workforce development, and in communications and outreach. Strategic partnerships and alliances, established through long-term relationship and trust-building, will be essential to establishing a true ocean exploration community of practice.

# PREFACE



Dean Claudia Mora, Jackson School of Geosciences,  
University of Texas at Austin

The 2022 National Ocean Exploration Forum (Forum) promoted partnerships and communications among scientific researchers and other stakeholders with the goal of developing a community-driven blueprint for the next decade of ocean exploration. The Forum was a nonpartisan event where ideas were presented in an environment of mutual respect and sound, science-based decision-making, consistent with the ocean exploration community's professional values and the meeting code of conduct. In addition to fulfilling its scientific goals, the Forum sought to promote equity and inclusivity and recognized the value of including diverse perspectives in completing this mission. In-person Forum participants gathered in Austin, Texas, a city recognized for its creative and entrepreneurial spirit and for empowering people to be true to themselves.

The in-person component of the Forum took place on the Indigenous lands of Turtle Island, the ancestral name for what now is called North America. The Alabama-Coushatta, Caddo, Carrizo/Comecrudo, Coahuiltecan, Comanche, Kickapoo, Lipan Apache, Tonkawa, and Ysleta Del Sur Pueblo, and all the American Indian and Indigenous Peoples and communities who have been or have become a part of these lands and territories in Texas, [were acknowledged](#) at the start of the Forum. To learn more, visit the University of Texas [Native American Indigenous Studies](#) website.

The Forum was endorsed by the [United Nations \(UN\) Decade of Ocean Science for Sustainable Development](#).



**2021** United Nations Decade  
**2030** of Ocean Science  
for Sustainable Development

# INTRODUCTION

The 2022 National Ocean Exploration Forum (Forum), titled *Ocean Exploration: Blueprint 2032*, was held in a hybrid in-person/virtual format from March 28-30, 2022, at the University of Texas at Austin. The event convened the ocean exploration community to envision community-driven actions for the next decade of ocean exploration. Nearly 170 participants attended (107 in person and 62 virtually via Zoom; *Appendix A*), representing 91 organizations across multiple sectors, including government, industry, academia, non-profit and private organizations, philanthropy, Indigenous/Tribal communities, media, and policy.



Organized through a partnership between the [Consortium for Ocean Leadership \(COL\)](#) (now the Center for Ocean Leadership at the University Corporation for Atmospheric Research) and NOAA's Office of Ocean Exploration and Research ([NOAA Ocean Exploration](#)), and modeled after the first Forum in 2013, [Ocean Exploration 2020](#), participants envisioned short-term and long-term actions to guide the community in identifying and addressing shared exploration priorities over the next decade. The Forum was intended to be inclusive of the perspectives and priorities of a broad range of stakeholders. This report synthesizes the outcomes of the discussions by participants at the Forum into a community-driven blueprint.

<p>Ocean Exploration: <b>BLUEPRINT</b> 2032</p>		<p><b>WHY WE EXPLORE</b></p>	
<p><b>HOW WE EXPLORE</b></p>	<p><b>Alliances and a Community of Practice</b> Organizations working together in an ongoing manner to achieve common goals that benefit the overall ocean exploration enterprise.</p>	<p><b>Data to Address Societal Needs</b> Ensuring that ocean exploration data collection, archiving, and accessibility meet the requirements of many different stakeholders who are addressing important societal applications.</p>	<p><b>Public Engagement and Impact</b> Informing and inspiring a diverse public that recognizes the relevance of ocean exploration, resulting in greater attention and support for the exploration community.</p>
	<p><b>Novel Collaborations and Partnerships</b> Organizations working together primarily on a project-by-project basis to utilize complementary capabilities and achieve mutually beneficial outcomes.</p>	<p><b>'Ocean Exploration in a Data-Rich World'</b> by Dr. Vicki Ferrini &amp; Colleen Peters (<a href="#">Click Here to View</a>) Short-term Milestones... Long-term Milestones...</p>	<p><b>'Re-envisioning the Collective Voyage for Ocean Exploration'</b> by Kalani Quiocho &amp; Allison Fundis, et al. (<a href="#">Click Here to View</a>) Short-term Milestones... Long-term Milestones...</p>
	<p><b>Platforms and Technology</b> Developing, improving, and scaling the wide array of both existing and emerging technological capabilities and operational models utilized in ocean exploration.</p>	<p><b>'Baselining How to Build Sustainable Ocean Exploration Partnerships'</b> by Dr. Megan Carr &amp; Dr. Jon Kaye (<a href="#">Click Here to View</a>) Short-term Milestones... Long-term Milestones...</p>	<p><b>'Branding the Ocean'</b> by Dr. Carlie Wiener (<a href="#">Click Here to View</a>) Short-term Milestones... Long-term Milestones...</p>

The blueprint framework, developed with input from the Forum’s advisory committee (see a list of the advisory committee members in the Acknowledgements section at the end of this report), was essential to achieving this objective. The blueprint captures the fundamental elements of ocean exploration: how we explore (*Platforms and Technology, Novel Collaborations and Partnerships, Alliances and a Community of Practice*) and why we explore (*Data to Address Societal Needs, Public Engagement and Impact*). These elements were generally defined as:

## How We Explore:

- **Platforms and Technology:** Developing, improving, and scaling the wide array of both existing and emerging technological capabilities and operational models utilized in ocean exploration.
- **Novel Collaborations and Partnerships:** Organizations working together primarily on a project-by-project basis to utilize complementary capabilities and achieve mutually beneficial outcomes.
- **Alliances and a Community of Practice:** Organizations continuously working together to achieve common goals that benefit the overall ocean exploration enterprise.

## Why We Explore:

- **Data to Address Societal Needs:** Ensuring that ocean exploration data collection, archiving, and accessibility meet the requirements of many different stakeholders who are addressing important societal applications.
- **Public Engagement and Impact:** Informing and inspiring a diverse public that recognizes the relevance of ocean exploration, resulting in greater attention and support for the ocean exploration community and its efforts.

Outcomes are presented in this report as short-term and long-term actions at the intersections of these topics within this blueprint structure.

## Whitepapers

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To provide aspirational yet achievable visions for the next decade of ocean exploration, and to further define the intersections within the blueprint, six whitepapers were commissioned in advance of the event. Each whitepaper (Appendix B) was written by pairs or teams of authors with complementary perspectives. They were shared with participants in advance of the Forum and provided foundations for the plenary and breakout discussions.

- *Ocean Exploration in a Data-Rich World* by Dr. Vicki Ferrini, Lamont-Doherty Earth Observatory and Colleen Peters, Saildrone
- *Re-envisioning the Collective Voyage for Ocean Exploration* by Kalani Quiocho, NOAA Office of National Marine Sanctuaries Pacific Islands Region and Allison Fundis, Ocean Exploration Trust (OET), et al.
- *Baselining How to Build Sustainable Ocean Exploration Partnerships* by Dr. Megan Carr, Bureau of Ocean Energy Management (BOEM) and Dr. Jon Kaye, Gordon and Betty Moore Foundation

- *Branding the Ocean* by Dr. Carlie Wiener, Schmidt Ocean Institute
- *Scaling the Connected Ocean* by Dr. Tim Janssen, Sofar Ocean and Drew Stephens, Cardinal Point Captains (CPC)
- *Exploring the Dynamic Ocean* by Dr. Allan Adams, Oceanic Labs and Woods Hole Oceanographic Institution (WHOI) and Neil Davé, Tidal (X, the moonshot factory)

## Short Video Series

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COL partnered with the Inner Space Center (ISC) at the University of Rhode Island (URI), through sponsorship provided by the Ocean Exploration Cooperative Institute (OECI), to produce a series of short videos capturing remarks from key members of the ocean exploration community. Dr. Dawn Wright (Esri), Gareth Damian Martin (Game designer and creator of *In Other Waters*), and Dr. Jerry Schubel (formerly of the Aquarium of the Pacific and host of the first Forum in 2013), shared personal reflections on the future of ocean exploration. The videos were posted to the Forum website (Appendix C) and shared with participants ahead of the event. They were also presented during the Forum program.

## Event Structure

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The Forum program is available in Appendix D and included the following elements:

- Panels focused on *Data to Address Societal Needs* and *Public Engagement and Impact* opened the Forum, to encourage participants to integrate these themes throughout the Forum discussions.
- The whitepaper co-authors participated in plenary panel discussions, during which they expanded on the visions described in their papers. These discussions were intended to set the stage for the breakout sessions that followed.
- Three breakout sessions (for in-person attendees only) focused on one element of ‘how we explore’ within the blueprint framework: *Novel Collaborations and Partnerships*, *Platforms and Technology*, and *Alliances and a Community of Practice*.
- Following each breakout session, one leader from each breakout group participated in a plenary panel to report on their group’s discussions, with a focus on highlighting overlaps and synergies across all the discussions.
- The Forum closed with a Synthesis Panel in which select members of the community summarized their key takeaways and offered input on next steps.

## Online Submission Form

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To gather information and perspectives from the attendees prior to and during the event, both virtual and in-person, an online submission form enabled participants to share their thoughts and suggest actions for inclusion in the blueprint. This input directly informed the outcomes described in this report. Responses received via this submission form are summarized [here](#).

# PANEL SUMMARIES

## Data to Address Societal Needs Panel

*Moderator: Dr. Vicki Ferrini, Lamont-Doherty Earth Observatory*

*Panelists: Dr. Kelsey Leonard, Shinnecock Nation*

*Justin Manley, Just Innovation*

*Millicent Pitts, Ocean Exchange*

*Drew Stephens, CPC*

Data represent a critical outcome of ocean exploration. In thinking about the purpose of and future for ocean exploration data, Forum participants were challenged to consider what data will be required to address specific societal needs over the next decade. Panelists considered how societal needs are defined, how ocean exploration data can meet the needs of society, and what the barriers and opportunities will be for ocean exploration data collectors and users over the next 10 years. Key outcomes included:

- Ocean exploration is not just about collecting data, but also enabling exploration of the data itself and sharing the stories they tell.
- Data are not central enough in planning research projects or expeditions; this model must be inverted so that projects are planned more intentionally with regard to data collection.
- Data are often not accessible by everyone; true data accessibility and inclusion must be aspired to.
- Technology, data collection, and information needs are changing quickly, and the opportunities for the ocean exploration community to collect, make use of, and share ocean exploration data over the next 10 years are numerous. However, to be fully realized, the community must break down silos and work across sectors and stakeholders. There is no one path to success, but together, the ocean exploration community must agree to prioritize diversity and inclusivity and work toward a future where ocean exploration data are collected by, shared with, and transformed into information products that are relevant to, available to, and beneficial for all.



*Data to Address Societal Needs panel; from left to right: Vicki Ferrini, Justin Manley, Drew Stephens, Millicent Pitts, and Kelsey Leonard*



## Public Engagement and Impact Panel

*Moderator: Dr. Carlie Wiener, Schmidt Ocean Institute*

*Panelists: Nai'a Lewis, Salted Logic*

*Adam Idelson, Silvergate Media (Octonauts Studio)*

*Jill Zande, MATE Inspiration for Innovation*

*John Steele, Nautilus Publishing*

Ocean exploration has the potential to help inform solutions for some of humanity's most pressing concerns (e.g., climate change, access to resources, human health, etc.). It is critical to engage the public in the value and importance of the ocean, so they are inspired and empowered to defend and care for it.

During this discussion, panelists explored how stories engage new audiences and why creativity, inclusivity, and collaboration in storytelling is so important. Key outcomes included:

- A demonstration of diversity from each of the panelists' own ocean stories, illustrating the variety of ways in which the general public arrives at an understanding about the ocean.
- The use of multiple channels and communication mediums – from artwork to a children's television show, a robotics competition, or a journal publication – to ensure that messages resonate with as much of the public as possible. This is essential to ensuring that engagement with the ocean is inclusive and available to all.
- The opportunities to enhance public engagement in ocean exploration through storytelling are abundant. However, common messaging and greater inclusivity are essential.
- Creative partnerships and collaborations provide opportunities to diversify engagement tools, ensuring that the public is informed about and appreciates the value of the ocean (see Wiener Whitepaper).



## Remarks by the Honorable Richard Spinrad

*Ph.D., Under Secretary of Commerce for Oceans and Atmosphere and National Oceanic and Atmospheric Administration (NOAA) Administrator*

The Honorable Richard Spinrad, Ph.D., Under Secretary of Commerce for Oceans and Atmosphere and National Oceanic and Atmospheric Administration (NOAA) Administrator, spoke about his vision for the future of NOAA and ocean exploration within the agency during his keynote presentation.

- NOAA's current priorities are climate science, balance, and equity. Dr. Spinrad emphasized equity in particular, which is embedded in all of NOAA's activities. Outwardly, NOAA supports the American public by addressing the needs of and co-designing products with underserved communities, and inwardly, the agency strives to ensure that the NOAA workforce reflects what America looks like.
- The new Blue Economy, defined by Dr. Spinrad as a knowledge-based economy made possible by the capability to collect data, information, and knowledge about the ocean and commercialize it in a sustainable way, presents an opportunity for the ocean exploration community to advance NOAA's vision and mission.
- Innovation is fostered by risk-taking, and Dr. Spinrad is working to redefine NOAA's risk tolerance to be able to support innovation and the development of disruptive technologies as well as to provide opportunities to develop new partnerships. He encouraged Forum participants to consider how the ocean exploration community can come together in new and creative ways through partnerships.
- Dr. Spinrad stated his commitment to ensuring that people from NOAA have the opportunity to be embedded where they need to be (for example, at other organizations) and share their expertise whenever the occasion arises, which is essential to make partnerships work.



*The Honorable Richard Spinrad, Under Secretary of Commerce for Oceans and Atmosphere and National Oceanic and Atmospheric Administration (NOAA) Administrator*

# Novel Collaborations and Partnerships Whitepaper Discussion

*Moderator: Dr. Monty Graham, Florida Institute of Oceanography*

*Panelists: Dr. Megan Carr, BOEM*

*Dr. Jon Kaye, Gordon and Betty Moore Foundation*

*Dr. Carlie Wiener, Schmidt Ocean Institute*

Turning data into information, then into knowledge, and finally into action, was an overarching theme of this whitepaper panel discussion. This “data-into-action” pipeline requires sustainable partnerships among organizations with different expertise and effective communication between such partners.

Some of the universal challenges to achieving sustainable partnerships highlighted included:

- Creating a shared vision that a broad spectrum of stakeholders and partners buy into or can accept;
- Identifying the actions required to achieve a shared vision in the short-term, while also being flexible and resilient to changes in funding amidst shifting political power structures;
- Identifying and providing extrinsically motivating incentives for increased levels of engagement; and
- Appealing to those who are intrinsically motivated to complete the planned actions and build momentum for long-term success.

Some of the partnership barriers unique to ocean exploration discussed included:

- Data and knowledge gaps between organizations;
- Shifting government priorities;
- Lack of funding for coordination;
- Differing cultures and incentives across communities; and
- Competing priorities and efforts within communities.

One example provided during this panel and discussed in the Carr and Kaye Whitepaper, the [Citizen Science Network for the Amazon](#) project, required partnerships between multiple organizations with different motivations. Everyone involved had to come to the table with honesty and forthrightness about capabilities, resources, and limitations. In order to ensure a successful partnership, an intentional effort was made to have multilingual discussions among all parties about appropriate terminology and relevant values. Establishing this kind of trust was not easy, and it took time. This partnership could serve as a model for the ocean exploration community, illustrating that such partnerships often initially require identifying groups that are already engaging the public in targeted ways, and then leveraging those engagements as avenues to form new partnerships. (Secondary Example: Marine Cadastre, Carr and Kaye Whitepaper)



*Novel Collaborations and Partnerships Whitepaper panel; from left to right: Megan Carr, John Kaye, Carlie Wiener, and Monty Graham*

## Platforms and Technology Whitepaper Discussion

*Moderator: Kasey Cantwell, NOAA Ocean Exploration*

*Panelists: Dr. Allan Adams, Oceanic Labs and Woods Hole Oceanographic Institution (WHOI)*

*Tosca Lichtenheld, Sofar Ocean*

*Drew Stephens, CPC*

This whitepaper panel discussion centered on the question: what is the meaning of and vision for a ‘connected’ ocean? Key outcomes included:

- The ocean exploration community should redefine ‘exploration’. This definition should include the importance of exploring both the ocean floor as well as the water column. For example, the ‘geography’ of light in the ocean is constantly changing and drives the movement and migration of biology. Studying light is challenging because the water column is dynamic in space and time, across many scales, and many traditional exploration tools are ill-suited for this task. Therefore, the ocean exploration community needs to reimagine traditional and standard exploration sensor packages to better suit the research questions of the next decade. Technology should be developed to enable the generation of data products and actionable outcomes – for science, regulation, industry, and the public.
- One panelist described how sitting at a window seat on an airplane can help one to understand the scale of terrestrial Earth’s geography. However, there is no equivalent experience for visualizing all that exists below the surface of the ocean. The issue isn’t necessarily needing more data, but instead, needing more effective methods to extract knowledge and perspective out of existing data. Policymakers and other decision makers, for example, need this knowledge to answer important questions, but they are not necessarily equipped with the skills and expertise to work with raw data.

Three technological improvements that will drive advancements in ocean exploration were highlighted:

- The availability of low-cost sensors;
- Advancement of communication networks; and
- Cloud computing capabilities for processing and organizing large amounts of data.

Panelists discussed that the ‘data-to-intelligence-to-insights’ value chain of ocean exploration will be fueled by funding from the government, philanthropy, venture capitalists/private equity, as well as by greater accessibility to data, creative funding and partnership mechanisms, and public-private partnerships. The following were presented as challenges and opportunities for scaling toward a connected ocean:

- The challenges:
  - › Creating the data value chain;
  - › High cost of platform integration and hardware interfaces; and
  - › Scaling public-private partnerships.
- The opportunities:
  - › New investment in a data-first strategy;
  - › Hardware interface standardization can remove barriers to scale; and
  - › Effective public-private partnerships built around dual-use technologies.

# Alliances and a Community of Practice Whitepaper Discussion

*Moderator: David Millar, Fugro*

*Panelists: Dr. Vicki Ferrini, Lamont-Doherty Earth Observatory*

*Allison Fundis, Ocean Exploration Trust*

*Colleen Peters, Saildrone*

*Hōkūkahalelani Pihana, Nā Wa‘a Mauō Marine Stewardship Program*

Ocean exploration, and access to data, can connect communities, including coastal communities in regions where exploration is being done. Equity and access in ocean exploration, including to the resulting data, should be an overarching goal of the community. This can be accomplished through improved communication and coordination; sharing, trust, and respect; and funding. This whitepaper panel discussion focused on these themes. Additional discussion points included:

- Start with attainable partnership goals; trying to do “everything” at once can be overwhelming.
- Take the time and make the effort to establish meaningful relationships with Indigenous/Tribal, coastal, and local communities in regions where ocean exploration is taking place well in advance of ocean exploration activities. This can heal previous ancestral pain, re-establish trust with those communities, and provide opportunities to incorporate local knowledge and perspectives into project planning.
- Any vision for an ocean exploration community of practice should advance national and local community priorities for ethical, sustainable, and inclusive exploration that delivers value to the American people.
- The ocean exploration community is currently advancing slowly on diversity and inclusivity, and on data equity and access issues.
- The community must work towards efficient progression on building alliances in methodical and productive ways.
- The community must set achievable and reasonable deadlines. Focusing on short-term goals can help.
- The purpose of ocean exploration missions is to collect data. However, creating ‘information products’ out of raw data should also be considered an essential part of the workflow. Sharing of the data, along with methodologies for collection and the information the data reveal, result in increased knowledge.
- The panelists provided a vision for ocean exploration in 2032, which includes a thriving community of practice that:
  - › Facilitates effective communication and coordination;
  - › Fosters networks of expertise and partnerships;
  - › Prioritizes, supports, and sustains data sharing and a diversity of perspectives; and
  - › Provides opportunities that lead to a diverse workforce.



*Alliances and a Community of Practice Whitepaper panel; from left to right: Vicki Ferrini, Allison Fundis, Hōkū Pihana, Colleen Peters, and David Millar*

# Ocean Exploration Blueprint 2032: Panel Discussion and Synthesis

*Moderator: Kristen Yarincik, Consortium for Ocean Leadership (COL)*

*Panelists: Priyanka Hooghan, U.S. House of Representatives Committee on Science, Space, and Technology*

*Ambassador Cameron Hume, NOAA Ocean Exploration Advisory Board Chair*

*Mike Khus, Northern Chumash Tribal Council*

*Jeremy Weirich, NOAA Ocean Exploration*

During the Synthesis Panel, which closed the 2022 National Ocean Exploration Forum, panelists shared their overarching takeaways from the discussions and highlighted, from their perspectives, critical opportunities for the community to advance ocean exploration over the next decade. They included:

- Ocean exploration needs improved storytelling. Data alone do not tell stories; what is done with the data and how they are interpreted and used is what makes for an engaging story.
- Make ocean exploration data permanent, understandable, and accessible for anyone interested in interpreting and exploring the data themselves.
- Ocean exploration data that have already been collected are not currently being fully utilized. Community-driven products and services should be built to inform data collection going forward and support its utilization.
- The value proposition for the Blue Economy can be used as motivation to participate in ocean exploration. Some examples include using data and information to support the reinsurance industry in addressing impacts to critical infrastructure or sustainably managing fish stocks and aquaculture.
- The language used to talk about ocean exploration should be re-evaluated. The community should determine a bold, shared vision.
- Ocean exploration has the potential to engage across a variety of societal issues, such as climate change, diversifying the workforce, and supporting the Blue Economy.
- The ethics of ocean exploration must be ingrained in all operations. Engage with local communities early and place value on citizen scientists. Create a contingency plan for cultural heritage discoveries before expeditions begin, during the planning process.
- NOAA Ocean Exploration pledges to advocate for the addition of spot on the NOAA Ocean Exploration Advisory Board (OEAB), to always be filled by an Indigenous representative.



# OCEAN EXPLORATION BLUEPRINT 2032: OUTCOMES AND ACTIONS

As described earlier in this report, breakout sessions focused on the “how we explore” elements of the blueprint: *Novel Collaborations and Partnerships*, *Platforms and Technology*, and *Alliances and a Community of Practice*. Breakout co-leaders and participants were also encouraged to consider the cross-cutting themes of *Data to Address Societal Needs* and *Public Engagement and Impact* during each session and envision specific actions at the intersections of the blueprint.

Those discussions and outcomes are summarized here. “Actions” are defined as opportunities for the community to make progress on specific activities in the next decade. They are intended to serve as a foundation for further discussions and/or for the community to take ownership of and determine how they can be advanced. “Short-term” refers to activities that can be accomplished in one to five years, while “long-term” refers to activities that can be accomplished in five to 10 years. Furthermore, metrics to understand and evaluate progress would be beneficial, but should be purposefully developed by the community and utilized in ways that are relevant and specific to the individual actions.

## NOVEL COLLABORATIONS AND PARTNERSHIPS

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**Vision for 2032:** The ocean exploration community builds robust mechanisms for partnerships with existing and emerging end users of exploration information that support ongoing dialogues and ensure efficient data collection, generation of useful information from the data, and effective uses of new knowledge for societal needs. Understanding partner and stakeholder needs and motivations is essential for effectively achieving shared and complementary goals. Accountability among stakeholders, partners, and the public builds trust in the process and value of ocean exploration and is important in building durable relationships, fostering equitable inclusion, and making progress toward mutual goals. Applying lessons learned from past partnerships improves chances for future success.

Storytelling and the human experience within ocean exploration is at the forefront of public engagement, to inspire all communities and increase awareness of the value of the ocean. Ocean exploration engages the public through a variety of mediums, communicating a cohesive value proposition that increases visibility and support for ocean exploration and its community.

### Data to Address Societal Needs:

In general, developing a code of conduct for data ethics and standards that is utilized by and shared among ocean exploration partners and stakeholders will be valuable in promoting best practices and planned outcomes. This code of conduct must include clear guidance on factors such as how data will be handled, what funding is available to archive and make the data accessible, and measures for accountability.

**SHORT-TERM ACTION:** Establish collaborative mechanisms and support programs for meaningful internships, fellowships, and mentorships (e.g., Marine Technology Society Early Career Ocean Professionals (ECOPs), including the new [\*Emerging Leaders in Marine Technology Program \(EMERGE\)\*](#) program) to embed students, early career researchers, and representatives from across academia, government, nonprofit and private organizations, philanthropy, Indigenous/Tribal communities, marketing, media, and policy in mutually beneficial, cross-organizational frameworks that assure a diversity of experiences and ensure that the expertise within these sectors is shared by all.

**SHORT-TERM ACTION:** Examine employment, incorporation, and inclusion across the ocean exploration sector (e.g., via the Department of Labor, matriculation, jobs, investments). Establish metrics to understand if the community is continually successful in reaching diverse audiences and training them to enter the workforce in ocean exploration-related fields. (See the National Science Foundation’s [Demographic Attributes of Science and Engineering Degree Recipients](#) and Quiocho, Fundis, et al. Whitepaper).

**SHORT-TERM ACTION:** As a community, compile and quantify potential new technology partners for applications in ocean exploration.

**LONG-TERM ACTION:** Leverage, focus, and expand existing relationships, building upon long-term shared values and trust between the ocean exploration community and other organizations, such as Sea Grant and NASA, to achieve mutual goals (similar to the [2002 NOAA/NASA Link Symposium](#)).

**LONG-TERM ACTION:** Develop ocean exploration and associated Blue Tech resources to fill knowledge gaps.

- For funders of innovations and risk management businesses that support data for societal needs, develop an “Ocean Exploration Handbook” to showcase opportunities for philanthropists, insurance companies, impact investors, and venture capitalists who currently do not have internal expertise in ocean exploration and/or Blue Tech.
- Encourage use of the National Science Foundation’s [Innovation Corps](#) (and similar curricula) for researchers, faculty, and students to learn about business/end user elements of data-based enterprises.

**LONG-TERM ACTION:** Develop new citizen science programs and continue to support existing ones that engage the public. Incorporate citizen science data into impactful analyses.

**LONG-TERM ACTION:** Address the funding gap between data acquisition, delivery, storage/maintenance, and communication so that comprehensive ocean data is easily accessible by all interested partners and stakeholders.

- Simplify/support well-functioning collaborations between interagency/external stakeholders, as evidenced by the seamless integration and exchange of resources and the revamping of grant making processes that enable better authority for exchange of funds. The grants themselves need to encourage collaborations among diverse stakeholders. Improve efficiencies of the tools available for data interpretation, data availability, and data delivery for stakeholders.

**LONG-TERM ACTION:** Establish communication pipelines with stakeholders who rely on ocean exploration data in order to understand their information needs, implement systemic policy changes for data accessibility and discoverability, and embed intrinsic and extrinsic incentives for this communication. Convey these needs to ocean exploration data collectors so they can make their data useful to a wider range of users.

## Public Engagement and Impact:

In general, the community should consider how to coordinate messaging related to the value of ocean exploration to engage a broader audience (e.g., informal educators, local, Indigenous/Tribal, and underserved communities). Efforts should be made to align outreach objectives with the needs of the regions/communities that exploration takes place in (Example: [Developing shared terminology](#) for OET/Papahānaumokuākea Marine National Monument exploration, Quiocho, Fundis, et al. Whitepaper). One overarching goal is to share the value of the entire ocean exploration process across generations. Target messaging to communities least familiar with the relevance of the ocean to test their effectiveness.



Armon Alex, Gulf Research Institute, engaging with panelists during a question and answer session



Furthermore, connecting with local/regional organizations (e.g., Non-Governmental Organizations (NGOs)) that already have connections in communities is essential; this can help in the creation of targeted programs within underserved communities. Partnerships with Indigenous/ Tribal communities should be intentional and relational, not transactional. They must utilize community experts that can, for example, share the mechanisms of storytelling that are well established to co-develop knowledge generation and share in the entire exploration process.

Finally, the ocean exploration community should consider ways to increase ocean-related content on a variety of social media platforms (e.g., YouTube, TikTok) by partnering with content creators and influencers and providing compelling ocean-related content to share with their audiences. (Example: Sea Shanty Challenge, Wiener Whitepaper)

**SHORT-TERM ACTION:** Identify audiences (e.g., youth, educators, early career, industry, investor market) and create purposeful communication strategies that highlight success stories. Develop media to advance this storytelling, tailoring outreach to targeted communities/constituencies. Ensure the relevance and impact of ocean exploration is clear, obvious, and coordinated in these messages.

**SHORT-TERM ACTION:** Create a website to collate and make accessible ocean exploration communication/outreach information. For example, compile a directory of organizations and media creators, perhaps within the Deep Ocean Education project website (<https://deepoceaneducation.org/>).

**LONG-TERM ACTION:** Ensure that the percentage of ocean exploration-focused grants and philanthropic contributions awarded equitably reflects United States' demographics and are provided to marginalized groups as well as organizations that support those communities.

**LONG-TERM ACTION:** Include support and provide resources (through grants and/or other funding sources) for planning and implementing outreach and communication activities at the outset of exploration expeditions and campaigns.

**LONG-TERM ACTION:** Work with Next Generation Science Standards and other curriculum developers to ensure that school programming includes ocean exploration concepts and immersive ocean exploration experiences.

**LONG-TERM ACTION:** Increase awareness through celebrity/influencer endorsements, partnerships, and collaborations with larger national agencies/brands that are already active in various communities (e.g., YMCA, food banks) for inter-generational incorporation and community-led learning. (Example: [LEGO Exploration Sets](#), Wiener Whitepaper)

- Utilize athletic sponsorships to communicate ocean-related messaging (at all levels, not just professional athletes) and support career opportunities.
- Place emphasis on developing skilled outreach and communications to build/grow expertise in connecting the public with ocean exploration.
- Coordinate with existing experts within the ocean exploration community and incorporate their specialization in storytelling, communications, public relations, interaction with policy makers, and data democratization/delivery, etc.

# PLATFORMS AND TECHNOLOGY

**Vision for 2032:** Advancement in technology is continuous, persistent, and constantly accelerating. Ocean exploration takes advantage of novel technologies, in some cases pioneering their use in ocean science (e.g., telepresence).

Human-centered design drives technology development so that ocean exploration is rooted in a non-invasive partnership with the ocean. Standards defining the fundamental components of modern marine science technology are created and adopted to facilitate more efficient technology development and use. Platforms for ocean exploration are flexible, versatile, and serve many stakeholders.

Exploration platforms are increasingly highly specified in their activities and the regions of the ocean they explore. High levels of interoperability guided by community standards help ensure that relevant and trusted data are collected regardless of the platform or region. Further, adopting consistent standards will lower the cost and accelerate the development cycle of new

systems and sensors by eliminating the need to continuously re-design system components and ensure their broad availability. This requires a high level of adoption as well as industrial-scale production, an area that might be incentivized by federal funding before larger-scale market forces come to bear.

The sheer magnitude of stakeholders, partners, collaborators, and constituent communities with varying incentives, interests, and specializations urgently requires alignment. The community recognizes the value of investing in high-risk, high-reward activities so that ocean exploration is at the forefront of ocean knowledge generation. Technologies that push the boundaries to open new areas for exploration and expand observing capabilities must be valued and incentivized.



*Maggie Peacock, Gulf Reach LLC, engaging with panelists during a question and answer session*

## Data to Address Societal Needs:

Intelligently designed technology will ensure that ocean exploration data contributes to addressing existential challenges facing the planet and the wealth and security of the U.S., enabling a broader and more diverse community to value ocean exploration. Achieving this will require envisioning new methods of delivering relevant and useful data/information to all stakeholders.

**SHORT-TERM ACTION:** Convene a technology oversight committee to review and prioritize the needs of the ocean exploration community and its end users, so that standardization efforts can be focused.

**SHORT-TERM ACTION:** Develop committees for ocean exploration data standardization, management, and interoperability. These committees should meet regularly (perhaps at each National Ocean Exploration Forum) to outline goals and address specific tasks.

**SHORT-TERM ACTION:** During the next Forum (or before), host a discussion on what data or technology standards are adoptable in one to five years. Create and disseminate a manual for these standards so that the community can adopt them. (Examples: [Draft OEI Data Management Plan](#), Ferrini and Peters Whitepaper; [Bristlemouth](#), Janssen and Stephens Whitepaper)

**LONG-TERM ACTION:** Establish a trusted and inclusive group of researchers, engineers, and industry partners to develop standards for a range of ocean technologies, including connectors, power management, sensor lifecycles, data formats, data management, and communication. Standards with the greatest impact should be established and new standards should be regularly developed if needed. All standards should be open source to promote wide adoption and revisited as necessary to maintain relevance. Adoption of standards may be self-incentivized, but they should be promoted widely. (Example: Data attribution and stewardship, Page 3, Ferrini and Peters Whitepaper)

**LONG-TERM ACTION:** Apply agreed upon standards so that sensors and systems can be less specialized, less expensive, and increasingly decoupled from platforms (when possible).

**LONG-TERM ACTION:** Develop new technologies with end users in mind, using their requirements to drive the design. Develop and support mechanisms/pathways that spur innovation in ocean exploration technologies (e.g., consider creating an Advanced Research Projects Agency for ocean exploration technologies (ARPA-OE)).

### Public Engagement and Impact:

Throughout the ocean exploration process, the community needs to strive for stakeholder buy-in by clarifying the value of engagement. Diverse ocean exploration stakeholders and communities must come together (e.g., partnering with ocean exploration ambassadors in every community) – especially with the public – to identify opportunities, work together strategically, and share actions, failures, and successes.

A fleet of new, dedicated platforms and modalities for ocean exploration to increase access to challenging regions, including mid-water ecosystems, should be generated. New modalities should include long-range autonomous vessels, vehicles, and vehicles targeted to unique environments (e.g., hadal, midwater, under ice).

**SHORT-TERM ACTION:** Include a session on challenges, successes, failures, and barriers faced when developing new technologies during the next National Ocean Exploration Forum.

**LONG-TERM ACTION:** Leverage platforms of opportunity (e.g., migratory animals, luxury travelers, Indigenous/Tribal, and industry vessels) both to collect data and to spark public interest and participation in ocean exploration (e.g., [the Great Turtle Race](#)). In addition, ensure that new modalities of exploration can perform responsible/ethical exploration that is inclusive of diverse communities and treats the ocean with respect.



*Breakout leaders summarize their sessions; from left to right: Suraida Nañez-James, Allison Miller, Jill Bourque, Jill Zande, and Symone Barkley*

# ALLIANCES AND A COMMUNITY OF PRACTICE

**Vision for 2032:** Building towards inclusivity, authenticity, and co-created alliances/communities of practice is intentional and requires establishing connections and trust through humility, relationship building, and understanding. Ocean exploration cannot be successfully accomplished without diverse perspectives and representation at all levels. Program support, impactful and meaningful messaging, emphasis on Diversity, Equity, Inclusion, and Justice (DEIJ), and ethics in programming and data acquisition/processing, as well as transparency of purpose, are all key factors in bridging intention to actions. Diversity includes various communities (e.g., LGBTQ+, socio-economic status, race, and ethnicity), and also types of careers, disciplines, degrees, trades, and resources. DEIJ must not be an afterthought. (See [Free, Prior, and Informed Consent](#), Quiocho, Fundis, et al. Whitepaper)

Strategic partnerships, including those with organizations outside the traditional ocean exploration community of practice, can help to achieve program support, messaging, and more. Furthermore, both quantitative and qualitative metrics can be used for evaluating progress and bringing accountability and action to intentions that have historically lacked follow-through.

## Data to Address Societal Needs:

The ocean exploration community can utilize best practices for addressing Environmental, Social, Governance ([ESG](#)) requirements, and work with corporations, businesses, and [financial markets](#) that are taking these factors into consideration as they make business decisions.

**SHORT-TERM ACTION:** Develop consensus definitions for key terms used often by the community.

For example: ocean exploration, community of practice, and cross-pollination. Standardized definitions will be helpful for coordinated community discussions, reporting, and compiling of information.

**LONG-TERM ACTION:** Leverage the Blue Economy and Blue Justice movements, which are gaining momentum and bringing greater attention to the importance/relevance of the ocean. Make connections, provide leadership, and support organizations with (extrinsic) financial interests, from shipping to marine renewables to financial markets, which are in need of ocean data (and the story the data tell) as they continue to recognize the importance and value of the ocean (and climate) and how the ocean impacts their work (e.g., insurance companies, investors, [Security and Exchange Commission](#)).



Suraida Nañez-James (left) and Daniel Kleinman (right) lead breakout discussions

## Public Engagement and Impact:

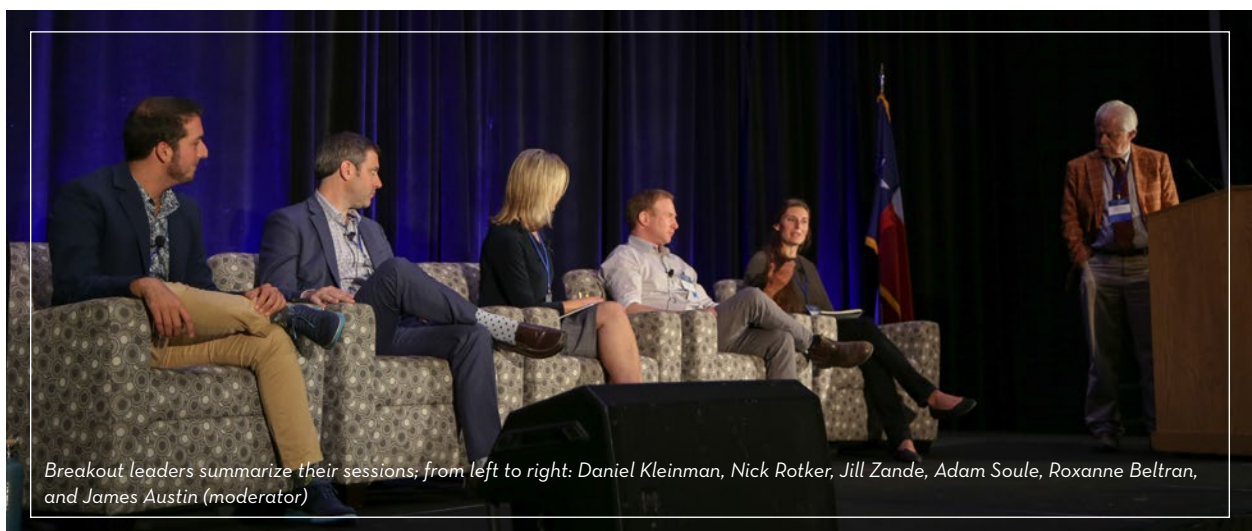
Community-driven best practices and processes for identifying, engaging, and supporting relationships and collaborations with Indigenous/Tribal, underserved, and unserved communities will advance shared ocean exploration priorities. Partner with local leaders and organizations who specialize in DEIJ and community engagement (e.g., community experts, science communication professionals, educators).

**SHORT-TERM ACTION:** Identify the best method of distribution for best practices for public engagement and impact and where they will be made available (e.g., publication, website).

**SHORT-TERM ACTION:** Consider reviving and reinvigorating the Ocean Exploration Professional Committee within the Marine Technology Society (MTS) with leadership (e.g., a Committee Chair), as a vehicle to engage current and potential members of the ocean exploration community of practice via information sharing, activities, and workshops (e.g., MTS Tech Surges).

**SHORT-TERM ACTION:** Use venues such as the annual [MTS/IEEE OCEANS Conference](#) to bring together a variety of ocean exploration sub-communities of practice to host workshops, demonstrations, and town halls around selected ocean exploration topics and to discuss topics such as sensors, platforms, DEIJ, messaging, and communication beyond the ocean exploration community of practice.

**SHORT-TERM ACTION:** Leverage community and partners' communication vehicles, for example, the MTS Journal, electronic newsletter, and webinar series, to share ocean exploration-related articles and disseminate information.



# CONCLUSION

The 2022 National Ocean Exploration Forum was an opportunity for the ocean exploration community to envision shared actions and opportunities that will help advance U.S. national ocean exploration priorities over the next 10 years. **Storytelling, data, equity, access, and inclusion** crosscut most of the Forum discussions and underpinned the actions that were synthesized.

In general, participants emphasized the need for actions to be as clear and specific as possible. Identifying specific organizations to lead these actions will increase efficiency and help the community move toward goals collectively. Accountability in achieving these actions was also encouraged. Future National Ocean Exploration Forums will provide an opportunity to both share successes and failures and track progress toward agreed upon activities. Taking small, achievable steps will improve chances for success and ensure the community remains motivated and engaged in the outcomes and shared vision for the future of the ocean exploration enterprise.

# Ocean Exploration: BLUEPRINT 2032

# ACKNOWLEDGEMENTS

## Thank You to the Following Generous Sponsors



**DR. JAMES  
A. AUSTIN, JR.**



## Advisory Committee

Thank you to the 2022 National Ocean Exploration Forum Advisory Committee for their critical role in shaping this event:

**Dr. Jill Bourque** - U.S. Geological Survey (USGS)

**Dr. Morgan Cable** - NASA Jet Propulsion Laboratory

**Kristen Crossett** - NOAA Ocean Exploration

**Dr. Vicki Ferrini** - Lamont-Doherty Earth Observatory

**Dr. Genene Fisher** - NOAA Ocean Exploration

**Ambassador Cameron Hume** - NOAA Ocean Exploration Advisory Board (OEAB)

**John Kreider** - Kreider Consulting

**Dr. Adam Soule** - Ocean Exploration Cooperative Institute (OECI)

**Dr. Jyotika Virmani** - Schmidt Ocean Institute

**Dr. Carlie Wiener** - Schmidt Ocean Institute

## Whitepaper Authors

Thank you to the 2022 National Ocean Exploration Forum whitepaper authors for presenting their visions that served as foundations for the Forum discussions:

**Dr. Allan Adams** - Oceanic Labs and Woods Hole Oceanographic Institution (WHOI)

**Dr. Megan Carr** - Bureau of Ocean Energy Management (BOEM)

**Neil Davé** - Tidal, X, the moonshot factory

**Dr. Vicki Ferrini** - Lamont-Doherty Earth Observatory

**Allison Fundis** - Ocean Exploration Trust (OET)

**Dr. Tim Janssen** - Sofar Ocean

**Dr. Jon Kaye** - Gordon and Betty Moore Foundation

**Colleen Peters** - Saildrone

**Kalani Quiocho** - NOAA Office of National Marine Sanctuaries, Pacific Islands Region

**Drew Stephens** - Cardinal Point Captains (CPC)

**Dr. Carlie Wiener** - Schmidt Ocean Institute

## Breakout Co-Leaders

Thank you to the 2022 National Ocean Exploration Forum breakout co-leaders, who expertly facilitated the breakout sessions and whose leadership ensured the Forum objectives and outcomes were realized:

**Symone Barkley** - NOAA National Ocean Service

**Dr. Roxanne Beltran** - University of California Santa Cruz

**Dr. Jill Bourque** - U.S. Geological Survey (USGS)

**Daniel Kleinman** - Seaworthy Collective

**Allison Miller** - Schmidt Ocean Institute

**Suraida Nañez-James** - Gulf Reach Institute

**Millicent Pitts** - Ocean Exchange

**Nick Rotker** - MITRE

**Dr. Adam Soule** - Ocean Exploration Cooperative Institute (OECI)

**Jill Zande** - MATE Inspiration for Innovation

## Short Video Speakers and Inner Space Center

Thank you to the speakers who provided video remarks for the 2022 National Ocean Exploration Forum, and to the Inner Space Center team at the University of Rhode Island for producing these videos.

**Gareth Damian Martin** - Game Designer, *In Other Waters*

**Dr. Jerry Schubel** - Aquarium of the Pacific (Emeritus)

**Dr. Dawn Wright** - Esri

**Ryan Campos** - Inner Space Center (ISC) and the University of Rhode Island (URI)

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## Participants

Thank you to all of the 2022 National Ocean Exploration Forum participants for their time and thoughtful input throughout the Forum, which directly informed the outcomes summarized in this report.



# COMMON ACRONYMS

- AI** – *Artificial Intelligence*
- BOEM** – *Bureau of Ocean Energy Management*
- CCOM/JHC** – *(UNH) Center for Coastal and Ocean Mapping/Joint Hydrographic Center*
- COL** – *Consortium for Ocean Leadership*
- CPC** – *Cardinal Point Captains*
- DEIJ** – *Diversity, Equity, Inclusion, and Justice*
- ECOPs** – *Early Career Ocean Professionals*
- EEZ** – *Exclusive Economic Zone*
- ESG** – *Environmental, Social, Governance*
- ISC** – *Inner Space Center*
- MTS** – *Marine Technology Society*
- NASA** – *National Aeronautics and Space Administration*
- NGO** – *Non-Governmental Organization*
- NOAA** – *National Oceanic and Atmospheric Administration*
- NOEF** – *National Ocean Exploration Forum*
- NOMECS** – *National Strategy for Mapping, Exploring, and Characterizing the U.S. EEZ*
- OEAB** – *Ocean Exploration Advisory Board*
- OECS** – *Ocean Exploration Cooperative Institute*
- OET** – *Ocean Exploration Trust*
- UN** – *United Nations*
- UNOLS** – *University-National Oceanographic Laboratory System*
- URI** – *University of Rhode Island*
- USGS** – *United States Geological Survey*
- WHOI** – *Woods Hole Oceanographic Institution*

# APPENDIX A: PARTICIPANT LIST

## In-Person Participants

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**Brian Kennedy** - Boston University  
**Bridgit Boulahanis** - Bedrock Ocean Exploration  
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**Christie Reiser** - NOAA National Centers for Environmental Information  
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**Colleen Peters** - Saildrone  
**Daniel Kleinman** - Seaworthy Collective  
**Dan Rogers** - Consortium for Ocean Leadership  
**Daniel Wagner** - Ocean Exploration Trust  
**David Millar** - Fugro  
**David Ryan** - X994  
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**Jill Bourque** - *U.S. Geological Survey*  
**Jill Zande** - *MATE Inspiration for Innovation*  
**John Armor** - *NOAA Office of National Marine Sanctuaries*  
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**Tosca Lichtenheld** - Sofar Ocean  
**Tyler Buckingham** - Coastal News Today, American Shoreline Podcast Network  
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**Vicki Ferrini** - Lamont-Doherty Earth Observatory  
**Yi Chao** - Seatrec

## **Virtual Attendees**

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**Amanda Demopoulos** - U.S. Geological Survey  
**Andrea Quattrini** - Deep Sea Biology Society  
**Andy Bowen** - Woods Hole Oceanographic Institution & Ocean Exploration Cooperative Institute  
**Artash Nath** - MonitorMyOcean.com

**Ashley Marranzino** - NOAA Ocean Exploration  
**Athena Alyssa Leal** - University of Texas at Austin  
**Bailey Riley** - U.S. House of Representatives Committee on Science, Space, and Technology  
**Ben Woodward** - CVision AI  
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**Caitlin Adams** - NOAA Ocean Exploration  
**Catalina Martinez** - NOAA Ocean Exploration  
**Chris Beaverson** - NOAA Ocean Exploration  
**Chris Coyle** - TAO: Tethra Advisors and Officers  
**Chris Scholin** - Monterey Bay Aquarium Research Institute  
**Christa Rabenold** - NOAA Ocean Exploration  
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**Dawn Wright** - Esri  
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**Ginny Catania** - University of Texas at Austin  
**Heather Carswell** - 11th Hour Racing  
**Jack Conroy** - NOAA Ocean Exploration  
**Jason Landrum** - Lenfest Ocean Program at The Pew Charitable Trusts  
**JC Semrau** - World Ocean League  
**Jeff Herter** - NYS Department of State  
**Jennifer Bowers** - NOAA National Centers for Environmental Information Uncrewed Systems  
**Jennifer Jencks** - NOAA National Centers for Environmental Information  
**Jerry Schubel** - Aquarium of the Pacific (Emeritus)  
**Jesse Ausubel** - Rockefeller University  
**Jim Palardy** - Pew Charitable Trusts  
**Joanne Flanders** - NOAA Ocean Exploration  
**Jyotika Virmani** - Schmidt Ocean Institute  
**Kalani Quiocho** - NOAA Office of National Marine Sanctuaries Pacific Islands Region  
**Katharine Egan** - NOAA Ocean Exploration  
**Kira Coley** - ECO Magazine  
**Kramer Wimberley** - Diving With A Purpose  
**Kristina Gjerde** - IUCN, Middlebury Institute of International Studies  
**Liang Wu** - NOAA Ocean Exploration  
**Liz Hoadley** - NOAA Ocean Exploration  
**Mark Fischetti** - Scientific American  
**Mark Stevens** - Microsoft

**Matthew King** - NOAA Ocean Exploration  
**Megan Carr** - Bureau of Ocean Energy Management  
**Melissa Madrigal** - National Association of Tribal Historic Preservation Officers  
**Melissa Ryan** - Global Foundation for Ocean Exploration  
**Meredith Westington** - NOAA National Ocean Service  
**Mike Miller** - Sealaska Heritage Institute  
**Mitchell Tartt** - NOAA Office of National Marine Sanctuaries  
**Morgan Cable** - NASA Jet Propulsion Laboratory  
**Nina Yang** - NOAA Ocean Exploration  
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**Rachel Gulbraa** - NOAA Ocean Exploration  
**Rob Munier** - Woods Hole Oceanographic Institution  
**Robin Cooper** - Nova Southeastern University  
**Steve Hammond** - NOAA Ocean Exploration  
**Susan Haynes** - NOAA Ocean Exploration  
**Susan Roberts** - The National Academies, Ocean Studies Board  
**Timothy Shank** - Woods Hole Oceanographic Institution  
**Valerie Grussing** - National Association of Tribal Historic Preservation Officers

## APPENDIX B: 2022 NATIONAL OCEAN EXPLORATION FORUM WHITEPAPERS

**OCEAN EXPLORATION IN A DATA-RICH WORLD** by Dr. Vicki Ferrini (Lamont-Doherty Earth Observatory) and Colleen Peters (Saildrone) [Download PDF](#)

**RE-ENVISIONING THE COLLECTIVE VOYAGE FOR OCEAN EXPLORATION** by Kalani Quiocho (NOAA Office of National Marine Sanctuaries Pacific Islands Region) and Allison Fundis (Ocean Exploration Trust (OET)), et al. [Download PDF](#)

**BASELINING HOW TO BUILD SUSTAINABLE OCEAN EXPLORATION PARTNERSHIPS** by Dr. Megan Carr (Bureau of Ocean Energy Management (BOEM)) and Dr. Jon Kaye (Gordon and Betty Moore Foundation) [Download PDF](#)

**BRANDING THE OCEAN** by Dr. Carlie Wiener (Schmidt Ocean Institute) [Download PDF](#)

**SCALING THE CONNECTED OCEAN** by Dr. Tim Janssen (Sofar Ocean) and Drew Stephens (Cardinal Point Captains (CPC)) [Download PDF](#)

**EXPLORING THE DYNAMIC OCEAN** by Dr. Allan Adams (Oceanic Labs and Woods Hole Oceanographic Institution (WHOI)) and Neil Davé, Tidal (X, the moonshot factory) [Download PDF](#)

## APPENDIX C: ONLINE MATERIALS AND VIDEOS

### 2022 National Ocean Exploration Forum Website:

<https://col.ucar.edu/2022-national-ocean-exploration-forum>

### Short Videos:

Dr. Dawn Wright (Esri): <https://www.youtube.com/watch?v=cVlnANW3M4>

Gareth Damian Martin (Game Designer): <https://www.youtube.com/watch?v=dpKUWAJvrX4>

Dr. Jerry Schubel (Aquarium of the Pacific – Emeritus): <https://www.youtube.com/watch?v=bcziNnTeg3A>

# APPENDIX D: 2022 NATIONAL OCEAN EXPLORATION FORUM PROGRAM

Please visit the [Forum website](#) for speaker, panel moderator, and panelist biographies as well as recordings of all plenary sessions.

## Day 1: Monday, March 28, 2022, 9:00am - 4:30pm CDT

- 8:00am Breakfast and Networking
- 9:00am Welcome and Opening Remarks  
Dr. Claudia Mora, Dean of the Jackson School of Geosciences, University of Texas at Austin  
Dr. Alan Leonardi, President and CEO, Consortium for Ocean Leadership (COL)  
Jeremy Weirich, Director, NOAA Ocean Exploration
- 9:30am Data to Address Societal Needs – Panel Discussion  
[Click here](#) to view introductory recorded remarks by Dr. Dawn Wright (Esri).  
[Click here](#) to view the slide deck for this session.  
Moderated by Dr. Vicki Ferrini - Lamont-Doherty Earth Observatory  
Dr. Kelsey Leonard - Shinnecock Nation  
Justin Manley - Just Innovation  
Millicent Pitts - Ocean Exchange  
Drew Stephens - Cardinal Point Captains (CPC)
- 10:30am Break
- 11:00am Public Engagement and Impact – Panel Discussion  
[Click here](#) to view introductory recorded remarks by Gareth Damian Martin (Game Designer).  
[Click here](#) to view the slide deck for this session.  
Moderated by Dr. Carlie Wiener - Schmidt Ocean Institute  
Adam Idelson - Silvergate Media (Ocnonauts)  
Nai'a Lewis - Salted Logic  
John Steele - Nautilus Publishing  
Jill Zande - MATE Inspiration for Innovation
- 12:00pm Lunch
- 1:00pm Remarks by the U.S. Department of Commerce/NOAA  
[Click here](#) to view the slide deck for this session.  
The Honorable Richard Spinrad, Ph.D., Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator, National Oceanic and Atmospheric Administration (NOAA)
- 1:45pm Novel Collaborations and Partnerships – Whitepaper Discussion  
[Click here](#) to view the slide deck for this session.  
Moderated by Dr. Monty Graham - Florida Institute of Oceanography  
Dr. Megan Carr - Bureau of Ocean Energy Management (BOEM)  
Dr. Jon Kaye - Gordon and Betty Moore Foundation  
Dr. Carlie Wiener - Schmidt Ocean Institute
- 2:30pm Break and Transition to Breakout Groups
- 3:00pm Novel Collaborations and Partnerships – Breakout Session #1  
This session was not broadcasted virtually or recorded.  
Breakout Group A Co-Leads: Dr. Adam Soule and Suraida Nañez-James  
Breakout Group B Co-Leads: Dr. Jill Bourque and Nick Rotker  
Breakout Group C Co-Leads: Symone Barkley and Daniel Kleinman  
Breakout Group D Co-Leads: Allison Miller and Dr. Roxanne Beltran  
Breakout Group E Co-Leads: Jill Zande and Millicent Pitts
- 4:30pm Adjourn
- 5 - 7pm Evening Reception in the AT&T Hotel Courtyard  
Generously sponsored by the University of Texas at Austin Jackson School of Geosciences and Texas A&M University College of Geosciences.



## Day 2: Tuesday, March 29, 2022, 9:00am – 5:00pm CDT

- 8:00am Breakfast and Networking
- 9:00am Welcome Back  
[Click here](#) to view introductory recorded remarks by Dr. Jerry Schubel (Aquarium of the Pacific – Emeritus).  
Dr. Alan Leonardi, President and CEO, Consortium for Ocean Leadership (COL)
- 9:15am Novel Collaborations and Partnerships – Breakout Session Report Out and Discussion  
Moderated by Dr. James A. Austin, Jr. – University of Texas at Austin, Jackson School of Geosciences, Institute for Geophysics
- 10:00am Platforms and Technology – Whitepaper Discussion  
[Click here](#) to view the slide deck for this session.  
Moderated by Kasey Cantwell – NOAA Ocean Exploration  
Dr. Allan Adams – Oceanic Labs and Woods Hole Oceanographic Institution (WHOI)  
Tosca Lichtenheld – Sofar Ocean  
Drew Stephens – Cardinal Point Captains (CPC)
- 10:45am Break and Transition to Breakout Groups
- 11:00am Platforms and Technology – Breakout Session #2  
This session was not broadcasted virtually or recorded.  
Breakout Group A Co-Leads: Dr. Adam Soule and Suraida Nañez-James  
Breakout Group B Co-Leads: Dr. Jill Bourque and Nick Rotker  
Breakout Group C Co-Leads: Symone Barkley and Daniel Kleinman  
Breakout Group D Co-Leads: Allison Miller and Dr. Roxanne Beltran  
Breakout Group E Co-Leads: Jill Zande and Millicent Pitts
- 12:30pm Lunch
- 1:30pm Platforms and Technology – Breakout Session Report Out and Discussion  
Moderated by Dr. James A. Austin, Jr. – University of Texas at Austin, Jackson School of Geosciences, Institute for Geophysics
- 2:15pm Alliances and a Community of Practice – Whitepaper Discussion  
[Click here](#) to view the slide deck for this session.  
Moderated by David Millar – Fugro  
Dr. Vicki Ferrini – Lamont-Doherty Earth Observatory  
Allison Fundis – Ocean Exploration Trust (OET)  
Colleen Peters – Saildrone  
Hökūokahalelani (Hökū) Pihana - Nā Wa'a Mauō Marine Stewardship Program
- 3:00pm Break and Transition to Breakout Groups
- 3:30pm Alliances and a Community of Practice – Breakout Session #3  
This session was not broadcasted virtually or recorded.  
Breakout Group A Co-Leads: Dr. Adam Soule and Suraida Nañez-James  
Breakout Group B Co-Leads: Dr. Jill Bourque and Nick Rotker  
Breakout Group C Co-Leads: Symone Barkley and Daniel Kleinman  
Breakout Group D Co-Leads: Allison Miller and Dr. Roxanne Beltran  
Breakout Group E Co-Leads: Jill Zande and Millicent Pitts
- 5:00pm Adjourn

## Wednesday, March 30, 2022, 9:00am – 12:00pm CDT

- 8:00am Breakfast and Networking
- 9:00am Welcome Back  
Dr. Alan Leonardi, President and CEO, Consortium for Ocean Leadership (COL)
- 9:15am Alliances and a Community of Practice – Breakout Session Report Out and Discussion  
Moderated by Dr. James A. Austin, Jr. – University of Texas at Austin, Jackson School of Geosciences, Institute for Geophysics
- 10:00am Break
- 10:30am Ocean Exploration Blueprint 2032 – Panel Discussion and Synthesis  
Moderated by Kristen Yarincik – Consortium for Ocean Leadership (COL)  
Priyanka Hooghan – U.S. House of Representatives Committee on Science, Space, and Technology  
Ambassador Cameron Hume – NOAA Ocean Exploration Advisory Board (OEAB)  
Michael (Mike) Khus – Northern Chumash Tribal Council  
Jeremy Weirich – NOAA Ocean Exploration
- 11:45am Closing Remarks  
Jeremy Weirich, NOAA Ocean Exploration  
Dr. Alan Leonardi, President and CEO, Consortium for Ocean Leadership (COL)
- 12:00pm Adjourn

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