



OCEAN DECADE U.S.

U.S. National Committee for the Decade of
Ocean Science for Sustainable Development



UNOLS Annual Meeting

3 Nov. 2021

The National Academies of
SCIENCES • ENGINEERING • MEDICINE



UN GENERAL ASSEMBLY PROCLAMATION

Dec. 6, 2017

Omnibus Resolution for Oceans
and the Law of the Sea
(A/RES/72/73)

- Proclaimed the **UN Decade of Ocean Science for Sustainable Development 2021-2030**
- Called upon the IOC to prepare an **implementation plan** for the Decade





UN Decade Implementation Plan

United Nations

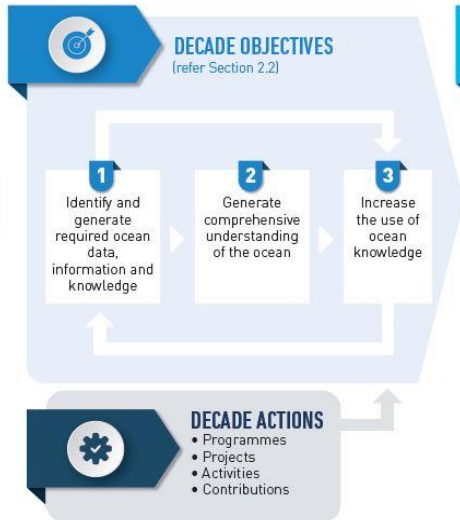


"THE SCIENCE WE NEED"

UN Decade of Ocean Science
for Sustainable Development



"THE OCEAN WE HAVE"



DECADE OUTCOMES

"THE OCEAN WE WANT"

- A clean ocean
- A healthy & resilient ocean
- A productive ocean
- A predicted ocean
- A safe ocean
- An accessible ocean
- An inspiring & engaging ocean



The Science We Need for the Ocean We Want

The United Nations
Decade of Ocean Science
for Sustainable Development
(2021-2030)



UN Decade of Ocean Science for Sustainable Development

Ocean Decade Challenges

Challenges will evolve over the life of the Decade.



Address land and sea-based sources of pollutants and contaminants.



Protect, monitor, manage and restore ecosystems under multiple stressors



Optimise the role of the ocean to sustainably feed the world's population.



Contribute to equitable and sustainable development of the ocean economy.



Understand the ocean-climate nexus, build resilience and improve predictions and forecasts.



Expand multi-hazard warning systems and mainstream community preparedness and resilience.



Ensure a sustainable ocean observing system that delivers timely data and across all ocean basins.



Develop a comprehensive digital representation of the ocean.



Ensure comprehensive capacity development and equitable access to data, information, knowledge and technology.



Identify and overcome barriers to the behaviour change that is required for a step change in humanity's relationship with the ocean.

Knowledge and Solutions

Essential Infrastructure

Foundational



DECADE GOALS: FOCUS ON SOCIETAL OUTCOMES



A Clean Ocean

Sources of pollution are identified removed from the ocean.



A Healthy and Resilient Ocean

Marine ecosystems are understood and managed.



A Productive Ocean

Supporting sustainable food supply and a sustainable ocean economy.



DECADE GOALS: FOCUS ON SOCIETAL OUTCOMES



A Predicted Ocean

Society understand and can respond to changing ocean conditions.



A Safe Ocean

Life and livelihoods are protected from ocean-related hazards.



An Accessible Ocean

Open and equitable access to data, information and technology and innovations.



OCEAN DECADE GOALS: SOCIETAL OUTCOMES



An Inspiring & Engaging Ocean

Society understands and values the diverse roles and different value systems of the ocean in relation to human wellbeing and sustainable development.



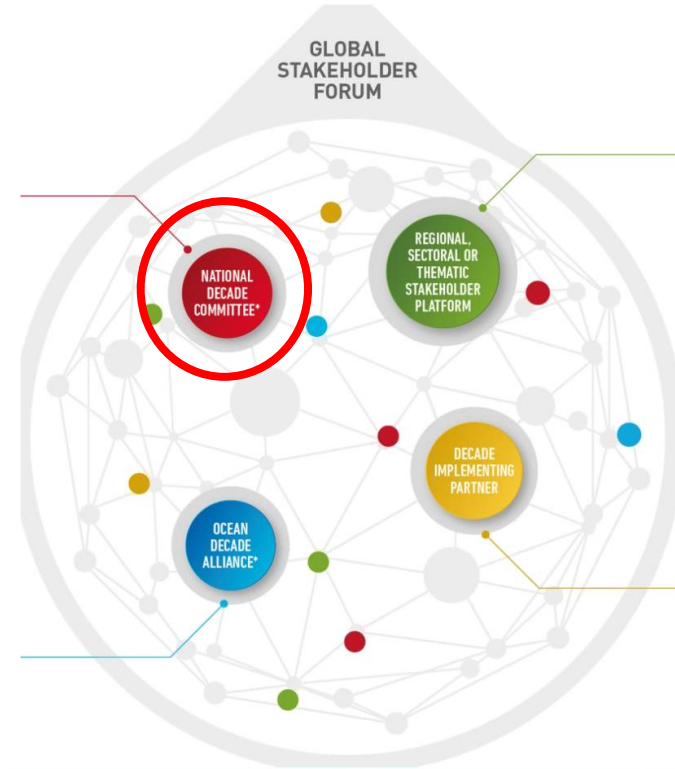
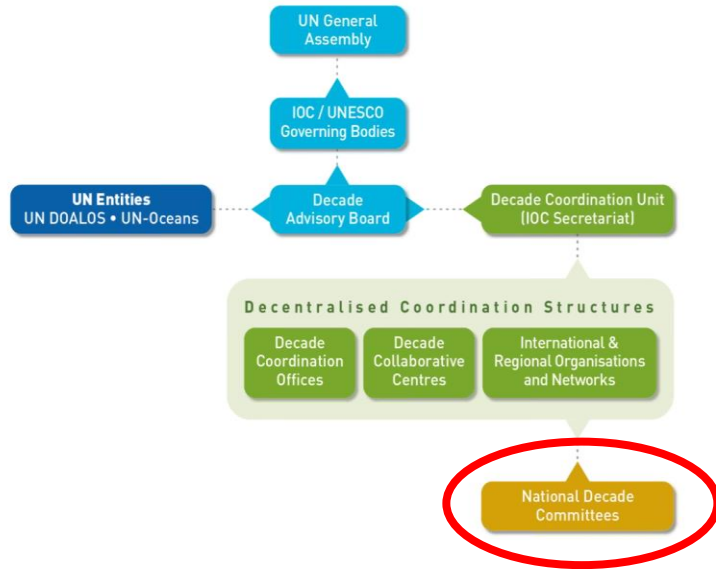
The UN Decade of Ocean Science for Sustainable Development is:



Transformative ocean science solutions for sustainable development, connecting people and our ocean

UN Decade Vision of National Committee Role

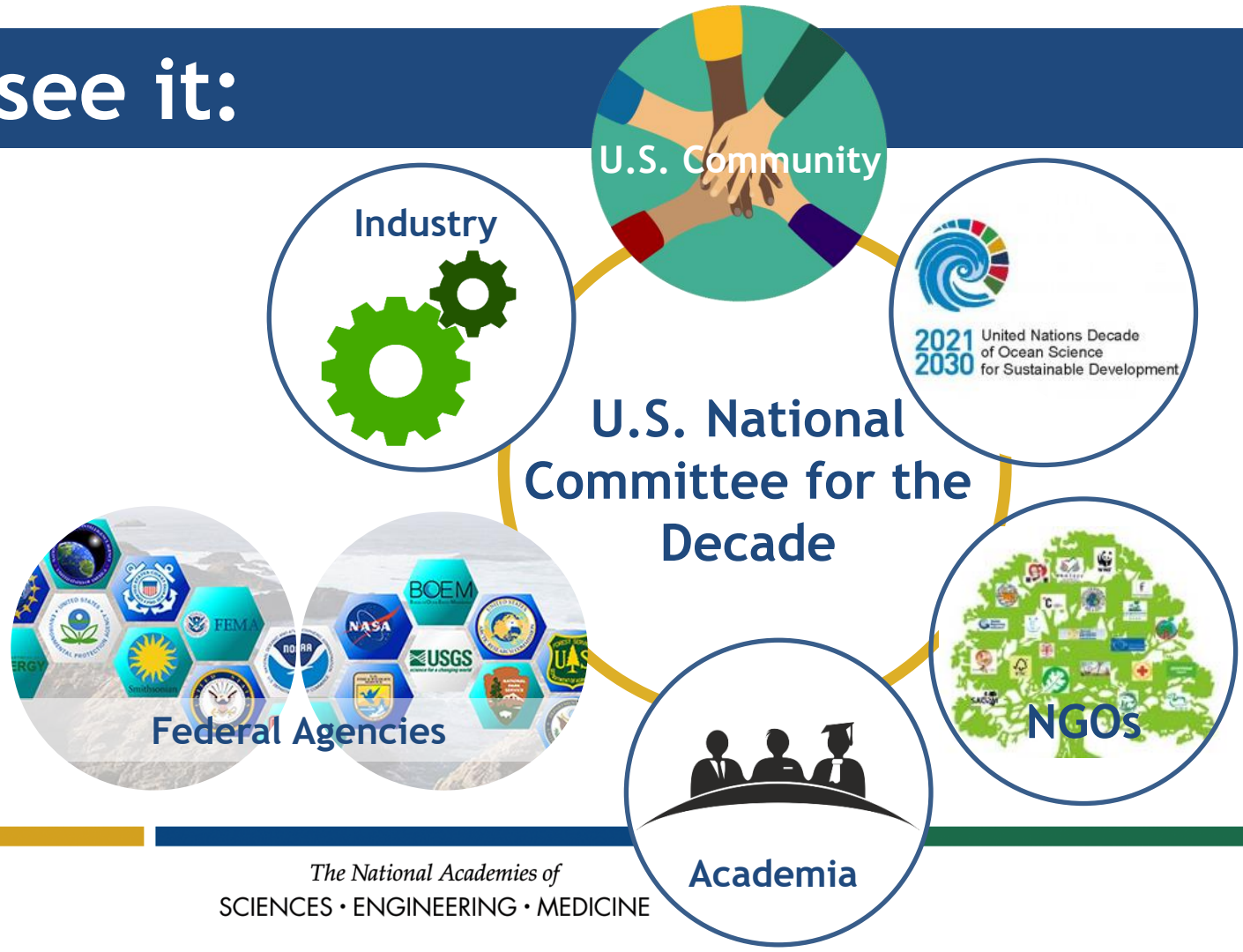
Coordination of the Decade



From UN: Role of National Decade Committees

105. Given the scope and breadth of the Decade, national coordination of Decade activities will in many cases be essential. The creation of National Decade Committees will be encouraged to facilitate national contributions to the Decade, engage national stakeholders, and enhance their access to Decade benefits such as data, forecasts, science-based decision support tools, or capacity development opportunities. The Decade Coordination Unit will use the Global Stakeholder Forum to promote exchange and cooperation between National Decade Committees. Ideally, these National Decade Committees should be multi-agency and multi-stakeholder platforms, involving the political and scientific institutions and actors concerned by the ocean and its management. Existing national coordinating mechanisms may provide the basis for performing such functions. The mandate and role of National Decade Committees will be tailored to the local context

How we see it:



Our Communications Role

Announcements



PUBLICATIONS

Booklet Outlines International Decade Goals

The United Nations has put the goals of the decade in a booklet called "The Science We Need for the Ocean We Want."



ARTICLE

Why We Need the Ocean Decade

A PNAS article explains why we need a global movement to transform ocean science. Lead author Linwood Pendleton is a member of the Executive Planning Group for the UN Decade of Ocean Science.

- Website
- Social media
- E-listserve

nationalacademies.org/oceandecadeus

Functions for U.S. National Committee

Strategic support of U.S. efforts during the start of the UN Decade of Ocean Science for Sustainable Development



A Goal: Engage Early Career Scientists

Goals include:

- Furthering the development of expertise in science for a sustainable

Early Career Scientists will:

- Serve for 2 years
- Support Ocean Decade US on social

82 applications!!

- inclusion in ocean studies
- Developing networks in the U.S. and internationally for building global capacity for ocean research

webinars

- Act as liaisons to other early career scientists, provide mentorship, and present feedback to US National Committee

Engage Early Career Scientists

Goals include:

- Furthering the development of expertise in science for a sustainable ocean
- Increasing diversity, equity and inclusion in ocean studies
- Developing networks in the U.S. and internationally for building global capacity for ocean research

Four individuals have been selected to serve as liaisons for two years:

Anjali Boyd

Duke University PhD student

Angee Doerr

Asst Professor, U. Florida College of Law

Annie Brett

Asst Professor, Oregon State U.

Grace Young

X, Alphabet's Moonshot Factory

The Ocean Decade U.S. Nexus



Nexus organizations:

Advance action for the Decade

Contribute to and disseminate information about the U.S. Decade efforts

Facilitate communication across organizations and sectors while enhancing public engagement

Robust web platform with >60 members



Engage the U.S. Science Community



OCEAN-SHOT

An ambitious, transformational research concept that draws inspiration and expertise from multiple disciplines and fundamentally advances ocean science for sustainable development

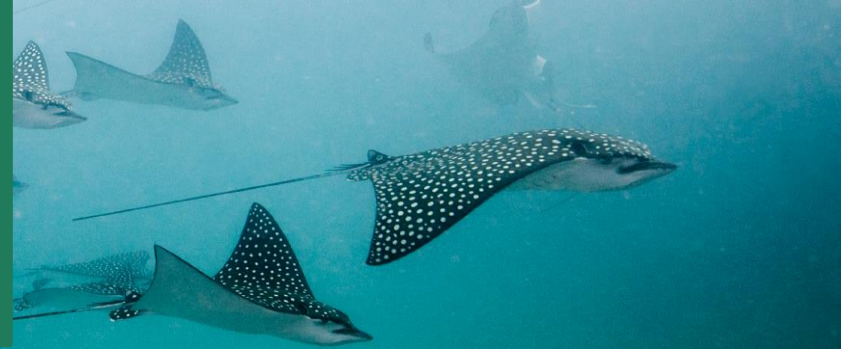
OCEAN SHOTS – BOLD, TRANSFORMATIVE IDEAS

CRITERIA for submission

- **RELEVANT**: Topic represents a key area of potential scientific advancement related to the ten Ocean Decade Challenges
- **VISIONARY/INSPIRATIONAL**: potential for disruptive or transformational impact
- **REALIZABLE**: connected to existing research and infrastructure
- **ENGAGING**: Trans-, interdisciplinary, and inclusive of traditional ocean sciences.
- **LEVERAGING**: international participation and collaboration.
- **CAPACITY BUILDING/STRENGTHENING**: developing world, next generation
- **JUST/DIVERSE/EQUITABLE/INCLUSIVE**: build community ...involves local or indigenous experts and knowledge.

102 submissions!!

Ocean Decade U.S. Launch Meeting Feb 3-4, 2021



- Plenary Speakers
- Ocean-Shots
- Networking Sessions by Challenge Themes
- Rapporteur Summaries

U.S. launch meeting drew
>1200 registrants;
featured **80** posters and
13 exhibits

Ocean-Shot Directory

- ~ 90 submissions to the [Ocean-Shot Directory](#)
- Second call for submissions was **July 1, 2021**
- Apply today using our [online form](#), or email oceandecadeus@nas.edu with questions



Ocean-Shot Directory

SHARE [f](#) [t](#) [in](#) [v](#)

"Ocean-Shots", defined as an ambitious, transformational research concept that draws inspiration and expertise from multiple disciplines and fundamentally advances ocean science for sustainable development. This directory is a growing collection of Ocean-Shots submitted and presented at the February 3-4 launch meeting in response to the U.S. National Committee for the Ocean Decade call for disruptive advances in ocean science.

Ecological Forecasts for a Rapidly Changing Coastal Ocean

Authors: Josie Quintrell, Clarissa Anderson, Gabrielle Canonico, Debra Hernandez, Molly McCommon, Jan Newton

Provide accessible, informative, high-resolution predictions on how changes - from genomes to cells to organisms to ecosystems - may impact people's lives, livelihoods, and property.

[WATCH THE PRESENTATION](#) →

COHORT 1

Envisioning an Interconnected Ocean: Understanding the Links Between Geological Ocean Structure and Coastal Communities in the Pacific

Authors: Megan Lubetkin, Sarah Gaines, Nicole Raineult

The Ocean Explorations Trust (OET) will conduct scientific expeditions to better understand the ocean through seafloor mapping and ocean exploration. OET seeks to collaborate with local communities to reveal the structural significance and interconnected nature of oceanic features, making a link to the livelihoods of Pacific Islanders.

[DOWNLOAD \(PDF, 177 MB\)](#) →

COHORT 1

EquiSea: The Ocean Science Fund for All

Authors: Alexis Valauri-Orton, Brian K. Arbic, Jorge Rafael Bermudez Monsalve, Gina Bonne, Marcia Creary Ford, Edem Mahu, Courtne Park, Aileen Tan Shau Hwai

EquiSea aims to improve equity in ocean science by establishing a philanthropic fund to provide direct financial support to projects, coordinating capacity development activities, fostering collaboration and co-financing of ocean science between academia, government, NGOs, and private sector actors, and supporting the development of low-cost and easy-to-maintain ocean science technologies.

[DOWNLOAD \(PPTX, 219 MB\)](#) →

SMART Subsea Cables for Observing the Ocean and Earth

AUTHORS

Bruce M. Howe
University of Hawaii at Manoa

Christopher R. Barnes
University of Victoria

Davie T. Meldrum
Scottish Association for Marine Science

ABSTRACT

The Joint Task Force for Science Monitoring And Reliable Telecommunications (SMART) Subsea Cables will facilitate integration of sensors into commercial submarine telecommunications cables for climate monitoring and disaster warning. Our vision is a planetary scale array monitoring ocean heat and circulation and sea level rise and revolutionizing real-time warning systems for earthquake and tsunami disaster mitigation. This is enabled by the trans-ocean cable infrastructure linking society together: 1.4 million km of cable, 20,000 repeaters every 70 km hosting the sensors, constantly being refreshed over 10-25 years, without interfering with telecom. Initial sensors are ocean bottom temperature, pressure and seismic acceleration. System suppliers are on board, the first major SMART project is funded and underway in Portugal (2020), and seven others are in various stages of planning and funding — a perfect example of the Blue Economy in action for the UN Decade.

JTF will provide coordination between ocean science, operational oceanography, hazard early warning centers, industry, and relevant government agencies. SMART cables will create profound opportunities for innovation — requiring people with appropriate depth and breadth of expertise. JTF will facilitate SMART Cable projects that will catalyze and include education, training and outreach programs to build necessary capacity.

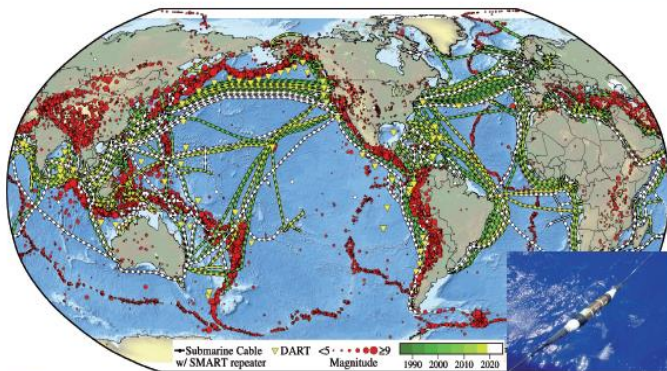


FIGURE 1. The global submarine telecommunication network as of early 2021, comprising 1.4 million km of cable, refreshed and expanded on a 10-25 year time scale. Potential SMART repeaters are indicated as dots every 300 km. Color (green-white) indicates year ready for service. The inset shows a typical repeater (courtesy of Alcatel ASN). Red dots show historical earthquakes and magnitude. Yellow triangles are DART tsunami warning buoys.

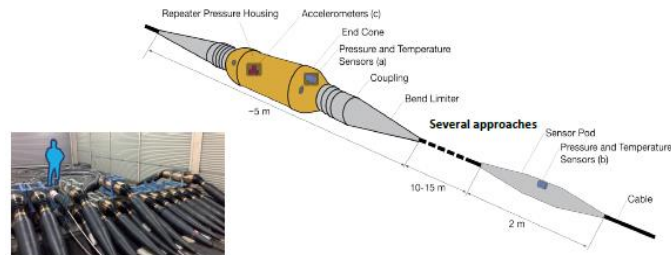


FIGURE 2. Two possible approaches to integrating sensors into SMART cables, either directly in/on a repeater housing and/or in a nearby sensor pod. The inset shows repeaters for a trans-ocean cable system.

Vision and Potential Transformative Impact

The mission of the UN ITU/WMO/IOC Joint Task Force for Science Monitoring And Reliable Telecommunications (SMART) Subsea Cables is to facilitate the integration of sensors into commercial submarine telecommunications cables for climate monitoring and disaster warning. Our vision is a planetary scale array of sensors monitoring ocean heat and circulation and sea level rise and revolutionizing real-time warning systems for earthquake and tsunami disaster mitigation to save lives. This transformative 1st order addition to the ocean and Earth observing system is enabled by the trans-ocean submarine telecommunications cable network infrastructure linking society together: 1.4 million km of cable with 20,000 repeaters every 70 km hosting the sensors, constantly being refreshed on a 10-25 year cycle. Science, blue economy and ocean safety will be significantly advanced without interfering with telecom. Initial sensors will be ocean bottom temperature, pressure and seismic acceleration; this suite can be progressively expanded. The sensors will improve the cable network integrity, reliability and resiliency. The first major SMART project is funded and underway in Portugal (2020); seven others are in various stages of planning and funding. Many of these initiatives provide uniquely economically viable solutions to multi-hazard monitoring in developing and smaller member states.

Realizable, With Connections to Existing U.S. Scientific Infrastructure, Technology Development, and Public-Private Partnerships

SMART Cables are realizable, building on the last 25 years of submarine cable technical developments in telecom and science/early warning systems (e.g., NSF OOI, S-net, Alcatel Submarine Networks' (ASN) press release in September 2020 their recognition of the need to proactively address climate change and indicated they would supply integrated telecom+science+early warning systems. The next day, the Portuguese government announced the Continent, Azores and Madeira Islands (CAM2) system, with seismic and environmental sensors (3700 km, €120M, 2024+), demonstrating demand for the industry. Other suppliers are expected to follow suit, including SubCom in the US and NEC in Japan.

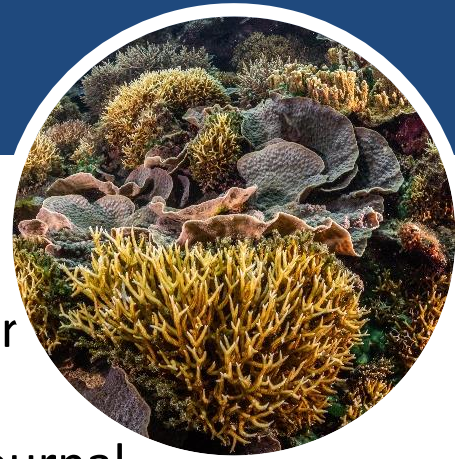
Scientific/Technological Sectors Engaged Outside of Traditional Ocean Sciences

By entraining telecom, SMART Cables, the Ocean Science community, and the UN Decade can leverage all the resources of the industry — the Blue Economy, immense by "our" standards. To realize this, JTF will provide coordination between the industry, ocean science, operational oceanography (GOOS) and tsunami and other sea level hazards early warning (IOC TOWS), and the relevant national government agencies and ministries. There are benefits for cable protection, detecting fishing, trawling and anchoring, as well as landslides and earthquakes, that can compromise cables. In Portugal, monitoring and managing the EEZ (e.g., illegal fishing) is part of the equation. The last decade of transformative SMART Cable planning and advocacy has led to the CAM2 system, a Wet Demo off Sicily (INGV, underway, €2.4M/EC+Italy, 2022), and other emerging systems in various stages including: Vanuatu-New Caledonia (planning, €2.5M/France on table); Indonesia (pilot systems under development); MEDUSA (Western Med; commercial/EU funding, RFP to include SMART capability); Namaste (India-Oman, planning, commercial); New Zealand-Chatham Islands (discussion); and Nzadi (Angola, planning, commercial). All of the planning includes local science and early warning colleagues, owners/funders, government, and suppliers; it is inherently an international process.

Develops Global Capacity and Encourages the Development of the Next Generation of Ocean Scientists, Engineers and Technologists

The fundamental technical innovation of SMART Cables is the provision of a power (sine qua non for everything else) and communication interface on the seafloor from shallow to deep with global distribution, enabling real-time interdisciplinary observations. This will create profound opportunities for innovation — requiring people with appropriate depth and breadth of expertise. The JTF will facilitate SMART Cable projects that will catalyze and include education, training and outreach programs to build necessary capacity and interest, including youth and early career professionals, in ocean data. Special efforts will also be made to engage local communities and utilize traditional knowledge.

What we could do....



Communications

- Expand and engage Nexus organizations
- Develop relationships with National Committees in other
- Engage early career and young ocean scientists
- Directory of Ocean-Shots is available on website; MTS Journal publication
- Initiate discussions on Ocean Decade activities
NGOs, federal agencies, foundations and philanthropies

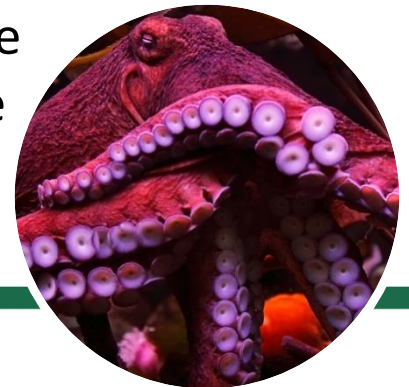
New Consensus Committee Formed – October 2021

Statement of Task

Based on the body of submissions to the call for Ocean-Shots as part of the NASEM project on U.S. Contributions to the Ocean Decade, the ad hoc consensus committee will identify 3-5 cross-cutting themes that incorporate the most promising and innovative research concepts. Specifically, the committee will examine how each theme aligns with the overall goal of the UN Ocean Decade in supporting ocean science for sustainable development –with potential for generating future UN Decade Programmes. In addition, the committee will connect the themes to U.S. ocean priorities, as identified in documents such as identified in the National Science and Technology Council, Subcommittee on Ocean Science and Technology document, Science and Technology for America's Oceans: A Decadal Vision (2018). The themes identified by the committee will address compelling areas for public and private sector investment and provide opportunities for inter- and multi-disciplinary activities in support of ocean science. The committee will prepare a short report that identifies the 3-5 themes and describes each briefly according to the criteria outlined above.

Cross-Cutting Themes

- Based on the the body of submissions to the call for Ocean-Shots: **identify 3-5 cross-cutting themes that:**
 - Incorporate promising and innovative research **concepts emerging from these Ocean-Shots**
 - **Aligns with the overall goals of the UN Ocean Decade** in supporting ocean science for sustainable development –with potential for generating future UN Decade Programmes



Statement of Task

- **Connect the themes to U.S. ocean priorities**, as identified in documents such as identified in the National Science and Technology Council, Subcommittee on Ocean Science and Technology document, Science and Technology for America's Oceans: A Decadal Vision
- Address **compelling areas for public and private sector investment and provide opportunities for inter- and multi-disciplinary activities** in support of ocean science

	A	B	C	D	E	F	G	H	I	J
				Ocean Decade Outcome	LM COMMENT	Alternate Decade Outcomes (For the Ocean-Shots that are not clearly 1 Outcome)	Ocean Decade Challenge	Poster URL	Target Audience	Field
1	Title	Authors	Summary							
	Carbon Sequestration via Drilling-Promoted Seawater-Rock Interactions	Craig Lundstrom	Finding effective methods to limit the accumulation of atmospheric CO2 through sequestration encouraged by seawater-rock interactions		Is CO2 a pollutant? Perhaps			https://vimeo.com/516866873		
2				1 better in 2		4	5			Climate Change & Mitigation
	BioGeoSCAPES: Ocean Metabolism and Nutrient Cycles on a Changing Planet	Mak Saito, Heather E	BioGeoSCAPES will improve our understanding of ocean metabolism and its interaction with nutrient cycling. Through an approach built on international collaboration, BioGeoSCAPES strives to provide significant and transformative advances in our knowledge at multiple spaces and time scales that will contribute to understanding the oceans and their role in influencing climate on a changing planet.					https://www.nationalacademies.org/docs/DFB2226196		
3				2		4	2, 3, 5, 7, 8, 9, 10			Climate Change & Mitigation
	Navigating the Ocean's Role in Carbon Dioxide Removal	Adam Subhas, Heather E	We propose an Ocean Shot to develop the science we need to assess the ocean's ability to sequester atmospheric CO2 and understand how the ocean can intentionally and responsibly be modified to increase uptake of atmospheric CO2.					https://vimeo.com/517315266		
4				4		2, 5, 7, 9				Climate Change & Mitigation
	Global Ocean and Human Health Program	John Stegeman, Dorinda	This Ocean Shot addresses the need for an international program to meet the challenges at the intersection of ocean health and human health. A Global Ocean and Human Health (GOHH) Program would build a transformative network encompassing essential research and engineering, policy, and economic					https://www.nationalacademies.org/docs/D90C7D8D7		
87				7		1, 2, 3, 4, 5, 6, 7, 8, 9, 10				Ecosystem Health

UN DECADAL GOALS



Accessible Ocean

Data sharing & application products, services, policy



Productive Ocean

Sustainable BE, safe thresholds for econ growth, mitigate impacts of envir. change



Safe Ocean

Disaster risk reduction



Healthy/Resilient Ocean

Ecosystems mapped & protected, impacts mapped, measured & reduced



Clean Ocean

Pollution identified, quantified, reduced & removed



Predicted Ocean

All ocean basins observed and mapped; obs. for mgmt. & BE; innovate tech



Inspiring & Engaging Ocean

Focus on ocean literacy to establish broad understanding of role/importance of ocean

U.S. DECADAL PRIORITIES



Modernize R&D infrastructure

Big data, models, R2O



Promote Economic Prosperity

Seafood competitiveness, energy, minerals, econ/eco balance, workforce



Resilient Coastal Communities

Disaster risk reduction



Safeguard Human Health

Plastics contaminants & pathogens, HAB, Natural Products



Ensure Maritime Security

Arctic transport, situational awareness, national security relies on *strong science literacy* in our communities

What is the timeline?



Draft Themes:

Foundational Themes:

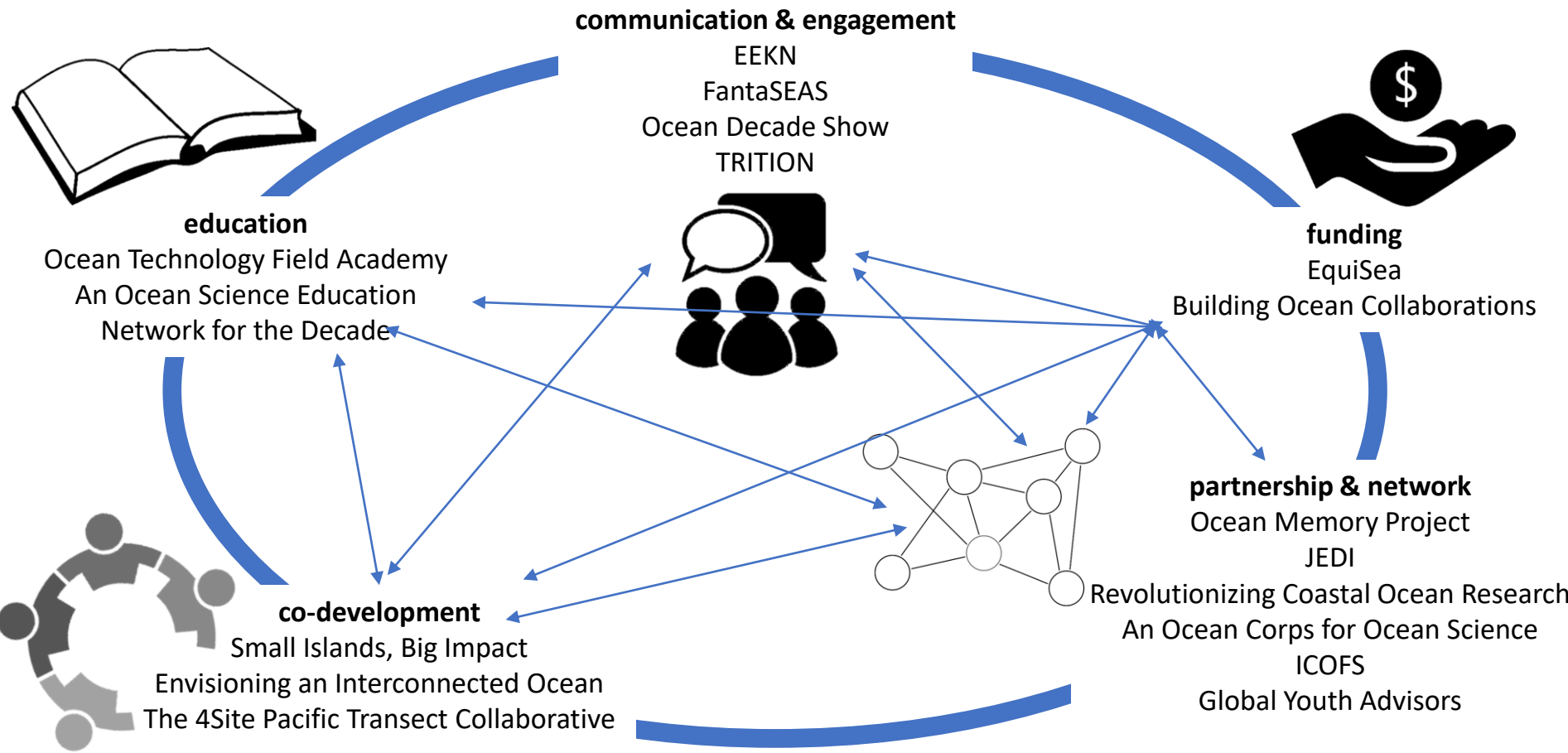
- An Inclusive and Equitable Ocean
- An Ocean of Data

Topical Themes:

- The Transparent Ocean
- The Restored and Healthy Ocean
- Ocean Solutions to Climate Resiliency
- Healthy and Resilient Urban Seas

An Inclusive and Equitable Ocean

Foundational Theme



An Ocean of Data

Foundational
Theme



- open science**
- Advancing Ocean Science through Open Science and Software on the Cloud
 - OceanCloud

A.I.
FathomNet



predictive modeling & collaboration

- Forward-Looking Decision Making in Fisheries in the Face of Climate Change
- OceanPredict.US

digital integration

- COVERAGE
- An INFOstructure Solution



long - term & sustained observation coverage

- BOON-GS
- Improved Value of the Observing System



The Transparent Ocean



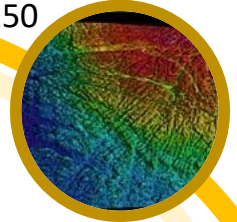
acoustics

- Observing the Oceans Acoustically
 - Ocean Sound Atlas
- Measuring the Pulse of Earth's Global Ocean
 - Complete mapping
- Long-Term, Global Seafloor Seismic, Acoustic and Geodetic Network



deep sea/twilight zone

- Challenger150
 - DORIS
 - iDOOS
 - COBRA

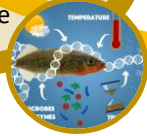


ocean observing

- Integrated Ocean Observing
 - The Endless Dive
- Accelerating Global Ocean Observing
 - OASIS
- Sustaining Ocean Observations
- Ocean Observing Living Action Plan
 - Building Ocean Collaborations
- Twilight Zone Observing Network

genomics

- A Global eDNA Monitoring System
- Great Global Fish Count by DNA
- The US Ocean Biocode



Arctic

- Arctic Shelves
- Unlocking the Secrets of the Evolving Central Arctic Ocean Ecosystem
 - Ocean Arc



Platforms and innovative sensors

- Battery-free Ocean of Things
- Ocean Technology Field Academy
 - PROTEUS
 - METEOR
 - RoCS
- Low cost sensors
 - AUVs/ASV
- Pulse of Earth's Global Ocean
 - Measuring the Ocean

The Restored and Healthy Ocean

ENABLING TECHNOLOGY

coasts

Accelerating Global Ocean Observing
An INFOstructure Solution
Ecological Forecasts for a Rapidly
Changing Coastal Ocean
ICOFs
Revolutionizing Coastal Ocean
Research



food

Feeding 10 Billion
Future Fisheries in a Changing World
SEAfood with Healthy Oceans
TOPS3
Meeting Protein & Energy Needs for 10
Billion People while Restoring Oceans



community

Small
Islands, Big
Impact



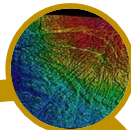
reefs

The Coral Reef Sentinels
A Call for Health
Diagnostics to Preserve
Coral Reefs
Plant a Million Corals
Reef Solutions
The TeleConnected Reef



ecosystem

Net Ecosystem
Improvement
PERSEUS



microbes

Development of Health
Indices for Microbe-
Dominated Ocean
Systems

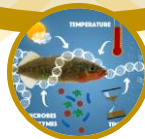


biodiversity

Marine Life 2030
The Endless Dive

genomics

A Global eDNA Monitoring System
Seascape Genomics of North
Pacific Forage Fishes
Great Global Fish Count by DNA
The US Ocean Biocode



deep sea

Challenger150
Twilight Zone
Observation Network

seagrass & kelp

Nature-Based Nutrient Reduction
for Seagrass Restoration
Developing Thermally Tolerant
Kelp Bloodstock



Ocean Solutions to Climate Resiliency



acoustics

- Observing the Oceans Acoustically

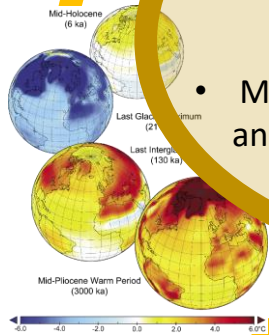
observation & predictive modeling

- Butterfly
- CARIBO
- OASIS
- Southern Ocean Storms
- A Real-Time Global Rivers Observatory
- Super Sites for Advancing Understanding of the Oceanic and Atmospheric Boundary Layers
- A Sensor Network for Mixing at the Ocean's Bottom Boundary
- Measuring Global Mean Sea Level Changes with Surface Drifting Bouys



hindcasting

- Why Paleooceanographic Observations are Needed to Improve Future Climate Projections
- Mining Five Centuries of Climate and Maritime Weather Data from Historic Records




CDR

- Carbon Sequestration via Drilling-Promoted Seawater-Rock Interactions
- Navigating the Ocean's Role in Carbon Dioxide Removal




Healthy and Resilient Urban Seas

Topical Theme



aquaculture & nutrients



Feeding 10 Billion
Novel Coastal
Ecosystems

funding
EquiSea

education

An Ocean Science Education
Network for the Decade



data

Ocean Cloud
OceanPredict.US
An INFOstructure Solution
Real-Time Global Rivers Obs

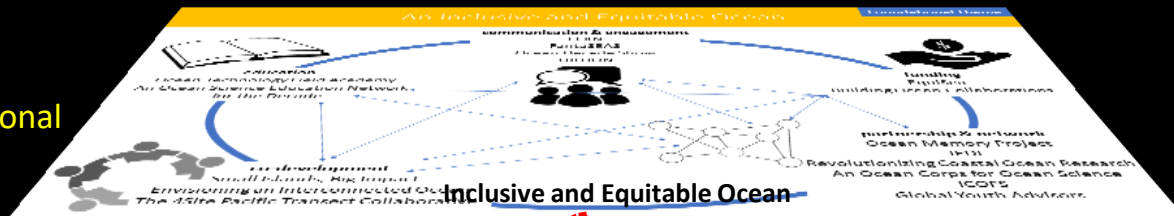
communication
TRITON



partnership & network

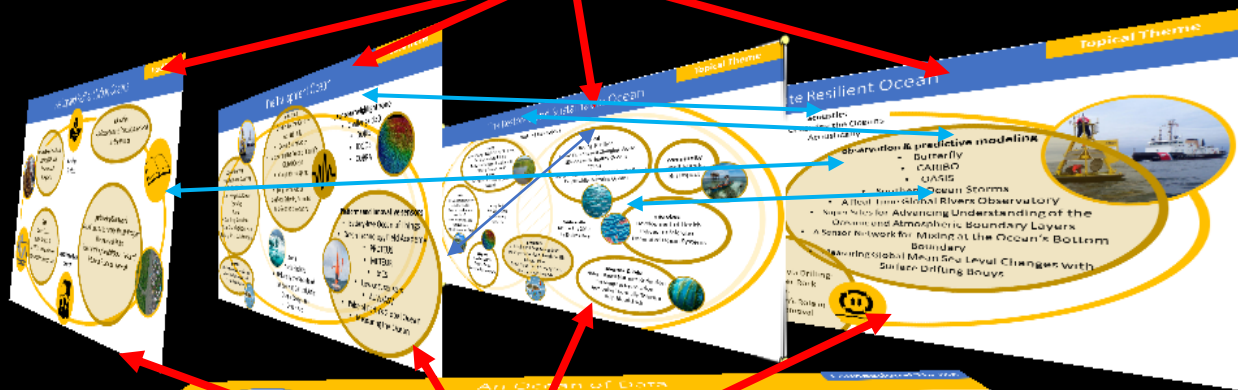
Global Ocean and Human Health
Program
Marine Health Hubs
Revolutionizing Coastal Ocean Research
Estuarine Ecological Network

Foundational

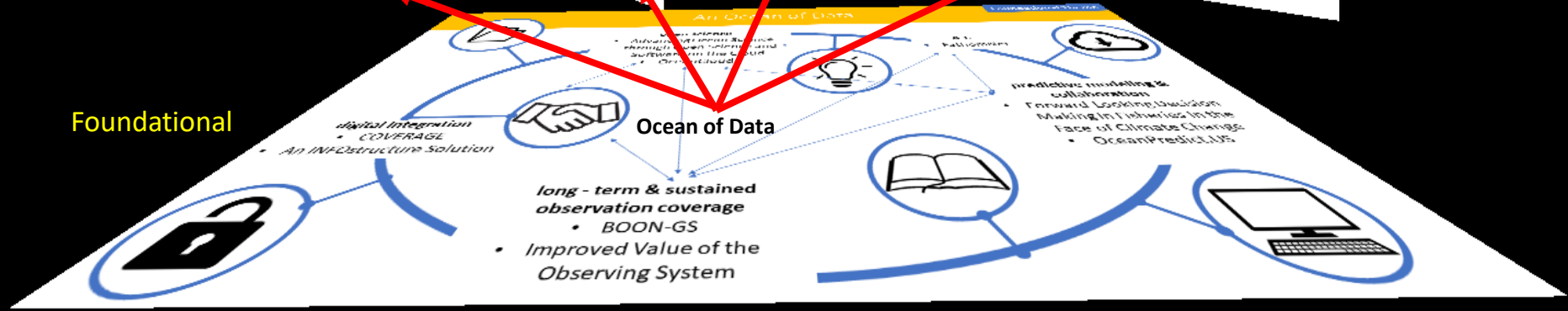


Inclusive and Equitable Ocean

Topical



Foundational



What is the timeline?



Cross-Cutting Themes for U.S. Contributions to the Ocean Decade

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The Transparent Ocean

I. **Overview of Theme:** Our understanding of the Earth has been revolutionized by our ability to see, sense and sample Earth processes by remote and direct sampling techniques. Electromagnetic sensors from satellites and airplanes have provided remarkable images of terrestrial and atmospheric processes and while they have revealed an increasingly comprehensive picture of the ocean’s surface, they cannot penetrate beneath the ocean surface. As a result, observations beneath the ocean’s surface are limited to the sparse, expensive, and time-consuming sampling from ships – leaving vast ocean regions unexplored and virtually unknown. Consequently, much of the ocean has yet to be mapped, explored, sampled, or described and the question then arises, “How can we manage and protect what we do not know and understand?” In the twenty-first century, an array of new technologies and approaches are being developed that offer the potential to make our oceans “transparent.” Yet we will only achieve such a goal if these technologies and approaches are developed and deployed in a coordinated fashion that is closely coupled to the science questions that the technology is trying to answer and, in the context of the Decade, focused on supporting sustainable development.

II. **Decade Outcomes Addressed:** This theme addresses most of the Ocean Decade outcomes but, most directly: Outcome 4: A predicted ocean where society understands and can respond to changing ocean conditions; it also addresses: Outcome 2: A healthy and resilient ocean where marine ecosystems are understood, protected, restored and managed; Outcome 3: A safe ocean where life and

III. Connections to Ocean-Shots; UN Ocean Decade Actions; U.S. Ocean Priorities:

The Transparent Ocean builds on more than 20 Ocean-Shot concepts and a number of UN Decade endorsed activities listed in the table below. This theme is further supported by other decade-related resources including the National Science and Technology Council’s Decadal Vision for America’s Oceans which underscores the importance of acoustic measurements and new technologies for exploration, discovery, and long-term monitoring.

Title	Brief Description
Ocean-Shots	
Long-Term, Global Seafloor Seismic, Acoustic and Geodetic Network	Establishment and maintenance of autonomous ships to collect and send data, including seafloor mapping, ocean sampling, and seafloor system maintenance ashore.
Unlocking the secrets of the evolving Central Arctic Ocean Ecosystem: A foundation for successful conservation and management	The Central Arctic Ocean is changing as fast as any other region, but understanding of the ecosystem is inadequate for effective protection, conservation, and management. A comprehensive expeditionary and autonomous approach will help quantify uncertain biological characteristics and rates over pan-Arctic spatial and temporal scales. This need is particularly timely given the recent international ratification of the "International Agreement to Prevent Unregulated Fishing in the High Seas of the Central Arctic Ocean," which has now come in to force. Meeting the challenges of the Agreement will require multiple nations and diverse stakeholders, including Indigenous coastal communities, to work together.

IV. Potential Research Elements:

- Improved description of the underwater environment from an acoustic perspective, including resolutions appropriate for applications using different frequencies (i.e. high-frequency high-resolution for high-bandwidth local communications, low-frequency, long-range for basin scale observation)
- Take advantage of the existing submarine telecommunications cable industry to provide global power and communications infrastructure services that are the *sine qua non* for the preceding topics
- Beginning the establishment of the acoustic equivalent of a global GPS network, allowing subsea geo-positioning for deep fixed and mobile platforms including floats, gliders and other autonomous undersea vehicles world-wide, and an underwater communications network, which would enable data transmission as well as coordination of underwater vehicles
- Global acoustic thermometry providing large-scale ocean temperature and heat content measurements
- Active and passive acoustic observations of biomass volumes, marine organism distribution and behavior, mass and heat transport, mixing, seafloor topography – all these observations can be made at a range of scales from basin-wide to micro-structure

Anticipated Outcomes & Next Steps

- IF there is support for these themes -- the report will be used to organize future workshops and other activities that will focus on bring together proponents, filling gaps and developing more detailed plans for implementing programs to meet objectives.



Thank you!



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Visit the website to:

- Join the Nexus
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- Watch video from launch meeting
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Please direct questions to oceandecadeus@nas.edu

DECADE ACTION FRAMEWORK

