

ACCELERATING GROWTH OF U.S. BLUE ECONOMY

Initial Recommendations

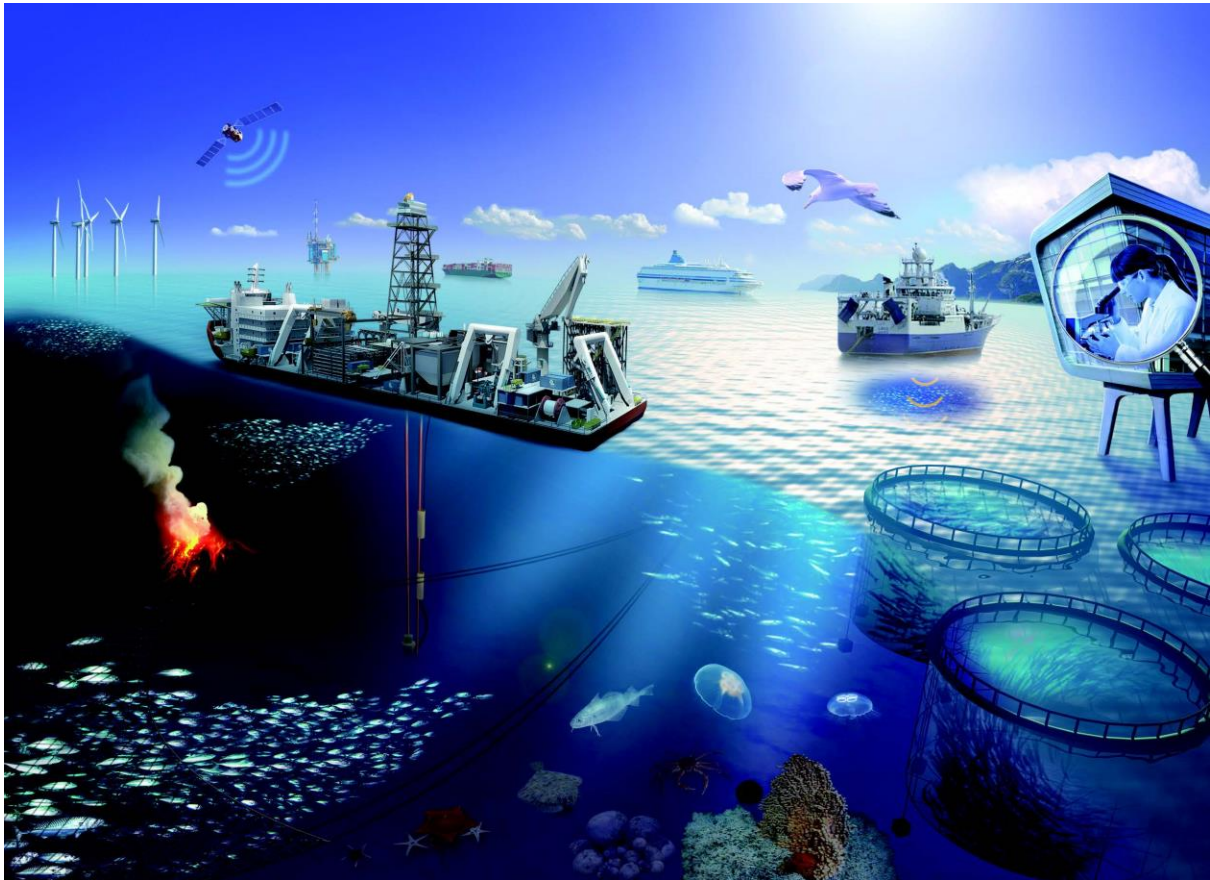


Image Source: The Ocean Economy in 2030, OECD

**An Interim Report
Blue Economy Subcommittee
Of
NOAA Ocean Exploration Advisory Board**

1 June 2020

To put into perspective the potential impact and outcomes of the OEAB Blue Economy Subcommittee's recommendations, the following narrative is provided in the context of a "future" interview.

Future Interview with the NOAA Administrator on the US Blue Economy (3 October 2030)

Q: Tell me about the success of your Blue Economy project – what is most meaningful?

Today is the 60th anniversary of NOAA's formation, and I'm incredibly proud of what our team has accomplished over the last decade. They've worked tirelessly over the past ten years to help build our nation's dynamic and growing Blue Economy. Today's U.S. Exclusive Economic Zone is a great model that shows the world the right way to manage the ocean as a shared resource, with multiple users and interests – we prefer to think of "shareholders" – working together for a healthy, sustainable ocean economy. We started this effort a decade ago. You may remember in 2020 we were dealing with a COVID-19 pandemic, and the economy was headed for trouble. While people squabbled over many initiatives, the Blue Economy was unique in that it had strong bipartisan support in Congress, support of the Administration, and general support from the public. We went into it knowing the ability to adapt would be key. We could not just rebuild using old approaches, we had to innovate using new tools to create a new, sustainable environment. Not only did we exceed our economic goal of doubling the Blue Economy, which we achieved last year, we have progressed far on a path of sustainable development. Our ocean is 50% healthier than it was a decade ago according to the Ocean Health Index.

Our key accomplishments include:

- We successfully increased food security with a 30% reduction in seafood imports as compared to 2019. This success is a direct result of early cash infusion in 2020 to save our seafood industry, followed by dedication to rapid Research-to-Operations (R2O) to support both aquaculture and wild-capture fisheries. The R2O focus enabled better science-based decisions for fisheries management and reduced barriers to entry to accelerate aquaculture development.
- Our National Ocean Innovation Consortium was another big win. After ribbon-cutting in 2021, it stands today as a model for approaching ocean development as a complex issue demanding multi-disciplinary approaches. We have successfully integrated best-in-class methods and models from government, academia, and the private sector.
- Another big milestone occurred in 2028 when we completed mapping of the US EEZ. We could not have achieved this without our private sector partners who developed innovative, cost-effective approaches using Autonomous Underwater Vehicles (AUVs) to transform ocean seafloor mapping far beyond what was possible with ships. This is a great example of not simply rebuilding the past, but of adapting and creating new approaches with innovative technology. In addition to achieving our objective, our approach resulted in several start-ups growing to mid-size companies; engaged large companies as partners, who then invested in R&D; and provided key data characterizing the EEZ to accelerate development through science-based decisions.

Q: What were key elements enabling the success?

From the very beginning, we had a dual focus: 1) create quick wins and build on early success; and 2) follow up on our overarching strategies critical for long-term success. The heart of the program was to stress NOAA's role as an ocean agency, with a renewed focus on our mission to enable science, service and stewardship. NOAA has always had a science focus. However, it was our additional dedication to service and stewardship which shaped the true mission-oriented ocean agency you see today. Three aspects were critical for our success.

First, we established a focused Blue Economy Program Team (BEPT) with an experienced, talented senior leader reporting directly to NOAA executive leadership. We placed a big bet and assigned our best and brightest to be part of this team. This clear priority attracted attention, and soon many talented young people wanted to be part of the team because they saw it as an opportunity to make a real difference for something meaningful – sustainable development of our ocean. And the BEPT provided a single focal point for parties outside of NOAA. Internally, the BEPT acted across Line Offices to align programs with mission priorities, work jointly to establish milestones, and increase/decrease budgets based on results. A very important result of this effort occurred in 2026 when Congress recognized NOAA as an overarching ocean agency rather than a loose assembly of Line Offices, each with its own priorities.

Second, we recognized the importance of partnerships – with the private sector, academia, and other government agencies at the federal, state, and local levels. We also formed innovative partnerships with key philanthropic organizations to fill gaps in investment and innovation. To succeed, we recognized we had to change our culture to become more agile and actively manage partnerships in order to leverage their true value. Leadership focus, training, and changing the reward system were key enablers, as well as establishing the ARPA-Ocean program in 2022.

Finally, NOAA has always been recognized for the value of its data. Early on, we realized the true value of data would occur only after we could provide access for a wide variety of users. With our focus on service and stewardship of the ocean, we worked hard within NOAA to convert raw data to usable information and communicate it in terms meaningful to policy makers and decision makers. Ocean exploration played a key role – expeditions increased our knowledge of the deep ocean and ocean processes, while providing critical information that allowed better decisions about ocean uses. Ocean exploration also played a key role as a catalyst for multiple sectors of the Blue Economy.

We knew the effort would enable better decisions and also stimulate new businesses. A big win was in more comprehensive approaches to ocean and climate data-driven infrastructure investment in coastal resilience. But I will say a key outcome was the result of simply getting people together to discuss data. This dialogue facilitated essential two-way communication, increased scientists' understanding of what data were needed, and went a long way to resolving conflicts among ocean shareholders. Mitigating conflicts was essential as the expanding Blue Economy increased activity levels, presenting considerable challenges to coordinate multiple federal/state/local agencies and users to facilitate co-existence.

To wrap up—NOAA had to make hard internal decisions, then execute challenging initiatives to change our culture. We couldn't do it alone, however. The vibrant network of partnerships allowed us to focus on what we did best—while our partners did what they do best. The result is a Blue Economy which delivers good jobs, drives innovation on land as well as at sea, ensures our food security, provides renewable energy, and provides outstanding recreation and tourism opportunities now and in the future.

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List of NOAA OEAB Blue Economy Subcommittee Members

- John Kreider, Kreider Consulting LLC, (Oceaneering, Ret), Subcommittee Chair
- Thomas Chance, (ASV Global, Ret), (C & C Technologies, Ret)
- RADM Matthew Klunder (USN, Ret), L3 Harris
- Rob Munier, Woods Hole Oceanographic Institution
- Michael Olsen, Equinor
- Dr. Ruth Perry, Shell Exploration & Production Company
- Millicent Pitts, Ocean Exchange
- Jerry Schubel, Aquarium of the Pacific
- Shally Shanker, AiiM Partners
- Mark Stevens, Microsoft
- VADM Scott Van Buskirk (USN, ret), Van Buskirk Associates, LLC
- Dave Whaley, Independent Fisheries and Ocean Consultant

Staff

- David McKinnie, NOAA, Designated Federal Officer
- Christa Rabenold, NOAA Office of Ocean Exploration Research, Staff Support

Summary

Accelerating Growth of U.S. Blue Economy

The Blue Economy is vital to our nation because: 1) health and resilience of our ocean are critical to our economy and our lives; and 2) a robust Blue Economy enhances our nation's leadership and competitiveness by strengthening our national, economic, food, energy, and environmental security. It is imperative that the U.S. government cannot stand by passively. It must engage now.

In addition, the COVID-19 environment demands innovative approaches and the ability to adapt, to not just re-create the past, but to create a new future of a vibrant and sustainable ocean economy. NOAA is in a key position to lead the Administration's efforts to increase the economic impact of the nation's ocean and coastal resources and be at the forefront of international discussions on the Blue Economy.¹ A collaborative and dynamic strategy for partnerships in ocean science and technology (S&T) – among government, private sector, academia, and philanthropy – is critical to coordinate, focus, and catalyze a national effort to achieve the goal of growing the Blue Economy.

At the request of the NOAA Administrator, the Ocean Exploration Advisory Board (OEAB) formed the Blue Economy Subcommittee to recommend actionable steps which NOAA can take to contribute to the doubling of the nation's Blue Economy over the next decade. The Administrator further requested an Interim Report with initial recommendations by 1 June 2020. The Subcommittee first met in February 2020 and has developed its Initial Recommendations* as summarized in the table on the following page.

The recommendations are grouped as NOAA Actions (blue), NOAA Acting with Other Agencies (green), Innovation Initiatives (orange), and Sector Initiatives (violet). The sequence does not indicate priority. It should be recognized that there is an inherent time domain associated with each recommendation's projected impact and required level of effort, some will be short term, while others will be long term. In addition, the Subcommittee identified "Quick Win" opportunities for each recommendation. These opportunities, which can be accomplished with 6- to 12-month efforts, are key to longer term efforts by building early successes.

Formed by the OEAB, the Subcommittee also recognizes the importance of ocean exploration as a catalyst for each of the efforts. While Ocean Exploration has been identified as a specific sector of the Blue Economy, ocean exploration plays an even bigger role as a catalyst and enabler for other sectors. Exploring the ocean to map the seafloor and characterize the water column provides basic, essential information to jump start economic activity and provide security for the nation.

*The Subcommittee believes Tourism and Recreation is an important sector for Blue Economy growth but was unable to finalize a recommendation for this Interim Report. The topic will be addressed in subsequent versions of these recommendations.

#	Recommendation	Impact	Effort
NOAA Actions			
1	Focus on NOAA Culture and Organization to Enable Growth of the Blue Economy	10	10
2	Establish NOAA Blue Economy Special Advisor and Executive Committee	10	8
3	NOAA Ocean Exploration as a Focal Point for Economic Stimulus and Recovery	7	7
4	Promote and Leverage Partnerships with Private Sector	9	3
NOAA Acting with Other Agencies			
5	Convene Shareholders to Promote Blue Economy Growth by Mitigating Conflicts for Ocean Use	8	7
6	Develop and Publish Blue Economy Metrics	8	7
7	Establish and Execute a NOAA Strategic Engagement Plan to Increase Public Awareness of the Importance of the Ocean and the Blue Economy	7	5
8	Develop & Execute Overarching Strategy for Ocean Data	8	4
9	Partner with Economic Development Administration (EDA) for Improved Business Outreach	8	5
10	Increase Pilot and Demonstration Programs	7	5
Innovation Initiatives			
11	Establish an ARPA-Ocean Program to Foster Innovation & Commercialization	9	8
12	Create National Ocean Innovation Consortium to Accelerate Blue Economy Growth	6	7
13	Create an Ocean Innovation Initiative	10	10
Sector Initiatives			
14	Increase Efforts to Enhance Coastal Resilience of Human and Natural Ecosystems	7	5
15	Ensure US Food Security through Modernized Wild Harvest and Increased Aquaculture Production	9	6
16	Support Next-Generation Services for Marine Transportation and Ports	9	6

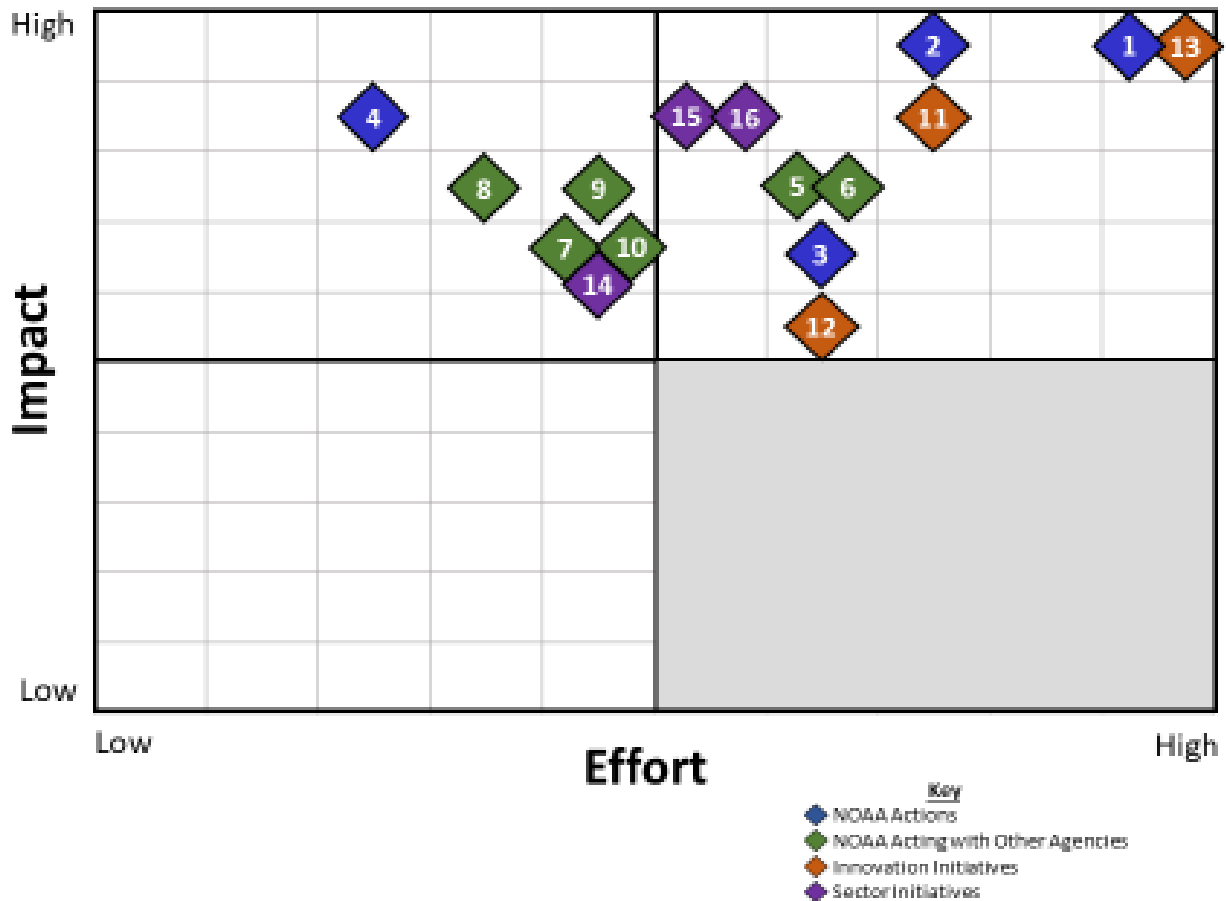
Impact – subjective assessment of potential impact if recommendation is implemented (1 – 10, 10 highest)

Effort – difficulty in implementing recommendation (1 – 10, 10 hardest)

Initial Recommendations of NOAA OEAB Blue Economy Subcommittee

Impact vs Effort Quad Chart

1 June 2020



NOAA Actions	
1	Focus on NOAA Culture and Organization to Enable Growth of the Blue Economy
2	Establish NOAA Blue Economy Special Advisor and Executive Committee
3	NOAA Ocean Exploration as a Focal Point for Economic Stimulus and Recovery
4	Promote and Leverage Partnerships with Private Sector
NOAA Acting with Other Agencies	
5	Convene Shareholders to Promote Blue Economy Growth by Mitigating Conflicts for Ocean Use
6	Develop and Publish Blue Economy Metrics
7	Establish and Execute a NOAA Strategic Engagement Plan to Increase Public Awareness of the Importance of the Ocean and the Blue Economy
8	Develop & Execute Overarching Strategy for Ocean Data
9	Partner with Economic Development Administration (EDA) for Improved Business Outreach
10	Increase Pilot and Demonstration Programs
Innovation Initiatives	
11	Establish an ARPA-Ocean Program to Foster Innovation & Commercialization
12	Create National Ocean Innovation Consortium to Accelerate Blue Economy Growth
13	Create an Ocean Innovation Initiative
Sector Initiatives	
14	Increase Efforts to Enhance Coastal Resilience of Human and Natural Ecosystems
15	Ensure US Food Security through Modernized Wild Harvest and Increased Aquaculture Production
16	Support Next-Generation Services for Marine Transportation and Ports

Introduction

Accelerating Growth of U.S. Blue Economy

The Blue Economy is vital to our nation because: 1) health and resilience of our ocean are critical to our economy and our lives; and 2) a robust Blue Economy enhances our nation's leadership and competitiveness by strengthening our national, economic, food, energy, and environmental security.

It is imperative that the U.S. government not stand by passively. It must engage now. It also must be a leader not only for national interests, but a global leader for oceans. Otherwise, the health of the ocean will continue to deteriorate. There are too many disparate interests to allow ocean development to simply happen. The U.S. must realize the full potential of its Blue Economy. The economic impacts of the COVID-19 crisis demand we aggressively act to employ innovative approaches to team government, private sector, and academia to build a sustainable Blue Economy of the future. The ocean is a national resource, and there is urgency for NOAA and the federal government to act now to position the U.S. as a leader—for the nation and for the global Blue Economy.

As part of the Department of Commerce, NOAA's mission to share knowledge and information on the Nation's climate, weather, ocean, coasts, and living marine resources and to conserve and manage coastal and marine ecosystems and resources uniquely positions the Agency¹ to support the Nation's Blue Economy and accelerate its growth. NOAA is poised to lead Administration efforts to increase the economic impact of the Nation's ocean and coastal resources, work collaboratively with federal, state, and private sector partners, and be at the forefront of international discussions on Blue Economy.¹

Many organizations have formulated a definition of the Blue Economy. While they are similar, there is no commonly accepted definition. NOAA has formulated the following definition:

The Blue Economy represents the science-based management and sustainable use of ocean resources in support of national, economic, and environmental security, providing jobs and economic growth, improved livelihoods, and healthy ocean and coastal ecosystems. The Blue Economy relies on data and information to inform decisions for the economic, social, and environmental dimensions of sustainable development.

The aspect of "science-based management" is key. A clear policy and framework for development of the Blue Economy is essential but not sufficient.² Key gaps are adequate targets have not been defined, resources have not been committed, and significant knowledge gaps currently exist in our understanding of complex marine ecosystems, seabed resources, and the resulting impact of human activities. Filling these gaps is critical for strong policy development, leadership, and governance to manage the ocean as a contiguous space. This is the only way we can attain sustainable use of the ocean while achieving national, economic, resource, and environmental security for our nation.

Ocean exploration has been identified as a specific sector of the Blue Economy, but ocean exploration plays an even bigger role as a catalyst and enabler for other sectors. Exploring the ocean to map the seafloor and characterize the water column provides basic, essential information to jump start economic activity and provide security for the nation.

In late 2019, the NOAA Administrator asked the Ocean Exploration Advisory Board (OEAB) to form a Subcommittee to provide advice and recommendations for how ocean exploration can help NOAA lead and contribute to the Blue Economy in order to double the economic contributions from the U.S. Exclusive Economic Zone over the coming decade (see Appendix A for Tasking). The Subcommittee was asked to assess potential strategies for NOAA and its ocean exploration activities to accelerate business growth in the Blue Economy, stimulating economic activity while improving the health of our ocean. The Subcommittee was to develop and evaluate alternative strategies for how NOAA can engage and partner with the other government agencies, private sector, academia, and philanthropy in innovative and more effective ways to advance the Blue Economy and also recommend actionable steps for NOAA to implement selected approaches.

The Blue Economy Subcommittee held their first meeting in early February 2020. At that time, NOAA Deputy Administrator Tim Gallaudet requested an Interim Report in June 2020 which included initial recommendations. At the first meeting, the Subcommittee developed a Team Charter (Appendix B) describing their objectives, tasks, strategy, and tactics to accomplish the work. Subsequent work included a comprehensive look at components of the Blue Economy (Appendix C).

As requested, this Interim Report provides initial recommendations of the Subcommittee after three months of work. Following review, the Subcommittee will proceed with further tasks to complete a Final Report by the end of 2020.

The Subcommittee developed 16 initial recommendations, described in the following pages. It is worth noting the Subcommittee believes Tourism and Recreation is an important sector for Blue Economy growth but was unable to finalize a recommendation in time for this Interim Report. The topic will be addressed in subsequent efforts.

Each recommendation contains a short description of Value, in other words, why it is important. A top level Scope of the Effort is provided. For each recommendation, the Subcommittee attempted to identify Quick Win Opportunities, which provide short-term (6- to 12-month) efforts resulting in measurable impacts. The role of ocean exploration as an enabler is also identified. The Subcommittee also felt it is important to identify Critical Barriers to successful implementation. Finally, the Subcommittee scored each recommendation on the following attributes:

Attribute	Description	Scoring
Impact	Subjective assessment of potential impact if recommendation is implemented, including direct economic impact as well as indirect impact from more intangible contributions	1 – 10, with 10 being highest impact
Effort	Difficulty in implementing recommendation as a combination of time, cost, resources, and resistance to change	1 – 10, with 10 being most difficult
Quick Win Opportunities	Whether the recommendation contains opportunities for Quick Wins (6- to 12-mo efforts)	Yes/No
Ocean Exploration as Enabler	Whether the recommendation includes ocean exploration components as key enablers	Yes/No

1. Focus on NOAA Culture and Organization to Enable Growth of the Blue Economy

Value

The stated goal of this effort is to double the size of the Blue Economy by 2030. Successfully accomplishing this grand challenge requires NOAA to think big and to formulate/enact bold policies, while creating a sense of ownership among diverse stakeholders. It requires NOAA to be good stewards of the ocean, while aggressively working with the private sector in new and innovative ways to promote both economic success and sustainable ocean development. A robust Blue Economy requires wise investment of taxpayer dollars, which will result in a robust, healthy ocean managed as a shared resource, with multiple users working together for a healthy, sustainable ocean economy.

Achieving this grand challenge demands targeting a core mission-oriented strategy of NOAA as an Ocean Agency, not just an Ocean Science Agency. This approach, applied to the ocean, is fully aligned with NOAA's overarching mission of Science, Service and Stewardship:

- Science – to understand and predict changes in oceans and coasts
- Service – to share knowledge and information with others for use by Nation's businesses, communities, and people's daily lives
- Stewardship – to conserve and manage coastal and marine ecosystems and resources

Success requires a change in NOAA's focus. External focus should be increased: recognize customers and users need reliable information in a timely manner to impact decisions (Service); and recognize the need to aggressively help industry succeed by taking measured risks, making timely decisions, and following through to completion. Internal focus should be on adapting to become an organization which is nimble, agile, and accountable – elements all required to engage effectively with the private sector.

Scope of Effort

- Set clear direction for Blue Economy which is both ambitious and realistic
 - Identify SMART Goals (Specific, Measurable, Achievable, Realistic, and Timely)
 - Communicate clearly and often
- Identify cultural roadblocks and focus on process/strategic innovations to lead a cultural shift in NOAA towards one that rewards agility, nimbleness, open-mindedness, and measured risk taking, including:
 - Bring together NOAA leadership in facilitated workshop to draft value statement and obtain buy-in for a comprehensive strategy reflecting focus on NOAA as mission-oriented Ocean Agency
 - Restructure incentive/reward system to encourage and reward teams who exemplify desired attributes of collaborative work, both internally and externally
 - Streamline the contracting process for Blue Economy initiatives to reduce contracting time so that it meets agility and nimbleness goals (e.g., consider USN 'Tech Bridge' Program as a potential model)
 - Existing funding mechanisms, such as cooperative institutes, cooperative agreements, CRADAs and OTAs, provide opportunities which should be further streamlined and exploited
 - Change hiring process to reduce time to hire (following position approval) from 350 days to 60 days
 - Accept DOD security clearances

- Introduce a philosophy of Continuous Improvement, which includes understanding the need to constantly improve performance quality and efficiency (time & cost)
- Provide clear, strong, and vocal leadership advocating a positive and supportive relationship with the private sector, which includes both for profit and not-for-profit organizations
- Create mechanisms to improve collaboration among NOAA Line Offices and lead a systems approach to Blue Economy initiatives
- Establish partnerships with the private sector and assign a Relationship Manager to each to nurture the partnership and ensure follow-through so that the partnerships are meaningful, productive and mutually beneficial

Quick Win Opportunities

- Appoint a Special Advisor and Office for the Blue Economy. The Special Advisor and Office must be a change agent with the authority, sense of purpose, and skills to champion the necessary cultural shift.
- Assign and incentivize Relationship Managers for existing and pending partnerships to build trust, establish goals and expectations, maintain 2-way communications, and ensure follow-through
- Simplify the permitting process for conducting science in MPAs
- Institute processes for assessment and continuous improvement of Blue Economy initiatives
- Implement changes to hiring and security clearance processes to demonstrate expectations of NOAA leadership
- Declare the importance the Blue Economy initiative in a statement by NOAA leadership having outward focus to engage with the private sector and help enable success of industry and other partners

Role of Ocean Exploration as an Enabler

- Ocean exploration is well positioned to be a vehicle for change because of its compelling mission, access to discretionary funding, and the Cooperative Institute mechanism
- OER can demonstrate Blue Economy leadership and cultural change through flexibility for ship and ROV time, both within NOAA and externally, such as with the academic research fleet

Critical Barriers

- The primary purpose of this task is to reduce impediments and establish a can-do culture of agility, nimbleness, open-mindedness, and measured risk taking. The primary barrier is cultural resistance to change. Addressing this barrier is absolutely critical to the success of the other recommendations, for without this cultural change, other initiatives will not be able to succeed.

Impact: 10	Effort: 10	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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2. Establish NOAA Blue Economy Special Advisor and Executive Committee

Value

Through creation of the OEAB Blue Economy Subcommittee, congressional testimony, white papers and both internal and external communications, NOAA leadership has made it clear that NOAA needs to better position itself to contribute more significantly to the Blue Economy. To achieve the required Blue Economy focus, coordination, direction, engagement and prioritization, NOAA should establish a Blue Economy Special Advisor reporting directly to the Assistant Secretary for Oceans and Atmosphere. The Special Advisor should lead an Executive Committee and Office with clear responsibility and authority (resources and budget) to integrate efforts across the NOAA enterprise. This executive level office is essential to serve as a focal point for the Blue Economy.

While a Special Advisor and Executive Committee form a starting point, the concept of a Senior Executive with an associated Program Office to unite NOAA efforts for the Blue Economy is critical and should be established with urgency.

Scope of Effort

Critical to establishing a credible Blue Economy Special Advisor, Office, and Executive Committee will be providing the requisite responsibility, authority and resourcing. Key considerations and components for this position and office include:

- Make and communicate the position and Office establishment as a top NOAA priority
- A primary responsibility of the Special Advisor and Office is to lead execution of the Blue Economy strategy
- Formalize NOAA's overarching Blue Economy Strategy establishing Senior Advisor position and Office
- Clearly articulate associated substantive responsibility and authority, including:
 - Strategy development and execution (Recommendations #1, 2, & 3)
 - Creation and oversight of ARPA-Ocean Program (Recommendation #11)
 - Creation and oversight of National Ocean Innovation Consortium (Recommendation #12)
 - Oversight of Ocean Innovation Initiative (Recommendation #13)
 - Focal point for industry, philanthropy, agency and institution Blue Economy partnerships (Recommendation #4)
 - Creation and oversight of Strategic Engagement Plan (Recommendation #7)
 - Creation and oversight of Blue Economy Personnel Exchange and Liaison Program (Recommendation #4)
- Align / realign associated resources and talent from each Line Office
- Immediately begin discussions and work to establish a Senior Executive position with a Program Office for the Blue Economy
- Establish metrics and Key Performance Indicators (KPIs) to gauge impact and measure progress

Quick Win Opportunities

- Internal and external audiences will be able to associate a top NOAA priority with an ambitious strategy with tangible organization and near- and long-term focused programs
- Immediate focal point to leverage partnerships
- Convene Blue Economy strategy discussions to integrate NOAA Line Offices

Role of Ocean Exploration as an Enabler

Ocean Exploration would be expected to be at the forefront of the activities associated with an ARPA-O Program, a National Ocean Innovation Consortium, the Ocean Innovation Initiative as well as many Blue Economy partnerships that are established.

Critical Barriers

- Pressure to create and execute a strategy using current organization
- Authority to create new position of Senior Executive and Program Office
- Internal cultural bias and resistance
- Realignment of resources

Impact: 10	Effort: 8	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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3. NOAA Ocean Exploration as a Focal Point for Economic Stimulus and Recovery

Value

NOAA's Ocean Exploration mandate, its multi-faceted connections to the Blue Economy, coupled with its desire to leverage its position to substantially increase the Blue Economy collectively provide NOAA the unique foundation to contribute to Covid-19 economic stimulus and recovery. The Office of OER leads efforts to improve our understanding of U.S. deep waters and expand seafloor mapping to include energy sources, critical minerals, and pharmaceuticals vital to our nation's interests. It is recommended that through several mechanisms NOAA aggressively offer near-term contracting, hiring and partnering opportunities, which accelerate economic stimulus and recovery and achieve NOAA's overall mission sets, including working closely with the Economic Development Administration (EDA).

Scope of Effort

Given the current economic crisis, NOAA should take the opportunity and impetus to evaluate and streamline organic processes and policies and adopt innovative industry practices to contribute to economic recovery, mission accomplishment, and implementation of new agency-wide strategies (e.g. AI, UxS, 'Omics, Cloud) implementation.

- Solicit for additional government resourcing to accelerate and enhance its Ocean Exploration mission and EEZ mapping mandate by aggressively contracting U.S. maritime industry surveying capability and capacity
- Accelerate implementation of UxS strategy, partnering with the private sector to rapidly field unmanned systems and support vessels to improve and increase ocean exploration, mapping, and characterization of the water column
- Solicit for additional government resourcing to create partnerships and startup incubators
- Address hiring practices that unnecessarily lengthen the recruiting and hiring of talent
- Streamline contracting processes that can shorten contracting timelines
- Assess applicability of using Department of Commerce National Technical Information Service congressionally authorized Joint Venture Partnership authority to expedite partnering with industry
- Assist with/lead Test & Evaluation of new sensors and systems, including AI, UxS, and 'Omics

Quick Win Opportunities

- Proactive and aggressive hiring, contracting and partnering will demonstrate commitment to the strategies, enable mission accomplishment and provide contributions to economic recovery

Role of Ocean Exploration as an Enabler

- NOAA's Ocean Exploration Mapping mandate provides a visible and tangible mission that would benefit from additional maritime surveying capability and capacity and a contracting vehicle to directly resource commercial businesses in need of economic stimulus.

Critical Barriers

- Executing Internal process and policy changes
- Identifying source of resources

Impact: 7	Effort: 7	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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4. Promote and Leverage Partnerships with Private Sector

Value

A significant opportunity exists to leverage the convening power of NOAA to bring together private, nonprofit, for-profit, research, and other entities to partner in growing the Blue Economy. Currently, entities are either working in their own silos to address issues of interest to NOAA, or are looking to provide resources (monetary and non-monetary) to de-risk ideas that could be readied for taxpayer funding through NOAA. A cohesive, well-articulated strategy and architecture would enable entities both internal and external to NOAA to come together under a common and unifying mission (e.g., Oceans as a Solution for Climate and Jobs). Successful partnerships depend on mutual trust, so it is critical to focus early on building trust. A successful enduring partnership depends on maintaining transparent communications and accountability for follow-through.

Scope of Effort

- NOAA should establish a Partnership Office under the oversight of the new Blue Economy Special Advisor and Office (see Recommendation #2) that provides the architectural focal point for Blue Economy partnerships. This Office provides a clear point of contact for interested potential partners in the private sector so the question of who/how to approach NOAA is simplified and not opaque.
- Assign a Relationship Manager to each partnership. Role and responsibility of this manager is to build trust, establish goals and expectations, maintain open 2-way communication, and ensure follow-through by both partners.
- Create and oversee a Blue Economy Personnel Exchange and Liaison Program to build trust by providing temporary assignment of personnel to other agencies and private sector positions (two-way exchange).
- The primary focus and effort is to use NOAA's convening power to bring together those working on technology innovations. Potential focus areas include:
 - Job creation aligned with NOAA's areas of focus
 - Fisheries, aquaculture as low carbon, sustainable alternative to carbon-intensive land-based proteins that can also future demand and supply shocks for the U.S.
 - Tourism, recreation, education, and job creation
 - Carbon storage, sequestration – leverage voluntary market, willing payers, and consumer demand. Unlimited carbon sequestration potential of the oceans positions NOAA to bring together resources to advance:
 - Partnerships for cost-sharing, providing economic incentives, and market-making to establish a new, credible market
 - Secondary revenue sources for fishermen, coastal business
 - Decarbonization of transportation, especially in the oceans, to get the younger generation of entrepreneurs to focus on innovation around efficiency, route optimization (tied to weather data with NOAA), hybrid power sources, robotics, etc.
- Define up front the rules of engagement to align partnership criteria for:
 - Philanthropy
 - As a source of non-profit, independent, third-party funding that is aligned with NOAA's priority areas
 - Fund research and pilot projects that are higher risk and don't have data support to get subsequent funding from NOAA
 - As a partner researching, mapping new areas and their potential impact
 - As a catalyst for creating community development and employment

- Private funding
 - Identify areas of partnership and support for technologies emerging from NOAA to scale them
 - Partnering in the path to commercialization and creating job initiatives
 - Source of follow on funding to NOAA funded ideas
- Create common assets for common good. All assets, including data, generated or gathered as a result of this initiative should be publicly available, for common good, even before the publication of scientific papers
- To ensure successful partnerships, NOAA should be prepared to place ‘skin in the game.’ A key contribution is in-kind assets, support, staffing to demonstrate commitment.

Quick Win Opportunities

- Announcement about the Partnership Office under the oversight of a new Blue Economy Program to provide a clear POC within NOAA for interested parties. This initiative is bi-partisan, unifying, and clear expression of NOAA intent and priority.
- No upfront cost for NOAA as it does not pay any of the external parties (the program underwrites the cost of some of NOAA’s priorities).
- Each prospective partnership should include a pilot project to jump start the partnership
- Provide NOAA experience with telepresence to enable broader awareness and engagement

Role of Ocean Exploration as Enabler

- Build on demonstrated past and ongoing successes of OER in establishing partnerships. To achieve results, it is essential to manage existing partnerships to leverage opportunities.
- Facilitating “sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystems” is a priority for a number of these organizations that could benefit from direction and leadership based on science, data, and outcomes. NOAA OER would be perfectly suited to play that role.
- OER can be a catalyst given their broad mission and the noteworthy things they have accomplished

Critical Barriers

- Setting up front expectations and being willing to say “no” if partnership does not fit in overall Blue Economy strategy
- Winning trust of each stakeholder at the table
- Willingness to commit resources to nurture and maintain an enduring partnership

Impact: 9	Effort: 3	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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5. Convene Shareholders to Promote Blue Economy Growth by Mitigating Conflicts for Ocean Use

Value

Human uses of the ocean and coasts are expanding rapidly, making planning and management difficult, while creating disputes between existing users and those engaged in new activities that spur U.S. Blue Economy growth. These conflicts present considerable challenges to society and to federal, state, and local governments, who serve both to make informed management decisions and to support health of the U.S. Blue Economy. Challenges with conflicting co-existence uses and multiple federal agencies with differing statutory authorities and missions have led to permitting delays and challenges, which significantly hinder economic growth, most recently with offshore wind energy development and aquaculture. In many cases, large uncertainties exist for permit applicants as to where to go and what the requirements are.

To minimize potential use conflicts and help identify suitable operating areas for new and emerging uses (including offshore conventional and renewable energy development, commercial and recreational fishing, shipping, tourism, and aquaculture), it is critical to understand patterns and implications of ongoing and future human uses of the ocean. To the extent possible, use conflicts should be resolved early to determine reasonable ways forward using science, data, and informed decision making to mitigate co-existence concerns.

As an Ocean Agency, NOAA should create a framework that balances its regulatory, management, and science obligations. NOAA should prioritize actions which convene shareholders to mitigate use conflicts and promote governance of the ocean as a contiguous space. NOAA's role is clarified in three clear policy statements:

- National Policy Executive Order 13840 (2018)³ delineates seven policy priorities focused on collaborative ocean governance. NOAA plays a key role on the Ocean Policy Committee, charged with improving ocean data collection, streamlining permitting, and innovation in how the federal government generates and interprets data in the exercise of statutory and regulatory mandates.
- Presidential Memorandum on Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore of Alaska, issued November 19, 2019, provides a clear role for NOAA to support the “policy of the United States to act boldly to safeguard our future prosperity, health, and national security through ocean mapping, exploration, and characterization.”⁴
- Executive Order on Promoting American Seafood Competitiveness and Economic Growth,⁵ issued May 7, 2020, emphasizes America’s need for a vibrant and competitive seafood industry, including a renewed focus on aquaculture. NOAA has a clear role in leading this effort as a regulator, manager, and promoter of fisheries resources.

Different shareholders – government, industry, academia, and non-profits – all have different objectives. In addition, many employees have had no direct experience with other sectors and do not understand them. As a result, collaboration for mutual benefit is frequently not pursued. NOAA can play a key role in bringing together diverse shareholders, promoting communication, and helping to define overarching shared objectives to develop a sustainable Blue Economy with a healthy ocean.

Scope of Effort

- Support multiple uses of the ocean as critical to the development of the Blue Economy
- Develop greater expertise and understanding of industries presenting various use conflicts

- Assess economic value of broad scope of ocean uses
- Improve data collection and sharing among consulting government agencies and most importantly among Line Offices and regions within NOAA and other agencies.
- Facilitate the and lead the science needed to support multiple offshore uses, including offshore energy and commercial fishing
- Help facilitate and streamline federal permitting of different offshore industries
- Encourage private sectors to increase cooperative science as a means to resolve ocean user conflicts
- Use fisheries expertise to help resolve conflicts
- Improve and make more efficient permitting of ocean research, mapping and characterizing activities to the benefit of ocean users
- Streamline NOAA’s role in project permitting to include clear approval requirements and processes in statutory requirements and as a consulting agency
- Innovate NOAA’s permitting processes and decision-making capabilities to better align with its intention to advance the nation’s Blue Economy
- Facilitate communications among stakeholders

Quick Win Opportunities

- Serve as a “convener” of commercial fishermen and offshore wind developers and members of the offshore wind supply chain to address concerns and potential conflicts between the two industries
- Facilitate increased data sharing between NOAA and lead agencies for Blue Economy opportunities (e.g. Department of Interior, BOEM, for renewable energy)
- Rapidly expand NOAA’s collaborative science with the private sectors

Role of Ocean Exploration as Enabler

- Improve permitting of ocean research; mapping; and data collection, analysis, and sharing among government agencies in order to facilitate development of multiple ocean industries and mitigate conflicts

Critical Barriers

- Lack of clear NOAA authority as lead or consulting agency to manage various ocean uses, including offshore energy
- Historic NOAA support for commercial fishing

Impact: 8	Effort: 7	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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6. Develop and Publish Blue Economy Metrics

Value

NOAA will need metrics to steer progress over ten years, across multiple administrations, budget and congressional cycles. This need was recently recognized by establishing the Ocean Economy Satellite Account, overseen by the Bureau of Economic Analysis and NOAA CFO Office of the Chief Economist. Communication with recommended partners and constituents will be facilitated and benefit by a standard set of Key Performance Indicators (KPIs) that are consistent year to year, without regard to politics and leadership changes. KPIs that show progress will facilitate requests for future funding and other resource requirements. The Subcommittee recommends NOAA work with key constituencies to develop and publish Blue Economy Metrics to measure annual progress and contributions to increasing the Blue Economy.

Scope of Effort

- Connect with key constituencies to solicit input on what should be measured. Consider partnering with other federal and oceans-based entities and a well-established metric-publishing organization.
- Identify the top 5-10 priorities that need to be measured for success
- Identify the key verticals of Blue Economy against which the metrics will be applied
- Establish KPIs associated with each vertical from the 5-10 priorities
- Establish the baseline KPI data against which future data will be compared
- Establish protocols for the data collection against the KPIs: frequency, methodology, and trusted sources
- Collect data at established intervals
- Publish metrics annually. Provide to the public, Congress, and partners.

Quick Win Opportunities

- Publish baseline information early to garner attention to Blue Economy and engage constituent interests
- Engage key public and private parties to seek input on KPI construction

Role of Ocean Exploration as Enabler

- Provide data streams to metric process

Critical Barriers

- Reaching consensus of relevant KPIs
- New data sources or metric calculations may need to be established that are not currently routine
- Funding

Impact: 8	Effort: 7	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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7. Establish and Execute a NOAA Strategic Engagement Plan to Increase Public Awareness of the Importance of the Ocean and the Blue Economy

Value

Public awareness of what the Blue Economy is and what it can deliver in terms of jobs and stimulation of the economy is important under ordinary circumstances, and in the wake of the COVID 19 crisis, it will be critical. Unfortunately, scientific understanding of the ocean and awareness of the opportunities it can provide is deficient among the general public and decision-makers. The Blue Economy represents a great opportunity for the U.S. to regain its lost status as the world's leading maritime nation. To seize this opportunity, Americans need to know more about the ocean and need a greater understanding of how sustainable uses of ocean resources benefit all. Establishing a NOAA Strategic Engagement Plan with commitment of resources needed to focus/coordinate/amplify all communication efforts is key. Greater awareness and understanding will help build the Blue Economy and kindle curiosity and the spirit of innovation essential to our nation's future.

Scope of Effort

- Form and authorize a team to develop and execute an overarching NOAA Strategic Engagement Plan, which integrates outreach efforts across all Line Offices so that external communications are consistent and meaningful.
- Add a component to existing OER educational programs focused on the Blue Economy.
- Direct the new ocean exploration Cooperative Institute to provide a focus on the Blue Economy in its public engagement activities.
- Develop compelling short curricular modules for use in on-line instruction for elementary, middle school and high school. There should be a generic module applicable to all regions of the U.S., and a supplementary module that focuses on each region and puts it in a national and global context. These modules should be delivered through Coastal Ecosystem Learning Centers and other informal learning institutions.
- Develop case studies (or pilot projects) through a consortium that includes Blue Economy sectors, NOAA, and a relevant not-for-profit organization (or advocacy group) to help the public envision a robust, sustainable Blue Economy. Wind energy, marine aquaculture, tourism, and pelagic fisheries are examples of sectors where ocean exploration can help ensure economic activities are sited and managed sustainably.
- Build on the existing NOAA Citizen Science Strategy to engage the U.S. populace in ocean science projects.

Quick Win Opportunities

- A series of podcasts featuring celebrities to whom different age groups relate.
- A media campaign designed to highlight the benefits of a sustainable Blue Economy managed by Blue Economy sectors, NOAA, and credible not-for-profit organizations.

Role of Ocean Exploration as Enabler

- NOAA's OER has an outstanding educational program focused on ocean exploration.
- OER and other education programs can unleash the imaginations of young people on how the ocean can create a better future for humanity and opportunities they can have in that future through STEM careers.

Critical Barriers

- Lack of public understanding and support for increased responsible uses of the ocean by humans.
- Apprehension among the general public and many environmental NGOs that the Blue Revolution will turn out to be like the Green Revolution and take a large environmental toll on the ocean.
- Lack of public support that leads to apathy on one hand and regulations and permitting processes that strangle innovation in our uses of the ocean on the other.

Impact: 7	Effort: 5	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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8. Develop and Execute an Overarching Strategy for Ocean Data

Value

NOAA's mission to understand and predict changes in climate, weather, oceans and coasts is predicated on quality data collection and the associated curation of that data to help conserve and manage coastal and marine ecosystems and resources. Sharing that knowledge and information with others via NOAA's extensive data services and products provides critical support to achieve overall Blue Economy objectives. Dissemination of critical data demonstrated by COVID-19 highlights the importance of timely, usable, and accurate data gathering, in which climate and weather play major roles. It is recommended that NOAA prioritize the collection and sharing of data from its current programs with a focus on data federation and data enrichment initiatives.

Scope of Effort

- Increase the available datasets through data.gov through consolidation of legacy data and the directive for data towards data.gov
- Identify data coverage gaps and foster market initiatives to fill those gaps (coordinated w/ Pilot Programs/Demonstrations/Exercises) when data are critical to Blue Economy development
- Provide incentives for technology enhancement programs leveraging AI and cloud to accelerate data use cases
- Direct private and public 'available data' / 'missing data' campaigns to help increase utilization and prioritize additional data gathering efforts

Quick Win Opportunities

- Edge analytics technology push to improve maritime and weather data
- Marketing campaign for the available data sets and access methods (includes value propositions towards the use of the data)
- Annual campaign and technology initiatives prioritized by mission verticals (weather, oceans, coasts, etc.) with an emphasis on Blue Economy wins

Role of Ocean Exploration as Enabler

- Ocean Exploration will use the identified data gaps (geographic and historical frequency) of ocean and climate data to improve EEZ ocean mapping, maritime logistics, and data processing/dissemination
- NOAA has a goal of mapping the remaining sub-sea territory by 2030 so increasing the use of the CRADA agreements can help advance the achievement of this goal

Critical Barriers

- Slow adoption of cloud technologies

Impact: 8	Effort: 4	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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9. Partner with Economic Development Administration (EDA) for Improved Business Outreach

Value

Supporting other recommendations for Blue Economy, there is a natural relationship between NOAA and its Commerce sister organization the EDA. As NOAA extends its reach outside of science into activities that grow the Blue Economy, there will be business activities and relationships that can be enhanced by furthering collaboration with the EDA. The EDA has expertise and processes that could be applied to NOAA's Blue Economy objectives. Conversely, NOAA provides the EDA with relationships in the ocean space a source of untapped economic growth. Because of the nature of the Blue Economy involving both the ocean and business growth, this represents an ideal opportunity to build strong collaboration between DOC bureaus and NOAA. Therefore, we recommend a formal working agreement between NOAA and the EDA (and potentially other bureaus) that are mutually beneficial.

Scope of Effort

- After a NOAA Special Advisor is appointed (recommendation #2), an early priority should be establishing the context of this formal agreement with the EDA, including a working group comprised of appropriate parties from both agencies.
- Identify EDA grant making and other funding mechanisms that may be suitable for use by NOAA
- Collaboration and exchange of data to support metrics to measure Blue Economy growth

Quick Win Opportunities

- 2021 Build-to-Scale grant with appropriate technology focus
- Incorporate ocean technology into various existing EDA programs like Delaware Technology Park, the Philadelphia Industrial Development Corporation or the Atlanta Opportunity Zone.
- Establish a pilot program where EDA administers a blue economy initiative on behalf of NOAA

Role of Ocean Exploration as Enabler

- Team with EDA on a Build-to-Scale grant
- OER could take the lead for a pilot program with the EDA.

Critical Barriers

- NOAA culture
- Regulatory constraints

Impact: 8	Effort: 5	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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10. Increase Pilot and Demonstration Programs

Value

NOAA's Vision of the Future for resilient ecosystems, communities, and economies is scalable through focused initiatives to meet the needs of the Blue Economy. The collective effort from NOAA's partners and public initiatives can best scale new technologies and contributors through the use of pilot programs and collaborative demonstration exercises that are different than traditional NOAA investments in technology (e.g. SBIR grants). It is recommended that NOAA prioritize the use of pilot programs and tech demos designed to improve current Blue Economy programs and foster discovery of new technologies and analysis methods beyond existing NOAA programs. Well-designed pilot and demonstration programs should emphasize transition of research to full scalability and integration into NOAA science and regulatory missions (R2O). These programs will significantly reduce risks of financial investment to enable more effective capital investment and fill knowledge gaps in understanding impacts to enable improved governance policies and science-based decisions.

Essentially, such pilot and demonstration programs should bridge traditional gaps in NOAA programs that prevent the merging of science innovation with regulatory resource management and decisions. Rather, such programs should enable innovative, world-class approaches of the private sector to transition U.S. resource management as a global leader.

Scope of Effort

- Sponsorship of annual demonstration programs
- Leverage the use of existing Government/Commercial demonstration exercises to inject Blue Economy technologies
- Investigate startup engagements
- Provide incentives for technology enhancement programs
- Pilot programs and technical demonstrations should be a natural byproduct of the larger Blue Economy Office and National Ocean Innovation Consortium initiatives
- Potential to utilize technology hubs and DoD/Government facilities to reduce infrastructure costs and quickly stimulate pilot demonstrations

Quick Win Opportunities

- Facilitate early lash ups with existing Government/Commercial technology incubators to create early successes
- Coordinate an initial joint demonstration within an existing DoD exercise to stimulate interest
- Use X-Prize-type campaign to tackle the top-technical challenges. Include a prize component for Citizen Science.
- Leverage regional collegiate initiatives to create localized efforts around blue economy

Role of Ocean Exploration as Enabler

Ocean Exploration will use the technology pilots and demonstrations to improve EEZ ocean mapping and data processing/dissemination

Critical Impediments

- The potential for confusion with other Commercial/Government technology pilot programs/technical demonstrations could exist

- Ensure “Blue Economy Task Force” and Nation Ocean Innovation Consortium are effectively used to synchronize and execute demos/exercises
- Leadership fostering/mentoring of the Pilot programs deliverables to production

Impact: 7	Effort: 5	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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11. Establish an ARPA-Ocean Program to Aggressively Foster Innovation and Commercialization

Value

A dedicated ARPA-Ocean (ARPA-O) Program focused on fostering innovation and commercialization will accelerate ocean technologies critical to increasing NOAA's Blue Economy leadership and contribution. An ARPA-O Program provides a bridge for NOAA-related initiatives and would be the connective tissue for other federal agencies looking to spur innovation in the ocean as well as near- and long-term focal point for partnerships focused on stimulating the Blue Economy.

We recommend NOAA establish an ARPA-O Program that focuses on results, milestones, and outcomes. Alternatively, ARPA-O could be established within a re-authorized National Oceanographic Partnership Program (NOPP) with a substantial funding vehicle not currently realized in the NOAA architecture. In focusing NOPP to promote commercialization of new technologies, ARPA-O becomes the acceleration vehicle enabling a bridge for NOAA to achieve its priorities by utilizing the strength and financial stability brought by non-governmental partners to spur and accelerate innovation.

Focus of ARPA-O is to accelerate commercialization of nascent technologies. The attention should be on post-basic research but before extensive commercial funding has been attracted. Should NOPP be reauthorized and redefined to more seamlessly merge private investments into government funding programs, NOPP could serve as the vehicle to house ARPA-O. NOPP reauthorization should either include appropriate language or budget flexibility for partnering with the private sector to allow NOAA and other federal agencies to allocate funds to ARPA-O and ensure this focus and objective are not lost in the broader, traditional scope of NOPP.

An ARPA-O initiative will by its very nature have the collateral benefit of injecting nimbleness and agility into the NOAA organization, thus providing an additional mechanism to enable Recommendation #1

Scope of Effort

- Provide an infrastructure supporting innovation that is clearly identified, defined, and prioritizes key target areas for commercialization of technology
- Establish priorities and clear success metrics that are commercially focused and accelerate technological development in areas that make the biggest difference
- Utilize performance contracts (versus grants) with a national focus (versus hyperlocal)
- Assign talent with defined term limits, forcing collaboration and focus on timely success
- Founding teams leverage the talent and culture of entities like ARPA-E, DOE, DARPA
- Programmatic and budgetary support; incoming pipeline, outgoing partnerships
- Leverage data – an area of global excellence for NOAA
 - Open-source approach to spur innovation
 - Invest in generation and curation of additional data
 - Combine sources of public data, invest in machine learning to derive patterns/insights
- Fund encouraging step-change solutions and boost profile of the ocean sector
 - Lower cost burden – ability to provide small pool of funding along with other resources, including access to labs, testing, and talent
 - Put focus on new, emerging fields

- Partner with existing entities, bringing ocean focus to their priorities
- Focus on the path to commercialization
- Establish partnerships to support early ideas (funding and market validation)

Quick Win Opportunities

- ARPA-Ocean Program announcement demonstrates NOAA commitment and leadership
- Attract respected and proven talent to build framework

Role of Ocean Exploration as Enabler

- Ocean exploration would be a key program focus area

Critical Barriers

- Resources commitment that is enough to make it appealing for the innovation ecosystem to pay close attention and participate

Impact: 9	Effort: 8	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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12. Create a National Ocean Innovation Consortium to Accelerate Blue Economy Growth

Value

Doubling the Blue Economy over ten years will require a consolidated effort across the public and private sector, including mechanisms to coordinate activities across government agencies, across states, and convening the private sector for shared goals. There are opportunities to escalate currently fragmented efforts in data and modeling, for example, to consolidate data into knowledge that can be either 1) spun out for private investment and/or 2) shared broadly for commercial/government purposes. There is an opportunity for the United States to claim an undisputed leadership position in data and modeling that supports multiple Blue Economy Sectors. A National Ocean Innovation Consortium (NOIC) of government, private sector, and academia partners, which attracts the brightest talent in the field/entrepreneurs/other resources, could take months and years off the development and dissemination of the tools required to grow ocean-based businesses.

In its April 2019 letter providing recommendations for re-authorizing NOAA's ocean exploration activities⁶, the NOAA Ocean Exploration Advisory Board (OEAB) recommended that a National Consortium for Ocean Exploration be established. Purpose of the Consortium is to bring together private sector and other non-federal stakeholders to collaborate and to respond quickly to national ocean exploration priorities while coordinating with NOPP. Elements of this recommendation, particularly those emphasizing the need for rapid response, may be useful here.

Scope of Effort

- Convene a cross-sector Blue Economy Task Force to define the mission of a NOIC, found it, and continue as its advisory/steering board.
- Under the Task Force select initial market verticals that NOIC activities will support.
- Develop near term and long-range plan for NOIC including first three-year operating plan. Develop metrics to manage.
- Secure funding to explore re-directing existing funds within different NOAA Line Offices.
- Secure physical assets, IP assets, and personnel for center (explore co-locating and cost-sharing with already established DoD or University type facilities to reduce costs).

Quick Win Opportunities

- Establish consortium type environment at the NOIC that provides quick start resource opportunities for "Data Analytic Improvement Tools" for processing, dissemination, and utilization of essential ocean data.

Role of Ocean Exploration as Enabler

- Output will support ocean exploration activities with data/modeling. Input from ocean exploration activities will feed the NOIC.

Critical Barriers

- Sharing of proprietary information
Ensuring this initiative does not duplicate efforts already being planned under the NOAA Blue Economy Office. The delineation of duties between the two entities (recommendations) must be well synchronized and aligned.

Impact: 6	Effort: 7	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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13. Create an Ocean Innovation Initiative, including a Fund, for Blue Economy Start Up and Early Commercial Companies by Formation of a Public-Private Partnership

Value

In the US today there are a limited number of funds with less than \$250 million available that exclusively target the ocean and the Blue Economy, a level of activity that is woefully inadequate for capital required for early stage innovative companies to contribute to the doubling of the Blue Economy in ten years. Most funds today for impact and sustainability invest in various other so-called clean tech areas like energy, fresh water, and food/agriculture. Many of these areas are more familiar to investors in terms of technologies and risk, thereby drawing disproportionate attention. Furthermore, investors/venture capitalists have not been fully made aware of ocean-based investment opportunities and have little experience in this vertical. There is somewhat of a chicken and egg problem. Entrepreneurs with ocean-based, scalable innovation are more likely to develop if there are funding sources. Governments and other private sources of funding, like philanthropic funders, need to provide that early funding before traditional sources will be active. Traditional investors need education about the opportunities in the ocean based Blue Economy sector. How do we break the current dynamic and unleash scalable innovation to commercialization?

A few years ago, Canada took a bold initiative to grow ocean business by forming and funding an Ocean Supercluster with 160 members from leaders in fisheries, aquaculture, offshore resources, transportation, marine renewables, defense, bio resources, and ocean technologies. The Supercluster is an industry-led transformative model to drive cross-sector collaboration and accelerate innovation to sustainably grow Canada's ocean economy. Funding is 1-for-1 matching between industry and Innovation, Science, and Economic Development Canada (ISED) of the Canadian government.

Scope of Effort

- Further benchmark existing ocean-based initiatives, like the public-private partnership of the Canadian Supercluster which is 2-3 years ahead of this recommended action. Seek other non-ocean impact initiatives that present good models for public-private partnerships for benchmarking as well. In addition to Canada, consider other government-led best practices.
- Develop an initial investment hypothesis. Convene experts to advise on the initial investment mission and a target amount. Combine effort with policy makers that can help enable the government investments to match the private investments.
- Develop a fund governance framework for fund manager, investment committee, and technical advisors, including pre-exit metrics.
- Develop an educational program for possible investors that supports the framework of the initial investment hypothesis.
- Develop plans to increase available deal flow, including "land based" solutions that may contribute to Blue Economy growth.
- Raise the fund upon selected pre-agreed timelines. Due diligence required pre-investment. Portfolio company mentoring efforts.

Quick Win Opportunities

- Education of an investor pool about ocean technology and the opportunities in Blue Economy by end of 2021.

Role of Ocean Exploration as Enabler

- Investments could support start-ups with ocean exploration benefits, depending on investment hypothesis of fund.

Critical Barriers

- Large upfront effort just to make a Go-No Go decision on fund and to determine fund governance. Large investor education needs due to general lack of appreciation and understanding of the value of and role that the Blue Economy can play.
- Large operating effort required, including the best practice of portfolio company mentoring. Funding from multiple sources.

Impact: 10	Effort: 10	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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14. Increase Efforts to Enhance Coastal Resilience of Human and Natural Ecosystems

Value

Nowhere are NOAA's Science, Service, and Stewardship missions expressed more clearly and urgently than in the coastal zone. According to NOAA, U.S. coastal counties are home to over 127 million people 40% of the Nations' total population. They produce more than \$8.6 trillion in goods and services, employ 56.8 million people and pay \$3.5 trillion in wages. With continuing and accelerated sea level rise that will continue well beyond the end of this century and associated coastal flooding, there is increasing threat to people, livelihoods, infrastructure, natural habitats, and coastal economies. NOAA has the most diverse set of research and management programs dealing with the coastal zone (including tsunami warning system) of any federal agency and its partnerships with states through the CZMA and Sea Grant put it in a unique position to demonstrate leadership in promoting and facilitating coastal resilience. With a rapidly rising sea, the concept of coastal resilience must be re-evaluated. Instead of getting "back to normal" as soon as possible after a major storm or flooding event, the emphasis needs to shift to adapting to the new normal and designing and developing the coast for the future.

Scope of Effort

- Local to regional to national.
- Demonstrate through partnerships with states and academic scientists how NOAA data can be used in specific examples to improve models and enhance coastal resilience
- Pick low-lying coasts and cliffed coasts to demonstrate the versatility of NOAA's data in the hands of good scientists to develop rational plans for increasing resilience.
- Demonstrate how to put "management" into "managed retreat."
- Develop concepts for resilient, economically diverse urban communities with EDA and other partners and coordinate funding to initiate redevelopment in one or more pilot communities

Quick Win Opportunities

- Conduct one case study on each of the Nation's coasts and in Hawaii or a Pacific Territory in collaboration with relevant state agencies and academic scientists to evaluate how the projections for sea level rise, both global, and regional will impact the region—its population, infrastructure, natural ecosystems, etc., and how these areas can be made more resilient. Include one or more urban areas.
- Add an economic component of the costs of protection and of managed retreat—and the opportunities for reduced risk and innovative economic redevelopment.
- Put these case studies in the context of conducting a comprehensive national program.
- Case studies could be completed with intense efforts in 6 – 12 months by teams of experts.
- Direct some of the stimulus funding to areas in urgent need of protection or reconstruction
- Partner with entities funding innovation to focus on identifying newer, resilient and cost effective alternatives to traditional materials used for the coastal resilience infrastructure

Role of Ocean Exploration as Enabler

- Many of the tools of exploration will take on added value: mapping, characterization of coastal environments, marine spatial planning, etc.
- The required studies are explorations of future conditions that requires the kinds of oceanographic and meteorological data that NOAA routinely collects: air and water temperatures, tidal elevations, long-term sea level rise and submergence, coastal flooding, etc.

- These data need to be transformed into information specific to each of the regions in which case studies are to be conducted to address specific questions.

Critical Barriers

- Lack of good science used by states in developing guidance for planning for sea level rise. California is a textbook example.
- Data are often cherry-picked to support existing or proposed state policies
- Opposition to any engineering solutions by some environmental groups
- There are large number of conflicting and overlapping interests and responsibilities for coastal resilience

Impact: 7	Effort: 5	Quick Win Opportunities: Yes	Ocean Exploration Components: No
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15. Ensure US Food Security through Modernized Wild Harvest and Increased Aquaculture Production

Value

Domestic commercial harvesting and seafood processing industries are critical industries. They contribute significantly to our nation's economy, provide jobs, and protect national food security. The U.S. is the world's second largest consumer of seafood after China; however, the U.S. imports 90 percent (by value) of its seafood, more than half of which is grown via aquaculture. Increasing the supply of domestically grown seafood can provide greater assurances that the seafood Americans consume comes from safe, environmentally and socially responsible sources. Offshore aquaculture can complement the well-managed domestic harvesting industry to provide a safe, sustainable, resilient protein source for the U.S. Offshore aquaculture can be managed concurrently within NOAA to enable permit streamlining to advance aquaculture alongside the current natural fisheries-based resource management structure.

The COVID-19 pandemic has severely stressed these industries and exposed structural weaknesses. In addition, the pandemic has clearly demonstrated food security is critical and the U.S. must play a role, domestically and globally. In May 2020, the White House issued an Executive Order on Promoting American Seafood Competitiveness and Economic Growth.⁵ The EO addresses good stewardship of marine seafood resources and facilitating aquaculture projects, with NOAA playing key roles.

Scope of Effort

- Investigate and address effects of public perceptions on growing and expanding marine aquaculture in the U.S.
- Address regulatory impediments to permitting farms in U.S. waters, including strengthening collaboration among agencies.
- Clarify and streamline offshore aquaculture agency authorities and permitting requirements.
- Create offshore "Opportunity Zones" and complete a programmatic EIS prior to permitting to streamline permits for Blue Economy activities such as aquaculture, AUV testing, and research.
- Encourage stronger collaboration among U.S. wild-capture and marine aquaculture producers to promote all seafood products under the umbrella of U.S. seafood.
- Invest in continued research and technology development to ensure U.S. fishermen and marine aquaculture producers can maximize benefits to society and the environment, while minimizing risks.
- Provide support for seafood producers with the same programs as agriculture producers.
- Identify incentives to address aging domestic fishing fleet and workforce.
- Improve monitoring and reduce costs of monitoring of fishery vessels and offshore farms.
- Improve real-time fishery data collection to enable more effective, timely management.
- Identify and provide incentives to reduce low-value fish being shipped overseas for value added processing, then re-importing back into U.S. markets as high-value seafood products.
- Provide reliable availability of H-2B or J-1 visa workers where U.S. labor cannot be found.
- Encourage development and validation of new technology (e.g., image recognition and eDNA/'Omics) as potential approaches to improve efficient and effective data collection for better fisheries management decisions

Quick Win Opportunities

- Clarify NOAA's role in permitting offshore aquaculture.
- Draft and forward legislation to Congress to clarify NOAA's authority to regulate and permit offshore aquaculture.
- Develop "Opportunity Zones" where permitting for activities such as aquaculture could be streamlined to improve predictability and reduce costs, without compromising ocean ecosystems.
- Leverage the momentum provided by the Executive Order and current collaboration among U.S. seafood producers during the COVID-19 pandemic to encourage a more collaborative and integrated approach to promoting U.S. seafood (farmed and wild – see #eatseafoodamerica campaign).
- Work with Department of the Interior to use decommissioned offshore oil/gas platforms for pilot aquaculture projects to gather data on impacts on ocean ecosystems.
- Finalize regulations for electronic monitoring of fishing vessels and develop increased monitoring capabilities for domestic fishing fleet.
- Spearhead development and validation of improved fishery data collection approaches.
- Identify scope of U.S. harvested fish shipped to foreign processors for secondary processing and returned to U.S. as finished seafood product, identify impediments to U.S. secondary processing, provide incentives for U.S. secondary processing.

Role of Ocean Exploration as Enabler

- Integrate marine aquaculture, fisheries and seafood into the Office of Ocean Exploration's education portfolio to educate the public and help address perception issues.
- Integrate marine aquaculture, fisheries and the blue economy into the Office of Ocean Exploration's research budget to complement research efforts by NOAA Fisheries and National Ocean Service to ensure adequate resources are devoted to aquaculture research to facilitate a stronger understanding of marine aquaculture's interactions with ocean ecosystems and develop appropriate science-based monitoring tools.
- Leverage scientific data and technological resources as appropriate to help inform siting and other activities that support responsible fisheries and marine aquaculture development in the U.S.
- Providing research and technology support for completing programmatic Environmental Impact Statements for specific "Opportunity Zone" areas to identify existing ocean physical characteristics / user conflicts and front-load the permitting approval process as new offshore economic activities are identified.
- Assist with Test & Evaluation of new technologies and sensors.

Critical Barriers

- Lack of clear statutory authority for NOAA to permit offshore aquaculture, number of permitting agencies.
- Time required to complete EIS prior to permitting and time required to finalize permitting once baseline data is obtained.
- Poor coordination and lack of consistency among permitting agencies.

- Graying of commercial fishing fleet and fishermen – need to encourage cleaner, efficient harvesting vessels as well as maintain a domestic workforce in the harvesting sector.
- Need for less costly monitoring and real time reporting by fishing vessels (electronic monitoring, etc.)

Impact: 9	Effort: 6	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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16. Support Next-Generation Services for Marine Transportation and Ports

Value

NOAA estimates approximately \$5.4 trillion in annual economic activity is generated by U.S. seaports. Between 2002 and 2015, total vessel calls at U.S. ports grew by 48 percent,² while deadweight tonnage increased from 2.6 to almost 4.2 million. Larger vessels carrying increased cargo require deeper and wider channels, more frequent surveys and nautical chart updates, and increased maintenance dredging. In addition, these larger ships require more cranes, berthing space, and associated landside port infrastructure, all of which must be designed for rising sea level and increased storm intensity. NOAA currently provides nautical charts, ocean and coastal mapping, marine weather forecasts, oceanographic services, and other data necessary for safe, efficient navigation. NOAA is well-positioned to provide 21st century navigation improvements, which will be critical to growth of the Blue Economy. It is recommended NOAA lead partnerships and integrate available and emerging technologies for the next generation of services to the maritime community.

Scope of Effort

- Employ new technology and processing tools for more effective collection and management of hydrographic, shoreline, and geospatial data, particularly for areas outside of the USACE federally-mandated channel areas. In particular, NOAA should take advantage of new developments of UxS and satellites for surveys and bathymetric mapping.
- Accelerate port area hydrographic/shoreline data processing for more rapid updates to nautical charts
- Increase installation and integration of real-time oceanographic sensors in key locations through PORTS® or IOOS Regional Associations
- Couple coastal and river forecast model and wave model development and convert to operations (R2O)
- Increase investment in precision navigation to allow better use of existing channel depths for under-keel clearance reducing need for dredging, which both saves money and reduces environmental impacts
- Evaluate application of COTS approaches for automated systems to provide more extensive data collection at reduced costs, then follow through by contracting with industry, including consideration of pay-for-data approaches
- Encourage development of and lead pilot programs for innovative design of port infrastructure to accommodate rising sea levels and withstand more severe storms
- Partner with International Maritime Organization (IMO) to encourage and facilitate innovative approaches for data collection/reporting/tracking of GHG emissions and fuel consumption leading to reduced GHG emissions of ships

Quick Win Opportunities

- Establish precision navigation product in the Lower Mississippi partnering with USACE to enhance detail and frequency of bathymetric and shoreline surveys
- Pilot programs of precision navigation
- Partner with IMO and U.S. partners to encourage private sector development of technology to reduce GHG emissions of ships

Role of Ocean Exploration as an Enabler

- Ocean Exploration can play a key role in test and evaluation of new approaches to data collection and processing

Critical Barriers

- Validation of new data collection/processing techniques

Impact: 9	Effort: 6	Quick Win Opportunities: Yes	Ocean Exploration Components: Yes
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References

1. Unattributed comment by NOAA Blue Economy Working Group.
2. *The Blue Economy: Growth, Opportunity, and a Sustainable Ocean Economy*, an Economist Intelligence Unit briefing paper for the World Ocean Summit 2015, sponsored by the Gordon and Betty Moore Foundation.
3. National Ocean Policy Executive Order 13840, June 19, 2018.
4. Presidential Memorandum on Ocean Mapping of the United States Exclusive Economic Zone and the Shoreline and Nearshore Alaska, November 19, 2019.
5. Executive Order on Promoting American Seafood Competitiveness and Economic Growth, May 7, 2020.
6. *National Ocean Exploration Act*, recommendations by NOAA Ocean Exploration Advisory Board in response to a request by the Deputy NOAA Administrator, April 7, 2019.

APPENDICES

Appendix A
NOAA Administrator Tasking of OEAB Blue Economy Subcommittee

**Blue Economy Subcommittee
of the
Ocean Exploration Advisory Board (OEAB)**

Role of Ocean Exploration

America's future depends on understanding the ocean. We explore the ocean because its health and resilience are vital to our economy and to our lives. We depend on the ocean to regulate weather and climate; to sustain a diversity of life; for maritime shipping and national defense; and for food, energy, medicine, and other essential services to humankind. Goals of Ocean Exploration are to discover and to provide new knowledge about our oceans, including new technology, improved knowledge of the state of our oceans, and knowledge of how our oceans are changing.

Blue Economy Subcommittee

The objective of the Blue Economy Subcommittee of the OEAB is to provide advice and recommendations for how ocean exploration can help NOAA lead and contribute to the blue economy in order to double the economic contributions from the US Exclusive Economic Zone over the coming decade. The goal is to develop a comprehensive strategy to support responsible, sustainable business growth in the marine and maritime sectors, which will also have a positive long-term impact on the health of the oceans. The blue economy is vital to our nation because: 1) health and resilience of the oceans are critical to our economy and our lives; and 2) a robust blue economy enhances our nation's leadership and competitiveness by strengthening our national, economic, and environmental security.

The Subcommittee will address strategic approaches in which NOAA can use ocean exploration to accelerate business growth in the blue economy, stimulating economic activity while improving health of our oceans. Scope includes: 1) assess the current extent to which ocean exploration supports development of the blue economy; 2) develop alternative strategies for how NOAA can engage and partner with industry in innovative and more effective ways to advance the blue economy; 3) analyze potential alternative strategies; and 4) recommend to the OEAB selected approaches. Ocean Exploration is identified as one sector of the blue economy. In addition, ocean exploration is a key contributor to other sectors by providing innovative tools and enriched knowledge to enable more informed management decisions:

- Seafood Production and Competitiveness (e.g., better tools and characterization to enable enhanced management of fisheries and aquaculture)
- Maritime Commerce
- Ocean Exploration (e.g., mapping/characterization of EEZ, modeling, critical minerals, pharmaceuticals)
- Energy Development (e.g., offshore oil & gas and renewables)
- Tourism and Recreation (e.g., ecotourism as well as virtual tourism, which provides popular, preferred websites on ocean topics to which the public is attracted)
- Other (e.g., national security, coastal risk reduction and preparedness, marine debris cleanup & prevention, information organization/search)

The Subcommittee includes selected members from government, academia, and industry. The Subcommittee should provide an interim report to the OEAB in approximately one year.

Appendix B
**Charter of OEAB Blue Economy Subcommittee Developed as an Internal Framework to Guide
Subcommittee Deliberations**

**Blue Economy Subcommittee
of the
NOAA Ocean Exploration Advisory Board (OEAB)
Charter**

1. Purpose

- Purpose of the Subcommittee is to recommend to the OEAB actionable steps which NOAA can take to contribute to the doubling of the nation’s blue economy over the next decade.
- The blue economy is vital to our nation because: 1) health and resilience of our ocean are critical to our economy and our lives; and 2) a robust blue economy enhances our nation’s leadership and competitiveness by strengthening our national, economic, and environmental security.
- A collaborative and dynamic strategy for partnerships in ocean science and technology (S&T) – among government, private sector, academia, and philanthropy – is critical to coordinate, focus, and catalyze a national effort to achieve the goal of growing the blue economy.

2. Objective & Tasks

- **Objective** – Assess potential strategies for NOAA to accelerate business growth in the blue economy, stimulating economic activity while improving the health of our ocean. The Subcommittee will develop and evaluate alternative strategies for how NOAA can engage and partner with the other government agencies, private sector, academia, and philanthropy in innovative and more effective ways to advance the blue economy and recommend actionable steps for NOAA to implement selected approaches. It is important to include milestones and metrics to measure progress which will lead to a doubling of the nation’s blue economy over the next decade (compound annual growth rate of 7.2%). Identification of “quick wins” is also important to build momentum.
- **Tasks**
 1. Obtain approval of charter.
 2. Define components of the blue economy and potential for future growth
 3. Benchmark current NOAA roles in blue economy (measure the starting point)
 4. Identify outside Subject Matter Experts (SMEs) and arrange venue for input
 5. Identify how ocean exploration can contribute to future growth of the blue economy
 6. Evaluate case studies of prior global efforts to stimulate business growth to identify best practices and constraints/impediments
 7. Identify examples of major impediments to blue economy growth and recommend actions NOAA can take to reduce their impact (within limits of the Subcommittee’s scope)

8. Evaluate and provide alternative strategies to engage the private sector to stimulate innovation and accelerate economic growth (e.g., anchor project, incubator, at-sea testing, etc.)
 9. Evaluate organization and resources required to take recommended actions
 10. Develop sample roadmap and/or stage gate process to demonstrate viability
 11. Prepare report
- **Scope & Limits**
 1. Address actions which can be taken by NOAA, including approach to DOC and other federal agencies to initiate/recommend action by others
 2. Focus on contributions of ocean exploration, but think broadly. Contributions include direct business opportunities as well as opportunities for ocean exploration to favorably impact growth of other blue economy components.
 3. Focus should be on US EEZ, but may include strategies impacting international blue economy if they benefit US economy.

3. Performance Goals & Measures

- **End Goal** – Submit report to NOAA OEAB by 1 November 2020
- **Intermediate Milestones**
 1. Phase 1 – 4 months
 - Complete Tasks 1 through 6
 - Summarize findings as high level bullets by 1 June 2020
 - Provide high level bullets to OEAB
 2. Phase 2 – 3 months
 - Complete Tasks 7 through 9
 - Initiate Task 10 to draft format of roadmap/stage gate process
 - Summarize findings by 1 September 2020
 3. Phase 3 – 2 months
 - Complete Tasks 10 & 11
 - Provide report by 1 November 2020

4. Strategy & Tactics

- **Schedule & Approach**
 1. Late March – virtual check-in on Phase 1 progress and identification of SMEs to present at May meeting
 2. Mid-May – in-person meeting in Washington, DC area
 - Review Phase 1 findings and prepare high level bullets
 - Listen to invited SME presentations
 - Check-in with RDML Gallaudet
 - Scope Phase 2
 3. Early August – virtual check-in on Phase 2 progress
 4. September – in-person meeting
 - Review Phase 2 findings
 - Review draft roadmap/stage gate process (Task 10)
 - Check-in with RDML Gallaudet
 5. October – meeting to finalize report and roadmap
- **General Strategy**

1. Look for input on multiple topics and document in Google Docs folder (input will be in variety of formats)
 - VC Investors – Shally, Milly
 - Canadian Ocean Super Cluster – Milly
 - Maritime Alliance – Shally
 - Center for Blue Economy, Middlebury Institute for International Studies (Charles Colgan) – Jerry
 - Norway – Mike, Mark, Shally
 - DOD (DIUX, USN) – Scott, Matt
 - Seafood – Dave (fisheries), Jerry (aquaculture)
 - Marine Transportation & Ports – Milly, Rob
 - Ocean Exploration – Shally, Thomas, Mark, Dave
 - Tourism/Recreation (beaches, terrestrial activities, FL Department of Tourism) – Milly, Dave, Shally
 - Coastal Resilience – Scott, Milly, Jerry
 - Energy (O&G, renewables) – Mike, Ruth, Mark
 - Scientific Research and Ocean Observing – Matt
 - Ocean Conservation
 - Minerals Mining
 - Climate Mitigation
- **Responsible Individuals (first name in list has responsibility to lead/coordinate task)**
 1. Phase 1
 - Task 1 – John, Scott
 - Task 2 – Thomas, Jerry, Dave, Shally
 - Task 3 – Thomas, John, Dave, Mike
 - Task 4 – Scott, Milly, Matt
 - Task 5 – Mike, Mark, Rob, Thomas, Jerry
 - Task 6 – Shally, Milly, Rob, Scott
 - Accelerators/Incubators
 - Permitting
 - Government Resource/Asset Utilization
 - Public Private Partnerships
 - Production & dissemination of Data
 - Cooperative Institutes
 2. Phase 2
 - Task 7 – Dave, Mike, Jerry, Rob
 - Task 8 – Thomas, Scott, Milly, Shally
 - Task 9 – Mark, John, Matt
 3. Phase 3 – TBD
- **Tactics**
 1. Google Docs Folder to be set-up and used for internal communication
 - Limit input to one page
 - Only author should change contents – others should use suggested change vs edit mode to make changes

- List in advance any upcoming conference calls for awareness of all Subcommittee members
- 2. Confidentiality
 - Message for external use to be drafted by Scott, approved by Subcommittee, and subsequently available for use by all for outside communications
 - Any information re DPC Ocean Initiative – within Subcommittee only
 - Other information – maintain within the Subcommittee unless authorized by John
- 3. Decision Making – strive for unanimity
- 4. External Interfaces – John to provide interface with OEAB

5. *Operating Norms*

- Be respectful – demonstrate consideration & appreciation
 - Listen to concerns of all team members
 - Share success of and assist in challenges to team
- Be accountable – be answerable and responsible for actions
 - Support commitments to team
 - Abide by team decisions
 - Commitment for regular attendance
 - Complete assigned action items by due date
- Be open-minded – be receptive
- Be trustworthy – act with integrity and honor
 - Honestly assess issues
 - Guard and protect the integrity and confidentiality of the team
- Ensure effective communications
 - Full & open discussions
 - Active participation
- Act as a team

6. *Sponsors & Support*

- Sponsor – RDML Gallaudet
- Must go through OEAB
- Support Needed
 - Metrics – NOAA Chief Economist
 - Administrative support for final report – NOAA
 - Travel – Nancy Curl
 - General administrative support – David McKinnie

7. Team Leader & Members

- _____
John Kreider, Kreider Consulting, LLC, Subcommittee Chair
- _____
Thomas Chance
- _____
RADM Matthew Klunder (USN, Ret), L3 Harris
- _____
Rob Munier, Woods Hole Oceanographic Institution
- _____
Michael Olsen, Equinor
- _____
Dr. Ruth Perry, Shell Exploration & Production Company
- _____
Millicent Pitts, Ocean Exchange
- _____
Jerry Schubel, Aquarium of the Pacific
- _____
Shally Shanker, AiiM Partners
- _____
Mark Stevens, Oceaneering International, Inc.
- _____
VADM Scott Van Buskirk (USN, ret), Van Buskirk Associates, LLC
- _____
Dave Whaley, Independent Fisheries and Oceans Consultant

Appendix C
Components of Blue Economy

Task 2: Define components of the blue economy and potential for future growth

1. Maritime Public Safety

- a. Forecasting
 - i. Weather related data acquisition efforts
 - ii. Wind, rain, temperature, & humidity forecasting
 - iii. Wave forecasting
 - iv. Ocean current forecasting
 - v. Tide forecasting
 - vi. Harmful algae blooms (HAB) forecasting
 - vii. Hypoxia and contaminate monitoring
 - viii. Production of associated equipment for above
 - ix. Installation and maintenance of associated equipment
- b. Nautical charting
 - i. Data acquisition
 - ii. Data processing
 - iii. ENC dissemination
 - iv. Production of associated equipment for above
- c. Maritime safety (Coast Guard and similar activities)
 - i. Vessel design & construction regulations
 - ii. Vessel inspection (dockside and at sea)
 - iii. Vessel operation
 - 1. Operator training requirements
 - 2. Aids to navigation (ATON)
 - a. Management of ATON
 - b. Production, installation, & maintenance of ATON
 - iv. Emergency maritime response & associated equipment
- d. Beach safety
 - 1. Riptide & sea state forecasting, hazardous fish monitoring, swimmer monitoring, rescue operations & equipment, hazardous beach debris, safety signage

2. Commercial Seafood

- a. Fisheries research, recommendations, management, & enforcement
- b. Aquaculture
 - i. Aquaculture research
 - ii. Aquaculture siting & planning assistance
 - iii. Education and training
 - iv. Aquaculture operations
 - 1. Equipment design and production

- 2. Equipment installation and maintenance
- 3. Stocking, monitoring, nourishment, & health
- 4. Harvesting and transport
- 5. Processing and distribution
- c. Wild capture
 - i. Education and training
 - ii. Wild capture operations
 - 1. Equipment design and production
 - 2. Equipment installation, operation, and maintenance
 - 3. Harvesting and transport
 - 4. Quality assurance and food safety
 - 5. Processing and distribution
 - iii. Mitigation of illegal fishing

3. Maritime Transportation

- a. Boat, ship, and barge transport - domestic, international
 - i. Waterway infrastructure (channel depth & width, anchorages)
 - ii. Port assistance
 - 1. Pilot assistance
 - 2. Vessel traffic management
 - 3. Customs and immigration
 - 4. Port infrastructure
 - a. Food, fuel, oil, waste disposal
 - b. Vessel and equipment maintenance
 - c. Dock adequacy
 - d. Stevedore equipment and personnel
 - e. Warehousing
 - f. Shore based transportation for goods and personnel
- b. Pipelines
 - i. Design, construction, maintenance, & removal

4. Energy

- a. Renewables
 - i. Wind energy
 - ii. Tidal energy
 - iii. Wave energy
- b. Oil and gas
- c. Support of renewables and non-renewables
 - i. Planning and permitting
 - ii. System design
 - iii. Production of required equipment
 - iv. System installation, maintenance, security, and removal
 - v. Shore based interface (power grid, pipeline tie-in)

- vi. Support vessels and technical specialists

5. Tourism & Recreational Activities

- a. Recreational fishing
- b. Recreational diving
- c. Recreational yachting, boating, & sailing
- d. Production of equipment for the above
- e. Beach activities
- f. Shore based tourist meals and lodging
- g. Education, awareness and public engagement
- h. Cruise industry
 - i. Port accessibility from sea by cruise liner
 - ii. Operating personnel
 - iii. Support infrastructure
 - 1. Food, fuel, oil, waste disposal
 - 2. Vessel and equipment maintenance
 - 3. Dock adequacy
 - 4. Shore based transportation

6. Insurance & Reinsurance

- a. Risk assessments
- b. Insurance for maritime vessels & personnel
- c. Risk mitigation technologies

7. Coastal Communities Support

- a. Sea level rise prediction
- b. Storm surge prediction
- c. Coastal desalination
- d. Beach renourishment
 - i. Design
 - ii. Implementation
 - iii. Monitoring
- e. Community maritime infrastructure
- f. Production of associated equipment for above

8. Waste Management

- a. Sewage management
- b. Agriculture runoff management
- c. Marine debris prevention, mitigation, and removal

9. Biotechnology

- a. Resources with medicinal applications
 - i. Research and development

- ii. Production and harvesting

10. Mineral Extraction

- a. Seafloor mineral assessment
- b. Salt, sand, and gravel
- c. Manganese, copper, nickel, iron, and cobalt
- d. Hydrothermal vent minerals

11. Shipyards

- a. Vessel design
- b. Vessel construction
 - i. Material supply
- c. Vessel maintenance
- d. Deepwater access

12. Scientific Research

- a. Data acquisition
 - i. Marine based
 - ii. Airborne based
 - iii. Satellite based
- b. Data analysis
- c. Policy recommendation
- d. Science based resource management
- e. Education & training

13. Enabling Technologies

- a. AUVs
- b. ASVs
- c. ROVs
- d. Oceanographic sensors
- e. Oceanographic deployment, monitoring, & recovery
- f. Electronic navigational charts (ENCs)
- g. AIS and Vessel traffic services (VTS)
- h. Vessel automation
- i. Optimum vessel routing technology

14. Carbon Sequestration

- a. Sequestration research
- b. Marine resources
- c. Blue carbon credits