IOOS Federal Advisory Committee Questionnaire Responses

Executive Summary

Purpose: This questionnaire is intended to provide the IOOS Advisory Committee with insights and personal perspectives from partners and key stakeholders across the IOOS Enterprise. The responses collected will be used to facilitate a discussion during the Advisory Committee's first public meeting of their current term, and may assist them in developing priorities and setting a vision for the next several years.

Methodology: The Advisory Committee's Designated Federal Official sent the following questionnaire to key partners and stakeholders across the IOOS Enterprise. The questionnaire consisted of 15 optional short-answer questions on a variety of topics related to perceived successes and opportunities, as well as weaknesses and challenges, to the IOOS Enterprise. Survey recipients were advised that their responses would remain anonymous to allow for open, candid input; that they were not obligated to answer all of the questions and should focus their time and energy on those topics for which they hold strong opinions. 17 individuals responded to the survey, representing the U.S. IOOS Office, NOAA, federal agencies within the IOOC, the IOOS Regional Associations, academic partners, private industry, and science consortia. Survey responses were analyzed first with a qualitative line-by-line coding and categorizing approach to identify recurrent words, themes, and concepts; then, themes and concepts were examined to identify cross-cutting connections and relationships present in the questionnaire responses.

Summary Results and Conclusions:

- Questionnaire responses were **very consistent** identifying four major strengths of the IOOS Enterprise: **(1)** partnerships, **(2)** meeting societal and regional stakeholder needs, **(3)** the flexible business model established between the federal and non-federal partners, and **(4)** the broad "technical" portfolio: conducting science, collecting observations, transitioning technologies from research to operations, and data management and integration. Considering the diverse set of stakeholders contributing to this survey, the consistency of these themes demonstrates strong agreement among Enterprise partners about what is working well.

- Responses regarding future opportunities for the Enterprise were far less consistent. While a few common themes emerged (enhancing and strengthening existing partnerships, as well as advancing the scientific and technical portfolios) there were 18 topical areas identified as potential future opportunities for the IOOS Enterprise, 16 of which were unique. This positively reflects the diversity of expertise in the Enterprise, but may also indicate challenges to develop a unified vision for the future.

- The most frequently-reported perceived weaknesses of the Enterprise are resource constraints, closely followed by a lack of recognition for the Enterprise-- despite its many

accomplishments and societal contributions, IOOS struggles to be a well-understood entity to the public, and to federal government executive leadership. Additional themes reported as weaknesses included staffing shortages in the U.S. IOOS Office and Regional Associations, aging observational infrastructure, a failure to develop a unified vision and long-term plan for the Enterprise, and, notably-- *partnerships*, which had previously been identified as one of the major Enterprise strengths.

- The partnership theme is present in the responses to almost every question on the questionnaire, and is tightly related to several other common themes. The specific challenges regarding partnerships that were identified included bridging regional and national initiatives and better aligning priorities. Additionally, at the national level, there was consistent identification throughout the questionnaire of the need to coordinate efforts better across the federal agencies. Those challenges could contribute to several other challenges noted throughout the questionnaire, such as inconsistency in messaging and in establishing priorities, perceived replication of work efforts, and a general lack of unity across the Enterprise.

- Strengthening partnerships emerged as a common answer to addressing a variety of Enterprise challenges-- for example, as an important consideration for future resource growth efforts, as a mechanism for aligning messaging and growing the Enterprise more inclusively, and as a key component that will facilitate the Enterprise's ability to lead the way to the next generation of data management.

- When asked about specific ways in which resource constraints are holding the Enterprise back, responses overlapped significantly with the weaknesses and challenges identified in an earlier question, potentially indicating that limited funding creates a damaging ripple effect across the Enterprise by negatively impacting staffing levels, the ability for members of the Enterprise to collaborate and partner with each other (as well as with external partners and stakeholders), inhibiting the recapitalization of aging observational infrastructure, and ultimately poses a major risk to the integrity of the scientific an observational portfolios.

- The themes that respondents identified as vulnerable to resource constraints are consistent with the major areas of growth identified if the Enterprise were able to double its current budget, and also with the common vision for where the Enterprise will be in 5-10 years. Those themes include maturing and modernizing the current system (including recapitalization), enhancing partnerships, and elevating the level of recognition for Enterprise contributions to society. It is notable that the vision for where the Enterprise will be in 5-10 years overlaps consistently with perceived weaknesses and impacts of resource constraints. This is a potential indicator that if those weaknesses are not addressed, and funding levels are not increased, the vision for Enterprise success in the next decade may be at risk.

- When asked about future resource growth, respondents grouped mostly into two categories: those identifying **where** to explore opportunities for resource growth (i.e., untapped federal agencies, non-profit organizations, and the private sector) and those identifying **specific**

subject areas for the Enterprise to focus future efforts (e.g., changing environmental conditions, technological innovation, ensuring the sustainability of current observing networks) in order to make the case for increased funding or open the door for new resource leveraging opportunities. A successful strategy for the Enterprise may take on a bifurcated approach to encompass both of these schools of thought.

- In addition to seeking increases to funding levels, several respondents recommended evaluating current organizational efficiency, as well as prioritization and decision-making processes, to determine whether there are structural or process changes that can be employed to make better use of existing resources across the Enterprise. That includes engaging in collaborative planning efforts, generating a common long-term vision and set of priorities for the Enterprise, and enhancing strategic alignment across Enterprise partners in order to ensure any increases to funding levels yield a maximum benefit for the system. Respondents also identified planning, setting a common vision, and identifying Enterprise priorities as important activities to undertake in order to make messaging and communications across the Enterprise more consistent, and to grow the Enterprise more inclusively. Furthermore, in response to the final open-ended question requesting "any additional comments for the Advisory Committee's consideration", respondents urged the Advisory Committee to help set high-level aspirational goals and to help steer a course by providing specific, forward-looking, practical recommendations.

- In regard to sustaining an operational system under the current competitive funding process, there was significant diversity in the responses but two broad themes: **(1) maintain the status quo,** but put effort into increasing Enterprise funding and improving partnerships and collaboration; and **(2) trying a variety of different approaches**, including introducing more competition, a different prioritization scheme for funding decisions, rewarding excellence rather than seeking equity across the system, and utilizing different fiscal/legal agreements between partners. Almost twice as many responses put forward an idea to try something new, rather than to maintain the status quo. However, the most frequent approach under the "try something new" category (introducing more competition and essentially "letting the strong survive") was less popular that maintaining the status quo.

- The inconsistency of the responses identifying future opportunities (noted above, pg. 1) is similar to the inconsistency of responses identifying priority improvement areas for the Enterprise. Regarding priority improvements, 9 topical areas were identified, 7 of which were unique. Following those specific topical areas, broad improvements to the current scientific and observing portfolio were identified, as well as increasing recognition of the Enterprise, improving the strategic alignment of partners, internal operations, and staffing levels. As noted above, this diversity of responses is both a positive and a negative-- it reflects the breadth of expertise present in the Enterprise, but also poses a challenge to developing a unified vision and aligned implementation/execution strategy.

- There is a slight discrepancy between the themes identified as priority improvement areas, the themes identified as ways in which resource constraints are holding the Enterprise back, and major weaknesses of the Enterprise. This raises a philosophical question about how the Enterprise is planning to address resource constraints and weaknesses while balancing growth and expansion. For example, recapitalizing aging infrastructure was *not* identified as a priority improvement area by any respondents, despite being identified as a major weakness of the Enterprise and a theme significantly impacted by resource constraints. Similarly, none of the topical areas identified as priority improvement areas were identified by respondents as being current weaknesses or of being negatively influenced by limited resources.

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Submitted Questionnaire Responses
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What do you perceive to be the strengths of the IOOS Enterprise?

- Deep expertise in bringing science value to operations.
- Grassroots and needs-driven
- health of our coasts and those who live there
- The key strength has been the ability to form and maintain an entity made up of federal and non-federal partnerships. This seems to allow some flexibility, solutions, and operations costs that are likely quite different than if this was performed solely, for instance, by NOAA or another federal agency.
- Addressing issues of societal importance.
- Ability to bring together stakeholders on ocean observing
- IOOS is a community builder, a developer of tailored ocean information for regional stakeholder needs, a catalyst for ocean observing and innovation and transition of research to operations.
- The IOOS Enterprise's strengths lie in its partnerships, and in its ability to bring together leaders across government, academia, industry, the non-profit sector. Collectively tackling issues at the regional and national levels using that diversity of thought, expertise, and experience is the most promising way to move the needle forward on ocean observing, and to realize the societal benefits that were intended through the ICOOS Act of 2009.
- IOOS is rather entrepreneurial, able to test new tech and ways of doing business more nimbly than a fully government program could. Another strength is the local connections that are made by the regional associations, which increases the likelihood that the data and information products provided are targeted to user needs.

- Targeted focus on regional requirements coordinated at a national level. Ability to allow ready access by agencies to academic partners.
- The federal-regional partnership dedicated to stakeholder needs. IOOS is one of the few Federal programs that incorporates 12 Federal agencies and a network of regional systems. It's brilliant, really. It is a single system that can be used many times. The partnership provides for flexibility and efficiency. The regional approach allows for resources to be allocated thoughtfully and in response to needs, existing assets and partnerships while working with the Federal agencies to address national issues. The data system that allows for the integration of data from across many providers is foundation of the system. Most importantly, it's the people that make IOOS - from the users to the regional systems to the national office.
- **(8/15 Update)** IOOS is designed to be interagency, and has a pedigree with higher order encompassing global ocean observing programs. Timely data for decision making including safety, response, and emerging environmental change. Non-federal organizations (RAs) certified for meeting federal data standards. Systematic approach to sustaining reliable and consistent ocean- and GL-based environmental information. Regional tailoring of investments and products and services driven by resident/relevant issues. Federal/academic partnership. R2O capabilities, and sensor testing/validation and issue-based analyses for advancing observing and monitoring strategies and protocols including through ACT. IOOS Association strategic support and partnership and political advocacy.
- **(8/19 update)** IOOS is by definition an observing system. IOOS is doing their best by focusing on their job. The HF radar network is the best component of a national ocean observing system created by IOOS so far.
- **(8/19 update)** Addressing important and vital areas of coastal and blue ecology and economy
- **(8/19 update)** The framework of partnerships and leveraging that IOOS uses to bring resources to bear to meet multiple mission needs. This framework is designed to implement IOOS as a stakeholder driven, policy neutral, and science based decision support system.
- **(8/19 update)** The IOOS network as a whole provides critical baseline time series data for much of the country. This fills a critical gap that is incredibly valuable meeting the need for science AND also operational needs. Having a national data system is great for the country.

What future opportunities would you like to see the IOOS Enterprise take advantage of?

- When OOI comes on line from NSF, how do we use that data within the IOOS domains?
- Going beyond monitoring and identifying environmental issues of concern to developing and implementing solutions
- integration with other ocean observing systems, one-stop for ocean data
- Additional areas of related societal importance such as offshore and nearshore aquaculture, marine renewable energy, and responsible bio-waste management.

- IOOS should be the leader in integrating community based models and best practices into government. That has started through the COMT, but the path to operations is still actively being determined.
- The IOOS Enterprise should take advantage of the success of the Fill the Gaps campaign and get visibility and growth for the federal assets that contribute to the success of the enterprise. Demonstrate the value of the enterprise to the Nation and the economy.
- I think we first need to define a strong, strategic framework or roadmap through which we can evaluate emerging opportunities with greater detail. The U.S. IOOS Enterprise Strategic Plan reads more like a Program Plan or a Business Plan than a "Strategic Plan"-- specifically, it tells the reader "what" but not "how", "when", or "in what priority order". It lacks focus, direction, and planned actions to move the Enterprise from where it is now to where it wants to be in 5 years (and does not even define where it wants to be in 5 years-- it simply lists everything the Enterprise does, and generally states "do all these things more/better"). Without that framework it's much more difficult to assess each new emerging opportunity and how it fits into the greater momentum of the Enterprise. We need to base our decisions on where to place our precious, limited resources on how effectively new opportunities will help us execute our mission-- there are too many shiny objects out there to distract us from our larger priority goals.
- negative carbon emission strategies that adopt coastal and marine implementation sites will demand considerable observing and related infrastructure. Expectations are that within the next 10 years the U.S. will likely be moving towards a carbon costing approach. Regional IOOS associations would make a logical regional coordination network to facilitate some required aspects.
- (1) Changes are happening rapidly in the coastal ocean and Great Lakes. Marine heat waves, lake temperatures and other extreme events not only affect physical dynamics but have cascading impacts on the food web. Managers and others need more timely and integrated information and alerts to be able to rapidly and effectively respond to changing conditions. IOOS should be leading the effort to ensure the nation has the coastal monitoring in place to detect these changes and to develop the decision support tools that managers and others need. IOOS needs to create a vision that is compelling to address the need for observations for the next decade. (2) A stronger connection between the IOOS Federal agencies and the regional systems will enable implementation of the above vision. This includes fostering innovation, championing state-of-the-art data systems and being responsive to users.
- **(8/15 Update) (1)** With a systematic approach to data collection and dissemination across all regions, advance quantitative measurements of short-term and longer-term variability and change in the characteristics of ocean and Great Lakes biogeochemical systems for national trends analysis and assessment. **(2)** Coordinate (continued) with the NERR system to develop a more seamless integration of data, information and services for systematic assessment of environmental conditions and decision support across the ocean/near-shore/estuarine domains. Build a communication network and data sharing framework to provide better access to coastal intelligence information collected by NERRS and IOOS and partners, create opportunities for collaboration, and increase capacity in observing networks to understand episodic (e.g., coastal

storms) and chronic events and their impacts on coastal ecosystems, including humans. **(3)** Data portals: work cooperatively with ocean and coastal managers on a regional basis to strengthen information access for management decisions, and to advance the President's Ocean Policy. **(4)** Coordinate with other NOAA programs (e.g. OCM Digital Coast) and agencies to co-develop and make available tool/data sets that serve national through local needs by: sharing best practices, cooperating in stakeholder engagement and requirements collection, integrating decision support tools and training materials, undertaking joint demonstration projects in application areas such as coastal inundation mapping, modeling and prediction, and building regional and local capacity. **(5)** Develop joint budget initiatives with other NOAA offices focused on supplementing existing efforts as needed, and serving longer-term gaps in customer requirements (validated or under consideration/less certain), especially considering the aggressive pace of environmental change.

- **(8/19 Update)** IOOS should look for opportunities to create observing networks in the coastal ocean.
- **(8/19 Update)** any associated programs and funding opportunities
- **(8/19 Update)** IOOS should continue to improve data, prediction, and information services from federal and non federal sources to meet stakeholder needs. As the nation experiences an ever-increasing reliance on ocean, coastal, and Great Lakes data, information, and prediction to support lives and livelihoods, IOOS should fill niche areas for data management at a national level in terms of data interoperability, standards, access, best practices, etc. IOOS should continue to build communities of practice around emerging technologies, coastal and ocean modeling, and provision of fit for purpose data. Opportunities continue to grow in all of the following - food (fisheries and mariculture/aquaculture), energy, commerce, safety (weather and health hazards), and sustainable ocean and coastal resources.
- **(8/19 Update)** The IOOS network will allow for sustainable management of coastal systems. There is a great value increasing and entraining state and regional populations. If fully built out and combined with continued research there would be improved physical-chemical-biological forecasting capable.

What do you perceive to be the weaknesses and/or challenges of the IOOS Enterprise?

- Fragmented leadership and lack of resources
- Internal competitions for limited resources
- Many facets of IOOS are legacy assets that have inertia and require most of the present budget just for operations. Some of these are capital assets that are quite old and their update and repairs are not easy to address, but are a clear issue. The legacy issues also make it difficult to reimagine or change course within the IOOS regional associations.
- The regional nature of the present IOOS design is also a challenge when attempting to connect/align with national agencies and global observing system planning organizations.

- Certainly a fuller integration of IOOS is still a challenge in terms of where IOOS sits within a range of other existing ocean observing system efforts within and outside of NOAA.
- Avoiding replication or conflicts with other agency programs (e.g. in modeling and data access) while also maintaining/growing relevance.
- Limited or level funding.
- The loss of staff at HQ has been a big impediment in advancing initiatives over the past year. Focusing on recruitment should be an important focus area. Also, IOOS seems a bit disparate in the types of products and be better at integrating services across the RA's. For example, AOOS is developing a water level database and they are making it transferable across the regions.
- The IOOS mandate is huge; the interagency contributions to the enterprise are ill-defined, and resources are insufficient to address the full scope of the mandate. IOOS is part of a global system, it has a national backbone, and it operates at the regional level. Telling the story of what IOOS is can be challenging. Enterprise systems are in need of recapitalization- current budgets are insufficient to support technology refresh at optimal scales. How to ensure succession planning for the components of the system.
- The Enterprise's greatest strength is also its greatest challenge: successfully harnessing the diversity of its membership in an effective and strategic way, and aligning all of its members toward a common goal with a distinct set of priorities. Messaging is inconsistent, and long term, multi-year goals and objectives are poorly defined, with the exception of the "Fill the Gaps" campaign, which is not comprehensive and arguably too focused on individual technologies (in the future, as an example, we might consider broader foci like "biological observing", or "ecosystem monitoring" rather than more focused initiatives like filling gaps in MBON or ATN--though those can certainly be critical components).
- The regional structure means that topics that are priorities for one region are not necessarily priorities for other reasons. This is very understandable. However, when working with national-level programs, the difference in regional prioritization makes collaboration sometimes challenging. It also means that relationships have to be built with at least 11 different people (usually more), with each requiring effort to be expended to initially create and then sustain those personal relationships that lead to collaborations.
- Not all RA's exhibit uniform capacity. The non-standardized model adopted across the nation probably can and should be optimized.
- As mentioned above, IOOS needs a new inspiring vision for the coming decade. This will broaden support for the system, capture people's imagination and move IOOS into the next decade. Ocean exploration is an excellent example and NOAA and Congress leadership are embracing it. IOOS has a similar compelling mission.
- **(1)** Limited resources is a major issue for the program. Gaps exist in the regional observing systems - both in assets, modeling capacity and data integration and product development - necessary to meet the requests of stakeholders. The regions are highly leveraged and have small staff. **(2)** The IOOS Program Office is also resource limited and would benefit from senior-level, subject-matter experts that can identify critical needs and opportunities, facilitate collaborations within NOAA and with the IOOS agencies, the regional systems and the broader

community. **(3)** One challenge is that IOOS supports many programs but is often invisible. We support weather forecasts but we don't issue them. We support HAB forecasts. We provide the data for models. **(4)** Lack of support from NOAA leadership and above is a major challenge for the program. They support IOOS but are not seeing it as an opportunity to address many of their priorities.

- **(Update 8/15)** **(1)** Look to strengthen the coordination of the national program with the RAs through clear delineation of respective roles and services, but looking essentially to approach this as a shared "enterprise," working as one. Clarify regional engagement and support strategies among the national IOOS program and RAs, and with other regional ocean and Great Lakes observing and monitoring efforts. **(2)** Convene a dialog around the next generation of information services and decision support for user/sector/community needs including: more sophisticated and credible applications of social science to influence understanding leading to behavior change; solid physics as inputs to more sophisticated tools; coupling and down-scaling models for environmental phenomena and producing 3D simulations, maps and projections based on improved physical inputs and the identification of relevant parameters.
- **(Update 8/19)** IOOS may sometimes be too much of an entitlement program, where each region gets similar funding as a signal of fairness. The downside of this approach is that excellence may not be expressed nor rewarded.
- **(Update 8/19)** IOOS needs to have the recognition in the larger organization of its importance with staffing and programmatic support
- **(Update 8/19)** **(1)** Perception challenges of IOOS range from misunderstanding the mission to viewing the IOOS program as a threat or competition for resources. **(2)** Organizational barriers to integration across NOAA line offices and other agencies are longstanding and persistent. Addressing these barriers is time consuming with uncertain payoff in terms of determining priority for taking action to seek change. **(3)** The IOOS enterprise as a whole has never tackled the challenge within the ICOOS Act to develop a comprehensive budget across agencies because of i) the complexities of OMB budget jurisdictions of varied agencies ii) the lack of dedicated IOOS funding lines in any agency other than NOAA iii) the risk of creating a perception of large ongoing IOOS investment in federal agencies when few non NOAA dollars are dedicated to IOOS Act implementation.
- **(Update 8/19)**The enterprise is chronically under-funded. The infrastructure, much of purchased with non-IOOS funds, is aging. With tight funds, the current refreshment rate of the aging infrastructure could lead to an increasingly decimated network.

What areas for future resource growth should the IOOS Enterprise look to in the future, that are currently not being looked at?

- How do we work with private sector entities who don't just see IOOS as a platform meal ticket.
- BOEM if not already being considered.

- IOOS already leverages many resources. Continued partnering with for profit/industry and non-profit entities could be explored.
- Utilizing prize competitions to engage the private sector in R&D to meet specific Enterprise requirements. Not exactly resource growth, but a way to minimize spending resources on R&D internally while maximizing private sector engagement to develop solutions for specific stakeholder needs.
- Again, negative carbon strategies the adopt the use of coastal a marine resources will likely be an area of growth in coming decades.
- (1) Innovation - IOOS needs to be an agent for change and for bringing those changes to the community. IOOS should develop an innovation center of excellence that brings together the OTT, COMT and the regional testbeds so that IOOS becomes the 'go to' program for transferring technologies from research to operations. Such a center could be a magnet for private investment - foundations, industry alike - to match the federal investment. This would be supported by NOAA leadership and the White House. (2) Changing conditions - Marine heat waves and extreme events are changing the coastal ecosystem. IOOS should be leading the effort to identify critical needs for monitoring these changing conditions and work with managers and other to provide information that would allow for quick response and adaptation. (3) Growth while ensuring sustainability - recapitalization of aging infrastructure is a looming problem with moorings, gliders and HF radars over 15 years old. IOOS needs to find a way to grow the system into the future while ensuring the core system is sustainable. (4) Biology - is a key issue but right now it is divided among different programs with little integration or vision for the whole. HABs is an immediate opportunity for IOOS. (5) Stakeholder needs - stakeholders preferences for accessing information are changing from web portals and websites to apps. Is IOOS positioned well to address this? App development is time consuming and costly.
- **(Update 8/15)** Before growing new areas, take a hard look at the out-year maintenance requirements and costs for the current system assets and delivery of services. Given IOOS is heavily dependent (and encumbered) by technology, hardware, and communication systems, weigh the timing and advocacy for new lines of effort with the responsibility to meet existing user requirements and expectations.
- **(Update 8/19)**I suppose there is always the hope of private funding.
- **(Update 8/19) (1)** Other agencies such as Dept. of Energy as IOOS is working with now on the powering the blue economy: ocean observing prize and Navy on unmanned systems technologies and marine biodiversity (applies to NASA and BOEM too). **(2)** Philanthropic organizations to find partners to invest in new technologies and advocate for the program. **(3)** Continue to work with the “ocean enterprise” private sector to co-develop new technologies.
- **(Update 8/19)** Need to define the end users using value-added projects and assess whether they could contribute to the system.

In what specific ways do you perceive resource constraints to be holding back the IOOS Enterprise?

- The DMAC has limped along for a long time. Considering the value is in the data this needs to be funded appropriately.
- TBD after first meeting,..more money meets more investment but not sure what that is for IOOS at this point
- Data management funding within the regional associations may need some increase to help unify the data 'face' of IOOS in ways that help the broader use and adoption of IOOS.
- Limited or level funding tends to limit growth since your forced to decide between putting out new systems in new areas vice keeping existing systems with long and valuable measurement time series going. Equipment sparing, operation and maintenance funding is critical for prolonged project success, however, continued money for that purpose is not always available or its importance recognized.
- Staffing.
- Resource allocations to the IOOS Regional Associations limit the geographic coverage of regional observing systems, the regional capacity to develop models, products, and tools, and the ability to develop operational national products and data information that unite the whole system. The federal backbone could also be expanded to support the work in the regions and further integrate federal data in the regions. National level capacity is also needed to further coordinate and leverage interagency partners and contributors to the enterprise.
- Across the Enterprise, it seems the Federal partners are overtasked and understaffed. While one answer is more resources to afford more people and capacity, a better answer is first analyzing whether we are organized to be as efficient as possible in fulfilling our responsibilities and leveraging resources and expertise in advance of common goals. If we built the Enterprise from scratch today, knowing all we know now that we didn't know decades ago, would it look the same?
- Probably a major contributor to the lack of uniformity across the regions particularly with respect to data management and project development.
- (1) This is a major issue. The ICE estimates that $599 m per year is required to operate a fully built IOOS. All regions have proposals for $4 million a year for shovel-ready (dock-ready?) projects. Clearly, IOOS is underfunded. (2) IOOS has been resourceful in the use of it limited funds and achieved an impressive amount through linking and leveraging. Yet, gaps remain – in assets, modeling and data services and products. The system is aging - both the assets and the people running the system. Many of the PIs are nearing retirement. The Program Office also needs capacity to coordinate the Federal-regional partnership and to set and guide the next generation data systems and innovations. (3) The Program Office needs more resources and needs to develop a vision for what a more fully staffed office would look like and what specifically would be accomplished. The current structure could be reviewed to see if organizational changes can foster efficiencies and improved outcomes. The original intent of creating a Program Office in NOAA is that it would serve as an interagency office, lead by NOAA. This mission should be revisited as it would likely strengthen the program and build IOOS brand.
- **(Update 8/15) (1)** I'm not knowledgeable enough about the balance of resources allocation among the national office, the RAs, and other enterprise efforts (e.g. ACT). However, I have a

general philosophy of pushing as much resources as practicable to on-the-ground (or water) execution. In the current budget environment, it is difficult to advance new and costly improvements or changes to existing programs without a solid economic and societal benefit justification. However, even before considering that, it is important to evaluate the efficacy of those existing efforts/programs, with an eye toward discontinuing lesser priority or under-performing activities, or transitioning those activities toward a new future -- both of which have the potential to free up existing resources to apply to higher priorities and new initiatives. Having such an evaluation in hand is helpful when people ask that fundamental question in light of new resource requests, as well as for basic marketing and credibility. **(2)** I'm also not clear about the staffing profile for the national IOOS office and the RAs. Are there talent and expertise gaps that are inhibiting the means to make the overall enterprise more effective. A question might be whether the regional engagement strategy is working well, including the "customer service" relationship of the national office with the RAs.

- **(Update 8/19)** I don't think resource constraints are the primary issue for IOOS.
- **(Update 8/19)** DMAC activities need to be funded at level to allow for the important data components to operate as needed
- **(Update 8/19)** (1) Barriers to integration exist where domain expertise resides in other programs - e.g. marine mammal protection (NMFS protected resources and Marine Mammal Commission) and the IOOS program can serve as a facilitator and integrator. (2) Small amounts of funding to integrate with other programs can make a big difference. A very modest investment in the NOAA Water Initiative in the form of $2.5M/year since 2017 to the National Ocean Service has accelerated joint planning and implementation of ocean and coastal modeling with NWS. (3) The IOOS Office national funding line limits its ability to increase depth and breadth of mission areas improved through IOOS.
- **(Update 8/19)** It is a big problem, the level funding for several years has effectively lead to a decrease, which is degrading the ability to maintain the existing system. The majority of the operational work is conducted by university laboratories, the majority working as volunteers, is this sustainable. However replacing the Universities would exclude the science leadership and majority of the infrastructure that is owned by the Universities. The constraints do not allow the full system to be built out.

Where do you see the IOOS Enterprise in 5 years? 10 years?

- I see it augmenting NDBC and serving as a tech incubator for operational oceanography.
- See strategic plans.
- IOOS may be moving towards a whole new vision and set of goals with new members as the current system is probably populated with those who have been involved for 15-20 years within this time window and many of the technologies originally deployed have continued to change and improve.
- Pretty much the same if the direction/focus remains the same.

- 5-years: mature data systems with more standardized processing in the cloud; 10 years: an operational system that has interoperable data for optimal use by operational models and forecasts.
- Maturing in its role as a great convener and being a stronger bridge between sectors, primarily across the Federal/ non-Federal asset divide. I expect in 5 years we will be a more holistic Enterprise and have less of an "us vs. them" culture at multiple levels. In 10 years, we will be able to harness that unity and really get after some major "moonshot" initiatives.
- I have always been interested in the split of funds/effort between data collection, data management/availability, and producing value-added information products from the data. It seems that the regions invest substantially different percentages of the funding in data collection, management, and info product development. In 5-10 years, what should that allocation be? A question that I cannot answer but look forward to hearing the vision for the IOOS system that gets at that question.
- Playing a more central and dominant role in the NOAA observing strategy
- The next decade is the UN Decade of the Oceans. IOOS will be leading the path for coastal observations - modernizing the existing system (includes recapitalization) while integrating new technologies and techniques. IOOS will be the system that is detecting changes, communicating those changes to users and managers so they have the information they need to respond in a timely manner.
- **(Update 8/19)** I hope that IOOS moves toward a truly national observing system in the years to come.
- **(Update 8/19)** a more prominent role in over all NOAA and other coastal/ocean activities
- **(Update 8/19)** More successful as an established ocean, coastal, and Great Lakes data and program integrator delivering success through actionable information and services to meet multiple mission benefits. Move from pilot to 'operational' in terms of HAB observing, forecasting, and mitigation tools. Mature biological and ecological observing networks building fit for purpose decision support tools and information.
- **(Update 8/19)** If properly resourced, IOOS can provide the first national systems providing a model for GOOS. The network will, if built out, would allow the country would realize significant and financial benefits. If not properly resourced, the system as it exists will likely degrade significantly.

What could the IOOS Enterprise do if we doubled the budget?

- Build a functioning DMAC and deploy new systems that cost less to get more data. IOT of the oceans.
- See strategic plans
- Reinforce the system's aging assets and raise the profile of the entity thru growth that targets key highest-impact users in each region AND/OR use this increase as leverage to find a matching partner that wishes to expand into an area that makes sense for both organizations.

- Expand into above suggested areas along with continued support of existing measurement systems.
- Regional observing systems would become more mature and operational and sustainable; more mature communities of practice, integrating biological and physical data. More analysis of the economic value of ocean observing.
- To quote the late Notorious B.I.G., "mo money, mo problems". A major risk is that we retain the current lack of effective coordination and strategically aligned momentum, moving in multiple directions and chasing more, bigger shiny objects while our existing observing assets age further past their intended service life, if we don't have some critical conversations about how we work together and what our roles, responsibilities, mutual expectations, and requirements are.
- Ensure not only observing assets are deployed, but also ensure that the data reporting and data quality are brought up to their intended purpose.
- IOOS would make such a difference! Key gaps would be filled, regional models would support enhanced decision-support tools, data, such as biological data, would be integrated into the systems and enhanced user products developed. There would be a workable plan would address recapitalization and modernization of the observing assets. The Program Office could further their work on data integration, fostering partnerships with agencies IOOS , and would be a hub for fostering the transfer of innovation into operational systems. Super-regional products would provide seamless access to data across regions. Weekly blogs or nightly reports on the evening news would highlight the changing state of the ocean based on IOOS data or IOOS integrated data. Managers would have instant access to data for management OA events, HAB, maritime safety or extreme events.
- **(Update 8/15)** Combining the previous question with this one. Lots of possibilities, but this is an important question, and probably should have a succinct and aspirational answer in the back pocket. While it's simple enough but not very compelling to say "more of the same" or just "densify the network," I would recommend a serious effort to look at plausible futures where IOOS assets would be arrayed best to meet essential national security and public well-being needs. The strategies needed to evolve to that future will determine the investment or perhaps modified operational pathways. What drivers will be most influential or critical, such as technology solutions to meet higher resolution needs for changing environmental conditions and improved forecasting and prediction? How might the science be expected to modify the approach to issues, or the relative importance of addressing them?
- **(Update 8/19)** Twice as much as is being done now, one hopes. This sort of question is less useful than addressing how the budget is currently spent.
- **(Update 8/19)** better serve the regions in the IOOS mission and have better DMAC components
- **(Update 8/19)** Improve system wide performance and services including common products and services across the enterprise. Better impact based analysis for prioritizing long term sustained capabilities.
- **(Update 8/19)** It would allow the backbone to be completed and augmented to allow system to realize its potential on a national scale.

How can we better align messaging across the IOOS Enterprise in order to grow the system more inclusively?

- We need NOAA's operational LO's to embrace NOS as an operational entity with IOOS at the heart of that operation. NOS should be the ocean equivalent of NWS. The NCEP OPC should reside in NOAA or at least a new one be created.
- Somehow unify the IOOS message and regional system face to the outside world while maintaining the successful aspects of the regional system approach. Inclusiveness may also mean funding and thus messaging may not be as important as finding efficient approaches to draw in new assets.
- Re-engage interagency and NOAA programs to define and articulate their contributions to the IOOS Enterprise. Define the two-way benefits that the IOOS Enterprise can bring to the Nation and individual programs that contribute.
- (1) Starting with the current Strategic Plan, work to develop multi-year goals that clearly state what we (the Enterprise) intends to do in the coming years to accomplish the objectives in our Strategic Plan. This will help unify efforts, prioritize appropriately and dedicate resources more efficiently. Furthermore, as we work through that multi-year plan, we demonstrate to stakeholders and funding sources that we are good stewards of their investments, that we have produced the societal benefits we said we would, and that we deserve more of their trust and investments in the future. (2) A critical part of demonstrating this success is also the development of IOOS Enterprise Performance Metrics. The IOOC is currently leading a Metrics for Ocean Observing Systems Task Team (MOOS-TT)-- this is important work and should continue, but I urge this to be done through the lens of the IOOS Enterprise-- a single entity, not a conglomerate of observing systems. That was the true intention of the ICOOS Act, which established the IOOC: for it to be a component of a larger IOOS Enterprise.
- Messaging is only part of the issue. IOOS needs to be the honest broker for addressing the nation's needs for observing - a program that integrates across programs, across disciplines and across institutions.
- **(Update 8/15) (1)** Per the mention above about joint budget initiatives or "good government" collaboration, look for opportunities to advance aims by partnering and building a stronger shared approach to business and outcomes. The core of this is the existing national office, RAs, and related partners. Building out from this, a more compelling message can be framed and sold where partnerships that achieve better results (especially more efficiently) are realized. Partnerships that have the qualities of shared vision, resources, risk, accountability, and credit. **(2)** In addition, and as always, the voices of customers, users, and 3rd party validators are generally more effective in marketing and advocacy with government and other funders. Point being to have everyone aligned on vision through services, so that the message is clean and universally supported.

- **(Update 8/19)** Establish and use resources towards clear national priorities for observing networks.
- **(Update 8/19)** work toward more complete integration in related NOAA and other activities
- **(Update 8/19)** Continue to convene the community to have a dialogue and identify opportunities to do this and hire expert communications talent to assist with this. Build upon the ongoing inclusive approach and strive for proper attribution and credit, but also team oriented branding to enable the enterprise to succeed. This is a difficult balancing act at multiple levels. Leadership level (NOAA Administrator and Assistant Administrator level or equivalent in other agencies) buy in and direction for programs to work collectively to better integrate capabilities would help.
- **(Update 8/19)** Need to develop some national IOOS priorities tied to defined products (example: HF Radar & Coast Guard Search and Rescue). This national backbone could then be regionally enhanced to serve local needs.

How can the IOOS Enterprise ensure that it successfully sustains an operational system under the current competitive funding process?

- Funding the best systems will ensure survival. Need to look at inside to outside funding ratios as well.
- Avoid over-promising and spreading too thin, focus on a few of key issues and activities, which are current areas of strength unique to IOOS
- show the benefit of public investment in IOOS
- This is a challenge noted above. Perhaps this is a question for the regional associations? Can the national office re-assign or carve out some of their annual budget for this purpose?
- Explore ways to bring competition in certain areas (e.g. DMAC, technology, model development) that leverage a sustained observing system.
- Move from a cooperative agreement construct to contract?
- First, a review of the options may reveal that the current system, while not perfect, is actually working okay. Options such as basing funding on a formula like Sea Grant would create winners and losers as well. The key is to increase overall funding. If funding were increased, then regions could dedicate a small percentage to recapitalization. The budget requests need to incorporate the full cost of the system - not just the specific technological cost but what it cost to sustain and grow the RA itself, to manage the data, to develop products, for spare parts and for recapitalization. The next campaign needs to grow and innovate IOOS while ensuring it has the resources to sustain the existing assets (where it makes sense).
- **(Update 8/15)** My view of this answer is colored by the desired long-term outcome, which I would challenge because the question appears framed to assume that the competitive process should continue, but needs a justification for how to support it. Is the outcome to achieve: (a) equality or equity across the enterprise; or (b) basic certainty of reliable, internally consistent, sustainable service?
    - If equality or equity...are the issues and drivers in some regions contrasted with others more significant and/or of greater public interest? Are there regions that currently, from a

view of equity, are unable to be as competitive or successful due to capacity gaps? Is the national approach to the enterprise designed to ensure that all regions have a basic level of operational capacity?
    - If sustainability...is the approach actually at question? A "non-competitive" analog would be the National Weather Service, where operational funding for delivering a suite of basic and uniform services to the public is ensured by a dependable budget supporting staff and technologies. This would have implications for the operational approach of IOOS, including the balance of research and operations. Is IOOS destined to be a fully operational and national asset that is executed by the government? Why or why not? Are there clear advantages to having a federal-academic-RA partnership that executes the system? What are the disadvantages? How does the purpose and benefit of RA certification play in this question? Has this question previously been asked and investigated?
- **(Update 8/19)** Define standards and reward excellence.
- **(Update 8/19)** strategically, effectively and efficiently
- **(Update 8/19)** Continue the partnership model with IOOS RAs and IOOS Office coordinating frequently on system needs, costs, risks, and opportunities. Continue practice of leveraging and linking with other funded programs. Continue communicating with Congressional staff and members across the enterprise and build on successes of the past.
- **(Update 8/19)** Need to prioritize the core observational tools to provide a national backbone.

How can we carry the success of the "Close the Gaps" campaign to other parts of the System?

- IOOS needs to revisit requirements every two years. And these gaps need to be explained so customers understand impacts.
- Push for manufacturer interoperability related to observation equipment. Improve partnership opportunities to pull external sensor data for use in models and forecasting. Needs include improved metadata, open source databases to gather data etc. to promote standardization, automation and access.
- Better define the dependencies between components of the system (federal vs. non-federal); identify and communicate the advantages in investing in the federal assets within the regions.
- Capture the storytelling pattern: “(1) Explain the present state or situation; (2) explain the problem, gap, shortcoming, threat, whatever; (3) explain how we intend to solve that problem and our plan, including resource allocation across a multi-year timescale; (4) report regularly on progress and demonstrate a capability to execute.” That pattern can be applied to any initiative to meet stakeholder needs and can be woven into budget formulation, constituent and congressional engagement.
- Closing the Gaps is a messaging campaign. It has worked because it has been targeted and has specific outcomes that benefit users. Many needs have been suggested for incorporation into the campaign but at some point we return to the previous approach - here are the myriad of

important actions IOOS does - and we lose effectiveness. IOOS needs a new campaign (not be confused with the IOOS vision and strategic plan) for taking IOOS to the next step. Like the Gaps, it needs the buy in of the Program Office, resonate with Congress and include enough resources to cover all the associated costs.

- **(Update 8/19)** First define the successes of "Close the Gaps" beyond the money was raised and spent.
- **(Update 8/19)** messaging of successes and needs
- **(Update 8/19)** Identifying other mission areas where gaps in data and services exist and building marketing and communications materials to use for communicating and educating Congress. For example, biological data, observations, predictions, and information services need to be sustained investments and made operational. Yet this part of the system is harder to define and therefore harder to market in 'widget' terms that Congress can buy into. Yet understanding changing biological conditions on multiple time scales will be important for food (fisheries and aquaculture), safety (health from toxins/HABs etc.), and ecosystem services.
- **(Update 8/19)** Target core backbone technologies. Include equipment refreshment.

What are the priority areas that need to be improved across the IOOS Enterprise (both federal and non-federal)?

- Better integration of Federal activities and links to the Navy.
- Federal, IOOS Office appears understaffed with a high level of turnover. Non-Federal, the critical nature of IOOS products and services appears to still not be appreciated by the broader stakeholder community (not sure people appreciate how their lives would change if there was no IOOS).
- Alignment of program goals with other stand-alone national ocean modeling and observing programs such that paths to improved integration become more evident and likely to occur.
- Coastal coupling through increased grant funding through the Regional Associations in conjunction with other NOAA needs (i.e. VDatum, Precision Navigation, HAB modeling, etc).
- data assimilation- ensuring observing system data are getting into the data tanks that support ocean and weather forecasting; research to operations transitions, especially for models; expansion of the enterprise to include biological observations
- Internal operations, biological observing, strategic outreach and self-promotion
- Product development and a more uniform approach to data management and access
- Elevating the importance of IOOS with NOAA leadership, the IOOC and the White House. Improved coordination between the regional systems and the IOOC Federal agencies.
- **(Update 8/19)** IOOS should focus on its role as an observing system by improving the quantity and quality of observations.
- **(Update 8/19)** integration of IOOS needs, activities and contributions at all levels
- **(Update 8/19)** Continued focus at the national and regional levels on Observing, DMAC, and Modeling as core components of IOOS that still need improvement. Observing investments need

better life cycle funding streams. Data management should continue as a priority as critical to integration and leadership globally. Increased emphasis on predictive capabilities (modeling) from IOOS to include improved research to operations framework and practice, along with refined understanding of service delivery and information products to meet stakeholder needs across the enterprise.

- **(Update 8/19)** Core areas provide a focus for the observations: Search & Rescue, Fisheries Management, Ocean pH, improved storm frequency, etc.

Engagement and Partnerships: Are there other partners the IOOS Enterprise should engage, and if so, how can we accomplish that? How can we engage federal agencies more in the Regional Association framework?

- Regional frameworks are difficult. Appropriations bills are not regional in nature. IOOS should team with insurance companies and re-insurers given the exposure they have in coastal areas. In the end the value is in the data.
- NSF and there ocean research programs, NASA, EPA, DOE offshore energy...
- Have the RA's partner with their membership to pursue future opportunities through grant proposals initiated and driven by commercial interest.
- Have district or regional Federal representation in the Regional Associations. More collaborative stakeholder engagement and customer feedback. (i.e. HABS requirements gathering). Requirements need to be gathered collaboratively or we spin the same groups up continuously around our products in NOAA.
- More staff to coordinate and educate relevant contributors in the region
- local, regional Federal engagement, not just those that reside "inside the beltway". Tighter connections between State and Federal Agencies, also.
- (1) Yes, building long-term, durable relationships between the IOOC agencies and the RAs. USGS and EPA are major players in water quality. BOEM, DOE and DOD are key to offshore energy, particularly the developing wind energy industry in the NE and the MA. IOOS should be the repository of data for these developments and sensors can be mounted on platforms. (2) Biology is another interagency example. Build on the examples of MBON and ATN. (3) Certification demonstrates the RA capacity to partner with Federal agencies on data collection, quality assurance, archiving and other needs. This should be a selling point for many agencies.
- **(Update 8/15)** **(1)** This is a good question. See earlier points about the nature of partnerships. Today's budget context and the interdisciplinary nature of customer service in complex domains such as those worked by IOOS requires addressing multiple stakeholder needs and issues. But you know that. The challenge in engaging others, as always, is a function of leadership, resources, and mutual dependency. If it's a one-way street or a one-way payee, it tends to not be sustainable. Needs skin in the game to survive. **(2)** One idea is to look to the evolution and needs of the global Blue Economy. What financial/business/service sectors in particular are going to be looking to IOOS data and information for their needs? Where does IOOS see partnerships (or quasi-contract

relationships) emerging with these kinds of dependencies? **(3)** Another is how risk and cost avoidance factors into business investment or service decisions. For example, in a 2019 industry survey, actuaries (the people who calculate insurance risks and premiums based on available data) ranked climate change as the top risk for 2019, beating out concerns over cyber damages, financial instability, and terrorism. Insurers and re-insurers pay attention to these shifts, and IOOS information helps underpin our ability to assess risk and reduce vulnerability to both short term episodic disturbances as well as to some degree longer-range chronic changes.

- A strength of IOOS is the people who are funded to make observations. In most of the cases I know of, these observations are highly leveraged. A great first step would be for IOOS to acknowledge this leveraging explicitly.
- **(Update 8/19)** Exploit and connect some of the science, engineering and data efforts in the RAs that are also supported and integrated into other agency efforts
- **(Update 8/19)** Build on successes of the past and recognize differences in varied agencies cultures and decision making styles, timelines, and criteria. Continue IOOS RA practice of applying to other agency funding opportunities and building expertise as a broker of capabilities and capacity to bring science into operations.
- **(Update 8/19)** I am happy that the NOPP process is being re-energized, it allows for agency cooperation and funding is based on the merits of the proposal.

How can the IOOS Enterprise lead the way to the next generation of data management by addressing issues such as cloud computing, big data, flexible platforms, data buys, and data security?

- Team with the private sector. If Amazon wanted to deliver to people's piers how would they use IOOS data? IOOS should identify the top 5 brown water risks and address those in its program planning.
- IOOS should go beyond data management and this list is good but data quality needs to be a primary consideration
- Earth observing data management seems like it is a fairly generic topic and thus it is unclear to me if IOOS should lead in this area. Rather it might be wise to consider the idea of integration again within the context of the tools and approaches being taken across the federal landscape - to leverage a large overall federal investment - but with oceanographic data as the focus.
- Managing data is important but so is collecting it and collecting it for a sound and scientifically based reason.
- Better consolidated data, modeling and mapping services that can be grabbed by private industry and made into community driven products.
- Continue to do community building, standardization of data and metadata formats, catalyze innovation with code sprints and workshops to bring the community together.
- Development of a modular uniform platform design could offer considerable cost efficiencies in the long-term. Having a means to plug-n-play various assets depending on regional priorities and

requirements would be great but it would need to ensure adequate power and data bandwidth to accommodate a means of growing out the asset. Also, movable platform designs that could be adopted not just for time-series applications, but also process investigations would be very valuable.

- (1) IOOS should host community workshops with thought leaders from the regions, academia, private sector and elsewhere to identify key opportunities, generate excitement and to answer this question. (2) Data buys are a hot topic now but have the potential to radically change access to data. There should be careful consideration to treating all data providers fairly (i.e., one could say that NOAA is buying data from the profiling gliders just like they are doing with the wave gliders - both should be required to make their data public).
- **(Update 8/15)** I don't know about leading the way, but IOOS can definitely help lead the way. IOOS has relevant and competent expertise across a number of these functional needs throughout the system. Things are moving so rapidly, especially in NOAA in terms of policy and operational approach for cloud computing and big data, so getting a voice and lending a strong hand in this evolving process is important. Regarding platforms and the advancement of AI solutions, IOOS definitely has a leadership role to play, and should look to platforms/technology as a mission enabler and multiplier (which is already the case). This is obviously an area for engagement with the private sector and other agencies as well.
- **(Update 8/19)** IOOS should focus on collecting high quality data.
- **(Update 8/19)** Have as a high priority and connect with some of the existing efforts in other agencies and groups
- **(Update 8/19)** Continue to be nimble and flexible by using the cooperative agreements and subaward structure of the IOOS RAs to innovate and problem solve rapidly when needed. Accompany that with innovations through competitive funding through the coastal and ocean modeling testbed and the ocean technology transition programs.
- **(Update 8/19)** Joint interagency programs

How can the IOOS Enterprise strengthen relationships with other ocean and Earth observing programs?

- GEO is an area where IOOS value is clear. But the private sector is key--what can't they live without? Big data in the oceans will be an IOT issue--how do we position IOOS?
- Avoid perception of redundancy and focus on provides critical and unique products and services
- periodically have joint program advisory committee meetings
- Perhaps by aligning gap analyses and planning efforts with common 5-10 year visions in mind.
- Strengthen partnerships especially with industry to innovate on ocean observations.
- Identify how these programs contribute to IOOS and identify points of intersection where leveraging makes sense.
- Ensure data quality and access meet the requirements for earth observing science.
- **(Update 8/19)** IOOS should make it a priority to highlight the contributions of other agencies to data sets that support the IOOS mission.

- **(Update 8/19)** many participants in IOOS programs are also involved with other ocean and Earth observing so tap into those interactions in various ways
- **(Update 8/19)** Continue to link to and integrate with efforts on the global level and build capacity through examples and best practices for coastal ocean observing.
- **(Update 8/19)** Integrated data systems

Are there any comments you would like to make for the IOOS Advisory Committee's consideration that were not captured in other parts of this questionnaire?

- In addition to their current role and structure, RA's could act as a conduit between Federal agencies looking for work to be done and commercial entities looking for a way to deliver - especially for small businesses that do not have experience with complicated proposal efforts or government contracts or the ability to meet grant match requirements.
- The FAC can help set high-level aspirational goals for the program and as an independent voice can communicate that to leadership and the IOOC.
- **(Update 8/15)** Although a FAC is just that...advisory...I find through experience that the most valuable recommendations are those that help steer a course during both troubled and opportunistic times, thus the FAC may want to look at the current context for where to focus and meet the needs that currently would be most helpful to IOOS. The more specific, forward looking, and practicable the recommendations are, the better.