Existing and New Resources to be Made Available for the Project

I. Currently Available Resources

The MOCEAN team will leverage new and existing resources made available from an array of leading university, research, industry, and nonprofit partners. The resources described below and organized by host institution are of particular relevance to the first two-years of activities for the convergent projects, working groups, and overall engine infrastructure described in the Project Description.

Entrepreneurship for All: Entrepreneurship for All (EforAll) is a national nonprofit organization founded in Massachusetts and dedicated to accelerating economic and social impact in communities through inclusive entrepreneurship EforAll's participation in the MOCEAN Engine will be led by Jeremiah Hernandez and Meralis Hood. EforAll has operations in 13 cities across five states and possesses office space and computers with the full suite of professional software. The organization will leverage these resources along with its network and experience in developing inclusive entrepreneurship in as a co-convener of WG-3 New Blue Economy, and in support of EI-1 Diversity, Inclusion, Accessibility, and Justice.

Innovation Institute at the Massachusetts Technology Collaborative: The Innovation Institute at the Massachusetts Technology Collaborative (MassTech) is state government organization that works fill strengthen the state's competitiveness in the technology and innovation sector by filling gaps in the state's innovation ecosystem, particularly in the areas of leadership development, industry organization, policy and planning, and innovation infrastructure. The organization possesses office space and a wide array of computer hardware and software. MassTech will leverage these resources in tandem with their extensive network and knowledge around the areas of Blue Technology and the Blue Economy to participate in WG-3 New Blue Economy.

INSPIRE Environmental: INSPIRE Environmental is a Rhode Island based environmental consultancy with experience designing and conducting benthic and fisheries research and monitoring studies at offshore wind areas along the US East Coast. The team from INSPIRE will be led by Dr. Annie Murphy, Dr. Drew Carey, and Dr. Kersey Sturdivant. This team will have full access to the imagery data collected at Coastal Virginia Offshore Wind (CVOW) in 2020 and 2022, including the underwater drone footage and the sediment profile and plan view imagery. The interpretative reports associated with these data and prepared by INSPIRE scientists will also be available. These data were collected by INSPIRE under a contract with Siemens Gamesa, with support from Dominion Energy, to fulfill the permit requirements for the CVOW research turbines under the Research Activities Plan. Dominion Energy has committed to support this NSF proposed project and through that support will allow researchers access to these data. INSPIRE Environmental will use these resources as a co-lead of CP-4 Monitoring Marine Life Around Monopiles.

Florida Institute of Technology: Dr. Geoff Swain leads the Center for Corrosion and Biofouling Control at the Florida Institute of Technology (Florida Tech) in Melbourne, Florida. The Center was established in 1984 to understand the processes of biofouling and corrosion in the marine environment and to develop and apply innovative solutions for management, control and prevention. The Center is currently fully funded and supports 2 faculty,1 post doc, 1 technician and 7 graduate students. The Center's seawater test site at Port Canaveral, FL is home to floating and fixed assets including a 34-foot floating control center with power and instrumentation that also serves as a base for underwater research with SCUBA capability. This facility is primarily funded by the Office of Naval Research. On campus, the Center includes laboratory, workshop and office space. The Center has recently researched cathodic protection and marine organism growth on human made equipment subjected to different corrosion control practices under the surface of the water. Dr. Swain and his team will use these resources as part of CP-1 Impact of Infrastructure Materials and Geometry on Marine Ecosystems.

Hampton University: Dr. Deidre Gibson, Dr. Joseph Reustle, and Dr. Jeanette Davis will lead Hampton University's contributions to MOCEAN. In leading this research, this team will utilize Hampton's 40-foot research vessel *R/V Aquaria III* and two smaller center console powerboats. *Aquaria* is designed for trawling and capable of handling heavy sampling devices. Hampton also owns numerous canoes and

kayaks which will be available to the team for research in shallower depth areas in the region's many small inlets and creeks.

On campus research at Hampton will be housed in the Marine Science Building, where laboratories are equipped with stereo, light, dissecting microscopes as well as a Leica inverted microscope. The Marine Science Building has four fume hoods and two temperature and light controlled growth chambers, as well as a full array of plankton and fisheries nets, water sampling bottles, bottom grabs, sediment cores, sorting sieves, YSI oxygen multifunction meters, pH meters, forestry gear, flourometers, spectrophotometers, balances, ovens, and a host of pipetters, glassware and basic supplies. The Developing Marine Biotechnology Laboratory currently has a Bio Rad T-100 Thermo Cycler, a FotoDyne Foto/Phoresis, an Owl B1A Easy Cast, and other basic equipment to partially support this project. Hampton's Department of Marine and Environmental Science, led by Dr. Gibson, has an abundance of environmental and laboratory water quality sampling gear including a Seabird CTD outfitted for chlorophyll, temperature, salinity, oxygen, light, depth, and turbidity, and two YSIs for temperature, light, and oxygen. These resources will be used to co-lead CP-4 Monitoring Marine Life Around Monopiles in cooperation with INSPIRE Environmental. The team from this Historically Black University will also contribute to MOCEAN's engine infrastructure as a key partner in EI-1 Diversity, Equity, Inclusion, and Access.

The Marine Biological Laboratory: The Marine Biological Laboratory (MBL), an affiliate of the University of Chicago, is located in Woods Hole, MA and will be represented in MOCEAN by Dr. Loretta Roberson and include Drs. Mirta Teichberg, Ketil Koop-Jakobsen, and Javier Lloret. MBL is home to a wide array of resources and equipment of immense vale to this Engine. The Marine Resource Center has more than 40,000 gallons of tank capacity distributed among a range of small to large systems that will allow us to build mesocosms of different scales and complexity to study the ecosystem function of modified structures. The Central Microscopy Facility contains electron, confocal and compound light microscopes and provides equipment and expert support for sample preparation. These will be used to characterize surfaces of modified structures before and after deployment at Engine sites. The Ecosystems Center stable isotope facility is home to Dual- Inlet and Continuous-Flow Isotope Ratio Mass Spectrometer systems for the measurement of δ15N, δ13C, δ34S, δ18O and δ2H on various types of samples. Both natural abundance and isotopically enriched samples can be accommodated for food web analysis of communities living on and around modified structures. Dr. Roberson's laboratory maintains the local coral *Astrangia* and red and green algae that will be used for seeding modified structures. The lab has a Walz PAM fluorometer and oxygen electrodes for physiological studies, and YSI Exosonde and SoFar Spotter buoys for field water quality measurements, and long-term wave and wind monitoring at the Engine test sites. An advanced microsensor profiling system, available in Dr. Koop-Jakobsen's lab, will be applied to the investigation of spatial and temporal variation of small-scale chemical gradients on the surfaces of the modified structures and their importance for settlement success and early succession of the colonizing community. The team will also leverage the environmental condition data collected by MBL's Dr. Anne Giblin on the Plum Island Ecosystems Long-Term Ecological Research project.

MBL also maintains a fleet of small boats and SCUBA facilities and equipment. MLB is compliant with the American Academy of Underwater Science, with a full dive facility capable of supporting all necessary field diving operations. A fleet of small whaler-type craft (18-24 feet) will be available for deploying water sampling equipment, monitoring deployed structures, and supporting field dive activities. These laboratory and field resources will be used in support of CP-1 Impact of Infrastructure Materials and Geometry on Marine Ecosystems, and in contribution towards WG-1.2 Nature Inclusive Design of Offshore Wind Farms: Scour Protection and Ecosystem Management.

NATRX: NATRX is North Carolina based company that combines a proprietary software platform with advanced manufacturing techniques and coastal biological engineering capabilities to deliver customized solutions that protect shorelines and the surrounding environment. NATRX maintains unique software to evaluate and design custom geometries for nature-based infrastructure, as well as the manufacturing and logistical capacity to produce and deploy pieces that include 3D printed scour protection, slope stabilization, and fisheries attachments. NATRX also develops and deploys satellite technology for

monitoring wetland health in proximity to energy infrastructure in coastal settings. NATRX will leverage these resources, knowledge, and experience to provide guidance on CP-1 and WG-1.2.

New Bedford Ocean Cluster: The New Bedford Ocean Cluster (NBOC) is a Massachusetts based 501(c)3 nonprofit organization created to leverage New Bedford's coastal position and extensive marine economy and knowledge base to attract investment, support the formation and growth of local maritime businesses, and foster initiatives that can create more value from the sustainable use of our ocean resources. The NBOC works collaboratively with the private sector, public sector, and academic institutions to further establish New Bedford as a leading ocean economy. NBOC is strategically located in the home of CP-1 and that nation's largest commercial fishing port by catch value, where they possess computers with the full suite of professional software. The organization Ewill leverage these resources along with its experience and professional network working with coastal economic development to contribute to WG-1 Nature Inclusive Design of Offshore Wind Farms, WG-3 New Blue Economy, and MOCEANs overall participation in the New Bedford community.

New England Aquarium: The New England Aquarium (NEAq) is a privately operated nonprofit institution open to the public in New England's largest city, Boston, MA. Aquarium staff involved in MOCEAN include Michelle Cho, Dr. Kathayoon Khalil, and Dr. Jessica Redfern. The work described in the MOCEAN proposal will take place in the Aquarium's main exhibit building, as well as the Anderson Cabot Center for Ocean Life at the NEAq and involve the Aquarium's Research and Conservation Department, Marketing & Communications Department, and Talent & Culture Department.

The NEAq has been conducting aerial surveys in waters scheduled for wind energy development off Massachusetts and Rhode Island since October 2011. Understanding the effects of wind energy development on the diverse community of marine mammal and turtle species found in US waters is essential to long-term sustainable development of US offshore wind energy. Surveys have followed consistent distance-sampling methods, which allowed comparisons of species distribution and abundance patterns over the past decade. These comparisons have identified changes in animal activity, such as the spatial distributions of the critically endangered North Atlantic right whale and increases in both right whale densities and the amount of time they spend in the survey area. This 10-year time series of consistent aerial survey data represents a unique opportunity available to the MOCEAN team to understand the potential effects of turbine construction on US marine species and develop solutions for mitigating these effects. In particular, these data can be used to develop habitat models for marine mammal species of interest. The models will use the variables being considered in other parts of the project to ensure that MOCEAN develops a framework that can be used to explore the potentials effects on marine mammals of changes in environmental conditions associated with turbine construction. These data and models with be available to scientists working on this Engine.

The NEAq has up-do-date technical equipment for educational, design, research and administrative purposes. Partial funding for an educational whitepaper and e-learning module on offshore wind development from the US Economic Development Administration's Build to Scale grant will also be used for developing informational content for workforce development. These resources will provide an avenue by which we can deliver information to future offshore wind energy workforce as part of CP-5 Establishing Equitable Pathways to Opportunity. NEAq will also contribute towards CP-1 Impact of Materials and Geometry on Marine Ecosystems, CP-3 The New Blue Fisheries Economy, WG-2.4 Ocean Science: Environmental Conservation, WG-4.1 Education, Outreach, and Training: Equitable Practices, and to the Engine's central infrastructure around EI-1 Diversity, Equity, Inclusion, and Accessibility.

New Jersey Economic Development Authority:

The New Jersey Economic Development Authority is the state's principal agency for driving economic growth with a mission of making New Jersey a national model for inclusive and sustainable economic development, particularly in offshore wind energy and clean energy development. In recent years NJEDA has launched and funded multiple programs and initiatives including: Global Wind Organization (GWO) basic safety training and survival facility at Atlantic Cape Community College; wind turbine technician training program at Rowan College of South Jersey; submerged arc training and coating programs to support heavy steel manufacturing at Gloucester County Institute Technology and Salem County Vocational Technical School; offshore wind workforce gap analysis; offshore wind workforce and skills

development grant challenge issued in fall 2022; and an offshore wind innovation facility feasibility study. These training courses, materials, studies, and reports will be made available to the MOCEAN team as they work to replicate and expand on the early work New Jersey has contributed to this space. WG-3.2 "Shared Use of Oceans and Coasts" that is part of WG-3 on "New Blue Economy"

Orsted: "Ørsted is one of the pioneers in the offshore wind energy sector and they have more than three decades of experience in this field. The Ørsted has built about 31 offshore wind farms along the coast of Europe (Denmark, UK, Germany, Netherlands) and Asia (Taiwan). The list includes the world's first (Vindeby along the coast of Denmark with the capacity of 4.95 MW) and the world's largest offshore wind farm (Hornsea 2 located at North Sea with about 1.3 GW capacity). Overall, 7.6 GW of offshore wind is installed, and 11.8 GW is either under construction or awarded by Ørsted. The Ørsted is also heavily engaged in clean energy development in the USA and is completing 8 offshore wind projects in the U.S. between Massachusetts and New Jersey with a total capacity of 5.004 GWs. Orsted's experience, U.S. projects, and connections through the industry will support the assessment of project findings, and identify new projects and how best to leverage physical and human capital.

The Ørsted vision is a world that runs entirely on green energy. Ørsted develops, constructs, and operates offshore and onshore wind farms, solar farms, energy storage facilities, renewable hydrogen, green fuels facilities, and bioenergy plants. Moreover, Ørsted provides energy products to its customers. Ørsted is the only energy company in the world with a science-based net-zero emissions target as validated by the Science Based Targets initiative (SBTi), and Ørsted aims to deliver a net-positive biodiversity impact from all new renewable energy projects it commissions from 2030 at the latest. Their ongoing work in nature-inclusive elements of offshore wind farms is well aligned with MOCEAN's mission.

Outer Harbor Consulting: Outer Harbor Consulting is a Massachusetts based consultancy focused on public policy, market development and strategic partnerships in support of the US offshore wind sector. Outer Harbor's participation in the MOCEAN Engine will be led by Fara Courtney. Outer Harbor possesses multiple computers and the full suite of professional software. The firm will leverage these resources along with its depth and breadth of knowledge on the US offshore wind sector in support of WG-3 New Blue Economy, WG-4 Education, Outreach, and Training, and EI-2 Data, Models, and Tools.

Regional Wildlife Science Collaborative for Offshore Wind: The Regional Wildlife Science Collaborative for Offshore Wind (RWSC) in a collaborative entity among four sectors, 1) federal agencies, 2) state agencies, 3) non-governmental organizations, and 4) offshore wind companies. RWSC is hosted by the Coastal States Stewardship Fund and supported by the Northeast Regional Ocean Council (NROC) and the Mid-Atlantic Regional Council on the Ocean (MARCO). RWSC currently has funding to convene several expert subcommittees at least bimonthly. In addition, RWSC's host and supporting entities convene expert work groups– several of which overlap and meet together with the RWSC Subcommittees–to support regional data development (such as the Seafloor Habitat Data Work Group and Marine Life Work Groups) and the presentation of data to the public via the regional ocean data portals. Many of the entities that participate in these existing Subcommittees and work groups represent the Engine's participating organizations and partners, and the groups are broadly representative of the varied expertise in the Engine's study area (Atlantic coast academic researchers, government scientists and resource managers, consultants, industry, and other experts). Funding to support the Subcommittees and work groups is collaboratively derived from NROC, MARCO, several individual Atlantic coast states, federal agencies, offshore wind companies, and environmental non-governmental organizations. The Subcommittee and work group meetings are fully supported by staff to facilitate and produce agendas, materials, recordings, and meeting summaries. RWSC Subcommittee meetings provide the opportunity for the Engine's Working Groups to coordinate with synergistic activities in the region, solicit expert feedback, and communicate project progress and results. RWSC is prepared to direct these resources towards leading WG-3.2 Shared Use of Oceans and Coasts, and to contribute towards the engine infrastructure in the area of EI-2 Data, Models, and Tools.

The Responsible Offshore Science Alliance: The Responsible Offshore Science Alliance (ROSA) is a nonprofit organization headquartered in Washington, DC and dedicated to research on the potential impacts of offshore wind on fisheries. ROSA's contributions to this Engine will be led by Dr. Mike Pol and Dr. Lyndie Hice-Dutton. ROSA possesses multiple portable computers with desktop stations and the full

suite of professional software. ROSA will leverage these resources along with their depth and breadth of knowledge on the intersection of offshore wind and fisheries in combination with their extensive network of collaborators in this space to convene WG-2 Ocean Science and support WG-3.2 Shared Use of Oceans and Coasts, WG-3.3 Future Fisheries, and the engine infrastructure around EI-2 Data, Models, and Tools.

Rutgers University: Dr. Josh Kohut, Dr. Aziz Ezzat Ahmed, Dr. Daphne Munroe, Dr. Douglas Zemeckis, Dr. Wade Trappe, Dr. Margaret Brennan, Amy Mandelbaum, and Dr. Jason Morson will represent Rutgers University in the MOCEAN Engine. Rutgers, The State University of New Jersey, is a recognized leader in academic research and education. Our faculty, technical staff, and students work together through state, national and international partnerships to conduct research, train and educate a skilled workforce, and ensure that output of these efforts inform decision-making, management, and policy.

The Rutgers University Center of Ocean Observing Leadership (COOL) integrates interdisciplinary scientific research, education and outreach and the application of an operational ocean observing system. Faculty and students comprising the scientific teams participate in collaborative research programs in which academic, industry and government partnerships are forged between physicists and biologists, between scientists and engineers, and between observationalists and modelers. The Operations Center maintains a sustained coastal ocean observatory that provides real-time ocean data and models including a fleet of underwater robots, satellite remote sensing, surface current mapping radar networks, and daily atmospheric and oceanographic forecasts. The education group is the focal point for outreach activities to the K-12 community and to non-science majors within Rutgers.

The Haskin Shellfish Laboratory operates facilities located in Port Norris, NJ an operational shellfish research farm in Green Creek, NJ and a state-of-the-art shellfish hatchery and nursery facility on the Cape May canal in Cape May County, NJ. The lab's locations are embedded within the shellfish fishing communities which are anticipated to have large vulnerability to impacts from overlap of fishing grounds and OSW lease areas. The Port Norris facility is a 19,000 square feet on the Maurice River, a tributary of Delaware Bay with 8 well-equipped laboratories for investigations on ecology, microbiology, histopathology, physiology, cell culture, molecular diagnostics, biochemistry, molecular genetics and cytogenetics. Additional facilities include meeting rooms, a large seawater wet laboratory, cold rooms, algal culture facilities, docks and a dormitory. The research farm in Green Creek, is located on the shore of Delaware Bay, and has an adjacent intertidal oyster farm, a hatchery and algal culture facility, labs, running seawater, offices, and dormitory space. The hatchery facility in Cape May is located on the Cape May canal. The Cape May facility has 22,000 square feet of interior wet lab space with running filtered and raw seawater, large algal culture capacity, three large laminar flumes, and capacity for large-scale shellfish seed production.

The Renewables and Industrial Analytics Research Group is led by Dr. Aziz Ezzat and focuses on spatio-temporal data science, machine learning, and artificial intelligence for energy sciences and analytics. His research group is assigned space at the Energy Lab at Richard Weeks Hall of Engineering. The lab consists of two connected rooms and hosts graduate student desks, research computers, and servers. The lab hosts a DELL PowerEdge T640 with two Intel Xeon Gold 6132 processors, and 2.4 TB of space, acquired as part of Dr. Aziz Ezzat’s startup fund, and is dedicated for his research group to store, process, develop, and implement data science and AI algorithms, computational experiments, simulations, and Big data analytics at high processing speeds. The server will host several datasets related to this project. In addition, as part of Rutgers faculty, Dr. Aziz Ezzat has access to the School of Engineering high performance supercomputing community cluster at Rutgers University. These resources will be directed towards Rutgers’ role as a leader of CP-3, The New Blue Fisheries Economy, and in contribution towards WG-3.3 Future Fisheries.

SeaAhead, Inc. SeaAhead, Inc. is based in Cambridge, MA and is formally partnered with Cambridge Innovation Center (CIC). CIC is a global leader in building and operating innovation campuses that support the growth of entrepreneurs and startups. CIC operates more than 1 million square feet of shared workspace, wet labs, and event space in the US, Europe, and Asia.Its collaborative work environments support thousands of individuals in the for-profit and nonprofit sectors who are focused on innovating solutions to local and global problems. Guided by the belief that stronger innovation ecosystems help to

propel economic development and social impact, CIC has co-founded several mission-aligned organizations where this ethos drove CIC to be an early corporate partner with SeaAhead. SeaAhead's BlueSwell incubator cohort startups are all issued CIC membership. Numerous other bluetech related startups and corporates have joined CIC's co-working space seeking to be part of an emerging Greater Boston bluetech innovation hub. CIC's startup innovation campuses are available for stakeholder convening as well as co-working in support of the MOCEAN Engine. SeaAhead has also funded the creation of an initial regional facility map in New England of support infrastructure that can help earlier stage startups reach their next technology readiness level. SeaAhead will direct these resources towards CP-1 Impact of Infrastructure Materials and Geometry on Marine Ecosystems, CP-4 Monitoring Marine Life around Monopiles, and in leading WG-3.1 New Blue Economy: Bluetech.

Dr. Yashwant Sinha: Dr. Ashwant Sinha is an experienced practitioner and educator in the area of offshore wind. He currently serves as the Director of the Offshore Wind Power program at Bristol Community College in New Bedford, Massachusetts. Over the last eight years he has designed and developed short-term courses to assist professionals in other industries to transition to the offshore wind industry – such as electricians, welders, divers, painters, and motor repair technicians. He has also developed an online platform where he answers questions relating to career options in offshore wind, stakeholder engagement, and health and safety considerations for offshore-based works. Dr. Sinha will direct these resources, materials, and platforms to lead WG-4.2 Education, Outreach, and Training: Workforce Training, and contribute towards CP-5 Establishing Equitable Pathways to Opportunity.

Tufts University: Tufts University is the lead institution on MOCEAN, and home to PI Dr. Dan Kuchma as well as a number of other key Engine contributors including: Dr. Eric Hines, Dr. Chris Swan, Dr. Grace Marie Festin Caldera, Kevin Oye, and Dr. Merredith Portsmore. The university will supply office space and all technology needs for Tufts faculty, staff, and postdoctoral fellows. Tufts will direct these resources towards CP-2 Concrete Gravity Based Foundations, EI-1 Diversity, Equity, Inclusion, and Accessibility, EI-3 Societal Cost of Energy, and EI-5 Lead Organization Management and Business Functions to include managing collaborations with the external evaluator and other necessary administrative and managerial functions as the lead institution of the MOCEAN Engine.

The University of Connecticut: The University of Connecticut (UConn) MOCEAN team will be led by Dr. Michael Whitney. UConn has existing computational resources that will be used for environmental modeling and analysis effort, including: high performance computing clusters at the Department of Marine Sciences (UConn Marine Sciences HPC) and the UConn Storrs Campus (UConn Storrs HPC). The UConn team will also utilize resources at the Connecticut Initiative on Environmental Research of Offshore Wind (CIEROW) centered at the UConn Avery Point Campus. Graduate student education will be enhanced through CIEROW's mission of scientific training to promote sustainable development of offshore wind power. These efforts will be undertaken in support of CP-3 The New Blue Fisheries Economy.

University of Delaware: MOCEAN efforts at the University of Delaware (UD) will be led by Dr. Matt Oliver, Dr. Christina Archer, and Dr. Yun Li. UD is the home of several high-power computing clusters to which Drs. Oliver and Archer have access to for intense computational efforts. The Caviness cluster consists of 126 compute nodes (4536 cores, 24.6 TB memory) configured as 36-cores per node. An OmniPath network fabric supports high-speed communication and the Lustre filesystem (approximately 200 TiB of usable space), and Gigabit and 10-Gigabit Ethernet networks provide access to additional file systems and the campus network. Drs. Oliver and Archer own four nodes that will be 50% dedicated to the proposed effort. In addition, Dr. Oliver maintains three nodes (16, 12, and 24 processors each with 256GB RAM) with the Delaware Biotechnology Institute's High Performance Computing Cluster, which could be used if additional need arises. UD provides technical support and assistance in the use of the high-performance computing facilities and maintains the hardware. All senior personnel have dedicated multi-core desktop machines to perform day-to-day computations, as well as laptops for conference travel and remote work. Local data storage capacity is available through hard-drive arrays and a 200-TB internal server. Dr. Oliver also maintains a server with 20-TB capacity to distribute NASA Earth

observations, model outputs, and analyze products via THREDDS and ERDDAP. The University of Delaware's resources will used in contribution to CP-3 The New Blue Fisheries Economy.

University of Massachusetts Boston: Drs. Robert Chen and Kerrie Wilkins-Yel will lead the University of Massachusetts Boston's (UMass Boston) contributions to this Engine. UMass Boston's Stone Living Lab consists of a coastal observatory in Boston Harbor that includes real-time instrumentation, a numerical model, and ongoing biological, physical, geological monitoring. The university's Environmental Analytical Core Facility provides instrumentation and expertise to analyze a wide variety of environmental samples and includes state-of-the art trace metal ICP-MS, Isotope Ratio-MS, elemental analysis, SEM and spectrometry. The Massachusetts Green High-Performance Computer Center provides environmentally friendly state-of-the-art infrastructure for computationally intensive research. The BlueTech, Energy, Aquaculture Coastal and Ocean Needs (or BEACON) Laboratory supports Blue Tech start-ups with a physical laboratory in the Integrated Sciences Complex as well as a JetYak autonomous bottom-sensing vessel, a particle size analyzer, a dockside lab with high-speed internet, and access to the faculty and students and their labs in the School for Environment. UMass Boston is also home to the Partners Aligned To Heighten diversity in STEM (PATHS) program, a NASA supported network that is part of the NSF INCLUDE network.

The School for the Environment (SFE) at UMass Boston is the host organization for the New England Ocean Science Education Collaborative comprised of roughly 50 ocean education organizations distributed across New England. This allows it to offer an established network for harvesting and disseminating educational activities and models. SFE is also host to the Mass Bays National Estuary Partnership and the Urban Harbors Institute.

UMass Boston also maintains facilities and equipment for a variety of marine research operations. The university operates the 110 passenger *M/V Columbia Point*, a 64-foot all weather research support vessel, a 25-foot Parker research vessel equipped with hydrowinch, CTD, Mini-Shuttle *tow-yo* vehicle, and a variety of sampling equipment, and a 25' landing craft. University watercraft operate from an Americans with Disabilities Act compliant dock. The Center for Environmental Sensor Networks provides access to sensor networks and sensor development expertise including the ECOShuttle (a towed, undulating vehicle) and Mini- Shuttle (*tow-yo* vehicle), in-line DOCN analyzer, in-line nutrient analyzer, and custom sea-going laboratory van equipment with TIC/TOC analyzer. These UMass Boston resources will be directed towards leading WG-4.3 Education, Outreach, and Training: Educational Pathways, and contributing towards WG-4.2 Education, Outreach, and Training: Experiential Learning, and CP-5 Establishing Equitable Pathways to Opportunity. The team from UMass Boston, a Minority Serving Institution with one of the most diverse student bodies in the nation, will also support the EI-1 Diversity, Equity, Inclusion, and Accessibility.

University of Massachusetts Dartmouth: The University of Massachusetts Dartmouth (UMass Dartmouth) will be represented in the Engine by Dr. Kevin Stokesbury, Dr. Gavin Fay, Dr. Robert Griffin, and Dr. Changsheng Chen. The UMass Dartmouth School for Marine Science and Technology has two research and teaching facilities (64,000 square feet and 32,000 square feet) in New Bedford, MA, the home base of MOCEAN's CP-1. These facilities include classrooms equipped for video conferencing and distance learning, state-of-the-art research laboratories, and a greenhouse for the growth and long-term maintenance of aquatic photosynthetic organisms under natural light. The School for Marine Science and Technology Conferencing Suite is a year-round conference venue. The flexible space accommodates a maximum of 120 people. The university maintains docking facilities on Clark's Cove in nearby Buzzards Bay in the Atlantic Ocean.

The UMass Dartmouth Marine Ecosystem Dynamics Modeling Laboratory is an active research group with a focus on the Finite Volume, primitive equation Community Ocean Model (FVCOM) development, ocean modeling, and ecosystem process studies. The laboratory is equipped with a super performance Linux cluster with a total of 3,784 processors. Other computer models needed for the project are supported by the university's computing facilities. UMass Dartmouth supports a super performance Linux cluster. The cluster includes 6 generation nodes, with a total of 3,784 processors, 2304 of which are from the latest upgrade done in June 2020. The Latest processors are 32-core 2.9 GHz Intel Cascade Lake with a total of 96 GB of RAM and 2000 TB storage. These servers are operated by IT professionals and

maintained with their security. UMass Dartmouth resources will support WG-3.3 Future Fisheries, CP-1 Impact of Infrastructure Materials and Geometry on Marine Ecosystems, EI-3 Societal Cost of Energy.

The University of Rhode Island: The team from the University of Rhode Island (URI) will be led by Dr. Christopher Baxter and Dr. Aaron Bradshaw. Their work will focus on desktop engineering analyses and require geotechnical publications and computer analysis software. URI has access to the needed resources including specialized geotechnical numerical analysis software such as FLAC and RS2. This work will support CP-2 Nature Inclusive Concrete Gravity Base Foundations for Offshore Wind Turbines and WG-3.3 New Blue Economies: Future Fisheries.

Woods Hole Oceanographic Institute: Woods Hole Oceanographic Institute in Woods Hole, Massachusetts (WHOI) is an independent, nonprofit organization dedicated to ocean research, exploration, and education. WHOI is home to a suite of facilities, resources, and shared use spaces that will be available to Dr. Colleen Hansel, WHOIs lead representative on the MOCEAN team. Dr. Hansel maintains 1,500 square feet of laboratory space in the Watson Building on the WHOI Quissett Campus (Woods Hole, MA) that is tooled for both lab and field work in biogeochemistry. The facilities and resource of particular relevance to the 2-year convergent projects proposed herein include instruments and other resources for designing and manufacturing materials for deployment (cement tiles, steel coupons/tubes, prototype structures), geochemical and biological analysis of waters and substrates, and accessibility for field deployments. WHOI also operates and manages the Martha's Vineyard Coastal Observatory, including the ASIT tower that is outfitted with an array of ocean and atmospheric sensors that will be available to this team for assessing infrastructure capabilities, sensor testing, and communications.

Dr. Hansel's Laboratory resources include biogeochemical instruments and sensors, including Ocean Optics O_2 sensors, a Varian Cary 50 UV-Vis spectrophotometer outfitted with both a fiber optic sensor and an integrated flow cell, a Dionex ICS-2000 Ion Chromatograph, Turner Inst fluorometer with chlorophyll module, World Precision microsensors (O2, CO_2, NO, H_2O_2, H_2S, pH), and lab and field-based chemiluminescent instruments, including the commercially available FeLume (Waterville Analytical). The laboratory is also home to two unique instruments developed on site by Dr. Hansel's team for measuring reactive oxygen species in shallow (DISCO) and deep environments (SOLARIS). For material characterization. The lab hosts a Rigaku Rapid II X-ray micro-diffractometer (u-XRD) with both Mo and Cu X-ray sources.

This Engine will also leverage several WHOI analytical resources, including the nutrient facility (e.g., N, POC, P), mass spectrometry facility (TOC, DOC), ICP-MS facility for metals, high performance computing cluster, shared small boat facility (including a 22-foot Calanus), and pier and dock facilities with cranes and testing wells. Particularly useful for this project is AVAST, an innovation center that is home to several facilities, including a fabrication lab equipped with laser and 3D printers, machine shop, various test and pressure tanks, and project space for multiple users. As part of this project, Dr. Hansel, a core member of AVAST, will secure AVAST resources for material design and manufacturing, sensor and sensor housing manufacturing and testing, and space for tile, coupon, and pipe preparation and testing prior to and after deployments. WHOI's resources will be directed in support of CP-1 The Impact of Infrastructure Materials and Geometry on Marine Ecosystems, as well as WG-2.2 Ocean Science: Marine Growths and Habitats, and WG-2.3 Ocean Science: Climate Effects.

II. New Resource Contributions

No external MOCEAN partners describe commitments of new resources in letters of collaboration, nor are any such contributions described in the project description. The work plan was intentionally designed to take advantage of existing physical and human infrastructure, and offshore wind projects and the relationships of all partners. These will be used in the Working Group discussion to develop joint-industry and public/private partnerships, as has been done in European entities such as the Fraunhofer Institute for Wind Energy System (Germany), the Offshore Renewable Energy Catapult (with $300M of test equipment in Blyth UK), and the Carbon Trust in the UK.