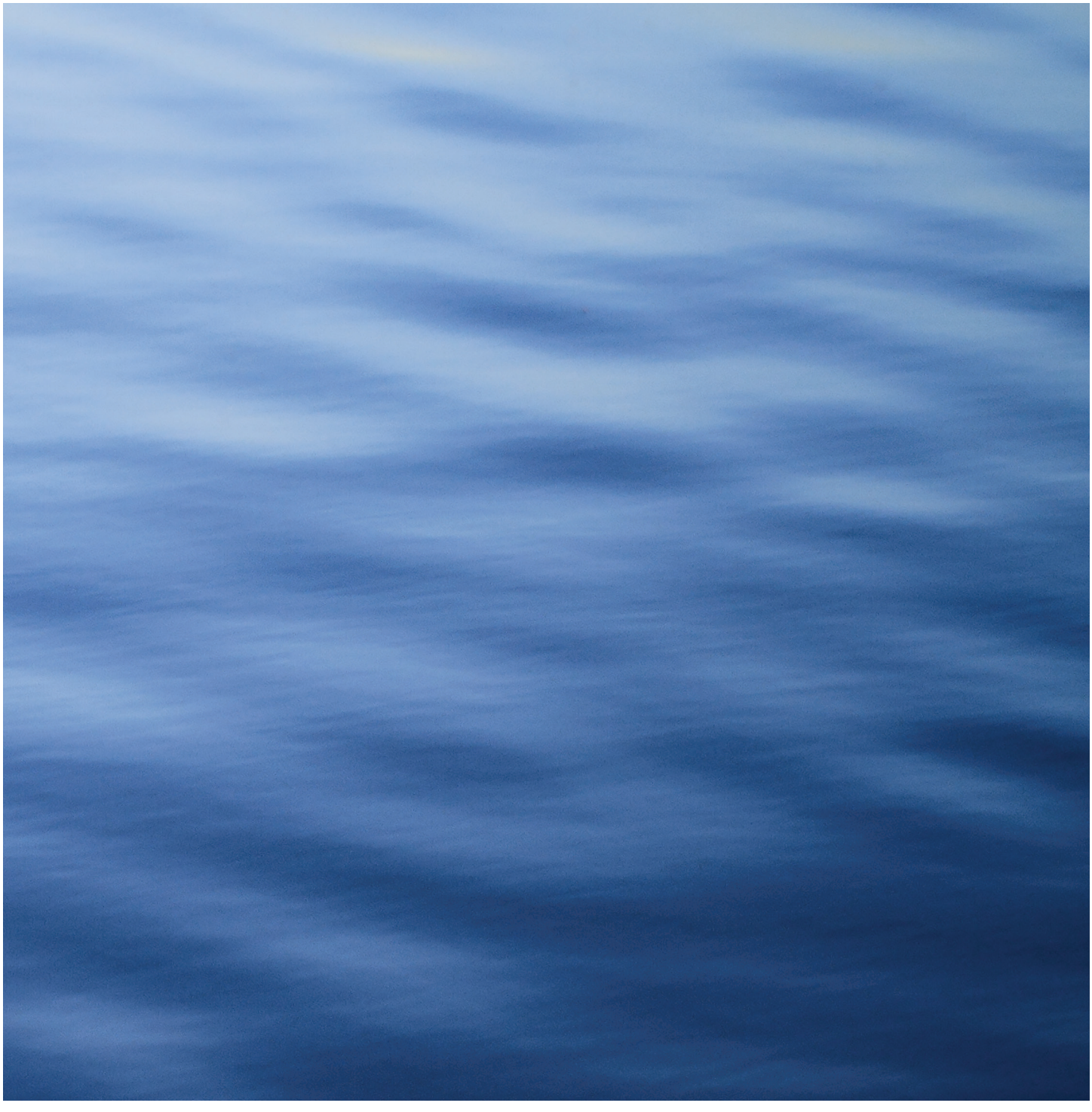
OCEAN TASK FORCE:

CHARTING THE FUTURE OF MISSISSIPPI'S OCEAN TECHNOLOGY ECONOMY



EXECUTIVE SUMMARY

The OTF was expressly created to provide expertise for the development of a comprehensive economic development master plan to increase the maritime economy and the synergistic relationship between the military and the government assets positioned along the Mississippi Gulf Coast.

A key underpinning to this Master Plan is a need to support the U.S. Navy's requirement for competitive advantage in ocean science and technology development as directed by the Chief of Naval Operations through the Task Force Ocean (TFO). Mississippi's challenge is to leverage this national TFO plan in a way that benefits the growing maritime Blue Economy, including research, education and workforce growth. This Master Plan recognizes the strong history of Mississippi's place in the technological evolution of U.S. Naval warfare including shipbuilding, Naval Oceanography and Meteorology, and Special Operations. Mississippi has a unique opportunity to research, develop, test, advance, and homeport the nation's next generation of unmanned maritime systems (UMS).

The Master Plan recommends investing in advanced facilities that support engineering joint ventures for Public-Private Partnerships (P3s) to accelerate technology development in months or weeks instead of years; UMS operational range development for testing and integrating these systems; warehousing and depot facilities to support Maintenance and Repair Operations (MRO) on UMS; and a national UMS Policy Center.

The Master Plan further identifies key areas of potential development that leverage the U.S. Navy's enormous buying power to create a much stronger market pull along the Mississippi coast. This market pull can be increased by coalescing our existing government, industry, and academic partners within a coordinated course of action, as well as by developing new partnerships with industry, technology-oriented philanthropic organizations, and capital resource entities. Strategic federal and state investments, including oil spill recovery funds, can create new infrastructure and technology-based programs and jobs to further leverage this buying power.

The Master Plan also recognizes the unique geographic setting of the Mississippi coast with respect to building our own capacity throughout the state without losing capacity to neighboring states at the edges. This creation of an inclusive plan with economic development opportunities extending northward is critical to its success. The Master Plan builds off the reality that much of Mississippi's overall economy is tied to the Blue Economy. As the maritime technology sector expands along the Coast, it will boost the State's economy with more technology-oriented, higher-paying jobs. Moreover, this plan builds a talent pipeline for a technology-based workforce to be trained at Mississippi universities and community colleges with Mississippi students from high performing Mississippi science, technology, engineering, and math (STEM) K-12 programs.

The following nine recommendations constitute a tangible Roadmap for implementing the Master Plan. The OTF believes its work should continue this effort by developing a series of proposals targeting state, federal, and private resources. A set of "Goals and Targeted Actions" are provided within the Master Plan to guide these proposal activities.

THE ROADMAP

DISTINGUISH MISSISSIPPI

Present Mississippi as a well-positioned world leader in ocean science and maritime technologies.

+ **Recommendation 1:** Establish a marketing and branding plan to support a maritime technology corridor across the coastal counties with reach and relevance to non-coastal counties.

+ **Recommendation 2:** Establish a capital resources program supporting innovation, commercialization, and business development activities to better foster government, industry, and academic interactions leading to economic growth in the Blue Economy.

STRENGTHEN OUR MARKET PULL

Grow and expand attractors unique to Mississippi that create a competitive advantage.

+ **Recommendation 3:** Establish a unique unmanned maritime systems (UMS) operational range that is cohesive across air, land, riverine, coastal, and shallow-to-deep ocean environments. The range will support both defense and non-defense activities requiring the ability to test and evaluate UMS and their interoperability across platforms and domains.

+ **Recommendation 4:** Establish and operate a UMS warehouse and depot to serve as a centralized facility to manage the range. The depot will work with defense and non-defense stakeholders to establish competencies and standards, conduct calibration and validation exercises, maintain an inventory of UMS vehicles, provide maintenance facilities, monitor field performance and communications, and conduct inter-comparisons under controlled laboratory and field settings to ensure performance and training requirements are met.

+ **Recommendation 5:** Establish a maritime systems innovation and commercialization center to foster new systems and platforms—focused on, but not limited to, UMS—within academic, industry, and business development spaces.

+ **Recommendation 6:** Establish a federally-supported regional engineering and development center, co-located with the innovation and commercialization center, to support development and application of maritime systems and platforms for ocean exploration, forecasting, and data collection.

+ **Recommendation 7:** Provide high-performance and cloud computing facilities (including data processing, integration, and archival support) to allow industrial, government, and academic partners to test autonomy, robotics, and artificial intelligence within maritime systems and platforms.

INCREASE OUR CAPACITY

Utilize and enhance foundational assets that create and retain Mississippi's competitive advantage.

+ **Recommendation 8:** Enhance high school, community college, and university education and workforce training programs to create a pipeline for success and retention of Mississippi students. These programs should complement the education required for a solid technology-based workforce and include technical career pathways, university-based certification and degree programs, and traditional STEM degrees. Build connections with local industry leaders to understand their workforce needs and to establish internship programs that provide hands-on experiences for students.

+ **Recommendation 9:** Establish a Mississippi-based national resource for understanding existing laws and regulations as well as the development of new policy and ethical considerations involving maritime systems and platforms, specifically UMS.

AREAS OF FOCUS

The work of the focus groups is summarized here to provide a high-level understanding of capacity, opportunities, and challenges within these areas. Gaps are specifically identified as they lead to the development of goals and targeted actions.

EDUCATION AND WORKFORCE

Mississippi has a long history of building collaborative partnerships with government, academia, and the private sector to develop the human capital needed for high-growth, high-demand, technology-based industries. These relationships are poised to continue to grow and develop with the ocean technology and unmanned maritime systems focus, necessitating partnerships among educational institutions ranging from K12 to community colleges to universities. Unfortunately, Mississippi suffers from a chronic loss of Science, Technology, Engineering, and Math (STEM) students after graduation, which hinders growth in these sectors.

Education and Training Programs

The growing importance of STEM subjects to the workforce is demonstrated in Mississippi's K12 schools with the existing STEM related Career and Technical (CTE) Curricula and initiatives such as Robotics programs and the Computer Science for Mississippi Initiative (CS4MS). The purpose of CS4MS is to implement computer science courses in all schools and grades by 2024. High schools are projected to provide a four-course sequence to allow students to earn a CTE endorsement in Computer Science at any comprehensive high school, not just CTE Centers.

Most high schools recognize the importance of preparing students for STEM-related careers. Lacking are programs that specifically correlate those STEM classes to careers within the Blue Economy. Examples of existing programs include ocean science classes or participation of teams in competitions such as the National Ocean Sciences Bowl. However, these programs do not necessarily inform students of the types of STEM jobs available within the State for any type of employer–federal or state government, large or small company, university or nonprofit. High school programs also need more internship opportunities for students that fit both need and schedule.

Post-secondary programs throughout the State offer fields of study and practice valuable to ocean technology and UMS industries. Programs include physical, life, and environmental sciences; engineering; earth, atmosphere, and ocean sciences; mathematics; computer science; cybersecurity; and other STEM related programs. The challenge is to ensure marine technology and UMS-specific education matches the need for alternative approaches to training based on progressive technological and systems advancements. Education and training programs must effectively blend theoretical and practical application, preparing marine technology and UMS operators and developers to translate complex information, patterns, and trends into usable data. Several research-intensive Mississippi universities have existing certification and degree programs as well as active oceanographic, hydrographic, or unmanned systems research engineering programs that address these issues.

The University of Southern Mississippi houses the School of Ocean Science and Technology (SOST). Most of the SOST academic and research programs are on the Coast, spanning from the Gulf Coast Research Laboratory in Jackson County to the Division of Marine Science's oceanographers and hydrographers at Stennis Space Center. The SOST will expand into a new marine research facility at the Port of Gulfport, where the Ocean Engineering program will be supported along with the research vessel Point Sur's shore operations. The SOST offers degrees ranging from undergraduate degrees in Marine Science and Ocean Engineering, to master's degrees, including one of only two Hydrographic Science degrees in the nation, and doctoral degrees. The SOST currently manages over $90M in contracts and grants in ocean engineering, oceanography, hydrography, fisheries,

aquaculture and other fields. USM also has research and education programs in Computer Science and Engineering, and a world-renowned Polymer Science and Engineering program.

USM recently offered the Nation's only university-sponsored academic certification in UMS. This inaugural class of 15 Navy-sponsored students represented a rigorous curriculum designed to give decision-making skills to the Navy warfighter when using UMS as an asset in ocean surveillance. USM and the Navy are developing a set of competencies that will expand the current Tier 1 certification to more advanced Tier 2 and 3 certifications and degrees.

In USM's School of Computing, advanced algorithms for big data analytics are being developed which, once validated, can provide the leading-edge technologies for handling the large amounts of data that are anticipated to be collected, processed, and analyzed in the implementation phase of the OTF Master Plan.

Mississippi State University (MSU) leads a wide range of research, service, and academic programs that support Mississippi's Blue Economy. The Bagley College of Engineering (BCoE) offers undergraduate, master's, and doctoral degrees that support coastal industries, including Chevron, Ingalls, and industries at Stennis Space Center, as well as federal, state, and local government. Recently, the BCoE started classes at Mississippi Gulf Coast Community College so students can earn either an electrical or a mechanical engineering degree from Mississippi State without leaving the Coast.

MSU has many significant research programs on the Coast. The Northern Gulf Institute, led by MSU and co-led by USM, has its program office and 30 employees in the MSU Science and Technology Building at Stennis Space Center. The building also houses the Associate Director of the Alliance for System Safety of UAS through Research Excellence (ASSURE) and the FAA Center of Excellence for UAS. MSU leads the Mississippi-partnership recently chosen to direct the new Department of Homeland Security Science and Technology Small Unmanned Aircraft Systems Demonstration Range Facility.

The University of Mississippi (UM) National Center for Physical Acoustics (NCPA) boasts a 30-year history in developing novel sensor applications for a wide variety of problems, including underwater acoustics. Interpreting the signals received from these sensors is an active field of study, specifically sub-bottom profiling and tomographic techniques for finding sub-surface features. NCPA works closely with the Department of Physics and School of Engineering to educate graduate students in cutting edge sensor and signal processing technologies to produce the next generation of scientists and engineers. Private sector partners have always played an important role in project development at NCPA which strives to transition bench-top research into deployable solutions.

UM also has a long history of partnering with the University of Southern Mississippi in developing a variety of undersea vehicle technologies including integration of sensor platforms in vehicles, data storage, and exploration of the Gulf and beyond. Scientists from the National Center for Natural Products Research at UM have used these tools to explore undersea flora with unique, potentially therapeutic compounds as a front line in novel drug development.

Both Mississippi Gulf Coast Community College and Pearl River Community College play key roles in workforce training in technical career pathways through their existing programs. New programs to specifically address technical career opportunities in maritime systems should be developed as the OTF Master Plan is implemented.

EDUCATION AND WORKFORCE

Existing Skill Framework/Preliminary Workforce Analysis

Preliminary workforce analysis to determine current marine technology and UMS education and workforce requirements revealed an increased manpower need in support of the Navy Shipbuilding Plan. While the increased manpower is not specifically for UMS, the increased workforce includes the need for UMS and similarly-trained personnel. Forty-one percent of the increased manpower will be in the civilian and contractor workforce, with the remaining increase in Naval Operational Oceanography (23%), enlisted personnel (26%) and officers (7%). Further analysis indicated that two-thirds of the current Stennis Space Center (SSC) Naval Oceanography (NAVO) workforce has at least a Bachelor's degree.

Research suggests that the increased use and integration of remote and cyber platforms will have a dramatic impact on the approach to training and recruiting methodologies, creating the need to include not only functional skills relevant to capabilities of marine technologies and UMS, but also the fundamentals of communication and information systems. Additionally, values such as integrity, teamwork, dedication to strategic goals/mission, the ability to maintain confidentiality, and creative problem solving under pressure are critical components of new training programs. Interviews with Navy leadership and the UMS Certification Program Directors revealed there is no recognized or widely accepted set of UMS standards or skill frameworks. The lack of historical experience in training and education specific for UMS, as compared to other disciplines and fields of practice, makes preparing the workforce with relevant skills to support UMS difficult.

A robust, research-based, practitioner-focused skills framework can provide the foundation for recruiting, training, and developing a marine technology and UMS workforce that closely aligns with the needs of the future jobs. The framework can identify the broad range of skills discussed above, and the required level of education for various career paths. Skillsets will drive the recruitment and enlistment criteria to more closely reflect the needs of the jobs.

Gaps:

Need for plans and programs to grow and retain the top STEM-performing high-school graduates in the Mississippi technology workforce.

Need for more diverse STEM programs in high schools throughout the state focused on target industry sectors—specifically maritime technologies and UMS—within the context of the OTF master plan. Internship and earlier career path opportunities should be associated with these programs.

Need for UMS Certification. Certification efforts are in their infancy, and development to meet unknown workforce needs will require close interaction among certification provider (USM), manufacturers, and end-users (defense and non-defense).

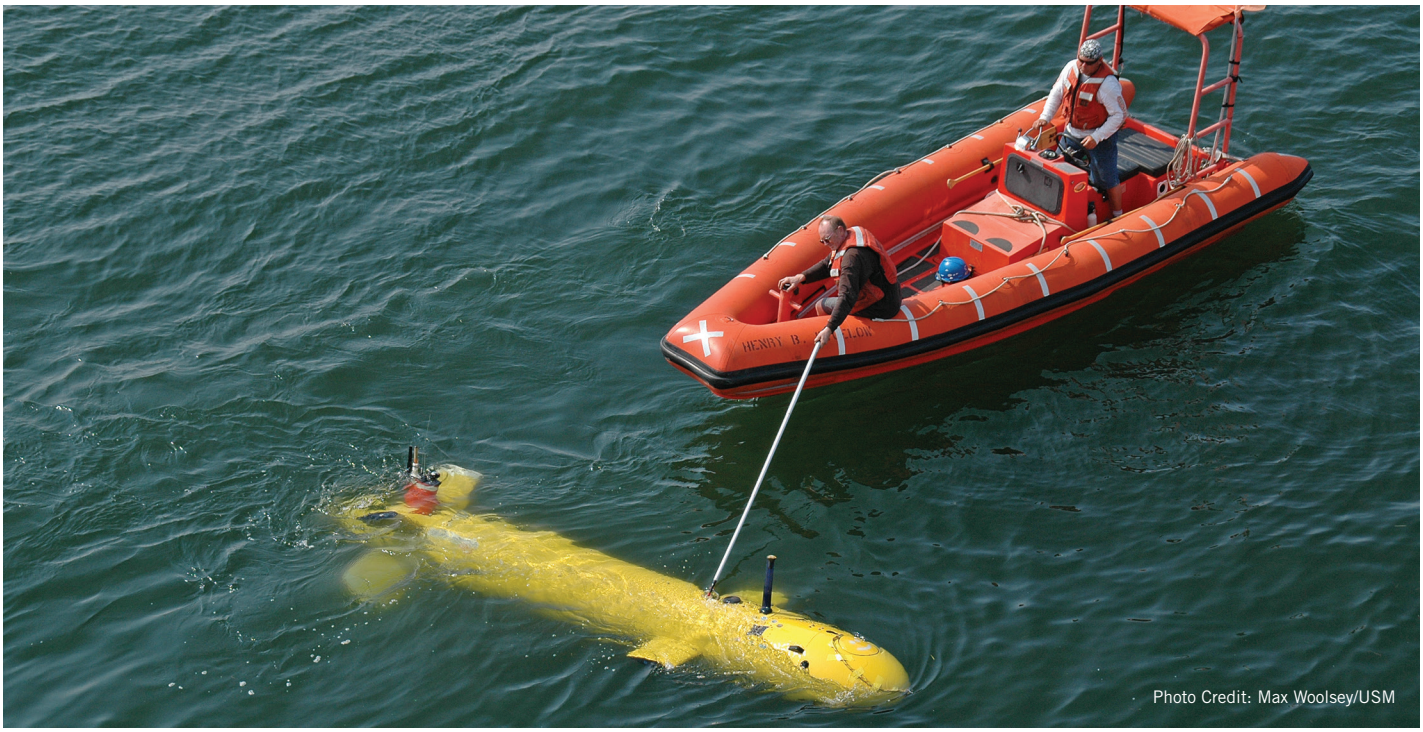
Need for UMS operator training across domains of air-sea-space currently exists due to the growing demand.

Need for established workforce competencies in UMS.

Need for a National Maritime Center for Policy and Ethics. Currently, there is not one. The pedagogic mission suggests this initiative should be university-based.

Need for workforce training and career technical specialists. The workforce demand for career technical specialists in mechanics, electronics, maintenance, and repair is expected to grow with the marine technology and UMS industries, yet workforce training of career technical specialists in marine technology and UMS is lagging.

ENGINEERING CAPACITY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ENGINEERING CAPACITY

Blue Engineering in Mississippi

A robust Blue Economy based on research, development, augmentation, validation, and application of unmanned maritime systems requires a steady supply of engineers and ideas. Together these two, engineers and ideas, are described as 'Engineering Capacity'.

Recent efforts to catalogue existing maritime 'blue' engineering capacity across organizations—federal, state, university, and private industry—indicate that Mississippi's blue engineering capacity is mainly centered on ocean-based projects and programs that are loosely organized at the project level. The tracking of engineers in the job market is ill defined for maritime. For example, an engineering company working on systems and sensors to understand nearshore waves is categorized under the broad category of 'professional engineering'. All of the engineering companies in the State can be identified; however, identifying those working specifically in the maritime sector is a much more difficult task.

This engineering capacity requires a modern collaborative environment, whether it be collaboration for science or collaboration for development. This means that engineers and scientists must have forums to communicate and collaborate. These forums may be a physical location, a virtual space, or, preferably, a combination of the two.

Unmanned Systems

For the purposes of the Ocean Task Force, the Engineering Capacity focus group targeted the UMS sector as an emerging field that is extremely relevant to organizations in the State, such as the Navy and NOAA, which represent existing, internal markets for these systems and the information they provide. In understanding the engineering capacity associated with UMS in the State, all organizations that support the development/enhancement of the systems, data acquisition and handling, data analytics and product development, operations and maintenance, and communications providers must be examined.

ENGINEERING CAPACITY

Existing Capacity

A catalog of Mississippi-based UMS assets was compiled. Using customized Asset Sheets, organizations were cataloged according to how they support UMS – associated with systems, services, or infrastructure. These Asset Sheets provide details of how each asset supports UMS; similar sheets were collected for organizations that are not currently supporting UMS efforts, but have the capacity to do so. The information on these sheets, combined with information gleaned from discussions with UMS users, formed the basis for the information that follows.

The review of organizations that support UMS systems identified twelve federal agencies, eight state agencies and universities, and thirty-six private companies. Based on the review, Mississippi has a large number of assets—systems manufacturers, service providers, operators, human capital, technology support, training programs, etc.—that support UMS. Another thirty companies that currently do not support UMS, but have the capability to do so, were identified.

Companies located in the State that are key participants in UMS, or could support UMS, include the following:

- Leidos
- General Atomics
- Lockheed Martin
- Teledyne
- Stark Aerospace
- Insitu
- Raytheon
- Aurora Flight Sciences

Gaps:

Need for a method to assemble and track data on engineering capacity. Currently, data is limited and largely held by industry at the project level.

Need for physical or virtual spaces to develop an innovative environment for collaborative research and development or engineering prototyping among academia, government, industry and non-profit organizations. These spaces should have capacity to handle both classified and unclassified projects with appropriately cleared staff.

Need for a systems maintenance and repair operation (MRO) in Mississippi. Without properly trained workforce and adequate MRO facilities, unmanned vehicles and sensors will continue to be sent out of state.

ADVANCED DEVELOPMENT AND TESTING

Current Capabilities in Mississippi

Advanced development and testing efforts related to the Blue Economy are currently taking place throughout the State but are often very specific to a system or technology, such as an aircraft with sensors that look down at the ocean or a new ship launched along the Coast. In some cases, an organization procures any needed equipment for development and testing, which tends to be costly. This results in a number of individual organizations spending project monies on the same types of equipment. A better solution would be to contract the use of another organization's development and test equipment, but this is currently difficult for several reasons: 1) Some equipment is not easily accessible (a federal asset, for example); 2) There is a lack of information on the assets available in the State and how to access them; 3) Research, development, and testing elements are conducted out-of-state, making personal interaction difficult, particularly during technology creation and development.

Up-and-Coming Programs

There are various Mississippi-based organizations that are currently working on efforts to grow the Blue Economy in terms of technology advancement, reduced costs, increased accuracy, and efficiency. These include federal laboratories, private companies with internal R&D efforts, and entrepreneurs. Recent efforts in federal programs like the Defense Advanced Research Projects Agency (DARPA), Office of Naval Research (ONR), and Naval Research Lab (NRL), as well as in companies such as Huntington Ingalls and Shell Oil Company, are focused both on the development of new techniques or new applications of existing techniques, and on the integration,interchangeability, and extensibility of systems to provide customized solutions to a number of scenarios. Challenges for these programs are all relatively consistent and include:

- Interoperability
- Autonomy
- Integration
- Communications
- Training
- Propulsion & Power
- Manned-Unmanned Issues

For example, long-term Navy goals are focused on Manned-Unmanned (MUM) Teaming, where actions and reactions of all types of fleet forces can be optimized based on the specifics of a scenario to be addressed. This strategy requires forethought during system design, with attention to open architectures in hardware and software components, interface standards, and even materials used. Intricacies of how systems will work together and development of rules of engagement are still a work-in-progress. A number of Mississippi assets exist that can be applied to the challenges facing these programs.

A need has emerged for a range that supports the operation of these systems in environments that closely mimic the environments where missions, whether military, humanitarian, or commercial, will be carried out. To showcase the need for such an operational range, the Commander Naval Meteorology and Oceanography Command (CNMOC) recently held a demonstration in the Gulf of Mexico exhibiting how a range would work in support of various Naval missions. There is growing support within the Navy for a permanent location for an operational range, a new concept in ranges.

ADVANCED DEVELOPMENT AND TESTING

The requirements for an operational range are anticipated to be far less complicated than other types of Navy ranges. The operational range will be well understood environmentally, but not require many expensive in-water assets. The Navy anticipates the use of its own survey systems, as well as those within NOAA, to gather in-situ measurements and use them to refine computer models of the range area. The Navy seeks to support a variety of training missions within an operational range with access to both shallow and deep waters, brown water as well as blue water, and riverine access and influences. The Mississippi Coast is uniquely suited for this goal. The Navy has anticipated many of the initiatives associated with the establishment of the operational range. These include:

- Environmental surveys/assessments
- Mission impact studies on the environment and local marine life
- Permitting process/COAs
- Inventory of systems (separate from NAVOCEANO)
- Command and Control Centers (2 anticipated)
- Expansion of CODAR on Singing River Island
- Improvements to Navy models
- Safety plans
- Communications/power infrastructure (e.g., in-water docking station)

The Navy is not currently equipped to handle each of these efforts, so there will be opportunities for contractor support from companies with relevant expertise. Additionally, there will be on-demand-type requirements for support from dive teams, patrol/other small boats, and other suppliers.

Gaps:

Need for an entity that addresses the combination of air and sea UMS operations. Given the goals of the Navy and other organizations to use a combination of satellite-, air-, and sea-based systems depending on the "mission", future efforts will require a working knowledge of which resources are best suited for which operations, uses, and applications. As the Navy leads this effort, other agencies will follow, and various industry uses will be identified.

Need for an incubator/accelerator focused on the development of new ideas in the Blue Economy with dedicated space supporting academia, government agencies, industry, and entrepreneurs and early stage companies. The facility should provide shared equipment needed for developing, prototyping, and testing; and should house organizations with the expertise for developing not only the technology, but also the business case for the technology. As a result, ideas for new sensors and systems can be developed, prototyped, tested, and commercialized from a single location.

Need for a location that the Navy, or any industry alliance, has identified as the gold standard for an operational range supporting all types of UMS. This range would need to be supported by adequate warehousing and depot spaces needed to manage large fleets of UMS vehicles and sensors while also providing the technical capacity to maintain the fleet.

Need for a national cohesive air-water corridor from river to coast to blue and deep water that is manageable as an operable range for purposes of defense and non-defense development, validation, verification and data acquisition testing across platforms.

APPLICATIONS

Applications for Existing Industry

Several maritime-based industries within the State use remotely operated and autonomous unmanned systems and other robotic instrumentation and sensors. Industries such as oil and gas; ports and transportation; commercial fishing; and aquaculture have recently started to utilize autonomous and remotely operated systems. Many industries are looking to expand their investments in these technologies.

Remotely operated vehicles (ROVs) are regularly used by the oil and gas industry. Examples include mapping of pipelines or inspecting wells and equipment. Autonomous underwater vehicles (AUVs) are being used for bathymetric data and sub-bottom profiling. The use of wave gliders has been on the rise as battery life and propulsion systems improve. There is potential for unmanned surface vehicles (USVs) to replace surface ships as relays for tethered ROVs and AUVs. Ports, harbors, and maritime transportation have benefited from unmanned technology and sensor development. Technology that can benefit ports and harbors includes unmanned systems for detecting, tracking, and assessing threats. Vehicle automation can advance maritime transportation to complete operations in environments that are geopolitically or environmentally hazardous.

The commercial fishing industry has recently started to utilize remotely operated technology. Fishermen often leverage the use of vessel monitoring systems mandated for compliance and enforcement in federal fisheries for safety and data collection. Fish trackers and unmanned aerial systems operate from vessels that help target schools of fish and look for potential bycatch issues are used by commercial fleets.

Robotic equipment in aquaculture can both increase production and reduce diver intervention for routine maintenance. Augmented reality technologies for diver operations can aid communication and improve efficiency underwater.

The Departments of Defense (DoD) and Homeland Security (DHS) are increasingly utilizing unmanned systems. The U.S. Navy operates the largest fleet of unmanned systems in the world from Stennis Space Center. The DHS Science and Technology Directorate recently selected Mississippi as the new base of operations for small unmanned aircraft systems.

Technology, Systems, and Systems Integration

Mississippi has significant assets for supporting UMS applications including government, industry, and university resources and expertise related to multi and hyperspectral, LIDAR, synthetic aperture radar (SAR), and other similar remote sensing sensor systems; image processing, data storage and processing; and decision support tools development and validation. The State and its federal partners have established both land and sea UAV flight zones within the state. Mississippi has prime sites along the Coast to manage operations of a large operational range encompassing multiple domains (air, water, space) requiring advances in:

- Development of inter-operational programs to address critical needs
- Processes for verification and validation of novel technologies leading to operational prototype (feedback to engineering)
- Valuation of data acquired through applications

Leading-edge technologies for big data analysis, on-board processing, artificial intelligence, machine learning, and cyber security in maritime technology and UMS markets are critical capabilities that should be developed in the State.

APPLICATIONS

Modern technological hardware is being designed as open and extensible platforms capable of acquiring accurate data almost anytime and anywhere. These hardware platforms have enormous application potential. The market for data about the physical world and about action occurring within the world is virtually limitless. UMS and other marine technologies are often primarily associated with data collection. The market for applications that transform that data into usable information holds the potential for tremendous economic growth.

Mississippi has three separate entities that co-exist on a continuum of moving basic engineering into the market place while closing the loop on market needs as a means of informing basic engineering and research: Mississippi Enterprise for Technology, National Oceans and Applications Research Center, and the Marine Industries Science and Technology Cluster. The Mississippi Enterprise for Technology (MSET) operates the Mississippi Technology Transfer Center—authorized by State statute and agreements with the Mississippi Development Authority and NASA—at Stennis Space Center. The Mississippi Technology Transfer Center houses many advanced technology companies specializing in fields such as engineering, aerospace, geospatial technology, defense solutions, environmental sciences, marine technology, energy innovation, and IT. MSET is committed to supporting existing industry and to establishing robust partnerships with new businesses to promote entrepreneurship and technology-based economic development within the State.

The National Oceans and Applications Research Center (NOARC) non-profit organization chartered by the State of Mississippi to grow UMS and marine technology companies in the State for ocean and coastal applications. To that end NOARC exists to leverage public and private capital resources, accelerate applications development through public/private partnerships, and leverage the UMS operational range for commercial and economic development.

The Marine Industries Science & Technology (MIST) Cluster is a regional group of organizations involved in the development and implementation of applied technologies for operating in, working around, and monitoring the marine and coastal environments. The MIST Cluster Program is where technology innovators come together with industry end-users to understand each other's capabilities and needs and collaborate to foster expanded business and address shared issues. The MIST Cluster Program provides services to Mississippi blue tech industries including helping government agencies and large businesses identify local companies that can assist them in meeting small business goals and to connect with the innovative culture within these small high-tech companies. The MIST Cluster serves as a repository and catalyst for understanding and advancing the Blue Economy in Mississippi.

Gaps:

Need for the development of a marketing plan to highlight the multiple sectors of marine technology and UMS development and application in Mississippi based on a broad view of the potential economic impact.

Need for trained accredited engineers in Mississippi to keep pace with computational needs, systems calibration, platform or vehicle validation, testing and advanced development needs of defense and non-defense industry should Mississippi serve as the nation's operational range and depot.

Need for a fully developed strategy to pull together existing critical investments. Three entities with linking missions that should function collaboratively and seamlessly are: NOARC as the State's lead program for application development, MSET as the State's lead agency for technology-based economic development, and MIST Cluster as the State's lead maritime technology cluster program.

ECONOMIC DEVELOPMENT

Business Retention and Expansion Program

A thorough and comprehensive business retention and expansion strategy will protect and grow Mississippi's existing ocean and maritime technology industries. Robust data on marine technology sectors need to be gathered using state of the art survey tools and methods. Innovative methods to identify Blue Economy and UMS companies may be necessary to combat the difficulties seen in using standardized classification codes. Additionally, industry surveys must include sectors not traditionally thought of as maritime specific. The initial target company list should consist of major players within the ocean/maritime industry, in addition to blue technology companies, and focus on the Navy's Task Force Ocean Focus Areas: Sensing and observation; modeling and prediction; application and decision aids; human capital and technical workforce.

Emerging Markets

There are a number of emerging markets associated with the Blue Economy sectors. Examples of these include the increased use of unmanned systems for ocean sensing and forecasting, including handling of increasingly large datasets and their real-time interpretation; large unmanned transportation; floating ports; and defense-related support. Enormous capacity exists within the State in federal and state agencies, and private organizations to support marine technology and UMS development and testing, evaluation, utilization, and maintenance. To be successful, continuous understanding of advances in select, Mississippi-relevant markets is needed. Coordination of efforts across all types of organizations to strategically push these markets forward is essential to effectively capitalize on developing opportunities.

Efforts to identify and foster the development of emerging Blue Economy markets need to be further developed and supported. Technology incubators and accelerators provide physical environments where early-stage companies can be co-located with subject matter experts and where innovative thinkers can collaborate. The process of technology commercialization requires knowledge and understanding of the applications and market for the innovation. In Mississippi, there is a wealth of technology being developed and used; however, there is little to support entrepreneurs in terms of funding (angel and venture), or for verification, validation, and modification of an invention. The process should encourage partnering among government, industry, higher education, non-profit and private sector entities to stimulate a strong network of technology and innovation.

Cluster Branding and Sales Plan

A well-structured and consistent communication strategy is a key component to the implementation of the OTF Master Plan. For a cluster management organization to stand out as a point of reference and be recognized for its unique assets, it must be well-branded and marketed. The marketing and branding strategy is a comprehensive process that begins with gathering and analyzing data, understanding assets, and clearly defining a strategic mission. After this process is completed, the Ocean Task Force can begin to develop a communication and branding strategy and identify tools to reach the target audience.

Gaps:

Need for a coastal region or state-wide business retention and expansion plan aimed at industries operating in the Blue Economy.

Need for a business incubator environment on the coast capable of supporting the engineering needs and expenses of small startup companies or emerging collaborative technologies.

Need for a marketing and targeting strategy. Despite effort being made to develop the MIST Cluster in Mississippi, there lacks a coherent message that quality of life, workforce training, collaborative engineering spaces and growth opportunities all exist in Mississippi.

POLICY AND ETHICS

Legal Environment

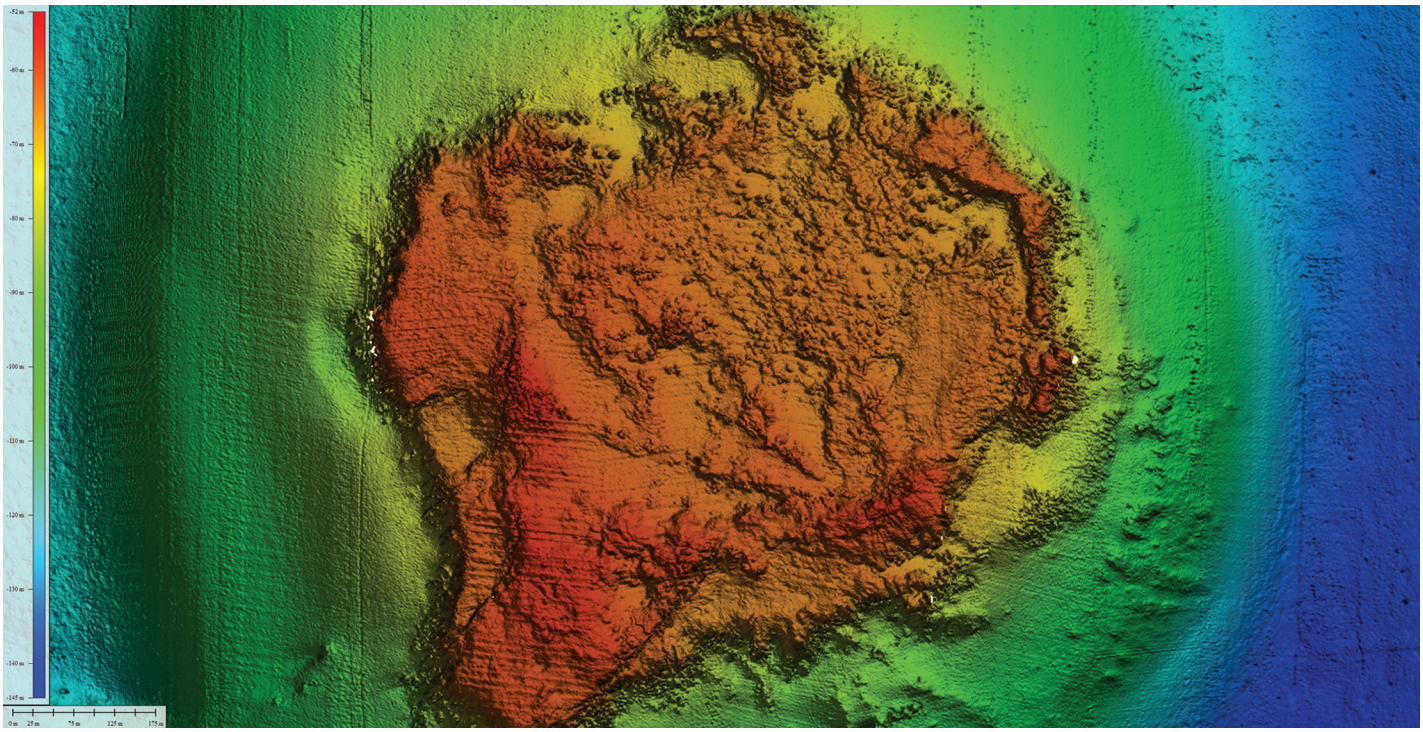
The legal and policy framework governing UMS activities is complex. On the federal level, more than 20 agencies administer over 140 laws affecting ocean waters and resources. In Mississippi, three state agencies (Mississippi Department of Marine Resources, Mississippi Secretary of State Office, and Mississippi Department of Environmental Quality) and associated Commissions implement a variety of coastal management and permitting programs. UMS activities occur in both state (0–3 nautical miles offshore) and federal waters (3–200 nautical miles offshore). Additional layers of legal complexity emerge as UMS seek interoperability across platforms and domains.

Consider, for instance, the complexity surrounding the necessary environmental reviews for an operational range. A review under the federal National Environmental Policy Act (NEPA) is required for any major federal action significantly affecting the quality of the environment. The NEPA review, which may include the preparation of an Environmental Assessment or Environmental Impact Statement, is handled by the federal agency controlling the project. Where multiple federal agencies are involved—for example, where a project needs permits from different agencies—the regulations require that a Lead Agency be designated to prepare and issue the NEPA document. Federal agencies are permitted to hire contractors to prepare the required environmental documents, but the documents must be reviewed and issued by the Lead Agency. Several federal agencies are in a position to be designated the lead agency, including the Navy, the U.S. Army Corps of Engineers, or the U.S. Coast Guard.

On the state level, the Mississippi Coastal Program has not been formally revised since 1988. The Mississippi Coastal Program was legislatively mandated in Section 57-15-6 of the Mississippi Code and approved by NOAA under the provisions of the Coastal Zone Management Act (CZMA) on September 29, 1980. Implementation of the Mississippi Coastal Program is the primary responsibility of the Office of Coastal Resources within the Mississippi Department of Marine Resources. Mississippi has submitted program changes to the NOAA Office of Coastal Management since the last revision, but the Mississippi Coastal Program document has not been updated and re-issued, making it difficult for the regulated community to assess applicability to proposed activities.

Additionally, certain assets and proposed activities bring with them additional regulatory policies and procedures as well as questions of oversight, ownership, and liability. Marine Technology and UMS assets must be clearly classified not only by use, but also by applicable regulations and other navigational rules. These may include the International Regulations for Preventing Collisions at Sea (COLREGS), as well as International Civil Aviation Organization (ICAO) flight procedures.

POLICY AND ETHICS



Ethical Environment

In an effort to enhance the moral connectivity of remote operators, the US Army developed The Human Dimension training concept, which posits the central importance of the moral, physical and cognitive components of the soldier in order to provide a balance to the tactile tools of war. The Human Dimension highlights the pre-eminent need for a human element for ethical decision making in the face of increasingly remote methods. Not only will future UMS training and education initiatives need to teach functional knowledge and advanced technologies, programs should include ethical considerations that prepare participants to confront multi-dimensional problems.

There are also public policy and ethical issues surrounding the increased use of UMS in the Gulf of Mexico. The waters of the Gulf of Mexico are home to a variety of public and private activities including oil and gas development, commercial fishing, recreational fishing and boating, and aquaculture. The proposed assets and activities could potentially negatively impact commercial fishing operations or state-sponsored projects such as shellfish aquaculture efforts and oyster mapping efforts in the western Mississippi Sound, so that impact must be considered.

Gap:

Need for a national resource center that can be used to assist Mississippi in developing a strategy that addresses existing or needed laws. The suite of state and federal laws that relate to marine technologies and UMS testing and application are expansive. The center would be a resource for ethical considerations of UMS development and applications. The center would also serve as a base of knowledge as various types of UMS are operated together.