

**OUR BLUE ECONOMY:
SUCCESSSES AND OPPORTUNITIES**

HEARING

BEFORE THE

**COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE**

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

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MARCH 27, 2019
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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

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OUR BLUE ECONOMY: SUCCESSSES AND OPPORTUNITIES

WEDNESDAY, MARCH 27, 2019

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 10 a.m. in room SD-G50, Dirksen Senate Office Building, Hon. Roger Wicker, Chairman of the Committee, presiding.

Present: Senators Wicker [presiding], Cruz, Blackburn, Cantwell, Blumenthal, Scott, and Peters.

OPENING STATEMENT OF HON. ROGER WICKER, U.S. SENATOR FROM MISSISSIPPI

Senator WICKER. This hearing of the Senate Committee on Commerce, Science, and Transportation will come to order.

This is our hearing on “Our Blue Economy: Successes and Opportunities.”

Glad to be here today with my colleague and friend, Ranking Member Cantwell, to discuss the topic of a Blue Economy. This is an issue that is vitally important to her state and my state and to the rest of the United States.

I’m particularly pleased to have this panel of witnesses today, including my dear friend of a number of decades, Governor Phil Bryant of Mississippi. He and I began our service together as state legislators back in the early 1990s. He has served as state auditor since then, lieutenant Governor, and as now in his eighth year as Governor of Mississippi. So, Phil, we are delighted to have you here and thank you for your public service.

We’re also joined by Mr. Scott Deal, President and CEO of Maverick Boats. Mr. Deal has not only built one of the premier boat companies in the world, he’s been recognized for his leadership in marine conservation efforts.

And also we welcome Mr. Michael Conathan, Executive Director of the Aspen Institute’s High Seas Initiative. He’s a former staff member of the Commerce Committee under our friend and former colleague, Senator Snowe.

The impact of the oceans on our economy is everywhere. In Mississippi, we move 25 million tons of goods through the Port of Gulfport every year and those goods end up throughout the Nation and the world. A hurricane that hits the Gulf Coast can have a crippling effect on energy prices, delayed freight, and economic damage throughout the country.

I recently spent two nights in Seattle, the home state of my colleague and Ranking Member, and it was wonderful and impressive to look out over the Puget Sound and see all of that commerce moving through there and it just continues to grow.

In the last Congress, my colleagues and I worked to grow the Blue Economy by leading the Modern Fish Act and the Commercial Engagement Through Ocean Technology Act or CENOTE, both of which were enacted into law and signed by the President.

Today, we will ask all of our witnesses to address what the Federal Government can do to ensure our Federal waters work for all sectors that use them.

Over the years, I've heard complaints from recreational fishermen about how they had been an afterthought for Federal fisheries managers. Our nation's fisheries law, the Magnuson-Stevens Act, was established to manage commercial fisheries. It's no surprise then that a management system designed for commercial activity did not work for recreational fishermen who want to spend more time on the water, not catch their quota as quickly as possible.

The Modern Fish Act requires the National Oceanic and Atmospheric Administration to be more responsive to the needs of our recreational fisheries. It allows for the use of additional management tools, like extraction rates, fishing, mortality rates, and harvest control rules.

We'll certainly be providing oversight to the Administration as they develop the ways to implement the Modern Fish Act.

I hope Mr. Deal will address the Modern Fish Act and other issues important to recreational fishermen in his testimony and responses to questions.

In addition, our oceans are woefully under-observed. That's why I've advocated for the strategic use of unmanned maritime systems. These systems are a cost-effective way to bring about a dramatic increase in the number of ocean observations NOAA obtains.

Unmanned maritime systems serve a valuable role when the mission is too dangerous, dull, or dirty for human crews. For example, knowing the water temperature below the surface is critical for predicting how quickly a hurricane will intensify. Getting these measurements is a job for unmanned systems.

The CENOTE Act encourages NOAA to think strategically and comprehensively about incorporating unmanned maritime systems.

I hope Governor Bryant and our other witnesses will address how we can harness marine technology, particularly when it comes to oceans, observations, and data collection.

Observations are also critically important for our Nation's increasingly busy ports where aging infrastructure and frequent changes in wind, tide level, and current make navigation a tricky business.

I'd like to hear from our witnesses about what the Federal Government can do to provide ports with real-time information on weather and tides and to support the efficient movement of freight.

We had some big successes last Congress and I can assure you this is a topic that is vitally interesting to this Chairman and this Ranking Member and we think there's more to do.

I look forward to working with Senator Cantwell and the rest of the members of this committee as we to continue to develop legislation to advance the Blue Economy in the 116th Congress.

So thank you to our witnesses, and I now turn to my friend and Ranking Member, Senator Cantwell, for her opening statement.

**STATEMENT OF HON. MARIA CANTWELL,
U.S. SENATOR FROM WASHINGTON**

Senator CANTWELL. Thank you, Mr. Chairman, and thank you again for visiting the Pacific Northwest and seeing how important the Blue Economy is in many complex ways.

Puget Sound is one of the busiest waterways in the Nation when you look at the amount of cargo, marine transportation system with our ferry system, and fishing and recreational activities. So it is a very busy waterway. So thank you for visiting.

Governor, very good to have you here before the Committee. I look forward to visiting your state very soon. We've been visited by many people already from your state who are very interested in going back to the continuation of the Amtrak service from New Orleans all the way across to Mobile and we want to continue to work with the Chairman on that issue and many others.

Mr. Conathan, very good to see you here again. Thank you for being here and for your work at the Aspen Institute and particularly for your global work on fisheries because I think that is a conversation we've had a little bit before the Committee and look forward to hearing your thoughts on that and some other specificity related to the U.S.

And, Mr. Deal, thank you for representing the maritime shipbuilding industry. I am very interested in what the United States can do to continue to build our naval architecture and technology framework in shipbuilding.

I think that the United States has many bright days ahead, particularly as we look at the opening of the Arctic as a way to move products and services to creating a shipbuilding fleet in the United States that can accommodate that. So I look forward to your comments.

The ocean represents not just a maritime industry but our culture and our heritage. The Blue Economy supports 69,000 jobs and indirectly supports a 191,000 jobs in the state of Washington. So it is a very big part of our economy. It includes shipbuilding, trade, transportation, fisheries, tourism, and, as I mentioned, recreation.

Our maritime economy is incredibly diverse, from the Ports of Seattle and Tacoma, which make up the fourth largest container gateway in North America, to the fifth generation shellfish growers at Hama Hama Oyster Company on Hood Canal. It's a pretty broad spectrum.

Obviously our Northwest tribes, which we have 29 tribes, are also very involved in the fishing fleet of our Nation. So it is my pleasure to work with the Chairman on the diverse set of maritime issues that come before this committee.

We must safeguard science-based fisheries management to protect fishing for generations to come and we need to restore habitats to support recreational and shellfish harvesting and tourism, so all of these are challenges every day.

Last Sunday marked the 30th Anniversary of the Exxon Valdez spill which resulted in 1,300 miles of pristine Alaska coastline being covered in oil. Billions of salmon eggs were destroyed and 30 years later, a stock of Pacific herring is nearly extinct. So we need to get these issues right and we need to continue to focus on protecting our environment.

Oil spills aren't the only threat to the Blue Economy. Commercial, recreational, and Alaska Native fishermen have joined outfitters, tourism businesses, and the large seafood industry to voice their concerns about the proposed Pebble Mine and its impact on the livelihood of their communities.

The Pebble Mine is a proposed large open pit mine in the headwaters of one of the most production salmon runs in the entire world. Half of the sockeye salmon on the planet comes from Bristol Bay. Last year, 60 million fish returned to Bristol Bay to support 14,000 jobs and yet the Administration is looking to fast forward a permit process for Pebble Mine which we think would reach very hazardous impacts if any kind of incident were to happen.

That's why I have supported calls to extend the public comment period for the Army Corps of Engineers impact statement and I've called for additional public hearings so that fishermen can have their voices heard. Unfortunately, those calls have been unanswered as of yet, but I hope that we will get the Administration to understand that it is not worth damaging future generations of salmon run to put an open-pit gold mine there.

The ocean economy also provides high-quality protein and countless riches and we need to continue, as I mentioned earlier, to do science-based management. My colleague mentioned the Magnuson-Stevens Act and I think the Pacific Northwest has probably done some of the best implementation of fisheries management in the entire world.

We need to continue to move forward but doing so means that we have to have good resources for stock assessment, which we need to make the investment in these things so that we can propose those opportunities for the future.

So I look forward to asking the witnesses questions on these important issues, Mr. Chairman, and thank you for scheduling this hearing.

Senator WICKER. Thank you very much, Senator Cantwell.

We will now begin with five-minute testimonies by our three witnesses. Your entire statements will be accepted into the record and we ask as close as possible for you to limit your opening statement to five minutes.

And I'm delighted to recognize Governor Bryant first.

**STATEMENT OF HON. PHIL BRYANT, GOVERNOR,
STATE OF MISSISSIPPI**

Mr. BRYANT. Thank you, Senator Wicker.

It is an honor to be here. I will do my best as a Governor to limit my comments to 5 minutes.

Senator Cantwell, thank you for having us. Ranking Member, I will join, I'm sure, Senator Wicker in inviting you to come to the beautiful Mississippi Gulf Coast and I will look forward to coming

back to your state. What a gorgeous state it is and how much I enjoyed my visits there.

So we will begin by saying it's an honor and pleasure to appear before the Senate Commerce Committee to discuss one of my favorite topics, the Blue Economy.

According to the Center for the Blue Economy, the term has three related and distinct meanings. First, the overall contribution of the oceans to the economics of the world; second, the need to address the environmental and ecological sustainability of the oceans; and, finally, the ocean economy's growing opportunity for developed and developing nations.

On the Mississippi Gulf Coast, we have embraced the Blue Economy with all our energy and ingenuity. Above all other concerns, we care about our land, our air, and our water. They're a part of our heritage and a part of our community.

Mississippians live, work, play, and learn on the beautiful waters of the Mississippi Gulf Coast. The finest seafood in the world comes from these waters. This industry provides thousands of jobs along with high-quality and delicious fish, shrimp, and oysters.

We work with the inspectors of the National Oceanic and Atmospheric Administration Seafood Inspection Services to ensure the safety and high quality of the seafood industry. We continue to grow this industry through research, innovation, and conservation practices.

For example, the Mississippi Oyster Council was formed in 2015. It has provided a detailed plan to reach our goal of a million sacks a year. The work of the Mississippi Department of Marine Resources enhances the opportunity to protect and grow the seafood industry in collaboration with our Federal partners in Congress, NOAA, U.S. Fish and Wildlife, and the White House.

Shipbuilding has long been a part of the Blue Economy on the Mississippi Gulf Coast. For 80 years, Huntington Ingalls has supplied the U.S. Navy and our allies with the most advanced warships in the world.

Nearly 12,000 employees now work in the shipyard of the future in Pascagoula, Mississippi. Hundreds more work at VT Halter Marine and U.S. Marine, Incorporated. We like to say in Mississippi that if it floats and fights, more than likely it was built on the Gulf Coast.

The Port of Gulfport, Port of Pascagoula, and Port of Bienville open the Gulf Coast and Mississippi to the world. These deepwater ports in Jackson and Harrison County continue to help increase exports by 259 percent in just the last 10 years.

The Port of Gulfport, which was totally destroyed by Hurricane Katrina on August 29, 2005, has been completely restored and reopened officially in December 2018. It has been designated as a strategic seaport by the U.S. Department of Defense and is currently the third busiest container port in the Gulf of Mexico. The \$570 million restoration after Katrina has been closely monitored by HUD since its conception.

The port has met and exceeded all requirements and we believe it is a model of efficiency for future restoration projects. The port also houses the University of Southern Mississippi's Marine Re-

source Center and plans to construct an ocean enterprise center in conjunction with the U.S. Navy and NOAA.

These plans are currently underway in order to meet the requirements of the CENOTE Act. As you know, the Act encourages NOAA to partner with the Secretary of Navy on unmanned maritime systems technology. At the Port of Gulfport, we have engaged private, academic, and public sectors to achieve this goal.

Keesler Air Force Base, located in the City of Biloxi, is headquarters to the 2nd Air Force, the 81st Training Wing of Air Education, the training command of 403 Wing of the Air Force Reserve, and the 85th Engineering Installation Squadron.

Since 1941, Keesler has trained some of the finest pilots in the Air Force, to include the Tuskegee Airmen. Today, the base is home to 11,000 civilian and military personnel who serve in a variety of duties, including the 53rd Weather Reconnaissance Squadron, known affectionately to us as “The Hurricane Hunters.”

Now I like to describe the Blue Economy as being the top of the sky to the bottom of the ocean. No one knows the sky better than NASA. The John S. Stennis Space Center in Hancock County, Mississippi, has tested the propulsion systems for every spacecraft since Apollo.

Today, SpaceX and Aerojet Rocketdyne test their deep space propulsion systems at Stennis Space Center in Hancock County. Man may go to Mars 1 day and return safely to earth, but he’s going to have to pass through Hancock County to get there.

Mr. Chairman, my limited time will not allow me to present all the exciting projects and benefits of the Blue Economy. If time permitted, I would be delighted to tell you about a world-class aquarium now under construction in Gulfport or the creation of the National Oceanographic Application Research Center, how we’re restoring the Gulf after the disaster of the Deepwater Horizon oil spill, and funding from the RESTORE Act has saved hundreds of miles of living shoreline and marine life and the habitats and their habitats along the Mississippi Gulf Coast.

I would brag on the Naval Construction Battalion Center in Gulfport and the great work of the two Coast Guard stations in Gulfport and Pascagoula, but it seems I’ve run out of time.

I’m extremely grateful to speak before you today and look forward to my fellow presenters’ statements and answering any questions you may have, and I request, Mr. Chairman, that you include the following two reports into the record, the Mississippi Defense Initiative Strategic Plan and the Ocean Task Force Report.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Bryant follows:]

PREPARED STATEMENT OF HON. PHIL BRYANT, GOVERNOR, STATE OF MISSISSIPPI

Blue Economy

Thank you, Senator Wicker. It is an honor and pleasure to appear before the Senate commerce committee to discuss one of my favorite topics, the Blue Economy.

According to the Center for the Blue Economy, the term has three related but distinct meanings: first, the overall contribution of the oceans to economics; second, the need to address the environmental and ecological sustainability of the oceans; and finally, the ocean economy as a growth opportunity for developed and developing

countries.¹ On the Mississippi Gulf Coast, we have embraced the Blue Economy with all our energy and ingenuity. Above all other concerns, we care about our land, air and water. They are part of our heritage and community. Mississippians live, work, play and learn on the beautiful waters of the Gulf Coast. The finest seafood in the world comes from these waters. This industry provides thousands of jobs² along with high quality and delicious fish, shrimp and oysters. We work with the inspectors at the National Oceanic and Atmospheric Administration's (NOAA) Seafood Inspection Services to ensure the safety and high standards of the seafood industry.³

We continue to grow this industry through research, innovation and conservation practices. For example, the Mississippi Oyster Council, formed in 2015,⁴ has provided a detailed plan to reach our goal of a million sacks a year.⁵ The work of the Mississippi Department of Marine Resources enhances the opportunity to protect and grow the seafood industry in collaboration with our Federal partners in Congress, NOAA, U.S. Fish and Wildlife and The White House.

Shipbuilding has long been a strong part of the Blue Economy on the Mississippi Gulf Coast. For over 80 years, Huntington-Ingalls has supplied the U.S. Navy and our allies with the most advanced warships in the world.⁶ Nearly 12,000 employees now work at the shipyard of the future in Pascagoula, Mississippi.⁷ Hundreds more work at V.T. Halter Marine and U.S. Marine.⁸ We like to say, "if it floats and fights," it more than likely was built in Mississippi.

The Port of Gulfport, Port of Pascagoula and Port Bienville open the Gulf Coast and Mississippi to the world. The deepwater ports in Jackson and Harrison counties have helped increase exports by 259 percent in the last ten years.⁹ The Port of Gulfport, which was totally destroyed by Hurricane Katrina on August 29, 2005, has been completely restored and re-opened officially in December of 2018.¹⁰ It has been designated as a strategic seaport by the U.S. Department of Defense¹¹ and is currently the third busiest container port in the Gulf of Mexico.¹² The \$570 million restoration since Katrina has been closely monitored by H.U.D. since its conception.¹³ The port has met and exceeds all requirements, and we believe is a model of efficiency for future restoration projects. The port also houses the University of Southern Mississippi Marine Research Center, and plans to construct an Ocean Enterprise Center, in conjunction with the U.S. Navy and NOAA, are currently underway in order to meet the requirements of the CENOTE Act (Commercial Engagement Through Ocean Technology Act of 2018). As you know, the Act encourages NOAA to partner with the secretary of the Navy on unmanned maritime systems technology. At the Port of Gulfport, we have engaged private, academic and public sectors to achieve this goal.

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I like to describe the Blue Economy as the top of the sky to the bottom of the ocean. No one knows the sky like NASA. The John C. Stennis Space Center in Hancock County, Mississippi, has tested the propulsion systems for every spacecraft

¹<https://www.middlebury.edu/institute/academics/centers-initiatives/center-blue-economy/about/history>

²<http://coastal.msstate.edu/economic-impact-seafood-mississippi>

³<https://www.fisheries.noaa.gov/node/9736>

⁴<http://www.dmr.state.ms.us/index.php/aquaculture-home/oyster-council>

⁵<http://www.dmr.state.ms.us/images/dmr/Oyster-Council-report-final.pdf>

⁶<https://ingalls.huntingtoningalls.com/who-we-are/>

⁷<https://ingalls.huntingtoningalls.com/who-we-are/>

⁸<https://www.linkedin.com/company/vt-halter-marine/>

⁹MDA Powerpoint and Tammy Craft e-mail 12/4/18

¹⁰Jonathan Daniels e-mail 1/4/19

¹¹<http://shipmspa.com/port-of-gulfport-receives-strategic-seaport-designation/>

¹²<https://www.ms.gov/node/321>

¹³<http://shipmspa.com/restoration-celebration-ceremony/>

¹⁴<https://www.keesler.af.mil/Units/>

¹⁵<http://www.keesler.af.mil/shared/media/document/AFD-090203-089.pdf>

¹⁶Mississippi Defense Initiative Strategic Plan 2019-2023

¹⁷<https://www.403wg.afrc.af.mil/About/Fact-Sheets/Display/Article/192529/53rd-weather-reconnaissance-squadron-hurricane-hunters/>

since Apollo.¹⁸ Today, Space-X and Aerojet Rocketdyne test their deep space propulsion system at Stennis Space Center.¹⁹ Man may go to Mars one day and return safely to earth, but he will have to pass through Hancock County to get there.

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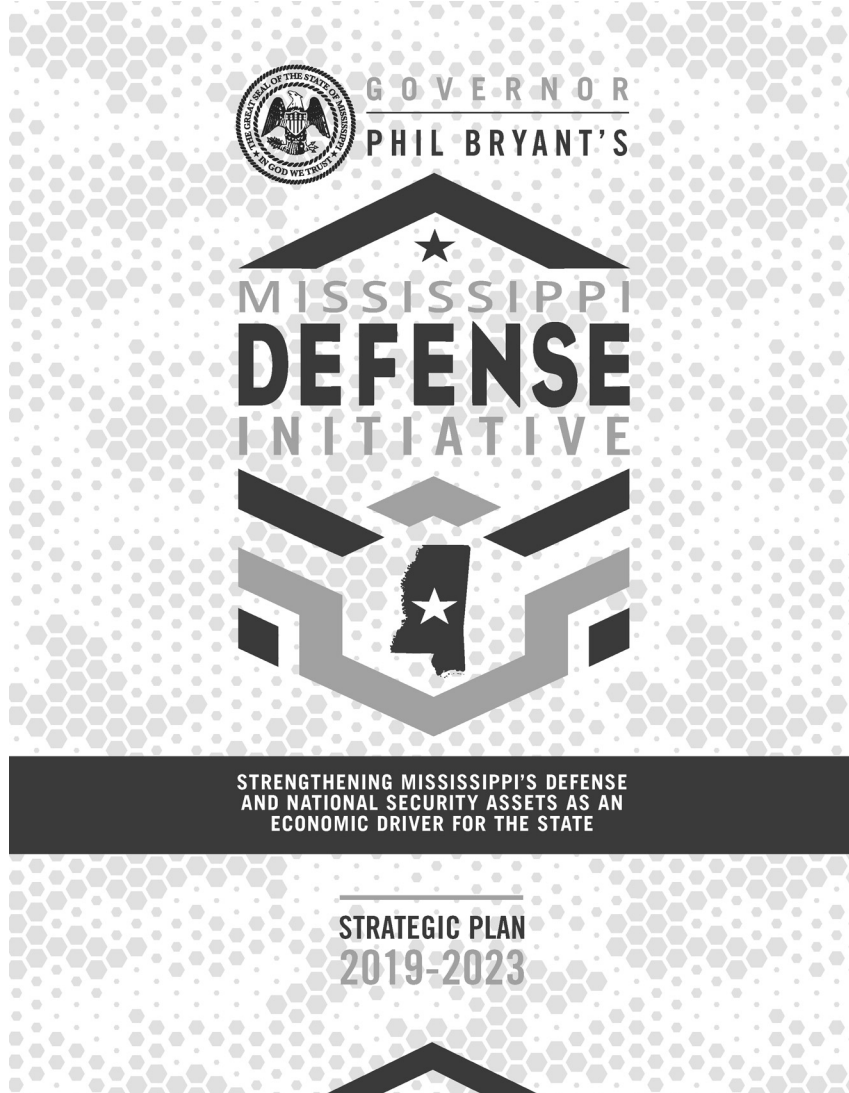
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I am extremely grateful to speak before you today and look forward to my fellow presenters' statements and answering any questions you may have. Thank you.

Senator WICKER. Without objection, they'll be received.
[The information referred to follows:]

¹⁸ <https://www.space.com/39498-stennis-space-center.html>

¹⁹ <https://aviationweek.com/awin/rolls-royce-selected-nasas-john-c-stennis-space-center-mississippi> and <http://www.wlox.com/story/23768172/spacex-signs-agreement-with-stennis-space-center/> and <http://www.rocket.com/article/aerojet-rocketdyne-announces-expansion-nasas-stennis-space-center-mississippi>





STRATEGIC PLAN
2019-2023



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The Mississippi Defense Initiative is a statewide effort to establish priorities that align with the United States Department of Defense's National Defense Strategy. This unclassified document is a summary of the overarching goals and objectives to best position Mississippi to compete for defense-related business and provide support for DoD's priorities for 2019-2023.

Department of Defense National Defense Strategy—Build a More Lethal Force

“We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment. ... The 2018 National Defense Strategy underpins our planned fiscal year 2019-2023 budgets, accelerating our modernization programs and diverting additional resources in a sustained effort to solidify our competitive advantage.”

— Secretary of Defense James Mattis

OUR MISSION



This Mississippi Defense Initiative will protect, grow, and diversify defense and national security assets as an economic driver for the state.

By strengthening relationships among military, government, education and private-sector partnerships, this comprehensive and actionable master plan will align efforts in:

- Strengthening the defense industry for existing and prospective contractors
- Leveraging public-private partnerships to maximize military assets
- Growing an advanced and technically skilled workforce
- Expanding research and development collaborations
- Enhancing quality of life for military communities
- Supporting procurement of military readiness

This state plan aligns with the 2017 Charting the Future of Mississippi's Ocean Technology Economy Report, which was developed to be a comprehensive maritime economic development master plan. It focused on increasing the state's maritime economy and the strategic relationship between the military and the state's assets along the Mississippi Gulf Coast.

02

MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

INTRODUCTION

Tens of thousands of our sons and daughters have fought for freedom. Our citizens take sheets of metal and craft them into the powerful Navy ships to carry sailors across the high seas; we prepare soldiers for hostile conflicts in arid deserts and dense forests; and we teach pilots how to take control of the skies over those who would do freedom harm.

But there is so much more. Mississippi is at the forefront of research into unmanned aerial, underwater vehicles; we test powerful jet engines. We conduct cutting-edge experiments at research facilities and universities across our state. Our communities welcome and embrace the soldiers, sailors and airmen who live among us — even if for a few months. We want to choose Mississippi as their home after their service. And, private-sector businesses that supply the Armed Forces are often some of our most prized employers and corporate citizens.

The Military is one of Mississippi's most unifying themes in our State's history. Through war and peace, Mississippians of all political stripe and race support the Army, Navy, Air Force, Marines and Coast Guard.

Now we are charged with asking ourselves, our communities and our partners in the military some key questions: How can we expand upon and diversify this historic support of the U.S. Armed Forces? How can we ensure our bases are renewed and needed? How can we foster a business climate for private-sector military contractors and suppliers? How can our federal research laboratories and research universities work hand-in-hand to grow clusters of technology?

This defense initiative plan was created with a two-fold mission: first, to grow the defense industry's presence in Mississippi and second, to ensure Mississippi is fulfilling its role in helping leverage military assets in

alignment with the National Defense Strategy. This report is designed to inform decision-makers and leaders of the state as to how the defense industry within Mississippi can be supported for growth. It also defines a continuous process of assessing stakeholders to review, refine and improve the state's ability to compete in the national defense economy. Each strategic goal is a key driver that will require unified actionable objectives and tasks through programs, partnerships, or initiatives to fully accomplish the state's full potential. Each goal is also juxtaposed by opportunities for improvement within their own individual scope.

The plan was developed by the Governor's Defense Task Force created in May 2018, and consisting of representatives from public, private, and governmental entities whose collective expertise and experience provided depth and richness on how to strengthen the state's defense ecosystem. The Defense Task Force assessed how the defense industry impacts the state economically and how this impact could grow to increasingly provide Mississippians with opportunities for good jobs and improved quality of life. Nine strategic goals with supporting objectives were defined along with supporting information regarding the anatomy of defense in Mississippi. Collectively, the goals and objectives provide a holistic plan to improve Mississippi's long-term defense strategy.

03

MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

SUMMARY OF GOALS

- **Goal 1.** Formalize its commitment by establishing a coordinating body to guide, monitor, disseminate information, and facilitate policy recommendations for Mississippi's defense economy.
- **Goal 2.** Improve its real and perceived quality-of-life to better motivate military personnel and their families to want to live and work in Mississippi, and to win new defense industry investments.
- **Goal 3.** Be the premier state for defense business and industry through economic development attraction and retention.
- **Goal 4.** Leverage interconnected networks of physical infrastructure and defense assets to aid in lowering defense costs and enhancing the lethality of the warfighter.
- **Goal 5.** Aid in encroachment planning and implementation for compatible community development for areas located near military installations.
- **Goal 6.** Be an international center of excellence for unmanned and autonomous land, aerial and aquatic systems.
- **Goal 7.** Attract and retain workforce talent to support defense employers and military careers.
- **Goal 8.** Encourage further expansion of joint training missions as an economic development engine within the state.
- **Goal 9.** Foster a healthy innovation base that includes traditional and non-traditional partners in support of defense modernization.

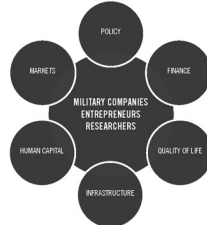
04

MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

GOAL 1. Mississippi will formalize its commitment by establishing a coordinating body to guide, monitor, disseminate information, and facilitate policy recommendations for Mississippi's defense economy.

This state plan will position Mississippi to be proactive in addressing defense-related opportunities and challenges in: policy, finance, quality of life, support services, human capital, and markets. The defense industrial base is not only the backbone of United States military technical advantage, but it is also a major contributor to the national economy, accounting for 9% of employment, 12% of Gross Domestic Product, 60% of exports, 55% of patents, and 70% of U.S. Research & Development. Mississippi's defense economy is comprised of a loosely interconnected network of military installations, military missions, private companies, small business, education providers and research and development groups. A more formalized mechanism of bringing these entities together offers potential to grow investments, jobs, and businesses through diversification of the state's defense assets into new markets, research and development, technologies and military support opportunities.

MISSISSIPPI DEFENSE ECOSYSTEM



05

MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

- OBJECTIVE 1A.** Establish a coordinating body to build a robust network of military, government and public/private stakeholders in achieving the state's vision for Mississippi and the military. Its mission would align with best practices with the following characteristics:
1. Dedicated staff focused on the defense economy,
 2. Broad engagement/involvement at the local and state level by elected officials, business leaders, and key stakeholders,
 3. Visible and active engagement at the national level with DoD and Congress,
 4. Partnerships to promote installation efficiency and enhance missions, and
 5. Comprehensive strategic missions.

Identify the relationships among the key participants in the strategic management plan of the statewide organization, recognizing the need for a military commanders' council, military community council (for economic development), research and educational consortium, and a defense community working group (for land use planning/Joint Land Use Study (JLUS) implementation and encroachment mitigation).

- OBJECTIVE 1B.** Develop promotional material on Mississippi's defense economy that can be used within the DoD, for economic development efforts, and to promote quality of life.

- OBJECTIVE 1C.** Define the areas of responsibility that the state entity will assume in developing a strong, robust military industry; to gather research and disseminate information; to educate and guide policy-making; and, to facilitate and expedite plans, projects and investments for advancement of the military installations and related industries in Mississippi.

- Survey military members living in Mississippi to identify important quality-of-life factors that must be addressed and to develop targeted messaging and collateral materials.
- Leverage military bases for economic development attraction and retention of businesses.
- Host regular base commanders' meetings that incorporate economic developers from defense communities.
- Benchmark best practices of other military bases and facilities around the country and in Mississippi that have a successful track record of supporting and leveraging its bases.
- Identify federal, state policy and/or regulatory hurdles that hinder a base's ability to work with communities to attract business.

- OBJECTIVE 1D.** Establish a justification plan for the state's overarching defense economic development strategies to provide to state policy makers.

- OBJECTIVE 1E.** Formalize the relationship between the coordinating body and Mississippi Development Authority to target defense business and industry attraction and retention.

06

MISSISSIPPI DEFENSE INITIATIVE ■ THE 2016 PLAN 2016-2020

GOAL 2.

Mississippi will improve its real and perceived quality-of-life to better motivate military personnel and their families to want to live and work in Mississippi, and to win new defense industry investments.

As a state, having real and perceived good quality-of-life (QOL) for military families within the public and private sectors leads to a more prosperous defense industry and a better Mississippi economy. For Mississippi to be competitive in attracting and retaining military personnel and their families, as well as winning new defense investments, we must excel in QOL measures such as, but not limited to, quality of schools, spousal employment, employment licensing, housing and daycare.



Military families are more vulnerable to QOL challenges than the average family due to frequent relocations and barriers that exist when transitioning from one state to another. Mississippi needs to reduce barriers that restrict good QOL, strive to alter any negative perceptions currently existing around Mississippi's QOL, and consistently re-evaluate QOL measures in the future in order to be innovative and pro-active in its efforts.

Factors cited frequently by military families as a drawback for military service include military dependent's difficulty assimilating into local school systems and the ability of spouses to obtain jobs and sustain careers. These two predominant QOL measures—public education and spousal employment—are top priorities being addressed by Mississippi. Addressing these can position Mississippi to be the state of choice for residence. According to the U.S. Department of Defense Education Activity, more than half of the children in military families are of school age, and more than 75% of them attend public schools. Thus, public education is a high-level factor for many military families. Although spousal licensure as a barrier to employment was addressed in previous Mississippi legislation, more emphasis needs to be placed on it.

07

MISSISSIPPI DEFENSE INITIATIVE ■ THE 2016 PLAN 2016-2020



- OBJECTIVE 2A.** Create a statewide system for measuring, monitoring and comparing QOL indicators and adopt a marketing strategy for promoting a positive QOL in Mississippi (See Appendix A).
- Undertake a periodic on-base assessment of QOL for military families to capture success stories for best practices, as well as to identify unmet needs, using a structured methodology that can be replicated statewide and on a defined frequency of recurrence.

- OBJECTIVE 2B.** Facilitate QOL related to military student transfer into a school district and recognize school districts that place high emphasis on the importance of military families.

- Enact an MS Code section 37-15-29 to commission to other successful state programs allowing for school choice for active-duty and civilian defense personnel regardless of whether they live on a military base, adopt best practices in school choice that allows Mississippi to be competitive with other states.
- Place emphasis on children of military families enrolling in education by removing relocation barriers. Encourage Mississippi Department of Education, Mississippi High School Athletic Association and Mississippi Association of Independent Schools to adopt policies allowing children of military families to participate in school activities and athletics without delay upon transfer into a Mississippi school. Encourage those same entities to adopt curriculum alignment strategies for student coursework completed

outside of Mississippi for credit when students transfer into Mississippi. Develop online options for courses unique to Mississippi and required for successful graduation that a student transferring in may not have completed.

- Identify and promote the use of pilot programs with school districts associated with military installations to improve ratings for underperforming districts to serve as a blueprint for improving underperforming districts statewide.
- Identify and promote best practices in home-schooling programs to incoming military families to Mississippi who are seeking education provider alternatives.

- OBJECTIVE 2C.** Expedite the licensing and credentialing process in accordance with MS Code 173-50-1 (2014).
- Recognize and promote best practices for expedited processes.
 - Eliminate employment barriers for transitioning military personnel and their families.

- OBJECTIVE 2D.** Align college tuition benefit packages targeted for military personnel and their families to compete with or exceed beyond other states, particularly for education, high-wage career opportunities.

- OBJECTIVE 2E.** Assess child care resources on and close to each base to maximize spousal employment opportunities; develop plan with actionable steps to address child care facility/efficiency shortfalls where needed.

08

MISSISSIPPI DEFENSE INITIATIVE ■ THE 2016 PLAN 2016-2020

GOAL 3.

Mississippi will be the premier state for defense business and industry through economic development attraction and retention.

In 2016, defense spending was \$4.7 billion, ranking Mississippi 26th in the nation (See Appendix A). In 2017, 450 defense companies located in Mississippi received DoD contracts in 2017 (source: USASpending.gov). Across the nation, military bases are collaborating with local communities on cyber security, national security training, renewable energy, and commercial development, aerospace, including unmanned autonomous systems, logistics, and technology industries. These initiatives not only benefit the military, but the military community through increased economic development opportunities.

A 2016, Federal Executive Order 13806 called for the establishment of a Federal Interagency Task Force to conduct a comprehensive assessment of the defense industrial base and to develop a set of specific, actionable recommendations to mitigate or eliminate the identified impacts. The Task Force assessed nine traditional and seven cross-sectoral industry sectors and identified challenges that need to be addressed in four broad categories: investment, policy, regulation, and legislation. Mississippi's defense industrial base will influence or be influenced by decisions in these four areas. It is therefore imperative that this state plan help position Mississippi to be responsive to the needs of the defense industrial base.

- Mississippi is a pro-business state offering advantages for defense-related business including:
- Right-to-Work State
 - Jobs Tax Credit – available to certain businesses such as manufacturing, warehousing, distribution, and others. Qualification is made by Mississippi A. Development Authority
 - Veteran Employee Credit – available to any industry that hires veterans

- Manufacturing Investment Tax Credit—available to manufacturers
- Research and Development Skills Credit—available to any industry which adds research and development jobs
- Historic 1987 Advocating Highways for Economic Advancement and Development (A.H.E.A.D.) that linked every Mississippiian within 30 miles or 30 minutes access to a four-lane highway.

PUBLIC-PUBLIC AND PUBLIC-PRIVATE PARTNERSHIPS Private & Public-Private Partnerships (PP) are contractual agreements between two or more public and private entities and are defined by a long-term relationship that includes shared resources, shared risks and shared benefits (See Appendix C). They take many forms but essentially include risk sharing as a principle linkage. Mississippi has success or emerging examples of public-private partnership initiatives including:

- A Partnership Incentivization Agreement (PIA) in Vicksburg for technology transfer
- Joint-Use Agreement (JUA) between Keesler Air Force Base and Clinton International Airport for military training operations
- Gifting of the Keesler Gate rehabilitation with state funding
- Realistic Military Training (RMT) agreements with Marine Corps Special Operations Command MARSOC and Navy Special Warfare for use of airport and port infrastructure
- Mississippi Enterprise for Technology Incubator for technology including defense technologies, at John C. Stennis Space Center
- Alliance for System Quality of Unmanned Aerial Systems (UAS) through Research Excellence (ASURE)

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MISSISSIPPI DEFENSE INITIATIVE ■ THE 2016 PLAN 2016-2020

The following objectives address legislative actions, international needs, and planning that must be accomplished to improve the competitiveness and connectivity of Mississippi for the defense economy.

- **OBJECTIVE 3A** Develop a comprehensive business retention and expansion program to identify and grow key value propositions associated with defense industry segments that would find Mississippi attractive, including, but not limited to:
 - Foreign military sales
 - Blue economy innovations
 - Land-based combat systems
 - Cybersecurity
 - Unmanned systems
 - Aerospace
 - Advanced materials
 - Joint military training missions
 - Space force
- **OBJECTIVE 3B** Create a robust marketing and corporate attraction campaign to promote Mississippi's advantages to the key segments and companies.
 - Focus the campaign at the regional or local level within the state to take advantage of the better than state average numbers.
 - Market the physical infrastructure's connectivity as a competitive advantage for Mississippi.
 - Work with local economic developers to implement the campaign.
- **OBJECTIVE 3C** Identify state law and programs that enhance a community's opportunity to partner with military bases to attract business.
 - Evaluate Mississippi port competitiveness as compared to other ports. This could include, but is not limited to, evaluating feasibility of amending Mississippi Code 27-7-2(2)(3) to add income tax credits for railroad switching fees.
 - State-owned Military Facility/Commander CDRs need authority to do:
 - Economic Development in support of quality of life
 - Enter into Public-Private Partnerships
 - Local Community Leaders need authority to start up "Defense Initiative Zones" to encourage economic development around military facilities.
- **OBJECTIVE 3D** Utilize the strategic Port of Gulfport to be an enticement for foreign military sales. Fully leverage the benefits of public-private partnerships.
 - Support the completion of an Interstate 10 connector from the Port of Gulfport to finalize previous investments and long-term commitments through the use of a local community cooperative planning strategy.

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MISSISSIPPI DEFENSE INITIATIVE • STRATEGIC PLAN 2019-2025

GOAL 4. Mississippi will leverage interconnected networks of physical infrastructure and defense assets to aid in lowering defense costs and enhancing the lethality of the warfighter.

The U.S. Department of Defense has challenged military bases in the United States to move toward innovative public-private partnerships between military and civilian communities. Accordingly, there are directives for the Installation Management Community to seek innovative, timely, and creative ways to operate. Installations are DoD's platforms for readiness, providing the mission and training areas, facilities, and infrastructure that prepare the military for its ultimate challenges. Guidance has been issued urging bases to consider entering into intergovernmental support agreements (IGSAs) with host communities as a way of saving money, providing quality services and forging closer ties with their civilian neighbors.

PHYSICAL INFRASTRUCTURE ASSETS

Mississippi can play a significant role in lowering DoD's \$150 billion operations and maintenance expenses while addressing the logistics challenges impacting the military's readiness. Mississippi's logistic physical infrastructure is a competitive advantage in having a Defense Logistics Agency Distribution Center located within five miles of the Port of Gulfport, Gulfport-Biloxi International Airport, railway and interstate accessibility.

The 2018 National Defense Strategy is prioritizing budget-discipline investments in resilient and agile logistics infrastructure consisting of prepositioned forward stocks and munitions, strategic mobility assets, partner and allied support, as well as non-commercially dependent distributed logistics and maintenance to ensure logistics sustainment.

*Additional examples of infrastructure assets are provided in Appendix D.

**A list of military installations and assets are provided in Appendix E.

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- **OBJECTIVE 4A** Be the leading state for new Pentagon base-employment initiatives, such as the new Defense Community Infrastructure Program.
 - Maintain a prioritized inventory of each base's infrastructure needs and important projects for federal and state policymakers.
 - Identify off-base infrastructure needs (using the Joint Land Use Study) critical to support the mission of the base. To be included in the statewide ranking.
- **OBJECTIVE 4B** Emphasize and market the state's key infrastructure and assets that allow for support of Department of Defense in providing a rapid, cost-effective and efficient mobilization and deployment of soldiers and equipment. Continuously engage and communicate these assets to key defense decision makers like United States Transportation Command (JSTRANZCOM), United States Maritime Administration (MARAD) and other key leaders in DoD.
- **OBJECTIVE 4C** Assist in the analysis of data from previous military deployments using multi-modal transportation methods.
- **OBJECTIVE 4D** Identify gaps in and address key elements of state military installations that provide value-added capabilities for training missions, mobilizing units, and economic development opportunities.
- **OBJECTIVE 4E** Exploit and grow the state's extensive maintenance and repair capabilities for mission support.
- **OBJECTIVE 4F** Develop a comprehensive freight rail and port plan addressing defense-related transportation needs for connectivity, capacity and integration with other modes of transportation.
- **OBJECTIVE 4G** Encourage the use of Enhanced Use Leases (EUL) agreements as a mechanism for site construction or renovation of underutilized federal properties through leasing options by private-sector partners.
 - Recognize the importance of EUL agreement of Dennis Space Center in allowing better utilization of available capacity for rocket engine test stands. Create a model for partnerships with commercial entities in testing innovative solutions through rocket engine testing.

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MISSISSIPPI DEFENSE INITIATIVE • STRATEGIC PLAN 2019-2025

GOAL 5. Mississippi will aid in encroachment planning and implementation for compatible community development for areas located near military installations.

Military installations across the nation were traditionally located in remote areas, due largely to the availability of land and for security purposes. Over time, however, many installations drew both people and businesses closer to take advantage of civilian job opportunities the installation offered and to provide the goods and services to support the installation's operations. Mississippi can utilize federal assistance programs to undertake land and air encroachment planning programs to protect and preserve military readiness and defense capabilities while supporting continued community growth and economic development. The increased number of people and businesses, in some cases, has impacted the military's ability to effectively train and accomplish the military mission.

- **OBJECTIVE 5A** Create a joint land-use planning defense community working group to plan for targeted encroachment issues that are documented by a collaborative planning process, a JLU or base encroachment plan adopted by the impacted community, with input of a Military Commander's Council and the Governor's staff.
- **OBJECTIVE 5B** Provide guidance and assistance in examining encroachment issues that may require a ruling or clarification of state policy, a revision to state regulations or policy, or mediation to resolve an issue critical to a military mission.
- **OBJECTIVE 5C** Identify funding mechanisms for implementation of measurable outcomes to reduce or eliminate encroachment for communities and counties without a comprehensive plan but with an active military installation to develop a joint land use study or military encroachment mitigation plan.

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MISSISSIPPI DEFENSE INITIATIVE • STRATEGIC PLAN 2019-2025

GOAL 6. Mississippi will be an international center of excellence for unmanned and autonomous land, aerial and aquatic systems.

Mississippi is well positioned as an established national leader in unmanned systems and autonomous technologies in being competitive for defense industry growth in autonomous technology given the abundance of air, land and aquatic space for research and development of unmanned systems. Much research and development still needs to be conducted within unmanned aerial and aquatic systems. Mississippi has an opportunity to truly excel within this defense space because of the assets that already exist within the state and the potential for expanding capabilities and bridging partnerships within the public and private defense sectors. Mississippi's innovative expansion within the unmanned technology realm will create diversification opportunities within the state's defense industry.

OBJECTIVE 6A Promote a unified effort across the state for autonomous vehicle efforts.

- Host periodic planning meetings to encourage business-to-business, business-to-academia, and business-to-government interactions.
- Evaluate if demand is enough to make the case for air space utilization in Mississippi.
- Support the Governor's Ocean Task Force in advancements in unmanned aquatic and maritime systems.

OBJECTIVE 6B Identify and alleviate export controls that limit foreign transposition in unmanned systems.

OBJECTIVE 6C Establish marketing materials that highlight existing capabilities that support unmanned system operations.

- Evaluate the value proposition of available land, aquatic and aerial assets, unmanned systems testing and use.

OBJECTIVE 6D Evaluate the feasibility of expanding airspace for Unmanned Aircraft Systems (UAS) operations in order to facilitate the growth of non-military testing in Mississippi, and to link the entire unmanned aerial community.

- Determine the economic value of establishing increasing Mississippi's already substantial airspace to better support UAS operations across the state.
- Expand Mississippi's education and outreach programs to the state's airports on the value of supporting safe and integrated UAS operations.
- Expand opportunities afforded by the Commercial Engagement through Ocean Technology (CENOTE) Act.

GOAL 7. Mississippi will attract and retain workforce talent to support defense employers and military careers.

The availability of a well-trained workforce is a national issue, and Mississippi is not alone in trying to find ways to supply a trained-and-ready workforce for its industries.

HIGH-DEMAND, HIGH-PAYING DEFENSE AND MILITARY CAREERS
By 2025 there will be roughly 3.5 million manufacturing jobs needing to be filled. And yet, approximately 2 million of those jobs will be left unfilled due to the skills gap within the manufacturing sector (Deloitte and the Manufacturing Institute, 2015). This shortage could impact the defense industry within Mississippi. The state can better align potential workers with employers by taking an approach of vertical academic/industry integration. It takes into account three common denominators that seem to increase the chance of academic programmatic success in connecting skilled workers with defense employment.

- Industry collaborations to ensure training programs are relevant
- Programmatic flexibility to adapt instructional methods and relevant content to changing workload needs
- Pathway focused programs to provide direct alignment for students pursuing careers within the industrial sector.

VETERAN EMPLOYMENT
According to the U.S. Department of Veterans Affairs, the number of veterans in Mississippi as of September 30, 2017, is 193,411 with 57.73% being under the age of 65. Within this population, military-trained veterans and veterans of working-age possess knowledge and skills potentially beneficial for private-sector employment. Progress is being made statewide to identify transferable skills required of high-demand, high-paying jobs (borderline and). A highly trained workforce attracts companies and is considered one of the top site selection factors for companies looking to locate to a new geographic region.

GOAL 8. Mississippi will encourage further expansion of joint training missions as an economic development engine within the state.

Mississippi is well positioned to further expand its Joint Training Enterprise Network (JTEN) opportunities in the state. Mississippi can accomplish this with an existing JTEN hub already established at Keesler Air Force Base consisting of virtual capabilities. Mississippi is also well positioned to create a Joint National Training Capabilities (JNTC) conference to explore mission enhancement opportunities. Joint training initiatives of these types stimulate spending in the economy and are thus an economic development contributor.

Competing states with large military economic drivers have developed military training exercises that link to multiple units throughout their state. Additional objectives to create economic development through mission enhancement activities include infusing commercial technology that enable the military to improve its ability to effectively bridge from the current force to one of greater strength.

Mississippi's community colleges and universities can support JTEN and JNTC through establishments of new certifications and credentialing services for military units.

State-owned Camp Shelby Joint Forces Training Center is already recognized as a premier center for maneuver training for National Guard Brigade Combat Teams, Special Operations exercises and Mobilization Force Generation installation and should be strategically marketed as such.

OBJECTIVE 7A Promote and market defense communities that are competitive in educational achievements as a means of attracting high-tech defense industry growth and interest of military families choosing the state as their home.

- As improvements are made and best practices established in workforce development models, create marketing materials that share success stories exemplifying these improvements.

OBJECTIVE 7B Promote a "learn-by-doing" philosophy to provide high school and college students with an opportunity to increase their likelihood of employment by creating vertical academic-to-industry collaborations (See Appendix E).

OBJECTIVE 7C Plan and grow science, technology, engineering and math (STEM) programs and partnerships focused in primary and secondary schools to create a pipeline of graduates entering the Mississippi technical and advanced workforce.

- Grow more STEM programs in high schools, community colleges and universities aligned with high-demand defense industry and advanced military occupations present in Mississippi.

OBJECTIVE 7D Help publicize the successes of Junior ROTC programs across Mississippi to encourage more local participation. Assist local programs interested in applying for new Junior ROTC Program startups.

OBJECTIVE 7E Be regarded as one of the most veteran-friendly states by encouraging a larger number of Mississippi employers to hire veterans and assisting military members transitioning into veteran status.

OBJECTIVE 7F Assist in the alignment of existing state employment systems, databases, and the Transition Assistance Program (TAP) to connect military personnel to civilian employment opportunities.

OBJECTIVE 8A Encourage further expansion of Joint Training Enterprise Network (JTEN) and Realistic Military Training (RMT) opportunities in the state that will further enable the entire spectrum of integrated joint training (i.e., live, virtual, and contracted) and involve underutilized civilian infrastructure assets.

OBJECTIVE 8B A Mississippi-based Joint National Training Capabilities (JNTC) conference to connect Mississippi bases to support training needs to meet the demand for a globally integrated joint training environment. These installations will focus on collective training across all phases of a joint campaign that enable full spectrum operations to be integrated into the joint training environment.

- Evaluate the economic impact of direct, indirect and induced impacts of joint training missions hosted in Mississippi.

OBJECTIVE 8C Encourage defense contractors and sub-contractors to provide support for joint training missions including, but not limited to, logistics, maintenance, and technical support.

OBJECTIVE 8C Promote Camp Shelby to become the Center of Excellence for maneuver training for National Guard Brigade Combat Teams, while continuing all requirements necessary to enhance collective training for all phases of a joint campaign for Special Operations exercises, and support Force Command as a Mobilization Force Generation installation.

OBJECTIVE 8D Establish installation certifications and credentialing opportunities relevant for military units needing advanced knowledge and skill development.

GOAL 9. Mississippi will foster a healthy innovation base that includes traditional and non-traditional partners in support of defense modernization.

Mississippi is home to four research universities and two federal defense laboratories that conduct defense-related research and development (See Appendix G). These entities produce new technologies and innovations for defense purposes, many of which could be of potential use in commercial applications. The following objectives place emphasis in support of Department of Defense's modernization priorities and in increasing the volume of new technologies with commercialization applications.

- OBJECTIVE 9A** Reoptimize Mississippi's extensive high-performance computing capability focused largely in support of DOD's research initiatives and military missions.
 - Build a mechanism for convening stakeholders to continuously leverage existing technologies and grow new ones, such as cyber security, data analytics, intelligent systems, high-performance computing, and data center capabilities.
 - Acknowledge and promote the significant human capital expertise present in Mississippi to attract the innovative and create roles of scientists, engineers, researchers and other technical workforce.
- OBJECTIVE 9B** Leverage and cross-connect Mississippi's expertise in unmanned technologies (air, maritime, and ground) to create a true multi-domain unmanned systems research, development, test and evaluation (RDTE&E) and operations capability.
 - Develop a cohesive managing strategy that exploits Mississippi's cross-domain unmanned systems capabilities.
 - Examine the feasibility of creating land- and maritime-based unmanned systems test ranges that can connect and exploit more than one technology domain.
- OBJECTIVE 9C** Aggressively pursue Federal funding for cross-domain unmanned systems RDTE&E projects to grow and mature Mississippi's expertise across the unmanned technology spectrum.
 - Leverage activities in geographic regions to grow research and development investments.
 - Leverage rural broadband to connect defense partners that align with USDA Rural Development and other initiatives.
 - Attract business and partners that have common interests, including, but not limited to, Mississippi Delta Region's barbed industries, Jackson-Vicksburg Region's ERDC initiatives, Golden Triangle's autonomous systems and the Gulf Coast Region's maritime systems.
 - Incorporate expertise from universities, technology laboratories, environmental systems groups, and transportation systems groups to build more comprehensive innovation planning.

- OBJECTIVE 9D** Place intentional focus on both internal and external communications promoting defense-related technologies developed in Mississippi.
 - Develop targeted messaging and communications for Mississippi congressional delegation.
 - Convene regular public and private stakeholders in the technology sector.
 - Build a Mississippi brand image to communicate research assets including an inventory of technology commercialization and innovative research conducted by the federal lab, research institutions, and the private sector.
- OBJECTIVE 9E** Better utilize streamlined federal contracting mechanisms and educate contractors on the use of these authorities like Other Transactions Authorities (OTAs) and Partnership Intermediary Agreements (PIAs).
- OBJECTIVE 9F** Infuse innovative and new commercial technologies, particularly those developed by Mississippi-based entities, into military applications.
- OBJECTIVE 9G** Incentivize growth of private-sector technology companies and attract new companies to start up in Mississippi.
 - Create defined focal points to foster technology incubators, particularly in relation to research labs.
 - Provide guidance regarding relevance of state incentives designed to foster research and development companies.
 - Provide guidance regarding state tax codes designed to foster investments in new research and development companies.
 - Build funding mechanisms like venture capital networks to provide financial support for growing the innovation base.

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MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

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APPENDIX A

MILITARY FAMILY QUALITY OF LIFE

LOWNES COUNTY & 30-MILE RADIUS

AREA DEMOGRAPHICS

LOWNES COUNTY 60,602
30-MILE RADIUS 181,122

MEDIAN AGE 37.7
LOWNES COUNTY 37.7
30-MILE RADIUS 37.7

MEDIAN HOUSEHOLD INCOME \$39,823
LOWNES COUNTY \$39,823
30-MILE RADIUS \$35,241

COST OF LIVING INDEX NOT AVAILABLE

HOUSING DATA

TOTAL HOUSING UNITS
LOWNES COUNTY 22,280
30-MILE RADIUS 82,484

OWNER-OCCUPIED UNITS
LOWNES COUNTY 58.46%
30-MILE RADIUS 69.45%

RENTER-OCCUPIED UNITS
LOWNES COUNTY 41.54%
30-MILE RADIUS 30.55%

VACANT HOUSING UNITS
LOWNES COUNTY 13.49%
30-MILE RADIUS 19.22%

MEDIAN HOME VALUE
LOWNES COUNTY \$105,050
30-MILE RADIUS \$112,747

MEDIAN RENT
LOWNES COUNTY \$751

EDUCATIONAL STRENGTH

HIGH SCHOOL DIPLOMA OR HIGHER
RESIDENTS AGE 25+

USA - 87.71%
LOWNES COUNTY 85.83%
30-MILE RADIUS 83.56%

BACHELOR'S DEGREE OR HIGHER
RESIDENTS AGE 25+

USA - 31.77%
LOWNES COUNTY 30.00%
30-MILE RADIUS 26.85%

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MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

PRIMARY & SECONDARY

SCHOOL DISTRICT	2017-2018 ENROLLMENT	2017 ACT SCORE	4 YEAR GRADUATION RATE	2017 ACCOUNTABILITY	4 YEAR DROP OUT RATE
LOWNES COUNTY	3,480	179	89.8%	B	6.1%
COLUMBIA MUNICIPAL	3,526	147	90.3%	D	10.6%
MISSISSIPPI	18				
NATIONAL	26.8				

HIGHER EDUCATION - LOWNES COUNTY

UNIVERSITIES: MISSISSIPPI STATE UNIVERSITY
COMMUNITY COLLEGES: EAST MISSISSIPPI COMMUNITY COLLEGE

SOURCE: MISSISSIPPI DEPARTMENT OF EDUCATION

AREA AMENITIES

TOTAL CHILD CARE FACILITIES
LOWNES COUNTY 27
30-MILE RADIUS 46

AVERAGE COMMUTE TIME
30-MILE RADIUS 21 MIN

HEALTHCARE FACILITIES
NORTH MISSISSIPPI MEDICAL CENTER
63 primary and specialty clinics throughout North Mississippi
300 Behavioral and Urgent Care

SOURCE: ESR COMMUNITY ANALYTICS 2017; MISSISSIPPI DEPARTMENT OF HEALTH

EMPLOYMENT TRENDS

TOTAL EMPLOYMENT	UNEMPLOYMENT RATE	% ANNUAL JOB GROWTH
25,780 LOWNES COUNTY	5.0% LOWNES COUNTY	0.1% LOWNES COUNTY
594 LOWNES COUNTY	\$19.73 LOWNES COUNTY	\$41,028 LOWNES COUNTY

SOURCE: BUREAU OF LABOR STATISTICS AND MISSISSIPPI DEPARTMENT OF EMPLOYMENT SECURITY AND DISABILITY INDEMNITY RATE ESTABLISHMENT BASED EMPLOYMENT LABOR MARKET STATISTICS 2018

MISSISSIPPI DEFENSE INITIATIVE ■ STRATEGIC PLAN 2019-2023

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MILITARY FAMILY QUALITY OF LIFE

CAMP SHELBY JOINT FORCES TRAINING CENTER GREATER HATTIESBURG MSA & 30-MILE RADIUS

AREA DEMOGRAPHICS

HATTIESBURG MSA 147,652
30-MILE RADIUS 190,895

MEDIAN AGE 34.6
HATTIESBURG MSA: 34.6
30-MILE RADIUS: 34.6

MEDIAN HOUSEHOLD INCOME \$46,365
HATTIESBURG MSA: \$46,365
30-MILE RADIUS: \$45,353

COST OF LIVING INDEX 83.7%
HATTIESBURG MSA: 83.7%
30-MILE RADIUS: 83.7%

HOUSING DATA

TOTAL HOUSING UNITS
HATTIESBURG MSA: 64,818
30-MILE RADIUS: 82,309

OWNER-OCCUPIED UNITS
HATTIESBURG MSA: 59.91%
30-MILE RADIUS: 64.21%

RENTER-OCCUPIED UNITS
HATTIESBURG MSA: 40.09%
30-MILE RADIUS: 35.79%

VACANT HOUSING UNITS
HATTIESBURG MSA: 11.96%
30-MILE RADIUS: 12.20%

MEDIAN HOME VALUE
HATTIESBURG MSA: \$146,223
30-MILE RADIUS: \$131,894

MEDIAN RENT
HATTIESBURG MSA: \$743

EDUCATIONAL STRENGTH

HIGH SCHOOL DIPLOMA OR HIGHER RESIDENTS AGE 25+

USA: 83.73%
HATTIESBURG MSA: 89.20%
30-MILE RADIUS: 87.56%

BACHELOR'S DEGREE OR HIGHER RESIDENTS AGE 25+

USA: 31.77%
HATTIESBURG MSA: 30.00%
30-MILE RADIUS: 26.95%

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PRIMARY & SECONDARY

SCHOOL DISTRICT	2017-2018 ENROLLMENT	2017 ACT SCORE	4 YEAR GRADUATION RATE	2017 ACCOUNTABILITY	4 YEAR DROP OUT RATE
LAMAR COUNTY	9,993	19.2	92.4%	A	2.2%
CITY OF HATTIESBURG	4,098	15.2	70.4%	D	17.0%
CITY OF PETA	4,468	20.2	86.7%	A	7.5%
FORREST COUNTY	2,120	19.0	77.8%	B	14.5%
MARKON COUNTY	2,657	16.6	77.5%	B	15.2%
COLUMBIA	1,664	18.2	88.4%	C	5.0%
BERRY COUNTY	1,301	15.8	75.9%	C	12.6%
RICHMOND	681	16.4	78.6%	B	17.9%
LUMBERTON	584	16.2	85.0%	D	18.0%
FORREST COUNTY JHS	539	18.3	77.9%	C	14.9%
PRESBYTERIAN CHRISTIAN SCHOOL	945	28			
SCOTTS HEAD	741	27			
LAMAR CHRISTIAN ACADEMY	320	25			
MISSISSIPPI	18				
MISSISSIPPI	20.8				

HIGHER EDUCATION - WARDEN COUNTY
UNIVERSITIES: THE UNIVERSITY OF SOUTHERN MISSISSIPPI, WILLIAM CAREY UNIVERSITY
COMMUNITY COLLEGES: PEARL RIVER COMMUNITY COLLEGE, JAMES COLLEGE
SOURCE: MISSISSIPPI DEPARTMENT OF EDUCATION

AREA AMENITIES

TOTAL CHILD CARE FACILITIES
HATTIESBURG MSA: 58
30-MILE RADIUS: 64

AVERAGE COMMUTE TIME
HATTIESBURG MSA: 24 MIN
30-MILE RADIUS: 24 MIN

HEALTHCARE FACILITIES

FORREST GENERAL HOSPITAL
512 beds
Level II Trauma Center
3,500 employees

WEITZ HEALTH WESTLY
211 beds
Level II Trauma Center
1,000 employees

HATTIESBURG CLINIC
Largest Specialty Care Clinic in our State
Over 60 locations
2,000 employees

EMPLOYMENT TRENDS

TOTAL EMPLOYMENT	UNEMPLOYMENT RATE	% ANNUAL JOB GROWTH	TOTAL JOB OPENINGS	AVERAGE HOURLY WAGE	AVERAGE ANNUAL WAGE
64,970	4.2%	1.4%	1,584	\$18.03	\$37,500

SOURCE: BUREAU OF ECONOMIC ANALYSIS OF THE U.S. DEPARTMENT OF EMPLOYMENT SECURITY AND 2018 UNDEREMPLOYMENT RATE & UNDEREMPLOYMENT RATE EMPLOYMENT LABOR MARKET STATISTICS BLS

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PRIMARY & SECONDARY

SCHOOL DISTRICT	2017-2018 ENROLLMENT	2017 ACT SCORE	4 YEAR GRADUATION RATE	2017 ACCOUNTABILITY	4 YEAR DROP OUT RATE
HARRISON COUNTY	14,904	19.9	85.3%	B	9.3%
HANDCOCK COUNTY	4,552	20.1	82.8%	B	10.9%
JACKSON COUNTY	9,242	20.1	89.3%	B	7.9%
BILBO	6,202	20.1	83.2%	A	11.6%
GULFPORT	6,900	16.6	87.6%	B	5.9%
807 ST. LOUIS-HIGHLAND	1,844	20.6	91.0%	B	10.5%
OCEAN SPRINGS	5,859	21.0	90.7%	A	7.4%
PASCAGOULA-GAULTER	7,054	18.5	87.3%	B	6.4%
SPRIS CHRISTIAN	2,656	21.4	87.1%	B	5.9%
LONG BEACH	9,231	20.8	87.2%	A	9.9%
MOSS POINT	1,915	16.8	70.4%	D	16.4%
MISSISSIPPI	18				
MISSISSIPPI	20.8				

HIGHER EDUCATION - WARDEN COUNTY
UNIVERSITIES: THE UNIVERSITY OF SOUTHERN MISSISSIPPI, WILLIAM CAREY UNIVERSITY
COMMUNITY COLLEGES: PEARL RIVER COMMUNITY COLLEGE, MISSISSIPPI GULF COAST COMMUNITY COLLEGE
SOURCE: MISSISSIPPI DEPARTMENT OF EDUCATION

AREA AMENITIES

TOTAL CHILD CARE FACILITIES
GULFPORT-BILOXI MSA: 54
30-MILE RADIUS: 61

AVERAGE COMMUTE TIME
GULFPORT-BILOXI MSA: 24 MIN
30-MILE RADIUS: 24 MIN

HEALTHCARE FACILITIES

GARDEN PARK MEDICAL CENTER
130 beds
Level II Trauma Center
700+ employees

WEITZ HEALTH BILOXI
200 beds
Level II Trauma Center
6-story, 170,000 sq ft facility
2,000+ employees

SINGING BREEK HEALTH SYSTEM
Level II Trauma Center
2,000+ employees

EMPLOYMENT TRENDS

TOTAL EMPLOYMENT	UNEMPLOYMENT RATE	% ANNUAL JOB GROWTH	TOTAL JOB OPENINGS	AVERAGE HOURLY WAGE	AVERAGE ANNUAL WAGE
155,990	4.9%	0.7%	3,667	\$21.48	\$44,668

SOURCE: BUREAU OF ECONOMIC ANALYSIS OF THE U.S. DEPARTMENT OF EMPLOYMENT SECURITY AND 2018 UNDEREMPLOYMENT RATE & UNDEREMPLOYMENT RATE EMPLOYMENT LABOR MARKET STATISTICS BLS

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MILITARY FAMILY QUALITY OF LIFE

KEESLER AIR FORCE BASE GULFPORT-BILOXI MSA & 30-MILE RADIUS

AREA DEMOGRAPHICS

GULFPORT-BILOXI MSA 381,021
30-MILE RADIUS 400,236

MEDIAN AGE 38.1
GULFPORT-BILOXI MSA: 38.1
30-MILE RADIUS: 38.1

MEDIAN HOUSEHOLD INCOME \$50,879
GULFPORT-BILOXI MSA: \$50,879
30-MILE RADIUS: \$50,904

COST OF LIVING INDEX 88.8%
GULFPORT-BILOXI MSA: 88.8%
30-MILE RADIUS: 88.8%

HOUSING DATA

TOTAL HOUSING UNITS
GULFPORT-BILOXI MSA: 181,369
30-MILE RADIUS: 172,679

OWNER-OCCUPIED UNITS
GULFPORT-BILOXI MSA: 62.64%
30-MILE RADIUS: 61.98%

RENTER-OCCUPIED UNITS
GULFPORT-BILOXI MSA: 37.36%
30-MILE RADIUS: 38.02%

VACANT HOUSING UNITS
GULFPORT-BILOXI MSA: 15.97%
30-MILE RADIUS: 15.75%

MEDIAN HOME VALUE
GULFPORT-BILOXI MSA: \$158,123
30-MILE RADIUS: \$154,738

MEDIAN RENT
GULFPORT-BILOXI MSA: \$629

EDUCATIONAL STRENGTH

HIGH SCHOOL DIPLOMA OR HIGHER RESIDENTS AGE 25+

USA: 83.73%
GULFPORT-BILOXI MSA: 87.85%
30-MILE RADIUS: 89.25%

BACHELOR'S DEGREE OR HIGHER RESIDENTS AGE 25+

USA: 31.77%
GULFPORT-BILOXI MSA: 21.14%
30-MILE RADIUS: 22.59%

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MISSISSIPPI DEFENSE INITIATIVE ■ FY18 FISCAL PLAN 2019-2023

APPENDIX B

OVERVIEW OF DEFENSE CONTRACTORS AND SUPPORTING COMPANIES IN MISSISSIPPI

Mississippi hosts a very vibrant defense economy with active and reserve facilities scattered throughout the state, two Department of Defense (DoD) research laboratories, and hundreds of defense-focused companies and respective supply chains. In 2017 defense spending was \$4.7 billion, ranking Mississippi 20th in the nation as a percent of GDP. This equates to 4.2% of Mississippi's GDP, and \$3.2 billion was contract spending and \$1.5 billion was personnel spending. Contract spending fell from a high of \$5.7 billion in 2013 to the \$3.2 billion shown for 2017, a 43.9% drop.

USAspending.gov lists 450 companies located in Mississippi as receiving DoD contracts in 2017.

About half of these companies are service focused (landscaping, laundry, construction, water providers, power providers, etc.). Service-focused contractors represent an estimated 250 companies of various sizes up to \$41,905,440. Additionally, an estimated 200 companies in Mississippi represent manufacturing-based contractors, including some of the most recognized names in defense:

- Raytheon Company
- Huntington Ingalls Shipbuilding
- General Atomics
- General Electric
- General Dynamics
- Boeing Lockheed Martin
- Airbus Helicopters
- Northrop Grumman

Mississippi defense companies are spread throughout the state however, they are clustered in several geographical areas. The South Mississippi Defense Corridor (EMDC) hosts the largest cluster in terms of

dollar amounts of contracts, size of the workforce, and number of companies. This 11-county corridor includes Covington, Forrest, George, Hancock, Harrison, Jackson, Jones, Lamar, Pearl River, Perry, and Stone counties and contains infrastructure assets geographically located in close proximity to one another. The location of these assets includes a concentrated group of defense industries, international airport, strategic support, Class A railroad, interstate highway, premier shipbuilding, water transportation industries, and high population, making it a prime region for future private investment in the defense industry.

Other defense cluster locations in Mississippi are State Capitol Region (Hinds/Rainbow/Madison Counties), the Golden Triangle Region, and PUL Region (Pontotoc, Union, Lee Counties, Vicksburg/Warren County is a cluster with the U.S. Army Corps of Engineers Research and Development Center (ERDC) and the Vicksburg District Headquarters both located there. Several defense contractors with ties to ERDC and the Vicksburg District have locations in Vicksburg (Downeast Information Technology Service, Customized Research and Development, Mav), Applied Geophysics Consultancy Applied Research Associates, Sentel Corporation, Fish Research and Development, PFCI Professional Solutions and KOS).

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

NDIA, comprised of its affiliates, chapters, divisions, and 1,600 corporate and 60,000 individual members, is a non-partisan, non-profit, educational association that has been designated by the IRS as a 501(c)(3) nonprofit organization – not a lobbying firm – it was founded to educate its constituents on all aspects of national security. Two chapters of the National Defense Industrial Association are affiliated with Mississippi: Red River Regional representing Louisiana, Arkansas, Texas and Mississippi and Gulf Coast Chapter.

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and USACE has allowed for a seamless integration into Department of Defense guidelines. Through this agreement, Hinds has already trained 30 personnel, with an additional 10 scheduled for March 2019.

ENHANCED-USE LEASING AND OTHER REAL PROPERTY AUTHORITIES

The Essential Use Leasing program under Title 30 USC 2667 allows federal assets like underused property to be leased for long-term or short-term purposes for defense installations to better optimize excess property in a way that maximizes potential for the military and the leasee. This authority is used by HASC Space Center in partnership with Rolls Royce and New Digital Windows for commercial space-related development. Enhanced Use Leases (EUL) or other innovative authorities promotes public-private and public-private ventures to accelerate both government and commercial space programs at Stennis Space Center.



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APPENDIX C

TYPES OF PUBLIC-PRIVATE PARTNERSHIPS

To fully capture the benefits for both Department of Defense and State of Mississippi with Public-Private and Public-Private Partnerships the following are examples of partnership agreements:

PARTNERSHIP INTERMEDIARY AGREEMENTS

More can be done in Mississippi to induce spin-off technology transfer and commercialization, and in 2018 ERDC entered into a Partnership Intermediary Agreement (PIA) with DEFENSEWERK, a 501(c)3 non-profit, to establish an innovation hub in Vicksburg called ERDCWERK. The partnership will benefit Warren County and Vicksburg in attracting new industry and creating new partnerships with existing industry. This will include a focus on, but not limited to, additional venture capital, business incubators and other means to commercialize government technologies. Similarly, the Naval Research Laboratory and other tenants at NASA's John C. Stennis facility in Hancock County provide technical assistance and business incubator space through a PIA with the Mississippi Enterprise for Technology.

JOINT-USE AGREEMENTS

This type of agreement between Keiser Air Force Base and Stennis International Airport (KCSIA) in Hancock County allows for low-cost use for service use of civilian airfields and environments for a wide range of training opportunities such as drop zones, night-vision training, and assault landings. This type of joint-use agreement could be expanded to other civilian aviation resources in the state and with other military airfields to boost military value.

REALISTIC MILITARY TRAINING AGREEMENTS

This DoD authority is presently used for special warfare communities to use civilian areas for training operations. It can be used with owners of public and

private property. This type of agreement should be marketed for military training operations for all services.

OFFING AUTHORITY

This authority utilizes state or private funds to provide enhancements of value for military bases. For example, this option was used for modifications and enhancements for Keiser Air Force Base's entrenchment.

INTERGOVERNMENTAL SUPPORT AGREEMENTS

(ISAs) This new authority agreement allows military installations to develop joint partnerships with local governments to exchange resources as a means to create mutually beneficial opportunities and reduce operating costs under Section 331 of the National Defense Authorization Act of 2013, codified as 10 USC 2679. In December 2018, Harrison County and the Naval Construction Battalion Center signed an ISA for municipal services to support mosquito surveillance and abatement services. This ISA was the Navy's first in its southeast region, and it paved the way for other similar agreements.

INTERGOVERNMENTAL PERSONNEL AGREEMENTS

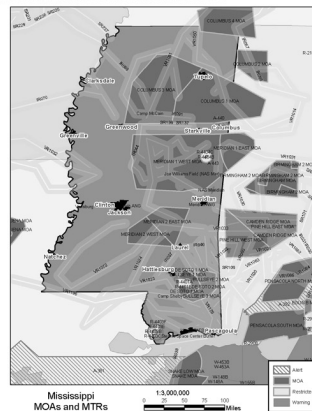
The Intergovernmental Personnel Act (IPA) Program provides for the temporary assignment of personnel between the Federal Government and state and local governments, colleges and universities, Indian tribal governments, federally funded research and development centers, and other eligible organizations. This agreement is used in partnership between Mississippi Department of Transportation and U.S. Army Corps of Engineers (USACE) with the goal of providing expertise to achieve timely design and implementation of adequate, safe, environmentally and economically sound transportation improvements. Similarly, an Educational Partnership Agreement has been established between Hinds Community College

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APPENDIX D

MISSISSIPPI MILITARY OPERATING AREAS AND MILITARY TRAINING ROUTES



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RAPSET FLIGHT RESEARCH LABORATORY'S UAS AIRSPACE

Unparalleled Restricted and CoA Airspace

- 6,000-plus square miles of medium-altitude, M30-managed CoA Airspace
- 330-plus square miles of Restricted Area SFC - 29,000' MSL
- 1,000-plus miles of assemble Warning Area SFC - 40,000' MSL
- 12 approved airports



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- The National Guard Counterdrug Training Academy
- Naval Technical Training Center Naval Operations Support Center Marine Training Aviation Squadron One
- Training Squadron Seven
- Training Squadron Nine
- Navy Security Forces
- Operational Support Unit (OSU) which sailors are cross-assigned to units all over the country
- Volunteer Training Unit

NAS Meridian supports more than 2,700 uniformed military personnel (Navymarine Corps), civilians, and contractors, dependents in housing, and Naval aviator students per year.

NAS Meridian is used for pilots to practice aerial gunnery and bombing practice programs.

Supervisor of Shipbuilding Gulf Coast (SSGC), Pascagoula

Mission: Provide professional oversight and waterfront management in the administration of Navy shipbuilding contracts to ensure the delivery of quality ships and crafts to the U.S. Navy that are on schedule, within cost, and of the highest possible quality.



The Mississippi Valley Division is commanded by an Army Major General and supports three active-duty soldiers and 100 civilian employees.

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U.S. Army Corps of Engineers - Mississippi Valley Division, Vicksburg

Mission: The Mississippi Valley Division Commander is directly responsible to the Chief of Engineers. Within the authority delegated, the division commander directs and supervises the district commander in six U.S. Army Engineer Districts (D). Paul, Rock Island, St. Louis, Memphis, Vicksburg, and New Orleans) in performing the following missions:

- Preparing engineering studies and design.
- Constructing, operating and maintaining flood control and river and harbor facilities and installations.
- Administering the laws on civil works activities.
- Acquiring, managing and disposing of real estate.
- Mobilization support of the military, natural disaster, and national emergency operations.

U.S. Army Corps of Engineers - Vicksburg District, Vicksburg

Mission: Provide quality engineering and other professional products and services to develop and manage the Nation's water resources needs in an economically and environmentally sustainable manner.

The Vicksburg District is a sub-unit of the Mississippi Valley Division responsible for a 68,000-square-mile area across portions of Mississippi, Arkansas, and

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APPENDIX E

MISSISSIPPI MILITARY INSTALLATIONS, OPERATIONS AND ASSETS

The presence of military operations has a variety of benefits for Mississippi in being a public good for national defense and safety. The following is a description of military installations, operations, and assets in Mississippi. Mississippi hosts multiple military facilities that include active military, reserves, and Army National Guard. Additionally, Mississippi is home to NASA's John C. Stennis Space Center whose primary mission is rocket engine testing. NASA is landlord to multiple defense tenants, including the U.S. Navy. The following is a summary of the military facilities in the state, a listing of some units housed at those facilities, and employment numbers for the facilities.

ACTIVE-DUTY MILITARY FACILITIES

Columbus Air Force Base, Columbus

Mission: Provide pilots, advance airman, and lead the fight.



Columbus Air Force Base (AFB) is an active-duty base specializing in training undergraduate pilots for four-wing aircraft. The base is home to the 14th Flying Training Wing (FTW) for the U.S. Air Force Air Education Training Command. The 14th Flying Training Wing operates and maintains facilities and infrastructure for a 6,013-acre pilot training base and provides contracting, law enforcement, supply transportation, fire protection, communications, recreation, recreation, and personnel management. Three runways of 12,000, 8,000, and 6,000 feet in length and 14 Auxiliary Airfield provide infrastructure and assets to support the base's mission. The 14th Operations Group and its nine squadrons are

responsible for the 52-week Specialized Undergraduate Pilot Training (SUPT) mission at Columbus. The 14th FTW primarily operates three types of aircraft: 96 F-16C/D trainer planes, 47 F-16A/B jethawk jets, and 912-38 T-38 Talon supersonic jets. The group also performs quality assurance for contract aircraft maintenance. Columbus AFB supported more than 3,000 civilians, enlisted members, officers, reserves, and students in FY 2017.

Meridian Naval Air Station, Meridian

Mission: Provide undergraduate pilot training for Navy aviators.

Naval Air Station (NAS) Meridian trains sailors and marines in aviation and related technical fields. Jet strike pilot training is organized under Training Air Wing One, which provides new aviators to the fleet and advanced pilot training in operational combat aircraft. NAS Meridian also trains international military aviators from many countries including France, Italy, Spain, and Brazil.

NAS Meridian is a multi-tenant, multi-service facility hosting other activities and missions. The primary tenants include:

- The John C. Stennis Naval Technical Training Center
- The Sonny Montgomery U.S. Navy Reserve Training Center

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Louisiana that holds seven major river basins and incorporates approximately 400 miles of mainline Mississippi River levees.

The Vicksburg District is commanded by an Army colonel and has approximately five uniformed service members and 1,100 civilian employees.

Naval Construction Battalion Center (NCBC) Subban, Gulfport

Mission: Maintain and operate facilities; provide, as appropriate, services and material to support operations of commands of the operating forces of the Navy and other organizations designated by the Chief of Naval Operations and perform other such functions and tasks as may be directed by higher authority.

NCBC is the home of the Navy's Atlantic Fleet Seabees, which are the Navy's construction battalions, and other Navy tenants. NCBC maintains and operates facilities; provides services and materials in support of Naval Construction Force Units, including Amphibious Construction Fleet Units, Maritime Prepositioning Force (Enhanced), other fleet and assigned organizational units deployed from or headquartered at NCBC; Gulfport, and to perform other such functions and tasks as may be assigned by higher authority.

NCBC Gulfport supports 5,400 active-duty members, reserves, and civilians. It supports 24,000 dependents and 5,500 students (annually), and navy tenants on more than 4,200 acres.

Keeler Air Force Base, Biloxi

Mission: Provide specialty technical training to airman under the auspices of the 81st Training Wing of the Air Education Training Command (AETC).

Located on the Mississippi Gulf Coast, Keeler is home to the 81st Training Wing and the Electronics Training Center of Excellence for the U.S. Air Force. Keeler is also home to 2nd Air Force, 402nd Wing (Harrisburg Hustlers), Matties NCO Academy, and the 86th Engineering Installation Squadron. Most of the training

activities involve initial skills training for new airman and are ranked fourth out of the 70 installations in providing such training. Also, Keeler AFB provides training in meteorology, air traffic control, cybersecurity, and radar operations. Keeler is one of the nation's largest installations providing technical training to military personnel.

Keeler Medical Center is the second largest Air Force medical center in the nation. It works in partnership with local Veterans Administration and area hospitals to provide medical care to over 27,000 enrolled patients and nearly 7,500 active-duty personnel in the Gulf Coast region. In addition to providing care, the medical center is a major home of Air Force medical training providing graduate medical education to doctors in general surgery and a variety of internal medicine specialties.

Keeler AFB supported 11,000 civilians and military personnel, more than 3,000 family members, and nearly 31,000 student graduates in FY 2017.

Coast Guard, Multiple locations along the Gulf Coast and Mississippi River

Mission: The United States Coast Guard has several units in Mississippi including: Patrol Cutters (205CG (Raccoon), Brant, Benjamin Dwyer and Jacob Forno (Gulfport, 2K Pascagoula), Buoy Tender (Greenwell, Tatchell, Vicksburg), Shipbuilding/Contract Oversight (Pascagoula), Aids to Navigation (Gulfport, Stennis Space Center), Marine Safety Detachments (Gulfport, Greenwell), and Logistics (Pascagoula). There are two Coast Guard active-duty stations, one each in Gulfport and Pascagoula that execute 11 Coast Guard missions: Port and waterway security, drug interdiction, aids to navigation, marine safety, search and rescue, ice operations, defense readiness, law enforcement, living marine resource and marine environmental protection, and migrant interdiction. Both Coast Guard Stations host two patrol cutters each and numerous smaller boats.

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The Coast Guard has a Port Security Unit 308 (PSU) in Killy, which is in Hancock County. PSUs are deployable Coast Guard units primarily composed of reservists and are designed to protect against waterborne and overboard threats to our nation's hard assets. These units can deploy anywhere in the world within 96 hours and be operational within 24 hours thereafter.

John C. Stennis Space Center, Hancock County
Mission: John C. Stennis Space Center is home to NASA's rocket engine and propulsion systems testing. Supporting the launch industry is Stennis Space Center's core mission. From its inception, Stennis Space Center has NASA's primary engine testing facility. Its history of success in supporting spaceflight mission has made Mississippi relevant in the aerospace industry. These sector companies, including defense contractors, testing rocket engines need access to large capacity test stands, which are available at Stennis Space Center. There is currently abundant test stand capacity and supporting infrastructure at Stennis.



The space and launch industry, a sub-sector of the aerospace industry outlook is bright and expected to grow. The nature of the space and launch industry is different than most manufacturing sectors because it is almost solely targeted for the public sector for defense and governmental purposes. However, private sector investments could generate new potential partnerships for Mississippi. The large installation is comprised of roughly 13,500 acres plus 125,000 acres of buffer zone making it attractive for military tenants needing

secure perimeters, supercomputing capability, and rocket engine test stands.

The Navy has chosen to locate six tenants at Stennis Space Center. The unique concentration of operational and research oceanographers makes Stennis Space Center the center of naval oceanography and the largest such grouping in the world. These organizations employ thousands of military, civilian, and contractor personnel on-site at Stennis Space Center.

Stennis Space Center supports more than 1,000 DoD government civilians and military personnel. Additionally, Stennis Space Center hosts multiple defense contractors. Most are working in the aerospace or blue economy sectors. Some of the more prominent companies include Aerojet Rocketdyne, Raytheon and Lockheed Martin.

Mississippi National Guard (MNSG)

Mission: The Mississippi National Guard maintains a strong presence throughout the Magnolia State. The entire force consists of approximately 12,400 soldiers and airmen, 1,100 of which are active guard and reserve (AGR). There are 2,700 federal technical employees and 960 state employees, both of which are composed of soldiers, airmen, and civilians. The MNSG has 72 Army National Guard readiness centers in 66 communities across Mississippi, and three major Air National Guard facilities.

Camp Shelby Joint Forces Training Center, Hattiesburg
Mission: To be the premier integrated war-fighting and force generation installation while serving as the world-class center of excellence for installation management customer service and community partnering.

Camp Shelby is the largest state-owned training site in the nation. It is one of the largest mobilization stations of the U.S. Army Forces Command (FORSCOM), and the largest reserve training facility supporting 142

active guardmembers, 296 full-time technicians, 324 state employees, and 87 contractors. Camp Shelby also houses the 377th Armored Brigade, a Combined Arms Training Brigade, belonging to the First Army and manned with both active-duty soldiers and reservists. Camp Shelby supports a wide variety of training and logistical support activities. These include heavy maneuver and collective gunnery; multiple battalion field artillery fire ranges; realistic environmental training; air-to-ground combat training capabilities; and theater-specific mobilization training for reserve and active components of the Army, Navy, Air Force and Marines. The 135,000-acre installation has served as a training and mobilization site for American troops from World War I and World War II to current worldwide Overseas Contingency Operations. The U.S. Army, Navy, Marine Corps, and Air Force have all trained at Camp Shelby at one time or another. It hosts yearly training missions for the National Guard and Army Reserve units stationed in Alabama, Mississippi, and Tennessee.



Camp McCain, Gretna

Mission: Camp McCain is a training facility of the Mississippi Army National Guard owned by the state of Mississippi and used for training guard units from Mississippi and other states and territories. Camp McCain provides a location for armored vehicle maneuvers, artillery training and force generation training for National Guard troops.

Camp McCain can house 2,500 troops and has a number of tactical training facilities for the Mississippi National Guard including:
• 6,000 acres available for maneuver training
• Live fire ranges from 100m to 1,500m
• Multipurpose Training Facility with one conference

room, two classrooms, six offices, and outside space for tactical operations center (TOC) operations
• Aviation Operations Area with 32 helicopters, two hot fuel pads, and a Flight Operations Center
• Barracks, administration and mess facilities with more than 1,000 beds with central air, heat, and a mess notification system
• Mail service quarters with cable television and Wi-Fi internet capability
• Three separate land navigation covering covering 60 points
• Three HMMWV Egress Assistance Trainers
• Mounted Urban Terrain Site
• Distance Learning Center

Camp McCain supports 2,100 guard members, 17 AGR, 75 technicians, 45 state employees and seven contractors on 13,000 acres.

Threats Aviation Sustainment Maintenance Group (TASMG), Gulfport

Mission: The 1108th Theater Aviation Sustainment Maintenance Group (TASMG), located in Gulfport,



Mississippi is one of four Army National Guard regional maintenance facilities nationwide and provides aviation sustainment maintenance, including limited depot capabilities. In each Army Aviation Support Facility (AASF) in the nine southern states, Puerto Rico and the Virgin Islands. The 1108th provides major airframe repair, aircraft painting, and repair of components, national maintenance program (NAMP) repairs, and special projects for each of the Life Cycle Maintenance Commands (LCMC) and the identification

and classification of aviation receipts and stocks in storage. The wartime mission of the 1108th TASMG is very similar to the stateside mission but occurs in the overseas theater of operation wherever the 1108th TASMG becomes the Theater Aviation Maintenance Program (TAMP) in support of Army Materiel Command (AMC).

TASMG supports more than 300 full-time members, AGRs and technicians.

Hawkins Field, Army Aviation Support Facility #1, Jackson
Mission: Hawkins Field Station is home to the 185th Theater Aviation Brigade's (TAB) UH-60 fleet and the Army National Guards fixed-wing assets.

Tupelo Regional Airport, Army Aviation Support Facility #2, Tupelo
Mission: Hosts the MSARNG Army Aviation Support Facility #2 and the state's fleet of both AH-64 Apache and UH-72 Lakota helicopters. Note: The UH-72 Lakota are manufactured in Columbus at the Airbus Helicopter Plant.

Key Field, Army Aviation Support Facility #3, Meridian
Mission: Home to B Company, 1st Battalion, 111th Aviation Regiment. B-111th AVR operates a fleet of Chinook helicopters designed as a multi-purpose transport/airlift helicopter capable of carrying troops, gear and other cargo.

155th Armored Brigade Combat Team, Tupelo
Mission: The 155th Armored Brigade Combat Team (ABCT) is the largest unit in the Mississippi National Guard. The "Coke Thunder" Brigade is headquartered in Tupelo and contains subordinate units covering the entire Magnolia State. The unit's history traces its lineage back to 1798 when the 1st Mississippi Regiment was raised. Today, the battalion carries on this legacy and is the seventh-oldest infantry regiment in the U.S. It contains brigade support, fire, special troops and

combined arms battalions (armor and infantry). The unit also possesses an armored reconnaissance squadron.

47th Civil Support Team, Flowood
Mission: To assist civil authorities with identifying chemical, biological, radiological, nuclear, and high yield explosive agents at state incident sites. Specifically, their support includes providing consequence management and immediate response operations for events that can result in catastrophic life and property losses. The joint group operates on a 24-hour per day deployment cycle and has responded to almost every state disaster since its establishment in 2005.

47th Civil Support Team supports more than 30 full-time soldiers, airmen, and occupational specialists.

Mississippi Air National Guard
Mission: Provide the Magnolia State, the U.S. Air Force, and the Department of Defense a trained, combat-ready strategic military force prepared to respond stateside or abroad. The MSANG has three active bases in Mississippi that are comprised of approximately 2,500 active and traditional Air National Guardmembers.

Key Field Air National Guard Base, Meridian
Mission: Home to the 186th Air Refueling Wing, which supports domestic counter-drug and emergency response missions as well as overseas combatant commander requirements. Additional units include the Air Support Operations Squadron which serves as a combat force multiplier to U.S. Army counterparts.

The 186th Air Refueling wing supports more than 1,100 full-time state, AGRs, and technicians.

Abercrombie Air National Guard Base, Thompson Field, Jackson
Mission: The 172nd Airlift Wing is based at Abercrombie Field in Jackson, Mississippi. Today, the 172nd AW operates the C-17 aircraft, and participates

in an all-volunteer mobilization and activation. Flying weekly missions into harm's way to return wounded patients safely back to the U.S. The 172nd Airlift Wing became the first Air National Guard unit to fly the C-17 and is one of only two Air National Guard units to operate the aircraft. In addition to delivering cargo to overseas forces, the unit has helped some in aeromedical evacuation missions. The 172nd Medical Group operated the first Expeditionary Medical Support Hospital, providing medical support and treatment for over 2,500 military and civilian personnel. Despite heavy demands on the unit, the 172nd Airlift Wing has consistently met mission requirements in an outstanding manner. When not currently mobilized, the unit is training for future mobilizations.

The 172nd Airlift Wing supports more than 400 service members, AGRs, and technicians.

403rd Wing, Keesler Air Force Base, Biloxi
Mission: The 403rd Wing is a unit of the Air Force assigned to the Air Force Reserve Command located as a tenant at Keesler Air Force Base in Biloxi supporting 3,300 airmen. The 403rd Wing provides command and staff supervision to its assigned units in support of tactical airlift missions, weather reconnaissance, and combat support. The unit executes missions in support of the theater commander, such as resupply, employment operations within the combat zone or forward area, and when required, aeromedical evacuation and augmentation of other military airlift forces.

The 53rd Weather Reconnaissance Squadron (Historic Weather) has a mission to recruit, organize, and train assigned personnel to perform aerial weather reconnaissance. The unit provides surveillance of tropical storms and hurricanes in the Atlantic Ocean, the Caribbean Sea, the Gulf of Mexico, and the central Pacific Ocean for the National Hurricane Center in Miami.

The 815th Airlift Squadron (Flying Jetties) performs a variety of global airlift missions. The C-130J primarily performs the tactical portion of the nation's airlift missions since it is capable of operating from rough, dirt airfields.

Gulfport Combat Readiness Training Center (CRTC), Gulfport
Mission: The Combat Readiness Training Center (CRTC) provides an integrated, joint, year-round, realistic training environment (Airspace, Ranges, Systems, Facilities, and Equipment) for military organizations to enhance their capabilities and combat readiness. CRTC supports more than 300 full-time airmen, AGRs, and technicians at its location adjacent to the Gulfport, Biloxi International Airport. This shared space allows the CRTC to focus on existing ground force commanders in control of regional airspace while directing joint service aircraft in the planning, requiring, coordinating and controlling close air operations, intelligence gathering and airlift. The Air National Guard CRTC hosts regular deployments of Air National Guard units and hosted 16,000 trainees in FY 2018.

The two primary Air National Guard tenant units at CRTC Gulfport are the 285th Air Control Squadron and the 209th Special Operations Civil Engineer Squadron.
• The 209th Air Control Squadron (ACS) provides a variety of ground control capabilities for the Air National Guard, including state-of-the-art ground control intercept capabilities. The unit organizes, trains, and equips the personnel needed to provide operation control capabilities in support of emergency contingencies and theater air operations.
• The 209th Special Operations Civil Engineering Squadron (SOCECS) is a highly mobile unit providing a variety of capabilities including creating a safe environment free from chemical, biological, and radiological contamination. This unit's civil engineering teams also provide planning and crisis operations support for theater headquarters sites. It also provides fire protection management, an

APPENDIX G

DEFENSE RESEARCH AND DEVELOPMENT INITIATIVES IN MISSISSIPPI

The most categories of defense-related are operated in Mississippi. Federal defense laboratories and public research universities. This section of the report will provide an overview of the two categories of research.

Department of Defense (DoD) Laboratories

Mississippi engages in activities ranging from basic research to defense system acquisition support to direct operational support of deployed warfighters. These laboratories are comprised of bases of facilities across 22 states and employ tens of thousands of both civilian and military scientists and engineers, public employees and contractors. Defense Laboratory Enterprise Research Directorate grew out of the Research and Development Board formed with the Department of Defense in 1947. The Office of the Assistant Secretary for Research and Engineering has four directorates: Research, Systems Engineering, Rapid Fielding, and Developmental Test and Evaluation. Two federal defense laboratories are present in Mississippi: U.S. Army Corp of Engineers Research and Development Center and the U.S. Naval Research Laboratory.

Engineer Research and Development Center (ERDC), Vicksburg

Mission: Help solve our Nation's most challenging problems in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, Department of Defense, civilian agencies, and our Nation's public good.

The Army Corps of Engineers Research and Development Center (ERDC) in Vicksburg, MS provides the Department of Defense and various other civilian agencies with solutions to problems regarding civil and military engineering, geospatial sciences, water resources, and environmental sciences. ERDC is one of the most diverse engineering and scientific research

organizations in the world. It oversees seven labs (four in Vicksburg) located in four states and administers an annual budget that exceeds \$1 billion in research and development funding. In addition to and in support of the primary research areas, ERDC houses and operates several of the world's highest capacity and fastest supercomputers. Vicksburg is the headquarters of ERDC's predominant civilian personnel leadership. However, as an USACE entity, ERDC retains an Army Colonel as Commander.

ERDC supports 1,590 civilian and six military employees throughout the four labs, executive office, and installations operations command.

Naval Research Laboratory (NRL), Stennis Space Center

Mission: Operate as the Navy's full-spectrum corporate laboratory, conducting a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems and ocean, atmospheric, and space science and related technologies.

The unique concentration of operational and research researchers located at John C. Stennis Space Center makes the location the largest such grouping of naval oceanography in the world. In fulfillment of this mission, NRL:

- Initiates and conducts broad scientific research of a basic and long-range nature in scientific areas of interest to the Navy.
- Conducts exploratory and advanced technological development deriving from or appropriate to the scientific program areas.
- Within areas of technological expertise, develops prototype systems applicable to specific projects.
- Assumes responsibility as the Navy's principal R&D activity in areas of unique professional competence.

upon designation from appropriate Navy or DoD authority.

- Performs scientific research and development for other Navy activities and, where specifically qualified, for other agencies of the Department of Defense and, in defense-related efforts, for other Government agencies.
- Serves as the lead Navy activity for space technology and space systems development and support.
- Serves as the lead Navy activity for mapping, charting, and geodesy (CMAG) research and

development for the National Geospatial-Intelligence Agency (NGA).

MISSISSIPPI INSTITUTIONS OF HIGHER LEARNING

Mississippi's university system also contributes to the continued development of our workforce in several fields that have a direct and meaningful correlation to defense manufacturing industry. Through partners/ sponsored research projects, well-developed CO-OP/ Internship programs, and specific undergraduate/ graduate programs tailored to meet industry needs, the IHL institutions provide real-world experiences for its students and potential employees for industry.

FEDERALLY FUNDED UNIVERSITY DEFENSE RESEARCH AND DEVELOPMENT EXPENDITURES (Values in thousands)

SOURCE OF FUNDS	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
DOI	500	2,096	819	2,242	915	5,558	5,953	4,256	7,182	4,725
MSU	13,439	12,381	10,677	10,341	20,612	20,652	24,791	28,398	27,244	27,402
UM	5,175	6,239	7,260	8,819	9,200	10,741	12,569	10,504	10,265	12,140
USM	7,734	5,001	5,500	6,370	8,272	11,099	8,515	8,771	5,622	7,011
GRAND TOTAL	26,548	26,307	24,253	27,372	31,093	40,044	31,729	34,163	31,313	31,280

NOTE: * DATA WERE NOT COLLECTED AT THIS LEVEL OR INSTITUTION WAS UNWILLING TO PARTICIPATE FOR THIS SURVEY YEAR.
SOURCE: NATIONAL SCIENCE FOUNDATION, NATIONAL CENTER FOR SCIENCE AND ENGINEERING STATISTICS, HIGHER EDUCATION DATA SURVEY

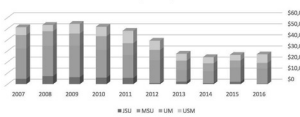
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DEPARTMENT OF DEFENSE UNIVERSITY RESEARCH SPENDING IN MISSISSIPPI (2007 – 2016) (MILLIONS)



Jackson State University boasts a comprehensive School of Engineering, along with Mississippi State University and The University of Mississippi. Within this professional school, students at undergraduate and graduate levels are provided opportunities to work within research areas that have a direct correlation to the defense industry within Mississippi. The University has several specific programs that impact the defense industry in both research and workforce development. The interdisciplinary Robotics Center has created a pipeline program that reaches deep into K-12 programming to attract young people into STEM careers, focuses on increasing the attainment of Ph.D.s within under-represented populations, and performs world-class research for the Department of Defense in the area of High Computational Modeling/hybrid Nanocomposite Coating for Improved Impact Resistance and Bond Durability. The University also provides extensive research within the areas of cybersecurity, big data analytics, unmanned aerial vehicles, and sensor technology. The beneficiaries of these local areas are groups such as the U.S. Army Corps of Engineers, U.S. Air Force, and U.S. Army Jackson State's role within defense-related workforce development is evident and robust.

Mississippi State University is the established national leader in unmanned aircraft systems research, development, test and evaluation (UDT&E). As the national lead for the Federal Aviation Administration's

ASSURE UAS Center of Excellence, MSU oversees a Federal UAS research portfolio of over \$36 million to date. ASSURE scientists routinely conduct groundbreaking research into key unmanned systems technology, with an emphasis on increasing the safety and availability of these systems. MSU's Predator Flight Research Laboratory (PFRL) is the nation's leading UAS RDT&E institution, and routinely conducts key research on behalf of the Department of Defense, the Department of Homeland Security, the Federal Aviation Administration, the National Oceanographic and Atmospheric Agency, the U.S. Geological Survey, and a host of others. PFRL also leads the Mississippi UAS Partnership, a statewide coalition that was national designation as the Department of Homeland Security's Common UAS Test Site. MSU's Geosystems Research Institute (GRI) and Northern Gulf Institute (NGI) have conducted more UAS-based research flights in Mississippi than any other entity. GRI and NGI research leverages the tremendous capabilities of UAS to help identify and mitigate the effects of natural disasters, track the progress of invasive species, assess crop health, and monitor the effects of coastal erosion. The collective UAS RDT&E capabilities across any of MSU's centers and institutes have fostered dozens of key partnerships with industry, government and academia across the nation and around the globe. The support from MSU's partners (such as Boeing, General Electric, Airbus and Aurora Flight Sciences) allow the university to support hundreds of graduate

and undergraduate researchers, and create a pool of skilled engineers, technicians and scientists that serves to fuel Mississippi's workforce growth across the entire aerospace industry.

The University of Mississippi's Haley Barbour Center for Manufacturing Excellence is an undergraduate, interdisciplinary program that brings together the schools of accountancy, business, and engineering to prepare young men and women for careers within modern manufacturing environments, including those exclusive to the defense industry within Mississippi. Students pursuing the CME experience work toward completing one of six different degrees from their respective schools. Over the course of their academic career they will participate in roughly 20 hours of manufacturing-based coursework that has been developed by industry members and educators. The courses vary between team-building, project management, strategic thinking, lean manufacturing, and project-based experiences within actual manufacturing facilities. At the culmination of their time within the CME, students will receive an emphasis in Manufacturing Engineering to go along with their accredited degree.

The University of Southern Mississippi was recently awarded a \$4.73 million-dollar contract from the U.S. Department of Defense's Domestic Preparedness Support Initiative to identify, evaluate, deploy and transfer technology, items and equipment to federal, state and local first responders. The contract through the USM National Center of Spectator Sports Safety and Security will enhance safety and improve homeland security. In other areas of defense-related research and initiatives, USM launched a Hack for Defense academic course to bring student groups to work collaboratively in studying and creating solutions facing everyday challenges spinning out of defense. Since 2015, USM has worked with the U.S. Army to develop and evaluate enhanced head protection for warfighters. Most notably in joint initiatives with defense, USM's School of Ocean Science and Engineering forged a long-term relationship with the U.S. Navy to offer a Navy

Unmanned Certification which is the first in the nation to address immediate knowledge and skill requirements for naval personnel. The new School of Science in ocean engineering is a response to the growing need of engineers in shipbuilding, maritime industry, offshore exploration, environmental monitoring, port operations, as well as in federal agencies. Ocean engineering is a high-demand occupation, and this program of study is one of only 10 programs in the nation and the only one in Mississippi.

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GOVERNOR BRYANT'S OCEAN TASK FORCE:

CHARTING THE FUTURE OF MISSISSIPPI'S
OCEAN TECHNOLOGY ECONOMY





THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

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October 31, 2017

Dear Governor Bryant,

On behalf of the Governor's Ocean Task Force stood up by Executive Order 1401 in June, it is my pleasure to present you with a Master Plan for economic development in the area of maritime technology. This Master Plan reflects the hard work of many individuals who are clearly committed and motivated to the future of Mississippi's growing footprint in Unmanned Maritime Systems and other related technologies. We all believe there are tremendous opportunities in front of us, and having a coordinated Roadmap to work with places Mississippi well ahead of the rest of the country in this very competitive arena. The vision is yours, and we are most happy to have the opportunity to work with you and your administration in developing the Master Plan.

In this document, you will find that the Governor's Ocean Task Force developed its strategy from three Guiding Principles:

- 1) Distinguish *unique* opportunities for Mississippi: No one else has it or does it, and few (if any) have capacity to establish it;
- 2) Strengthen the *market pull* for the Blue Economy in Mississippi by defining new investments and partnerships that position for us future competitiveness.
- 3) *Build and retain capacity* by using the geographic setting of the coast as a strategic advantage.

The Governor's Ocean Task Force was divided into six Focus Groups including i) Education and Workforce, ii) Engineering Capacity, iii) Advanced Development and Testing, iv) Applications, v) Economic Development, and vi) Policy and Ethics. These groups refined a set of Goals and Actionable Tasks and then further developed the nine Key Recommendations that constitute the Roadmap.

This Master Plan is only the end of the beginning. The Governor's Ocean Task Force is committed to implementation of the Master Plan through a series of cohesive project proposals to support the recommended programs, facilities, legislation and other critical activities. I hope you will allow us to continue this good work as I know first-hand that other states are learning of our efforts and pushing for similar activities. The competition exists, but our advantage is real. I look forward to your review of the Master Plan and indication that the Governor's Ocean Task Force can continue with implementation strategies. Please let me know if you have any questions regarding this Master Plan. For the Governor's Ocean Task Force, I am

Yours truly,

Monty Graham, Chair

Cc: Governor's Ocean Task Force
G. McCullough
R. Morgan

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ACKNOWLEDGMENTS

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Applications: *Robbie Ingram*, CEO MS Enterprise for Technology, USM Accelerator Manager

Economic Development: *Brian Useforge*, Economic Development Director, MS Power Company

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EXECUTIVE SUMMARY

Governor Phil Bryant established, by Executive Order 1401 on June 1, 2017, the Governor's Ocean Task Force (GOTF). The GOTF 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 GOTF 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.

INTRODUCTION

The traditional Maritime Economy sectors in Mississippi—shipbuilding, oil & gas, transportation, fishing, and tourism—have long been recognized as vital sectors of the coastal economy. But, the impact of the greater Blue Economy has been largely underestimated, and this issue is not unique to Mississippi. Over the past few years, efforts to bring attention to Mississippi’s Blue Economy have revealed that this sector, including the traditional Maritime Economy, may in fact represent the largest contributing economic sector in the State.

For a recent request submitted to the Mississippi Enterprise for Technology (MSET), a cursory search for companies operating in the Blue Economy along the Coast revealed as many as 109 organizations working in the sector in the lower three counties—Hancock, Harrison, and Jackson counties. Areas of focus in those organizations included specializations in technology development, urban concerns/coastal resiliency, observation and exploration, modeling/prediction/forecasting, marine-based research, and unmanned maritime systems (UMS¹) development. Current and future efforts to quantify the Blue Economy in Mississippi must focus on identifying and understanding these organizations—federal, state, university, and private industry—that support essentially poorly categorized industries, projects, and programs related to water.

This initial GOTF Master Plan is meant to serve as a vision for the future for establishing Mississippi as a national resource for innovation, commercialization, policy, and talent development in ocean technologies and UMS. The Mississippi Gulf Coast is strongly positioned to attract and maintain maritime and ocean technology industries and, specifically, the UMS subset of the industry. This assessment reveals a clear opportunity to expand the economic base and add maritime and ocean technology businesses across the coast and impact the economic development of related businesses statewide.

One example is the larger opportunity to develop an operational range for UMS that is cohesive across air, land, riverine, coastal, and shallow-to-deep ocean environments exists across the Coast and would create a new market pull from competitive states. The Blue Economy is not limited to UMS, but includes all technology sectors relating to the marine and coastal environments. A targeted branding, marketing, and incentive strategy focused on the Blue Economy will attract new maritime industries to south Mississippi and contributes to supply chain growth throughout the State.

The GOTF Master Plan is intended to develop Mississippi-specific activities that work in parallel with the Chief of Naval Research’s Task Force Ocean (TFO) initiatives to maintain U.S. Navy competitive advantages maritime sensing and observation; modeling and prediction; application and decision aids; and human capital and technical workforce. As the TFO completes its recommendations, Mississippi will be well-positioned to contribute to the national need while enhancing our own economy through growth in the Blue Technology industries.

METHODOLOGY

On June 1, 2017, Governor Bryant signed Executive Order 1401 (EO1401) creating the Governor’s Ocean Task Force (GOTF). The Governor appointed 22 members, and named Dr. Monty Graham, Director of the School of Ocean Science and Technology at The University of Southern Mississippi, as Chairman of the GOTF. Key focus areas identified by EO1401 include: growing existing research and development for oceanography; unmanned maritime vehicles; technical workforce development; marine science research; and private sector activity. The GOTF was directed by Governor Bryant to develop a Master Plan for Mississippi that would include:

- a. Cataloging existing investments in the areas of ocean technologies and unmanned maritime systems; understanding the State’s competitive position in these fields; and recommending a strategy to bring the State into international competitiveness in this area.

¹In this document, UMS refers to Unmanned Maritime Systems—whether surface, sub-surface, or seafloor. “Autonomous” systems are a subset of these that incorporate decision-making algorithms within the vehicle. UxS refers to all unmanned systems including maritime, aerial, ground, or space-based systems.

- b. Establishing a tangible and achievable roadmap to build capacity in maritime systems with an emphasis on national defense, energy exploration, marine resources, environmental monitoring, and aquaculture.
- c. Proposing a strategy for working with state and Federal lawmakers to develop a vibrant economy around these technologies that includes a means for encouraging maritime technology companies to locate in the state.

Task Force members were assigned to individual focus groups: Policy and Ethics, Engineering Capacity, Applications, Economic Development, Education and Workforce Training, and Advanced Development and Testing. Each focus group was assigned one of the GOTF members as the focus group lead, and each group recruited other advisors and subject matter experts for support. From these additional advisors, a technical lead was chosen to assist each focus group lead. Each focus group was instructed to survey the State's current assets (related to their specific areas), identify the capabilities and infrastructure, and determine the gaps.

More specifically, this survey included ocean technologies and maritime systems focused on national defense, energy exploration, marine resources, environmental monitoring, and aquaculture. Specific emphasis was focused on UMS manufacturers; the organizations that support the development/enhancement of these systems; data acquisition and handling; data analytics and product development; operations and maintenance; and communications providers. The existing infrastructure within the State to support UMS deployment, test, evaluation, and use is also included in the survey.

Each group's efforts resulted in a synopsis of the current state of their focus areas and recommendations on how the State should strategically advance future development of ocean technologies and maritime assets along the Gulf Coast. Recommendations from all six groups were compiled into a list of Goals and Targeted Actions. These Goals and Targeted Actions support the Roadmap by providing steps to be taken during implementation of the GOTF Master Plan.

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 GOTF 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 GOTF Master Plan is implemented.

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 percent), enlisted personnel (26 percent) and officers (7 percent). 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—with in the context of the GOTF 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

**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 Governor’s 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.

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 pro-

grams, 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

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.

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*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.

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

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 GOTF 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 Governor's 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

POLICY AND ETHICS

Legal Environment

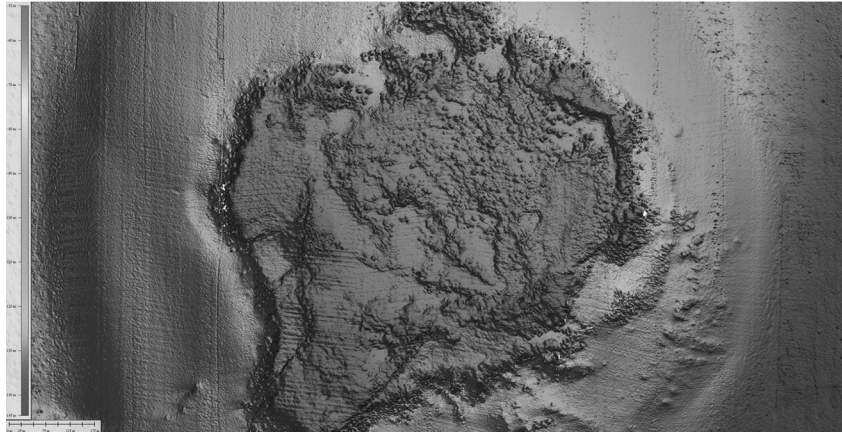
The legal and policy framework governing UMS activities is complex. On the Federal level, more than 20 agencies administer over 140 laws affecting ocean waters and resources. In Mississippi, three state agencies (Mississippi Department of Marine Resources, Mississippi Secretary of State Office, and Mississippi 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.



Ethical Environment

In an effort to enhance the moral connectivity of remote operators, the U.S. 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.

GOALS AND TARGETED ACTIONS

The following goals and targeted actions have been synthesized from GOTF Focus Group reports and are intended to address the gaps identified in each area of focus. 'Goals' are measureable targets with specific 'Actions' being recommended activities to achieve them. All are relatable to at least one of the Roadmap's Key Recommendations. The GOTF expects these Goals and Targeted Actions to be refined with time as the Master Plan is implemented.

Education and Workforce

Goal: Grow and retain the top STEM-performing high-school and university graduates for entrance into the Mississippi technology workforce.

- *Action: Define career pathways and competencies in maritime technologies from K12 through graduate studies. Implement high velocity learning at every level, determine the best concepts, techniques and technologies to accelerate learning at the individual, team and organizational levels.*

Goal: Expand UMS certification programs to meet unknown workforce needs through collaboration between certification provider (universities), technology domain, and potential employer (defense and non-defense industries).

- *Action:* Create a strategic plan for learning and development of UMS to guide future training and formalize training skills and standards in order to ensure a consistent level of capability.

Goal: Establish universally acceptable marine technology and UMS workforce competencies and develop training across domains of air-sea-space to meet the growing demand of cross-domain operators.

- *Action:* Build out local infrastructure and develop collaborative opportunities to strategically integrate and align the workforce with future growth and development in maritime technologies.

Goal: Overcome the dearth of multidisciplinary technical specialists in mechanics; electronics; and maintenance and repair operations within marine technology industries in the State.

- *Action:* Create a talent pipeline by accelerating the training and reskilling that allows people and technology to reach their full potential.

Engineering Capacity

Goal: Assemble and maintain data on engineering capacity and assets in the engineering sector of the Blue Economy for the entire State.

- *Action:* Catalogue organizations and assets by current capabilities, avenues for growth, and emerging needs.

Goal: Grow the pool of accredited engineers in the Mississippi workforce to keep pace with computational needs, systems calibration, platform or vehicle validation, testing and advanced development needs in marine technology industries.

- *Action:* Leverage current educational programs to produce more engineers graduating from Mississippi universities and develop recruitment strategies to attract talent to the State.

Advanced Development and Testing

Goal: Provide complete end-to-end support for development of new technologies and advanced capabilities in the marine technologies and UMS sectors along the Mississippi Coast through a robust process of verification and validation of novel products. The process will need to begin in the design phase; address both digital and physical product development and realization; and include complex system and network design and development across an integrated range of product platforms aimed at addressing customer needs.

- *Action:* Identify commercializable Federal or university technologies and create a mechanism for pairing those technologies with entrepreneurs, small businesses, or large corporations capable of productization of those technologies.
- *Action:* Create an instrument that offsets costs associated with assessing a technology for the commercial market.
- *Action:* Develop a comprehensive test and evaluation capability for marine technologies and UMS, whether aerial, surface, or underwater.
- *Action:* Reinforce existing infrastructure and build new infrastructure that is conducive to Mississippi's intrinsic strengths in systems engineering, polymer engineering, and computational engineering.

Applications

Goal: Cultivate programs to develop new marine hardware platforms—especially unmanned and autonomous systems—with a connected architecture, specifically for data collection applications allowing interface with cloud computing capabilities enabling seamless, real-time analytics. Platforms across sea, air, and space technologies domains should be developed with common architectures allowing for seamless systems communication and data integration across the platforms.

- *Action:* Integrate hardware and software design to garner their features from the software, allowing for updates with new abilities and improved performance parameters over the life of the hardware.
- *Action:* Design hardware and software technologies with integrated cyber security components; additional research and development thrusts should be implemented to ensure systems security.

- *Action:* Develop advanced algorithms for big data analytics to provide leading-edge technologies for handling the large amounts of data garnered by new technological platforms.
- *Action:* Develop high performance, real-time analytics capabilities with dynamic sampling and critical feature selection to evaluate the performance of various combinations of feature ranking/selection algorithms, clustering algorithms, sampling methods, and learning machines.

Goal: Build capacity within the State for development of new battery technologies and novel power sources/generators for unmanned systems; advanced vehicular automation technology development; and augmented reality technologies development for integration into existing and future applications.

- *Action:* Create cross-over programs that provide both the academic and industry expertise necessary to develop, test, operate, and understand the functionality and applications of developmental systems.

Goal: Expand capabilities and expertise in marine technologies focused on fisheries management and aquaculture.

- *Action:* Develop technologies to remotely monitor fishing and help protect the marine environment by aiding in the reduction of illegal, unregulated, and unreported fishing.
- *Action:* Develop autonomous cages that follow optimal ocean and atmospheric environmental conditions for aquaculture research and industrial development.

Economic Development

Goal: Capitalize on Mississippi's vast potential for development of multiple sectors of maritime technology and UMS development by providing State and local economic development agencies the resources to fully comprehend the economic impact of the Blue Economy which is currently not well understood.

- *Action:* Engage a highly-qualified consultant to conduct a thorough analysis of Mississippi's ocean, maritime, and related technology industries against competitive states to identify Mississippi's advantages and its gaps (SWOT); analysis should include workforce, available incentives, venture capital and private funding sources, and state and Federal resources. The study should include a comprehensive report on the Blue Economy within the State.

Goal: Improve collaboration and a more seamless functioning of existing tech-focused non-profit organizations and programs along the Gulf Coast that have linking missions. Among these are NOARC as the state's lead organization for marine technology applications development, MSET as the state's lead organization for technology-based economic development along the Gulf Coast, and USM's MIST Cluster program as the state's lead program supporting the northern gulf coast region's maritime technology cluster.

- *Action:* Designate MSET as the lead project management agency to carry forward the strategic actions of the GOTF Master plan. Provide appropriate resources and funding to ensure MSET is properly staffed and able to assist in attracting both external and internal interest and resources that support development of ocean science and maritime technologies along the Gulf Coast.
- *Action:* Provide long-term funding to complement non-State resources and ensure the sustainability of the MIST Cluster program and investigate potential transfer to an independent, state-chartered, non-profit organization for long-term management.
- *Action:* Develop R&D tax credits, applied R&D seed fund, and similar programs that attract capital investment in marine-related applied research to leverage in conjunction with NOARC's development and validation capabilities. Provide long-term funding to ensure that NOARC is properly staffed and able to fulfill its mission.

Goal: Increase the focus and promote a shared vision among economic development organization for the growth of the Blue Economy in the State of Mississippi.

- *Action:* Develop a comprehensive economic development recruitment strategy targeting industry working in the Blue Economy, specifically marine technologies and UMS sectors.
- *Action:* Identify emerging markets in the Blue Economy and target markets that are synergistic to Mississippi capabilities.
- *Action:* Create focused Blue Economy marketing materials and incentives.

- *Action:* Develop a GOTF-specific business retention and expansion program.
- *Action:* Partner with the MS Gulf Coast Alliance to survey key industries and determine what policies and services will support their long-term viability and growth. Utilize survey results to identify current opportunities for growth, market constraints, and local obstacles.
- *Action:* Develop a coherent message that quality of life, workforce training, collaborative engineering spaces, and growth opportunities all exist in Mississippi.
- *Action:* Target recruitment of MRO operations for marine technologies and UMS systems for expansion into Mississippi.

Policy and Ethics


Goal: Position Mississippi as a leader in the development of policy and law in the marine technology and UMS domains.

- *Action:* Create a statewide resource center that can be used to assist Mississippi in developing a strategy that addresses existing or needed laws and ethical considerations for marine technologies and UMS development and applications.
- *Action:* Update the Mississippi Coastal Program to include UMS operations and activities.
- *Action:* Develop a comprehensive inventory of state, federal, and international laws and regulations governing UMS activities and operations in the Gulf of Mexico.
- *Action:* Develop a series of policy documents to support future marine technology and UMS activities in the Gulf of Mexico.

APPENDIX A: EXECUTIVE ORDER 1401

STATE OF MISSISSIPPI

Office of the Governor



EXECUTIVE ORDER 1401

WHEREAS, the Mississippi Gulf Coast has a diverse maritime industry including ports with deep water access, transportation, commercial fishing, shipbuilding, offshore drilling operations, environmental research, and aquaculture; and

WHEREAS, Mississippi is home to strategic military and government entities that provide aquatic research and environmental information such as collecting, processing, and exploiting oceanographic, meteorological, and hydrographic information; and

WHEREAS, the Chief of Naval Operations has created Task Force Ocean to advance science and ensure that the U.S. Navy maintains a competitive advantage in our ability to utilize the ocean environment; and


WHEREAS, the State of Mississippi and the Mississippi Development Authority desire to increase the maritime economy and the synergistic relationship between the military and government assets positioned along the Mississippi Gulf Coast especially as it pertains to the integration and development of unmanned maritime systems and supporting the U.S. Navy's competitive advantage:

NOW THEREFORE, I, Phil Bryant, Governor of the State of Mississippi, by virtue of the authority vested in me by the Constitution and laws of the State of Mississippi, do hereby order and direct as follows:

1. The Governor's Ocean Task Force is created to provide expertise for the development of a comprehensive economic development master plan that will focus on growing existing research and development for oceanography, unmanned maritime vehicles, technical workforce development, marine science research, and private sector activity.
2. The Governor's Ocean Task Force shall be advisory in nature and shall be composed of a Chairman and such other members that the Governor deems necessary. The members shall serve voluntarily with no compensation.
3. The Governor's Ocean Task Force shall meet periodically at the call of the Chairman to create an economic development master plan for Mississippi that shall include:
 - a. Cataloging existing investments in the area of ocean technologies and unmanned maritime systems and identifying existing strengths and weaknesses with a recommended comprehensive strategy to bring the state into regional, national and international competitiveness in this area;
 - b. Establishing a tangible and achievable roadmap to build capacity in maritime technology with special emphasis on national defense, energy exploration, marine resources, environmental monitoring, and aquaculture; and
 - c. A strategy for working with state and federal lawmakers for the purpose of developing a vibrant economy around these technologies that includes a means for encouraging maritime technology industries to locate in the state.

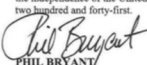
APPENDIX A: EXECUTIVE ORDER 1401

BE IT FURTHER ORDERED that the Governor's Ocean Task Force shall by November 1, 2017, provide to the Governor a written economic development master plan incorporating the mandates of this Executive Order.



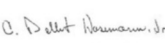
IN WITNESS WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Mississippi to be affixed.

DONE in the City of Jackson, on the 1st day of June in the year of our Lord, two thousand and seventeen, and of the independence of the United States of America, the two hundred and forty-first.



PHIL BRYANT
GOVERNOR

BY THE GOVERNOR



C. DELBERT HOSEMAN, JR.
SECRETARY OF STATE

APPENDIX B: FOCUS GROUP REPORTS

The following reports were compiled by each of the focus groups for their respective areas of focus. Each focus group was assigned one of the GÖTF members as the focus group lead, and each group recruited other advisors and subject matter experts for support. The groups were instructed to survey the State's current assets (related to their specific areas), catalogue the capabilities and infrastructure, and identify the gaps. Each group's efforts resulted in a synopsis of the current state of their target areas and recommendations on how the state should strategically advance future development of ocean technologies and maritime assets along the gulf coast. Recommendations from all six groups were then synthesized to create the "key recommendations," as well as to identify 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 UMS focus, partnering with educational institutions, from K12 to community colleges to universities, in areas of mutual interest and mutual benefit.

Education and Training Programs

The growing importance of the STEM subjects to the workforce is demonstrated in Mississippi's K12 schools with the existing STEM related Career and Technical Curricula and initiatives such as the Robotics and CS4MS Programs. The focus for CS4MS is to implement computer science in all schools in all grades by 2024 or sooner. Middle school implementation began this school year. High Schools are projected to provide a 4-course sequence to allow students to earn a CTE endorsement in Computer Science at any comprehensive high school, not just CTE Centers.

Existing post-secondary programs throughout the State offer fields of study and practice representing related domains to develop the human capital for UMS. Programs include physical, life and environmental sciences, engineering, earth/atmosphere/ocean sciences, mathematics, computer science, cybersecurity and other STEM related programs. The challenge is to ensure UMS-specific training is matched by training advancements that reflect the need for alternative approaches to education and training based on progressive UMS changes. Education and training programs must effectively blend theoretical and practical application, preparing UMS operators and developers with the training, education, and experience to translate complex information, patterns, and trends to make decisions.

The Navy supports a three-tier academic certification program for civilians and Navy officers in response to their goal of "integrating manned and unmanned systems and developing trust." The inaugural first tier certification had fifteen participants.

Several research-intensive Mississippi universities have existing certification and degree programs as well as active oceanographic, hydrographic, or unmanned systems research engineering programs.

The University of Southern Mississippi houses the School of Ocean Science and Technology (SOST). Nearly all of the SOST academic and research programs are on the coast spanning from 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 large 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 research enterprise 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 (Coast and Hattiesburg) as well as a world-renowned Polymer Science program in Hattiesburg.

USM recently offered the Nation's only university-sponsored academic certification in Unmanned Maritime Systems. 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 GOTF 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 a plethora of 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 is home to the National Center for Physical Acoustics (NCPA) with 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 also 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 GOTF Master Plan is implemented.

+ *Recommendation:* Define career UMS pathways from K12 through graduate studies.

+ *Recommendation:* Leverage NAVSEA lessons learned and best practices and implement internship and apprenticeship opportunities for UMS.

Existing Skill Framework / Preliminary Workforce Analysis

Interviews with NAVO CNMOC, NRL, and the UMS Certification Program Director yielded no recognized or widely accepted set of UxS standards or skill frameworks. The lack of historical experience in training and education specific for unmanned maritime systems, as compared to other disciplines and fields of practice, makes the task of preparing the workforce to support UxS with the relevant skills difficult.

Some 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, which will need to include not only functional skills relevant to capabilities of UxS, but also the fundamentals of communication and information systems and values such as integrity, teamwork, dedication to strategic goals/mission, the ability to maintain confidentiality, and creative problem solving under pressure.

In an effort to enhance the moral connectivity of remote operators, the U.S. 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 preeminent need for a human element for ethical decision making in the face of increasingly remote methods. Not only will future UxS 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.

Preliminary workforce analysis to determine current UxS education and workforce requirements revealed an increased manpower need in support of the Navy Shipbuilding Plan. While the increased manpower is not specifically for UxS, the increased workforce includes the need for UxS 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 percent), enlisted personnel (26 percent) and officers (7 percent). Further analysis indicated that two-thirds of the current SSC NAVO workforce has at least a Bachelor's degree.

A robust research-based, practitioner focused skill framework can provide the foundation to recruit, train and develop a UxS workforce that closely aligns with the needs of future jobs. The framework can identify the broad range of skills discussed above, as well as the required level of education and career paths. Skillsets will drive the recruitment and enlistment criteria to more closely reflect the needs of the jobs.

+ *Recommendation:* While the UxS field is growing with many self-taught experts and practitioners, there is a need to formalize training skills and standards in order to ensure a consistent level of capability.

+ *Recommendation:* As the UxS field of practice grows, the Learning & Development (L&D) function will play a critical role for industry growth. L&D must help organizations and regions drive business. Creation of a Strategy Map for Learning and Development of the UxS will help guide the future efforts of the training function.

Gap:

Need to match the workforce demands and present state-of-the art training and education for a growing range of applications.

+ *Recommendation:* Expand local infrastructure and develop collaborative opportunities to integrate and align the workforce with UMS future growth and development.

+ *Recommendation:* To achieve what the Navy references as high velocity learning at every level, determine the best concepts, techniques and technologies to accelerate learning at the individual, team and organizational levels.

+ *Recommendation:* Create a talent pipeline that allows people and technology to reach their full potential by accelerating the training and reskilling of people. Labor productivity, talent acquisition and retention, innovation, and creativity help to solidify a UxS talent pipeline.

+ *Recommendation:* Clearly define the career pathways for UxS and the competencies required along the career pathways.

ENGINEERING CAPACITY

Blue Economy in Mississippi

Efforts to quantify the Blue Economy in Mississippi must focus on identifying and understanding those organizations—federal, state, university, and private industry—that support poorly categorized ocean-based projects and programs. For example, an engineering company working on systems and sensors to understand near-shore waves is categorized under “professional engineering.” All of the engineering companies in the State can be identified; however, identifying those working specifically in the maritime is a much harder task.

+ *Recommendation:* Form a diverse group of federal, state, academic, and private companies to work on furthering the Blue Economy sector as a whole. It will be important to know which organization is doing what, where they plan to go in the future, and how internal Mississippi assets can be applied to emerging needs. Subgroups may be necessary to address specific topics, for example unmanned systems.

For a recent request submitted to the Mississippi Enterprise for Technology (MSET), a week-long task that involved prior knowledge of local efforts and a cursory Internet search for companies revealed as many as 109 organizations working in the Blue Economy in the lower three counties.

+ *Recommendation:* An effort to fully compile similar information for the entire State should be initiated.

Unmanned Systems

For the purposes of the Governor's Ocean Task Force, the Engineering Capacity Work Group selected a promising sector as an example of what already exists in Mississippi and resonates with local federal, academic, and private entities—unmanned systems. This is an emerging technology 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 unmanned systems (UxS) in the State, not only must the system builders be considered, but also organizations that support the development/enhancement of the systems, data acquisition and handling, data analytics and product development, operations and maintenance, and communications providers. Infrastructure within the State to assist in UxS deployment, testing, evaluation, and use is also critical to document.

Existing Capacity

A catalog of Mississippi-based assets was compiled that relate to ocean-based UxS, whether the system is deployed underwater or on the water's surface, or is looking at the water from airborne or space-based platforms. Using customized "Asset Sheets," organizations were cataloged according to how they support UxS—associated with systems, services, or infrastructure. Additionally, a list of Mississippi-based suppliers supporting the industry was compiled. These Asset Sheets provide details of how each asset is supporting UxS; similar sheets were collected for organizations that are not currently supporting UxS efforts, but have the capacity to do so. The information on these sheets, combined with information gleaned from discussions with UxS users, formed the basis for the information that follows.

The review of organizations that support underwater and surface UxS systems identified the following:

- 15 Federal agencies
- 8 State agencies and universities
- 50 Private Companies

These 73 organizations provide the following types of support to UxS:

- Manufacture of space-based, airborne, and surface systems
- Operation and use of UxS to characterize coastal, national, and international waters
- Deployment and recovery of UxS in support of contracted and/or research projects
- Manufacture of ships capable of easily deploying underwater UxS
- Program/project management support
- Engineering expertise to design new UxS
- Incorporation on new sensors onboard UxS
- Research vessels and other ships available for UxS deployment
- Aircraft available for flying UxS
- Drone deployment to support environmental programs/projects
- Trainers to assist others in certification process for proper drone operation
- Expertise in the determination of drone use within commercial airspace
- Use of UxS during disaster response to re-survey shipping channels/navigation routes
- Restricted air space for the test of airborne systems
- Remote operation of underwater and surface-based UxS
- Programming of UxS for remote operation
- Manufacture of communication systems supporting UxS
- Laboratories to support post-deployment cleaning and prep of underwater/surface UxS
- Calibration of the instruments used in UxS repair and maintenance
- Manipulation of data received from UxS
- Software development to manipulate UxS data to address environmental characterizations and to prepare data for use in forecast models/predictions
- Quality assurance and metadata generation of UxS data
- Creation of databases for UxS data
- Data analysis to address various environmental issues and monitoring
- Creation of maps and other data products generated from UxS data
- Expertise in the use of UxS data collection to address various scientific, environmental, and military purposes
- Web-based access to data, maps and other data products created from or including UxS data

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 UxS.

Eighteen companies that currently do not support UxS, but have the capability to do so, were identified. Companies located in the State that are key participants in UxS include the following:

- BAE Systems
- Lockheed Martin
- Teledyne Marine
- Tyonek

+ *Recommendation:* Conduct a focused study on quantifying the Blue Economy in Mississippi. Results from this report indicated 73 organizations involved in one sector of the Blue Economy. A comprehensive study of the Blue Economy is needed to understand its total contribution to the Mississippi economy.

Gaps:

Based on the data collected, three gaps were identified in Mississippi's UxS capacity. It is expected that similar gaps will be determined within other sectors.

- *System maintenance and repair operations (MRO)*—in general, organizations with UxS systems had to either assign staff to the repair and/or maintenance of hardware, or send them out to the original manufacturers located out-of-state.
- *Sensor Calibration*—many of the UxS are equipped with sensors to collect environmental data. Following their use, or a certain number of uses, they must be calibrated. Although the NASA Laboratories at Stennis can provide some of this support, most return their sensors to out-of-state manufacturers for calibration.
- *Underwater/Surface System Test and Evaluation Infrastructure*—as systems progress through the development process, they must be tested, verified, and validated. Mississippi has the infrastructure for the test and evaluation of airborne systems; however, no in-water infrastructure has been established.

+ *Recommendation:* Create a program to identify and recruit companies that would further advance Mississippi's Blue Economy. A number of companies have or are looking to re-locate given the expenses associated with traditional east and west coast areas.

+ *Recommendation:* Create focused marketing materials and incentives associated with Mississippi sites. Begin efforts with existing industry (BAE Systems, Lockheed Martin, Teledyne, Tyonek) or those that fill gaps in the current capacity.

+ *Recommendation:* Leverage the existing UxS capability to expand and create new assets. There is synergistic support for the creation of a test range in the Gulf Coast area. Mississippi has distinct advantages over other locations. For example, Mississippi is home to the largest fleet of underwater UxS operated from Navy groups at Stennis, and the coastal/nearshore environment provides access to all types of scenarios for testing.

+ *Recommendation:* Create a plan to use Singing River Island as a UxS Test Range Operating Station and designate rules and regulations for using coastal Mississippi waters for UxS testing, research, and operations.

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, 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. It also results in a number of individual organizations spending project monies on the same types of equipment. Another solution to the problem is to contract the use of another organization's development and test equipment. This is currently difficult for several reasons—1., some equipment is not easily assessable (a Federal asset, for example). 2. There is also a lack of understanding on the assets available in the State and how to use them. 3. And finally, and as a result 2, development and testing elements are conducted out-of-State.

+ *Recommendation:* Form a diverse group of federal, state, academic, and private companies to work on furthering the Blue Economy sector as a whole. In addition to understanding which organization is doing what, specific emphasis needs to be

on the identification of internal Mississippi assets and how they can be used by others.

Proposed efforts to bring an incubator/accelerator focused on the development and test of new ideas in the Blue Economy have not been successful. As a result, ideas for new sensors and systems cannot be prototyped, modeled, or tested. In most areas where these sensors and systems are being successfully developed (San Diego/Massachusetts/Florida), there is a dedicated space supporting students, entrepreneurs, and hi-tech companies where not only can the equipment needed for prototyping and testing can be shared, but receive education on developing the business aspects of their technology.

+ *Recommendation:* Create an incubator/accelerator that is customized to support the hi-tech aspects of the Blue Economy. Ensure the infrastructure is conducive to Mississippi strengths, such as advanced materials and additive manufacturing. Accessibility by students of Mississippi universities is essential for furthering the productive development of small companies based on new and fresh ideas.

Up-and-Coming Programs

There are various types of Mississippi-based organizations that are currently working on, or have proposed, efforts that will drive the success of the Blue Economy in terms of technology advancement, reduced costs, increased accuracy and understanding, and efficiency. Some of these are Federal research laboratories, some are private companies with internal research and development efforts, and others are start-ups. Recent efforts in Federal programs such as DARPA, ONR, and NRL, as well as larger companies such as Huntington Ingalls and Shell, are focused on not only the development of new techniques or new applications of existing techniques, but 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 are:

- Interoperability
- Autonomy
- Integration
- Communications
- Training
- Propulsion and 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 much 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 developing rules of engagement are still a work-in-progress. A number of Mississippi assets exist that can be applied to the challenges facing programs like this.

+ *Recommendation:* Create programs that provide the expertise necessary to develop, test, operate, and understand the functionality of these systems and their use. In the case of the Navy's MUM Teaming goals, Mississippi has two universities, each with specific and relevant expertise of their own. Leveraging the curricula at the University of Southern Mississippi in underwater systems and Mississippi State University in aerial systems to form a cross-over educational experience would create globally unique program and position the State as a leader in the field.

+ *Recommendation:* Leverage current activities on Singing River Island to develop a comprehensive test and evaluation capability for UMS, whether aerial, surface, or underwater. Dedicate a building to house standardized tools, equipment, software, control stations, and other elements needed to fully support the deployment and assessment of these systems in a very-well-understood environment and within proximity to a variety of operational scenarios.

+ *Recommendation:* Using the previous two recommendations, position Mississippi as a leader for developing policy, rules of engagement, and operating procedures for interoperable UMS, including the use of multiple systems and multiple types of systems.

+ *Recommendation:* Create a mechanism or group to identify other examples of where Mississippi-based programs of excellence can be leveraged for the expansion of the State's Blue Economy. This might include shipbuilding, oil and gas, ocean monitoring/observing/forecasting, and others.

Current Shortfalls

In the Engineering Capacity Section of this document, 73 organizations were identified that currently provide some type of direct support to UMS. The shortfalls identified in that Section are also relevant here, with emphasis on the need for an MRO capability. Adding this to the recommendations in the previous section will then provide a complete end-to-end support for UMS along the Mississippi coast.

+ *Recommendation:* Identify private entities that provide MRO services to aerial and underwater UMS and facilitate/expand their offices in Mississippi.

+ *Recommendation:* Create a program to identify and recruit companies that would further advance Mississippi's Blue Economy. A number of companies have or are looking to re-locate given the expenses associated with traditional east and west coast areas.

APPLICATIONS

To position the State of Mississippi as a leader in maritime technologies and ocean-based unmanned systems applications, the GOTF will develop a comprehensive assessment strategy and development plan for applications for maritime technologies and ocean-based unmanned systems within the State. The following focus areas have been identified as key drivers for success in this field:

Technology, Systems, and Systems Integration

Mississippi has significant assets for supporting aerial and spaced based remote sensing applications, as well as unmanned aerial, surface, and submersible vehicles. This includes government, industry and university assets 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 also established both land and sea UAV flight zones.

+ *Recommendation:* Expand and enhance current—and establish new— aerial, surface, and subsea unmanned vehicle test ranges and their supporting infrastructure.

+ *Recommendation:* Develop and implement a methodology for identifying existing assets, expertise, and investments as well as tracking new developments for cataloging and reporting.

Modern technology 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. Modern technology hardware is oft primarily associated with data collection. The market for applications that transform that data into usable information holds the potential for tremendous economic growth.

+ *Recommendation:* The focus on assets and expertise for the development of new technological hardware—especially unmanned and autonomous systems—should be primarily on design of data collection platforms with a “connected” architecture, allowing interface with cloud computing capabilities.

+ *Recommendation:* Attention on existing and developmental assets and capabilities should be focused on the integration between hardware and software so that data collected can be uploaded to the cloud, analyzed, and presented seamlessly in a usable format. Integrating the hardware and software systems designs will enable devices to garner their features from the software, allowing for updates with new abilities and improved performance parameters over the life of the hardware.

+ *Recommendation:* Effort should be made to ensure that hardware platforms across sea, air, and space technologies are developed with common architectures allowing for seamless systems communication and data integration across the platforms.

+ *Recommendation:* Prioritize the design of hardware and software technologies with integrated cyber security components. Additional research and development thrusts should be implemented to ensure systems security.

Target Agencies and Industries for Support

Mississippi has a robust ecosystem of existing industry and governmental agencies operating in the fields of marine and ocean sciences and technologies. To support this base, accelerate tech-based innovation, and grow the high-tech economy, a concerted effort should be undertaken to identify needed support and capabilities.

+ *Recommendation:* Conduct regular systematic reviews of agencies and report on:

- Technology Road Maps
- SBIR/STTR and similar technology development solicitations topic areas
- Federal labs mission statements and associated research focus areas.

+ *Recommendation*: Conduct regular systematic reviews of marine related industries and report on:

- Technology Road Maps where available
- Conferences related to applied technologies
- Trade journals and other publications
- Industry research groups.

+ *Recommendation*: Conduct interviews with key agency and industry leaders and technologists to better understand and verify problems and opportunities that may be addressed by technology applications development through state, federal, and industry joint partnerships.

Creation of operational programs within the state to help address identified critical needs of target agencies and industries related to marine technology applications should be considered. Existing models in the high-performance materials (Mississippi Polymer Institute) and automotive industries (CAVS-E) have been implemented and have shown great success.

+ *Recommendation*: Establish joint agency/industry/state-university applied research development programs.

+ *Recommendation*: Support tech-based incubator programs and extension services aiding tech-startups and industry applied research projects.

+ *Recommendation*: Conduct regular conferences and meetings among agency/industry/state-university research and development organizations.

+ *Recommendation*: Explore R&D tax credits, applied R&D seed fund, and similar programs that may attract capital investment in marine-related applied research.

Process for Verification and Validation of Novel Technologies for Operational Prototype

To bring new technologies and advanced capabilities to fruition within the State, public and private partnerships can address identified applications themes in the marine and ocean sciences sectors through a robust process of verification and validation of novel products. The process will need to begin in the design phase; address both digital and physical product development and realization; and include complex system and network design and development across an integrated range of product platforms.

+ *Recommendation*: Establish a product innovation, development, and pilot production facility (such as USM's Accelerator) on the Gulf Coast to facilitate new product design and prototyping.

+ *Recommendation*: Expand existing and establish new physical environment test ranges in the gulf coast region.

+ *Recommendation*: Develop a digital proving ground of ultra-high resolution, precisely characterized geospatial information/data based on the physical test ranges for use in future systems prototype development and performance verification testing.

+ *Recommendation*: Utilize a collaborative research framework that leverages collective resources to accelerate development of new system prototypes.

+ *Recommendation*: Orchestrate a collective integration of expertise across university, industry, government, and non-profit (NOARC, MSET, etc.) where stakeholders all participate and all benefit from results.

Valuation of Data Acquired through Applications

The rapid proliferation of connected devices, sensors, and (Internet of) things has ushered in the era of big data, which holds tremendous potential for problem solving and applications development in various fields.

+ *Recommendation*: Identify university, state, and Federal resources focused on development of advanced algorithms for big data analytics to provide leading-edge technologies for handling the large amounts of data garnered by new technological platforms.

+ *Recommendation*: Focus resources on developing a methodology for high performance, real-time analytics with dynamic sampling and critical feature selection to evaluate the performance of various combinations of feature ranking/selection algorithms, clustering algorithms, sampling methods, and learning machines.

+ *Recommendation*: Conduct a comprehensive literature review by an interdisciplinary team that may lead to the finding of algorithms suitable for specific tasks. Subsequently, software development teams made up of university, industry, and Federal partners may be composed to undertake customized development projects capitalizing on the published algorithms and open-source software and leading to additional education and R&D opportunities to Mississippi communities.

Applications for Existing Industry

Several maritime-based industries within the State use remotely operated and autonomous unmanned systems, and other robotic instrumentation and sensors. The defense industry uses autonomous unmanned and remotely operated technology regularly. Other 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 waver 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.

+ *Recommendation:* Assess capacity within the State for development of new battery technologies and novel power sources/generators for unmanned systems.

+ *Recommendation:* Position or develop assets and infrastructure along the coast to encourage greater adoption of USVs for commercial applications, and subsequently implement incentives and recruiting strategies to grow the USV production capacity within the State.

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.

+ *Recommendation:* Assess capacity within the State for advanced vehicular automation technology development.

+ *Recommendation:* Develop a test range for verifying capabilities of ocean-based autonomous vehicles.

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 operated from vessels that help target schools of fish and look for potential bycatch issues are used by commercial fleets.

+ *Recommendation:* Assess capacity within the State to develop technologies aiding selective fishing practices that help reduce bycatch and environmental impacts related to the commercial fishing industry.

+ *Recommendation:* Examine growth opportunities that include the ability to remotely monitor fishing and help protect the marine environment by aiding in the reduction of illegal, unregulated, and unreported fishing.

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.

+ *Recommendation:* Assess capacity within the State to develop autonomous cages that follow optimal ocean and atmospheric environmental conditions for aquaculture research and industrial development.

+ *Recommendation:* Determine existing capabilities related to augmented reality technologies and examine the potential for integration into existing and future applications.

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

+ *Recommendation:* Leverage existing and develop new assets and capabilities in parallel with the directives generated by the Navy's Task Force Ocean.

+ *Recommendation:* Leverage existing and develop new assets and capabilities in parallel with the directives generated by DHS's expanding need for drone technologies.

Identification of Relevant Ocean Applications

Commercial Industry

- Commercial Exploration
 - Offshore Drilling
 - Survey and Seabed Mapping

- Pipeline/Cabling/Inspection
- Marine Fisheries
 - Commercial and recreational fishing
 - Commercial shellfish production/Mariculture—Offshore and Onshore
- Commercial shipping and Port and Harbor operations
 - Ocean weather monitoring and prediction
 - Security, Detection, and Inspection
 - Navigation and Accident Investigation
- Coastal Restoration and Recovery
 - Environmental engineering
 - Coastal wetland plant production

Scientific Research

- Seabed Mapping and Imaging
- Oceanographic Studies
- Environmental Research and Monitoring
- Pharmaceutical Research

Defense

- ISR (Intelligence, Surveillance, and Reconnaissance)
- Mine Countermeasures
- Anti-Submarine Warfare
- Defense logistics and Port and Harbor operations
 - Ocean weather monitoring and prediction
 - Security, Detection, and Inspection
 - Navigation and Accident Investigation

Miscellaneous

- Search and Rescue
- Marine Salvage and Debris Removal
- Marine Archaeology

ECONOMIC DEVELOPMENT

Mississippi is home to 15 ports situated along waterways throughout the state, including two deep-draft ocean ports along the Mississippi Gulf Coast in Gulfport and Pascagoula, making Mississippi a major competitor in ocean, maritime and marine-related technology industries. Beyond the coastline, an array of suppliers and technology companies support the maritime industry.

Business Retention and Expansion Program

A thorough and comprehensive business retention and expansion strategy will protect and grow Mississippi's existing ocean and maritime industries. Robust data on marine industry sectors needs to be gathered using state of the art survey tools and methods. 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.

+ *Recommendation:* Develop a GOTF-specific business retention and expansion program:

- Partner with the Gulf Alliance to survey key industries and determine what policies and services will support their long-term viability and growth.
- Utilize survey results to identify current opportunities for growth, market constraints, and local obstacles. Throughout the process, the team will gather valuable insight into expansion opportunities, skill gaps, and competitive advantages that can be used in conjunction with real-life data.
- Examples of survey topics: permitting, both state and local; employment issues; utility issues; serving as a liaison to local, state and Federal officials; workforce

issues; advocating on issues important to local industries and small businesses in the areas of transportation, regulations, and policy matters; identifying sites and buildings available for expanding business and industry; and coordination with existing businesses and industries to continue improving the business environment.

Emerging Markets

There are a number of emerging markets associated with the blue economy and blue-tech 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; transportation; floating ports; and defense-related support. Enormous capacity exists in local federal, state, and private organizations to support unmanned systems 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.

+ *Recommendation:* Identify emerging markets in the blue economy, specifically those markets that are synergistic to Mississippi capabilities.

The Blue Economy is encumbered by a lack of reporting mechanisms—NAICS and SIC codes do not adequately separate organizations working in the Blue Economy. Therefore, a clear understanding of which engineering companies support maritime engineering, for example, is not going to be easily determined unless direct connections are made and maintained. The utilization of networking organizations (Innovate MS, MSET, MIST Cluster, etc.) to understand the capabilities of their members and their technological capabilities is essential to identifying Mississippi-based companies best able to address emerging opportunities. An organization such as this should also understand the actions of similar organizations across the Nation and internationally.

+ *Recommendation:* Create, or designate an existing, networking organization to facilitate interaction among blue economy/blue-tech companies in the State and remain current with ever-changing technologies.

Efforts to identify and foster the development of emerging blue economy and blue-tech 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.

+ *Recommendation:* Create mechanisms to support and fund emerging markets, specifically using technology business incubators and accelerators.

Competitive Advantage

Understanding the State's current market position as compared to other states in the blue economy sector is essential to gaining and maintaining a competitive advantage.

+ *Recommendation:* Conduct an initial self-analysis of Mississippi's ocean, maritime, and related technology industries against competitive states to identify Mississippi's advantages and its gaps (SWOT).

+ *Recommendation:* Benchmark Mississippi against the states of Florida, Virginia, North Carolina, California, Washington, Massachusetts, and Maryland—all of which constitute a heavy Navy base and technology footprint, similar to Mississippi. This comparison would give Mississippi an opportunity review programs and resources that are publicly available against the State's offerings.

- Analysis should include workforce, available incentives, venture capital and private funding sources, state and Federal resources.

+ *Recommendation:* Upon finalization of the strategic plan, implementation should include funding sources to hire a consultant to conduct an industry survey of these items against identified competitive states.

Research and development, both university and industrial, can create major advantages for the state. Research partnerships between university and industry provide additional value.

+ *Recommendation*: Create a catalog of current and potential partnerships to identify the impacts of those partnerships. This should include R&D dollars, employment, and potential expansion opportunities or new locations into the State.

+ *Recommendation*: Identify tax credit or incentive programs specifically tied to research and development and catalog against competing states.

+ *Recommendation*: Identify existing or create R&D tax credits specifically for university and industry partnerships.

Testing

Mississippi has a unique position in evaluation and testing of unmanned platforms including air, land, and marine—both surface and subsurface in all environments. The South Mississippi Training Complex, thanks to a huge military presence in Mississippi, is already ahead of other areas, especially being the FAA's Center of Excellence for unmanned integration into National Airspace. Mississippi State has now been granted a Certificate of Authorization (COA) for unmanned access to the Warning and Restricted Training areas over the Gulf of Mexico, which provides unlimited test access for ocean-based programs as well as air-to-surface testing.

+ *Recommendation*: Create, or designate an existing organization to manage and expand current test ranges; develop new ranges, and market the capabilities offered to national and international markets.

Cluster Branding and Sales Plan

A well-structured and consistent communication strategy is a key component to the implementation of the Oceans Task Force final 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 Governor's Ocean Task Force can begin to develop a communication and branding strategy and identify tools to reach the target audience.

+ *Recommendation*: Develop a cluster branding and sales plan focused on attracting both external and internal interest and resources that will support the strategic development of ocean science and maritime technologies along the Coast.

+ *Recommendation*: Add subject matter experts in cluster branding and marketing to this effort. At a baseline, the strategy should include the following elements:

- Clearly define roles and responsibilities of various agencies and organizations throughout the state.
- Develop a branding process that will be based on final vision of the study. This includes brand name, theme and consistent messaging.
- Develop a communications plan using multiple types of media (website, social media, print) that is targeted to sectors identified in the final plan.
- Integrate branding and marketing into the existing economic development infrastructure.
- Develop an implementation and coordination plan for ongoing sales activities.
- Identify events and activities that will provide for continuous dialogue from stakeholders, both internally and externally, creating a broad recognition and acceptance of the brand.

+ *Recommendation*: Leverage the extant SBA supported Marine Industries Science & Technology Cluster (MIST Cluster) as a baseline starting point for further cluster branding and development under an independent non-profit organizational structure.

POLICY AND ETHICS

Mississippi has a unique opportunity to become the leader in testing and advancing the Nation's next generation of Unmanned Maritime Systems. While there are numerous unmanned systems efforts ongoing in the United States, there is a lack of focus on underwater systems development. Mississippi is uniquely positioned to fill this void; however, as with any innovative technology there are legal and regulatory barriers that must be addressed to achieve desired goals.

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 nau-

tical miles offshore) and Federal waters (3–200 nautical miles offshore). Additional complexities emerge as UMS seek interoperability across platforms and domains.

Consider, for instance, the complexity surrounding the necessary environmental reviews for the 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.

Furthermore, the legal status of UMS is unclear under both Federal and international law. Unlike UAVs, which the Department of Defense has classified as aircraft, UMS classification remains uncertain. Clear guidance has yet to be developed regarding which UMS should be considered vessels and additionally in the military context, warships and weapons. The classification of an UMS will impact how that UMS is treated under Federal and international law with respect to navigational rights such as innocent passage, collision regulations, and liability.

+ *Recommendation:* Update the Mississippi Coastal Program to include UMS operations and activities.

There are also public policy and ethical issues surrounding the increased use of UMS in the Gulf of Mexico. Ethics, as used within this master plan, refers to standards of right and wrong in terms of the obligations that UMS developers and operators have to their employers, funders, partners, and the wider society. UMS activities may lead to collaborations between military, scientific, and private industry partners involving classified or confidential information, such as trade secrets or proprietary data. Surveillance activities can raise privacy concerns. 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. Proponents of UMS activities must consider the competing uses of ocean space and the navigate a variety of user needs and demands.

UMS activities should be undertaken in adherence to a maritime industry codes of conducts and best practices, in addition to applicable legal requirements. The UK Marine Industry Alliance, for example, developed an industry code of conduct for maritime autonomous systems. The U.S. Coast Guard's Navigation Safety Advisory Council Resolution 16–0 provides best practices for UMS. Certification and other educational programs for UMS should provide training on industry codes of conduct, best practices, and other ethical consideration related to scientific integrity, data management, and privacy requirements.

Gap:

The suite of state and Federal laws that relate to Unmanned Maritime Systems development, testing and application are expansive. There is currently no national center focusing on the legal, policy, and ethical issues surrounding the use of UMS, thereby limiting the resources that are available to assist Mississippi in developing a strategy that addresses existing or needed laws. There is a significant need for legal research and outreach activities to inform UMS policy development on the state, federal, and international levels. UMS legal research and outreach would also directly support the development of the UMS in industry by increasing stakeholder awareness of the existing legal framework governing their activities, facilitating stakeholder engagement, and informing law and policy reform efforts on the state and Federal level.

+ *Recommendation:* Provide funding support to establish the “Mississippi Unmanned Maritime System Policy Center” within the Mississippi Law Research Institute (MLRI) at the University of Mississippi School of Law. MLRI, established

under Miss. Code Ann. § 57-55-5, is the official advisory law revision, research, and reform agency of the state of Mississippi. MLRI's Ocean, Coastal, Natural Resources, and Environmental Research Group is a nationally recognized resource for ocean and coastal law, and is well-positioned to draw upon the diverse law and policy expertise of faculty and programs at the University of Mississippi, including the National Center for Remote Sensing, Air, and Space Law.

+ *Recommendation:* Develop a comprehensive inventory of state, federal, and international laws and regulations governing UMS activities and operations in the Gulf of Mexico.

+ *Recommendation:* Develop a series of policy documents to support future UMS activities in the Gulf of Mexico.

APPENDIX C: SUPPORTING COMPANIES, AGENCIES, AND ORGANIZATIONS

COMPANIES CURRENTLY SUPPORTING UMS	COMPANIES THAT COULD SUPPORT UMS	STATE AGENCIES CURRENTLY SUPPORTING UMS
A2Research	Acquisition Logistics Engineering	Hancock County Port & Harbor Commission
AeroTec LLC	Anchor QEA	Harrison County Development Commission
Aurora Flight Sciences	BAE Systems	Jackson County Economic Development Foundation
Chevron	Clear Point Engineering	Mississippi State University
Datastar	Compton Engineering	National Oceans & Applications Research Center (NOARC)
Debris Tech	Cuevas Machine Co	Pearl River Community College
Drone Assist, Inc.	David Evans & Associates	University of Mississippi
Dungan Engineering	Digital Engineering & Imaging	University of Southern Mississippi (USM)
Eaton Aerospace	Engineering Services	
EMC, Inc.	GE Aviation	FEDERAL AGENCIES CURRENTLY SUPPORTING UMS
Entergy	General Atomics	Camp Shelby Joint Forces Training Center
Environmental Management Services	Harrison Hydrographic and Oceanographic	Naval Meteorology and Oceanography Command
Fugro Marine Geoservices	Heinrich & Associates	Naval Oceanographic Office
Geocent	High Tech	Naval Oceanography Operations Command
General Dynamics Information Tech	Huntington Ingalls	Navy Special Operations
Information Management Resources Inc.	Hyperion Technology Group	Keesler Air Force Base
Innovative Imaging & Research	International Welding & Fabrication	National Aeronautics and Space Administration
Insitu (Boeing subsidiary)	LogLinear Group	NOAA's National Data Buoy Center
Kopis Mobile	Mississippi Aerospace	NOAA's National Center for Environmental Information
Leidos	OpTech/Teledyne	NOAA's Navigation Response Team-1
Lockheed Martin Space Systems	Pickering Firm	NOAA National Marine Fisheries Service
Mississippi Enterprise for Technology (MSET)	Pittmann Engineering	Naval Research Laboratory - Stennis
Necessity Systems LLC	Precision Products	
Northrop Grumman	Professional Services Corporation International (PSCI)	FEDERAL AGENCIES THAT COULD SUPPORT UMS
NVision Solutions	Raytheon	Joint Airborne Lidar Bathymetry Technical Center of Excellence
Orion Engineering	Seymour Engineering	National Guard, Combat Readiness Training Center
PAE (Pacific Architects & Engineers)	Skylla Engineering	Naval Air Station Meridian
Pelagic Research Services	Tenax Aerospace	
Power Dynamics	Tyonek	
Qrisq Analytics		
Riverside Technology Inc		
SaiTech		
Sinhatech		
Stark Aerospace		
Vencore Services & Solutions		
VT Halter Marine		

Mr. BRYANT. Thank you, sir.
 Senator WICKER. Thank you very much, Governor Bryant.

Mr. Conathan, we're delighted to have your testimony. Welcome.

**STATEMENT OF MICHAEL J. CONATHAN,
EXECUTIVE DIRECTOR, ASPEN HIGH
SEAS INITIATIVE, THE ASPEN INSTITUTE**

Mr. CONATHAN. Well, thank you very much, Senator Wicker. Thank you, Senator Cantwell, and other Members of the Committee, and other staff of the Committee, including some of my former colleagues. It's a pleasure to be back. It's a bit of a homecoming of types for me and particularly to come and talk to you today on the topic of the Blue Economy.

Today's hearing does represent a bit of a homecoming for me. I spent 5 years as a Republican staffer on this committee and while my current role is Executive Director of the new Aspen High Seas Initiative at the Aspen Institute, that means that my work now focuses more on the distant and deep ocean rather than on the domestic marine policy issues that were my daily work here in the Senate. As a coastal resident of Maine, where, by the way, Governor, we also have some pretty exceptional seafood and shipbuilding, and as the husband of a part-time commercial lobsterman, I remain deeply connected to all aspects of America's Blue Economy.

The ocean is intimately connected to everyone on the planet, whether hauling pots on Casco Bay, hiking the snowy peaks of the Rocky Mountains, or traversing the Sahara Desert, and while I appreciate the optimism inherent in today's hearing title, before we can truly engage in a discussion of the successes and opportunities found in our Blue Economy, we must start first by establishing a common understanding of what it is we're talking about.

In addition to my role at the Aspen Institute, I also chair the Board of Advisors to the Center for the Blue Economy at the Middlebury Institute of International Studies at Monterey, and while there's no internationally-accepted definition of the Blue Economy, the CBE defines it as "comprising the economic activities that create sustainable wealth from the world's oceans and coasts."

Other international organizations, such as the World Bank and the United Nations Development Program, also define the Blue Economy to include this critical component of sustainability. They include this term because sustainability is not just a buzzword. It's an imperative.

Humanity has set our climate on the precipice of a catastrophic point of no return. We've decimated fish populations and put countless species, from microscopic plankton to the largest animals on the planet, like the North Atlantic right whale, at risk of extinction.

We've turned the oceans' gyres into plastic soup and strewn waste from the poles to the depths of the Marianna Trench. If we continue this business as usual, if we fail to treat the system with an abundance of precaution, it won't just be our Blue Economy that will suffer in the long run, it will be our entire planetary economy.

This is why we established the Aspen High Seas Initiative, to address the existential threats currently facing even the deepest remotest areas of the global ocean, our final conservation frontier.

While people may conceptually understand that we live on an ocean planet, the ocean remains primarily out of sight and out of mind. Thus, our goals are to increase understanding of the global ocean, cultivate a new diverse set of ocean champions, and inspire world leaders and key decisionmakers to protect the high seas and the ocean at a global scale.

To do this will require us to take advantage of an exponential increase in our capacity to acquire data. A 2017 piece from the World Economic Forum asserted that we have collected more data on our oceans in the past 2 years than in the history of the planet.

A blog piece in *Scientific American* further reported that NOAA's ocean sensors alone collect 20 million megabytes of data daily.

But for this volume of information to actually mean anything, we must ramp up our ability to process, analyze, and understand what those data are telling us.

Fortunately, we have partners, such as the World Economic Forum's Center for the Fourth Industrial Revolution and XPRIZE, who are diving in to assist, and the private sector's involvement will be critical in this effort.

While there's sure to be a cost, the good news is there's plenty of room for the budget to grow. Annual funding for NOAA's Office of Ocean Exploration increased to \$42 million last year, yet that figure is still literally a rounding error compared to the multiple billions of dollars we spend on NASA's space exploration.

No knock on space exploration but unlike what we're likely to find on our next space mission, I can give you a 100 percent guarantee that our ocean is absolutely teeming with alien life forms just waiting to be discovered.

So protecting this marine biodiversity is central to an effort underway right now at the United Nations to negotiate a new treaty aimed at protecting biodiversity beyond national jurisdiction, that is, on the high seas. When complete, this treaty will provide a mechanism for establishing marine-protected areas on the high seas, among other key topics aimed at safeguarding these critical components of our last global commons.

Science has shown that protecting 30 to 40 percent of the ocean will be necessary to safeguard biodiversity, preserve ecosystem services, and achieve socioeconomic priorities. Strongly protected areas allow fish to grow large and reproduce, protect important habitats, and have spillover effects that replenish fish stocks outside their boundaries.

And the same technological advances that have led to our ocean data revolution can also provide the keys to enforcing restrictions against industrial fishing and illegal activity in these ocean parks.

The ocean acts as the planet's lungs, producing half the oxygen we breathe and absorbing half the carbon dioxide we have pumped into the atmosphere. It acts as the planet's heart, circulating heat and nutrients around the globe, and it acts as the planet's liver and kidneys, absorbing and filtering our waste, and just like these internal organs and systems so critical to our bodies, we must take great care not to overtax these vital marine functions.

To protect the health of our ocean and in turn our Blue Economy, we must, as the saying goes, first do no harm.

The signs carried by students, the young people with the most to fear from the future of climate change, the signs they carried during the climate strike earlier this month were wise in their simplicity. There is no Planet B. There is no Ocean B. First do no harm.

Once again, Mr. Chairman, I thank you for the invitation to be here today, and I look forward to answering any questions you may have.

[The prepared statement of Mr. Conathan follows:]

PREPARED STATEMENT OF MICHAEL J. CONATHAN, EXECUTIVE DIRECTOR,
ASPEN HIGH SEAS INITIATIVE, THE ASPEN INSTITUTE

Chairman Wicker, Ranking Member Cantwell, and members of the committee, thank you for the opportunity to provide testimony on this critical topic. Having formerly served for five years on the Republican staff of this committee's former subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard, first as a Knauss Sea Grant Fellow and then as Professional Staff, it is my great pleasure to appear before you today in my current capacity as Executive Director of the Aspen High Seas Initiative,¹ a new program of the Aspen Institute focused on igniting awareness of the urgent need and inspiring action to protect the health of the High Seas at a global scale.

I also serve as Chair of the Advisory Council to the Center for the Blue Economy (CBE), a program of the Middlebury Institute of International Studies at Monterey, a graduate-level education and research program with the mission to promote a sustainable ocean and coastal economy through leadership in research, analysis, and education. CBE defines the blue economy as distinct from the ocean economy insofar as it includes sustainability as an inherent principle.² This makes the blue economy a subset of the ocean economy—where the latter may include all economic activity on and in the water as well as beneath the seabed, the former only accounts for economic activity that is environmentally sustainable and either benefits from or contributes to healthy oceans and coasts. For purposes of this testimony, therefore, reference to the blue economy will mean the portion of the ocean economy that meets these criteria.

Much of my past work, here for the committee and subsequently in my role as Director of Ocean Policy at the Center for American Progress, focused on management of the United States' ocean resources and our own blue economy. However, my current position with the Aspen High Seas Initiative has widened my focus to cover the two thirds of the global ocean—45 percent of Earth's surface—that comprises the High Seas, the area of the ocean beyond any single nation's jurisdiction. And while I recognize that this committee is primarily concerned with issues that affect the coastal economy of the United States, any discussion of the blue economy must begin by acknowledging that our ocean is singular, global, and an inextricable component of the system that allows all life to thrive here on Earth. In short, what happens in the ocean doesn't stay in the ocean.

The ocean acts as the lungs of our planet, producing half the oxygen we breathe and absorbing half of the carbon dioxide humans have pumped into the atmosphere. It acts as the heart of our planet circulating heat and nutrients around the globe and ensuring our climate remains livable at all latitudes. And it acts as our liver and kidneys, filtering and absorbing waste. Just like in our bodies, we must take great care not to over tax these systems lest we put them at risk of breaking down.

When we think about the blue economy, we must first think in broader terms. If our respiratory, circulatory, and waste filtration systems fail, our entire life support system fails. And so, to extend the metaphor, we must think in terms of a Hippocratic Oath for the ocean: First, do no harm.

Today's hearing title focuses our attention on the "successes and opportunities" related to the blue economy. My testimony will be divided into three sections. The first section will discuss the need to define and measure the economic drivers and fundamental ecosystem science in the ocean and our coastal regions. This knowledge gap is a fundamental hurdle we must clear if we are to account for and ultimately

¹Aspen High Seas Initiative homepage, available at: <https://www.aspeninstitute.org/programs/high-seasinitiative/>

²Center for the Blue Economy homepage available at: <https://www.middlebury.edu/institute/academics/centersinitiatives/center-blue-economy>

grow the blue economy. The second section will include an overview of some of the threats to the health of our ocean and coasts that we must minimize for the sake of our economic and existential future. These threats must necessarily begin with carbon pollution and our changing climate, proceed to the potential negative impacts of offshore oil and gas development, and to overfishing and unsustainable aquaculture. Then, with a fuller understanding of what we do and don't know about these threats, we can move to a discussion of what we're doing well and opportunities to maximize our return and minimize harm.

Ultimately, America's future, and indeed the world's, is irrevocably tied to the health of our ocean. Fifty years ago this past Christmas Eve, three American astronauts on the Apollo 8 mission became the first humans to orbit the moon. As they circled back around from the dark side, William Anders spotted our home planet seeming to "rise" above the moon's desolate gray surface. He scrambled for the mission camera, loaded a roll of color film, and snapped what has been called "the most influential environmental photograph ever taken."

That image, "Earthrise" (figure 1), showed the world two fundamental truths that Anders and his fellow astronauts grasped immediately. First, that Earth is a blue planet—it's one thing to understand intellectually that 70 percent of its surface is covered with seawater; it's another for us as creatures of the land to see it captured on film. And second, the immense fragility of our existence on this blue marble, wrapped delicately in an atmosphere as thin as the skin on an apple.



Figure 1: "Earthrise" Image credit: NASA.

Earth's ocean is unique in the known universe. It is the single most vital building block for life and ensures that our planet remains habitable. It is, quite simply irreplaceable and fundamental to our very existence. The more we research and explore, the more we understand how human activity is putting our planetary life support system at risk. And now that we know, there is only one responsible choice: We must reduce our footprint, wean ourselves off the destructive behaviors. Humanity has set our climate on the verge of a catastrophic point of no return, decimated fish populations and put countless species—from microscopic plankton to the largest animals on the planet—at risk of extinction and turned the ocean's gyres into plastic soup and strewn waste from the poles to the depths of the Marina Trench. If we fail to treat this system with an abundance of precaution, it won't just be our blue economy that will suffer in the long run; it will be our entire planetary economy.

As this discussion moves into what the blue economy is, how we measure it, and the threats and ultimately opportunities it presents for us, we must not lose our grip on this image, and what it represents for all of humanity. Earth is our one functional spaceship in the otherwise hostile lifelessness of space. Everything we do must be with an eye toward protecting our planetary life support system. As recognized in the one universal truth broadcast on signs held by inspirational young climate protestors around the world just ten days ago during the Youth Climate Strike: There is No Planet B.

Defining and Measuring the Blue Economy

This discussion must begin by calling out an important distinction between two terms that are often used interchangeably: the ocean economy and the blue econ-

omy. Both lack widely agreed upon and applied definitions, but the most common distinction made is that the ocean economy is comprised of all activities in the ocean that generate economic activity. The National Ocean Economics Program (NOEP)—which was initially established under the auspices of the National Oceanic and Atmospheric Administration (NOAA)—measures ocean-related employment, wages, and gross domestic product contributions from Bureau of Labor Statistics data in the construction, living resources, minerals, ship and boat building, tourism and recreation, and transportation sectors.³ This database is now housed at the CBE.

Meanwhile the blue economy includes an element of sustainability. CBE defines the blue economy as comprising “the economic activities that create sustainable wealth from the world’s oceans and coasts.”⁴ Again, note the inclusion of principles of sustainability. Like the Center for the Blue Economy, the World Bank defines the blue economy to include an element of sustainability (see infographic below), clarifying that it is “sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health” (figure 2). The United Nations Development Program also adheres to this sustainability element in its definition of the blue economy, calling it “the utilization of ocean resources for human benefit in a manner that sustains the overall ocean resource base into perpetuity.”⁵ Similar definitions with an inherent sustainability component can be found in other UN bodies,⁶ and throughout the current scope of literature on the topic. By these definitions, activities such as oil and gas extraction or sand and gravel mining which are accounted for in the ocean economy should not be thought of as part of the blue economy.

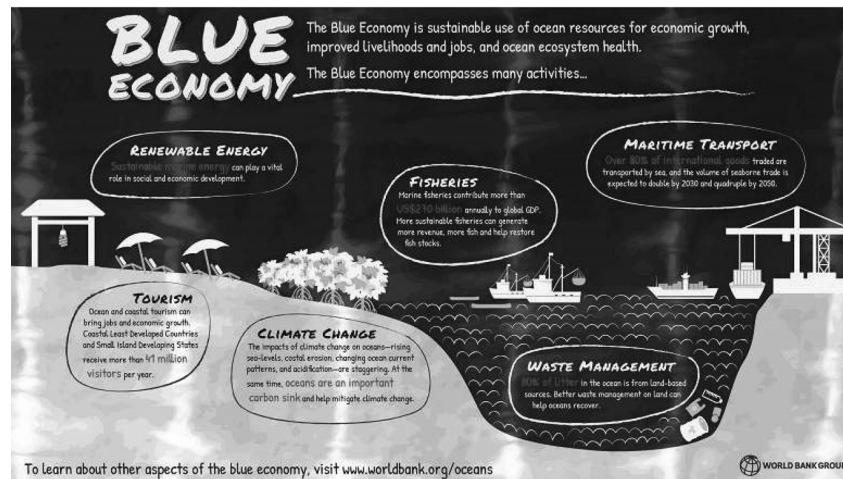


Figure 2: Image credit: World Bank Group.

As such, when we talk about the blue economy, the focus should be on industries that either contribute to or are dependent on healthy ocean and coastal ecosystems. These include such sectors as sustainably managed commercial and recreational fisheries, tourism and other low impact forms of ocean and coastal recreation, off-shore renewable energy development, and coastal resilience and restoration activities. It necessarily excludes such activities as offshore oil and gas exploration and development, sand and gravel or deep seabed mining, some higher-risk forms of open water aquaculture, and other extractive industries.

With a definition of the blue economy in hand, the next step must be accumulating enough tools and methodologies to measure its size, scope, and influence. Yet

³ National Ocean Economics Program. Available at: <http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp>

⁴ Center for the Blue Economy homepage available at: <https://www.middlebury.edu/institute/academics/centers/initiatives/center-blue-economy>

⁵ Hudson, Andrew, “Blue Economy: a sustainable ocean paradigm,” United Nations Development Programme, 26 November 2018. Available at: <http://www.undp.org/content/undp/en/home/blog/2018/blue-economy-sustainable-ocean-economic-paradigm.html>

⁶ United Nations Conference on Trade and Development, “Oceans Economy and Fisheries,” undated. Available at: <https://unctad.org/en/Pages/DITC/Trade-and-Environment/Oceans-Economy.aspx>

our tools for carrying out this critical mission remain woefully inadequate, even compared to other economic sectors in the United States. For example, the U.S. Department of Agriculture operates an Economic Research Service (ERS), with a stated mission to “anticipate trends and emerging issues in agriculture, food, the environment, and rural America and to conduct high-quality, objective economic research to inform and enhance public and private decision making.”⁷ ERS’s annual budget has averaged approximately \$86 million over the past three years.⁸

By comparison, there is no entity charged with a similar mission for the ocean or blue economy, and NOAA’s total annual investment in this area is estimated to be less than \$1 million. Yet collectively, the U.S. ocean economy, to the extent we are able to measure it, is estimated to provide 3.1 million jobs, more than the crop production, telecommunications, and building construction sectors combined (figure 3), and this is likely a lowball conjecture.

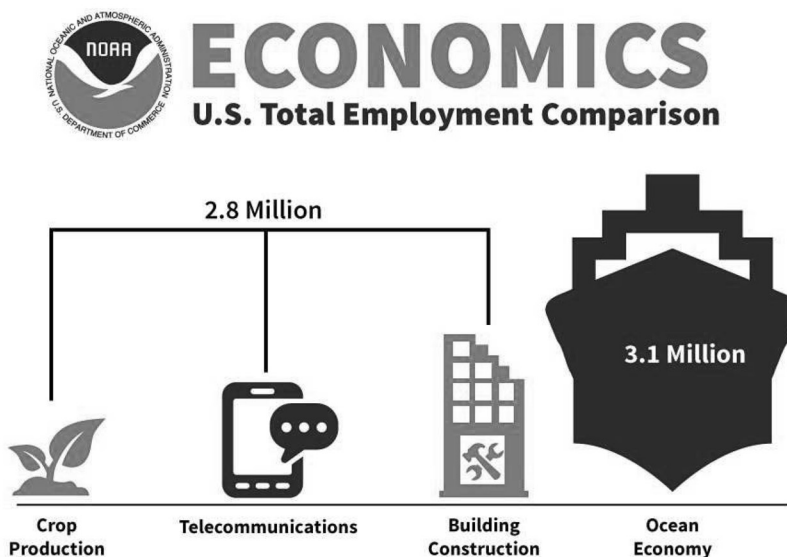


Figure 3: Image credit—NOAA Office for Coastal Management

NOAA is currently amid a 2-year process to develop the first ocean economy satellite account through a new program called Economics: National Ocean Watch (ENOW).⁹ This program will track statistics across six sectors of activity in the ocean economy, including living resources, marine construction, marine transportation, offshore mineral extraction, ship and boat building and tourism and recreation. While this effort will begin to provide some foundational accounting for the scope of the ocean economy, it still will fall short of analysis of the blue economy with its inherent sustainability component. And if we fail to measure sustainability in our blue economy today, we will inevitably fail to predict what it will be tomorrow.

Chronic underinvestment in ocean science and economics hampers our understanding

This lack of economic measure is critical, as we cannot manage what we do not understand, nor can we understand what we do not measure. This need for greater understanding extends beyond economics to the world of ocean science as well. A common trope in ocean circles is the truism that we have higher quality maps of the surface of Mars and the moon than we do of the ocean floor. This is largely be-

⁷ United States Department of Agriculture, Economic Research Service, “About ERS,” undated. Available at: <https://www.ers.usda.gov/about-ers/>

⁸ FY2019 President’s Budget Request: Economic Research Service, see page 16–2. Available at: <https://www.obpa.usda.gov/16ers2019notes.pdf>

⁹ National Oceanic and Atmospheric Administration, Office for Coastal Management, Digital Coast, “Economics: National Ocean Watch,” undated. Available at: <https://coast.noaa.gov/digitalcoast/data/enow.html>

cause we can map celestial bodies without the pesky visual interference that sea-water presents to imaging, but it is also telling that we have invested far more resources and effort into finding answers to the mysteries of our nearest celestial neighbors than we have in solving the riddles of our own deep ocean. This shortcoming is particularly notable in areas of the High Seas, the ocean beyond any one nation's jurisdiction. NOAA estimates that less than ten percent of the global ocean has been mapped using modern sonar technology, while in U.S. waters, that number is closer to 35 percent.¹⁰

Even as our industrial activity expands into the most remote and unexplored regions of our ocean, we are spending exponentially more on space exploration than investigation of the undiscovered regions of our home planet. A 2013 analysis I conducted in my previous role as Director of Ocean Policy at the Center for American progress found that NASA's space exploration budget out-classed NOAA's ocean exploration budget by a mind-boggling ratio of roughly 150 dollars to one.¹¹ Twelve people have set foot on the surface of the moon while only three have traveled to the Challenger Deep at the bottom of the ocean's deepest point, the Mariana Trench. And while we have yet to find life or other resources in our interstellar exploration that could prove economically recoverable, our ocean continues to be a treasure trove of new life and remarkable discoveries. Some estimates are that our ocean could still hold millions of species that have never been seen or catalogued.

The species discovered in these regions are not just scientific curiosities. As they have in countless instances before, newly discovered marine organisms will provide us with new products, medicines, materials, or inspiration for technologies that could pay unimaginable dividends in any number of ways that benefit human wellbeing. They also may hold keys to greater understanding of the ocean's role in the carbon cycle or prove to be pivotal links in the ocean food web. This incredible marine genetic diversity can also provide an insurance policy against environmental disruption, as it offers pathways for evolution. And we need only imagine the great technological and biomedical benefits of understanding how life has adapted in millions of amazing ways to some of the harshest environments on planet Earth. The more we know about the interplay of life, the less likely we are to take yet another misstep and inadvertently disrupt important ecosystem services.

Meanwhile, we do know enough already to understand that human activities pose significant threats to the future health of the world's ocean, the U.S. exclusive economic zone, and our coastal regions. We must now take inventory of these threats before we can talk about our successes or consider opportunities to mitigate and minimize them.

Threats to Ocean Health and the Blue Economy

There are numerous threats to ocean and coastal ecosystem health that impact our blue economy, but I will focus on the top priorities: climate change, offshore oil and gas development, overfishing and illegal, unregulated, and unreported fishing, and poorly planned aquaculture operations.

Climate change

We cannot have a conversation about the blue economy and the future of our ocean without addressing the existential environmental challenge of our time: global climate change. While a full accounting of the irrefutable science establishing the reality of a changing climate is beyond the scope of this testimony, we know that human-caused greenhouse gas emissions are fueling increases in extreme weather events, threatening coastal communities with sea-level rise and salt water intrusion, harming marine life with warming and acidifying waters, and bleaching coral reefs with alarming rapidity. To set the economic tone for what climate change could cost the U.S. economy in general, we can turn to the fourth National Climate Assessment that the Trump administration released in November 2018. This report suggested that climate change could reduce the overall economy by 10 percent by the

¹⁰National Oceanic and Atmospheric Administration, National Ocean Service, "How Much of the Ocean Have We Explored?" undated. Available at: <https://oceanservice.noaa.gov/facts/exploration.html>

¹¹Conathan, Michael, "Rockets Top Submarines: Space Exploration Dollars Dwarf Ocean Spending," Center for American Progress, 18 June 2013. Available at: <https://www.americanprogress.org/issues/green/news/2013/06/18/66956/rockets-top-submarines-spaceexploration-dollars-dwarf-ocean-spending/>

end of this century,¹² including \$140 billion from the loss of recreational opportunities due to harm to coral reef ecosystems alone.¹³

In its summary on the implications for oceans and coasts, the report states in part:

Rising water temperatures, ocean acidification, retreating arctic sea ice, sea level rise, high-tide flooding, coastal erosion, higher storm surge, and heavier precipitation events threaten our oceans and coasts. These effects are projected to continue, putting ocean and marine species at risk, decreasing the productivity of certain fisheries, and threatening communities that rely on marine ecosystems for livelihoods and recreation, with particular impacts on fishing communities in Hawai'i and the U.S.-Affiliated Pacific Islands, the U.S. Caribbean, and the Gulf of Mexico. Lasting damage to coastal property and infrastructure driven by sea level rise and storm surge is expected to lead to financial losses for individuals, businesses, and communities, with the Atlantic and Gulf Coasts facing above-average risks. Impacts on coastal energy and transportation infrastructure driven by sea level rise and storm surge have the potential for cascading costs and disruptions across the country. Even if significant emissions reductions occur, many of the effects from sea level rise over this century—and particularly through mid-century—are already locked in due to historical emissions, and many communities are already dealing with the consequences.¹⁴

The implications of documented changes in ocean ecosystems are already proving harmful. In 2012, for example, when the Gulf of Maine was hit with an “ocean heat wave.”¹⁵ As a result, lobsters migrated to inshore waters three weeks earlier than expected, leading to a supply glut as processors were not prepared to buy product in the volume that was available, and prices plummeted to their lowest level in 18 years.¹⁶

No region of the country is immune from these effects. From heat waves and drought to the hurricanes and unprecedented torrential rainfall events like the 60 inches of rain that fell on parts of Houston, Texas during Hurricane Harvey in 2017, the effects of our warming climate are wreaking havoc throughout our country and around the globe, and the economic impacts are already adding up. And this is only the beginning.

In the last five years, the frequency of extreme weather events causing over \$1 billion in damages has doubled. In 2018 alone, the U.S. was hit with 14 separate billion-dollar disasters, fueled by climate change, that took 247 lives and collectively inflicted \$91 billion in damages. Still, this figure is less than a third the cost of the prior year, when Hurricanes Harvey, Irma, and Maria combined to cause over \$300 billion in damages.¹⁷ The impacts are real, the causes are becoming clearer with every new study, and it is without question the number one threat to our blue economy.

Offshore oil & gas development

Of course, the ultimate source of carbon and other greenhouse gas emissions is the world's thirst for fossil fuels. And in addition to carbon pollution, offshore oil and gas drilling also causes more direct impacts to ocean and coastal ecosystems from drilling, extraction, and transportation.

Thirty years ago this week, the oil tanker Exxon Valdez ran aground in Alaska's Prince William Sound and dumped 11 million gallons of crude oil into what had been one of our most unsullied marine wildernesses. Though the direct costs of clean up and damages ran into the billions of dollars, the economic ramifications of that

¹²Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States, undated. Available at: <https://nca2018.globalchange.gov/>

¹³Fourth National Climate Assessment, Chapter 9: Oceans and Marine Resources. Undated. Available at: <https://nca2018.globalchange.gov/chapter/9/>

¹⁴Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States, undated. Available at: <https://nca2018.globalchange.gov/>

¹⁵Pershing, Andrew J., et al., “Fisheries Management in a Changing Climate: Lessons from the 2012 Ocean Heat Wave in the Northwest Atlantic.” *Oceanography*, 2 October 2015. Available at: <https://tos.org/oceanography/article/fisheries-management-in-a-changing-climate-lessons-from-the-2012-oceanheat->

¹⁶Trotter, Bill, “2012 Maine lobster catch increases by 18 percent, but price continues to decline.” *Bangor Daily News*, 4 January 2013. Available at: <https://bangordailynews.com/2013/01/04/news/hancock/2012-maine-lobsterlandings-leap-18-percent-but-price-continues-to-decline/>

¹⁷Dennis, Brady and Mooney, Chris, “Wildfires, hurricanes, and other extreme weather events cost the Nation 247 lives, nearly \$100 billion in damages during 2018.” *The Washington Post*, 6 February 2019. Available at: https://www.washingtonpost.com/climate-environment/2019/02/06/wildfires-hurricanes-other-extremeweather-cost-nation-lives-nearly-billion-damage-during/?utm_term=.840b8aacb120

one incident are still being felt with toxic oil still spoiling areas of the Sound, and the region's herring fishery has yet to return to commercial viability following what was at the time the largest oil spill in American history.

Of course, all records are made to be broken, and next year will mark the 10-year anniversary of the tragedy that unseated the Exxon Valdez for that infamous title, by gushing nearly 170 million gallons of crude from beneath the seabed into the Gulf of Mexico. I was serving as a Republican Professional Staff member on this committee at the time of that disaster, and I toured the region with the U.S. Coast Guard in the weeks after the explosion and sinking of the Deepwater Horizon drilling rig that cost 11 men their lives and started that gusher that spewed oil unchecked into the Gulf for 87 days.

Often, industrial activities in our ocean suffer from an “out of sight, out of mind” mentality: if we don't see it, it must not have a negative effect. In this case, I saw the massive harm done by BP and Halliburton's carelessness, and I will never forget the smell of oil burning on the ocean surface, images of sludge sloshing in the Louisiana marsh grasses, or the shrimp boats and other fishing vessels pressed into duty as impromptu skimmers in a futile attempt to clean up that unmitigated disaster.

These offshore oil and gas disasters harm commercial fisheries, aquaculture, tourism, recreational fishing, boating, and numerous other industries that, when carried out in a sustainable manner, contribute immensely to our blue economy and can foster economic wellbeing indefinitely. The irresponsible drilling and expansion of drilling into new areas for short term economic gain puts into our principle in a way that is unacceptable for long term wellbeing of our Nation.

While offshore energy development is obviously important to some coastal regions, its harmful effect on other coastal industries must be accounted for. Furthermore, some coastal areas are proving the value of pivoting to offshore renewable energy development. In 2016, Rhode Island began producing electricity at the Nation's first offshore wind farm in state waters near Block Island. And Rhode Island and Massachusetts are now poised to follow suit with plans to build an 800-megawatt offshore wind farm south of Martha's Vineyard. This project was approved following a lengthy negotiation with other stakeholders in the region, including the commercial fishing industry proving that these two uses of coastal space are not mutually exclusive.

Overfishing and illegal, unregulated, and unreported fishing

Thanks to the efforts of this committee and many others involved in the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act in 2006, the United States is now viewed as a world leader in fisheries sustainability. Under the auspices of this law, 44 stocks have been rebuilt and removed from the “overfished” list as of 2017, and overfishing was not occurring on 91 percent of U.S. fish stocks.¹⁸ We should be proud of this achievement and maintain the policies that have allowed us to take this leadership role.

Yet, overfishing is still occurring in other parts of the world, including in the EEZs of other nations with less stringent regulations and enforcement regimes, often due to limited capacity. NOAA estimates that roughly 90 percent of the seafood consumed in the U.S. is imported from other countries. That means if we want to support sustainable seafood, we must promote consumption of domestic product and strive to improve management among our trade partners. It will require a greater global investment in fisheries monitoring, research, and reporting in both the commercial and recreational sectors. It will also require an increased commitment by this Nation and other great consumers of seafood to import only verified sustainable seafood from abroad. Doing so will ultimately pay dividends in the form of global fisheries that continue to provide economic returns and food security in perpetuity.

Overfishing also continues on the High Seas, an area where the U.S. can have significant influence. As individual nations have permitted overfishing in their exclusive economic zones leading to precipitous fish population declines, fishermen have been incentivized to travel further from shore and in many cases have moved into the High Seas. Here fisheries are managed by international agreement centered around Regional Fishery Management Organizations (RFMOs). These RFMOs must operate by consensus among countries whose delegations are often heavily influenced by their industries, and their science branches are often insufficiently funded to carry out the research necessary to set sustainable catch limits. The U.S. can

¹⁸National Oceanic and Atmospheric Administration, National Marine Fisheries Service, “2017 Report to Congress on the Status of U.S. Fisheries,” undated. Available at: <https://www.fisheries.noaa.gov/national/2017-reportcongress-status-us-fisheries>

play a constructive role in advocating for stronger science and stricter limits by RFMOs to prevent overfishing.

In addition, the economics of most High Seas fishing operations don't add up, pushing operators into illegal activity. To counter the increased cost of operating further from shore and still turn a profit, operators in some fisheries have taken advantage of the remote nature of what is effectively a lawless Wild West, far from any enforcement authority. The Food and Agriculture Organization of the United Nations estimates that illegal, unregulated, and unreported fishing activity affects "one in every five fish caught, with an annual cost of up to \$23 billion."¹⁹ And the illegal activity doesn't stop with fishing. Operations from several countries have recently been found to rely on forced labor (*i.e.*, human slavery) and other egregious human rights abuses, including murder. These activities are often carried out on vessels that spend years on end at sea, out of sight or reach of regulators and law enforcement, providing no opportunity for escape or relief for enslaved workers. The vessels are resupplied by mother ships that take on the catch from these modern-day slave ships and mingle it with legally caught fish so that by the time the catch is brought in to shore it's impossible to tell the clean fish from the dirty. Fishing vessels provide easy vectors for human trafficking as well as trade in drugs, arms, and other illegal activity, particularly in the remote High Seas.

Adding economic insult to environmental injury and this ongoing abhorrent human rights tragedy, a 2018 report published in the journal *Science*, found that "54 percent of the present high seas fishing grounds would be unprofitable at current fishing rates" absent the abundant government subsidies that many fishing nations provide to their fleets operating on the High Seas. In effect, countries are paying their fishermen to put future generations out of business rather than investing in the research and knowledge that will allow this natural system to function and continue to provide benefits for generations to come.

The World Trade Organization has promised to make progress on the issue of harmful fishing subsidies at their 2019 Ministerial Conference with an eye toward achieving a key target of the UN Sustainable Development Goal 14: on Life Below Water.²⁰ Making progress on subsidies would address a host of environmental and human rights issues that harm our blue economy, and U.S. fishermen's ability to fish sustainably in our own waters and beyond.

Poorly planned aquaculture operations

Aquaculture is often regarded as an opportunity to reduce pressure on wild capture fisheries, while continuing to provide healthy food to a growing world population with a relatively smaller carbon footprint than other forms of animal protein. However, all too often aquaculture operations are subject to lax oversight and poor regulation, particularly abroad, that inflict significant damage on ocean and coastal ecosystems and economies. Furthermore, because many farmed fish must subsist on a diet that includes wild-caught fish, it can exacerbate the overfishing problem rather than relieving the pressure on wild stocks.

For example, in 2017, as many as 263,000 Atlantic salmon escaped from net pens legally permitted to operate in Washington's Puget Sound. There is concern among some scientists that these fish, which are non-native to the Pacific, could weaken the Pacific northwest's robust wild, native populations, either by outcompeting native species for resources or by transmission of disease. Several of the fish that were recaptured and turned over to Washington Fish and Game officials have tested positive for an "exotic strain of piscine ortheovirus," according to a report from the *Seattle Times*.²¹

Also of concern is the amount of wild capture fish that is required to feed farmed carnivorous fish such as salmon and shrimp. Rates of wild capture fish required to feed farmed fish are coming down in general due to the incorporation of additional plant-based and alternative feeds such as soy and algae. According to the international Marine Ingredients Organization also known as IFFO, the so-called "fish in/fish out" ratio is now down to 0.22 meaning it takes on average 0.22 kilograms of wild fish to produce 1 kilogram of farmed fish. However, as aquaculture production increases, the overall amount of wild fish required will necessarily increase.

¹⁹ Food and Agriculture Organization of the United Nations, "Growing Momentum to Close the Net on Illegal Fishing," 5 June 2018. Available at: <http://www.fao.org/news/story/en/item/1137863/icode/>

²⁰ World Trade Organization, "Negotiations on Fisheries Subsidies," undated. Available at: https://www.wto.org/english/tratop_e/rulesneg_e/fish_e/fish_e.htm

²¹ Mapes, Linda V., "800,000 More Farmed Atlantic Salmon Coming to Puget Sound before industry's permits expire," *Seattle Times*, 29 August 2018. Available at: <https://www.seattletimes.com/seattle-news/environment/800000-more-farmed-atlantic-salmon-coming-to-puget-sound-before-industrys-permitsexpire/>

The fish used in aquaculture feed are low economic value, high volume fish such as menhaden, or even species lower down on the food chain such as Antarctic krill. Yet when these creatures are removed from the ocean food web in massive quantities, the cascading effects of food scarcity on other ocean populations can be significant. As a result, in the Mid-Atlantic and New England, many commercial fishing groups have joined with environmental organizations in arguing for reduced catch limits on menhaden because they rightly fear that removing too many of these so-called “forage fish” from the ecosystem will have negative long-term ramifications for their target species, including high-value tuna and swordfish, among others.

Aquaculture can help solve both our seafood trade deficit and our need to produce low-carbon intensive, healthy protein to feed a growing global population, but it must be sited, permitted, and carried out in a manner that does not inflict additional pressure on already stressed and damaged ocean ecosystems. Multi-trophic aquaculture, where farmers grow seaweed, shellfish, and finfish together can help mitigate impacts from fish farming, and actually include environmental benefits. Likewise, closed loop aquaculture, primarily of fish that subsist on a vegetarian diet, and which takes place in shoreside facilities where inputs and outputs can be controlled also presents an opportunity for aquaculture to be a net benefit.

Supporting a Healthy Ocean and a Robust Blue Economy

Even with these serious threats, the future for our blue economy can indeed be full of successes and opportunities, and America is poised to continue leading the world toward a future of healthy productivity for our ocean and coasts. While some recent decisions and actions by the current administration have halted progress we made earlier in this century, it's not too late to reverse course and take the necessary steps to protect our Nation's and the world's greatest natural asset. Here is an agenda that can help set the tone for a new era of ocean sustainability and strong growth of the blue economy.

Support strong United Nations action

Two days ago, the United Nations kicked off the second of four planned rounds of negotiations on a new treaty to manage biodiversity beyond national jurisdiction (BBNJ). Once completed, this new agreement, developed under the auspices of the United Nations Convention on the Law of the Sea (UNCLOS), will for the first time establish a mechanism for the international community to prioritize a holistic approach to the world's deep and remote ocean ecosystems. It contains four major components: 1) creating a mechanism to establish, manage, and enforce marine protected areas on the High Seas; 2) set a process for conducting environmental impact assessments for High Seas activities; 3) develop a management regimen for marine genetic resources of the High Seas; and 4) create an agreement on technology transfer and intellectual property among developed and less developed countries.

The first step the United States can take to ensure a positive outcome from this process is to at long last ratify UNCLOS, the seminal, non-controversial international agreement that forms the foundation of international maritime law. However, recognizing that such action is unlikely given the current makeup of the U.S. Senate, short of full ratification, the U.S. delegation can still exert significant influence over the ongoing negotiations, and help ensure that the treaty includes strong protections against over-exploitation of marine resources, and establishes a clear path for the world to designate critical areas of the High Seas as fully-or highly-protected marine protected areas (MPA).

In addition to supporting completion and ratification of a robust BBNJ treaty, the U.S. should also support strong ocean protection across a range of international bodies and decisions they will make throughout 2020, a major year for international ocean action. By the end of this decade, international bodies will make major decisions on a suite of topics that will have lasting ramifications for our marine resources. These include working to ensure achievement of key targets in the UN's Sustainable Development Goal 14, “Life Below Water,” contains several targets for the international community to meet by 2020, including protecting 10 percent of the ocean; ending harmful fishing subsidies such as those that promote fishing activity on the High Seas; and bringing an end to global overfishing.²² The U.S. delegation should support all international efforts to achieve these goals.

²²United Nations Development Programme, Sustainable Development Goals, Goal 14: Life Below Water. Undated. Available at: <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-14-life-belowwater.html>

In addition, the International Seabed Authority (ISA) is in the process of revising its Mining Code²³ in a manner that could result in issuance of permits to extract minerals from fragile areas of the deep seabed that are filled with marine life. Many of these ecosystems have not yet been carefully studied and have never before been disturbed by human activity. Although the U.S. does not have a formal seat at the negotiating table due to our failure to ratify UNCLOS, American statements and indications that it does not support High Seas seabed mining would send a strong signal to negotiators. Specifically, the U.S. should adopt the position that the ISA should issue a moratorium on permits and regulations for the duration of the UN's Decade of Ocean Science that will kick off in 2021. Setting aside mining activities for this period will allow scientists to explore these areas, take stock of the yet undiscovered resources that exist there, and ensure that if mining is to proceed it will only move forward with a full understanding of the implications for the health of the deep ocean ecosystem and under a robust and precautionary management regime.

Establishment of Marine Protected Areas

In 2016, a group of scientists led by Bethan C. O'Leary published a comprehensive review of over 140 studies and found that "results consistently indicate" that protecting 30 to 40 percent of the ocean would be necessary "to protect biodiversity, preserve ecosystem services, and achieve socioeconomic priorities."²⁴

In recent years, several nations including Chile, the United Kingdom, Palau, the Cook Islands, and others have moved proactively to establish large marine protected areas (MPA) in their waters, affording varying degrees of protection to areas of the ocean comparable in size to entire countries. The U.S. briefly held the title of world's largest marine protected area following President Obama's 2016 action to expand the Papahānaumokuākea Marine National Monument. The largest is currently the Cook Islands' Marae Moana area designated in 2017.²⁵

However, as with so many things, size is not always the most effective measure. Arguably the most critical factor to ensure MPAs achieve their intended goals of increasing ocean health is the level of protection they are afforded. And while Marae Moana includes 50 km no-take zones around 15 islands, the remainder of the area has only limited protections. Current estimates are that approximately 7 percent of the world's ocean has some level of protection, but less than 3 percent is either fully or strongly protected.²⁶

While we may yet be able to achieve the 10 percent by 2020 goal, these will likely not be fully or strongly protected MPAs. And getting to 30 percent or more by 2030 will certainly require a mechanism to safeguard critical areas of the High Seas. For this reason, one of our key goals at the Aspen High Seas Initiative is to work with scientists and research organizations to create data-sharing mechanisms that will enable us to identify the areas of the remote ocean that are most critically in need of protection. Simultaneously, we work to advance new and improved governance mechanisms, such as those proposed for the BBNJ treaty, to create mechanisms for the establishment and enforcement of strong High Seas MPAs.

Promoting sustainable, legal seafood at home and abroad

Thanks to the provisions included in the 2006 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the U.S. is recognized as a global leader in ending overfishing and producing sustainable seafood. The model has proven so successful that major overhauls of management systems in the European Union, Indonesia, and most recently Japan have used the MSA as a model.

Key provisions of the MSA include a requirement for strict annual catch limits to be set in every U.S. fishery that cannot be set higher than the level recommended by each Regional Fishery Management Council's Science and Statistical Committee. With few exceptions, stocks found to be overfished must be rebuild to sustainable levels within ten years. While the act is proving to be successful at meeting the ar-

²³ International Seabed Authority, "The Mining Code," undated. Available at: <https://www.isa.org.jm/mining-code>

²⁴ O'Leary, Bethan C., et al., "Effective Coverage Targets for Ocean Conservation," *Conservation Letters: a Journal for the Society of Conservation Biology*, 21 March 2016. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1111/conl.12247>

²⁵ International Union for the Conservation of Nature, "The Journey of Cook Islands: Marae Moana," 26 June 2018. Available at: <https://www.iucn.org/news/oceania/201806/journey-cook-islands-marae-moana>

²⁶ Sala, Enric, et al., "Assessing real progress towards effective ocean protection," *Marine Policy*, vol. 91, May 2018, pp 11–13. Available at: <https://www.sciencedirect.com/science/article/pii/S0308597X17307686>

duous task of rebuilding our fish stocks, some of which had been subject to extended periods of overfishing, because the U.S. imports the vast majority of seafood it consumes, we must also work to incentivize other fish producing nations to adopt similarly strict standards.

While we of course have no jurisdiction over what happens in other countries' waters, we do have some control over market demand and individual consumer choice here at home. One powerful new tool is NOAA's Seafood Import Monitoring Program (SIMP) which was established in 2016 as a key measure to improve transparency and combat illegally harvested seafood entering the U.S. market. Blocking entry of illegal, unsustainable foreign seafood offers a more level playing field for our domestic fishermen who play by the rules, and it puts pressure on other countries to clean up their act if they wish to do business here. The committee should support the ongoing improvement and expansion of that program. Furthermore, ongoing efforts to educate American consumers about the benefits of buying American seafood for its environmental, health, and quality benefits can buoy the domestic fishing industry and ensuring consumers are choosing sustainably-harvested fish that happens to also have a smaller carbon footprint.

A United Nations treaty known as the Port States Agreement also provides a critical enforcement method against illegal fishing activity. Countries that have ratified this agreement, including the United States, have agreed to place stronger restrictions on foreign fishing vessels coming into their ports to offload fish, and if vessels are known to have been involved in illegal fishing, party states can refuse them entry to their ports. As additional countries ratify this agreement, and illegal fishing identification methods increase, the bad actors will be left with no markets into which they can sell their ill-gotten product.²⁷

Another important opportunity we are seizing to address unsustainable and illegal practices is our increasing ability to identify fishing vessels operating illegally on the High Seas and in remote areas of individual nations' EEZs, and provide information about them to governments who can hold those actors responsible. Satellite monitoring by organizations such as Global Fishing Watch are providing eyes in the sky that use data from satellite tracking systems, are even able to detect light from fishing operations at night, and combine that raw data with groundbreaking algorithms to identify potential illegal activity and even individual bad actors. We urge continued investment in these technologies and in multi-sectoral partnerships between government agencies, private industry, and not-for-profit organizations like Global Fishing Watch that are leading the charge.

Improving scientific research capacity, data-sharing, and technology

The one thing each of these proposed opportunities has in common is the need to rely on improvements in scientific research, data-sharing, and technology. Fortunately, we are living in a time when opportunities to gather data are increasing exponentially, as is our ability to process that data. A piece published by the World Economic Forum in August 2017 asserted boldly that "we have collected more data on our oceans in the past two years than in the history of the planet."²⁸ A blog piece for Scientific American reported that NOAA's ocean sensors collect 20 million megabytes of data daily.²⁹

While all the remote sensors, buoys, data tags, satellites, autonomous underwater and sea surface gliders observing, measuring, and reporting back their findings are giving us a better picture of how the infinitely intricate interactions between various aspects of the natural world might actually function, in order to truly unlock the secrets they provide will require not just a data gathering revolution, but a data management revolution. What good is your daily 20 terabytes of data if you have no way to sort it and understand what it means?

This is why organizations like the World Economic Forum's Centre for the 4th Industrial Revolution and XPRIZE are showing an interest in solving this ocean data management puzzle. They recognize that ensuring a fully functioning ocean system is fundamental not just to ocean life, and not just to ensuring we do all in our power

²⁷The Pew Charitable Trusts, "The Port State Measures Agreement: From Intention to Implementation," 12 April 2018. Available at: <https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2018/04/the-port-state-measures-agreement-from-intention-to-implementation>

²⁸Degnarain, Nishan and Adler, Steve, "How data can heal our oceans," World Economic Forum, 4 August 2017. Available at: <https://www.weforum.org/agenda/2017/08/how-data-can-heal-our-oceans/>

²⁹Mulrennan, Matthew and Johnson, Ayana, "7 Award-Winning Apps Launch a Mobile Age for the Ocean Economy," Scientific American, 16 February 2018. Available at: <https://blogs.scientificamerican.com/observations/7-award-winning-apps-launch-a-mobile-age-for-the-oceaneconomy/>

to avoid the worst possible outcomes of the climate crisis, but to ensuring a viable future for humanity as our population continues to soar towards 9 billion.

Conclusion

With our increased knowledge and opportunity comes increased responsibility. When our predecessors made missteps with the natural world, they could at least fall back on ignorance as an excuse for the havoc they had unleashed. Few in Oklahoma in the 1930s could have predicted that uprooting prairie grasses for wheat fields would have led to the wholesale destruction of the Dust Bowl. While nuclear scientists in the 1950s surely understood that radioactive fallout wasn't exactly beneficial to remote Pacific atolls, they probably failed to fully appreciate the scope and permanence of their actions.

Today we do know. We know what we could not have known before. We know that the ocean is not too big to fail. If we turn away from science and ignore the warnings in order to carry on with our business as usual approach, chasing short-term economic gain at the expense of longterm environmental health, we will be dooming future generations.

Fortunately, we also have the means to avoid the worst of these possible outcomes. By tracking, measuring, understanding, and managing our ocean and blue economy, and making the hard decisions that may cost a little more today but promise a sustainable future for tomorrow we can overcome the challenges that lay before us. The critical life-support system that is the global ocean will support us as long as we take care of it and hold to this one fundamental principle: First do no harm.

Chairman Wicker, Ranking Member Cantwell, and members and staff of the committee, thank you once again for your invitation to testify here today, and I look forward to answering any questions you may have.

Senator WICKER. Thank you so much, Mr. Conathan. Welcome back to the Committee.

Mr. Deal, you are recognized.

**STATEMENT OF SCOTT DEAL, PRESIDENT AND FOUNDER,
MAVERICK BOAT GROUP**

Mr. DEAL. Thank you, Mr. Chairman and Ranking Member Cantwell. I appreciate the Committee Members inviting me here.

I'm a businessman from Florida and to stay on the seafood theme, a fish caught is always tastier than a fish bought. So I'm here to represent the recreational boating industry and how it relates to the Blue Economy.

As you said, I'm a boat builder from Fort Pierce, Florida. My family-owned and operated business which builds boats under four different distinct brands that do different things: Maverick, Hewes, Pathfinder, and Cobia. Last year, we built and distributed around 1,300 boats to our dealer partners all over the country and we employ currently around 450 people building those boats in Fort Pierce on our 45-acre campus.

While most people think of recreational boating and the boating industry as just a fun business, the term "recreation" is a bit of a misnomer. Boating means business. Recreational boating contributes \$170 billion in economic impact, supporting 691,000 U.S. jobs, and 35,000 separate marine businesses.

Our industry is uniquely American. 95 percent of the boats that are used in the United States are made in the United States, made by boat builders like myself, but boat builders all over the country, and it's not just the boat builders, it's the workers who make the components and the raw materials that go into the boats that we build.

So even though you may not be in a state that has a big boat-building presence, like, for instance, propellers are made in Indian-

apolis by Precision Propeller that go on the offshore fishing boats that we build and many others build. So a lot of people don't realize the depth of the tendrils that go through the economy of the U.S. that's all related to the Blue Economy as it relates to recreational fishing.

According to the Bureau of Economic Analysis, which we didn't have this figure until just last year, 2.2 percent of GDP is related to recreation, outdoor recreation. Boating and fishing are a big part of that. Boating and fishing are growing faster than the economy.

But the ability of my company to expand and manufacture more products is directly tied to the ability of saltwater anglers to get out on the water. Each year, 11 million Americans travel to our Nation's coasts and take part in one of America's favorite pastimes, of course, recreational fishing.

These saltwater anglers, many of which are Maverick customers, support 472,000 jobs in saltwater fishing alone across a variety of sectors, including 68 billion in economic impact.

There are three basic requirements to support the businesses and the jobs that I'm talking about. One is updated and robust infrastructure. We've got to have boat ramps to get on the water and if anybody doesn't believe there's a problem with boat ramps, get up on a Saturday morning and go drive by one and you'll see trailers and cars all over the side of the road because we simply don't have enough.

Obviously echoing what everyone else has said, we've got to have clean water. We've got to have a good environment for fish to grow and to prosper and grow to abundance because, frankly, our guys aren't particularly good at what they do. They just like doing it. So we've got to have lots of fish. That means abundance. So when we don't have clean water, we don't have abundance and our jobs and everything else are threatened.

We need sound fisheries management policies that support the efforts of recreational angling. It's critical to our business, whether it's NOAA's fisheries, the actual councils and appointments, or laws made right here in Congress. These decisions directly impact my ability to hire people and put more people to work and to grow the economy.

In 2014, I spearheaded, along with Johnny Morris of Bass Pro Shops, the Morris-Deal Report. It was a visioning document that led to many of the adopted points in the Modern Fish Act, something that I thank Chairman Wicker very much for helping to see through signature. Thank you very much, Chairman.

The Modern Fish Act did address many of the key recommendations of the Morris-Deal Report but not all, and more work needs to be done.

One particular area of concern that was in the report is the Forge Fish Conservation. It's a critical component of the report and fish, such as Menhaden, are under an unprecedented amount of pressure, something that I hope can be addressed in this next session because with that little fish, you don't have big fish because the big fish have to have little fish to grow.

I look forward to seeing NOAA fully implement the Modern Fish Act and despite some of the recent improvements, Federal marine

fisheries management still is not maximizing the needs of the Blue Economy.

Whether it's seasons or equitable council representation or recreational sectors, decisions by NOAA, the councils have a real impact on jobs and business growth. For instance, the simple decision to allow 39 days of red snapper instead of three days.

I built a new facility and invested \$15 million and created 200 more jobs just myself. The rest of the saltwater fishing boat builders put in 46 million in CAPEX and hired another 615 people. So good fisheries policy management and access to good fisheries for my people is a critical thing, but it pays off.

As you know, the recreational sector takes 2 percent of the fin fish taken in America but we produce twice the number of jobs that the other 98 percent take.

So back to the central theme, it's about jobs. The recreational fishing community provides a lot of jobs, well-paying jobs, and we will grow and we will continue to grow this economy as long as you give us access and a reasonable shot at the fishery.

Thank you very much, and I look forward to your questions.

[The prepared statement of Mr. Deal follows:]

PREPARED STATEMENT OF SCOTT DEAL, PRESIDENT AND FOUNDER,
MAVERICK BOAT GROUP

Chairman Wicker, Ranking Member Cantwell and Members of the Committee:

Thank you for the opportunity to appear before you today to discuss an issue important to my business and the recreational boating industry: The Blue Economy.

My name is Scott Deal, and I am President and Founder of Maverick Boat Group, a 34-year-old recreational boat manufacturing business in Fort Pierce, Florida. My family-owned and operated business builds boats under four brands—Maverick, Hewes, Pathfinder and Cobia. Last year, we built and distributed around 1,300 boats to our dealer business partners all over the U.S. Our company currently employs 450 people and recently finished a 155,000-square-foot factory expansion.

While most people think of the boating industry as a fun form of recreation, the term "recreation" is a misnomer—boating means business. Recreational boating contributes \$170 billion in economic impact supporting 690,000 U.S. jobs and 35,000 marine businesses. Our industry is a uniquely American made product: 95 percent of boats sold in the U.S. are made in the U.S. From boatbuilders like myself all the way down to workers who produce raw materials we use to build those boats—boating creates jobs, lots of them. According to the Bureau of Economic Analysis, outdoor recreation accounts for 2.2 percent of GDP, with boating and fishing growing at a faster rate than the overall economy.

The ability of my company to expand sales, grow market share, and manufacture more product is directly tied to the ability of saltwater anglers to get out on the water. Each year, 11 million Americans travel to our Nation's coasts to take part in one of America's favorite pastimes—recreational fishing. These saltwater anglers, many of whom are Maverick customers, support 472,000 U.S. jobs across a variety of sectors and \$68 billion in sales annually.

There are three basic tenants required to support the businesses and jobs behind the recreational boating and fishing industry:

1. Updated and robust infrastructure is needed to ensure the 141 million American boaters and 46 million anglers have sufficient access to get out on the water. Whether it's through public boat ramps, fishing piers, or marinas—infrastructure is the key gateway to the water. Once on the water, boaters and anglers need infrastructure for safe and enjoyable operation, including navigational markings, mooring buoys and properly dredged channels.
2. A clean and healthy environment is critical for enjoyable recreation. I've personally experienced the impacts of water quality and quantity issues as my coastal home faced algae blooms this past year. The side effects pose serious harm to fish habitat, impede access, and raise human health concerns. When

our waters are not clean and our fisheries are not healthy and abundant, the businesses and jobs supported by boaters and anglers are threatened.

3. Sound fisheries management policy that support recreational angling is critical to my business. Whether its NOAA Fisheries, Fishery Management Councils or laws made right here in Congress—these decisions directly impact my ability to hire workers and contribute to the economy.

In 2014, I spearheaded, along with Johnny Morris of Bass Pro, the Morris-Deal Report—the first-ever vision for managing America’s saltwater anglers. This report made six recommendations for the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including allocating marine fisheries to the greatest benefit for the nation; creating reasonable latitude in stock rebuilding timelines, and codifying a process for cooperative management. Thanks to your leadership Chairman Wicker and a bipartisan effort from those on this Committee, the Modern Fish Act, which addressed many of the key report recommendations was passed last Congress and signed into law. Yet there is still more work to be done. Improved forage fish conservation was a critical component of the Morris-Deal report and forage fish such as menhaden are under intense pressure, something that I hope Congress will address this session. I look forward to seeing NOAA fully implement Modern Fish Act, because despite some recent improvements, Federal marine fisheries management is still not maximizing the needs of the blue economy.

Whether its seasons or equitable Council representation for the recreational sector—decisions by NOAA and the Councils have a real impact on jobs and business growth. For example, the announcement by Secretary Ross to extend the 2017 Gulf red snapper fishing season by 39 days from only 3 days, was followed by my own factory expansion, creating 200 jobs and investing \$15 million in the local economy. A survey by the National Marine Manufacturers Association and American Sport-fishing Association, estimates boat manufacturing companies have invested \$46.1 million in capital expenditures and hired 615 people due to the extended seasons and retailers found a 20 percent increase in tackle sales. While much progress has been made in recent years to improve Gulf management and access, unfortunately, the South Atlantic fishery lags behind. We hope many of the data collection and state-based management solutions implemented in the Gulf can be replicated in the South Atlantic as well. Doing so would generate investments from boat manufacturing companies of another estimated \$18.7 million and the hiring of 312 more people.

These are real jobs and real contributions to the Blue Economy due to the confidence by our industry and anglers in improving public access and consistency in fisheries management.

I’ll leave you with this—recreational fishing is more than a family enjoying the water on a Saturday afternoon. It provides for hundreds of thousands of American jobs. Anglers and boaters are good stewards of the environment. We need clean water and sustainable fisheries to enjoy our sport. We directly contribute to infrastructure and conservation efforts, totaling \$600 million annually through the Sport Fish Restoration and Boating Trust Fund. Recreational anglers take only two percent of the finfish in America’s oceans, while generating more than half the jobs in the entire fishing industry.

The boating and fishing community looks forward to continuing to work with you, Mr. Chairman, the members of this committee and the administration to maximize economic contributions to the Blue Economy and keep our oceans sustainable for generations to come.

Thank you for the opportunity to appear before you today, I look forward to answering your questions.

Senator WICKER. Well, thank you to all three of our witnesses for some very excellent and thought-provoking testimony.

And, Mr. Deal, I have been to the Miami Boat Show, the enormous economic impact that that has, I think it’s greater than the Super Bowl, and it’s just amazing the number of jobs created throughout the entire country, including in my home state of Mississippi.

Mr. Conathan, thank you for mentioning shipbuilding in Maine. I have witnessed shipbuilding in Maine and I’ve experienced seafood in both the state of Maine and the state of Florida and it’s good to have you here.

Let me begin with Governor Bryant. Governor Bryant, you might want to take a moment to introduce a special guest or two that you brought along with you that you might have referred to in your testimony.

Mr. BRYANT. I have the President of the University of Southern Mississippi, my alma mater, Dr. Rodney Bennett, and Dr. Bennett.

Senator WICKER. Dr. Bennett, wave at the crowd. Good to have you here. We're glad to have Southern Miss represented.

Mr. BRYANT. And, Dr. Bennett, your staff, would you like to introduce who you have? Could he introduce who he has here?

Senator WICKER. Please, absolutely.

Dr. BENNETT. Mr. Chairman, we have with us from the University of Southern Mississippi Dr. Gordon Cannon. Dr. Cannon is our Vice President for Research and has more than 33 years of distinguished academic service to the university.

Also joining us is Dr. Monty Graham. Dr. Monty Graham works on the Mississippi Gulf Coast and is in charge of our School of Ocean Science and Engineering.

Senator WICKER. Well, good, and when he comes back, we'll put him on the front row next time.

Mr. BRYANT. I was going to say Mr. Chairman, if you asked me a question, it would be so easy, and I would let Dr. Graham answer it.

Senator WICKER. Well, but he won't have that opportunity, but I know you probably wanted to elaborate, Governor Bryant, on how you envision the universities working with you at state government and also the private sector in creating opportunities for new economic growth in the Blue Economy.

Mr. BRYANT. Not only the University of Mississippi but all our research universities, University of Southern Mississippi, University of Mississippi, and Mississippi State University have been a part of this, whether it's at NASA, whether it's involved in our Oceanic Research Center with the University of Southern Mississippi, Gulfport, or our planned new Ocean Enterprise Center that we're working with, thanks to your help with the CENOTE Act, that will be involving the research universities, the private sector, NOAA, as well as the United States Navy, bringing all of these elements together primarily for the research, monitoring, observation, testing, mapping, and protection of the Gulf of Mexico and the entire ocean by extension.

So it's critical that we have that research component after the spill, after we had one of the largest manmade disasters in the nation, following one of the largest hurricanes known in our time.

We had to take a really serious look at what that ocean will look like not only now but a hundred years from now and that includes sub-surface testing, not only for scientific methods as we work with NOAA to see if there is any change in temperature, what that ocean bottom is looking like, how anything living in that water is progressing or changing, but also for our protection, how we might be able to see what's going on beneath the oceans around the world.

So the United States Navy is moving quickly into sub-surface vessels. As I like to say, every general wants to know what's over the next hill and every captain wants to know what's out in front

of his ship and sub-surface vessels are our most efficient way of being able to gather information to be able to protect the men and women that sail the seas for the United States Navy and our allies.

So we look forward to working diligently with the United States Navy. We are, as the University of Mississippi has had interaction with NOAA, representatives of the United States Navy, desperately working toward being able to achieve the requirements of the CENOTE Act there on the Port of Gulfport.

Senator WICKER. Well, let me sneak in another question and then make an observation.

I know you want to talk about ports, also, and I can assure you that this is a topic that's near and dear to the heart of Senator Cantwell as well as this member of the U.S. Senate.

So how do we need to help meet the demands of the 21st Century with our ports and make our existing facilities better prepared?

Mr. BRYANT. As the economy of this great country is growing, we're exporting now. Mississippi, as we said earlier, has exponentially increased the amount of exports that we're seeing move through our ports all over the state of Mississippi but particularly along the Mississippi Gulf Coast, but that's infrastructure.

I just spoke to Secretary Chao in the hallway just a moment ago. So as we're looking—as you are helping with Senator Baldwin with the Port Operations Research and Technology Act, as we look at infrastructure, so not only do we have a port that's important but how do we get there and how do we do so, quite honestly, in a safe and environmentally safe way?

So we've brought in, for example, three 60-ton electric cranes to replace the old diesel-driven cranes that we had, so our air quality is so important, access roads that are there, our multimodal system with rail that is so important to us, deepening the channel. The opening of the Panama Canal and the widening of the Panama Canal will bring the Panamanian ships in. So it's got to be deeper.

I am one that embraces the Corps of Engineers. There are those that might say the Corps takes its time and they do, but for a reason. When you have the responsibility of moving that much ocean bottom, you want to do so in a safe and effective manner, but we've got to deepen that port. We've got to have multimodal opportunities to move products in and out of that in a safe way and maintain the air quality in and around there and provide jobs, particularly to low-and moderate-income personnel.

Senator WICKER. Thank you, Governor Bryant.

Senator Cantwell.

Senator CANTWELL. Well, thank you, Governor, for mentioning port modernization and that's an impressive number you mentioned in your testimony, 259 percent increase in exports. We definitely, all up and down the Pacific Coast, feel the same kind of pressure, particularly being a neighbor of Vancouver, British Columbia, where product can be shipped to and from there if we aren't competitive in Seattle or Tacoma or elsewhere.

So your mentioning of the Panamax, which is the competition that people need to realize that every day trade and getting product to Asia is growing competition from other parts of the world and so we need to keep making that infrastructure investment.

So I think this is the second hearing we've had on this, but I definitely want to work with the Chairman on making sure that we make infrastructure investments in all of the aspects that you're talking about, channel deepening, port modernization, and I think you articulated very well what some of the challenges that are already being met by West Coast ports on that, Clean Air Act attainment levels, and there are some really great technologies that are helping our ports diversify and to get on to cleaner sources of fuel as it relates to that.

So I appreciate your knowledge and depth on all of that.

Thank you for bringing your guests, too, because one of the things that we're also working on jointly is the University of Southern Mississippi's Ocean Weather Laboratory and the University of Washington's Applied Physics Laboratory on all of the NOAA's observing systems.

Could you comment a little further on this sector that Mississippi is becoming such a knowledgeable place for on gliders and radar system and buoys?

I mean, I ask you to do that just because as a state, you understand very well the information that you get out of those systems. So what are you hoping that this becomes?

Mr. BRYANT. Information is critical to those of us that live and work and play and learn on the ocean, particularly when we talk about hurricane season, which is quickly approaching.

So as we work with our universities to make sure that we have the smart buoys that are in that water that are constantly monitoring that, when the temperature change begins, particularly below the ocean surface and below the seabed, you can begin to predict when that storm may come in and be able to give warnings to the people that are living there, evacuations, if necessary.

So it's truly life and death, but to me, as much as we love that ocean, we want to know if it's changing, if it's changing at all, if the temperature is moving, if we see ocean life being affected. It's amazing how they will talk to you if you will listen, and if it begins to change, why is it changing?

We talked about ports. Not only can we modernize those ports but we have new technology now that make them cleaner and safer and more effective. In the old days when we were running the gasoline and diesel constantly moving to and from, the air quality in and around ports were very challenging.

So the opportunity to modernize and bring them in an environmental-friendly way into a new age of exporting products all around the world from the United States to and from but monitoring that ocean must be done every day, 24/7, and to determine if we are doing anything that we need to adjust to better protect our oceans.

Senator CANTWELL. Well, I thank you for that. Our two colleagues, the late Senator Ted Stevens and late Senator Danny Inouye, helped us start that buoy system and I can tell you for our oyster industry and shellfish industry, it was critical to giving data on when to do seeding because, as water temperature changed, they were having a tough time maintaining that sector and having that buoy information and the changes in conditions was what helped save it. So thank you—

Mr. BRYANT. Critical.

Senator CANTWELL.—for that.

Mr. Conathan and Mr. Deal, what about science? I mean, you both mentioned it in your testimony. Obviously the Fish Modernization Act that my colleague, the Chairman, sponsored was a little bit of a debate about how much science, but what do we need to do to keep everybody understanding that there's more science and data. More science and data helps us grow the population of fish, thereby then having a larger pie as opposed to just fighting over the current piece of pie? How do we do that?

Mr. CONATHAN. Thank you, Senator Cantwell.

Briefly, so on that observation point, I think that's a critical piece of what we need in order to keep this moving forward.

As you know, my former boss, Senator Snowe, was also a tremendous proponent of the Integrated Ocean Observing System. We worked on that quite a bit while I was on the Committee, and it's excellent to see how that process is advancing through work with CENOTE and work at USM and obviously throughout the country.

As I mentioned in my testimony, we are gathering a lot of data now, more than we can possibly handle and digest, and I think really one of the critical components to how we're going to take this to the next level and really begin to understand fundamentally what the ocean has, what it can produce and how we can make it more productive for the future will be in figuring out how to manage that data and how to process it so that we can actually extract as much as possible and so that means the data needs to come in in formats that are comparable, so you're comparing apples to apples as opposed to apples to oranges, so that it can all be integrated and put together, and ultimately so that the collaboration among the data-gathering entities has to be improved so that all the scientists are talking to each other.

We're not duplicating efforts on data collection and we're really being able to process it to the fullest.

Senator CANTWELL. Thank you. I know my time has expired but Mr. Deal.

Senator WICKER. Go ahead.

Senator CANTWELL. Thank you. Thank you, Mr. Chairman.

Mr. DEAL. Thank you.

As it relates to recreational and commercial fishing in Federal waters, I'd like to see better cooperation between the states and the Federal Government, NMHS in particular, and the actual measurement of the biomass of the fish. I think there's general consensus that the data is very, very poor. The state data is much better, but as is often the case, there are pillars and fiefdoms that don't work together as well, you know, much to your point.

So I think if we can make data collection of the fisheries that we have a much higher priority within the budgeting of NMHS and fast track that, I think there will be a lot of good decisions made. I think if the science is not good and not sound, then we're going to be making guesses and potentially bad decisions.

Senator CANTWELL. Thank you. Thank you, Mr. Chairman.

Senator WICKER. Thank you very much.

Now, Governor Bryant, it's my distinct honor to recognize for the next set of questions your former colleague, the former Governor of the State of Florida, Senator Rick Scott.

**STATEMENT OF HON. RICK SCOTT,
U.S. SENATOR FROM FLORIDA**

Senator SCOTT. Thank you. Thank you, Mr. Chairman.

Well, Governor Bryant, thank you for being here. You and Rick Perry probably were the two best competitors at selling your states. You've done an unbelievable job, always talking about the success of the citizens of your state, and I just want to commend you for what you've done over the last 7 years, and I always liked to compete with you for jobs and you held your own.

Mr. BRYANT. You were quite a competitor, Senator. I welcomed you to the U.S. Senate.

[Laughter.]

Senator SCOTT. The beautiful state, you did a great job.

And, Mr. Deal, thank you for all the jobs you've created in Florida and congratulations on all of your different brands selling so well. I see them all over our coast, so I'm sure they're selling outside the state.

So, Mr. Deal, you said that the state and feds need to cooperate better and share the data better. How would you do that? We have a very good Fish and Wildlife Conservation Commission in Florida. I'm sure Governor Bryant has the same thing there.

It was a problem for us to get the Federal Government to cooperate with us on the red snapper season, any of this stuff, and the way we had to look at it was they must be looking at different data than we're looking at.

Mr. DEAL. Yes, and understand I'm a boat builder, a business person, and not a fish squeezer or whatever you call the biologists that are experts in this area. So I defer to those guys.

I just know that, like you say, that it's an issue and that they really need to follow the practices of cooperative management and work together and use the best available data and not fight over who gets to choose the data because ultimately if the data is good and the science is good, the facts present themselves.

Senator SCOTT. Governor Bryant, did you have the same issue?

Mr. BRYANT. Absolutely. The Modern Fish Act, Senator, has helped so much. Our program, called Tails and Scales, where we report the extraction rate of red snapper, has been wildly successful. We are able to track the number of fish that are being caught both recreationally and commercially.

We need to expand that, if we can, to other species of fish. It is not difficult for any of us that are fishing on that water to be able to catch and report, particularly electronically now, that extraction rate, and it is a huge help to those that look at how we are removing the fish from the water, particularly on a commercial rate, and when we need to adjust those seasons and just those catch rates.

So Tails and Scales has been a huge success with us and we'd love to share it with any state that would like to have that technology.

Senator SCOTT. Governor, were you able to get them to change their red snapper season as a result of that, the feds?

Mr. BRYANT. If I remember correctly, the Modern Fish Act did so. I think it expanded it to about 36 days from about three, so quite a number, and Mr. Deal can tell you more about that, but when you buy one of Mr. Deal's great boats and you fill it up and you get your friends out and you go out and you get to catch three fish, that's quite a day.

So it will grow that economy tremendously being able to expand the number of fish that you're able to catch that particular day or the weekend.

Senator SCOTT. So, Mr. Conathan, is there ability for the state and the feds to share better data to where we can make better decisions?

Mr. CONATHAN. There absolutely is, and I think one critical point to raise on this red snapper question in particular is that, you know, as I alluded to in my answer to Senator Cantwell's question, it's really about making sure that the data that is coming in to each of these states comes in in a form where they can compare effectively and measure effectively what the total amount of fish being removed from the system actually is.

As I understand it, the states have their own monitoring systems which are all independent and different and the data that comes into those systems isn't necessarily comparable or easily shareable among them.

So I think an effort to bring those organizations together, those state organizations together and resolve and get that data into one particular format will be incredibly valuable and, of course, we have to remember that red snapper is a federally managed fish species and those fish don't stay in the waters of whatever state they're caught in and they don't stay in the state waters; they cross in and out of Federal waters, as well.

And so at the end of the day, what's most important is that the fish stays on its rebuilding trajectory and that we get that population back to the healthy state so that these fish are available in a larger size, that guys love to go out and catch and women love to go out and catch so that they are available for future generations there, as well.

Senator SCOTT. I had more complaints about how many days you got to fish red snapper than anything probably I had in my years as Governor and at the state, of course, we didn't have any control over it. So it was controlled by the feds.

Thank you, Mr. Chairman.

Senator WICKER. Thank you, Senator Scott.

Senator Peters.

**STATEMENT OF HON. GARY PETERS,
U.S. SENATOR FROM MICHIGAN**

Senator PETERS. Thank you, Mr. Chairman, and thank you to our witnesses for your testimony here today talking about the Blue Economy and being from the state of Michigan, I can tell you we have a blue economy, as well, a little different than what you have been talking about and focusing on the oceans, but we have inland seas surrounding my great state.

As you know, 20 percent of the world's fresh water and they are pretty amazing bodies of water and if you look at our blue economy, we have the fishing, we have the boating. In fact, I'm not sure exactly where we are, Mr. Deal, we have been Number 1 in boat registrations. I think Florida now is ahead of us but we're usually in the top three in terms of boating registrations.

But the difference for the Great Lakes versus our oceans is that you can actually drink the water which is a really pretty remarkable thing. In fact, 40 million Americans drink their water out of the Great Lakes.

So, Mr. Conathan, I wanted to pick up on your comments about how we have to protect the oceans from environmental problems. Certainly the Great Lakes are in that category, as well.

One concern that I have is oil spills in the Great Lakes. We have a very old pipeline, for example, through the Straits of Mackinaw that has been labeled as perhaps the worst possible place for an oil disaster anywhere in the Great Lakes Basin.

But I know you've had experience with the Deepwater Horizon Gulf spill and have talked about that. I want to kind of pick your brain a little bit about lessons learned there and what you can tell us about Federal agencies coordinating for cleanup, research that's done on cleanup, kind of what's your reflection on how we deal with the disaster should it happen.

Mr. CONATHAN. Well, obviously the Deepwater Horizon disaster, you know, we're talking about the worst case scenario and the response that was there, I think the men and women on the ground who were engaged in that cleanup effort certainly did so to the best of their ability, but I think, you know, large-scale what it really speaks to is, you know, similar to the issue that this committee will be discussing this afternoon with the Boeing concern, is that industry simply cannot be trusted to regulate itself in these instances.

To this day, there has still not been legislation passed to strengthen Federal requirements for oil spill response or to raise the liability cap for these events as they occur and so I think, you know, while the response was sort of as good as it could have been under those circumstances, what we really have is a failure to address the underlying principles and now, as we see with the looming confirmation hearing of the next head of the EPA, you know, it does appear that industry leaders will be taking on additional positions of leadership in the Federal Government agencies that are poised to regulate them and I think that's one of the biggest challenges that we face across the board here is ensuring that these industries actually get the oversight that they require so that these mistakes don't happen in the first place.

I also have a bit of experience with a local pipeline issue myself. I sat on a committee that wrote a local ordinance in my hometown of South Portland, Maine, to prevent the reversal of a flow of oil through that pipeline that would have crude oil coming down from Canada to be exported, and so as a result of that and my experience in Deepwater Horizon and being on the ground there as a staffer of this committee and talking to the folks who were impacted by that on a daily basis, it really is an issue that we need to hear the local voices and ensure that the local voices are being heard in these questions, as well.

Senator PETERS. Well, I appreciate those sentiments. I think you're absolutely right and we have to hold people accountable and we have to make sure that they're doing what they have to and don't assume that it's being done because that's when accidents happen and they can be catastrophic.

Speaking of a pipeline accident, we had the most expensive pipeline accident in the country in the Kalamazoo River with cleanup costs exceeding \$1 billion. So it's something that is simply unacceptable.

One thing that I'd also like you to comment on is that I am working actually with Senator Young, a colleague of mine here on the Committee, on legislation to update NOAA's Environmental Sensitivity Indexes.

As we're looking at cleaning up a site or if a disaster happens, you have to actually know the lay of the land and the lay of the water and the currents and how you actually move forward.

You know, I'm particularly disappointed in the fact that most of the Great Lakes Sensitivity Indexes haven't been updated in over 20 years and as I mentioned in my opening comments, this is water that 40 million people drink and we don't have the kind of analysis of sensitivity that we have along our ocean coastlines.

Could you speak a little bit to the importance of having these Sensitivity Indexes in your mind so that we can deal with these accidents appropriately?

Mr. CONATHAN. I'm not familiar with the latest updates to that program through NOAA.

As I mentioned, I've been focused a little more on deeper ocean issues of late, but, in general, I mean, I think it's pretty clear that drinking water in particular is a critical part of our Nation's infrastructure that has significant challenges.

We're seeing more reports of lead in drinking water in schools. Obviously the issue in Flint is an ongoing problem and concern and we don't want that replicated on a larger scale and again, this is an area where acquiring additional environmental sensitivity data and learning how to process that data and understand what that actually means will pay significant dividends.

A member of our Leadership Council on the Aspen High Seas Initiative is a scientist, Barbara Block from Stanford, who's done a tremendous amount of work on bluefin tuna, including in the Gulf of Mexico, after Deepwater Horizon and determining what the effect of that, the negative implications of that disaster were on that species, and I think while that work is still ongoing, I think it's clear that the natural world, as well as our human health, is incredibly sensitive to these issues and the better we know about what those thresholds need to be, the better we'll manage them.

Senator PETERS. I appreciate it. Thank you.

Mr. Chairman, the bill I was referring to passed out of our committee last year; I appreciate your support. Hopefully we'll be able to move it out again this year and get it through the House. It's certainly a critical piece of legislation and I look forward to continuing to work with Senator Young.

Senator WICKER. Thank you very much, Senator Peters, and thank you for your leadership there.

Senator Blackburn.

**STATEMENT OF HON. MARSHA BLACKBURN,
U.S. SENATOR FROM TENNESSEE**

Senator BLACKBURN. Thank you, Mr. Chairman.

Governor, good to see you and welcome, and I am so happy that you brought somebody from Hattiesburg.

Mr. BRYANT. Yes, ma'am.

Senator BLACKBURN. That sounds like a good thing to me.

I've got a couple of questions kind of from a different perspective. We're all for clean air, clean water, and we appreciate the work that's been done for a healthy environment, for growing, making certain that you do have the fish or, as Governor Scott, Senator was saying, the red snapper there, that you can have those good days when you go out to fish.

But I want to turn a little bit toward tariffs and trade because you've got to have that good boat to get in and in Tennessee, we have some mighty fine boat manufacturers and they're doing good work and they talk with me sometimes about sheet aluminum and steel and tariffs.

Mr. Deal, what I'd like to hear from you quickly is how it has affected your business and the volume that you're able to produce each year.

Then, Governor, if you'll talk a little bit about the Port of Pascagoula and the exports, imports, exports, what you have seen in the volume that is going through the port.

Mr. Deal.

Mr. DEAL. Yes, understand I build fiberglass boats.

Senator BLACKBURN. OK.

Mr. DEAL. So we don't, but I do work with the National Marine Manufacturers Association and the subject of the sheetmetal, sheet aluminum tariffs is a very unctuous one for many, many, many builders in Tennessee and all over the country.

You take the additional throughput costs of the materials, some of which we are experiencing on our component parts on the fiberglass side, as well, but primarily on the aluminum side, and you couple that with the retaliatory tariffs of Canada and the EU, it has been a real, real problem for a lot of builders.

You know, a 25 percent tariff is pretty much a death blow to your export markets. So it has been a real bad thing for our industry.

Senator BLACKBURN. OK, and I imagine the EPA with your fiberglass finishing is probably more of a hazard for you.

Mr. DEAL. Really, no. We manage. We work very closely with in Florida the—

Senator BLACKBURN. Good.

Mr. DEAL.—Department of Environmental Protection and we actually are working our way toward a zero emission facility. So we do a lot of closed molding and our industry is moving toward that. So that our relationship with the EPA is very cooperative.

Senator BLACKBURN. Good. Sounds good.

Governor?

Mr. BRYANT. Yes, ma'am. Ports are so important. As I said earlier, 259 percent increase in exports in 10 years. We are—and that's after Katrina destroyed the Port of Gulfport, heavily damaged the Port of Pascagoula and Port Bienville.

So we are seeing products that are now being manufactured across the United States particularly going to South America, that the emerging middle class that we see there is demanding more consumer products, and we're all too happy to ship those products to them, while at the same time we're bringing in fresh fruit.

We're the largest fresh fruit distributor in the Southeastern United States there at Port of Gulfport. I think it has immeasurable opportunities for jobs, for growth.

I agree with you on the tariffs. As I've talked to my farmers, as I've talked to our manufacturers, the tariffs are a challenge to them, and I think if we can unbridle that at some point and settle those disputes, if we can agree with Canada and Mexico to get that free trade agreement ratified, you're going to see more business at our ports. You're going to see more blue economy and again if we're going to get to a 355-ship Navy, it's going to take all of us working together.

Parts of the ships that are manufactured there at Ingalls come from all over the United States and so we're all too happy to be America's shipbuilder, but it will take hard work with this committee to make sure that we have the leverage and the opportunity and the flexibility in the states to grow those economies.

Senator BLACKBURN. Excellent. Yield back.

Senator WICKER. Thank you, Senator Blackburn.

Mr. Deal and Mr. Conathan, the CENOTE Act and the Modern Fish Act are new statutes. We are just now implementing them.

I want to give each of you an opportunity to give us suggestions about how to exercise our oversight responsibility and what we might need to look out for as we work with the agencies in getting these up and running.

Mr. CONATHAN. Very well. Thank you, Senator.

So I would say that, first of all, the outcome of the Modern Fish Act I think was a very good compromise. I know there were concerns about the bill as initially introduced and some of the efforts to potentially weaken some of the building requirements that are fundamental to the Magnuson-Stevens Act, which is, you know, not just a model for how we manage fisheries here in the United States but one that's been replicated around the world and one that we should be incredibly proud of for the positive outcomes that it has had for our fisheries.

So I think for me, the most critical piece to pay attention to there, and I alluded to it earlier in the response to Senator Scott's question, is that we really ensure that our ultimate goal remains rebuilding these fish stocks to their maximum sustainable yield as the law requires and that we get to that point as quickly as feasible because of the economic benefits that it will pay and the long-term returns to the recreational and the commercial sectors.

So I think the provisions of the Act that will be implemented in terms of the reports that NOAA is going through now and the returns from those reports, you know, we need to wait to see what the outcomes of those are, but they will likely produce results that I think will have positive outcomes for the future of the fisheries down there.

On the CENOTE bill, I would just say that I think that is a tremendously positive piece and I think that it's going to pay signifi-

cant dividends in terms of how we acquire data and how we bring more data into the system to ultimately understand more about the ocean that frankly we know very little about still to this day. So solving that mystery will pay dividends in itself.

Senator WICKER. Mr. Deal, anything to add?

Mr. DEAL. Yes. I do actually. Mr. Conathan's reference to maximum sustainable yield is sort of emblematic of the whole dichotomy between recreational and commercial take. Maximum sustainable yield is take, you know.

One fewer fish than will collapse the stock and it's all about biomass and pounds, whereas recreational anglers want to catch fewer trophy fish that are bigger, and so it's just an example of how we need to work together in the implementation process to recognize these differences and develop management strategies that are unique to each subset and that we prioritize the data collection so that we really understand what the biomass is, what the health of the resource is, and don't just make guesses based on bad data. We really need to prioritize data collection.

Senator WICKER. Thank you very much.

Mr. Conathan, I've certainly enjoyed my association with the Aspen Institute over time. Your aspect of it is a relatively new shop. So tell us a little bit about it.

I understand in your written testimony, there's a website that our viewers can go to to find out about it, but where you're located, how big is your shop, and will you be recommending legislation and governmental practices?

Mr. CONATHAN. Well, thank you, Senator Wicker. I certainly appreciate the opportunity to talk about the exciting work we're moving into at the High Seas Initiative.

So, yes, you're correct, it is a new program of the Aspen Institute, and it's really focused on protecting the health of the high seas and the ocean at a global scale.

So really our primary goals are to help develop additional data, to facilitate the science that's going to help us understand better what is in the ocean and communicate that to the public in a way that gets the people more excited and energized about ocean issues in general, and then use that outcome to influence policy.

So really the goal of the program in general is to inspire new champions for the ocean and for the high seas that ultimately lead to the protections for the ocean that we're going to need going forward at a global scale.

Senator WICKER. When you go to work, where do you go?

Mr. CONATHAN. Well, mostly I go downstairs and I work in my home office in South Portland, Maine, but when I come down here to D.C., that's where the home office of the Aspen Institute and then, of course, we have our campus out in Colorado, as well, and so I'm out there, you know, as much as I'm able. It's a beautiful spot to be and, frankly, it's a great place to talk about the ocean because it's a place where, you know, when you're high in the Rocky Mountains, people are not typically thinking about the oceans and the coasts, but again as I mentioned in my earlier remarks, no matter where you are in the world, the ocean is affecting everything that's occurring to you, whether it's producing the snow that you're skiing on or the air that you're breathing. It's integral

to everything that we do and it is a fundamental system for the planet and one that we need to protect.

Senator WICKER. Well, I will tell you Senator Gardner was here for part of the testimony today and he wanted to assure me as the Senator from Colorado that he is interested in the Blue Economy, also.

Senator Cruz.

**STATEMENT OF HON. TED CRUZ,
U.S. SENATOR FROM TEXAS**

Senator CRUZ. Thank you, Mr. Chairman. Thank you to each of the witnesses. Governor, good to see you. Welcome.

Mr. BRYANT. Good to see you, Senator.

Senator CRUZ. Sorry to bring you to Washington, D.C.

Mr. BRYANT. It's all right. It's only temporary.

[Laughter.]

Senator CRUZ. I hope you survive the travels and return home safely and quickly.

Mr. BRYANT. Thank you, sir.

Senator CRUZ. In 2017, in Texas, our commercial fishing landings pulled in nearly \$224 million in fisheries landings, an increase of more than \$30 million over 2016 levels, and our recreational anglers took more than 1,100 trips and harvested more than two million pounds.

As we look to expand the economic output of the U.S. Exclusive Economic Zone, how can we protect these existing industries which make such substantial economic impacts in Texas and more generally, in our Nation's coastal communities? I would welcome thoughts from any of the witnesses on that.

Mr. BRYANT. Well, if—

Mr. CONATHAN. It speaks—

Mr. BRYANT. Go ahead.

Mr. CONATHAN. It speaks to the data collection issue. I mean, we have to have better science to manage these fisheries and we have to have better data collection on the health of the fisheries and real-time understanding of where the biomass is.

Mr. BRYANT. I think if we look at the program with the Modern Fish Act now, as we have in Mississippi, the Tails and Scales Act, where we are monitoring the red snapper, no angler minds doing that because we know it is helping future fishermen. We know our children will benefit from what we're looking at with the extraction rates and mortality rates of the fish.

So it is about monitoring. It is about making sure that we have a uniform opportunity across this Nation to be able to report those.

Now the government doesn't need to know every fish that you catch but as we, as fishermen, understand that if it's helping that great sport and that economy, we don't mind doing that, particularly in a commercial level.

Eighty-four percent of the seafood we consume in the United States is imported. Imagine if we were to give the flexibility and opportunity, within guidelines, of our commercial fishermen and anglers to be able to share that catch. We might be able to reduce the import and, quite honestly, there's all types of concerns from mercury to other concerns of imported seafood that have sup-

planted the seafood industry here in the United States and that's something we desperately need to look at.

Mr. CONATHAN. Sorry. I would just add quickly that the other piece of that, and I agree with both of the statements, but the other piece of that is communicating those messages to the people who are using that resource, both on the consumer side and on the producer side and the recreational angler side. The importance of communicating that data and getting that into the system is critical, as well.

Senator CRUZ. OK.

Mr. DEAL. Can I also add the logical thing, if you look at the import numbers, the vast majority of that food that's imported, seafood that's imported is grown through aquaculture, and we need to take a serious look at our aquaculture opportunities and manage them in ways that make sense, that are environmentally safe and friendly and to increase our domestic aquaculture so we don't have to import so much from overseas.

Senator CRUZ. Well, when you say a serious look, what would you recommend? What makes sense in that regard?

Mr. DEAL. Well, I think Senator Wicker's got some thoughts on that that he might be able to share with you, as I understand.

Senator WICKER. Indeed, I don't want to take Senator Cruz's time, but I've introduced the Aqua Act. We're probably going to need some help from our witnesses about that and particularly Mr. Conathan. I hope your institute is going to work with us because indeed the Governor's correct.

We ought to be growing a lot of this aquaculture in the sort of controlled safe environments that we can be sure of here in the United States rather than some fairly sketchy places around the world where you've got antibiotics and mercury and other contaminants.

Mr. CONATHAN. Yes. I think there's a tremendous opportunity to develop—again, Senator Cruz, I apologize for this diversion, but I think there's a tremendous opportunity to develop an aquaculture industry in the United States, but there are also a lot of pitfalls that we need to watch out for.

Those include issues that Senator Cantwell recognized with the farming of non-native fish species and the large release of Atlantic salmon that occurred in the Pacific Northwest. There are also issues of feed and how you produce food for particularly carnivorous aquaculture species and what the ratio of fish, wild capture fish, often forage fish, which is important to all aspects of the environment and the fisheries, as well, that has to be ground into meal to feed the farmed fish when they are carnivorous.

But certainly there are opportunities in aquaculture, particularly in multitrophic aquaculture or multispecies aquaculture where you're farming seaweed and shellfish and fin fish together in a single site that allows some of those natural cycles to really take full advantage of the nutrient load that's being put in.

Again, we have to be very careful about how those nutrients are distributed throughout the rest of the ecosystem.

And, second, in closed loop onshore aquaculture facilities where we can really be producing these seafood, particularly again vegetarian fish that do not require wild capture fish as part of their

diet and can grow in systems that are easy to control, where you can control the inputs and the outputs and treat the affluent from those facilities, so that it doesn't cause the environmental impacts of open ocean aquaculture.

So lots of things to be aware of but, indeed, you know, if we can control a sustainable, truly sustainable aquaculture industry in this country, that's certainly better than some of the fish that are coming from places where we have extremely little control over what goes into those facilities.

Senator WICKER. And, of course, farm-raised catfish would be an excellent example of that, which we do more of in Mississippi than any other state.

I hope Aspen will help us develop a good aquaculture program and I want Senator Cruz to take as much time as he needs to get his questions in.

Senator CRUZ. Just briefly, Governor. As you're aware, last year, NOAA announced a 2-year pilot program that gives more power to five Gulf states, including Mississippi and my home state of Texas, to manage recreational fishing for red snapper and I wanted to ask what conclusions do you think are likely to result from that program?

Mr. BRYANT. I think you're going to see that industry grow. It was the former Governor from Florida who was just talking about how he probably got more phone calls about that than anything else and I understand that remark completely.

So it has given the states some flexibility to be able to expand that recreational fishing primarily in these Gulf of Mexico states and so you see more people investing. People are coming from all over the United States to fish in Texas and Mississippi. The economy has grown. So it has been wildly successful in my mind.

And again, the industry will monitor itself but there's always an opportunity, particularly as we look at the Modern Fish Act, to help with that, but they understand their industry depends on how they go about the proper management of those red snappers and they're doing a very good job of that. That was a wonderful piece of legislation and has relieved a great deal of tension and stress on administrators and Governors and senators. Thank you for it.

Senator CRUZ. Well, very good. Thank you.

Senator WICKER. Thank you, Senator Cruz.

Gentlemen, you've come all this way. Is there anything that we really need to cover? Any final remarks from any of you? Governor Bryant?

Mr. BRYANT. You know, Senator, better than to ask me that.

I just think the CENOTE Act is one that has probably been underrated at this point. I equate it to the creation of NASA.

CENOTE will help us map the ocean floor. It will help us explore and find new species that were unknown to man. This is going to be a remarkable opportunity for us to find out what's really in that ocean and how we can go about preserving it and utilizing it for our economy throughout the world.

Senator WICKER. Thank you, Mr. Conathan.

Mr. CONATHAN. Thank you, Senator Wicker.

I would just also add that, of course, the Blue Economy is not just an American phenomenon. It's an international phenomenon.

The ocean is planetary in scale and there are on the international front tremendous opportunities coming to the fore in the international policy world over the next 2 years.

We talk about 2020 as being an oceans super year where there will be decisions made through the various bodies of the United Nations on issues as diverse as the Biodiversity Beyond National Jurisdiction Treaty that I mentioned as currently negotiations are underway in second session there. That treaty will be out hopefully by 2020.

The International Seabed Authority is developing new regulations for the future of potential industry in the deep seabed mining space which is something that we have significant concerns about in terms of how that will affect these deep ocean ecosystems.

The Convention on Biodiversity is talking about protecting hopefully 30 percent of the planet by 2030. So I would also urge the Committee to continue to be aware of these international opportunities as they arise and ensure that your voices are heard there and happy to provide you more information on those opportunities as they're coming up.

So thank you for the time.

Senator WICKER. Very good. Mr. Deal, anything else to add?

Mr. DEAL. Very briefly, just let's make sure that the intent of the Modern Fish Act is carried through the implementation process, all the way to the end, and I think we'll be much better off for that.

Senator WICKER. Thank you very much.

Senator Blumenthal.

**STATEMENT OF HON. RICHARD BLUMENTHAL,
U.S. SENATOR FROM CONNECTICUT**

Senator BLUMENTHAL. Thanks, Mr. Chairman.

I know that Senator Cantwell asked about the importance of science in fisheries management and I wonder if you have, any of you, suggestions for us in how to change, because undoubtedly, there will be change the current fisheries management structure, that is, how facts and science are used because right now in Connecticut, the system essentially is not working for either recreational or commercial fishing.

The quotas are off because of the migration of fish populations and so I see a need for reforming the management system to be more responsive more quickly to the changes in the fish populations and management that result from changes in climate and other factors.

Perhaps I can open that for you.

Mr. CONATHAN. Sure. Thank you, Senator Blumenthal.

I think you hit on it at the end there. I mean, the critical factor is, and as a New Englander myself, I mean, I've seen over the last, you know, 40 years now, I've watched the changes in fish populations and they're increasing obviously extremely rapidly over the last decade or so in particular and, you know, we've talked about the issue of Black Sea bass in the past and that migrating up from the Mid-Atlantic into the New England region.

Obviously significant changes in the lobster fishery in your part of the world, and I think becoming more responsive more quickly to these changes is going to be a critical part of the system, and

I think we're really at a point in our ability as a result of technological advances and data management advances where we should be able to incorporate these changes and these shifts more quickly and part of that will come from increasing access to data, particularly from commercial fishing vessels.

I think electronic monitoring systems will be critical in this and those data can then be incorporated much more rapidly into, for example, stock assessments or management models that are required to set some of those levels.

I also think greater collaboration between the regional fishery management councils is critical in ensuring that, for example, the New England Council and the Mid-Atlantic Council are managing perhaps more collectively than they have in the past. I don't know exactly what that needs to look like and certainly there are complications and history and personalities and everything else that goes into that, but that will be critical to making sure that we make better decisions for our fisheries, as well.

Senator BLUMENTHAL. Do you think that structure of councils organized regionally should be changed?

Mr. CONATHAN. That's a good question. I think that there needs, at the very least, to be a more formalized mechanism for that inter-council communication to occur, and over the last couple of years, I have not been as deeply involved and my knowledge of the intricacies of the Magnuson Act is a little rustier than it has been in the past, but I think that's definitely something worth looking at.

Senator BLUMENTHAL. I mean, we wouldn't—for example, you analogized space to the seas, and I agree with you that, Number 1, we're far more likely to find new forms of life at sea but also probably more payback on investment in the sense of resources and so forth, but we wouldn't divide different areas of space into different councils and the sea is likewise difficult to divide in terms of boundaries and geography because fish have no respect for the councils that we just pretty arbitrarily establish.

Mr. CONATHAN. Yes. No, we do draw those lines based on political boundaries that certainly have no or at least very little, in many cases, overlap with the biological realities of the regions.

However, I do think there's also a place for local knowledge in fisheries management and I would want to make sure that that aspect is not lost as things are, you know, potentially shifting in that direction.

Senator BLUMENTHAL. Thank you, and thank you to all the witnesses for being here today.

This has been a very useful hearing. I apologize. I had an Armed Services Committee meeting, as well, and I know Mississippi cares a lot about shipbuilding.

Mr. BRYANT. Yes, sir. Yes, sir. Thank you.

Senator BLUMENTHAL. Happy you're here and thank you so much.

Mr. BRYANT. We were glad you were in that meeting, Senator. Thank you.

Senator BLUMENTHAL. Thank you.

Senator WICKER. And who knows, I may be able to run over and get in on the tail end of that hearing.

Gentlemen, we thank you very much for your participation, for your testimony, and, Governor, thank you for bringing our friends from USM.

Mr. BRYANT. Thank you.

Senator WICKER. And we will now close the hearing, and I think I've got some words I'm supposed to read into the record.

The record will remain open for two weeks. During this time, Senators are asked to submit any questions for the record. Upon receipt, witnesses are requested to submit their written answers to the Committee as soon as possible but no later than Wednesday, April 10, 2019, if that's all right.

So thank you very much.

We'll conclude the hearing and thank the witnesses.

[Whereupon, at 11:21 a.m., the hearing was concluded.]

A P P E N D I X

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. JOHN THUNE TO SCOTT DEAL

Question. In my home state of South Dakota, hunting and fishing are not just hobbies, but major drivers of our economy. In the 114th Congress, I sponsored S. 834, the Sport Fish Restoration and Recreational Boating Safety Act, which became law as part of the FAST Act, reauthorizing a popular program that has benefitted anglers and fishermen since 1950.

This program generates nearly \$600 million dollars per year which are set aside in a Trust Fund for distribution among the states for coastal wetlands conservation, fisheries restoration programs, and a national boating safety program. The States decide where the money goes, which means those dollars get spent on the projects that matter the most to our States.

a. Mr. Deal, can you talk about the benefits of a program like the Sportfish Restoration Program?

Answer. Senator Thune, thank you for your continued support of and interest in the Sport Fish Restoration and Boating Trust Fund (Trust Fund). As you know, the Trust Fund, which was created in 1950 at the behest of the boating and angling community, is a user fee-public benefit system funded through motorboat fuel, import duties, and excise taxes on small engines, electric motors, and fishing equipment. The Trust Fund provides nearly \$650 million annually for aquatic conservation, infrastructure projects, and boating safety programs in all 50 states.

Not only is the Trust Fund the main source of funding for the Nation's fisheries conservation efforts, but it serves as the backbone to state fish and wildlife agencies throughout the country—including South Dakota, which was apportioned through the Trust Fund more than \$4.7 million in Fiscal Year 2019. Since 2010, the Trust Fund has accounted for nearly 27,000 sites constructed to improve the public's access to waterways; more than 2 billion fish stocked in lakes, rivers, and streams; and 3.5 million students educated about the benefits of conservation, boating, and fishing. These are just a few examples of how the Trust Fund is a model for how users of our natural resources can ensure that we—and future generations—can continue enjoying clean waters, abundant fisheries, and plentiful access.

With the Trust Fund set to expire in 2020, not only is it crucial that Congress protect and reauthorize the Trust Fund, but with participation rates increasing—especially in the form of paddle craft users—it is important that we identify solutions to help grow the Trust Fund to help reduce user-conflicts and ensure the safety of those that take to our waters each day. Again, I thank you for your leadership on this important issue, and please let me know if you have additional questions.

