UNITED STATES COAST GUARD

MARITIME COMMERCE STRATEGIC OUTLOOK

OCTOBER 2018
WASHINGTON, D.C.

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The United States Coast Guard's VISION for Enabling Maritime Commerce

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Table of Contents

THE COMMANDANT
OF THE UNITED STATES COAST GUARD

America is a maritime Nation. It is a Nation shaped by seafarers who recognized the tremendous economic potential derived from unrestricted access to the oceans, internal waterways, deep-water ports and protected straits and bays. This geostrategic advantage favorably shapes our Nation's security, economic prosperity, and global standing.

American prosperity remains inextricably linked to the fate of the maritime environment. In an era of increasing technological and political change, we continue to be a maritime Nation that has come to expect free access to, and movement within, the maritime environment. Access to outdoor recreation, fisheries and mineral resources, global commodities, and markets for manufactured goods define the American experience. Our waterways, a wealth of natural resources and marine transportation networks, remain critical to our prosperity, our security, and our identity as a Nation.

I am pleased to present the U.S. Coast Guard's Maritime Commerce Strategic Outlook to guide our Service efforts in securing this strategically critical maritime environment while enabling its impact on our Nation's economic prosperity. This document establishes three lines of effort that are critical to the success of the Coast Guard: 1) facilitating lawful trade and travel on secure waterways; 2) modernizing aids to navigation and mariner information systems; and 3) transforming our workforce capacity and partnerships to meet the increasingly complex operating environment.

The Coast Guard must anticipate transformative changes in technology and maritime governance in order to retain our leadership role providing for the safety, security, and stewardship of our Nation's precious ocean, bay, and river resources. Through collaborative leadership and strategic vision, the Coast Guard will maintain and grow our strategic advantage in the maritime domain, forever fostering a prosperous and secure America.

Semper Paratus.

Admiral Karl L. Schultz
Commandant

Maritime Commerce STATISTICS

Maritime commerce is the lifeblood of the global economy. The Coast Guard has the enduring responsibility to safeguard the Marine Transportation System (MTS) and enable the uninterrupted flow of maritime commerce.

U.S. MTS BY THE NUMBERS

95,000
Miles of shoreline

50,000
Federal ATON
(buoys, beacons, ranges)

25,000
Miles of navigable channels

361
Ports
(commercial)

20,000
Bridges
(crossing waterways)

ANNUAL ECONOMIC VALUE

23 million
U.S. jobs sustained

$4.6 trillion
of economic activity

90%
of U.S. imports enter and exports exit by ship

By 2025,

worldwide demand for waterborne commerce is expected to more than double.

I.

Introduction

America's geography provides a key advantage to the Nation's economic competitiveness with its abundance of natural resources, fertile farmlands, navigable waterways, and deepwater ports. America's unrestricted access to the Atlantic and Pacific Oceans, Gulf of Mexico, Western Rivers, Great Lakes, and Arctic region power domestic and global commerce. The ease of moving cargo and people beyond our coasts fuels this Nation's economic competitive advantage, advances trade, generates capital, and drives the domestic economy forward, in turn protecting power abroad and safeguarding our national interests.

The Marine Transportation System (MTS) is an integrated network that consists of 25,000 miles of coastal and inland waters and rivers serving 361 ports.[1] The MTS supports $4.6 trillion of economic activity each year and accounts for the employment of more than 23 million Americans.[2] The maritime transportation of cargo is considered the most economical, environmentally friendly, and efficient mode of freight transport. As the economic lifeblood of the global economy and critical to U.S. national interests, the MTS connects America's consumers, producers, manufacturers, and farmers to domestic and global markets. The MTS also enables critical national security sealift capabilities, supporting U.S. Armed Forces' logistical requirements around the globe. Any significant disruption to the MTS, whether man-made or natural, has the potential to cause cascading and devastating impact to our domestic and global supply chain and, consequently, America's economy and national security.

As a multi-mission, maritime armed force, with unique law enforcement, intelligence, and regulatory authorities, the Coast Guard ensures the safety, security, and stewardship of our Nation's waters from internal waters to the outer limits of the 200-nautical mile Exclusive Economic Zone (EEZ) and beyond. The Coast Guard leverages its unique authorities, jurisdiction, and operational capabilities to safeguard the efficient and economical movement of maritime commerce through the MTS. No other U.S. Government agency can have such far-reaching impact within the maritime domain.

A growing number of factors threaten the uninterrupted flow of maritime commerce and present challenges for the Nation and the Coast Guard. Aging and obsolete waterways and congested ports inhibit America's competiveness and resiliency. The maritime industry's desire to remain viable in a competitive global marketplace drives innovation in new technologies, including increasingly complex vessels, propulsion systems, fuels, and advanced operational models. Greater interconnectivity and automation within the MTS increase risks in the cyber domain. Advanced autonomous vessels and robotic technologies, projected to be commonplace within the next decade, may revolutionize maritime shipping and present new regulatory, legal, and operational challenges. These challenges and opportunities are not unique to vessels. The entire intermodal logistics supply chain operates under a just-in-time delivery method—a means for reducing inventory and lowering operational costs for industry. Increasing complexity and interconnectivity of the maritime domain render the MTS more vulnerable.

The accelerated pace of innovation and drive to increase productivity through the MTS poses significant challenges for the Coast Guard. To best ensure an efficient, safe, and secure MTS, the Coast Guard must keep pace with technological advancements, invest in capabilities, leverage artificial intelligence, apply big data analytics, recruit and retain a highly educated workforce, and adapt to the changing environment. Over the next decade, the Coast Guard must have the adaptive capacity, strategic awareness, and modern systems, assets, and workforce to facilitate, safeguard, and advance commerce on America's waterways.

To meet these challenges, the Coast Guard's Maritime Commerce Strategic Outlook identifies three lines of effort:

- **Facilitating Lawful Trade and Travel on Secure Waterways**
- **Modernizing Aids to Navigation and Mariner Information Systems**
- **Transforming Workforce Capacity and Partnerships**

Guided by the National Security Strategy, National Military Strategy, Maritime Security Strategies, and Quadrennial Homeland Security Review (QHSR), this document directly links and supports the National Strategy for the MTS and complements the Coast Guard's Western Hemisphere Strategy, Cyber Strategy, and Arctic Strategy. Furthermore, this strategic outlook is a living document and builds upon the Service's broad, complementary authorities, multi-mission capabilities, and expansive network of partnerships.

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1 Committee on Marine Transportation System, http://www.cmts.gov/Background/Index.aspx; U.S. Department of Homeland Security, online at https://www.dhs.gov/transportation-systems-sector.

2 American Association of Port Authorities, online at http://www.aapa-ports.org/advocating/content.aspx?ItemNumber=21150.

II.

Executive Summary

The Coast Guard's enduring responsibility to safeguard the MTS and enable the uninterrupted flow of maritime commerce is becoming more challenging. Emerging technologies, including the increased complexity in vessel designs, propulsion systems and operations; automation, interconnectivity, robotics and networked systems; and new methods for offshore natural resource exploration, production and transportation pose challenges and can be risk aggravators for the Service. These factors produce a system highly susceptible to disruption. Any man-made or natural disruption, even of brief duration, has the potential for lasting damaging effect on the Nation's economy and national security.

The Coast Guard's long term outlook for maritime commerce emphasizes three lines of effort: *Facilitating Lawful Trade and Travel on Secure Waterways, Modernizing Aids to Navigation and Mariner Information Systems,* and *Transforming Workforce Capacity and Partnerships.* This outlook emphasizes the critical need to build a Ready, Relevant, and Responsive Coast Guard that maximizes America's economic prosperity across the maritime domain. To ensure the Service's enduring roles of safety, security, and stewardship, the Coast Guard must look to the future and anticipate rapid innovation in the maritime industry and the resulting complexity in the marine environment. To that end, the Coast Guard will pursue three lines of effort:

Facilitating Lawful Trade and Travel on Secure Waterways. The ease of moving people and cargo on America's waterways is a competitive advantage and wellspring for economic prosperity and national security. The Coast Guard's enduring role of enabling the uninterrupted flow of maritime commerce requires a multi-faceted approach that includes managing risks to critical infrastructure, ensuring the efficient delivery of Coast Guard services, supporting uniform/consistent vessel and facility standards, and promoting resiliency and unity of effort among all MTS stakeholders.

Modernizing Aids to Navigation and Mariner Information Systems. The Nation must invest in the waterways of the future to sustain global economic competitive advantage. The Coast Guard must build the information, digital, and physical infrastructure to manage emerging sources of risk within America's waterways brought about by the introduction of new technologies and operating constructs. Leveraging technological advancements such as artificial intelligence, mobile and cloud-based computing, and data analytics will help keep the Service in step with emerging trends in the maritime industry. This includes modernizing information technology (IT) networks and applications that enable the Coast Guard to assess, monitor, and manage risk. Given the competing uses and growing demands for commerce, energy, food, resources, and recreation in U.S. waters, the Coast Guard must optimize maritime planning. The Service must also balance sustaining traditional navigation systems while building next generation waterway management systems, modernizing Inland and Coastal Aids to Navigation cutters, and applying emerging technologies. Regulatory frameworks, applications, and standards will be adapted to accurately incorporate the implementation of emerging technologies that will transform maritime operations such as autonomous systems and new logistics platforms.

Transforming Workforce Capacity and Partnerships. Given the increased demand on America's waterways, the Coast Guard must have a transforming workforce capacity and strengthen linkages/partnerships to facilitate, safeguard, and advance maritime commerce. The Service must develop an adaptive force that is proficient operating in a highly complex environment amid rapid evolution of technology. It needs to strengthen its nimble workforce with the digital competencies to respond to changes in commercial markets and the maritime industry. With an ever expanding MTS, the Coast Guard will leverage robust auditing capabilities of Third Party Organizations (TPOs) to improve vessel plans, surveys, and certain required certificates, while strengthening an extensive audit regime that ensures the highest standards of compliance oversight are being maintained. It is imperative to transform the workforce and roles of other enabling organizations to have the capability, experience, and expertise to address the broad spectrum of threats to our national interests.

This document also outlines a number of enabling concepts that will ensure the Service's long-term success. These include:

- Unity of Effort: The Coast Guard will leverage established partnerships and look for opportunities to build new partnerships within Federal, State, local, and tribal governments and private industry to bring a balanced approach to improving America's maritime economic competitiveness.
- Adaptive-Focused Service: The Coast Guard will anticipate change, become more agile, apply lessons-learned, and embrace the fast pace of technology. Service members must be comfortable operating in a dynamic, complex, and ambiguous environment.
- Marine Transportation as a National Priority: The MTS is vital to America's prosperity. The Coast Guard will advocate the importance of America's waterways and articulate how economic and national security is inextricably linked to the MTS.
- Investment in the Future: The Coast Guard must invest in data and information infrastructure that enables big data analytics and operations research in an environment of increasing complexity of systems, accelerated pace of innovation, and rapid incorporation of new technologies.
- Situational Awareness: The Coast Guard will provide decision makers real-time, accurate, and actionable information and intelligence for maritime operations. The Coast Guard must understand industry trends, patterns, and threats to the MTS in order to position the Service to address them. The Service must take advantage of emerging technologies to improve situational awareness.
- International Engagement: The Coast Guard will assertively seek opportunities to be a leader at international maritime regulatory bodies and maximize international relationships with key trading partners to reduce risks to America's MTS.

III.

Today's Realities

With more than 90% of global trade traveling by sea, America depends on a safe, secure, sustainable, efficient, and resilient MTS.[3] The MTS is part of an integrated and interdependent transportation network and is the foundation of our economic prosperity. It is inextricably linked to America's national security. This section explains the strategic context, along with the current trends and realities, that are guiding the Coast Guard's strategic approach to supporting America's economic prosperity and upholding its national security.

AMERICA IS A MARITIME NATION

America is endowed with natural navigable waterways, deepwater ports, protected harbors, and unfettered access to the world's two largest oceans. This robust maritime capability underpins America's economic and national security. The Mississippi River and its tributaries, which include the navigable sections of the Missouri and Ohio Rivers, is one of the largest and busiest inland waterways in the world. With more than 6,000 miles of navigable waterways passing 17 States, the Mississippi River and its tributaries account for 95 percent of all inland river system tonnage and more than half of all the American agriculture products exported globally. [4]

The American barrier island chain parallels nearly three quarters of the East and Gulf Coast States, creating the Intracoastal Waterway and adding more than 2,000 miles of navigable waterways for moving grain, coal, refinery products, natural gas liquids, chemicals, and other cargo supplying feeder traffic to the Nation's seaports. The Great Lakes and the Saint Lawrence Seaway play essential roles in moving raw materials, such as iron ore for the steel industry, limestone and cement for the construction industry, and coal for generating electrical power.

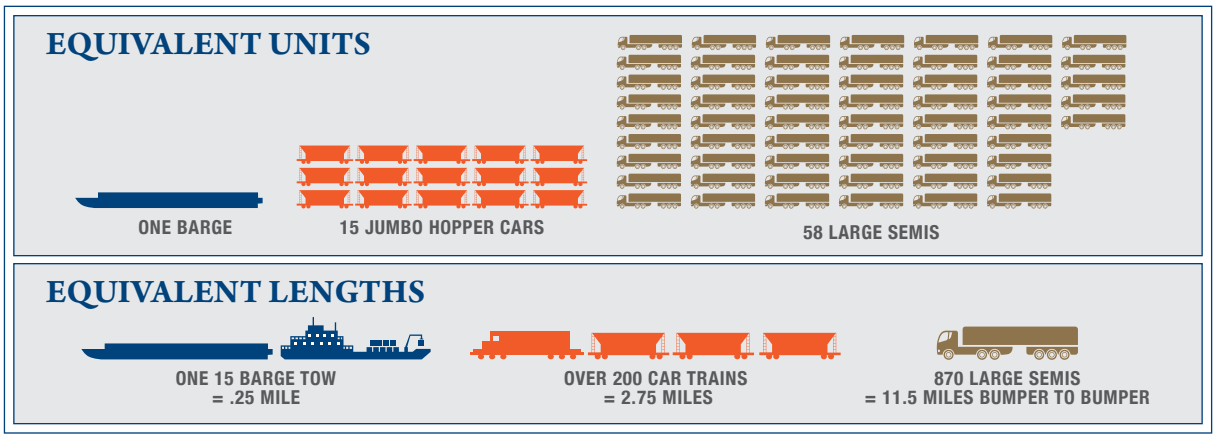
With natural harbors, such as Puget Sound, San Francisco Bay, and Chesapeake Bay, and deep-draft ports such as Los Angeles/Long Beach, New York/New Jersey, Houston/Galveston, Portland, and Charleston, the Nation's seaports are plentiful and highly capable. The natural network of inland navigable rivers, protected bays, barrier islands, ocean access, and supreme port potential, provides a large segment of the American population with ready access to manufactured and agricultural products and inexpensive waterborne transportation. In addition, America's waterways and ports enable critical national defense global sealift capabilities, providing mobilization, logistics, and sustainability of U.S. Armed Forces. This vast interconnected MTS advances national security and fuels the Nation's economy.

GATEWAYS FOR ECONOMIC GROWTH

America's intermodal national transportation system is a connected network of railways, roads, seaports, rivers, canals, pipelines, and airways that are absolutely critical to economic prosperity and national security. Each transportation mode is directly dependent on the other to form a highly-

3 International Maritime Organization, "IMO Profile," https://business.un.org/en/entities/13.

4 National Park Service, "Mississippi River Facts," online at https://www.nps.gov/miss/riverfacts.htm.



Source: Iowa Department of Transportation

integrated, interconnected, and interdependent transportation and supply chain. Key to this chain is the MTS, which consists of more than 25,000 miles of navigable waterways, 361 ports, over 1,400 intermodal connections, and millions of vessels and users. These waterways considerably advance trade with the resulting infusion of capital fueling America's economy, facilitating prosperity, and ensuring economic and national security.

The transportation of goods by sea is considered the most economical, efficient, and environmentally sound mode of transport. For example, one Great Lakes bulk carrier has approximately the same cargo capacity as seven 100-car freight trains.[5] More than 90 percent of the volume of overseas trade enters or leaves the United States by ship. Moreover, the environmental impact of maritime transportation is far less than any other mode. The extensive network of waterways and ports provide the crucial access for American consumers and businesses to connect to domestic and foreign markets.

America's extensive network of ocean, coastal, and inland waterways, harbors, and seaports supports $4.6 trillion of economic activity each year and accounts for the employment of more than 23 million Americans.[6] With 41 States directly served by navigable waterways, America's MTS is the lifeline of the Nation's economic prosperity and a vital link to global trade.[7] The inland waterways allow interior ports such as Pittsburg and St. Louis to reach global markets, substantially increasing economic opportunities for all Americans. Because the MTS facilitates the worldwide distribution of the Nation's agricultural and manufactured products, any disruption in the MTS will delay the movement of goods, resulting in higher costs, lost sales, missed export targets, and other significant detrimental effects on the global supply chain, America's economy, and the well-being of the general public.

Finally, the United States is a fisheries leader with the largest EEZ in the world. The United States is the third largest producer of captured fish, harvesting approximately 4.9 million metric tons annually.[8] In 2015, the U.S. commercial and recreational fishing industries supported 1.62 million jobs and generated $208 billion dollars of economic activity.[9] In 2016, the United States exported $28 billion in fish products.[10] Oceans provide the world with its largest single source of protein. It is in the U.S. strategic national interest

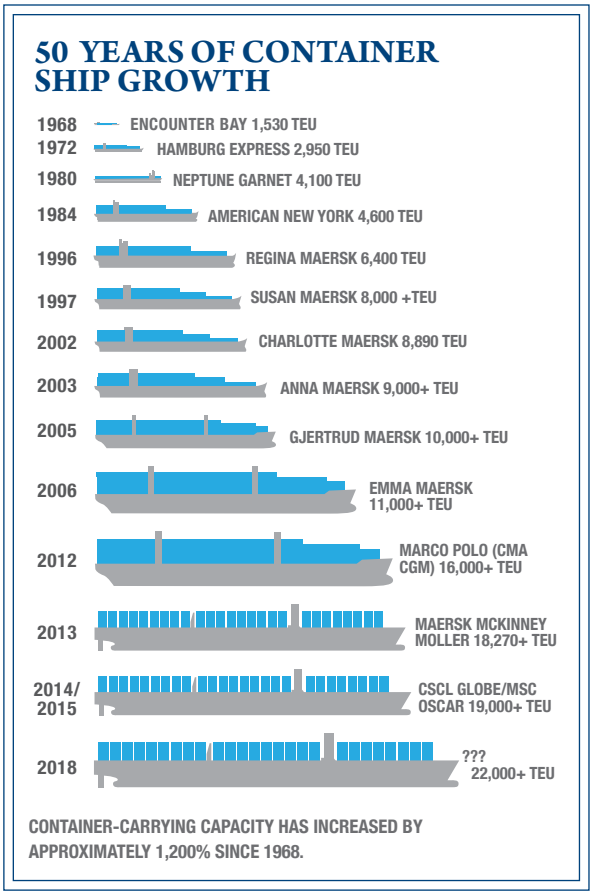
5 Illinois International Port District, online at http://iipd.com/operations/services.
6 American Association of Port Authorities, online at http://www.aapa-ports.org/advocating/content.aspx?ItemNmber=21150
7 U.S. Army Corps of Engineers, online at http://www.sam.usace.army.mil/Missions/Civil-Works/Navigation/.
8 U.S. Dept. of Commerce, NOAA, National Marine Fisheries Service, "Fisheries of the United States, 2016," August 2017.
9 U.S. Dept. of Commerce, NOAA, National Marine Fisheries Service, "Fisheries Economics of the United States Report, 2015," September 2017.
10 U.S. Dept. of Commerce, NOAA, National Marine Fisheries Service, "Fisheries of the United States, 2016," August 2017.

to manage and preserve its fisheries. The Coast Guard is the primary Federal agency to enforce U.S. fishery conservation and management activities.

MTS CAPACITY

Congested networks of railways and highways have placed a greater demand on the MTS.[11] Larger vessels and increased demands on the MTS have escalated the risk of collisions, allisions, groundings, security and environmental incidents. Since 1968, container-carrying capacity has increased by approximately 1,200 percent.[12] A just-in-time delivery system relies on the ability to move cargo to and from vessels and ports on tight schedules and requires ever increasing means of efficiency and well-coordinated, interconnected intermodal networks. This trend of rising capacity and efficiency propels innovations in vessel and port design and operations, and places increasing demands on the MTS and its intermodal infrastructure. Current trends indicate that U.S. container volumes will continue to expand and container ships calling at U.S. ports will continue to grow in size. The expansion of the Panama Canal added a third lock that is longer, wider, and deeper than the original locks completed in 1914. This allows the transit of larger vessels with much greater cargo capacity between the Pacific and Atlantic Oceans, resulting in a significant demand increase on East Coast and Gulf Coast ports. Port infrastructure and intermodal connectors to ports, normally funded through a combination of local public and private investments and Federal earmarks, have exceeded their designed service life. To ensure American competitiveness, significant capital investment in ports, intermodal connectors to ports, and waterways are needed.

America's waterways support a wide range of competing activities within the marine environment. These activities include commercial fishing, recreational boating, mineral extraction, ocean tourism, alternative (wind, tidal, and wave) energy, and marine sanctuaries, to name a few. The recreational boating industry is growing and has an annual economic impact of more than $121 billion.[13] The United States has increased the number of marine sanctuaries to conserve critical ocean ecosystems and the vital resources they provide. New technologies in mineral extraction are enabling the unearthing of previously inaccessible deep sea-bed energy reserves. Balancing these competing activities in the maritime domain with those of the MTS is crucial to economic prosperity, marine safety, and navigation. However, as the waterways become more constrained, they inevitably become more politicized.



Source: Alliance Global Corporate & Specialty
Approximate ship capacity data: Container-transportation.com

11 Department of Homeland Security, "Aging and Failing Infrastructure Systems: Navigation Locks," December 8, 2015.

12 World Shipping Council, "Container Ship Design."

13 National Marine Manufacturing Association, "NMMA releases new U.S. economic impact report at American Boating Congress," May 14, 2013, online at http://www.nmma.org/press/article/18350.

EVOLVING MARITIME INDUSTRY

Market competition and just-in-time logistics are driving global maritime supply chains to evolve and innovate. Extraction technologies such as hydraulic fracturing and directional drilling that have fueled the shale gas boom, as well as deep sea oil exploration, are advancing. Natural gas is one of the fastest growing and most readily available energy sources in the world. The United States has become one of the world's largest producers of natural gas and is expanding liquefied natural gas (LNG) facilities to export it to markets overseas. In fact, using natural gas instead of marine diesel as a shipboard propulsion fuel is becoming a leading alternative for meeting the stricter domestic and international air emission requirements. The 2017 lifting of a 40-year ban on exportation of crude oil has opened the market for U.S. crude oil shipments overseas. New products, new routes, new fuels, and new operations are required to transport oil, gas, chemicals, and other products through the MTS.

Additionally, the development of new markets is affecting the global supply chain. For example, platform-based, online freight forwarding and customs agent services are revolutionizing intermodal shipping. But they are also placing greater demands on efficient cargo operations and shorter ocean transit times, significantly disrupting traditional intermodal shipping markets. As online markets gain interest in the maritime industry, they will charter, operate, and possibly own vessels and port infrastructure that will be tailored to their demand for rapid, just-in-time services. While creating more traffic for the MTS, online logistics services will also enable greater participation by commercial entities that previously did not conduct business directly with the maritime industry and related maritime services.

The drive to innovate contributes to increased complexity in designs, operations, and systems management. Ship systems integrate information technologies that are networked with each other using common protocols. Networked systems enable real-time monitoring of shipboard systems by vessel owners and equipment manufacturers. This integrated system is a manifestation of a current trend in manufacturing and logistics that incorporates Internet of Things (IoT) technologies. Autonomous vessels, which shift the locus of control from an onboard ship's master to land-based control, are being developed and will present new regulatory, legal, and operational challenges. Port facilities are becoming more automated, reducing human interface and relying on technology and artificial intelligence to move equipment and cargo. These technological

MARITIME CYBER INCIDENT

IN JUNE 2017, the largest maritime shipper in the world, Maersk/A.P. Moller (APM), was one of many victims of the NotPetya global malware outbreak. The malware was introduced into the company's enterprise Information Technology (IT) system from a routine accounting software update that was managed by a Ukrainian vendor. Once infected, the rapid lateral movement of the virus required no human intervention to spread, rendering thousands of corporate systems unusable following the incident. Within the United States, five APM facilities were hampered with the malware, which caused significant delays in processing cargo and containers. While APM facilities were able to process cargo slowly using older manual methods, the delays in moving cargo were considerable. The financial setback was substantial to fully remediate their network of nearly 90,000 computer systems. This event serves as a stark reminder of the importance of cybersecurity for all business processes across the integrated supply chain.

"To retain U.S. advantages over our competitors, U.S. Government agencies must improve their understanding of worldwide science and technology trends..."

—National Security Strategy, December 2017

advances in energy production, propulsion systems, and automation are causing tremendous change across the MTS.

CYBER THREATS AND OPPORTUNITIES TO THE MTS

Maritime industry operations are becoming more integrated through automation to reduce costs and improve efficiency. Modern automation depends on a single source of precision navigation and timing provided by the Global Positioning System (GPS). This dependence on GPS continues to increase as systems become more interconnected, automated, and complex. Although this creates efficiencies, new risks and challenges emerge. For example, GPS is susceptible to jamming and spoofing which could significantly impact vessel and port operations, resulting in cascading effects throughout the interconnected intermodal system. The trend in networked ship systems renders critical shipboard operations increasingly vulnerable to cyber attacks. Long-range monitoring of shipboard networked IoT systems further exposes these vessels and the MTS to risk via cyber attack.

THE CHANGING ARCTIC

The Arctic environment is changing dramatically and with that change comes increasing risk posed by maritime activities in the increasingly accessible region. Satellite observations show decreasing multi-year ice and increasing open water during the Arctic summer and early fall. Although winter and spring sea travel is still severely limited due to extensive seasonal ice coverage across the region, recent summer and early autumn sea ice record lows have made seasonal maritime navigation more feasible. Economic development, in the forms of resource extraction, fisheries, adventure tourism, and destinational and trans-Arctic shipping, drives much of the current maritime activity in the region. The physical changes of the Arctic sea ice increases the viability of the Northern Sea Route and the Northwest Passage for commercial shipping during summer months. These shorter sea routes have the potential to reduce the time it takes to transport goods between Asian and European ports by several days.[14] The Arctic region contains an estimated 13 percent of the world's undiscovered oil and 30 percent of undiscovered natural gas.[15] Decreasing sea ice and diminishing onshore oil production are creating incentives for further exploration offshore. These activities bring risk, which can be mitigated through appropriate maritime governance, marine planning, and capabilities development.

THE FUTURE

There are three key drivers that will shape America's maritime domain over the foreseeable future: 1) a drive to increase the capacity of the MTS; 2) a growing demand to reduce the environmental impacts of ships and facilities; and 3) the incorporation of new technologies, platforms, and operating concepts to increase efficiency, exploit opportunities, and reduce wasted capacity. While enhancing efficiency and reducing costs, these drivers will also increase the operational complexities and vulnerabilities of the MTS.

14 Congressional Research Service, R41153, "Changes in the Arctic: Background and Issues for Congress."

15 U.S. Geological Service, "Assessment of Undiscovered Oil and Gas in the Arctic," online at http://www.pubs.er.uscg.gov/publication/70035000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IV.

Background: U.S. Coast Guard's Enduring Role in Facilitating Commerce

America's enduring maritime interests—its reliance on the seas for commerce, sustenance, and defense—has changed little since colonial days. The Coast Guard protects these national interests, thereby enabling unrestricted and unimpeded trade and travel on America's waterways. For more than 228 years the Coast Guard has facilitated maritime security to promote and safeguard American commerce.

The Nation's first Treasury Secretary, Alexander Hamilton, founded the Revenue Marine (later named the Revenue Cutter Service) to enforce Federal tariff and trade laws and prevent smuggling from the sea. The authorities and missions of today's Coast Guard are derived from these foundational decisions for the Revenue Marine cutters to conduct maritime law enforcement, monitor commerce, and assess and improve the operations of the Nation's major ports. At the same time, the Lighthouse Service took over control of the Nation's existing lighthouses and buoys from the States and went on to establish more aids to navigation that greatly assisted mariners in avoiding danger. During the early evolution of steam propulsion, thousands of lives were lost due to boiler explosions and fires. Congress began enacting laws in 1838 that required the inspection of steam vessels and the Steamboat Inspection Service was formed and issued licenses to steamship officers. The U.S. Lifesaving Service was formed in 1848 to help save shipwrecked mariners and passengers. In 1884, Congress established the Bureau of Navigation to support the Nation's growing merchant fleet of officers and crew. The Steamboat Inspection Service and the Bureau of Navigation merged in 1932 to form the Bureau of Navigation and Steamboat Inspection, which became the Bureau of Marine Inspection and Navigation in 1936.

With the merging of the Revenue Cutter Service and Life-Saving Service in 1915, the modern day Coast Guard was formed. In 1946, the Coast Guard incorporated the Lighthouse Service and the Bureau of Marine Inspection and Navigation, consolidating Federal authority for maritime safety, security, and environmental stewardship into a single Federal agency. Today the Coast Guard has broad statutory authorities, unique capabilities, and partnerships as a military, law enforcement, regulatory, emergency response, and humanitarian service, all to advance American prosperity through the facilitation of a safe, secure, and environmentally sustainable system of maritime commerce.

The Coast Guard is the lead Federal agency responsible for the maritime mode of the Transportation Systems Sector under the National Infrastructure Protection Plan, which directs the Coast Guard to protect and promote the MTS.[16] In accordance with the Maritime Transportation Security Act of 2002, the Coast Guard is charged with preventing transportation security incidents, which are

defined as incidents that can lead to loss of life, environmental damage, transportation system disruption, or economic disruption to a particular area.[17] The Coast Guard ensures restoration to the functionality of ports and waterways affected by emergencies that significantly impact the MTS. The Coast Guard also conducts icebreaking operations necessary to keep harbors, ports, and waterways open for commerce as long as possible during the winter months, as well as to prevent flooding from ice dams during spring thaws.

The Coast Guard has the overarching responsibility for ensuring the safety of vessel operators, crew, and passengers. In carrying out the aids to navigation (ATON) mission to prevent vessel groundings, allisions, and collisions, the Coast Guard maintains and positions more than 50,000 buoys, day markers, fog signals, radio towers, and beacons. Through the twelve Vessel Traffic Systems (VTS) at various locations on the MTS, the Coast Guard monitors, informs, recommends, and, if needed, directs the safe operation of vessels in congested waterways. The Coast Guard is also responsible for permitting the location and clearance of more than 20,000 bridges over navigable waterways. This includes drawbridge operations, construction monitoring, alteration of unreasonably obstructive bridges, and bridge lighting to facilitate the safe passage of vessels.

16 Department of Homeland Security, "National Infrastructure Protection Plan," online at https://www.dhs.gov/national-infrastructure-protection-plan.

17 Maritime Transportation Security Act of 2002, online at https://www.congress.gov/107/plaws/publ295/PLAW-107publ295.pdf.

The Coast Guard's unique military, law enforcement, intelligence, and regulatory authorities provide security for the MTS. Under the Captain of the Port (COTP) authorities and its role as the Federal Maritime Security Coordinator (FMSC), the Coast Guard is responsible for the safety and security of these multi-modal transportation hubs. Uniquely capable of protecting international and interstate commerce, the Coast Guard conducts Maritime Security Response Operations (MSRO) and can deploy short-notice maritime response forces to address urgent security threats to our maritime critical infrastructure.

As the Officer in Charge, Marine Inspections (OCMI), the Coast Guard ensures domestic commercial vessels meet all statutory and regulatory requirements, and that those who operate these vessels have met the requisite training and proficiency standards. The Coast Guard inspects vessels and approves vessel and facility security plans while promoting uniform standards and unity of effort among all stakeholders with maritime security interests at the port level. Through international agreements, the Coast Guard enforces safety and security standards for foreign passenger and cargo ships operating in U.S. waters. As the Federal On-Scene Coordinator (FOSC), the Coast Guard maintains its role as a steward of the environmental health and economic viability of our precious maritime natural resources. As the Search and Rescue (SAR) Mission Coordinator (SMC), the Coast Guard coordinates rescues for those in peril on the high seas and waters subject to jurisdiction of the United States. These authorities are essential for the safety, security, and efficiency of America's waterways and offshore waters.

V.

Facilitating Lawful Trade and Travel on Secure Waterways

As the lead Federal agency protecting our Nation's MTS and the primary regulator of the maritime shipping industry, the Coast Guard advances American prosperity through securing ports and waterways that enable commerce and ensuring vessels are subject to uniform, consistent standards. The Coast Guard must seek a balance between risks and costs to support the efficient flow of commerce while reducing the risk of disruption to the MTS.


TERMINAL BURCHARDKAI

OBJECTIVE 1. Mitigate Risk to Critical Infrastructure:

Understanding the vulnerabilities associated with interrelated systems enables the Coast Guard, its Federal, State, and local partners, and the marine industry to take appropriate steps to reduce the risk to the MTS from attack, exploitation, failure, or misuse. The Coast Guard remains vigilant for unique risks associated with low-probability but high-consequence events, such as those on board high capacity passenger vessels, chemical and gas ships carrying dangerous cargoes, and floating facilities and vessels working on the outer continental shelf. This includes the threat from environmental disasters, whether man-made or natural. Further, the increasing reliance of vessels and port facilities on cyber infrastructure creates new vulnerabilities for critical vessel and port operations. In order to mitigate the risks associated with high consequence events, the Coast Guard will:

- Fortify information technology (IT) security in the maritime domain. As the DHS Sector Specific Agency for maritime critical infrastructure, the Coast Guard will align with national and DHS policies to develop effective prevention and response frameworks for the protection of maritime critical infrastructure. The Coast Guard will expand a prevention regime that relies on existing authorities for risk governance for port facilities and vessels, tying safety and security compliance to recognized industry cybersecurity standards.

- Employ Risk-Based Maritime Security and Response (MSRO) activities, such as security boardings, fixed and moving (vessel escorts) security zone enforcement and aerial, shore-side, and waterborne patrols to address emerging threats. The Coast Guard will seek to expand the use of risk-based planning to inform the execution of its MSRO activities. The current suite of MSRO activities is largely appropriate for the maritime threats that exist today. However, emerging challenges, such as those associated with unmanned, autonomous aerial, surface, and subsurface vehicles, and the emergence of high-latitude operations in support of destinational and trans-polar shipping, require additional prevention and response capabilities.
- Prevent threats from reaching U.S. ports and enhance programs, such as the International Port Security Program (IPSP), to improve security procedures, facilitate dialogue, and share best practices. The Coast Guard will bolster the intelligence collection and communications link between Sector intelligence and the IPSP to leverage Sector intelligence capabilities for conducting Foreign Port Security Surveys in support of the IPSP.
- Enhance Maritime Domain Awareness (MDA) and information sharing among maritime security partners. The identification of threats, screening of vessels and associated crews and passengers, information sharing, and collaboration with in the intelligence community and international partners are critical to mitigating risk.

OBJECTIVE 2. Build Resiliency within the MTS:

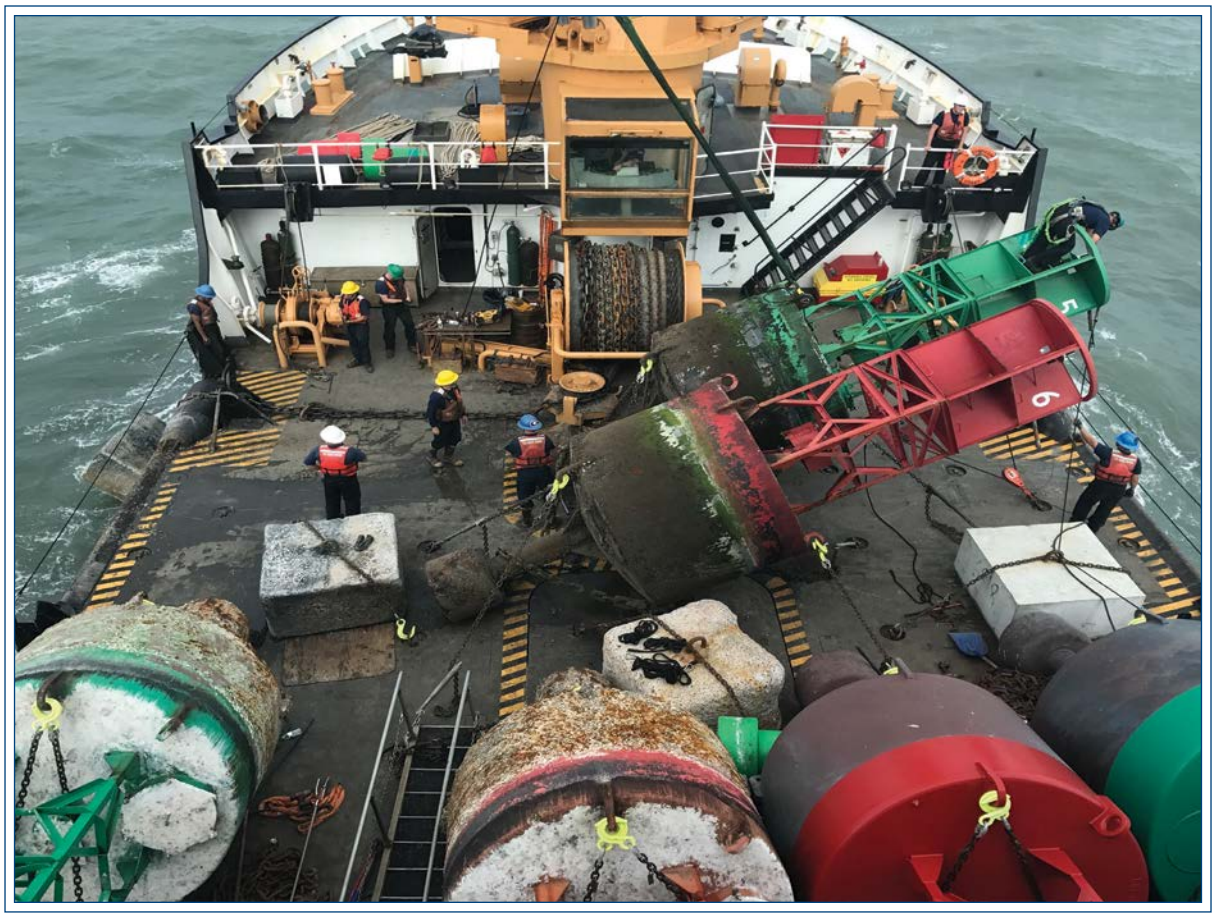
To ensure that the Nation has uninterrupted access to the global supply chain, the Coast Guard will continue to lead the response to major disruptions in the MTS under the auspices of the National Response Framework. The Coast Guard's broad authorities well position the Service to coordinate short-term recovery activities aimed at restoring the flow of commerce and other critical maritime activities within the ports. The Coast Guard will:

- Assess and update existing triage models for re-opening ports following widespread disruptions and port closures to include strengthening the Marine Transportation System Recovery Unit (MTSRU). The Coast Guard will build a formal internal review process using lessons learned from past major disruptions.
- Optimize the effective use of safety management systems and enhance a culture of safety in industry to identify and mitigate risks.
- Identify physical aids to navigation critical to opening ports following natural disasters or emergencies. The Coast Guard will refine recovery policies, plans, and procedures at the national, regional, and local levels. The Coast Guard will work closely with other agencies and maritime stakeholders to develop and implement policies, procedures, and plans for rapid response and recovery operations.

- Analyze protocols for the resumption of trade in the event of a transportation disruption. The Coast Guard will gather input from maritime stakeholders to review disruptive incidents with a goal of reassessing risk and improving preventative measures and response plans.
- Advance the operational flexibility of the inland tender fleet to ensure a sufficient surge capacity for emergency events.

OBJECTIVE 3. Enhance Unity of Effort in the MTS:

The complexity and challenges facing America's waterways require government agencies at all levels and private sector stakeholders with maritime interests work together to achieve common goals and continuously improve unity of effort. As user interactions in the global maritime environment grow more complex, collaboration is more critical than ever. The Coast Guard continually seeks to improve these relationships and identify new opportunities for engagement. The Coast Guard relies on



industry and allied agency partnerships to achieve results, and many performance initiatives depend on coordinated effort with external stakeholders. This has been evident as industrial innovations in advanced fossil fuel and mineral exploration pose new risks to American maritime resources and change the geography of oil extraction, thereby placing new demands on existing waterways. The Coast Guard will:

- Improve and enhance cooperative relationships with the maritime community, including local Harbor Safety Committees (HSCs). The Coast Guard will champion engagements with all stakeholders to ensure safe and efficient operations in the Nation's MTS. It will leverage the planning and advisory committees to improve coordination mechanisms with key subject matter experts on emerging technology from various interests within the private sector.
- Redouble efforts to build interagency partnerships to support and improve MTS efficiency through participation on the U.S. Committee on the Marine Transportation System (CMTS). The Service will continue to enhance partnerships with CMTS, U.S. Army Corps of Engineers (USACE), National Oceanic and Atmospheric Administration (NOAA), U.S. Customs and Border Protection (CBP), State, local, and tribal agencies and industry stakeholders, such as American Waterways Operators (AWO), American Association of Port Authorities (AAPA), American Pilots Association (APA), and World Shipping Council (WSC).
- Continue to exercise leadership in global maritime safety, security, and stewardship. The Service will also leverage bilateral and multilateral relationships to assist foreign coastal nations in building the regimes, awareness, information sharing, and operational capabilities needed to enhance maritime governance.
- Encourage and empower Area Maritime Security Committees (AMSCs) to continually focus on the identification, prevention, mitigation, response, resiliency, and recovery efforts on high consequence risks to the MTS, to include maturing their cybersecurity sub-committees and advocating cyber information sharing for the MTS.
- Evaluate new and emerging environmental threats to the MTS, including those that anticipate industrial innovations in advanced fossil fuel and mineral extraction and exploration technologies, to focus on the most effective prevention, mitigation, response, and recovery efforts. Coast Guard efforts include updating Area Contingency Plans (ACP) and conducting realistic exercises to ensure an effective coordinated response.
- Use its status and expertise in the international maritime community to shape international standards and guidelines to include autonomous vessels and other cyber-related issues. The Coast Guard will continue to be a key contributor to international forums such as the International Maritime Organization (IMO), International Association of Lighthouse Authorities (IALA), and International Hydrographic Organization (IHO).
- Continue to engage with State and local governments to ensure vessels are subject to consistent standards of universal application and enforcement, while locally collaborating on protecting and preserving State waters.

VI.

Modernizing Aids to Navigation and Mariner Information Systems

Technological advancements have led to greater efficiencies in maritime trade and have allowed for greater exploitation of natural resources. Innovations have led to a more interconnected and productive world, while subsequently introducing new risks for all stakeholders. The Coast Guard must have relevant and up-to-date infrastructure to deliver timely, relevant, accurate, and user-accessible navigation safety information to mariners. The Coast Guard has a responsibility to ensure America's waterways and maritime industry employ innovative, state-of-the-art systems that ensure America's competitiveness as a global trading partner. The Service must also reduce or mitigate risk to mariners, vessels, and maritime resources.

OBJECTIVE 1. Improve the Nation's Waterways:

America's waterways play a critical role in facilitating the Nation's trade and travel. American economic competitiveness depends on a modern, state-of-the-art intermodal ports and waterways network. The Coast Guard will leverage new and emerging technologies to ensure the MTS offers reliable and secure solutions to enduring navigational and operational challenges to maximize the safe and sustainable use of American ports and maritime resources. Fixed and floating ATON, such as buoys, day markers, and visual ranges, will continue to comprise a large part of the ATON system, although electronic aids to navigation (e-ATON) is increasingly expected to supplement the existing aids constellation in the future. Obstructions to waterways can reduce capacity causing delays in maritime traffic and disrupting America's supply chain. One potential obstruction is the presence of aging bridges that span these waterways, jeopardizing the vital flow of commerce. The Coast Guard will:

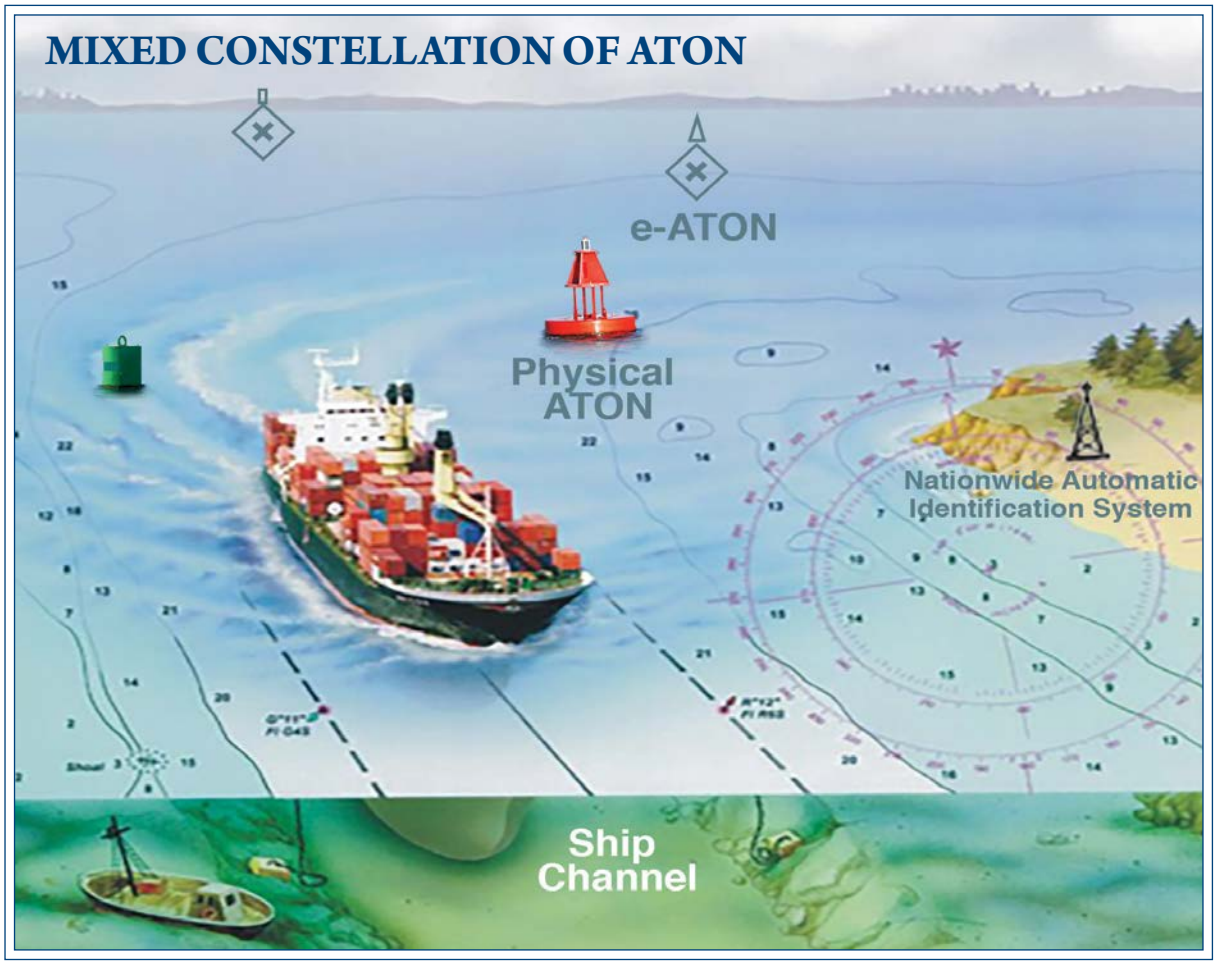
- Support American waterways to become the most technologically advanced maritime transportation network in the world by developing a world-class Coast Guard workforce best able to meet the needs of modern electronic, autonomous ship systems, and new and emerging alternative fuels and propulsion systems.
- Deliver enhanced Marine Safety Information (MSI) to provide mariners with real-time, accessible, and relevant voyage planning data that will result in more efficient, economical, and safer transits through the MTS. The Coast Guard will bolster engagement with NOAA to integrate real-time information to broadcast hydrographic and weather data through the Automatic Identification System (AIS), and continue to seek additional partnerships and information sources.
- Accelerate integration of modern navigation systems such as e-ATON into a world-class system of buoys and beacons.

2017 HURRICANE RESPONSE

The Coast Guard successfully leveraged electronic aids to navigation (e-ATON) during three hurricanes that made landfall in the United States during September 2017. Following the devastation of Hurricane Harvey, the Coast Guard employed e-ATON to temporarily mark physical ATON that were destroyed or damaged along the Gulf Coast. The location of the individual e-ATON, which were transmitted over the Nationwide Automatic Identification System (NAIS), could be "seen" by any mariner with a radar or electronic charting system capable of displaying AIS information. Additionally, as a backup to the NAIS network, a portable AIS system was deployed to the effected regions in Texas. The system provided the ability to broadcast e-ATON in areas NAIS did not cover. These efforts contributed to the reopening of the Port of Aransas, Texas several days sooner than physical ATON restoration allowed.

Capitalizing on the lessons learned following Hurricane Harvey, and in anticipation of Hurricane Irma the Coast Guard again utilized e-ATON around critical U.S. waterways in Hurricane Irma's forecasted track. The Coast Guard established 301 e-ATON in waterways from Tampa to Key West, Florida, and up the eastern seaboard to Charleston, South Carolina, as well as in Puerto Rico, all prior to the powerful hurricane making landfall. In the aftermath of the storms, e-ATON provided a constant aid to navigation while buoy tenders and ATON teams repaired and reconstituted the physical ATON constellation. As the Coast Guard works with international, interagency, and industry partners to pioneer the future of navigation, e-ATON is playing a critical role in making U.S. waters safer, more efficient, and more resilient.

- Improve the process for optimal marking of navigable waterways through data-driven and risk-based methodology and augment the use of e-ATON to best supplement physical aids. The Coast Guard must examine the current constellation of aids to navigation using a systematic and holistic approach that considers stakeholder input, environmental considerations, channel framework, user capabilities, and available technology and resources.
- Promote the use of electronic navigation charts in lieu of paper charts where applicable, as long as conditions of accuracy, reliability, and cybersecurity are met. The Coast Guard will be a strong proponent of a "paperless bridge" approach to safe navigation.
- Leverage partners within industry and advisory councils, such as the Towing Safety Advisory Committee and Navigation Safety Advisory Council, to apply risk-based decision making to identify ways to relax navigational chart display performance standards while maintaining an equitable level of safety.
- Support the U.S. Army Corps of Engineers in its efforts to find more efficient ways to improve reliability of the locks and dams on the Nation's inland waterways.
- Minimize chokepoints at bridge-waterways intersections with a focus on improving bridge permitting processing times and continuously monitoring and assessing bridges that may hinder navigation.



OBJECTIVE 2. Optimize Maritime Planning:

Effective maritime governance and planning are integral to meeting the Coast Guard statutory responsibilities. Maritime planning is a comprehensive, adaptive, integrated, and transparent process based on disciplined analysis of current and anticipated uses of ocean, coastal, inland waters, and Great Lakes areas. Maritime planning reduces conflicts among users, enhances predictability, promotes business opportunity, reduces environmental impacts, facilitates compatible uses, and preserves critical ecosystem services and marine transportation systems to meet economic, environmental, security, and social objectives. The Coast Guard must be attuned to emerging requirements of the maritime domain, such as renewable energy, new energy products and development, wind farms, hydrokinetics, aquaculture, and the construction and operation of offshore facilities and other infrastructure. The Coast Guard will:

- Engage maritime stakeholders to identify potential conflicts, future marine use trends, and needs of the industry. The Coast Guard must be forward leaning in interagency, Federal, State, and regional ocean partnerships, as appropriate, to carry out statutory obligations and national policy objectives.
- Use national and regional data portals to identify potential conflicts and impacts to inform decisions and to enhance opportunities.
- Facilitate, as appropriate, coordination and consultation regarding maritime matters among Federal, State, tribal, and local governments, marine industries, the ocean science and technology communities, and other stakeholders.
- Support evolving requirements in traditional and renewable energy, aquaculture, and emerging changes in ship design and construction, construction and operation of coastal and offshore facilities and other infrastructure, and the safe and secure transportation of new and emerging energy products.
- Develop and implement next-generation waterway system designs to improve service delivery, enhance mariner situational awareness, and increase waterway resiliency. The Coast Guard will leverage technology to enhance mariners' situational awareness and reduce risks.
- Improve information sharing with interagency partners and the maritime industry to monitor industry's emerging technology, such as autonomous systems, robotic vessels, and the development, availability, and use of alternative fuels and propulsion systems.

OBJECTIVE 3. Recapitalize Aging Assets:

The Coast Guard is faced with aging surface and aviation assets and antiquated shore infrastructure. An alarming number of Coast Guard buoy and construction tenders remain in the active Coast Guard inventory well beyond their service life. This jeopardizes the Service's capability to establish, maintain, and repair beacons and buoys in America's waterways. Mariners depend on fixed and floating aids to navigation (ATON) to safely navigate and prevent catastrophic accidents such as collisions, allisions, and groundings. ATON provides assistance to mariners by acting as road signs on the waterway or marking the location of an isolated danger. In addition to positioning buoys and erecting aids to navigation, Coast Guard tenders are the only Federal maritime presence on the inland rivers. They provide flood recovery and emergency response, perform search and rescue operations, and are an immediately deployable Federal response asset during times of national emergency in remote areas of

the country. Also, the Coast Guard's only operational heavy icebreaker is a single-point of failure for extreme ice operations and any breakdown would likely necessitate seeking assistance from a willing foreign nation with heavy icebreaking capability. As the Arctic becomes more accessible, the longer maritime routes between Asia and Western Europe will be eclipsed for some purposes by the shorter and more direct Northwest Passage, Northern Sea Route, or trans-Arctic route. With increased interconnectivity and the proliferation of data, the Coast Guard must harness the power of data and invest in information infrastructure, to include information technology (IT) storage and processing capabilities, which can handle the additional maritime data. The Coast Guard will:

- Invest in modern assets to perform the ATON mission, to include investment in inland construction and buoy tender fleets such as the new Waterways Commerce Cutter, and IT storage and data processing capabilities.
- Revitalize domestic and polar icebreaking capabilities. The Coast Guard must be able to project and maintain presence and perform icebreaking operations with the Great Lakes, along the East Coast, and in the polar regions to guarantee sovereignty and national and economic security through ice-choked seas and waterways.
- Strengthen the partnership with industry in reviewing the existing tiered system for prioritizing icebreaking services.

"We will invest in technology to counter emerging threats to our aviation, surface, and maritime transportation sectors."

—National Security Strategy, December 2017

OBJECTIVE 4. Streamline and Update Information Systems:

The ability to leverage and operationalize data into information, and information into intelligence, serves as a force-multiplier. Within the maritime industry, companies are investing extensively in IT systems to keep pace with the flow of commerce in a highly competitive market. They are also increasing their use of electronic condition-based monitoring of ships and equipment, electronic certificates, electronic credentials, and electronic navigation systems. The age and increasing obsolescence of Coast Guard marine safety, credentialing, and navigation information systems can be an impediment and jeopardize the efficiency of the MTS as much as aging cutters, bridges, locks, and silted waterways. The Coast Guard must modernize these information systems to achieve a 21st century MTS. The Coast Guard will:

- Initiate research and development to develop modern adaptable information systems to facilitate the safe, secure, and sustainable flow of commerce. Such systems should be able to promote sharing and leverage different public and private data sources to improve risk-based identification of safety, security, and environmental threats.
- Improve credentialing, certification, and documentation systems to promote a user-friendly, secure, and transparent delivery of service.
- Streamline the regulatory process. The Coast Guard must promote a shift from a rules-based regulatory structure in the maritime environment to a risk and principles-based regulatory structure to keep pace with emerging issues and technology advancements, such as electronic and autonomous systems.
- Increase efforts to work with interagency partners on IT solutions that improve intelligence, surveillance, and reconnaissance, intelligence analysis, and screening/identity management.

VII.

Transforming Workforce Capacity and Partnerships

The Coast Guard must have a highly adaptive mission-ready total workforce to advance, safeguard, and facilitate lawful trade and travel in an MTS made increasingly complex by the pace of innovation. The Service must have the capacity and be able to flex capabilities as commercial markets and demands are transformed by these innovations. The Coast Guard must build an adaptive force that is comfortable operating in volatility amid the rapid acceleration of technology. The Service will continuously review the human capital system that recruits, develops, and retains the best possible workforce to ensure it can adapt within a constantly changing environment. The Coast Guard will:

OBJECTIVE 1. Leverage and Ensure Effective Oversight of Third Parties:

Congressional, DHS, Coast Guard regulatory, and International Maritime Organization requirements have pushed the Coast Guard to increase the use and oversight of third-party organizations for regulatory functions and standards accrediting bodies. To achieve this, the Coast Guard will:

- Judiciously leverage the use of third-party organizations, while ensuring the Coast Guard Prevention workforce retains the necessary competencies, proficiency, and technical expertise and is provided the doctrine, strategies, training, and education needed to manage and conduct proper oversight.
- Strengthen third-party oversight, auditing, and integrated risk management. The Coast Guard must develop a system that measures performance by third-party organizations to ensure continual high performance standards are met, and improvements to the training platforms are made as needed.
- Adapt the organizational structure and related authorities, roles, and responsibilities to ensure the Service sustains the ability to monitor the global performance of the U.S. flag fleet and the third-party organizations that perform delegated functions on the Coast Guard's behalf.

OBJECTIVE 2. Sharpen High-Tech and Adaptive Service Competencies:

The drive to increase capacity and competitiveness while reducing environmental impact has led the industry to develop more complex and highly automated operations. Increased reliance on automation and cyber capabilities create new risks for marine safety. Further innovations in engineering, materials, fuels, and cargoes challenge the existing prescriptive regulatory regime. At the same time, the Coast Guard has the opportunity to leverage new technology to beneficially change the way the Service conducts compliance and oversight through expanded use of condition-based monitoring, data, and analytics. The Coast Guard mission-ready total workforce will possess the technical expertise to effectively audit and validate these new systems. The Service must maintain awareness over major, high-impact industry trends and innovations that have the potential to transform, or possibly disrupt,

the maritime transportation sector. The Coast Guard must encourage innovation, cultivate divergent viewpoints, and foster unconventional ideas and solutions. The Coast Guard will:

- Advance digital tools in the performance of marine safety duties. The Coast Guard will optimize the use of technology, mobility, cloud computing, big data analytics, and artificial intelligence to enhance mission execution to include vessel inspections and investigations.
- Focus investment in advanced education and industry training in emerging fields such as automation, artificial intelligence, data analytics, and cybersecurity.
- Identify first adopters and other innovators within industry, academia, and government and seek new partnerships with emerging technology industries to expand workforce competencies in advanced and complex systems.
- Advance organizational peripheral vision. The Coast Guard will develop a group of non-traditional strategic thinkers to continually scan the Service periphery for emerging trends, new technologies, and other environmental changes or strategic shifts in domestic and international context to inform senior leadership.
- Leverage the Coast Guard's Evergreen Project to scan across maritime industry trends and develop alternative futures to best position the Service for the fast-changing world.
- Promote and establish consortiums of maritime emerging technologies with industry, academia, and government stakeholders.

OBJECTIVE 3. Advance the Prevention and Response Operations Workforce:

Attracting and retaining the best officers, warrant officers, enlisted members, and civilians is crucial to building capacity, competencies, and experience necessary to keep pace with the brightest within industry and to ensure a safe, secure, efficient, and economically vibrant MTS. The Coast Guard must broaden the diversity of our workforce to be more reflective of the population we serve and commit to

"Departments and agencies must work with industry to experiment, prototype, and rapidly field new capabilities that can be easily upgraded as new technologies come online."

—National Security Strategy, December 2017

fostering an inclusive environment. The Coast Guard workforce must achieve an edge in strategically relevant advanced technologies. This will require the implementation of robust, state-of-the-art training and qualification programs that will achieve professional mastery at the highest level of mission performance. The Coast Guard will:

- Recruit, develop, and retain capable and agile Prevention and Response professionals who can thrive in an environment characterized by constant changes in technology and tools. The Coast Guard will build workforce skills and expertise to span the technology continuum, including cybersecurity. The Coast Guard will reinforce Prevention and Response career paths that are professionally rewarding and intellectually invigorating with full opportunities for promotion and leadership positions.
- Develop a repository of information of technically advanced systems, to include state-of-the-art vessel propulsion and navigation control systems.
- Partner with academia, industry, and government organizations to inculcate agile, cutting-edge training and education that keeps pace with technology. The Coast Guard will expand internships, professional courses of study, and field experience in emerging technology fields.
- Address cultural and legal barriers hindering the use of cutting-edge technology for mission execution in Prevention and Response.
- Advance flexibility and proficiency in incident management, crisis response, and contingency planning. The Coast Guard will build a repository of shared experiences in crisis leadership that describes how responders adapted to changing conditions, leveraged new technologies, and made decisions on a compressed timeline while faced with great uncertainty and incomplete information.
- Further a culture of professionalism that embraces the lessons of the past, constantly evaluates the current environment, and actively prepares for the future.

VIII.

Ensuring Long-Term Success

In addition to the three lines of effort, there are several additional overarching concepts crucial for the Coast Guard to ensure long-term success.

Unity of Effort: The Coast Guard will leverage established partnerships within Federal, State, tribal, and local governments and private industry to bring a balanced whole-of-government approach to safeguarding America's economic security. The Coast Guard will capitalize on the unique nature of its broad authorities, relationships, and capabilities. The Coast Guard will continue to be a leader in marine planning to help regions best address management challenges, while concurrently ensuring MTS efficiency and safety. Coast Guard leadership will continue to facilitate collaboration with the Committee on the Marine Transportation System (CMTS), relying on them for effective and efficient MTS coordination. This unity of effort will ensure the Coast Guard priorities reinforce all of the key national goals.

Adaptive-Focused Service: The Coast Guard will create a culture that is highly adaptive to the rapid acceleration of technology. Although greater interconnectivity and digital integration present new threats, they also offer tremendous opportunities. The Coast Guard will rise to these challenges and make prudent investments in supporting artificial intelligence, mobile systems, and cloud computing in the performance of its missions. The Coast Guard will anticipate change, become more diverse, apply lessons learned, and embrace the fast pace of technological change.

Marine Transportation as a National Priority: The Coast Guard will continue to advocate the importance of America's ports, waterways, and inland rivers and articulate how economic and national security are inexorably linked to the best possible maritime infrastructure and marine transportation network.

Investment in the Future: The Coast Guard will strive to stay abreast of advancements in the maritime industry. The Coast Guard will invest in resources critical to meeting the challenges beset by the increasing complexity of systems, accelerated pace of innovation, and emerging technologies. To enable the uninterrupted free flow of maritime commerce, the Coast Guard will recapitalize its aging assets, to include cutters, boats, aircraft, and facilities. The Coast Guard will invest in information technology infrastructure to support emerging platforms. The Coast Guard will continuously exercise sound risk management, contingency planning and response, and regulatory frameworks to ensure an MTS that remains safe, secure, and resilient.

Situational Awareness: The Coast Guard will provide decision makers and maritime partners timely, useful, and actionable information for maritime operations. The Service will make informed decisions concerning emerging technological trends, new ship systems and designs, environmental impacts, maritime threats, hazards, competing interests in the maritime domain, and potential disruptions to America's waterways.

International Engagement: The Coast Guard will continue to maximize use of the Port Security Liaison Officers to assess implementation of the International Ship and Port Facility Security Code and other anti-terrorism security measures in foreign ports, thereby reducing risks to ports, waterways, ships, and the entire MTS.

IX.

Conclusion

A safe and secure waterway enables America to transport goods on the MTS, advances trade, generates capital, and drives America's economy forward. The ease of moving cargo and people on the waterways within its borders and beyond its coasts fuels our Nation's economic competitive advantage. Any man-made or natural disruption, even of brief duration, to America's MTS has the potential for devastating effect on the Nation's economy.

The accelerating pace of innovation, new technologies, and the expansion of natural resource exploration, production, and transportation is manifesting in larger, more complex vessels, increased traffic, and greater demands on the MTS. Greater interconnectivity and digital integration of maritime shipping increases productivity, but it also amplifies the vulnerability in the cyber domain. Advanced technologies like autonomous vessels usher in an era of new regulatory, legal, and operational challenges. New propulsion technologies will transform the Service as it did at the advent of steam propulsion. These factors combine to produce a system highly susceptible to disruption.

While these new factors pose challenges for the Coast Guard and can be risk aggravators, they also present opportunities for the Service to better enable commerce and support the MTS. The Coast Guard will invest in capabilities, and strategically adapt to the changing environment to more efficiently facilitate safe and secure commerce. This document offers a framework that outlines the Coast Guard's efforts over the next decade in sustaining America's maritime economic prosperity. It seeks to build a collaborative, adaptive-focused, and technologically advanced Coast Guard that maximizes America's economic security. It emphasizes three lines of effort: ***Facilitating Lawful Trade and Travel on Secure Waterways; Modernizing Aids to Navigation and Mariner Information Systems;*** and ***Transforming Workforce Capacity and Partnerships***. It outlines a number of critical success factors that will ensure the Service's long-term success.

It is in the national interest that maritime commerce remains efficient and unobstructed through America's waterways. Since 1790, the Coast Guard has played a major role in protecting our Nation's economic security—facilitating maritime commerce and ensuring safe and unimpeded lawful trade and travel through America's waterways—and will continue to do so. The Coast Guard cannot successfully implement this Vision alone. The Coast Guard will closely coordinate with partner agencies at the Federal, State, tribal, and local levels and with private stakeholders, academia, and industry to protect America's maritime interests.


U.S. COAST GUARD
105

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Appendix: Glossary of Key Terms

Area Contingency Plan (ACP)

An ACP is a reference document prepared for the use of all agencies engaged in responding to environmental emergencies within a defined geographic area. An ACP may also contain Sub-Area and Geographic Response Plans, which may have more limited scope than the ACP itself. An ACP is a mechanism to ensure all responders have access to essential area-specific information and promotes interagency of coordination to improve the effectiveness of responses. The Coast Guard is designated the lead agency for planning and response in coastal zones and certain major inland water bodies. The EPA is the designated lead for inland zones. (EPA)

Automatic Identification System-Aids to Navigation (AIS-ATON)

Synthetic AIS-ATON is a message that is broadcasted from a remote location to provide information that corresponds to the position of an existing physical aid to navigation. Virtual AIS-ATON is a message that is broadcasted from a remote location to provide information on a location that does not coincide with a physical aid to navigation. Physical AIS-ATON is a message that is broadcasted from an AIS transmitter located on an existing physical aid to navigation. (U.S. Coast Guard)

Committee on the Marine Transportation System (CMTS)

In accordance with Coast Guard and Maritime Transportation Act of 2012 (Pub. L. 112-213), the stated purpose of the CMTS is to serve as a Federal interagency coordinating committee to: 1) assess the adequacy of the MTS; 2) promote the integration of the MTS with other modes of transportation and other uses of the marine environment; and 3) coordinate and make recommendations with regard to Federal policies that impact the MTS. (National Strategy for the Marine Transportation System: Channeling the Maritime Advantage 2017-2022)

Critical Infrastructure

The Nation's critical infrastructure provides the essential services that underpin American society and serve as the backbone of our Nation's economy, security, and health. Overall, there are 16 critical infrastructure sectors that compose the assets, systems, and networks, whether physical or virtual, so vital to the United States that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof. The National Protection and Programs Directorate's Office of Infrastructure Protection (IP) leads the coordinated national effort to manage risks to the Nation's critical infrastructure and enhance the security and resilience of America's physical and cyber infrastructure. (Department of Homeland Security)

Exclusive Economic Zone (EEZ)

The EEZ is the zone where the United States and other coastal nations have jurisdiction over natural resources. The U.S. EEZ extends no more than 200 nautical miles from the territorial sea baseline and is adjacent to the 12 nautical mile territorial sea of the United States, including the Commonwealth of Puerto Rico, Guam, American Samoa, the U.S. Virgin Islands, the Commonwealth of the Northern Mariana Islands, and any other territory or possession over which the United States exercises sovereignty. (NOAA)

Harbor Safety Committees

Harbor Safety Committees are the principle building block in the National MTS Coordinating Structure. Membership is typically comprised of representatives of government agencies, maritime labor and industry organizations, environmental groups, and other public interest groups, to the extent that they are active in a particular port. (U.S. Coast Guard)

International Maritime Organization (IMO)

The International Maritime Organization was established in Geneva in 1948, and came into force ten years later, meeting for the first time in 1959. Headquartered in London, the IMO is a specialized agency of the United Nations with 170 member States, three Associate Members, several indigenous groups, and observers. The IMO's primary purpose is to develop a comprehensive regulatory framework for shipping. It focuses on marine safety, environmental concerns, and the efficiency of global shipping. (U.S. Coast Guard)

Maritime Domain Awareness (MDA)

The effective understanding of anything associated with the global maritime domain that could impact the security, safety, economy, or environment of the U.S. (National Maritime Domain Awareness Plan for the National Strategy for Maritime Security)

Navigable Waterways

In addition to various statutory definitions, Title 33 of the Code of Federal Regulations defines navigable waterways as generally consisting of:

- Waters of the U.S. EEZ;
- U.S. territorial sea;
- Waters internal to the United States that are subject to tidal influence; and
- Waters internal to the United States that are not subject to tidal influence.

Risk

The potential for an unwanted or adverse outcome resulting from an incident, as determined by the likelihood that a particular threat will exploit a particular vulnerability, with the associated consequences. (Department of Homeland Security)

Transportation System Sector

The Transportation System Sector consists of seven key subsectors, or modes: Aviation includes aircraft, air traffic control systems, and about 19,700 airports, heliports, and landing strips; Highway and Motor Carrier encompasses more than 4 million miles of roadway, more than 600,000 bridges, and more than 350 tunnels; MTS consists of about 95,000 miles of shoreline, 361 ports, more than 25,000 miles of waterways, and intermodal landside connections that allow the various modes of transportation to move people and goods to, from, and on the water; Mass Transit and Passenger Rail includes terminals, operational systems, and supporting infrastructure for passenger services by transit buses, trolleybuses, monorail, heavy rail—also known as subways or metros—light rail, passenger rail, and vanpool/rideshare; Pipeline Systems consist of more than 2.5 million miles of pipelines spanning the country and carrying nearly all of the nation's natural gas and about 65 percent of hazardous liquids, as well as various chemicals; Freight Rail consists of seven major carriers, hundreds of smaller railroads, over 138,000 miles of active railroad, over 1.33 million freight cars, and approximately 20,000 locomotives; and Postal and Shipping moves about 720 million letters and packages each day and includes large integrated carriers, regional and local courier services, mail services, mail management firms, and chartered and delivery services. (Department of Homeland Security)

Vulnerability

A characteristic or specific weakness that renders an organization or asset (such as information or an information system) open to exploitation by a given threat or susceptible to a given hazard. (Department of Homeland Security)

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