An Assessment of the U.S. Marine Transportation System: Report to Congress

March 28, 2022

This report completes an action directed to the CMTS under the *Coast Guard and Maritime Transportation Act of 2012* (Pub. L. No. 112-213).

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PREFACE

The U.S. Committee on the Marine Transportation System (CMTS) was authorized on December 20, 2012 in the *Coast Guard and Maritime Transportation Act of 2012* (Pub. L. No. 112-213.) The CMTS is a Cabinet-level, interdepartmental committee initially established by Presidential Directive on December 17, 2004, and consists of representatives from Federal departments, agencies and offices with jurisdiction and interests in the Marine Transportation System (MTS).

Pursuant to 2012 statute, the CMTS is responsible for:

- Assessing the adequacy of the MTS (including ports, waterways, channels, and their intermodal connections);
- Promoting the integration of the MTS with other modes of transportation and other uses of the marine environment; and
- Coordinating, improving the coordination of, and making recommendations with regard to Federal policies that impact the MTS.

The CMTS was further directed to "provide to the Committee on Commerce, Science, and Transportation and the Committee on Environment and Public Works of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a report" that includes:

- Steps taken to implement actions recommended in the 2008 CMTS document titled *National Strategy for the Marine Transportation System: A Framework for Action*;
- An assessment of the condition of the MTS;
- A discussion of the challenges the MTS faces in meeting user demand, including estimates of investment levels required to ensure system infrastructure meets such demand;
- A plan, with recommended actions, for improving the MTS to meet current and future challenges and;
- Steps taken to implement actions recommended in previous reports required under this subsection.

The steps taken to implement actions recommended in the 2008 CMTS document titled, *National Strategy for the Marine Transportation System: A Framework for Action* were summarized in the appendix of the CMTS document, *National Strategy for the Marine Transportation System: Channeling the Maritime Advantage* (2017 National Strategy), published in October 2017, available at: https://rosap.ntl.bts.gov/view/dot/60705. In addition, the 2017 National Strategy provides actions to improve the MTS. The 2021 *Assessment of the Marine Transportation System* (Assessment Report) replaces the multiagency report issued through the U.S. Department of Transportation in 1999 titled, *An Assessment of the U.S. Marine Transportation System.*

https://www.cmts.gov/assets/uploads/documents/Assessmnt_of_the_US_MTS_-_Rpt_to_Congr_Sep_1999_combined.pdf.

In the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, the CMTS authorizing language [46 U.S.C.A. § 55501 2014 (e)(2)] was amended to require "a conditions and performance analysis" of the marine transportation system. This modified the original 2012 language which referenced an "assessment" of the MTS. This MTS Assessment report fulfills the original language and the CMTS is evaluating current conditions and performance measures for the marine transportation system for future reports to Congress.

Lastly, this report was completed with extensive interagency review prior to February 2021 and passage of the Bipartisan Infrastructure Law of November 2021, which authorized funds for a wide array of transportation programs including to the U.S. marine transportation system. The passage of this landmark legislation is expected to positively impact the performance of the MTS and national supply chain. This MTS Assessment may be viewed as foundational information on the nature and performance of the system and Federal maritime agencies upon which to build future reports.

ORGANIZATION OF THIS REPORT

Chapter 1, ***Introduction to the Marine Transportation System,*** is included in the report to provide a description of the MTS.

Chapter 2, ***Assessment of the Marine Transportation System,*** contains an overview of four priority areas: Infrastructure; Safety; Security; and Environmental Stewardship.

Chapter 3, ***Focus Areas***, highlights five aspects of the MTS: U.S. Arctic, MTS Resilience, Energy Development, Conditions and Performance Measures, and Impacts to the MTS from the 2020 COVID-19 Pandemic.

Chapter 4, ***General Observations on the State of the Marine Transportation System,*** adds to the statistics and observations presented in the document.

METHODOLOGY AND MTS PERFORMANCE MEASURES

This Assessment Report is a compilation of existing citable resources identified through extensive review of literature sources and published reports from government, industry, media, and academia. The CMTS has generally accepted the veracity of cited findings, although in some cases further research was conducted to provide additional detail. This assessment is the product of the combined effort of several dozen representatives from all the CMTS member agencies, working together to address each priority and focus area through their respective roles and responsibilities.

To define the boundaries of the MTS for assessment purposes, we reference the notation in the *Coast Guard and Maritime Transportation Act of 2012,* Section 310(b)(1), where one of the purposes of the establishment of the CMTS is to:

- assess the adequacy of the MTS (including ports, waterways, channels, and their intermodal connections);

While there is varying Federal Government information about the state of specific components of the MTS, resources that address the broad scope and "state" of the MTS do not include comprehensive and repeatable performance measures. Assessing the state of the MTS is an intricate task that reflects the complexity of the system itself and, as noted, it is the intent of the CMTS, in future MTS assessment reports to Congress, to focus on existing and repeatable performance measures, as well as identifying gaps where additional metrics would support a comprehensive and ongoing assessment of the MTS as a complement to, but not a replacement of, the Port Performance Freight Statistic Annual Report by the Bureau of Transportation Statistics. There is additional discussion about the use of conditions and performance measures under Chapter 3, ***Focus Areas***.

EXECUTIVE SUMMARY

The U.S. Marine Transportation System (MTS) is the primary system by which goods enter and leave the United States (U.S.). During 2018, waterborne trade through U.S. ports accounted for more than 42 percent of U.S. international trade by value, moving $1.76 trillion of goods.[1] Approximately 2.3 billion tons of domestic and foreign commerce are carried annually on the U.S. inland waterways.[2] The MTS touches virtually every aspect of American life—from the clothes we wear, to the cars and trucks we drive, to the food we eat, to the oil and natural gas used to heat and cool our homes.

The U.S. Committee on the Marine Transportation System (CMTS) was authorized on December 20, 2012 in the *Coast Guard and Maritime Transportation Act of 2012* (Pub. L. No. 112-213.) The CMTS is a Cabinet-level, interdepartmental committee initially established by Presidential Directive on December 17, 2004, and consists of representatives from Federal departments, agencies and offices with jurisdiction and interests in the MTS [www.CMTS.gov]. The CMTS was directed in the 2012 authorization to provide to Congress, an assessment of the MTS including steps taken to implement actions recommended in the 2008 CMTS document titled *National Strategy for the Marine Transportation System: A Framework for Action.*

The steps taken to implement actions recommended in the 2008 CMTS document titled, *National Strategy for the Marine Transportation System: A Framework for Action* were summarized in the appendix of the CMTS document, *National Strategy for the Marine Transportation System: Channeling the Maritime Advantage* (2017 National Strategy), published in October 2017, available at https://rosap.ntl.bts.gov/view/dot/60705. In addition, the 2017 National Strategy provides actions to improve the MTS.

This 2021 *Assessment of the Marine Transportation System* (Assessment Report) replaces the multiagency report issued through the U.S. Department of Transportation (DOT) in 1999 titled, *An Assessment of the U.S. Marine Transportation System.* [https://www.cmts.gov/assets/uploads/documents/Assessmnt_of_the_US_MTS_-_Rpt_to_Congr_Sep_1999_combined.pdf.]

It was noted in the 1999 DOT Report to Congress: *An Assessment of the U.S. Marine Transportation System*[3], that to attain a modern MTS by 2020, the following should be performed:

- Facilitate coordination among MTS users and stakeholders;
- Address MTS funding issues;
- Achieve the vision for system mobility and competitiveness;
- Improve awareness of the MTS;

- Establish information management and infrastructure supportive of the MTS;
- Meet national security objectives; and
- Achieve safety and environmental objectives.

Federal MTS agencies, individually, and collectively, both within and outside of the CMTS partnership, have made great strides that have contributed to implementing these recommendations. In addition, industry continues to be innovative within the MTS to meet user demand as well as aggressive with direct MTS investment, estimated in excess of $46 billion in 2017. Certainly, within the Federal Government, the awareness of the MTS has been enhanced by the myriad of activities and publications by the CMTS and its member agencies.

There has been a groundswell of events and developments that have impacted the MTS since 1999, including the 2009 recession, the expanded Panama and Suez Canals, the unforeseen boom (and 2020 downturn) in energy exports like liquefied natural gas (LNG) and the onset of the COVID 19 Pandemic.

The U.S. Census Bureau projects that the U.S. population will increase from the current level of 323.1 million to 404.4 million people in 2060.[4] The demand for goods for this increasing population coupled with increasing movements of energy resources could lead to a significant increase in needed MTS capacity. In a 2015 report, "U.S. Container Port Congestion and Related International Supply Chain Issues," the Federal Maritime Commission (FMC) noted that "In many ways, the elimination of congestion is today's most critical and relevant trade-related issue."

Infrastructure is a key component of a country's economic competitiveness. In a 2019 report, the World Economic Forum (WEF) ranked the U.S. second among 141 countries overall in a Global Competitiveness Index and thirteenth overall in infrastructure. With respect to U.S. ports and quality of seaport services specifically, the WEF ranked U.S. ports 10th from the top (out of 141 countries). Further, in 2020, the average age of all locks in the U.S. was 64 years old. A study by the National Surface Transportation Policy and Revenue Study Commission states that an investment in freight transportation infrastructure that reduces direct transportation costs by 10 percent will result in supply chain improvements that will help companies reduce their operating costs by 1 percent.[5]

The DOT Bureau of Transportation Statistics Port Performance Annual Report to Congress (2019), accounting for measures from 2018, lists the top 25 U.S. ports by tonnage, indicating that total tonnages grew by 7.5 percent between 2015-2018. [Table 1.] The onset of the COVID-19 pandemic also impacted U.S. ports and MTS industries. The MTS was impacted by reduced cargo shipping activity in U.S. and global ports. Lines canceled sailings, as some grappled with outbreaks prior to the effective shutdown of the industry. Decreased demand for petroleum products along with the near-complete utilization of mainland storage capacity led to overflow

production being stored on nearly 200 tankers anchored off U.S. coasts. MTS stakeholders and agencies have responded in dramatic fashion to address the challenges posed by COVID-19, by adapting policies and procedures to protect workers and the public from infection, maintain essential functions in a rapidly-changing and economically-challenging environment, and ensure the continued operation of the MTS in support of overall recovery efforts.

Table 1 Tonnage, Container Cargo, and Dry Bulk Handled by Maritime Ports, 2015–2018

Year	Total tonnage handled at top 25 ports (billion)	Total TEU handled at top 25 container ports (million TEU)	Total dry bulk tonnage handled at top 25 dry bulk ports (million)
2015	1.75	46.2	702
2016	1.75 ↑	47.6 ↑	684 ↓
2017	1.83 ↑	51.1 ↑	729 ↑
2018	1.88 ↑	54.0 ↑	732 ↑
Percent growth since 2015	7.5% ↑	16.8% ↑	4.2% ↑

KEY: TEU = twenty-foot equivalent unit.

NOTES: Totals include domestic and international tonnage. Total tonnage increase for 2016 is not evident due to rounding.

SOURCES: **Total and dry bulk tonnage**: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation, as of November 2019. **TEU**: American Association of Port Authorities, *Port Industry Statistics (series)*, available at www.aapa-ports.org/ as of November 2019 and Port Authorities.

The 2022 Assessment reviews the MTS in two general ways:

1. Overall assessment in the areas of: Infrastructure; Safety; Security; Environmental Stewardship; and
2. Highlight on Focus Areas: Arctic Maritime Transportation; MTS Resilience; Energy; MTS Performance Measures; and Impacts from COVID-19 Pandemic.

At present, some nationally consistent conditions and performance metrics exist for parts of the MTS (e.g., tonnage and value of cargo transported for Customs Ports, percent availability of aids to navigation (ATON), and average number of navigational accidents); however, conditions and performance metrics for the MTS as a system are lacking. This is in contrast, for example, to the Federal highways and transit systems, for which the Federal Highway Administration (FHWA) regularly produces a conditions and performance report using a multitude of specific quantitative indicators. It is the intention, in future MTS assessments, to capture a baseline of conditions and performance that complement the annual port performance report by the BTS.

[1] U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *FT920 U.S. Merchandise Trade Selected Highlights,* 2018.

[2] U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, *Final Waterborne Commerce Statistics for Calendar Year 2017.*

[3] U.S. Department of Transportation, Bureau of Transportation Statistics, https://rosap.ntl.bts.gov/view/dot/4377, June 2020, Washington, DC.
[4] U.S. Department of Commerce, U.S. Census Bureau, *National Population Projections,* 2017.
[5] David Jacoby and Daniel Hodge, *Infrastructure Investment: The Supply Chain Connection, CSCMP Supply Chain Quarterly, Quarter 4/2008.*

CHAPTER ONE: BRIEF INTRODUCTION TO THE MARINE TRANSPORTATION SYSTEM

The Marine Transportation System (MTS) of the United States encompasses a vast network of waterborne transportation along our Nation's marine coastlines, our inland river systems, and the Great Lakes. More international trade is carried via the MTS than any other mode of transportation, providing critical support to the entire U.S. economy.[1] The MTS is commonly referred to as a "system of systems" because of the many components that combine to facilitate the water and land supply chains. The MTS comprises a variety of components including: navigable waterways and channels, ports and marine terminals (liquid, dry, and break bulk as well as container), intermodal connection pathways between waterborne and land transportation systems (highways and rail lines), vessels, users (commercial, military, and recreational), infrastructure (locks and dams), and offshore continental shelf structures (oil exploration and wind energy facilities).[2]

The U.S. MTS includes:

25,000 miles of navigable channels

239 locks at 193 locations

More than 3,700 marine terminals

324 shipyards

Almost 13.1 million U.S. cruise passengers in 2018

45,000 aids to navigation

75,000 fishing vessels

1,400 designated intermodal connections

233 ferry operators providing service through 515 terminals

Components of the MTS

The MTS has six main components:

1. Navigable Waterways
2. Ports and Terminals
3. Vessels
4. Terminal – Vessel Interface
5. Information Infrastructure
6. Stakeholders, including Workforce and Communities Near Ports

NAVIGABLE WATERWAYS

There are more than 25,000 miles of navigable waterways in the United States which include the Great Lakes and St. Lawrence Seaway System; inland rivers such as the Mississippi, Illinois, Ohio, and Columbia-Snake river systems; and the Atlantic and Gulf Intracoastal waterways. Navigation on these waterways is supported by systems of physical infrastructure such as canals,

locks, dams, fixed and floating aids to navigation (ATON), channels, and harbors; and informational infrastructure such as nautical charts, weather and sea ice broadcasts, Automatic Identification System (AIS), Marine Safety Information Bulletins (MSIBs), Local Notice to Mariners (LNM), and electronic aids to navigation (eATON), among others. In addition, our Federal channels serve to transport a variety of trade goods (e.g., manufactured, mineral, agricultural, and bulk commodities) as well as passengers to, from, and within the United States. They are also used for a variety of commercial, recreational, scientific, and military purposes.

PORTS AND TERMINALS

The American Association of State Highway and Transportation Officials (AASHTO) refers to ports and terminals as the "on the ground" assets of the MTS.[3] Ports – consisting of coastal and inland river locations – may be publicly or privately owned and/or operated. Port managers may have direct operational capabilities over port and terminal operations, while others are managed in a landlord or development corporation capacity. There are also deep-water ports located beyond State boundaries that are fixed or floating manmade structures used as ports or terminals.

VESSELS

Vessels, as key components of the MTS, vary widely in size and design based on their use. Commercial vessels include oil and chemical tankers, dry bulk carriers, container ships, breakbulk ships, roll-on/roll-off ships, ships carrying goods in refrigerated containers (reefers), passenger ships, towboats and barges, ferry boats, dinner cruise vessels, fishing boats, dredges, and offshore supply boats. Non-commercial vessels include those used for recreational purposes, those engaged in solely Government service, and those with military application. Commercial vessels include tankers, dry bulk carriers, and barges carry both crude and refined oil, chemicals, grains and fertilizers, coal, ore, and other bulk products. Ferries carry vehicles, people, and some local freight, while cruise ships handle vacationers. Containerships move a huge percentage of the finished products that support our Nation's essential needs and high quality of life. There are over 11.8 million registered recreation vessels of various sizes, propelled by engine, human effort, or wind which provide enjoyment to millions of people.[4]

PORT–VESSEL INTERFACE

An important link within the MTS is the interface point between the vessel on the water and where it is docked or anchored within a harbor or at the terminal located in a port. This may be referred to as the vessel intermodal connection point. Container ships load and unload alongside a dock using shore cranes specifically designed for this purpose. Break bulk ships are designed to carry various sizes and types of liquid and dry cargo. In both instances, the work of loading/discharging is generally conducted by stevedoring companies who in turn hire longshore labor. In both loading and discharge operations, cargo or containers may be stowed on the dock,

in a transit shed for temporary holding, or may be transferred to or from a land or water-side mode of transportation, i.e. truck, rail or another vessel. For example, loading or unloading a tanker (under a well-regulated operation) is managed via hoses hooked up to the ship from the shore location.

INFORMATION INFRASTRUCTURE

Information is an essential component of the MTS. These services are often dynamic, real-time inputs relied on by mariners and other MTS users for situational awareness to ensure safe, secure, and efficient marine transit. Often interdependent, MTS information infrastructure requires a systematic approach. For example, the production of accurate nautical charting to support safe and efficient marine navigation requires accurate sea level information, hydrographic surveys, geodetic control, shoreline and channel delineation, and Aids to Navigation (ATON) data. Information infrastructure includes, but is not limited to:

- Navigational charts, including those embedded in software employed by Electronic Chart Display and Information System (ECDIS);
- Hydrographic and shoreline mapping data;
- Aids to Navigation (ATON);
- Marine weather and sea ice forecasts;
- Tide and tidal current predictions;
- Real-time and forecast oceanographic navigation information;
- Automatic Identification Systems (AIS); and
- Communications capabilities

MTS STAKEHOLDERS

FEDERAL GOVERNMENT - There are more than 25 agencies, offices, and interagency committees with specific roles, responsibilities, and interests in the MTS.[5] The Federal MTS stakeholders, such as the U.S. Coast Guard (USCG), U.S. Army Corps of Engineers (USACE), Maritime Administration (MARAD), Federal Maritime Commission, EPA, the Department of Energy (DOE), Centers for Disease Control and Prevention (CDC), and National Oceanic and Atmospheric Administration (NOAA), have various roles regarding the construction, operation, maintenance, safety, security, fuel availability and port energy, and environmental protection of the MTS, as well as research and development to enable affordability and next-generation technologies. A matrix of Federal agency roles and responsibilities in the MTS can be viewed at www.CMTS.gov.

STATE GOVERNMENT – The U.S. MTS physically touches 41 States and 5 Territories, which vary economically, socially and geographically. Some States border oceans, others border navigable rivers and waterways, and some border both. While the Federal Government has laws

and regulations covering safety, security and environmental protection, many states have similar laws and regulations covering these issues. Federal and State governments aim to coordinate and harmonize law and regulation while supporting the free flow of maritime commerce, but they may regulate under different standards.

LOCAL GOVERNMENT (CITY, COUNTY, BOROUGH, REGIONAL ASSOCIATIONS, ETC.) – At the local government level, ports may span across jurisdictions of towns, cities and counties and even up to the State level. The majority of ports in the U.S. are governed by port authorities. Some port authorities are semi-autonomous operations, generally answering to the populace through appointed commissions or boards. Others are operated by State, County, or Municipal governments. Local and regional transportation plans, issuing bonds, noise ordinances, designated industrial zones, truck routing, and issues regarding air pollution are some of the areas of jurisdiction and interest. As noted, a port may be operated by a government entity or entities or act as a landlord port or development organization. The Ports of Detroit and Pittsburgh, for example, are development authorities with no land holdings.

TRIBES AND INDIGENOUS PEOPLES – Many Tribes and indigenous communities have rich heritages deeply rooted in coastal and marine environments. Traditional homelands, territorial hunting and fishing grounds, and resources associated with these areas create a sense of place that is important in defining cultural identity. As noted by the Marine Protected Areas Federal Advisory Committee, "the Federal Government has a unique relationship with American Indians, Native Hawaiians, Native Pacific Islanders, Alaska Natives, and native peoples from U.S. territories and its protectorates based in law and supported by a shared commitment to the stewardship of land and marine resources."[6] Executive Order 13175[7] reaffirms the Federal Government's commitment to tribal sovereignty, self-determination, and self-government. The purpose of EO 13175 is to ensure that executive departments and agencies respect Tribal sovereignty as they develop policy on issues that impact Indian communities. The U.S. and Canadian St. Lawrence Seaway authorities, for example, actively engage with Tribal interests in the region.

MTS USERS - Following is a sample of the myriad of MTS users:

- Pilots: Ships entering and leaving the U.S. waters, after having been in foreign ports, are guided by a State or Federally credentialed mariner with specific expertise in the waterway being navigated.
- Seafarers: Commercial U.S.-flag boats and ships are operated by U.S. credentialed merchant mariners. Foreign-flag commercial vessels may be operated by merchant mariners who are credentialed or certified by other countries.
- Port and Terminal Operators: The representatives of a port authority, port development organization, or company that operate a port or terminal or oversee the landlord responsibilities.
- Stevedores: Companies that contract to load/discharge ships.

- Longshoremen: The dock and terminal labor hired by stevedores.
- Shippers: The parties responsible for transporting items via the MTS.
- Cargo Owners: The owners of the cargo that is moved to or from the United States or along U.S. coasts and inland waterways. Depending on operational practices, the shipper and cargo owner may be the same.
- Ship chandlers: A person or company that assists a ship by providing supplies such as food and repair equipment.
- Vessel owner/operator: The person or company that owns and/or operates a vessel or vessels in maritime transportation.
- Commercial fishing interest: Those who participate in the act of catching fish and other seafood for commercial profit.
- Offshore service industry: Industry providing support to energy extraction and development.
- Public vessels of various types and missions: Including military, law enforcement, and maritime safety and emergency response vessels.
- Recreational boaters: Those who leisurely travel by boat, or the recreational use of a boat whether powerboats, sailboats, or man-powered vessels.
- Cruise ships and passenger vessels: This includes larger ocean-going ships and relatively smaller vessels that carry passengers for hire, both domestically and internationally.

HIGHLIGHT ON LABOR

Maritime work is as old as the first ships that were put to sea thousands of years ago. On board vessels in the MTS, workers include a variety of positions from masters, mates, engineers, able-seamen, deck hands, qualified members of the engine department, to pilots and cooks. In October 2020, the Bureau of Labor Statistics reported that there were 56,700 employees in the water transportation subsector which includes deep-sea, coastal, Great Lakes, inland water transportation.[8] On land, longshore labor including signalmen, crane operators, forklift operators, and checkers, work aboard and alongside the vessels.

The industry has typically been organized by craft and there are U.S.-based unions that have worked over the past 100 years to organize labor to improve working conditions and pay. Supporting industries include shipbuilders, equipment services, repairmen, suppliers, vessel agents, truck drivers, and port authority personnel. In 2019, the wages and salary of persons working just within the water transportation North American Industry Classification System was approximately $6.1 billion.[9] In the absence of an able workforce, the MTS is helpless to operate efficiently and effectively no matter how deep our channels are dredged.

[1] U.S. Department of Transportation, Bureau of Transportation Statistics, *Transportation Statistics Annual Report,* 2018.

[2] U.S. Committee on the Marine Transportation System, *The National Strategy for the Marine Transportation System: Channeling the Maritime Advantage 2017-2022,* 2017.
[3] American Association of State Highway and Transportation Officials, *Waterborne Freight Transportation, Bottom Line Report,* 2013.
[4] Department of Homeland Security, U.S. Coast Guard, *COMDTPUB P16754.33 – Recreational Boating Statistics 2019*, *Table 36 and 37*, 2020.
[5] U.S. Committee on the Marine Transportation System, *A Compendium of Federal Programs in the MTS.*
[6] Marine Protected Areas Federal Advisory Committee, *Cultural Resources Toolkit, Tribal and Indigenous Communities*. https://marineprotectedareas.noaa.gov/toolkit/tribal-indigenous-communities.html. Accessed July 2020.
[7] EO 13175: Consultation and Coordination with Indian Tribal Governments (2000). Retrieved at: https://www.federalregister.gov/documents/2000/11/09/00-29003/consultation-and-coordination-with-indian-tribal-governments.
[8]Department of Labor, Bureau of Labor Statistics, Industries at a Glance, Water Transportation (NAICS 483), January 15, 2021, https://www.bls.gov/iag/tgs/iag483.htm. [The subsector includes captains, mates, and pilots of water vessels; general and operations managers; laborers and freight, stock, and material movers, hand; sailors and marine oilers; ship engineers.]
[9]U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts Tables, table 6.3d, available at https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey as of Jul. 31, 2020.

CHAPTER TWO: ASSESSMENT OF THE MARINE TRANSPORTATION SYSTEM

SECTION 1: MARINE TRANSPORTATION INFRASTRUCTURE

Infrastructure systems and assets, whether physical, virtual, or informational, are vital to achieve effective, reliable, and safe operation of the MTS. The physical and informational infrastructure of the MTS is developed and maintained through a unique system of Federal, State, and local government and privately funded projects. The national investment in marine transportation infrastructure, much of which was invested in the early- to mid-20th century, has reduced the cost to transport goods and contributes to the global competitiveness of American products. Infrastructure maintenance and improvements are required to positively impact the ability of the United States to continue to compete on a global scale, such as recent initiatives to modernize U.S. port facilities to handle larger vessels now employed in Asia to the U.S. Pacific Coast and Asia to U.S. Atlantic Coast trades.[1] In the Arctic, information infrastructure is critical due to hazardous conditions in the harsh and changing environment while large gaps in data, information, and investment persist.[2]

The movement of goods from one point to another requires essential infrastructure; therefore, our ability to compete in the global marketplace is underpinned by safe and reliable maritime infrastructure. Transportation and logistics costs can account for a significant share of the total cost of a product.[3] Congestion factors resulting in inefficient operation of the transportation system cost U.S. companies and citizens many billions of dollars each year.[4] Investment in U.S. infrastructure has a significant positive impact on efficient operations and the U.S. economy in general. A study by the National Surface Transportation Policy and Revenue Study Commission states that an investment in freight transportation infrastructure that reduces direct transportation costs by 10 percent will result in supply chain improvements that will help companies reduce their operating costs by 1 percent.[5]

This section addresses three critical components of MTS infrastructure:

- ***Capacity****:* The capacity of the MTS to efficiently handle the volume of domestic and international freight and domestic passengers, including through intermodal connections, over the next several decades will have a major impact on the economic success of U.S. businesses and farms.
- ***Physical Infrastructure****:* MTS infrastructure includes locks, dams, bridges, ports and terminals, channels, aids to navigation (ATON), geospatial references, and the equipment

needed to operate and maintain them. For example, landside infrastructure in a port may need modifications to accommodate larger ships.

- ***Information and Technology Infrastructure****:* The safe and efficient movement of vessels through the Nation's ports and waterways relies heavily on electronic navigation and internet-related tools including charts, shoreline mapping, electronic ATON, marine safety information, real time oceanographic and meteorological data, weather and water forecasts, and communications. Improved paperless systems enable expedited processing of cargo documentation.[6] In addition, the use of intelligent transportation systems supports land-side operations in monitoring and assisting port operations.

CAPACITY

A broad challenge facing the MTS is how to utilize existing system capacity in the most efficient manner to accommodate growing trade volumes and ship sizes, supply chain adjustments, and new or changing cargoes such as liquefied natural gas. There is substantial public and private infrastructure in place throughout the Nation's waterways and ports; however, as the volume of domestic and international cargoes grows, bottlenecks in the maritime and landside supply chain challenges the system's ability to accommodate this growth.

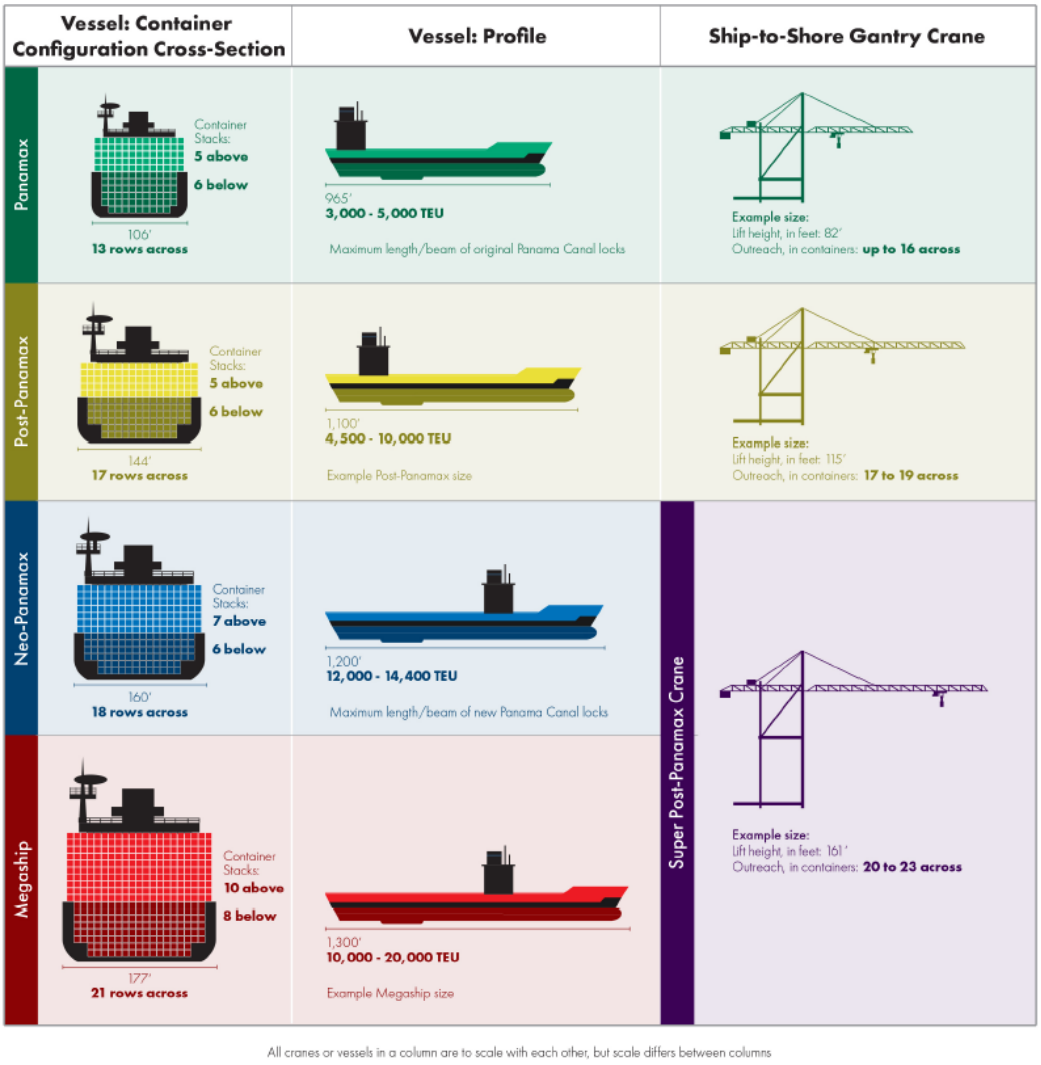
Port congestion challenges the MTS supply chain because when a ship or truck or rail car is ensnared at a port, the cargo can miss its intermodal connection in either direction, may incur demurrage charges, compromise the shipping contract, or compromise the integrity of the cargo. When a ship arrives at a port and cannot load or unload, the only choice for ships is to wait in line, putting pressure on cargo owners, shipping lines, and port management, while adding operating and inventory-holding costs. Worldwide, the average waiting time at ports has gone up. A 2012 report from National Bureau of Economic Research reports that when the ships do not unload and are in transit, they pay 0.6% to 2% of the value of the goods every day[7].

There are many and varied reasons for port disruptions. Bottlenecks can be associated with accommodating cargo surges from larger container ships, when cargo movement to or from a port is delayed due to supply chain slowdowns, and an infrastructure related disruption. According to the Federal Maritime Commission, in its 2015 report, *U.S. Container Port Congestion and Related International Supply Chain Issues*", "[i]n many ways, the elimination of congestion is today's most critical and relevant trade-related issue."[8]

An overburdened MTS increases the possibility of systematic supply-chain disruptions and delays; potentially resulting in losses to the U.S. economy and increased costs to the consumer. The Congressional Budget Office estimates that a one-week shut down of the container ports of Los Angeles and Long Beach could result in losses of $65 million to $150 million per day.[9]

With respect to U.S. ports and quality of seaport services specifically, the World Economic Forum ranked U.S. ports 10th out of 141 countries in 2019, lower than 2018 when U.S. port infrastructure was ranked 5th out of 140 countries.[10] Methodologically, capacity of a port is measured by throughput, i.e. number of containers/tons of cargo over the dock; number of vessels served, etc., but may not fully measure the ability of a port to manage cargo in tandem with the waterside components such as efficiencies in vessel transits through navigable channels and landside components such as terminals and surface transportation connectors.

The MTS is subject to the normal commercial pressures to reduce costs and increase speed of cargo handling and reliability without sacrificing safety, security or environmental protection. The use of deeper channels and real-time and forecast oceanographic and meteorological information at existing ports, on-dock rail, and off-site intermodal hubs increase capabilities, but only if associated infrastructure and operations are modified accordingly. Other factors generally must be addressed simultaneously including the accommodation of new technologies, reducing port impacts on communities, and improving impacts of port and marine activity on air and water quality. It should also be noted that there are a number of ports in the U.S. considered "niche" ports (particularly those that handle bulk and break bulk cargoes) that are meeting shipper demands that do not necessarily require 55 foot drafts. Addressing these challenges is complex because the transportation and logistics needs of the supply chain are continuously evolving.



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, *Port Performance Freight Statistics Program*, available at www.bts.gov as of September 2018.

FIGURE 1 Container Vessel Configurations.

Today's post-Panamax containerships require a berth with a depth of at least 42 feet. For those ships carrying more than 10,000 twenty-foot equivalent unit (TEU) containers, a depth of 50 feet is required.[11] While most of major U.S. container ports have now been deepened to accommodate larger ships [Table 1], a challenge within the system is to repurpose other existing infrastructure to meet current demands and be flexible to anticipate supply chain requirements.

Port or Harbor	Average Minimum Depth of Berth (feet)
Mobile Harbor, AL	52
Charleston, SC	52
Tacoma Harbor, WA	51
Los Angeles Harbor, CA	50
Long Beach Harbor, CA	50
Valdez Harbor, AK	50
Port of New York	50
Oakland Harbor, CA	50
Port of Virginia	48
Houston Ship Channel, TX	47
Savannah Harbor, GA	46
Seattle Harbor, WA	45
Charleston Harbor, SC	45
Wilmington Harbor, DE	45
Port of New Orleans, LA	45
Miami Harbor, FL	45
Baltimore Harbor and Channels, MD	44
Tampa Harbor, FL	43
Port of Wilmington, NC	42
Port Everglades Harbor, FL	42
Philadelphia Harbor, PA	42
Honolulu Harbor, HI	40
Port of Boston, MA	40
Jacksonville Harbor, FL	38
San Juan Harbor, PR	38
Gulfport Harbor, MS	36
Kahului Harbor, HI	35
Anchorage, AK	35
Camden-Gloucester, NJ	35
Palm Beach Harbor, FL	33

TABLE 1 U.S. Port and Harbor average minimum depths. SOURCE: U.S. Army Corps of Engineers, Hydrographic Surveys, as cited by the U.S. Department of Transportation, Bureau of Transportation Statistics, Port Profiles, available at https://www.bts.gov/ports as of October 2020.

As noted, the capacity and cargo handling capability of our MTS is impacted by a range of operational requirements, including the deployment of increasingly larger container ships on major ocean trade routes. The requirements associated with the handling of these larger vessels include:

- U.S. pilots are trained to maneuver and dock these larger ships;
- Having navigable 50-foot draft channels with associated navigation infrastructure, such as Vessel Traffic Service (VTS), nautical charts, and ATON;
- Having real-time and forecast weather and water information for situational awareness critical for all ship operations;
- Modification of bridges and other structures over channels to ease air draft constraints, and equipping bridges with air draft sensors to ensure safe clearance;
- Cranes capable of loading/discharging these larger ships;
    - The top 25 container ports operated a total of 534 ship-to-shore gantry cranes in 2018, of which 227 were classified as super post-panamax[7]
- Docks large and strong enough to support the larger cranes and loads;
- A sufficient number and trained workforce to handle the vast number of containers on such a ship;
- An intermodal capacity that would facilitate the efficient movement of more than 20,000 TEUs from the ship to the dock; and from there to storage or a subsequent transportation mode;
- Port intermodal capacity to facilitate the efficient movement of a comparable number of outbound TEUs from inland locations to the port and from there to the ship;
- Sufficient road, rail, and warehouse infrastructure to accommodate the surges in traffic generated by the container movements of these ships; and
- The rail and truck capacity to move them further into the Nation's supply chain.

FIGURE 2 Built in 1931 to accommodate a 151-foot clearance over the Kill Van Kull waterway between New Jersey and New York, the roadbed of the Bayonne Bridge was raised in 2019, under a joint venture, to 215 feet, to handle post-Panamax ships. [Photo credit: Bayonenju.org]

The DOT Bureau of Transportation Statistics (BTS) Port Performance Freight Statistics Program and Annual Reports provide nationally consistent performance measures on capacity and throughput for the Nation's largest tonnage, container, and dry bulk ports. The Annual Report to Congress 2019 provides port performance statistics for 2018. New to the report is the inclusion of "Port Profiles" that provide interactive capacity and throughput data, as well as port characteristics such as vessel calls by type; terminal dwell times for container, tanker, and roll-on/roll-off vessels; contextual information; and updates specific to each port.[12] The Port Profiles are available at https://www.bts.gov/ports. Readers are directed to the Annual Report to Congress, available at https://rosap.ntl.bts.gov/view/dot/43525, for more detailed information.

The annual BTS report provides several summary tables. Following is the total tonnage by cargo type through U.S. ports which shows that total tonnages grew by 7.5 percent between 2015-2018. [Table 2.]

Year	Total tonnage handled at top 25 ports (billion)	Total TEU handled at top 25 container ports (million TEU)	Total dry bulk tonnage handled at top 25 dry bulk ports (million)
2015	1.75	46.2	702
2016	1.75 ↑	47.6 ↑	684 ↓
2017	1.83 ↑	51.1 ↑	729 ↑
2018	1.88 ↑	54.0 ↑	732 ↑
Percent growth since 2015	7.5% ↑	16.8% ↑	4.2% ↑

KEY: TEU = twenty-foot equivalent unit.

NOTES: Totals include domestic and international tonnage. Total tonnage increase for 2016 is not evident due to rounding.

SOURCES: **Total and dry bulk tonnage**: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, special tabulation, as of November 2019. **TEU**: American Association of Port Authorities, *Port Industry Statistics (series)*, available at www.aapa-ports.org/ as of November 2019 and Port Authorities.

Table 2 Tonnage, container cargo, and dry bulk handled by maritime ports, 2015-2018.

The top twenty-five ports for the combined metrics of combined Tonnage, twenty-foot container equivalent units (TEUs), and dry-bulk cargo tonnage are listed in the BTS Annual Report. However, there are seven ports that are in the top 25 in all categories. These are, in alphabetical order: Baltimore; Houston; Long Beach; Mobile; New Orleans; New York/New Jersey; and Virginia. The report notes that the top 25 ports for these measures has remained consistent from 2017 to 2018, with one exception.

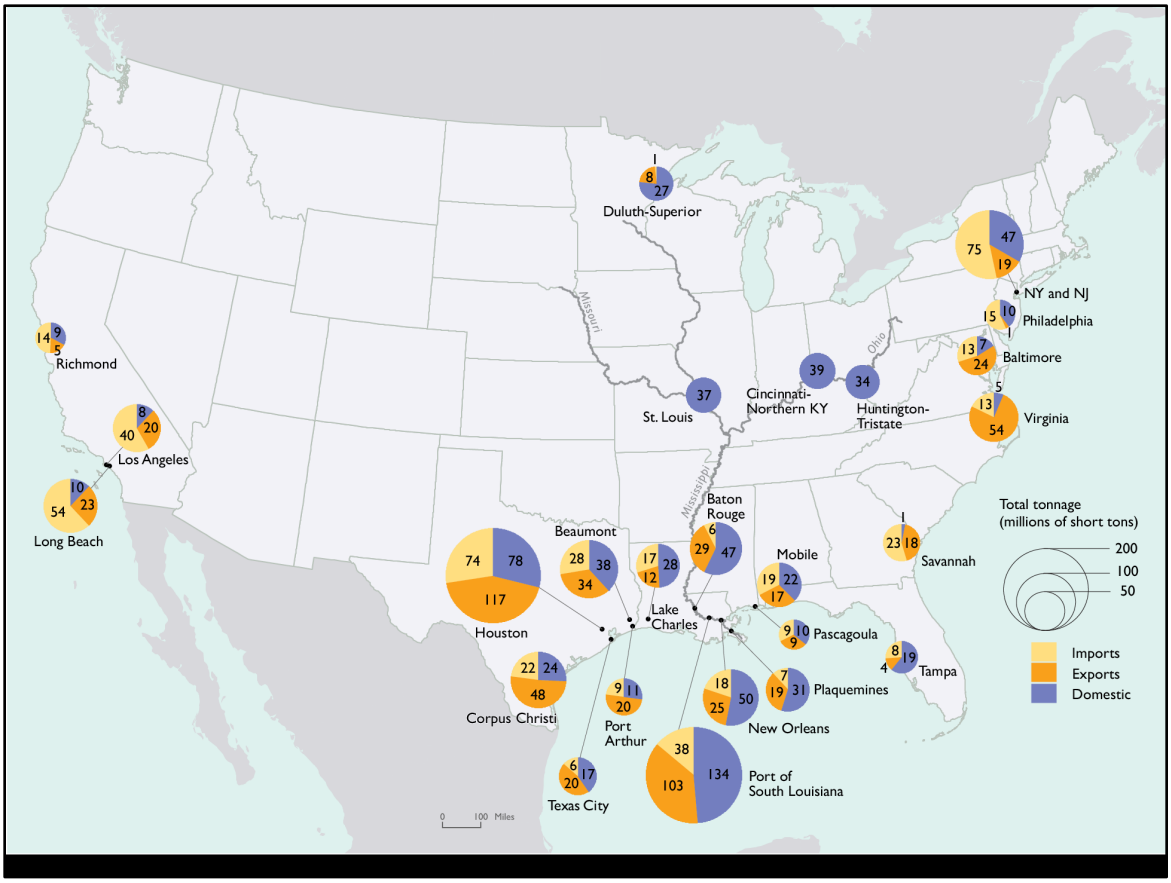


FIGURE 3 Top 25 Ports in the United States by Tonnage. Source: DOT Bureau of Transportation Statistics "Port Performance Freight Statistics for 2018: Report to Congress 2019."

The BTS annual report also states that port throughput is affected by many variables beyond its physical capacity, such as the volume of international or domestic cargo, competition and relative cost efficiency between ports, contractual arrangements with shipping lines, disruptions caused by extreme weather (e.g., hurricanes), and connections to inland origins and destinations. The capacity of a port is impacted by physical limitations such as air draft (ability of a vessel to get under bridges, etc.), size of terminals, length of berths, depth of access channels, and the amount and type of cargo handling equipment. Readers are, again, referred to the most recent port performance report to Congress from BTS for more detail about these factors.

Cargo is handled through the multimodal connection pathways from ports to rail connections, pipeline systems, and the National Highway System (NHS) infrastructure. Multimodal connections are a vital link for a port in transferring goods to and from vessels, trucks, rails, and pipelines. Several critical issues such as system management, urban/interstate congestion, availability of technology, upgrade costs, and even cyber incidents can impact goods movement. A 2018 report by the American Trucking Research Institute (ATRI) reports that the trucking industry experienced nearly 1.2 billion hours of delay on the NHS as a result of traffic congestion in 2016.[13]

The nature of intermodal freight movements has changed dramatically in the past fifty years with the invention of the container, double-stack rail cars instituted into the system, and automated and purpose-built terminals, all contributing to economic growth and the expansion of goods movement. However, the momentum is slowing. Intermodal volume, nationally, declined from 2018 to 2019 while total port volumes increased during the same period [Table 2]. The cause of the decline of intermodal volumes is unclear: market correction or result of sweeping changes brought on by precision scheduled railroading.[14]

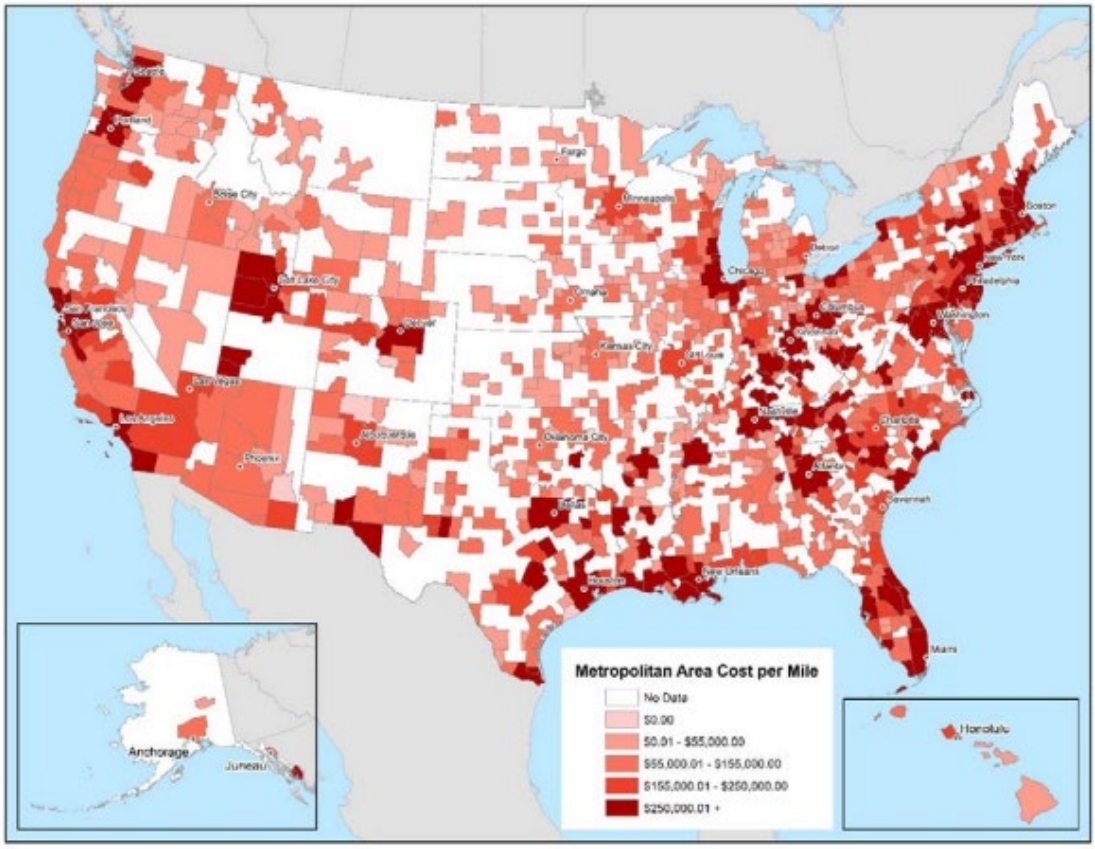


FIGURE 4 Cost of Truck Congestion by Metropolitan Area. (2016)[15]

It is not yet fully clear how efficiency of the MTS will be impacted from implementation of the IMO-2020 low-sulfur fuel regulations and the cost of diesel fuel in North America. Increased cost may have an impact on the current fuel efficiencies and cost advantages of waterborne and intermodal transportation.[16]

The USACE policy for operations and maintenance (O&M) of navigation and dredging projects, as well as their related structures and equipment, are established by Regulation No. 1130-2-250. It is required that the USACE consult with USCG during the design of channel and harbor

improvements to discuss the ATON requirements. Re-aligning ATON and updating navigation charts are an essential part of maintaining and improving the safety and efficiency of the navigation channels.

Due to varying sedimentation rates, some channels require dredging at a frequency of once or twice per year whereas other waterways require dredging at much longer intervals. For example, the Lower Mississippi River is a major supply chain artery for U.S. freight movement of more than 500 million tons of cargo in 2017.[17] It also requires much more frequent maintenance dredging. In an effort to maintain the authorized channel dimensions on the Mississippi River Ship Channel (MRSC) during the "Great Flood of 2019", the USACE dredged 87 million cubic yards (mcy) of material from the Ship Channel – well above the 51 mcy average. A record was also set at that time for mcy of beneficial use of the dredge material. The USACE New Orleans District utilized 25.6 mcy of dredged sediment creating approximately 2,048 acres of wetlands below Venice, Louisiana, as a way to preserve the environmentally sensitive Plaquemines-Balize delta.[18]

Without the ability to dispose of dredge material, the capacity of navigation channels and the MTS cannot be maintained. There are basically three ways to dispose of dredge material: place for beneficial use; open water disposal; and deposit into a confined disposal facility (CDF). A CDF is a diked impoundment designed to contain dredged sediments and associated contaminants. They may be constructed on land, adjacent to the shoreline, and in the water (island CDF). Open water disposal is often the least expensive alternative but is often the least environmentally acceptable. Despite the increased application of dredge material for beneficial use, an overall shortage of CDF is a serious challenge to maintaining the integrity and capacity of Federal navigation channels. Dredge material CDFs are a major capital and operating investment for the USACE and need to be managed to maximize their useful life.[19] Many CDFs are nearing or exceeding design capacity. Acquisition of land for a new CDF is difficult because much of the land around a waterfront is already in use, while underdeveloped areas may be more ecologically sensitive. In any case, the cost to establish a new CDF has increased exponentially over the past 20 years while fewer ports and local governments are capable of sponsoring a new one.[20]

It should be noted that the use of available channel depth, whether it is considered to be dredged to an adequate depth or not, can be optimized by having accurate real-time water level information available so that vessels can take maximum advantage of actual water levels. Water levels can fluctuate significantly due to not just normal tidal cycles but also meteorological conditions, freshwater runoff, and other factors. Combining this information with channel depths from hydrographic surveys enables vessels to make full use of the available channel depth to maximize cargo load.

The availability of trained and available mariners, longshoremen, and other personnel working within the MTS is an important capacity consideration. Concern has been expressed that the average age of the MTS workforce is above the national workforce average age. The U.S. Bureau of Labor Statistics summarizes household data annual averages which includes numbers and ages of workers in specific professions. While the numbers do not fully calculate the breadth and scope of all maritime workers, the following information was reported in January 2020 from which to assess some maritime worker age averages:[21]

INDUSTRY	AVERAGE AGE (YRS.)
Ship and Boat Building	42.9
Water Transportation (undefined further)	45.4
All Unions	50.7

TABLE 2: Average age of workers in selected sectors.

As of 2013, the State of Washington reported that the average age of its maritime workforce was upwards of 54 years old.[22] While the nation's seven maritime academies have no difficulty in attracting student applications and graduating credentialed merchant mariners, for example, it is generally challenging to recruit and retain 18-24 year-olds as merchant mariners nationwide. In 2001, MARAD and USCG recognized a shortage of mariners and hosted a conference called, "Maritime Careers Creating an Action Plan for Recruiting and Retaining American Mariners." Included was a subject related to public education and awareness of the maritime industry. In 2008, the Ship Operators Cooperative Program (SOCP) sponsored a two-day event titled "Maritime and Intermodal Education for Primary and Secondary Schools in America - On Board to a Future Career." An outgrowth of these efforts is the development of maritime schools, from grade school to grade twelve. There are now 65 primary and secondary schools in the United States with maritime and/or marine science/technology programs.[23]

MARAD estimates that the U.S. deep-draft mariner pool needs an additional 1800 credentialed mariners[24] to sustain a prolonged sealift mobilization beyond the first four to six months. MARAD has well-documented the challenges of ensuring there is a cadre of available credentialed mariners in time of national security need. While there are thousands of foreign-flag vessels operating internationally, the limited number of vessels in the U.S. flag, non-Jones Act international trading fleet limits career advancement opportunities for the highly-trained U.S. merchant mariners credentialed to work on the bigger oceangoing ships. In addition, the high cost associated with maintaining the internationally accepted mariner credentials adds to their skepticism toward a prolonged maritime career and promotes seeking comparable career openings where their skills are easily transferable. The COVID-19 pandemic has added another

layer of uncertainty in the minds of the deep-sea mariner community which may further worsen the nation's ability to maintain a much-needed cadre of sealift qualified mariners.

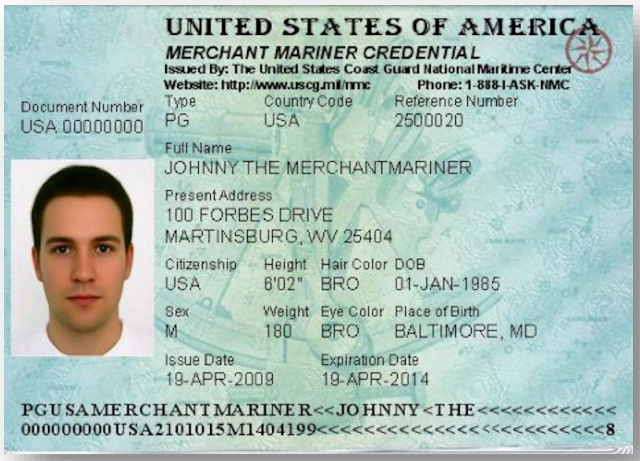


FIGURE 6: Example of U.S. Merchant Mariner Credential as issued by the USCG National Maritime Center.

Statistics compiled by MARAD, using 2015 U.S. Census foreign trade data, indicate that just 1.5 percent of U.S. waterborne imports and exports by tonnage move on oceangoing commercial vessels registered under the flag of the United States. The U.S.-flag fleet carried close to 4 percent of our ocean freight by tonnage from 1977 until 1993, down to 2 percent as of 2003.

The U.S. domestic water transportation market is served by approximately 41,000 vessels owned, operated, and built by U.S. citizens. The great majority of vessels in the domestic trades consist of tugs and barges, work and supply vessels used in the offshore oil industry, and specialty vessels such as pilot boats, dredge vessels, and others. As of August 2019, only 99 of the 41,000 vessels operating in the U.S. domestic market are large cargo-carrying merchant-type vessels capable of self-propelled operation in the deep oceans (comparable to vessels operating in international trades). These 99 larger vessels consist of 57 tankers, 24 containerships, 9 general cargo/multipurpose ships, 7 Ro-Ros, and 2 dry bulk ships. An assessment of the U.S. flag fleet is more thoroughly addressed in the MARAD 2020 publication, "Goals and Objectives for a Stronger Maritime Nation: A Report to Congress."
https://www.maritime.dot.gov/sites/marad.dot.gov/files/2020-07/Final_2_25_Stronger%20Maritime%20Nation%20Report_.pdf

To build a cohort of credentialed mariners, the CMTS established a Military to Mariner Task Force in 2014, co-led by MARAD and Military Sealift Command. The interagency Task Force, which includes USCG, USACE, U.S. Navy, Transportation Security Administration (TSA), Veteran's Administration (now the U.S. Department of Veterans Affairs), and DOD Defense Force Education, and Training, supports sea service agency efforts to promote the transition of military sea service experience to merchant mariner credentials (MMC). While it is not expected

that Veterans can fill the needed deep-sea merchant mariner requirements, it also promotes Veterans for well-paying employment in the maritime industry. The work of the Task Force included development of Executive Order 13860, *Supporting the Transition of Active Duty Service Members and Military Veterans into the Merchant Marine*, signed by the President in March 2019. In December 2019, Congress authorized the language in statute. Since 2014 and subsequent to the EO and statute, a significant number of activities have been implemented by sea service agencies to support the transition of active duty sea service personnel to credentialed merchant mariner:

- Graduates of the U.S. Coast Guard Academy graduate with a 100-ton merchant mariner license;
- The Services have considerably increased the number of training courses that have been submitted to USCG or are approved for merchant mariner credentials, and have continued to maintain course approvals as the courses change, are updated, or expire;
- Eligible Service members with sea service experience can have fees related to the MMC paid for by their respective Services and, in certain cases have their Transportation Worker Identification Credential (TWIC®) paid for, through the Voluntary Credentialing Programs;
- Navy and USCG have established "Credentialing Opportunities On-Line" (COOL) sites for active duty and Veterans to verify applicability of their experience to merchant mariner credentials;
- In June 2019, the Commandant of the USCG signed a decision memorandum that recommended initiating a regulatory change to allow for waiving credentialing fees for Active Duty military members and members of the Uniformed Services;
- In April 2020, Navy enhanced COOL with Milgears which analyzes your unique history—your military duties and training, civilian education and credentialing, and apprenticeships—to provide customized results. https://www.cool.navy.mil/usn/resources_and_links/milgears.htm
- Customized outputs of Milgears includes:
    - Civilian occupations that may be attainable or nearly attainable.
    - Mariner Wizard which calculates sea time and displays credentials that may be attainable or nearly attainable.
- A summary of the work by the services in support of M2M may be found at https://www.cmts.gov/downloads/report_otmp_m2m_2020.pdf

The Marine Highway Program, managed by MARAD, seeks to expand use of U.S. waterways which can help reduce landside congestion as well as highway system wear and tear by taking cargo off busy roadways by incentivizing shippers to use these alternative byways. The program includes 25 "Marine Highway routes" that serve as extensions of the surface transportation system. Each all-water route is designated by the Secretary of Transportation and offers relief to landside corridors suffering from traffic congestion, excessive air emissions, or other environmental challenges. Once designated, representatives from a route can apply for Marine Highway Program funds.

CHALLENGES

- The broad and continuing need to use existing port system capacity in the most efficient manner to accommodate larger ships, growing cargo volumes, and shifting freight movement patterns.
- Instituting regional or corridor planning and investments to meet national requirements without picking winners and losers.
- The requirement to dispose of dredge material in an environmentally responsible manner, including beneficial uses, under dwindling capacity in contained disposal facilities.
- The need to ensure sea time to maintain and grow the cadre of U.S. merchant mariners, particularly to support military sealift requirements.
- Recruiting and retaining a younger workforce to the MTS requires awareness, education, opportunities, and internal support.
- Local jurisdictions are responsible for maintaining and managing designated multimodal connectors; however, these first and last mile connectors may not receive priority at the local planning level due to competing needs such as schools, hospitals and public transport. This leads to underinvestment in connectors, resulting in relatively poorer physical condition versus other infrastructure. The FHWA's 2000 *NHS Intermodal Freight Connectors: Report to Congress* found that connectors to ports had twice the percent of mileage with pavement deficiencies when compared to non-Interstate NHS routes.
- Activities in and around freight terminals (e.g., port and railroad terminals) and corridors (e.g., freeways with many trucks) can generate local high pollution areas. Innovative solutions are needed to mitigate these impacts in a way that does not put shippers at a competitive disadvantage.
- Inflows and out-flows of cargo are, in some cases, hindered by terminal and yard inefficiencies and challenges to the use of information technology (IT) and intelligent transportation systems (ITS) to expedite the transfer and movement of cargo.
- A shortage of trucks due to equipment shortages.
- A shortage of truck drivers due to working conditions, hours of service requirements and terminal truck waiting times for port entry.
- Chassis shortages due to poor equipment condition and staging issues.
- Balancing the needs of construction and maintenance activities with ongoing cargo movement.
- Communications and exchange of data and information across modes and the need for and challenges of acquiring MTS-related proprietary data related to congestion.

PHYSICAL INFRASTRUCTURE

"Physical infrastructure refers to the basic physical structures required for an economy to function and survive, such as transportation networks, a power grid and sewerage and waste disposal systems."[25] As is the case in any country's economy, the infrastructure of the United States is a key component of its economic competitiveness. U.S. infrastructure has enormous value, both directly as a capital asset and indirectly to support human well-being and a productive economy. Total public spending on transportation and water infrastructure exceeds $300 billion annually; roughly 25 percent of that total is spent at the Federal level and accounts for three percent of total Federal spending. Recent analyses point to large gaps between existing capital and maintenance spending and the level of expenditure necessary to maintain current levels of services.[26]

Physical infrastructure of the MTS includes locks and dams, piers, wharves, terminals, in-water buoys, the fences, the rails, and even movable equipment such as cranes and fork lifts.

In its 2019 report, the World Economic Forum ranked the U.S. second among 141 countries overall in the Global Competitiveness Index (GCI), combining 103 indicators organized into 12 pillars: Institutions; Infrastructure; ICT adoption; Macroeconomic stability; Health; Skills; Product market; Labor Market; Financial system; Market size; Business dynamism; and Innovation capability.[27] Countries receive a progress score on a 0-to-100 scale, where 100 represents the "frontier," an ideal state where an issue ceases to be a constraint to productivity growth. With regard to infrastructure in the U.S., the GCI ranked the U.S. thirteenth overall, down from ninth in 2018.[28]

The Nation's primary inland waterways system–the upper and lower Mississippi River, Arkansas River, Illinois and Ohio Rivers, Tennessee River, and the Gulf Intracoastal Waterway–moves grain from America's heartland to New Orleans for export, transporting about 60 percent of U.S. corn and soybean exports with a combined value of $17.2 billion.[29] Even though age does not always reflect operational capabilities, the USACE has noted that more than half of the 239 lock chambers at 192 sites they operate on the inland waterways, are older than 50 years and many are more than 100 years old.[30] In 2017, the average age of all locks was 61 years old.[31] The American Society of Civil Engineers (ASCE) reported in their 2017 Infrastructure Report Card that 15,498 dams out of 90,580 were identified as a high-hazard potential.[32] As a result, managing the operation of these locks and dams is more challenging because of the risks associated with infrastructure that must survive water and severe weather events while maintaining consistent functionality beyond the planned life cycle.

The ASCE issued grades for a broad range of national infrastructure including dams, inland waterways, ports, rail and bridges. The grades for bridges and rail are not just for maritime related connections. However, they are a critical connection for the U.S. supply chain that may connect with the MTS. Infrastructure grades were calculated for capacity, condition, funding, future need, operation and maintenance, public safety, resilience, and innovation.[33]

TABLE 3 ASCE "Grades" for MTS-related Physical Infrastructure in the U.S. (2017)

INFRASTRUCTURE CATEGORY	ASCE GRADE
DAMS	D
INLAND WATERWAYS	D
PORTS	C+
RAIL	B
BRIDGES	C+

The USACE launched the Inland Marine Transportation System (IMTS) Implementation Plan and Execution Strategy in Fiscal Year 2009. An IMTS Board of Directors and Working Group (WG) were established to implement the 115 improvement ideas that came from the USACE Navigation workforce and industry during a study conducted 2006-2008. The IMTS WG progress report of January 2018 reported that significant progress was made on improving the IMTS in the areas of: Human Capital; Operations; and System Reliability.[34] A sampling of enhancements include:

- Lock Operator's Training & Certification - Developed standardized, nationwide training and certification for new lock operators.
- Enhance hiring process for lock operators - Reduced time to backfill positions by standardizing hiring processes and planning for expected turnover.
- Plant Replacement & Improvement Program (PRIP) user guide - Drafted recommended improvements to plant asset replacement to expedite acquisition and reduce costs.
- Tow Boat Crew Change Policy - Established standardized methods for accomplishing tow boat crew changes at lock sites (this has been overcome by security issues).
- National Maintenance Standards, both national & regional & Interlock Standards - Established and implemented a national standard maintenance management system through a National Maintenance Standard, supplemented by MSC Maintenance Standards and aligned with USACE's national Asset Management Program.
- IMTS alignment with Asset Management - Asset Management is an important addition to a smart long-term planning strategy for O&M to extend the useful life of the infrastructure in an environment of constrained funding and the IMTS Implementation Plan is part of that long-term strategy.

FIGURE 7 July 27, 2020, the 101st Airborne Division, U.S. Army transports equipment from Fort Campbell to Fort Polk via barge for a Joint Readiness Training Center rotation. Though it took a few days longer than transporting via rail, the inland move saved $3 million per roundtrip. [https://www.facebook.com/nashvillecorps/videos/290960665449855]

As part of its management of the MTS, the USCG monitors and ensures that approximately 20,000 bridges crossing navigable waters of the United States are not unreasonable obstructions to navigation and expedites the review of bridge permit applications to modify or replace aging infrastructure on the waterway. The USCG does not currently keep condition statistics on those bridges but is responsible for addressing unreasonable delays to bridge openings which constitute the majority of drawbridge operation cases received at the USCG Hearing Office.[35] In particular, USCG notes that trains are usually controlled by the block method where the track is divided into blocks or segments of a mile or more in length. When a train is in a block with a drawbridge, the draw may not be able to open until the train has passed out of the block and the yardmaster, or other manager, has "unlocked" the drawbridge controls.[36] One surmises, then, that inoperable bridges are not the most common cause of railroad-associated delays.

U.S. port administrations advance infrastructure investment through various sources. In July 2020, for example, the American Association of Port Authorities (AAPA) reported the Port of Galveston, Texas had been awarded a $3.75 million State grant for a new internal roadway to improve port access and traffic flow between 14th and 20th streets, that MARAD released a draft study on environmental impacts of the Pier B On-Dock Rail Support Facility, Port of Long Beach California project, and that port officials initiated the process for a Draft Environmental Impact Study, to make the project eligible for Federal grant funding. In addition, AAPA noted that the Port of Pascagoula is set to receive $6.6 million in Gulf Coast Restoration Funds that will be used to complete the North Rail Connector, providing enhanced rail service in Jackson County and into the port.[37]

CHALLENGES

- Infrastructure faces increasing risks due to age and increased usage. Today's volume of trade and size and design of vessels was not anticipated 50 years ago when much of our transportation infrastructure was designed.

- There is currently no formal system-wide strategy for prioritizing MTS investments.
- New projects are subject to complex regulations that did not exist for previous construction. For example, innovative maintenance operations such as using dredged materials to build protective wetlands often face constraints that make implementation more difficult.

INFORMATION AND TECHNOLOGY INFRASTRUCTURE

Advances in marine information technology over the last few decades have been substantial and rapid; including development of Automatic Identification Systems (AIS), electronic charts and display systems, global positioning, in-water observations, autonomous systems, and communications to support safe and efficient navigation. Accurate real-time information and assistance applications to mariners directly supports MTS capacity by making it more efficient, safe, and secure as larger vessels enter congested waterways, constrained spaces, dynamic operating environments, and the need to respond quickly, including in extreme weather events. Information technology can mitigate some of the effects of under-investment in physical infrastructure or lack of additional space; as well as the effects of limited capacity by facilitating more efficient use of existing infrastructure. There has been a significant increase in not just the volume, but the types of real time and forecast oceanographic data available. The NOAA Physical Oceanographic Real Time System® (PORTS), a public private partnership, has added hundreds of water level, current, air draft, meteorological, and other sensors to major seaports around the nation. The 35th PORTS was established in 2020, providing real time data that supports safe and efficient vessel transits. New sensors such as air gap (bridge clearance), visibility for fog, and high frequency radar for surface currents have expanded the type of information available, providing a more complete picture of the environmental conditions needed to make sound decisions. Studies have documented the ability of PORTS to significantly reduce overall accident rates (33%), particularly groundings (59%) when a PORTS has been established.[38] Historic data, such as from AIS observations, can support planning and decision-making.

The Maritime Safety Committee of International Maritime Organization (IMO) identified information technology as affecting the safety and efficiency of navigation and adopted a strategy for the development and implementation of e-Navigation (eNav).[39] eNavigation is an overarching term that describes the collection of systems that ideally work in harmony to provide real-time information to mariners. In response to the IMO Strategy, the CMTS Future of Navigation Committee developed the "eNavigation Strategic Action Plan" in 2012. An update to the eNavigation Strategy is expected by January 2021. While the underlying principles for e-Navigation in the U.S. have remained constant since 2012, there have been technical advances and better understanding of the overall e-Navigation architecture that require adjustments to the way forward and clarification of U.S. e-Navigation implementation policy.

The goal remains to develop a framework of components that, as they are incorporated into navigation systems, will foster emergence of a more integrated marine navigation information environment. Nationally, there are five agencies supporting navigation technology and information systems. These are the USACE, USCG, NOAA, Great Lakes Saint Lawrence Seaway Development Corporation (GLSLSDC), and the National Geospatial Intelligence Agency (NGA).

A core element of successful eNav implementation is partnering across the spectrum of stakeholders. In April 2021, the CMTS Future of Navigation Integrated Action team updated the 2012 eNavigation Strategy. [https://www.cmts.gov/assets/uploads/documents/CMTS_USNavigation2021_SAP_FINAL.pdf] Though it is too soon to report on the recommendations from the U.S. Navigation Information Strategic Action Plan 2021-2026, in the 2012 Strategy, the Federal eNav partners committed to adhere to the following principles and for which there has been great progress:

TABLE 4 Summary of Recommendations from the eNavigation Strategic Action Plan 2012

eNavigation Principle	2020 Status
Focus on meeting users' requirements. Develop a collaborative partnership with the MTS community	Through collaborative engagement, agencies have expanded IT applications including open source software, cloud computing and mobile devices. For example, NOAA charts are readily available online for free and accessible through a recreational boater's mobile device. USACE developed an inland "Lock Operations Management Application" to more efficiently operate locks and acquire better information from vessel operators. USACE also provides inland charts[40].
Make best use of existing systems and data.	Agencies are expanding access, use and exchange of existing AIS-derived information. For example, USCG now provides timely AIS data to the public via MarineCadastre.gov. NOAA's Precision Marine Navigation program was initiated to seamlessly integrate high-resolution bathymetry, high accuracy positioning and shoreline data with forecast data—such as water levels, currents, salinity, temperature, waves, and weather forecasts—to provide

	data in a format easily accessed and integrated into maritime portable pilot units or decision support tools. As a result, mariners will be better equipped to make critical navigation decisions.
Review and implement low cost/no cost systems wherever possible but not at the expense of navigation safety.	Where possible, agencies are maximizing employment of existing information technology architectures. For example, USCG is expanding mobile and web access to frequently updated information products previously only available through weekly publications.
Encourage and support regular and frequent communications. Be thoroughly transparent in decision-making activities.	Through bi-lateral agreements and through the CMTS, agencies have expanded interagency collaboration to support the MTS. For example, in June 2020, USCG signed an MOU with NOAA, Hawaii DOT, and USACE regarding maritime emergency harbor assessments within Federal waterways in Hawaii.
Align with other national strategies that affect marine transportation.	The work of the CMTS eNavigation Future of Navigation team is aligned with the 2017 CMTS *National Strategy on the MTS: Channeling the Maritime Advantage*.
Align with international standards wherever possible.	U.S. Federal navigation agencies and industries continue to play key roles, including the International Association of Lighthouse Authorities, International Maritime Organization, International Hydrographic Organization, and the Radio Technical Commission for Maritime Services. NOAA developed a prototype Precision Marine Navigation Dissemination system deployed on a public cloud to ingest, process, and disseminate selected NOAA marine navigation data via International Hydrographic Organization (IHO) S-100 framework compliant datasets.

Automation and autonomous technologies have also advanced to vessels, dock operations, and research uses. Navigation assisted (semi-autonomous) applications support the mariner in the operation of a vessel. NOAA uses autonomous underwater vehicles (AUV) and autonomous surface vehicles (ASV) to conduct hydrographic surveys in areas that may be too volatile or remote for traditional survey vessels; while USACE uses AUVs for underwater inspection purposes, as well as ASVs for other purposes. In addition, NOAA and other agencies leverage autonomous vessels and automated remote sensing technologies for collecting weather data, and other environmental data critical to safe navigation.

While the use of fully autonomous or unmanned vessels has been tested in other countries for limited uses, there are no autonomous vessels being operated in the U.S. commercial maritime marketplace. Rolls-Royce and Finnish state-owned ferry operator Finferries, to name just one of many initiatives, successfully demonstrated the world's first fully autonomous ferry in the archipelago south of the city of Turku, Finland.[41] IMO has commenced work to address how Maritime Autonomous Surface Ships (MASS) could operate safely, securely and in an environmentally sound manner. USCG is participating in those discussions from which it may eventually promulgate U.S. regulations for MASS in U.S. waters. In August 2020, USCG issued a Request for Information seeking to identify any regulatory or other barriers that might hinder the development or deployment of commercial autonomous vessels in the U.S.

The world's first automated terminal was opened in Rotterdam in 1993.[42] Automated port applications in North America are restricted to yard operations, rather than ship to shore cranes. There is a recent surge by West Coast ports to develop highly-automated terminal operations. East Coast ports also currently using some form of automation or planning for future expansion. However, the challenge is to implement practical automated technologies to improve productivity that also generate new valuable, high-paying jobs, in part by facilitating greater throughput.

In summary, navigation and MTS operations technology capabilities – governmental and non-governmental - are expanding rapidly. Federal navigation services have improved immensely to support navigation safety in U.S. waters. Vessel and port-related technologies are evolving with growing investment.

CHALLENGES

- Develop, define and provide clarity of an effective framework that can foster, facilitate and manage all these evolving and disparate technologies, resulting in an organized and productive environment for the development and operation of navigation technology and data sets.
- Define a structure for organized development of new and use of existing standards, services, and data supporting eNav, based on the IHO S-100 framework.

- Identify authoritative data sources and focus on efforts to improve access to them and establish stewardship policies and procedures. Specifically, an authoritative vessel database is needed.
- More fully using data sharing, processing and dissemination systems under security-related IT firewalls – even between Federal agencies – and between government and non-government systems.
- Electronic data interchange standards for exchanging business-related and/or cross-modal information have not been adopted in all applicable areas of the maritime industry, particularly for Federal reporting requirements for the inland waterway industry.
- Information security standards and procedures, while necessary, can interfere with efficient exchange of required information in a realm where business interests are rightfully concerned that their proprietary information is protected.
- The MTS information infrastructure depends on the continued acquisition and delivery of hydrographic survey and mapping data, physical oceanographic observations, and reports of problems with ATON, etc. for updates to navigation products and adequate situational awareness for mariners, ports and others operating in the MTS.
- Implementing practical automated technologies while mitigating the net impact on wages and employment.

AREAS FOR MTS INFRASTRUCTURE POLICY CONSIDERATIONS

CAPACITY

- Greater collaboration and analysis among all levels of government and modal operators to identify where it is feasible to shift cargo and passenger transport from over-utilized modes to under-utilized modes (i.e. from highways to waterborne transport).
- Use of interdepartmental expertise to build upon respective flow-through modeling and operations assessments such as the USACE "Channel Portfolio Tool (CPT)," the Bureau of Ocean and Energy Management (BOEM) and NOAA multipurpose marine.cadastre.gov initiative, and the DOT Freight Analysis Framework.
- Support for enhanced communications between Federal maritime data collectors that foster efficient use of capacity to understand and fill gaps in data that are not presently being collected or tracked.
- Promote the use of freight transportation modes with high volume capability or less congested locations to enable staging, sorting, and distribution activities which would otherwise be conducted at the port.
- Create incentives for the local regulatory and transportation planning bodies to optimize freight movement between major multimodal connectors. Local rules on delivery times, evening and weekend loading and parking restrictions add complexity to the supply chain and have a negative impact on attempts to mitigate the impact of port operations. For example, the ports of Los Angeles and Long Beach development of the PierPASS

program, which established off-peak hours at both the ports of Los Angeles and Long Beach, required changes in how and when the cargo was delivered to local storage and warehouse facilities in any number of local jurisdictions.

PHYSICAL INFRASTRUCTURE

- Provide interagency support for MTS application of the DOT National Freight Strategy to more effectively use appropriate resources.
- Consider the holistic review of infrastructure-related recommendations made by over thirty Federal MTS-related Federal Advisory Committees.
- Improve the usability of AIS-derived information products by establishing links to external data sources.
- Utilize investments in information technology and infrastructure to minimize the need for more costly and disruptive physical infrastructure projects.
- Initiate a methodology to support investment decisions with plausible, accepted performance metrics that demonstrate economic, transportation, and environmental benefits.

INFORMATION AND TECHNOLOGY INFRASTRUCTURE

- Develop policies and encourage strategic investments that will facilitate the most efficient multimodal distribution of freight across the existing system through increased use of information technology.
- Support and participate in the development and implementation of data standards both nationally and internationally.
- Accelerate development of enhanced navigation safety technology such as implementing a nationwide AIS program, continued growth of PORTS® and other environmental information, and its transmission via AIS or other mechanisms and integration of multiple Federal "Notice to Mariners" by addressing interoperability and transmission hurdles.
- Share navigation technology expertise and capabilities with land-side application projects and connect and integrate technologies.
- Expand Federal Government access to improved data on port cargo flows, waterway usage, and other performance criteria to identify opportunities for making and leveraging strategic investments in both hard and soft infrastructure.
- Improve cross-modal freight movement investment by combining the Freight Analysis Framework with data from other transportation modes to identify key interchange and choke points.
- Better define and articulate the value proposition of open and easy access to AIS data across the Federal Government and public stakeholders.
- Expand options for user access to AIS data by leveraging the Federally-managed MarineCadastre.gov as a platform for enhanced accessibility.

- Identify geographic and temporal coverage gaps in U.S. AIS data and develop plans to fill them.

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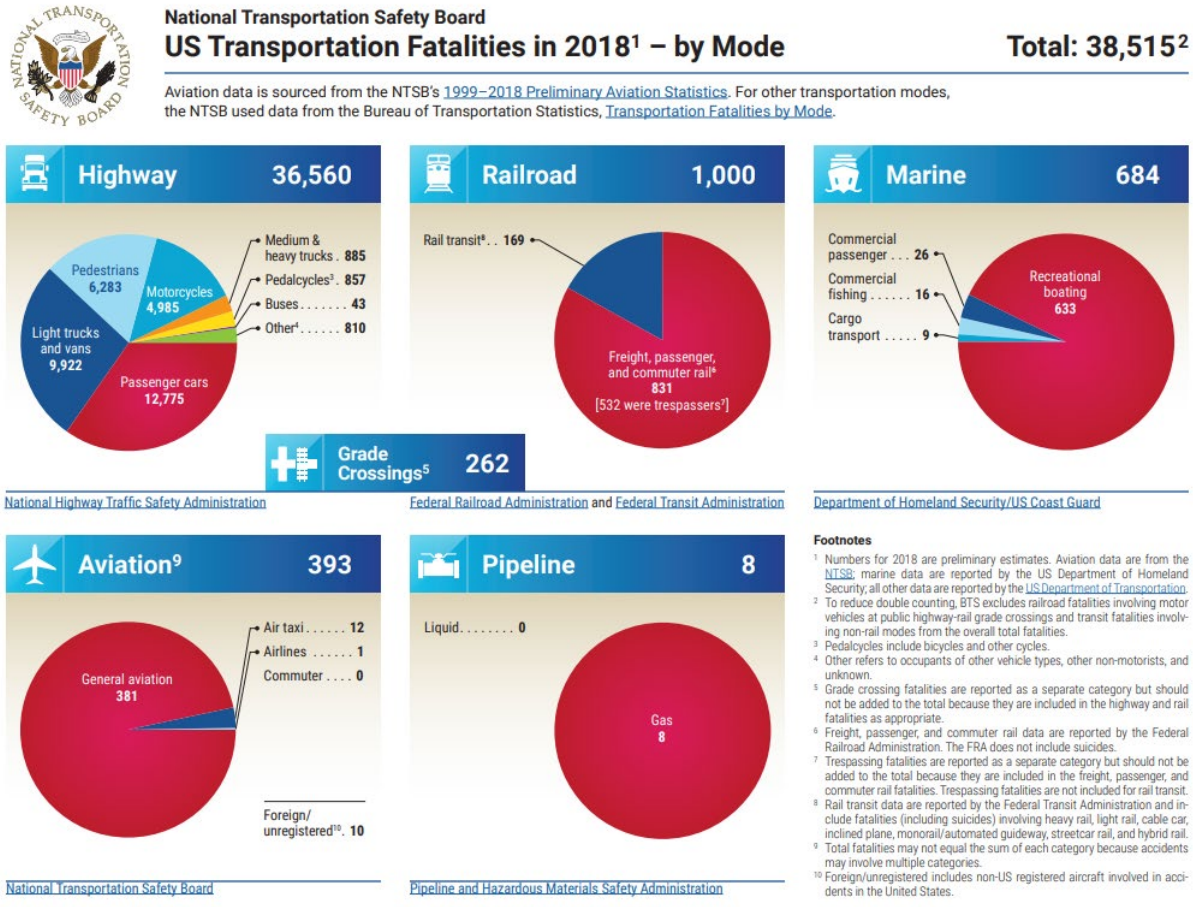
SECTION 2: MARINE TRANSPORTATION SYSTEM SAFETY

Marine transportation is one of the safest modes of transportation. While the USCG has the primary maritime safety responsibility in the Federal Government, other agencies have a role in MTS-related prevention, response, and investigations including: the National Transportation Safety Board (NTSB), NOAA, the Bureau of Safety and Environmental Enforcement (BSEE) within the Department of Interior (DOI), and Occupational Safety and Health Administration (OSHA) within the Department of Labor (DOL).

FIGURE 8: U.S. Transportation Fatalities in 2018.



Between 2000 and 2009, passenger fatalities per billion passenger miles traveled by ferryboat riders were roughly half that of drivers or passengers in cars or light trucks. Further, workers in the water transportation sector as a whole had a fatality rate lower than truck, taxi, and limousine drivers[1]. In 2018, there were 684 fatalities attributed to the maritime mode compared to 36,560

for highways and 1000 for rail. The majority of the marine fatalities are attributable to recreational boating with only 9 attributable to cargo transport and 26 attributable to commercial passengers.

The USCG is responsible for inspecting over 20,000 commercial vessels and 8,600 waterfront facilities annually. In addition, the USCG completes nearly 6,000 commercial fishing exams and screens over 10,000 foreign-flagged vessels from 84 different flag states that make over 83,000 U.S. port calls every year. Annually, it responds to 9,000 pollution incidents and carries out over 3,500 investigations into reportable marine casualties, including 45 major marine casualty investigations. Approximately 25,000 volunteer Coast Guard Auxiliarists and the USCG's boating safety program help ensure the safe operation of 12 million registered recreational vessels every year.

The USCG issues more than 125,000 merchant mariner credentials, endorsements, and medical certificates to the Nation's 200,000 active U.S. mariners and documents nearly 230,000 vessels annually.

The NTSB also may perform maritime accident analysis that provides the USCG and other organizations with recommendations to prevent similar incidents. In addition, BSEE provides post-accident analysis for offshore oil and gas related accidents on the Outer Continental Shelf (OCS) and with actionable recommendations to prevent similar accidents.

The USCG's National Recreational Boating Safety Coordinator also works to minimize loss of life, personal injury, property damage, and environmental harm associated with the movements of more than 20 million recreational boats. The program involves public education and outreach efforts; regulation and compliance enforcement of boat construction standards concerning flotation, electrical and fuel components, and capacity allowances; approval of boating safety equipment; and regulation and compliance enforcement of boating activity, vessel numbering, casualty investigation and reporting and safety equipment carriage requirements. The all-volunteer USCG Auxiliary plays a central role in related public education, outreach, and voluntary vessel safety check efforts.

Safety of the MTS is presented in the following areas:

- ***Regulations and Standards.*** The USCG, NOAA, USACE, BSEE, and OSHA publish regulations for ship construction, manning, and ship and maritime facility pollution prevention, security, and operations to mitigate risk and promote MTS stability and resiliency. The IMO develops conventions and codes for ocean-going ships and certain maritime facilities. Federal regulatory agencies and the IMO rely on partnerships with industry standards development organizations to create voluntary consensus standards that augment regulations and international treaties and codes.

- ***Navigation Safety:*** Federal agencies promote navigation safety through infrastructure maintenance and improvement including dredging, ATON, nautical charts, meteorological, and other marine safety information.
- ***Investigations:*** Federal agencies (USCG and NTSB) conduct investigations after MTS accidents to determine causal factors to prevent recurrence as well as investigate violations of U.S. marine safety laws and regulations. These actions are for the purpose of deterring non-compliance and assessing appropriate criminal, civil, and administrative enforcement actions with the aim to improve navigation safety.
- ***Search and Rescue:*** The USCG is the lead Federal agency responsible for conducting search and rescue missions on the high seas and on waters subject to the jurisdiction of the United States. NOAA administers the Search and Rescue Satellite Aided Tracking System (SARSAT) which is a component of the worldwide Global Maritime Distress and Safety System, and is an integral part of maritime search and rescue.
- ***Worker Safety:*** OSHA is responsible for developing and enforcing safety and health standards for longshoremen and shipyard workers who form a major part of the MTS workforce.

REGULATIONS AND STANDARDS

GENERAL

Multiple government agencies develop and publish regulations to fulfill their statutory responsibilities as stewards of maritime transportation in U.S. waters and on the high seas, i.e. USCG, BSEE, NOAA, EPA, and USACE. The regulations promulgated by these agencies address the spectrum of complex issues that affect safety, security, and environmental protection such as vessel construction, manning, training, vessel and facility operations, and accident investigations. These agencies often supplement their regulations with supporting policy and augment their regulations by incorporating voluntary consensus industry standards and other publicly-available material by reference.

U.S. COAST GUARD

The USCG regulates a broad range of U.S. maritime transportation issues to ensure marine safety, security, and environmental protection on all types of U.S. and foreign vessels and certain maritime facilities (Figure 9). USCG regulations fulfill three primary purposes: to meet statutory mandates, to implement treaty obligations or internationally-developed best practices of entities like the International Maritime Organization, and to promote maritime safety through discretionary rulemakings. USCG regulations must undergo a period of public comment (except in cases of good cause) and the effects on all potentially affected stakeholders must be taken into account.

FIGURE 9 A USCG inspector inspects the life boat onboard a vessel. The inspection is part of a port state control examination, which is conducted periodically to ensure vessels are in compliance with safety regulations.

The 2020 rulemaking portfolio includes 31 projects with the distribution of primary subject matters being 71 percent maritime safety, 10 percent environmental protection, 3 percent maritime security, and 16 percent USCG administrative issues including technical amendments and vessel documentation procedures. In addition, fourteen of the 31 active projects in the rulemaking portfolio are projects focused on reducing the regulatory burden on the public. The size of the rulemaking portfolio is down approximately 50% from two years ago due to the combined loss of regulatory development resources and the ever-increasing scope of the analyses required to justify regulatory actions.

The USCG incorporates by reference more than1000 industry consensus standards into its regulations in lieu of publishing detailed, government-unique, technical specifications, making it one of the most active and robust programs in Government. These standards are developed in partnership with more than 30 national and international standards development organizations. Through Office of Management and Budget (OMB) Circular A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, Federal agencies are directed to use industry consensus standards. The USCG's standards development program supports its rulemaking objectives through engagement with industry stakeholders and the regulated public to help achieve early acceptance of USCG policies, foster innovation, create opportunities in the global marketplace, and facilitate regulatory consistency. The USCG coordinates its rulemaking activities with other Federal agencies and with Canada through the Regulatory Cooperation Committee established through Executive Order (EO) 13609, Promoting International Regulatory Cooperation.

BSEE

BSEE's Regulations and Standards program is responsible for the development and implementation of regulations for OCS oil and gas operations and for the evaluation and

incorporation of industry standards into those regulations. The regulatory component focuses on regulations that reduce the risks of oil and gas operations, increase safety, protect the environment, and ensure the conservation of oil and gas resources. The standards component engages with standards development organizations, such as the American Petroleum Institute and the American Society of Mechanical Engineers. BSEE's Safety and Environmental Management Systems program develops and enforces regulations requiring oil and gas operators to have management systems to mitigate hazards. Regulations require all oil and gas lessees and designated operators to establish, implement, and maintain a Safety and Environmental Management Systems program. BSEE, with BOEM's support, is leading the development of offshore wind health, safety, and environment guidelines and other processes that ensure the safety of operations. BSEE is also participating in the development of U.S. design standards, and health and safety standards for offshore wind.

BOEM

BOEM is responsible for the designation and leasing of areas on the Outer Continental Shelf (OCS) for renewable energy development. BOEM oversees the review of project plans submitted under these leases for compliance with regulatory requirements as mandated under relevant environmental legislation. BOEM considers multiple uses of the OCS, such as vessel traffic, during identification of wind energy areas and in its review of individual project plans. In addition, BOEM, in collaboration with BSEE, is responsible for development and enforcement of regulations related to the protection of the environment and personnel safety for the developing renewable energy industry. These regulations require a management system approach to understand and mitigate hazards to the environment and personnel safety, and are being used to promote "safe by design" technologies as this industry prepares to construct their first installations on the OCS. BOEM is also responsible for oil and gas leasing on the OCS.

NOAA

NOAA provides standardized products and systems used in the MTS to enable ships to safely and efficiently operate in the MTS. These include nautical charts that contain information essential to navigators such as the nature and form of the coast, accurately surveyed water depths, character and configuration of the sea bottom and locations of hazards, dangers, and aids to navigation. NOAA provides hydrographic survey data, tides and currents information, as well as meteorological observations, forecasts, warnings and geodetic positioning. NOAA runs the PORTS® program in many ports around the Nation which provides real-time water levels, air gap, currents, and visibility information, allowing ships to enter and depart at greater drafts and navigate more safely. NOAA's Operational Forecast System helps mariners plan ahead to time entry and exit with best water.

USACE

The USACE produces and provides standardized channel condition chart products and provides channel condition hydrographic survey data to NOAA for updates to NOAA nautical charts, in accordance with the *Water Resources Development Act* (WRDA) of 2000. Electronic Navigation Chart (ENC) data is provided by the USACE for all inland waterways and other Federal navigation channels maintained by the USACE to be used by commercial Electronic Chart Systems (ECS). Combined with the existing Differential Global Positioning System (DGPS), these products improve the safety and efficiency of marine navigation in both inland and coastal waterways of the United States.

OSHA

OSHA has broad worker safety responsibility under the *Occupational Safety and Health Act of 1970* to develop workplace safety standards. Within the MTS, OSHA has primary responsibility for the safety and health protection of longshore labor and shipyard workers. The OSHA standards apply to both shore and shipboard exposures. For shipboard exposures of longshore labor and shipyard workers, the U.S. occupational safety and health standards are applied on all ships entering the United States and conducting cargo operations or undergoing repair. OSHA standards also cover other workers within the MTS such as truck drivers, rail yard workers, and warehouse employees, and to the extent hazards are not addressed by Coast Guard regulations, seamen working on uninspected vessels.

CHALLENGES

- Changes in technology often move faster than regulatory development can accommodate, and proactive rulemaking is difficult to justify without, for example, accidents on which to base benefit estimates.
- The increasing complexity of vessel systems and operations requires subject matter experts to devote more time and resources to the approval, testing, and inspection of these systems.
- The carriage of standardized, official electronic charts and appropriate navigation systems was agreed to at the IMO under the International Convention for the Safety of Life at Sea, commonly referred to as SOLAS, and mandated in the United States in 2004. The U.S. inland waterway system is shifting under USCG supervision from hard-copy navigation charts to Inland ENCs. Technology developments will require continuing development of relevant standards. NOAA is also planning to gradually phase out paper and raster nautical charts and distribute the next generation of enhanced ENCs.

NAVIGATION SAFETY

GENERAL

MTS safety is impacted by human behavior, equipment, information, operational controls and external factors such as weather and traffic. Federal agencies have long provided a comprehensive suite of products and services that contribute to a low accident rate in the U.S. marine environment. Presently, that suite of products and services are undergoing a significant review to accommodate rapid advances in information technology and electronic systems. While many Federal agencies are involved in navigation safety, USCG, NOAA and USACE have the primary responsibility for navigation safety. The USCG, along with NOAA and USACE, are committed to designing and implementing Federal navigation safety systems that leverage the benefits of electronic technologies in order to fully meet current and future navigation requirements and bring America's waterways into the 21st century.

NOAA

NOAA's National Ocean Service (NOS) provides real-time oceanographic, meteorological data and other navigation products such as nautical charts and precise shoreline mapping to promote safe and efficient navigation within U.S. waters. The use of these products is great and increasing; maritime commerce has tripled in the last 50 years and continues to grow. Ships are getting larger, drawing more water and pushing channel depth limits to derive benefits from every additional inch of available draft. Increased marine commerce can increase risks to safety within the coastal environment, making marine navigation safety a serious national concern.

NOAA's National Weather Service (NWS) issues wind, sea state, sea ice forecasts and analysis and significant weather warnings, observations, forecasts and weather statements. These are essential to the conduct of safe and efficient maritime operations and for the protection of the marine public. NWS marine weather information is provided in several different formats, including text, digital and graphical. Local Weather Forecast Offices provide information for their coastal waters (ranging from 5 nautical miles on the Great Lakes to 60 nautical miles on the Southeast and West coasts, and 120 nautical miles in Alaska) while national centers disseminate products for offshore and high seas areas and Alaska. Short-term and long-term watches and warnings are provided to assure mariners have ample time to take action ahead of volatile weather. Forecasts and warnings for marine weather hazards in the offshore and high seas areas are delivered to ships at sea via USCG radio facsimile and text broadcasts (as well as HF broadcasts). These services meet U.S. commitments under SOLAS and the Global Maritime Distress and Safety System.

USCG

The USCG plays a critical role in ensuring the safety, security, and efficiency of the MTS through port and vessel traffic services, providing maritime situational awareness tools, and by providing waterway resiliency and restoration capabilities after extreme natural or manmade events. The USCG works in concert with other Federal agencies, Tribal, State and local governments, the marine industry, maritime associations, and the international community to optimize the use and champion the development of the MTS.

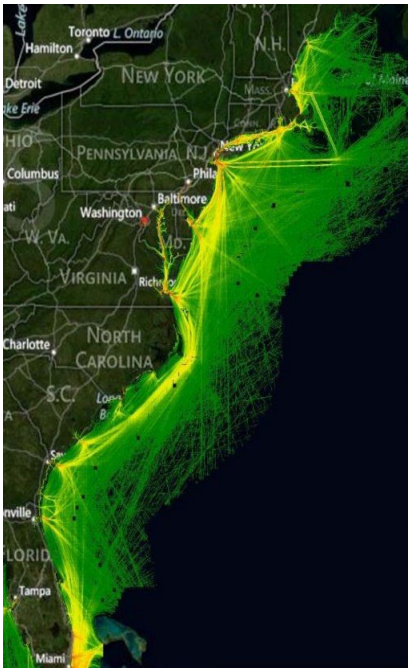


FIGURE 10 Heat map vessel AIS activity from Maine to Florida. The USCG estimates that at any given time there are 4,500 vessels off the U.S. East Coast.

In managing the MTS, the USCG mitigates transit risks by promoting the safe, economic and efficient movement of military, commercial, and other vessels by assisting navigators with determining their position, a safe course, and warning them of dangers and obstructions. MTS management encompasses all ATON related missions as described throughout the U.S. Code of Federal Regulations (CFR) including ATON, bridges, waterways management, VTS, AIS, Great Lakes Pilotage, DGPS and Marine Safety Information.

USACE

USACE conducts hydrographic surveys to assess the condition of Federally-maintained channels and waterways, including inland waterways. The survey data is also used to produce Inland Electronic Navigation Charts (IENC) necessary for safe and efficient navigation and reliable waterways infrastructure. USACE either permits or builds, operates and maintains substantial navigation infrastructure, including locks, dams, canals, jetties, and breakwaters. The USACE Lock Operations Management Application (LOMA) collects and disseminates real-time information on lock operations and navigation safety for inland waterways leveraging the AIS. Lock Performance Monitoring System (LPMS) collects data on lock performance to ensure efficient lock operations and to guide infrastructure investment. Additional systems and services collect and analyze waterway infrastructure operational data to ensure safety, efficiency and reliability; examples include the Waterborne Commerce Statistics Center, Dredging Quality management, Dredging Information System, and the Channel Portfolio Tool (CPT).

CHALLENGES

- Coordinating increased maritime trade passing through fixed and already congested port environments causing safety and security challenges. Collisions and other accidents are more probable, with cascading impacts across the energy and transportation sectors. Initiating port recovery becomes more complex, and more important as an ever-growing community of stakeholders rely on safe, reliable, just in time marine transportation services.
- Continuing development of marine safety information systems that provide accurate, timely navigation safety and weather information in a usable format to mariners.
- Augmenting navigation safety information infrastructure, e.g., the USCG National AIS system, throughout the MTS.
- Developing public-private partnerships and other innovative financing methods to develop, implement, and maintain navigation safety information systems like NOAA's PORTS® system, which provides oceanographic and meteorological information.
- Needs continuous inter-agency and international coordination to refresh information technology with new and emerging technologies.
- Researching causes and effects as many safety failures have a prominent human factor involvement.

INVESTIGATIONS

GENERAL

In most cases, the lead Federal agency involved in maritime safety investigations is the USCG. The USCG's Marine Investigations program, guided by its marine safety mission, has two main goals:

- To investigate marine casualties for the purpose of determining the cause of accidents and preventing recurrence through improving laws and regulations, policies, and international agreements that govern commercial vessel operations in U.S. waters and on U.S. commercial vessels anywhere in the world, and
- To investigate violations of U.S. marine safety laws and regulations for the purpose of deterring non-compliance through appropriate civil, criminal, and administrative enforcement actions.

To accomplish these tasks, the USCG works closely with the NTSB, the Department of Justice (DOJ), IMO, the Marine Accident Investigators International Forum, as well as the investigative branches of other Federal/State agencies and foreign governments.

Federal agencies work both independently and collaboratively to determine what happened to cause an incident. For many incidents, investigations include the collection of evidence and the interview of personnel and often include an assessment of company compliance and safety

management policies and procedures. Each investigation results in a public report that explains the incident, details the causes of the incident, and addresses possible regulatory violations. Investigation reports may also include a variety of possible actions such as issuance of safety recommendations, safety alerts, consideration of new or revised regulations and/or standards, and revision of inspection procedures.

On the OCS, BSEE and USCG coordinate their respective responsibilities for regulation and enforcement of oil and gas related activities under the *OCS Lands Act* and other statutes through a Memorandum of Understanding (MOU) signed in 2012. BSEE and the USCG also have a Memorandum of Agreement (MOA) for casualty/incident investigations that was signed in 2017. Under the MOA, BSEE and the USCG coordinate closely to effectively respond to OCS incidents, determine which agency will be the primary investigator, and to provide assistance to each other in the conduct of investigations. The USCG and OSHA also have a MOU concerning personnel working on the OCS signed in 1979.

The USCG and the NTSB work jointly to investigate Major Marine Casualties but issue separate reports. The NTSB may issue safety recommendations following the investigation of transportation accidents and the completion of safety studies. Recommendations usually address a specific issue uncovered during an investigation or study and specify how to correct the situation. Letters containing the recommendations are sent to the organization best able to address the safety issue, whether it is public or private.

CHALLENGES

- USCG Investigating Officers (IO) require extensive field experience in the various aspects of Prevention (i.e., vessel inspections, waterways management, etc.) as well as training in the discipline of accident investigations. As such, IOs take many years to develop into viable Senior Investigating Officers.
- Foreign companies operating vessels on the U.S. OCS are not required to report marine casualties to the same extent as U.S. operators.
- Identifying the best way to efficiently adjudicate and share safety recommendations, resulting findings of concern, and investigation information with mutual Federal and stakeholder interest.
- Prevention efforts are currently underway to address the aging IT infrastructure for casework to include investigations, enforcement actions, and mariner suspension and revocation.

SEARCH AND RESCUE

As a party to both the *International Convention on Maritime Search and Rescue* and the *Convention on International Civil Aviation*, the U.S. has implemented a national search and rescue (SAR) system that fulfills both Conventions with respect to international SAR system obligations. The U.S. National Search and Rescue Plan (NSP) details responsibilities and requirements for the Federal Government in managing and implementing the U.S. national SAR system. In particular, the NSP assigns the USCG as the Federal SAR Coordinator for the U.S. aeronautical and maritime SAR regions in the ocean environment and waters under U.S. jurisdiction.

The USCG maintains nine Rescue Coordination Centers that coordinate with international, state, tribal, territorial, local SAR authorities, and professionals. The USCG maintains aircraft, ships, boats, and cutters that can respond to the call to aid persons in distress in the maritime environment.

FIGURE 11 The USCG works with local partners, and U.S. military, other nations, and other shipping stakeholders to conduct successful SAR operations at sea. Above, USCG Station Honolulu transports members of the Honolulu Police Department to conduct underway ship-boarding exercises.

CHALLENGES

- The U.S. SAR regions are geographically very large. With limited USCG SAR resources available, the USCG must work with other nations, the other branches of the U.S. Armed Forces, commercial shipping, and Good Samaritans to assist in the rescue of persons at sea.
- It is challenging to conduct SAR operations in the Arctic and other outlying areas of the US SAR Rescue Regions such as the South Pacific and Mid-Atlantic regions.
- With millions of people traveling by passenger ferry, ships and aircraft from U.S. ports and airports, the possibility of a mass rescue incident in the maritime environment continues to be a low probability/ high risk scenario for which the USCG continues to plan and prepare for mass rescue response.

WORKER SAFETY

GENERAL

April 2020 marked 56 years of the use of shipping containers in world shipping (Figure 12). While the advent of intermodal shipping containers decreased much of the associated hazards during cargo operations, the use of containers has not eliminated the safety hazards of maritime shipping entirely. For the past two decades, cargo movement has risen steadily and the requirement for efficient movement of heavy loads continues to require a vigilant focus on the safety of workers.

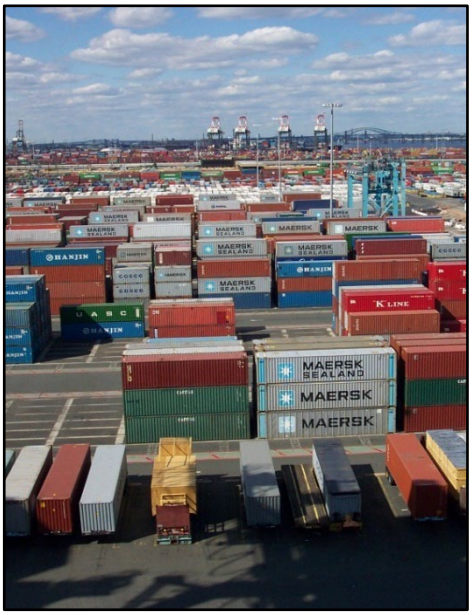


FIGURE 12: Thousands of shipping containers at the terminal Port Elizabeth, New Jersey illustrates the prevalence of containerization in the MTS.

According to the Bureau of Labor Statistics (BLS), between 2008 and 2017 in private industry there have been 86 fatalities in marine cargo handling[2] and 73 fatalities in ship and boat building.[3] An increasing number of marine cargo-handling facilities have workers loading intermodal containers onto specialized railcars. Working close to rail lines exposes workers to struck-by hazards from mobile equipment and vehicles such as top and side handlers, reach stackers, rail-mounted gantry cranes, rubber-tired gantry cranes, straddle carriers, semi-tractors, rail cars and pickup trucks.[4]

In addition to USCG broad responsibilities for marine safety, executed through its regulatory, inspection and search and rescue programs discussed previously, OSHA promulgates and enforces safety and health standards for maritime workers in shipyards and marine terminals, including all persons performing longshoreman tasks such as offloading containers or bulk products, moving and stacking containers, and loading containers onto trucks. OSHA also protects employees that may handle these containers or materials after leaving the marine terminals through safety and health provisions found in the General Industry standards.

While the life of a mariner can be quite interesting and rewarding, it can be both physically and mentally challenging. Many mariners work unique schedules represented by several weeks embarked on a vessel, followed by a time period at home otherwise known as your "off-time" or "off hitch." Schedules are largely driven by customer or geographical requirements and generally comprised of embarkation days ranging from hours to a number of months. Anyone aboard an operating vessel is subject to the elements; whether it be a harbor dinner boat, coastal tug, or deep sea-going ship. While ships work to avoid extreme weather, working in heavy winds,

freezing rain, and kicked up seas, can make working on deck and operating the vessel much more challenging. If cargo shifts, it can impact vessel stability. Fortunately, modern safety regulations, management procedures, advanced emergency communications, and effective international rescue systems place modern mariners in a much safer position. As noted, mariners can spend months away from home and while in close quarters. This aspect has been exacerbated by the COVID-19 pandemic, whereby mariners have had to stay on board for an extended period of time with greater stress on their health and well-being. While it does not entirely ease the stress of long periods away from home, most newer vessels are air conditioned, soundproofed from noisy machinery, and equipped with comfortable living quarters. Also, modern communications such as email, instant messaging and social media platforms link modern mariners to their families.

CHALLENGES

- Measuring the efficacy of Federal and industry safety programs.
- Coordinating safety regulations and compliance programs between agencies, particularly when jurisdictions may overlap.

AREAS FOR SAFETY POLICY CONSIDERATION

REGULATIONS AND STANDARDS

- Develop new methods to promote transparency of standards development activities.
- Develop best practices and more flexible legislation to reduce the burden of updating material incorporated by reference.
- Promote continuous improvement in interagency rulemaking coordination.
- Broaden the use in the United States of emerging international standards for data and technology.
- Coordinate implementation of IMO and other international treaty provisions with rulemaking and standards development activities.
- Support the consistent implementation of the IMO Polar Code for navigational safety in polar regions.

NAVIGATION SAFETY

- Promote and enhance navigation services to expand safety information including for weather forecasting, NOAA's PORTS®, the national buoy system, notice to mariners, and hydrographic surveys.
- Ensure that proposed bridge actions meet the reasonable needs of navigation through early coordination with waterway stakeholders.

- Establish a Federal interagency data exchange framework and common policy statement to enable seamless exchange of unclassified navigational data among Federal agencies.

INVESTIGATIONS

- Continue refining and improving USCG's maritime investigation and analysis program.
- Continue coordinating investigation activities and sharing investigation information and investigation report recommendations among Federal agencies particularly for areas where multiple agencies have jurisdiction.
- Identify ways to enhance general sharing and analysis of incident information to identify trends, accident precursors, and hazards associated with OCS operations.
- Coordination of incident reporting requirements to streamline the reporting process and ensure efficient sharing of information.
- Encourage industry participation in BSEE's voluntary confidential near-miss reporting program.

SEARCH AND RESCUE

- Continue to pursue improving the U.S. and international SARSAT system.
- Expand the national suite of hydrodynamic models to be inclusive of the U.S., including the Arctic, to support SAR.

WORKER SAFETY

- Continue to pursue agreements and/or renewals of memorandums of understanding between agencies, particularly when jurisdictions may overlap.

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[1] Savage, I. *Comparing the fatality risks in United States transportation across modes and over time,* Research in Transportation Economics 43 (2013) 9-22.

[2] U.S. Department of Labor, Bureau of Labor Statistics, CFOI Table A-1 – Marine cargo handling – NAICS.

[3] U.S. Department of Labor, Bureau of Labor Statistics, CFOI Table A-1 – Ship and boat building – NAICS 3366. NOTE: The 2017 A-1 table does not contain data for NAICS 336600. This indicates that no data were reported or that data do not meet publication criteria.

[4] OSHA Fact Sheet, *Work Safety Zones for On-Dock Container Rail Operations in Marine Terminals*, 2014.

SECTION 3: MARITIME TRANSPORTATION SYSTEM SECURITY

The United States is a maritime Nation and the interconnectivity and stability of our national economy, commerce, and security is tied to the global maritime nature of international commerce. Within the MTS, maritime security is among the highest priorities.

In response to the terrorist attacks of September 11, 2001, Congress passed the Maritime Transportation Security Act (MTSA) of 2002 (MTSA 2002) [Public Law 107-295], which was accompanied by a range of policies, directives, security strategies and implementation plans, interagency facilitators and managers, fusion centers, and advisory committees. Since MTSA 2002 was enacted, the United States has led the effort at the IMO to develop international requirements that complemented domestic law and regulations. This effort resulted in the International Ship and Port Facility Security Code (ISPS), part of Safety of Life at Sea (SOLAS). The ISPS Code is an international standard that strengthens security aboard vessels and at ports around the world.

In December 2004, the President directed the Secretaries of DOD and DHS to lead the Federal effort to develop a comprehensive National Strategy for Maritime Security (NSMS), to create an overall strategic framework and better integrate and synchronize the existing Department-level strategies and ensure their effective and efficient implementation. Published in 2005, The NSMS aligns Federal Government maritime security programs and initiatives into a comprehensive and cohesive national effort involving appropriate Federal, State, local, and private sector entities. In 2005 and 2006, the Departments developed eight national supporting implementation plans under the NSMS to address the specific threats and challenges of the maritime environment. While the plans address different aspects of maritime security, they are mutually linked and reinforce each other. The supporting plans include:

- The National Plan to Achieve Maritime Domain Awareness (NPAMDA) provides the framework for collaboration to appropriately share and safeguard information within the Global Maritime Community of Interest (GMCI) to position decision-makers to prepare for, prevent, respond to, and recover from a broad spectrum of potential maritime related threats.
- Global Maritime Intelligence Integration Plan uses existing capabilities to integrate all available intelligence regarding potential threats to U.S. interests in the maritime domain. This plan was also merged with the NPAMDA and published as the National Maritime Domain Awareness Plan (NMDAP).
- The Maritime Operational Threat Response (MOTR) Plan facilitates a coordinated U.S. government response to threats against the United States and its interests in the maritime domain by establishing roles and responsibilities, which enable the government to respond quickly and decisively.

- The International Outreach and Coordination Strategy (IOCS) provides a framework to coordinate all maritime security initiatives undertaken with foreign governments and international organizations and to solicit international support for enhanced maritime security.
- The Maritime Infrastructure Recovery Plan (MIRP) recommends standardized procedures for restoring maritime transportation systems following an incident of national significance.
- The Maritime Transportation System Security Plan (MTSSP) provides strategic recommendations to holistically improve Maritime Transportation System security.
- The Maritime Commerce Security Plan (MCSP) establishes a comprehensive plan to secure the maritime supply chain.
- The Domestic Outreach Plan (DOP) seeks non-Federal input to assist with developing and implementing maritime security policies.

The MTS industry has readily joined to implement associated requirements as outlined in MTSA 2002 and similar legislation through approved vessel security plans, facility security plans, and joining by Area Maritime Security Committees (AMSC) and other activities, to increase resilience and contribute to the security of port communities. USCG and numerous independent Government Accountability Office (GAO) reviews consistently show that this system is operating as intended.

In recent years, cybersecurity has risen dramatically as a security area of concern. On May 11, 2017, the President issued Executive Order (EO) 13800, *Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure*. The EO focuses Federal efforts on modernizing Federal information technology infrastructure, working with State and local government and private sector partners to more fully secure critical infrastructure and collaboration with allies. In March 2020, USCG issued Navigation and Vessel Inspection Circular (NAVIC) NO. 01-20, *Guidelines for Addressing Cyber Risks at Maritime Transportation Security Act (MTSA) Regulated Facilities.* This NAVIC clarifies the existing MTSA 2002 requirements related to computer system and network vulnerabilities of MTSA-regulated facilities. It also provides owners and operators of the facilities with guidance on how to analyze these vulnerabilities in their required Facility Security Assessment (FSA) and address them in the Facility Security Plan (FSP).

This section presents maritime security activities through four areas: Maritime Domain Awareness; Critical Infrastructure Protection; Vessel and Facility Security; and Cybersecurity.

MARITIME DOMAIN AWARENESS

"Maritime Domain Awareness" (MDA) is the effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment of the United States.[1] The NSMS defines the spectrum of maritime domain threats facing our Nation to include Nation-states, terrorists, transnational criminal activities, piracy, environmental destruction, and illegal seaborne immigration. These challenges to our security and economic livelihood require a mindset that views the totality of these threats and takes all necessary actions through an active, layered, and shared defense. The NSMS provides the strategic policy framework for implementing such actions.

The NSMS calls for promoting unity of effort, fostering information sharing and integration, and facilitating the safe and efficient flow of commerce among government, public, and private entities. The interest of the United States is best served by also working with our international partners, both public and private, to facilitate MDA to defend against the spectrum of maritime threats.

The NMDAP, as one of the eight maritime-related plans under the NSMS [as described in the previous section], establishes the foundation for the effective understanding of potential and actual maritime threats and challenges by promoting favorable conditions for integrating and sharing information, including intelligence, to inform decision-makers. The NMDAP tasks the Maritime Domain Awareness Executive Steering Committee (MDA-ESC), the interagency coordinating board under the authority of the National Security Council's (NSC) Maritime Security Policy Coordinating Committee (MS-PCC), with Coordination of Federal Interagency MDA policies, strategies, and initiatives.[2]

In December 2016, the MS-PCC approved a new U.S. Maritime Alert and Advisory System called, "Maritime Security Communications with Industry." Interagency coordination under this new system began in January 2017, in accordance with the MOTR Plan and its Protocols. The National Geospatial Agency (NGA) and MARAD lead the industry outreach portion of this effort, in conjunction with the Departments of State, Defense, and Homeland Security, and the National Maritime Intelligence Integration Office (NMIO).[3]

This industry communication function is a highly-successful, interagency collaboration that provides basic information (location, incident type, and date/time) on reported maritime security threats to U.S. maritime industry interests. The alerts and advisories are disseminated through the NGA "Maritime Safety Information Portal" and MARAD's Maritime Security Communications with Industry (MSCI) portal. MARAD maintains a list of current and expired alerts and warnings at https://www.maritime.dot.gov/msci-advisories. For example, on June 26, 2019, MARAD issued a warning to U.S. flag carriers related to violence in the Red Sea, Gulf of

Aden, Arabian Sea, Gulf of Oman, and Indian Ocean due to regional conflict and piracy. In 2019, there were eleven alerts and warnings issued.

Other robust communication initiatives include the Industry National Maritime Interagency Advisory Group (NIAG) updates and workshops, managed by the National Maritime Intelligence Integration Office (NMIO). Further, MARAD maintains an active list of the company security officers of U.S. flag operators, which they gather together annually to share updates on past, new and emerging security related issues. The Global Maritime Coordinating Center (GMCC), MOTR efforts provide a go-to, rapid interagency coordination mechanism to address maritime-related threats in the MDA worldwide. Hosted at the USCG, the GMCC was established in 2010 by the President, and provides highly functional, full-time support to interagency and international partners, as the national interagency MOTR. The GMCC also provides MOTR training, process guidance, and expertise to ensure that there is a coordinated and collaborative response to threats in the maritime domain.

Since 2005, the Global Maritime Community of Interest (GMCOI) has enhanced transparency in the maritime domain through information sharing; enabled accurate and confident decisions across a full spectrum of threats and challenges; and sustained freedom of navigation and overflight, while promoting the legitimate, continuous, and efficient flow of commerce. The maritime industry will continue to maintain maritime information-sharing arrangements while simultaneously implementing effective measures to strengthen and significantly improve them through the MDA enterprise architecture. To facilitate maritime information sharing, engagement and communications, a great deal of effort has made to address: data sources, data fusion and visualization, policy and guidance, operational forces, and organizational coordination.

CHALLENGES

Appendix C of the NMDAP identifies validated national challenges to MDA. These challenges are currently undergoing review, but can be grouped into three National MDA Focus Areas:

- **Data:** Ensuring all maritime data is conditioned in such a way as to make it accessible and usable in a system agnostic method to the entire maritime enterprise.
- **Policy:** Information sharing policy barriers to whole-of-government MDA collaboration.
- **Process:** Whole-of-government Entity (Vessel, Cargo, Persons) of Interest/Request for Information (RFI) process to share appropriate information to allows stakeholders to request information, provide updates, and receive collected information in a seamless way; agnostic to security domain or mission area.

CRITICAL INFRASTRUCTURE PROTECTION

As described under the MTS physical infrastructure section in this report, infrastructure are those assets, systems, and networks that underpin U.S. society. Critical infrastructure is defined in the USA PATRIOT Act (P.L. 107-56, §1016(e)) as "systems and assets, physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health and safety, or any combination of those matters."

More specifically, "Critical Infrastructure and Key Resources" (CIKR) include physical or virtual assets, systems, and networks so vital to the United States that the incapacity or destruction of such assets, systems, or networks would have a debilitating impact on security, national economic security, public health or safety, or any combination of those matters.[4] To achieve security and resilience, critical infrastructure partners collectively identify priorities, articulate clear goals, mitigate risk, measure progress, and adapt based on feedback and the changing environment. The MTS is an integral part of the national critical infrastructure and shares in the threats associated with disruptions to the system.

Critical infrastructure within the MTS is owned and operated by public and private sector entities. The community involved in managing risks to maritime critical infrastructure is wide-ranging and composed of partnerships among owners and operators, governments (Federal, State, local, Tribal, and territorial), local and regional entities (port authorities, response organizations), non-profit organizations, and academia. In 2013, the Department of Homeland Security, in collaboration with Federal partners, published the National Infrastructure Protection Plan (NIPP). The NIPP frames the requirements to protect critical infrastructure, while establishing the Federal and non-Federal sector communication chains for implementation.

The NIPP specifies the key initiatives, milestones, and metrics required to achieve the Nation's CIKR protection mission. It provides a risk management framework and defined roles and responsibilities for the Department of Homeland Security (DHS), Federal "Sector-Specific Agencies" (SSAs), and other Federal, State, local, Tribal, territorial, and private sector partners. The cornerstone of the NIPP is its risk management framework, which establishes the processes for combining consequence, vulnerability, and threat information to produce a comprehensive, systematic, and rational assessment of national or sector risk.[5]

Homeland Security Presidential Directive 7 (HSPD-7) identified 17 CIKR sectors which includes the "Transportation System Sector" (TSS). There are seven modal sectors under the TSS, including the MTS sector. The USCG is a co-SSA, alongside the Department of Transportation and the Transportation Security Administration, for the TSS. The TSS includes the MTS sector, and USCG collaborates with DOT, TSA, the Cybersecurity and Infrastructure

Security Agency (CISA), U.S. Customs and Border Protection (CBP), MARAD, and other agencies with interest or equities.

As noted, there are seven overarching coordination bodies under the TSS with modal components for aviation, freight rail, highway and motor carrier, mass transit, maritime, pipelines, and postal and shipping. DOT and DHS (delegated to USCG and TSA for DHS) serve as co-SSAs for the overall Transportation Systems Sector. Each subsector is represented by a Government Coordinating Council and Sector Coordinating Council. USCG serves on the Government Coordinating Council for the Maritime Subsector. Sector Coordinating Councils (SCCs) serve as one mechanism under the NIPP from which to facilitate collaboration between the private sector and government for critical infrastructure security and resilience activities, and are encouraged to establish voluntary practices to ensure that the sector perspectives are included.[6] For the maritime mode, there is a Maritime Government Coordinating Council (MGCC), co-managed by DHS (via USCG) and USDOT (via MARAD); and the private sector Maritime Sector Coordinating Council (MSCC), which is self-organized and self-governed. Though the GMCC was dormant for a while after its initial establishment, it is now fully up and operating.

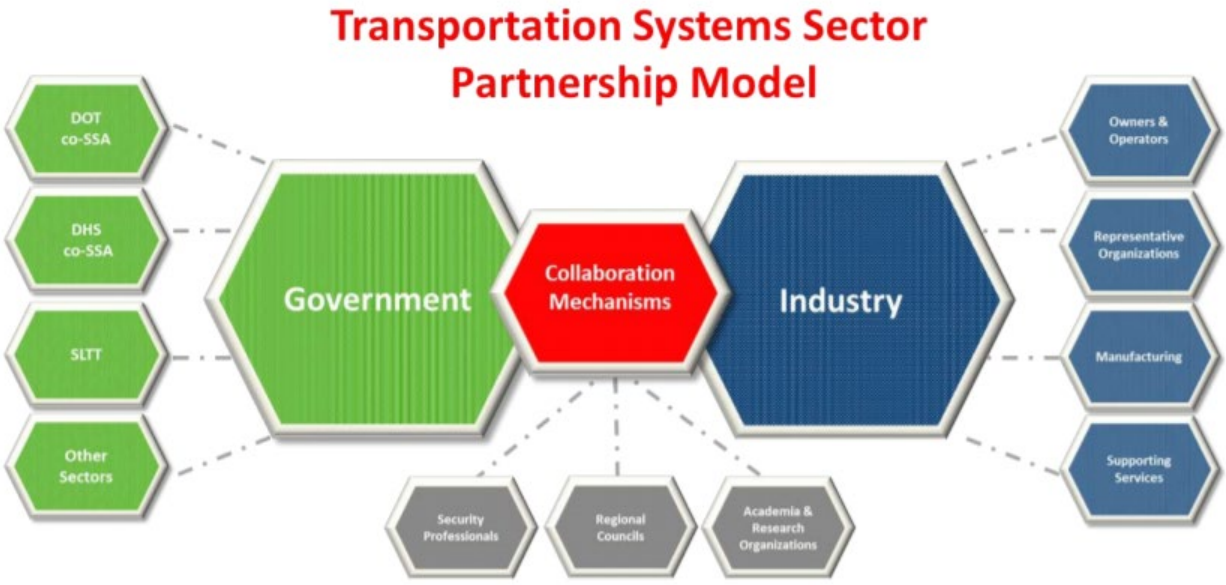

FIGURE 13 Transportation Sector Partnership Model from the Transportation Systems Sector-Specific Plan, an annex to the National Infrastructure Protection Plan. (2015)[7]

Established after MTSA 2002, Area Maritime Security Committees within port sectors have flourished as established fora for USCG and other Federal maritime security-related engagement with industry and MTS stakeholders, particularly at the local level. Also, under MTSA 2002,

USCG established the National Maritime Security Advisory Committee (NMSAC), a formal Federal Advisory Committee. NMSAC reports to the Secretary of Homeland Security via the Commandant of the USCG. These two other maritime security committee structures have been fairly robust since established. In the annual Federal Advisory Committee Act reporting requirements from Fiscal Year 2019, the USCG noted that the NMSAC had made 68 recommendations since its inception, of which 99% were or will be fully implemented.[8]

A non-Federal, MSCC was stood up soon after the NIPP but languished. In an editorial in the USCG "Maritime Commons" blog from May 2015, it was noted that there was no maritime SCC but that having one stood up again would be of benefit.[9] Subsequently, a new Maritime Modal Sector Coordinating Council has been stood up, has been approved by DHS and will "serve as the primary domestic maritime industry liaison with government and to coordinate strategies, activities, policy, and communications between the government and private industry in support of emergency preparedness and response activities."[10] In April-June, 2020, the MSCC was instrumental as a liaison between FEMA and MARAD to assess the need for and distribution of 2.4 million face masks to MTS stakeholders. In recent years, the Government Maritime Coordinating Committee has not been active.

While DHS had an established an infrastructure protection directorate per directive in the Homeland Security Act of 2002, in November 2018, the Cybersecurity and Infrastructure Security Agency (CISA) was established. CISA describes itself as "the Nation's risk advisor, working with partners to defend against today's threats and collaborating to build more security and resilience infrastructure for the future."[11] During the COVID-19 global pandemic, CISA published guidance for essential critical infrastructure workers on how jurisdictions and critical infrastructure owners can use the list to assist in prioritizing the ability of essential workers to work safely while supporting ongoing infrastructure operations across the nation. More information on CISA mission areas can be found in the CISA Services Catalog at https://www.cisa.gov/publication/cisa-services-catalog.

CHALLENGES

- Increasing global reliance upon computers, computer systems, and networks coupled with an increasingly interconnected world increases the potential risk of supply chain disruption through exploitation of vulnerabilities and resulting compromise of critical computer systems and networks.
- The effects of extreme weather pose a significant risk to critical coastal and inland port infrastructure—rising sea levels, more severe storms, extreme and prolonged drought conditions, and severe flooding combine to threaten infrastructure that provides essential services to the U.S. [See resilience focus section]
- Adaptive strategic approaches to lower the risks in the cyber domain to account for evolving technologies and technology dependencies.

- Though concerted efforts are made to gather Federal security interests together, federal security stakeholders' breadth and scope challenges policy-makers to provide one-stop-shop directives.

VESSEL AND FACILITY SECURITY

Maritime trade pathways could be used to transport a wide spectrum of threats including: nuclear, chemical, biological, radiological, nuclear, and high-yield explosive weapons and precursor materials; weapons; narcotics; currency; stowaways; and prohibited or restricted commodities. From a risk management perspective, the threat with the greatest consequences would be the use of the MTS to deliver a weapon of mass destruction via personnel access to facilities or vessels. The intelligence community continues to assess and validate the credibility of any of these threats.

In MTSA 2002, Congress established a range of port security measures, including personnel vetting and credentialing requirements to help prevent a transportation security incident that results in a significant loss of life, environment damage, or transportation system or economic disruption. The Transportation Worker Identification Credential (TWIC®) program was established by the TSA and USCG to vet personnel who required access to secure areas of regulated MTS (or any transportation) facilities and vessels.

Since 2007, TSA enrolled 5.8 million applicants for TWIC® and it manages nearly 2.3 million active cardholders, including recurrent criminal history, immigration, and terrorism vetting. By law, the Secretary of DHS is required to assess the effectiveness of the TWIC program at enhancing security and reducing security risks for regulated maritime facilities and vessels. A 2019 assessment determined that TWIC® is intended to help prevent a high-consequence attack in the transportation environment or terrorist event and TSA's security threat assessment incorporating terrorism watch lists reduces the terrorism risk. While TWIC®'s threat deterrence and risk mitigation value cannot be separated from other security systems or investments employed by MTS entities, DHS determined that TWIC® is strongest at reducing risk from a known or suspected terrorist who needs persistent insider access to a facility or vessel for a potential attack.

The traditional approach to foreign cargo security has been to inspect cargo before it arrives to a United States port of entry but international supply chain security measures have also increased drastically. CBP, is the lead agency for import/export cargo examinations. In cooperation with USCG, the maritime industry, and other stakeholders, CBP identifies and screens cargo bound for the United States before it is loaded on a ship. Other measures address cargo security while in transit and account for cargo once it reaches U.S. shores. In addition, USCG works with foreign countries under the International Port Security Program to share information and improve the security of ports that send cargo to the United States. In Fiscal Year 2019, enforcement by Air and Maritime Operations section of CBP for both air and maritime resulted in the seizure or disruption of 284,825 pounds of cocaine, 101,874 pounds of marijuana, 51,058 pounds of methamphetamine, 935 weapons and $34.1 million, 1,575 arrests, and 52,036 apprehensions of illegal aliens.[12]

FIGURE 14 Each year, over 11 million containers are offloaded at U.S. seaports from ships. In cooperation with USCG, the maritime industry, and other stakeholders, CBP identifies and screens cargo bound for the United States even before it is loaded on a ship.

The Customs Trade Partnership Against Terrorism (CTPAT) is one effort CBP takes related to cargo enforcement. CTPAT is a voluntary supply-chain security program focused on improving the security of private companies' supply chains with respect to terrorism. Established in November 2001, CTPAT has more than 11,400 certified partners certified into the program. Partners include U.S. importers/exporters, U.S./Canada highway carriers; U.S./Mexico highway carriers; rail and sea carriers; licensed U.S. Customs brokers; U.S. marine port authority/terminal operators; U.S. freight consolidators; ocean transportation intermediaries and non-operating common carriers; Mexican and Canadian manufacturers; and Mexican long-haul highway carriers, all of whom account for more than 53 percent (by value) of cargo imported into the U.S.[13]

Members in the program are considered to be low risk and must address a broad range of security topics as well as present security profiles that list action plans to align security throughout the supply chain. In turn, these low risk companies are to receive a reduced number of CBP examinations, front of the line inspections, shorter wait times at the border and access to the “Free and Security Trade (FAST) Lanes” at land orders, and “Advanced Qualified Unlading Authorization (AQUA) Lane” for sea carriers, to name a few.[14]

In a February 2017, a U.S. Government Accountability Office (GAO) report, “Providing Guidance and Resolving Data Problems Could Improve Management of the Customs Trade

Partnership Against Terrorism Program," (GAO-17-84), reported that CBP could not determine the extent to which CTPAT members were receiving benefits because of data problems with their data reporting tool; lack of standards, in particular, being an issue. In response to the first GAO recommendation for the program to develop standardized guidance for the field offices to manually track and report the number of required and completed security validations, CTPAT developed standardized guidance in the form of an updated standard operating procedure and a manual "common worksheet," allowing field offices to assign and track validations in a standardized manner. CTPAT then conducted webinars to ensure that all personnel fully understand how these procedures need to be implemented. And on the second GAO recommendation for CTPAT to resolve the issues that led to questionable system data, so that the program can produce accurate metrics for measuring CTPAT members' benefits, CTPAT took a two-step approach. First, it terminated the use of the dashboard system. And second, it created an action plan designed to demonstrate that accurate, verifiable, and reliable data is being used to demonstrate CTPAT examination benefits. The action plan details an iterative development process – with defined milestones – to build an automated reporting capability. Both of the GAO recommendations were eventually closed to the satisfaction of GAO.

In July 2019, CTPAT reauthorization legislation was introduced in Congress that sought to address two key complaints among cargo owners and transportation providers regarding the CTPAT program: strict program entry requirements with undocumented beneficial return and concern over backlash if a participant is suspended or expelled. It is important to note that each suspension, removal, or determination of ineligibility is preceded by extensive outreach efforts in order to provide Members with the opportunity to demonstrate compliance with program requirements. The success of this working relationship is evidenced by the small percentage of the program's Members who are suspended or removed from the program. In addition, subsequent to removing a Member's benefits, additional outreach efforts are conducted to help the Member address gaps, vulnerabilities, or weaknesses which led to the suspension, removal, or ineligibility determination. These efforts are aimed to help the Member move toward reinstatement. However, in accordance with the SAFE Port Act, cases involving a potential threat to national security, or situations involving false/misleading information, may require immediate action to suspend or remove a CTPAT Member.

Small vessels, less than 300 gross tons and generally less than 100 feet in length, such as recreational, fishing, or small commercial vessels, can also be a security risk. On October 12, 2000, the U.S. Navy destroyer COLE was attacked by a small boat laden with explosives during a brief refueling stop in the harbor of Aden, Yemen. The suicide terrorist attack killed 17 members of the ship's crew, wounded 39 others, and seriously damaged the ship.

This incident of the COLE, in particular, prompted the development of a "Small Vessel Security Strategy" in April 2008, aligned with the NSMS 2005. Given the relatively free flow of small vessels in and around the U.S., the USCG recognized the importance of its partnership with the small vessel community, Tribal interests, and public/private sectors in a multi-layered approach

that built on existing fora such as the Area Maritime Security Committees, technology, and risk assessment.[15]

The capability to board and take control of large underway vessels – demonstrated in numerous piracy incidents – could also be employed to facilitate terrorist acts. While these threats need to be taken seriously, the NSMS cautions that overly restrictive, unnecessarily costly, or reactionary security measures to reduce vulnerabilities can result in long-term harm both to the U.S. and global economies, undermine positive countermeasures, and unintentionally foster an environment conducive to terrorism. The strategy also notes that security measures must accommodate commercial and trade requirements, facilitate faster movement of more cargo and more people, and respect the information privacy and other legal rights of Americans. To support the accelerating growth of global commerce and security concerns within the MTS, security measures must:

- Be aligned and embedded with supply chain information flows and business processes;
- Keep pace with supply chain developments; and
- Optimize the use of existing databases and be implemented with the minimum essential impact on commercial and trade-flow costs and operations.

This acknowledges that new and enhanced partnerships, as well as cost- and burden-sharing between the private and public sectors, must take place.

The Port Security Grant Program (PSGP) was also established in MTSA 2002. Responsibility for administering the PSGP has changed numerous times since its inception. When first established, TSA managed the PSGP in partnership with MARAD and the USCG. In March 2003, TSA was transferred from the DOT to the Department of Homeland Security (DHS) under the Homeland Security Act; however, TSA continued to operate the program. In March 2004, the Secretary of Homeland Security established the Office of State and Local Government Coordination and Preparedness (OSLGCP), and for Fiscal Year 2005, OSLGCP was appropriated funding for the PSGP. In October 2005, the Secretary of Homeland Security created the Preparedness Directorate, and within that directorate, the Office of Grants and Training (OGT). Thus, for fiscal years 2006 and 2007, OGT administered the program. In April 2007, under the Post-Katrina Emergency Management Reform Act, many of the functions and authorities of the Preparedness Directorate were transferred to FEMA, and since that time, FEMA has administered the PSGP and reports that PSGP plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient Nation.

Applicants for a port security grant must describe how the investment addresses the USCG Captain of the Port (COTP) priorities, explain how the investment will achieve a more secure

and resilient port area, identify assets being requested, and identify similar assets that already exist.[16] PSGP funding from FY 2002 to FY 2020 has totaled $3,453,000,000.

FISCAL YEAR	FUNDING (millions $)		FISCAL YEAR	FUNDING (millions $)
2002	93		2010	288
2002 Supplemental	104		2011	235
2003	148		2012	98
2003 Supplemental	20		2013	93
2004	124		2014	100
2005	142		2015	100
2006	168		2016	100
2007	202		2017	100
2007 Supplemental	110		2018	100
2008	389		2019	100
2009	389		2020	100
2009 ARRA*	150		**TOTAL FUNDING**	3,453

TABLE 5: Funding for the Port Security Grant Program. [Source: TSA, July 2020].

FEMA identified enhancing cybersecurity capabilities as a funding priority for the first time in PSGP funding fiscal year 2013 and had provided guidance for cybersecurity-related proposals. In a 2014 report regarding Maritime Critical Infrastructure Protection, the GAO recommended that FEMA include cyber specialists in port security grant reviews but, to date, there have been relatively few cyber-related applications to warrant inclusion of dedicated cyber experts on the National Review Panel, but such expertise is available on call to answer questions if necessary.

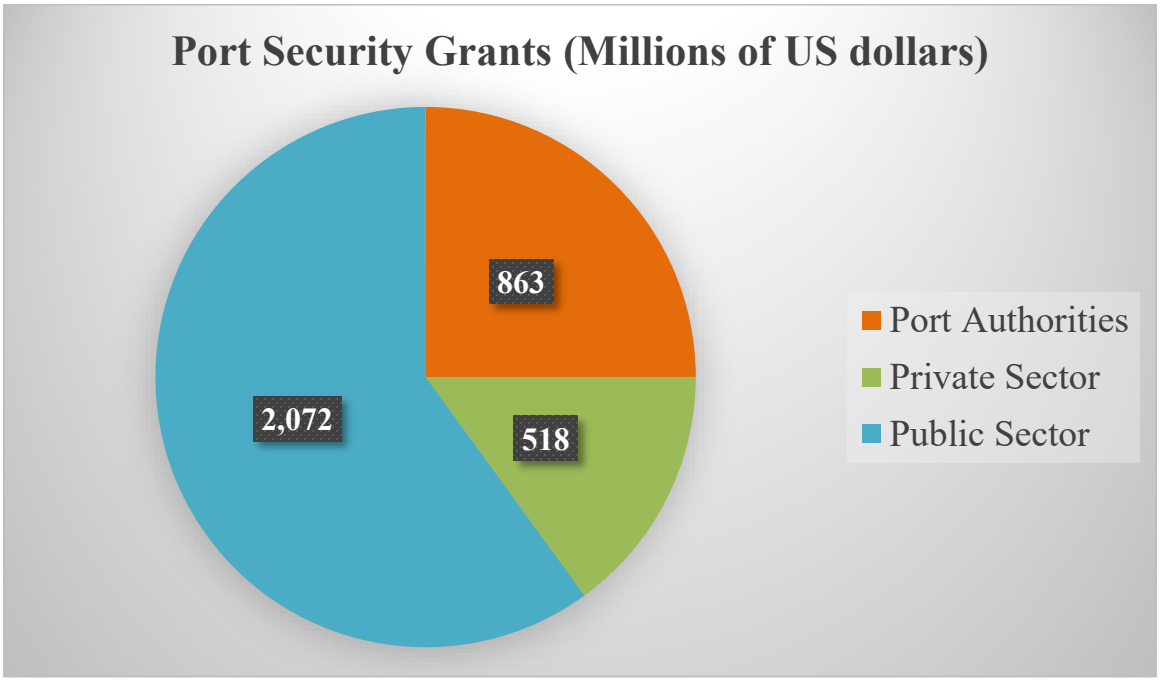

FIGURE 15: Distribution of Port Security Grants through 2018.

CHALLENGES

- Until 2007, the PSGP focused on security funding to ports. In the 2007 supplemental bill, the program expanded the pool of eligible port applicants to all entities covered by an Area Maritime Security Plan (AMSP). The sheer volume of port and related security requirements challenges the ability to meet all requirements.
- Developing effective detection and deflection strategies for difficult to find threats (e.g., mines, bombs, and contraband) as well as small vectors of potential destruction (e.g., small boats, stowaways, and drones).
- Performing adequate inspection of cargo prior to entry into the United States – and implementing a system that is flexible to the type of cargo and method of entry into U.S. waters.
- Fostering effective communications among Federal agencies and stakeholder partners and on-the-ground security teams.
- Training employees to recognize and mitigate vulnerabilities through tools such as exercises and drills.

CYBERSECURITY

Cybersecurity threats include any activity that could compromise the security, availability, confidentiality or integrity of a system or the information stored by the system. The MTS is vulnerable to cyber actions directed to port and terminal operations, vessel navigation systems, vessel traffic services, and electronic ATON. International shipping organizations have recognized the ongoing and increasing concern with cyber security and have issued guidelines on cyber safety and security on board ship.[17] The IMO has also issued Interim Guidelines on Cyber Risk Management (CRM) which provides a foundation for understanding and managing cyber risks. Following the interim guidelines, other IMO efforts in maritime cybersecurity included MSC-FAL.1/Circ.3 Guidelines on Maritime Cyber Risk Management (2017), which provides high level recommendations for maritime CRM into existing risk management processes, and IMO MSC Resolution 428(98) Maritime Cyber Risk Management in Safety Management Systems (2017), which encourages administrations to ensure CRM is incorporated into Safety Management Systems by Jan 2021.[18]

The connected-ness of our electronic, internet, and cloud systems can impact any business system – even if not intended for that business. For example, on June 27, 2017, the "NotPetya wiperware" [a variant of the Petya malware] attack, infected tens of thousands of computers worldwide – including the Maersk systems, the world's largest container shipping company - and became the most damaging cyberattack in history when measured by cost. Damages are estimated at more than $10 billion, including at least $300 million in losses by Maersk, alone. Malicious actors were able to upload the wiperware to Maersk's systems through a compromise of M.E. Doc, a Ukrainian accounting software package. Once M.E. Doc had been compromised, these hackers used the software's update system to deliver the NotPetya ransomware to M.E. Doc users, including Maersk. While the virus was not intended for Maersk or its maritime operations, the multi-propagation technique had a devastating domino-effect.
The cyber-attack prompted a MOTR and subsequent tabletop exercise in April 2019 that focused on cyber threat responses. Approximately 50 U.S. and Canadian Government officials examined the Cyber Protocol to the MOTR Protocols of 2018 through scenario discussions to identify gaps, and seams among cyber reporting requirements, information sharing protocols, and the interagency response coordination process. One of the observations was the need to clarify the Federal response, if any, to a maritime related cyber-attack in the private sector. An attack that shuts down port operations would impact USCG jurisdiction. But, if it is related to ransom ware, there is a FBI response.

Industry and government have not stood idle. Maersk did an infrastructure overhaul and reinstalled thousands of machines.[19] As early as July 2014, the Ship Operations Cooperative Program, in coordination with MARAD, issued a free cybersecurity prevention DVD and subsequently held a cybersecurity summit in 2018. In 2019, the USCG released a Marine Safety Information Bulletin 04-19 alerting shipping companies of targeted phishing attempts to

commercial vessels, and Marine Safety Alert 06-19 providing best cyber hygiene practices for vessel owners/operators.

In February 2015, the President signed EO 13691, *Promoting Private Sector Cybersecurity Information Sharing,*[20] to encourage the voluntary formation of private sector information sharing organizations to partner with Federal Government or between industry organizations, on a voluntary basis, to share industry cyber-related attacks, hacks, and issues in a way that could protect the proprietary information of an industry or industry member. These cyber-specific "Information Sharing and Analysis Centers" (ISAC) are industry-specific organizations that gather and share information on cyber threats to critical infrastructure.[21] Banking ISACs are generally considered top tier industry cyber information organizations.

The National Council of ISACs lists two maritime ISACs, the *Maritime ISAC* and the *Maritime Transportation System ISAC*.[22] There are two additional significant maritime cyber information sharing organizations that are not listed with the National Council of ISACs but have significant involvement with maritime industry stakeholders. All four have varying levels of services, engagement, and recognition by Federal agencies. Federal stakeholders are monitoring the development of these groups to gauge their respective ability to broadly and efficiently facilitate the sharing of maritime cybersecurity threat and mitigation information (i.e. best practices and lessons learned) among maritime industry stakeholders, as well as to facilitate appropriate information sharing between government and industry stakeholders.

In March 2020, the USCG issued a Navigation and Vessel Inspection Circular (NVIC) NO. 01-20, ***Guidelines for Addressing Cyber Risks at Maritime Transportation Security Act (MTSA) Regulated Facilities.***[23] This NVIC provides guidance to facility owners and operators on complying with the requirements to assess, document, and address computer system and network vulnerabilities. In accordance with 33 CFR parts 105 and 106, which implement the Maritime Transportation Security Act (MTSA) of 2002, regulated facilities (including Outer Continental Shelf facilities) are required to assess and document vulnerabilities associated with their computer systems and networks in a Facility Security Assessment (FSA). Regulations require that any cybersecurity vulnerabilities identified in the FSA must be addressed in the Facility Security Plan (FSP) or Alternative Security Program (ASP).

The NVIC does not change the existing requirements found in regulation; it only provides guidance on how facility owners or operators may meet those requirements. Owners and operators may choose alternatives to the guidance in the NVIC if those alternatives meet the regulatory requirements.

In order to assist facilities in incorporating cybersecurity into their FSAs and FSPs, an implementation period of 1.5 years is being provided, ending 09/30/2021. Facility owners and operators who already address cybersecurity in their FSAs and FSPs/ASPs should continue doing so, while considering whether the guidance in NVIC 01-20 can improve their ongoing practices.

Finally, in recognition of the importance of effective cybersecurity policy to the MTS, the National Maritime Cybersecurity Plan was approved in December, 2020. The Plan lays out priority actions within three separate action areas: risks and standards, information and intelligence sharing, and creating a maritime cybersecurity workforce. The Plan unifies maritime cybersecurity resources, stakeholders, and initiatives, aggressively mitigating current and near-term maritime cyberspace vulnerabilities and complements the seven supporting plans of the National Strategy for Maritime Security. As the landscape of cybersecurity threats rapidly evolves, the Plan is designed to be reassessed and updated no less than once every 5 years through the policy coordination committee process.[24]

CHALLENGES

- Ensuring that all maritime stakeholders have awareness to risks and mitigation techniques to reduce vulnerabilities to malicious cyber effects.
- Need for a single, diverse, uniformly recognized maritime cyber ISAC as a trusted partner between the maritime sector and government authorities. The Maritime Sector Coordinating Council under DHS and the National Maritime Security Advisory Committee under USCG are not designed to receive, assess, and disseminate proprietary cyber related incidents from the private sector to government.

AREAS FOR SECURITY POLICY CONSIDERATION

Maritime Domain Awareness

- Sustain efforts to establish new and maintain existing information sharing partnerships among the Federal and State governments and law enforcement.
- Continue ongoing efforts to enhance coordination among stakeholders and collaboration through education and outreach.
- Improve maritime domain awareness through enterprise-level access to maritime data for use by whole-of-government.

Critical Infrastructure Protection

- Jointly develop priorities among stakeholders.
- Formalize, as appropriate, the interagency partnership of the Government Maritime Coordinating Committee.
- Utilize incentives to encourage private sector investment in MTS resilience and security when individual firms cannot monetize the system-wide benefits of their investments.
- Analyze infrastructure dependencies, interdependencies and associated effects.

- Identify and assess potential unanticipated infrastructure cascading effects during and following incidents such as secondary impacts from COVID-19.
- Continue to promote and support infrastructure, community, and regional recovery following incidents.
- Strengthen coordinated development and delivery of technical assistance, training, and education.
- Improve critical infrastructure security and resilience by advancing research and development solutions.
- Continue to learn and adapt during and after exercises and incidents. Develop a set of national multi-year priorities with input from all levels of government and private sector stakeholders. Develop appropriate metrics as a basis for assessment of the effectiveness of current and future protection methods which may include documented training, standard operating procedures and drills and exercises.

Vessel and Facility Security

- Expand advanced electronic information to support cargo risk assessments.
- Further develop business security procedures to secure cargo at loading.
- Expand capabilities to screen for illicit cargo such as weapons of mass destruction
- Continue to assess the effectiveness of ISPS code implementation to prevent smuggling of weapons of mass destruction, other volatile materials, and/or stowaways while a vessel is in port.
- Strengthen engagement with cargo owners in AMSCs and other relevant information sharing and outreach activities.
- Review regulations for container seals and other measures to ensure cargo integrity.
- Continue to enhance in-transit visibility through improved maritime domain awareness and electronic cargo information.
- Promote effective international standards in the areas of business practices and data management.

Cybersecurity

- Strengthen public and private sector relationships to share cybersecurity best practices.
- Assess and evaluate cyber incident response protocols and interagency relationships through exercises, drills, and assessments to increase cybersecurity incident response and cybersecurity defense.

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SECTION 4: MARINE TRANSPORTATION SYSTEM ENVIRONMENTAL STEWARDSHIP

Marine transportation is a very efficient form of commercial transportation and the dominant mode of cargo transportation connecting the United States to the rest of the world.[1] The energy used and air emissions per ton-mile of freight moved are lower than combined land transport.[2]

The Federal Government has addressed protection of the marine environment for decades. The Federal Government, in concert with U.S. States and the IMO engages in environment-related initiatives associated with maritime vessel operations (i.e. ballast water management and aquatic nuisance species, air emissions, water pollution, underwater noise generation, and ship strikes of marine mammals and other marine life). Landside impacts related to maritime transportation are often related to vessel operations while in port, emissions from shore cranes and other cargo handling equipment, trucks, and rail equipment at and adjacent to docks, terminals, and intermodal connections. International, Federal, and State environmental regulations have broadened in scope; in some cases, have become more stringent, and are not always aligned across jurisdictions. For example, some states have enacted environmental requirements more stringent than Federal requirements, such as California's regulation of port-related air pollution.

Three environmental stewardship areas are discussed in this Assessment to highlight critical environmental issues in the MTS:

Vessel Operations and Associated Programs: Environmental implications of shipping are diverse and are subject to regulatory oversight at the international, national, state, and local levels. In the U.S., environmental requirements are issued and enforced by various Federal, state, and local agencies.

Alternative Fuels and Technologies: Focus on new technologies for cleaner domestic and international marine transportation is growing rapidly in an effort to comply with stricter SOx and NOx requirements in addition to concerns over greenhouse gases (GHG) emissions.

Marine Environmental Response: Prevention, response, and mitigation of the introduction of contaminants into the marine environment from marine transportation engages international, national, State and local stakeholders. Response requires a robust response community with authorities to take immediate action, in tandem with industry.

VESSEL OPERATIONS AND ASSOCIATED PROGRAMS

As ships transit domestic or international waters, they can be vectors for moving, depositing, and expelling contaminants into oceans, inland systems, and the air. The value of waterborne transportation to trade, national economies, and our every-day lifestyle is well-recorded. And, while maritime transportation has also been recorded as being less detrimental to the environment than other modes, carrying international trade from and to all points on the globe, from the Mississippi River System to the Suez Canal, from the Great Lakes to South America and beyond, can have environmental impacts as well.

The IMO provides a global forum for Member States to consider and adopt international maritime safety and environmental requirements through international treaties. The United Nations Convention on the Law of the Sea (UNCLOS) contains an over-arching framework to protect the marine environment and holds accountable ships that damage the environment. Although the United States has not acceded to UNCLOS, its treatment of the traditional uses of the oceans is considered customary international law to which the United States adheres.

In the Federal Government, various agencies, including the EPA, USCG, and NOAA, develop and implement environmental requirements. State and local governments may also adopt environmental requirements that affect the MTS. This requires maritime operators to consider multiple domestic stakeholder requirements and standards which may differ from international standards established by IMO and other countries. Inconsistent standards impact types of equipment, crew requirements, speed restrictions, and other operating parameters.

Improved coordination and outreach benefit the regulated community in key areas: water polluting discharges (e.g., ballast water, gray water, and oily water), air pollution from main and auxiliary engines, and impacts on sensitive natural resources like marine mammals.

Vessel Incidental Discharge Act - On December 4, 2018, the President signed into law the Vessel Incidental Discharge Act (VIDA). VIDA restructures the way EPA and the USCG are to regulate incidental discharges, primarily from commercial vessels, into waters of the United States and waters of the contiguous zone out to 12 miles from shore. This law is intended to streamline the patchwork of Federal, state, and local requirements for the commercial vessel community. Specifically, VIDA requires EPA to develop new national standards of performance for commercial vessel discharges by December 2020, and the USCG to develop corresponding implementing requirements two years thereafter. These new requirements are to be technology-based and, with few exceptions, at least as stringent as existing Federal requirements. Current requirements remain in effect until new USCG implementing requirements are final, effective, and enforceable for all incidental discharges.

At that point, many of the pre-existing EPA and USCG requirements cease to apply and states, political subdivisions of a state, and interstate agencies are prohibited from adopting or enforcing

any more stringent requirement. VIDA does revise the CWA to provide EPA, the USCG, states, and political subdivisions of a state with authority to enforce these new Federal VIDA requirements. In a May 2018 Federal Register Request for Information, the Office of Information and Regulatory Affairs (OIRA) under the Office of Management and Budget, sought public comment on how best to achieve meaningful burden reduction in the maritime sector—across all agencies operating in this space—while continuing to fulfill agencies' statutory responsibilities and objectives. There were 19 comments related to the VIDA. Eight comments were in support of passing the VIDA (subsequently passed in December of 2018) and eleven comments were critical of the vessel discharge, eight of which were specifically about the Vessel General Permit (VGP), either to eliminate or streamline recordkeeping.

VIDA includes several provisions for states to petition EPA or the USCG to establish more stringent requirements, including to issue emergency orders, to establish more stringent national standards and requirements, or to establish no discharge zones for any of the incidental discharges in any portion of state waters. Upon enactment, VIDA also exempts small vessels (less than 79 feet in length) and all fishing vessels, from Federal discharge requirements, except for ballast water.

Vessel General Permit (VGP) - Under the authority of the *Clean Water Act* (CWA), EPA has been regulating discharges incidental to the normal operation of commercial vessels since 2008 through the VGP. Vessel owners and operators have been required to comply with permit requirements for 27 different incidental discharges, including ballast water, graywater, bilge water, deck washdown, hull cleaning, exhaust gas scrubber wash water, oil discharges from equipment with oil-to-sea interfaces, and others. Generally, the VGP is applicable to commercial vessels greater than 79 feet in length operating in U.S. inland and coastal waters out to three miles from shore. Affected vessel types include tankers, cargo ships, cruise ships, ferries, barges, tugboats, and other utility vessels, as well as commercial fishing vessels. The VGP also includes state-specific conditions for 25 of the U.S. states pursuant to authority granted to the states under Section 401 of the CWA. As noted under the discussion of the VIDA, stakeholder comments from an OIRA Request for Information in 2018 received eleven comments that were critical of vessel discharge, 8 of which were specifically about the Vessel General Permit.

Pursuant to VIDA, the existing VGP requirements continue to be in full force and effect, and unchanged, until the new USCG VIDA implementing requirements are final, effective, and enforceable.

Ballast Water - Ballast water is vital to safe ship operations. It acts as a stability aide and offsets dangerous hull stresses when ships sail without cargo (which is referred to as “sailing in ballast”). Tankers and dry bulk carriers routinely sail in ballast and container ships routinely use ballast water to manage stability, hull stress conditions, and for trimming during cargo operations. The practice of taking on ballast water in one body of water and releasing it in another has caused problems throughout the world and has been the primary focus by U.S. regulators for the management of vessel discharges. In the United States, the practice has

introduced invasive animals, plants, and pathogens into coastal, lake, and river waters including the zebra mussel, round goby, alligator weed, and harmful species of phytoplankton. In the Great Lakes, for example, at least 25 invasive species of fish have entered the system since the 1800s.

In addition to regulation of ballast water under the EPA VGP, the USCG implements a regulatory program for ballast water management pursuant to the Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA) as reauthorized and amended by the National Invasive Species Act (NISA). Under the USCG regulatory program, vessels are required to demonstrate compliance with numeric discharge standards, typically through the installation and operation of a USCG type-approved ballast water management system (BWMS). As of June 2020, the USCG has type-approved more than 30 different BWMS, with these systems primarily based on filtration followed by UV- or chlorine-disinfection. Prior to the compliance date, including any vessel-specific authorized USCG extension to that date, vessels are generally required to perform a ballast water exchange or use an alternative BWMS type-approved by a foreign-flag administration, until such time as a USCG-type approved BWMS is installed onboard the vessel. Similar to the VGP, the USCG ballast water requirements remain in effect until the new USCG VIDA implementing requirements are final, effective, and enforceable.

As noted, State requirements can be more stringent and several U.S. states have enacted their own requirements aimed at preventing the introduction and spread of aquatic invasive species. As described above, states will be unable to adopt or enforce more stringent requirements for these discharges once the new USCG VIDA requirements are in force and effect.

Member States of the IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediment in 2004 (BWM). While this treaty entered into force in September 2017, the U.S. is not a party to the BWM Convention, and therefore U.S. ballast water requirements are not directly affected by this international treaty. However, the international nature of shipping strongly supports the goal of the U.S. continuing to participate in IMO discussions of ballast water management, such as has been done for decades. For example, the USCG worked closely within the IMO recently to more closely harmonize the international BWMS testing procedures used to certify ballast water management systems with the USCG type-approval processes. Of particular importance, Canada, as a party to the BWM Convention, is updating its requirements and issues are being raised about the potential for disparity in the different U.S. and Canadian requirements for U.S. vessels operating in boundary waters such as the Great Lakes.

U.S./Canadian Regulatory collaboration - There are several tools in place to establish working relationships and dialog among public, private, and international stakeholders on ballast water and other vessel discharge issues, mostly related to the health of the Great Lakes. For example,

the Great Lakes Water Quality Agreement is a U.S.-Canadian agreement initially signed in 1972 and last updated in 2012 that facilitates United States and Canadian action on threats to Great Lakes water quality and includes measures to prevent ecological harm. Annexes of the agreement that address significant shipping concerns include discharges from vessels, aquatic invasive species, and climate change impacts. It also supports continued work on existing threats to people's health and the environment in the Great Lakes basin such as nutrients, habitat degradation, and groundwater protection.

Another collaborative effort is the bi-national Ballast Water Working Group (BWWG), formed in 2006, that brings together representatives from the USCG, U.S. Saint Lawrence Seaway Development Corporation (SLSDC), Transport Canada Marine Safety, and the Canadian St. Lawrence Seaway Management Corporation (SLSMC) to coordinate regulatory, compliance, and research efforts for reducing aquatic nuisance species invasions via ballast water in the Great Lakes. The program has been effective at both reducing the risk of introduction of aquatic invasive species into the Great Lakes and ensuring extremely high compliance rates by industry.

In June 2020, the Federal Maritime Commission (FMC) ruled unanimously to accept a petition from the Lake Carrier's Association (LCA) alleging that Transport Canada's proposed ballast water regulations are unfavorable to shipping in the United States/Canada trade.

In Federal Register Notice 2020-13313, the FMC notes that the proposed regulations by Transport Canada would exempt vessels of a non-signatory party to the IMO Convention on the management of ship's ballast water – such as the U.S. – if those vessels operate exclusively within the Great Lakes Basin and do not load ballast water from or release ballast water into Canadian waters. Many of the U.S. flag "lakers" under the LCA call on Canadian ports in the Great Lakes.[3] The LCA postured that the rule requires U.S. flag vessels in the Great Lakes to install ballast water treatment technology in order to call on a Canadian port.

The Pacific Ballast Water Working Group (PBWG) was formed in 1998 following a series of informal meetings of West Coast state/provincial and Federal agency and shipping industry representatives from the US and Canada concerned about the introduction of aquatic nuisance species through ballast water discharge. The PBWG serves as a coordinating body to share information and formulate consensus solutions on ballast water management and research issues of common concern to regulators, managers, scientists and the shipping industry on the West Coast (Canada, California, Oregon, Washington, and Alaska).[4]

Other Discharges – Decades ago, discharges of ship-generated garbage into open waters, discharging tank washing from oil and chemical tanks, and pumping bilge water into the ocean was common practice. In order to provide effective stewardship of the maritime ecosystem, rules and requirements were enacted on international, national, and regional levels. On an international level, the International Convention on the Prevention of Pollution from Ships (MARPOL)[5] addresses these areas:

- Annex I – Regulations for the Prevention of Pollution by Oil
- Annex II – Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
- Annex III – Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
- Annex IV – Prevention of Pollution by Sewage from Ships (United States is not a party to Annex IV although sewage pollution is controlled under Clean Water Act authority)
- Annex V – Prevention of Pollution by Garbage from Ships
- Annex VI – Prevention of Air Pollution from Ships

In 1980, Congress enacted the Act to Prevent Pollution from Ships (APPS) [33 U.S.C. §§1905-1915] which implements MARPOL and the annexes[6], forbidding or restricting the discharge of oils, noxious liquid substances, dry cargo residues, sewage, and garbage. The U.S. is not party to MARPOL Annex IV; therefore, sewage discharges are regulated domestically under the CWA. Vessels with installed toilets are required to be fitted with USCG approved Marine Sanitation Devices to either treat sewage to levels established by EPA as required under the CWA or hold sewage on board for later disposal at an appropriate facility. In addition, under the CWA, States may request the establishment of vessel sewage "no-discharge zones," areas where the discharge of both treated and untreated sewage from vessels is prohibited. No-discharge zones have been established in bodies of water across 30 States.

AIR EMISSIONS

Emissions from marine diesel engines and their fuels affect human health by contributing to air pollution in regions around seaports, other coastal areas, inland waterways, and are transported far inland as well. The fuels largely used by vessels include gasoline, diesel fuel, and residual fuel oil, which, when combusted, can release particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO), sulfur oxides (SO_x), carbon dioxide (CO_2), and air toxics. EPA estimates that millions of people in the United States currently live in close proximity to ports. These people can be exposed to air pollution associated with emissions from diesel engines at ports including particulate matter, nitrogen oxides, ozone, and air toxics, which can contribute to significant health problems—including premature mortality, increased hospital admissions for heart and lung disease, increased cancer risk, and increased respiratory symptoms – especially for children, the elderly, outdoor workers, and other sensitive populations.

In 2017, U.S. water transportation consumed 170.4 trillion British Thermal Units (BTUs) of gasoline, 290.5 trillion BTU of diesel fuel, and 669.6 trillion BTU of residual fuel oil and consumed 517.3 thousand barrels/day of petroleum.[7] Ocean-going cargo ships, most of which are flagged in other countries, are typically powered by large, slow-speed diesel engines that burn heavy fuel oil (HFO). HFO is a low-cost fuel, when compared to distillate diesel fuel, and

has a much higher sulfur content. The level of sulfur in the fuel being used is directly proportional to the level of SO_X emissions generated. Together, the 90,000 ships worldwide burn 370 million tons of fuel each year – and produce 20 million tons of sulfur oxide. In inland shipping, marine diesel is used as a fuel, which is less harmful than heavy fuel oil when it is combusted. In addition, fewer dangerous nitrogen oxides are emitted.[8]

The Clean Air Act of 1970 and 1990 amendments authorized the development of comprehensive Federal and State requirements to limit air emissions from both stationary and mobile sources, including non-road sources integral to the MTS, such as vessels, locomotives, and non-road diesel equipment used at ports.

In 1997, in order to address maritime generated air pollution, the Member States of the IMO adopted a set of international marine diesel engine standards and fuel sulfur limits. These standards, which are contained in the MARPOL Annex VI, came into force in 2005 after the requisite number of ratifications was obtained. The U.S. acceded to the annex in 2008, when MARPOL Annex VI was amended to include more stringent engine standards and fuel sulfur limits.

In 2010, the U.S. joined with Canada and France to obtain Emission Control Area (ECA) designation for waters extending as far as 200 nautical miles off the coasts of much of North America as well as the eastern parts of Alaska and Hawaii. The following year, the United States obtained ECA designation status for the Commonwealth of Puerto Rico and the U.S. Virgin Islands. ECAs are part of EPA's Coordinated Strategy to reduce emissions from large ships that operate in and around the United States and are designated through amendment to MARPOL Annex VI.

The North American ECA sets emissions standards for both SOx and NOx. EPA projected that the implementation of the North American ECA would reduce annually 320,000 tons of NOx, 90,000 tons of fine particulate matter (PM2.5), and 920,000 tons of SOx emitted from ships, corresponding to reductions of 23%, 74%, and 86% respectively of levels in 2020. The value in health-related benefits of the ECA was projected to be as much as $110 billion in value, including preventing 14,000 premature deaths and relieving respiratory symptoms for millions.[9] The implementation of the North American ECA also had quantifiable improvements on air quality in the U.S. Kotchenruther (2017) found and quantified statistically significant reductions in the contribution of RFO to PM2.5 concentrations in 13 sites around the country from before the NA-ECA compared to after the NA-ECA.[10]

The sulfur content of the fuel used in ships operating in these ECAs may not exceed 1,000 ppm, as of January 1, 2015. Outside of designated ECAs, the sulfur limit was reduced to 0.50 percent m/m (previously the limit was 3.5 percent) beginning January 1, 2020. Ships can meet these sulfur limits by burning low sulfur fuel oils or liquid/compressed natural gas (LNG/CNG). In

addition, engines installed on ships operating in a designated ECA must meet stringent NOx limits. For the North American and U.S. Caribbean Sea ECAs, engines on ships constructed on or after January 1, 2016 must meet Tier III NOx limits (80% reduction from Tier I) while operating in a designated NOx ECA. Outside of designated NOx ECAs, the NOx Tier II standards are in place (20% reduction from Tier I). While the Tier I and II NOx standards can be achieved using engine-based controls, the Tier III NOx standards are expected to require emissions "after treatment" for vessels operating on HFO.

MARPOL Annex VI permits the use of equivalent methods to meet the emission standards. For the sulfur limits, this generally means the use of alternative fuels, such as liquefied natural gas (LNG), or exhaust gas cleaning systems (scrubbers).

In an effort to further reduce emission from ships**,** some commercial operations and ports and terminals are implementing or exploring the increased use of shore power when ships are at idle in ports. This is known as *cold ironing*. When engaged in cold ironing, a ship receives electrical power from shore instead of using on board generators, reducing ship-generated air emissions while at berth. Shore power can come from a port city's power grid or from other more localized cleaner power sources.

California ports that serve cruise, container, and reefer vessels have at-berth requirements dictating the use of shore power by ships that visit their ports, and thus the ports provide cold ironing infrastructure. While the practice may be contributing to the reduction of air pollution in those port cities, the equipment required to be installed on board is only useful in ports that provide the option for shore power. As of July 2020, ten U.S. ports provide shore power capabilities for container, reefer, and cruise ships. California's At-Berth Regulation covers six ports: Los Angeles, Long Beach, Oakland, San Diego, San Francisco, and Hueneme. The other ports with cold ironing capability are Tacoma, Seattle, Juneau, and Brooklyn Cruise Terminal.

In 2017, EPA's Office of Transportation and Air Quality (OTAQ) published the report, *Shore Power Technology Assessment at U.S. Ports*[11]*,* which characterizes the technical and operational aspects of shore power systems in the United States. The report also presents a methodology for calculating emission reductions of using shore power. The initial findings note that shore power may be an important method to significantly reduce diesel emissions from ships at dock thus benefitting air quality for communities located near ports.

To further reduce emissions from vessels as well as landside diesel equipment and vehicles at ports, OTAQ established the EPA Ports Initiative. This program is responsive to 2016 recommendations from the Clean Air Act Advisory Committee[12] on designing a voluntary program to improve air quality around ports, as well as input during an EPA-led national conversation on ports in 2013-2014, which brought together a wide variety of stakeholders from community organizations, port authorities, shippers, local governments and academia. The EPA

Ports Initiative works in collaboration with port stakeholders to help accelerate the adoption of cleaner technologies and operational strategies, as well as good planning practices that pave the way for strategic clean air projects such as emissions inventories, clean air plans, and community engagement.

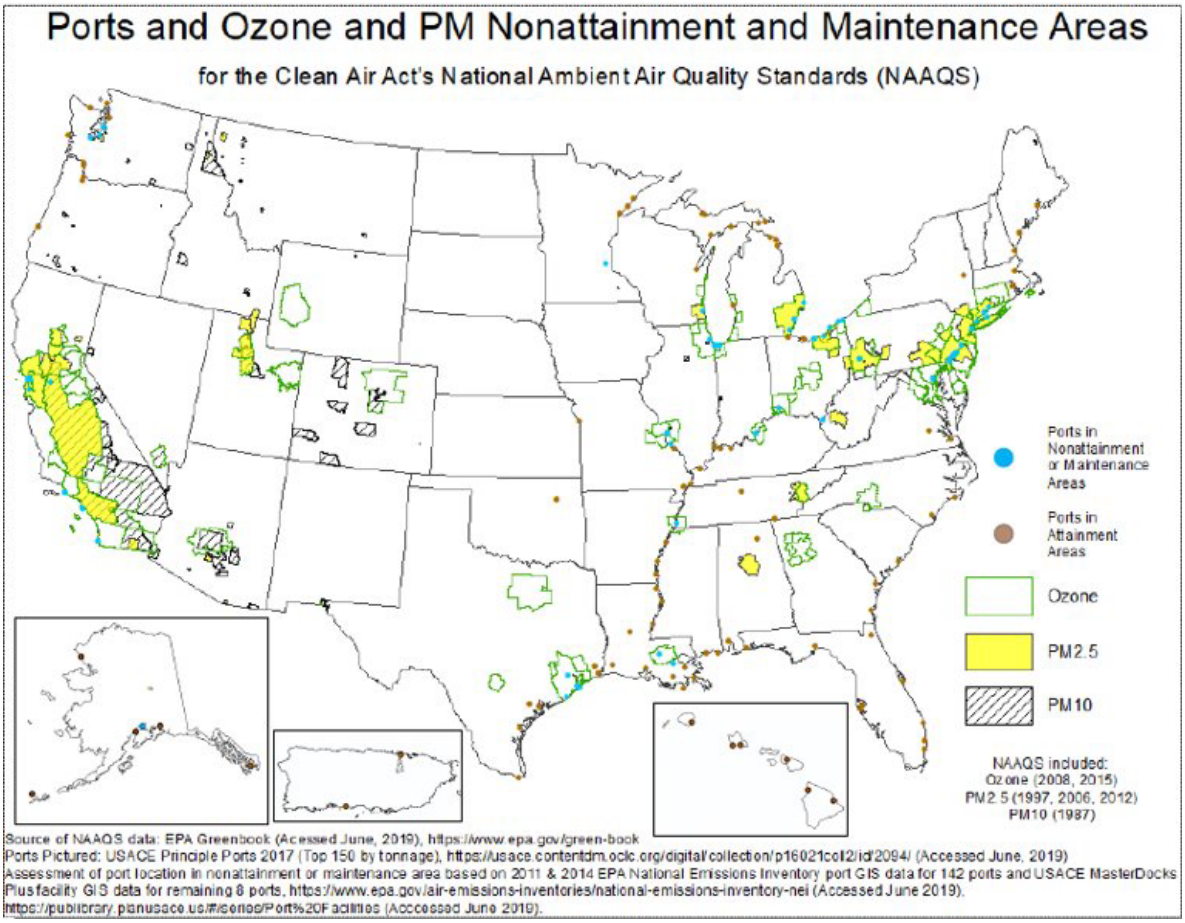

FIGURE 16: This map illustrates the regions where principal pollutants exceed National Ambient Air Quality Standards and the ports that fall within the nonattainment or maintenance areas.

The Ports Initiative helps port authorities and other port operators better understand their energy use and emissions, including through measurement tools and other technical resources that can help identify the best clean air investments. For example, in 2016 EPA published a *National Port Strategy Assessment*[13] exploring available strategies to reduce emissions from port-related vehicles and equipment; and in 2020 released updated *Methodologies for Estimating Port-Related and Goods Movement Mobile Source Emissions Inventories*.[14] The Ports Initiative is also focused on engagement with other Federal organizations and agencies (i.e., CMTS, MARAD,

DOE, NOAA, USCG, Navy and USACE) in supporting air quality projects in port areas, as well as identifying viable cost-effective funding for air quality improvement infrastructure such as the EPA's Diesel Emissions Reduction Act (DERA) grant program. These funding opportunities can be utilized to accelerate emission reductions from diesel engines at ports.

SENSITIVE NATURAL RESOURCES

As ships travel, it is inevitable that they will come into close proximity with sensitive natural resources such as resident or migrating sea life (e.g., marine mammals, birds, fish, and sea turtles) and coastal or near-shore ecosystems. Marine mammals use sound for vital functions such as communication, individual recognition, predator avoidance, prey capture, orientation, navigation, mate selection, and mother-offspring bonding. Anthropogenic sound is produced by numerous sources including seismic operations and ship engines. Noise from shipping is generally in the 20 to 300 Hz range which is the same range used by many whale species, therefore the sounds are within their hearing range and have the potential to disturb their behavior or interfere with their communication. The potential adverse effects of sound on marine mammals and other species include physical injury, physiological dysfunction, disturbance, and behavioral modification.[15]

FIGURE 17 – North American right whale mother and calf (photo credit: NOAA)

Fatal ship and boat strikes in U.S. waters have involved various species of cetaceans, including right, humpback, blue, and minke whales. It is uncertain to what extent vessel noise is a contributing factor to ship strikes. Many ship strikes occur on the continental shelf or slope where there are high concentrations of both cetaceans and shipping traffic. Vessel size and speed are factors, with studies showing that both the risk of ship strikes and of death in the event of a strike, are reduced as vessel speed is reduced. With an approximate population of 400, the North Atlantic right whale has been listed as an endangered species under the *Endangered Species Act* since 1973. NOAA's National Marine Fisheries Service instituted rules in 2008 (renewed indefinitely in 2013) requiring all vessels transiting designed Seasonal Management Areas to maintain speeds at not more than 10 knots and asking for voluntary speed restriction transiting Dynamic Management Areas. Ships are also required to report right whale sighting. U.S. Federal requirements state that all vessels and aircraft must stay a minimum of 500 meters away from North Atlantic right whales. In addition, shelf and slope areas near major ports experience heavy shipping, leading to increased stress, disturbance, and masking of whale vocalizations.

Ship wakes are another environmental disturbance. They can dissipate harmlessly or they can adversely affect shoreline characteristics. Examples of impact are re-suspension of sediment in the water, allowing it to be carried and deposited elsewhere, and inundation of bird nests in tidal marshes. Wakes vary according to ship size, speed and direction, and water depth. Under-keel clearance is also a factor, particularly in narrow shallow waters where a ship's handling characteristics and wake patterns are different. Wake effect is best controlled through speed management.

Providing sufficiently deep navigation channels for large ships requires regular dredging. Dredging disturbs benthic habitats. Dredged material must be appropriately managed to protect human health and the environment. Dredged material can be appropriately disposed in open water or on land. Some dredged material can be used beneficially materials, i.e. to help build critical wetlands and provide fill material for development.

Infrastructure that supports the MTS can also potentially harm the marine environment. For example, physical ATONs negatively impact their surrounding benthic environment through physical contact, potentially damaging sensitive natural resources.

CHALLENGES

- While many ports are seeking ways to improve air quality and provide alternative energy sources to vessels, air quality remains a challenge at many ports and for near-port communities.
- Unless managed, vessel wildlife interactions are likely to increase with recovering marine mammal populations and increased shipping around the continental United States.
- Increased Arctic shipping holds potential consequences for endangered species, e.g., North Pacific right whale, bowhead whale, and walrus. In addition, the Bering Sea, Chukchi Sea, and Bering Strait regions are also home to vast seabird populations that could be impacted by shipping accidents. Alaskan Native communities are also seeking to address concerns about possible interference of marine traffic with their traditional subsistence hunting via disturbance of marine mammals.
- Identifying additional compliance assistance, monitoring, inspection, and enforcement tools to improve compliance with requirements for vessel discharges, emissions, and other environmental requirements.

ALTERNATIVE FUELS AND TECHNOLOGIES

Alternative technologies for marine fuels and energy have great potential for improving the environmental footprint of waterborne commerce. Recent international and national standards for conventional marine fuels, innovative new fuel concepts, new exhaust remediation

technology, and shore-to-ship alternative powering techniques are providing policies, products and methods to reduce emissions.

Historically, the marine industry has relied largely on carbon-based fuels, and specifically HFO, but advances in available technologies and fuels, requirements, and priorities are shifting the diversity of fuels used in the maritime sector. The existence of ECAs provides vessel operators operating within U.S. waters additional motivation to shift to less polluting fuels and mechanisms. Mandated decreases in the allowable sulfur content of fuel oil will drive continuing efforts to find and use lower sulfur fuels.

Liquefied Natural Gas (LNG)
LNG is a clean burning, non-renewable fossil fuel consisting primarily of methane (CH_4) and very little sulfur. The outlook for U.S. natural gas supply has changed significantly over the past few years, primarily due to the evolution of horizontal drilling and hydraulic fracturing; these techniques have enabled energy companies to tap the huge shale gas reserves in the U.S. at commercially sustainable rates.

There are more than 110 LNG facilities operating in the U.S. performing a variety of services. Some facilities export natural gas from the U.S., some provide natural gas supply to the interstate pipeline system or local distribution companies, while others are used to store natural gas for periods of peak demand. There are also facilities which produce LNG for vehicle fuel or for industrial use. Depending on location and use, an LNG facility may be regulated by several Federal agencies and by State utility regulatory agencies. The Federal Energy Regulatory Commission (FERC) is responsible for authorizing the siting and construction of onshore and near-shore LNG import or export facilities under Section 3 of the Natural Gas Act.[16]

The use of LNG as a marine fuel is not new to the marine industry and has been the primary fuel source for the boilers of LNG carriers as a way of utilizing cargo boil off for over 50 years. Low prices and the environmental benefits of LNG are fueling the growth of natural gas as a transportation fuel. U.S. and international interest in LNG as a marine fuel for new construction is strong with consideration being given to vessel conversions. However, LNG is not without its disadvantages and challenges. The cost of supply/refueling infrastructure and the price difference between LNG and conventional fuel does not currently provide sufficient return on investment for wide-scale adoption. Furthermore, LNG has a lower BTU value than conventional fuels.

As noted, LNG as a main fuel is promising but mostly with lean burn spark ignited engines and low-pressure dual fuel. The main drawback of low-pressure gas engines is rather high levels of methane slip, especially at low loads, as a result of poor fuel utilization due to low operational fuel–air ratios. In addition, there are no standards that directly regulate methane slip for marine gas engines.[17] Safely storing large amounts of LNG poses additional challenges, particularly for

smaller vessels. Interlake Steamship Company has put their LNG conversion plans on hold for the foreseeable future because installation plans for a refueling site on the Great Lakes were shelved. Within the U.S. alone, several new ships have been built with dual-fuel engines, including a number of U.S. flagged offshore supply vessels and container vessels. Other U.S. new build projects are designed to accommodate a change from oil to LNG power at a future point in time.

A few examples of maritime-related LNG activities taking place in the United States include:

- In late 2015 and early 2016 Totem Ocean Carrier Express (TOTE) built two new dual fuel (LNG and diesel fuel) 3100 TEU container ships in its service to Puerto Rico. Constructed at NASSCO Shipyard in San Diego, these are the world's first container ships built to operate on LNG. However, the plans to complete retrofitting of two roll-on/roll-off-container ships to operate on LNG in service to Alaska was pushed off.
- Crowley has two dual-fuel ConRos (combination of a container ship and a Roll-on Roll-off ship) operating on a Jacksonville/Puerto Rico route.
- Matson, in addition to its dual-fuel Aloha Class container vessels completed in 2018 and 2019, has accepted delivery of one of two Kanaloa Class dual-fueled ConRos ships for Hawaii service.
- Pasha has two LNG as fuel container vessels under construction at Keppel in Brownsville, TX.
- In the offshore oil industry, Harvey Gulf has five U.S. flag, dual fuel offshore supply vessels in operation and three additional under construction.
- Crowley Maritime is operating four tankers and an American Petroleum Tankers affiliate is operating four tankers that are LNG conversion capable.
- VT Halter Marine designed and constructed *Q-LNG 4000* barge, designed to provide ship-to-ship transfers of LNG to vessels that use LNG as a fuel source and also ship-to-shore transfers to small scale marine distribution infrastructure in the U.S. Gulf of Mexico and abroad.
- Fincantieri Bay Shipbuilding laid the keel on June 24, 2020 for the construction of a LNG bunker barge for Polaris New Energy. The barge will be named the Clean Canaveral and will operate as an articulated tug and barge unit that initially runs along the U.S. East Coast providing LNG bunkering solutions.[18]

Biofuel

Biodiesel, a subset of biofuel, is a domestically produced, renewable fuel that can be manufactured from vegetable oils, animal fats, recycled restaurant greases, or other feedstocks. Most biodiesel in the United States is made from soy. The processes for manufacturing biodiesel are complex, although the resulting fuel has no sulfur content and is therefore being considered

for use in the marine environment. Since 2002, NOAA has been operating four research vessels on the Great Lakes using B100 soy-based biofuel.

The U.S. Navy initiated a biofuel program, called "Great Green Fleet," in 2012 to provide more operational flexibility and support rural economies. In January 2016, Navy promoted an event to demonstrate the destroyer USS William P. Lawrence being refueled with a blend of diesel and biofuel. The ship was part of a strike group intended to upgrade other Navy ships to receive the biofuel blend by the end 2017.[19] Since then, the program has been scaled back and in 2018, Navy cancelled plans to retrofit 34 destroyers to run partly on electric power.

In 2009, a working group of three Government agencies, U.S. Department of Agriculture (USDA), DOE, and the EPA, was formed to study the use of biofuels as a greenhouse gas reduction effort.[20] There are a plethora of biofuel laws and incentive programs from the Federal Government which can be found at https://afdc.energy.gov/fuels/laws/BIOD?state=US.

Electric

Many ships have been partly electrified through a diesel-electric transmission system. Diesel generators generate the electricity, which then drives the electric engine. This moves the ship's propeller, which can save between five and twenty percent of the fuel. The electrical machines also consist of fewer components, are less prone to faults, and have less wear and tear. This translates into reduced energy loss and higher efficiency.[21]

Hydrogen and Hydrogen Fuel Cells

For several years, there has been a determined effort involving DOE, national labs, MARAD, and others to research and demonstrate fuel cells and hydrogen for maritime applications. The technology has many technical, infrastructure, supply chain, safety considerations, and safety requirements that must be addressed to make these technologies viable for commercial marine application.

The Department of Energy's H2@Scale initiative is a "concept that explores the potential for wide-scale hydrogen production and utilization in the United States to enable resiliency of the power generation and transmission sectors, while also aligning diverse multibillion dollar domestic industries, domestic competitiveness, and job creation."[22] H2@Scale "brings together stakeholders to advance affordable hydrogen production, transport, storage, and utilization to increase revenue opportunities in multiple energy sectors. It includes DOE-funded projects and national laboratory-industry co-funded activities to accelerate the early-stage research, development and demonstration of applicable hydrogen technologies."[23]

The cost of hydrogen and the associated infrastructure to support it, is a major hurdle to the wide-spread adoption. Port facilities, by the nature of their high density of diverse activities and specialized cargo handling equipment, provide an opportunity for economies of scale for hydrogen. Figure #18 illustrates the wide variety of equipment that could utilize hydrogen in a port complex, Figure 19 shows the resulting potential for hydrogen demand at some of the top U.S. ports, and Figure 20 shows potential Hydrogen demand at ports. Co-locating clean hydrogen production with multiple end uses at ports in one way that economies of scale can help drive down cost and establish the needed infrastructure for hydrogen – one of the objectives of the H2@Scale initiative.

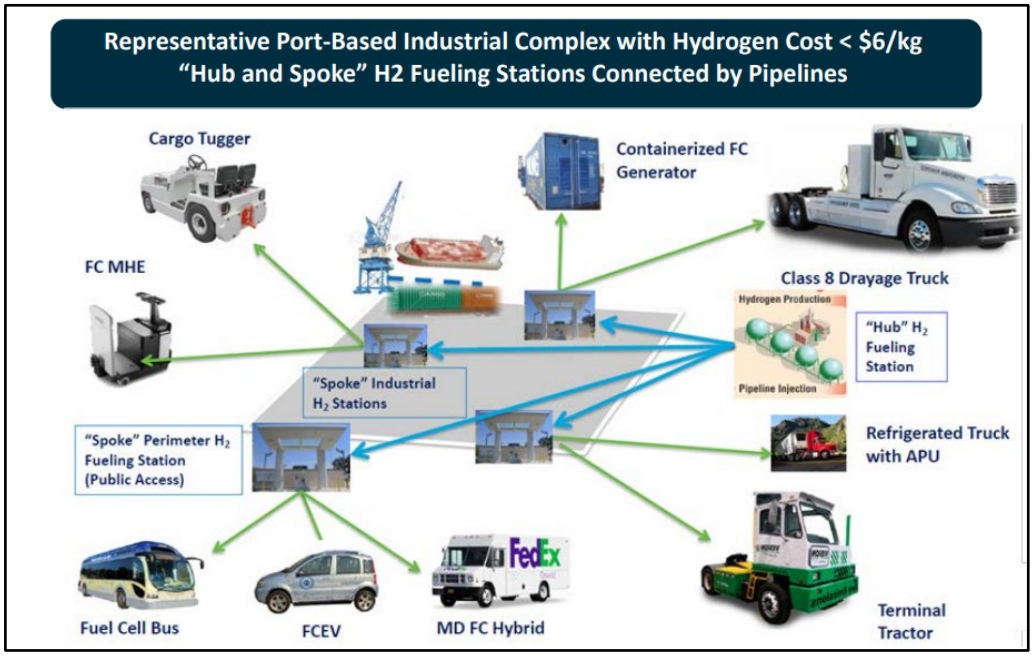

FIGURE 18 – "Clustering" Fuel Cell Electric Vehicles (FCEVs) can drive H2 Demand in Port-Based Distribution Complexes. (Satyapal 2019).[24]

From August 2015 to June 2016, Sandia National Laboratories, under sponsorship from DOE and MARAD, conducted an operational test of a prototype 100 kW hydrogen fuel cell generator purpose-built for marine application. The purpose of the project was to "develop a fuel cell system for the marine environment that will reduce emissions and be a viable, affordable, competitive alternative to diesel-based systems."[25] Results from the project showed "it is possible to increase energy efficiency by up to 30% at part load and reduce emissions to zero through the use of hydrogen fuel cells, and identified paths forward to wider adoption of the technology in this sector."[26]

To identify challenges as well as opportunities for hydrogen and fuel cells in the maritime sector, DOE's Hydrogen and Fuel Cell Technologies Office organized an international workshop in September 2019 in coordination with MARAD's Office of Environment, and the European Commission's Fuel Cells and Hydrogen Joint Undertaking. It included representatives from industry, government and port officials from multiple countries to share information on current

status and key research, development and demonstration needs. This global collaboration is also being fostered through multiple mechanisms, particularly the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), a government partnership with 20 countries and the European Commission formed in 2003 to share information and accelerate progress in hydrogen and fuel cell technologies (https://www.energy.gov/eere/fuelcells/h2ports-workshop). IPHE has a specific task on compiling regulations, codes and standards for multiple applications to assess gaps and areas requiring additional focus by governments to ensure harmonized global standards and a robust supply chain. (www.iphe.net)

In March 2020, SWITCH Maritime awarded a contract to All American Marine to complete construction of a 70 foot, 84-passenger electric drive ferry (e-ferry") that is powered by hydrogen. The e-ferry is slated to be the first commercial vessel in the U.S. powered by hydrogen fuel cell technology[27]

FIGURE 19 – Potential Hydrogen Demand at U.S. Ports. (Satyapal 2019) [28]

In July 2020, DOE's Hydrogen and Fuel Cell Technologies Office announced a competitive, cooperative agreement with Hornblower Energy to develop an integrated hydrogen production and power supply system mounted on a barge to deliver renewable fuel and power to fuel cell and electric powered ferries in San Francisco, CA. This project will enable development of fueling protocols, providing over half a ton of hydrogen to fuel the first hydrogen fuel cell ferry in the western hemisphere capable of carrying 150 passengers. (https://www.energy.gov/articles/energy-department-announces-approximately-64m-funding-18-projects-advance-h2scale)

CHALLENGES

- Associated regulatory requirements to the implementation of alternative fuels can take time to develop and implement. In particular, new hydrogen-fuel cell and electric vessels face unique challenges, particularly cost and refueling/charging infrastructure. Safety, codes, and standards have yet to be addressed.
- The main drawback of LNG low-pressure gas engines is rather high levels of methane slip.
- Bunkering of LNG requires expensive shore side infrastructure. Ports that are located near or in densely populated areas, have historically experienced negative perception about the development of LNG facilities.
- Biodiesel is more expensive than traditional fuels.
- While the Federal Government is exploring innovative approaches such as electrification, biofuels, and hydrogen fuel cells to power vessels, industry is looking more closely in diesel electric systems.[29]

MARINE ENVIRONMENTAL RESPONSE

Marine environmental response (MER) includes actions related to and mitigation of a variety of environmental impact events, especially oil spills and hazardous waste discharges and spills. Responsibility for marine environmental response is shared among several Federal agencies including the USCG, EPA, NOAA, and BSEE.

USCG

The USCG responds to oil and hazardous substance incidents domestically and throughout the world. The USCG's MER program leads the coastal and maritime element of the National Response System (NRS). The NRS is a multi-agency public-private system that implements the National Oil and Hazardous Substances Pollution Contingency Plan and is the Nation's system for preparing for and responding to oil and hazardous substance spills. The system also provides a national approach to incident response using an interlocking planning system built on national, regional, and area plans as well as industry plans and response capability consistent with this system maintained by regulated vessels and facilities. All ships (and facilities where spills may impact water) are required to have Oil Spill Response Plans (OSRP) which detail the amount of equipment that must be available in the event of a spill, the time limits for activation of the equipment and training required for spill responders.

The USCG is the lead Federal agency for oil and hazardous substance spill response and preparedness in the marine environment (excluding inland waters where EPA is the lead Federal agency). In that capacity, USCG is responsible for directing the removal and mitigation of oil and hazardous substances from the marine environment. The USCG supports this mission through program elements ranging from policy support at headquarters to Federal On-Scene

Coordinators in Captain of the Port Zones. The USCG enhances the MER program through an emphasis on developing people through training and experience, improving policy, and fostering internal and external partnerships. These initiatives support the USCG's leadership role within the NRS and strengthens the oil and hazardous substance spill preparedness and response capabilities, capacity and performance.

EPA

EPA is the lead Federal response agency for oil spills occurring in inland waters. One of EPA's top priorities is to prevent, prepare for, and respond to oil spills that occur in and around inland waters of the United States. EPA's oil spill prevention program includes the Spill Prevention, Control, and Countermeasure (SPCC) and the Facility Response Plan (FRP) rules. The SPCC rule helps facilities prevent a discharge of oil into navigable waters or adjoining shorelines. The FRP rule requires certain facilities to submit a response plan and prepare to respond to a worst-case oil discharge or threat of a discharge.

NOAA

NOAA's Emergency Response Division of the Office of Response and Restoration supports the USCG by providing round-the-clock scientific expertise for oil and chemical spills in U.S. waters. These efforts facilitate spill prevention, preparedness, response, and restoration through its network of Scientific Support Coordinators; a team of scientists, technical experts, and software developers; and Federal, state, and academic partners.

The Assessment and Restoration Division, a division within NOAA's Office of Response and Restoration is responsible for evaluating and restoring coastal and estuarine habitats damaged by hazardous waste releases, oil spills, and vessel groundings. Working with partners, ARD determines the harm to the environment and defines the amount of environmental restoration required to compensate the public for those impacts.

The National Weather Service (NWS) supports the USCG by providing routine operational weather data and information on meteorological, hydrological, and ice conditions for marine, coastal, and inland waters. NWS can also provide tailored forecasts (SPOT forecasts) and briefings to support the incident response. NWS meteorologists and hydrologists are available to deploy on site or at an Incident Command Center (ICC) to provide decision support services if requested.

In addition to these efforts, NOAA also makes oil and chemical spill modeling tools freely available to the public. The applications are downloadable from the website and include an oil fate prediction tool, a 3D pollutant transport model, and a public website that allows a user to download winds, currents, and shoreline that are formatted for use with the referenced tools. The data sources come from NOAA, the Navy, various IOOS associations, and academic institutions.

NOAA's General Oil Modeling Environment relies on the availability of local real-time data and good wind forecasts to provide spill trajectory estimates. In some cases, NOAA will respond by installing short-term real-time instrumentation to collect data for input to the trajectory models and deploy NWS Incident Meteorologists to assist with real-time analysis and forecast support during a spill or release.

BSEE

BSEE requires all facilities seaward of the coastline to maintain an approved oil spill response plan describing their capability to respond to a spill up to and including a worst-case discharge before operations commence. The plan includes requirements for cyclical exercises, equipment maintenance, personnel training, and government initiated unannounced exercises. There are more than 110 approved OSRPs that cover facilities in Alaska, California, and the Gulf of Mexico Federal and State waters. BSEE works closely with the USCG, the agency with Federal authority to oversee the response to a spill in coastal waters.

CHALLENGES

- There is a growing number of vessel movements and increasing complexity of situations including deep water exploration and use of the ocean for aquaculture and wind energy production. While much was learned after the Deepwater Horizon accident, these developments bring novel situations in both use of resources and adequacy of appropriate response from both government and private sector participants.
- Communication among the various government agencies with authority over portions of or specific areas of the marine, State government agencies, semi-public authorities such as port authorities, and private parties is complex.
- Technology is evolving at a faster pace in both hardware and software components.

AREAS FOR ENVIRONMENTAL STEWARDSHIP POLICY CONSIDERATION

VESSEL OPERATIONS AND ASSOCIATED REQUIREMENTS

- Promote smart speed and wake management practices through waterways with sensitive natural resources; and promote continued research into wakeless vessel design.
- Promote the use of cleaner fuels, technologies, and other emission reduction strategies to improve air quality, including by supporting collaborative efforts between government, private port operators, marine vessel operators, and near-port community groups to identify strategic clean air projects.
- Ensure that the new U.S. vessel discharge regulatory framework, and eventual new requirements, is communicated fully to both the domestic and international shipping community.

- Continue dialogue with public and private, domestic and international, stakeholders to identify improvements to vessel-based treatment technologies and management practices.
- Establish a risk assessment and response framework to identify and track aquatic invasive species, evaluate the risks, and establish emergency best management practices to respond to emerging threats.
- Support efforts to research and develop ballast water management solutions for vessels operating in the Great Lakes.
- Coordinate with State partners to develop inspection, monitoring, data management, and enforcement procedures for Federal and state enforcement of discharge requirements.

MARINE ENVIRONMENTAL RESPONSE

- Improve MER system capabilities in remote areas, e.g., the U.S. Arctic.
- Continue to develop MER proficiency, planning, preparedness capacity and policy guidance.
- Continue to support USCG's R&D initiatives through the Interagency Coordinating Committee for Oil Pollution Research (ICCOPR).
- Continue to support International multi- and bi-lateral partnerships, especially in the Arctic and Caribbean areas.
- Expand the national suite of hydrodynamic models and real-time oceanographic and meteorological capabilities to be inclusive of the United States, including the Arctic, Canadian and Western Hemisphere areas.
- Plan for deployment of Federal support to assist State and local decision makers when MER events occur.
- Commit to long term preparedness, such as advanced development and practicing of response procedures.

ALTERNATIVE FUELS AND TECHNOLOGIES

- Support and assess Federal Agency R&D activity in alternative fuels and technologies.
- Leverage new or existing funding mechanisms to promote vessel related uses of alternative fuels and technologies and associated infrastructure.
- Promulgate requirements and permitting in a timely manner regarding alternative fuels and technologies approvals and associated shore side infrastructure.
- Join with industry, as appropriate, to educate the public on the safety record of the various alternative fuels and technologies and their respective advantages and disadvantages for the MTS environmental footprint.

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CHAPTER THREE: FOCUS AREAS

As discussed in the preceding chapters, Federal activities in support of the MTS are broadly based and extensive. In addition, the CMTS has emphasized interagency collaboration in five key focus areas:

U.S. Arctic MTS: Drawing upon increased attention on the U.S. Arctic, Administration and Federal MTS agency engagement, and a number of published reports by the CMTS, including:

- 2013 report *U.S. Arctic Marine Transportation System: Overview and Priorities for Action*;
- *Ten-Year Projection of Maritime Activity in the U.S. Arctic* (2015 and 2019);
- *A Ten-Year Prioritization of Infrastructure Needs in the U.S. Arctic* (2016 and 2018);
- *Recommendations and Criteria for Using Federal Public-Private Partnerships to Support Critical U.S. Arctic Marine Infrastructure (2017);*
- Arctic reports and strategies from a number of other Federal agencies, organizations, and offices.

Resilience of the MTS: Increased extreme weather events, sea level rise, and other disruptions in the supply chain, including from pandemics, warrants a focus on the resilience of the MTS. A number of analyses of MTS and coastal resilience have been performed by Federal agencies including:

- NOAA's report, Positioning America for the Future: Port Tomorrow Resilience Planning Tool (2012);
- USCG report, Port Recovery in the Aftermath of Hurricane Sandy Improving Port Resiliency in the Era of Climate Change (2014);
- USACE Quantification of Integrated Watershed System Resilience: A Tiered Method 2015 (2015);
- CMTS report, U.S. Federal Activities Analyzing Marine Transportation System Resilience (2016);
- CMTS report, The 2017 Hurricane Season: Recommendations for a Resilient Path Forward for the Marine Transportation System.

Energy Development and the Marine Transportation System: Since 2017, the U.S. had been a net exporter of natural gas, a net exporter of petroleum products since 2011, and biomass (for most years) since 2008.[1] U.S. energy ports had expanded tremendously in recent years and are impacted by marketplace fluctuations.

Conditions and Performance Measures (C&P): To provide consistent and repeatable measures of the state of the MTS, the use of performance measures, somewhat akin to the annual conditions and performance analyses performed by the Federal Highway Administration [https://www.fhwa.dot.gov/policy/23cpr/] may provide a baseline from which to assess the MTS. While the FHWA reports provide scenarios under levels of Federal investment, the

complexity of the ownership, operations, and funding for the MTS make a C&P more challenging and limited. The focus area addresses those limitations and outlines a baseline of Federal performance methods from which to begin.

COVID-19 Pandemic: The MTS, along with the entire U.S. supply chain, was impacted by the 2020 COVID-19 pandemic. Cruise ships and passenger vessels were, essentially, shut down. The liner services ebbed and flowed as world trade fluctuated in unpredictable patterns. Work force protection became paramount on ships, on the dock, in terminals, and with port administrations. However, the unprecedented event provided an unexpected plethora of data from which to assess how the MTS has responded and managed as a critical component in the national supply chain.

SECTION 1: ARCTIC MARINE TRANSPORTATION SYSTEM

OVERVIEW

Among the many different ways to define the Arctic, § 112 of the Arctic Research and Policy Act of 1984 defines it as: "all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers [in Alaska]; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi Seas; and the Aleutian chain."[2] This includes over 46,600 miles of shoreline in Alaska, including the Aleutian Islands (Figure 20).

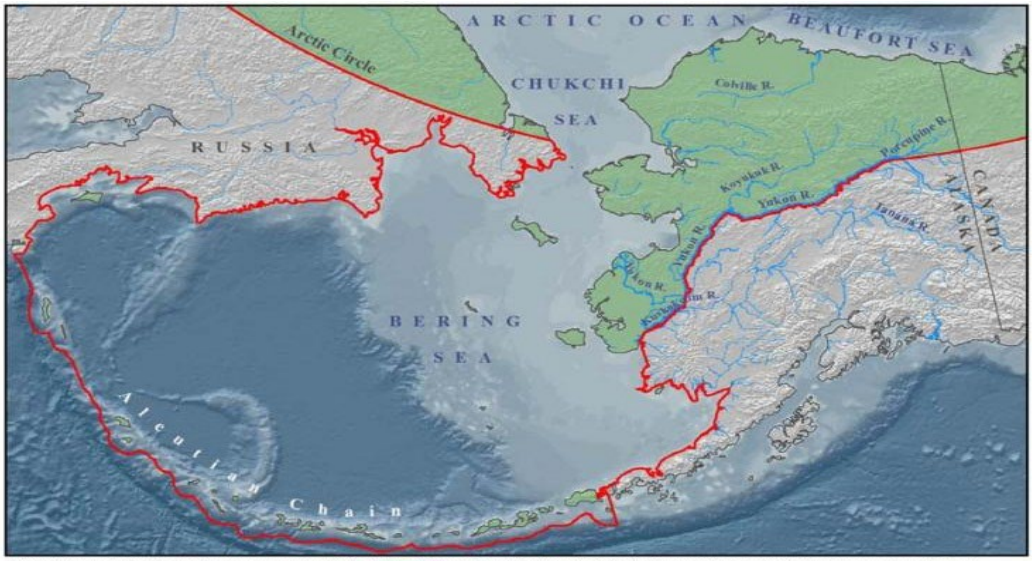

FIGURE 20. Arctic Boundary as defined by the *Arctic Research and Policy Act*

Historically, these seas are frozen and inaccessible for more than half of the year. The general Arctic maritime season typically lasts only from June through October, and unaided navigation occurs within a more limited time frame. However, this pattern appears to be changing as ice-diminished conditions become more extensive during the summer months. The thirteen lowest September ice extents – the month when Arctic sea ice reaches its yearly minimum extent – have all occurred in the last 13 years. The lowest extent ever recorded was in 2012, which paved the way for the longest Arctic navigation season on record.[3] The CMTS report, *A Ten-Year Projection of Maritime Activity in the U.S. Arctic Region, 2020-2030*, showed that maritime activity is expected to continue to increase. Activities related to natural resources, commercial shipping, infrastructure development, research, and tourism will all influence vessel activity in the region, and the report projected annual growth rates for vessel activity ranging from 0.3% to 4.9%.[4] Marine transportation in the region will continue to be challenging and potentially

hazardous due to unpredictable ice floes, inclement weather (e.g., extreme cold, heavy fog, severe storms), and seasonal accessibility based on variation in ice location.

The current limitations for ports, nautical charts, ATON, communications, emergency response, and rescue capabilities make operations difficult and potentially volatile, hindering U.S. maritime advancement in the Arctic. The CMTS has published multiple reports that address the state of and recommended priorities to support an Arctic MTS, including:

- *U.S. Arctic Marine Transportation System: Overview and Priorities for Action* (2013)
- *A Ten-Year Projection of Maritime Activity in the U.S. Arctic* (2015)
    - Updated in 2019: *A Ten-Year Projection of Maritime Activity in the U.S. Arctic Region, 2020-2030*
- *A Ten-Year Prioritization of Infrastructure Needs in the U.S. Arctic* (2016)
    - Updated in 2018: *Revisiting Near-Term Recommendations to Prioritize Infrastructure Needs in the U.S. Arctic*
- *Recommendations and Criteria for Using Federal Public-Private Partnerships to Support Critical U.S. Arctic Maritime Infrastructure* (2017)

The CMTS 2013 Arctic Report highlighted the risks and opportunities of increasing maritime activity. It presented a vision of a U.S. Arctic MTS capable of meeting the safety, security, and environmental protection needs of present and future Arctic stakeholders. The report included sixteen issue papers discussing elements of the U.S. Arctic MTS, including gaps that inhibit safe U.S. Arctic marine transportation and necessary physical and informational infrastructure improvements to support U.S. Arctic commerce and security.

In the 2013 report, the table, "U.S. MTS Arctic Infrastructure Table," summarized the state of MTS infrastructure in the region at the time. Infrastructure gaps were further detailed in the 2016 report, *Ten-Year Prioritization of Infrastructure Needs in the U.S. Arctic*. This report provided a framework to address the critical infrastructure gaps over the following decade by developing 43 recommendations that would lead to a comprehensive, safe, and successful Arctic MTS. Of these, 25 were considered near-term recommendations, which were reviewed and updated in the 2018 report, *Revisiting Near-Term Recommendations to Prioritize Infrastructure Needs in the U.S. Arctic*. This report found that while major strides had been made to support the growing Arctic MTS, significant challenges and gaps remained. The 2018 and 2021 reports also provided the latest updates to the "U.S. MTS Arctic Infrastructure Table."

Priority areas identified in the CMTS and other U.S. reports include recapitalizing the Nation's icebreaker fleet; improved nautical charts and communications capabilities; better weather, ocean, and sea ice forecasting and modeling; construction of a deep-draft U.S. Arctic port(s); and developing community and regional emergency response networks to respond to vessel, aircraft, and environmental incidents.

CHALLENGES

- Lack of places of refuge for ships, deep-draft Arctic ports, navigation aids, and limited communications capability.
- Limited Federal capacity for emergency response (oil spill containment, search and rescue).
- High cost to build the critical infrastructure needed for U.S. Arctic MTS activity.
- Gaps in MTS information infrastructure such as accurate hydrographic and obstruction surveys, real-time water level data, and shoreline mapping that impact the quality of nautical charts and other navigation products necessary for safe navigation. In November 2019, a Presidential Memorandum was signed to address the overall lack of maps and charts of the Arctic and sub-Arctic shoreline and nearshore Alaska, and as a result, a ten-year strategy for mapping the coast of Alaska was released in June 2020.[5,6]
- The ability to maintain U.S. icebreaking capability and grow capacity within the Arctic to ensure marine safety, security and stewardship. The U.S. Coast Guard has requested six new polar icebreakers as part of the Polar Security Cutter program. Construction on the first ship is slated for 2021, with an estimated delivery in 2024. In addition, a Presidential Memorandum to build a fleet of polar security icebreakers that will be deployable by 2029 was issued in June 2020.[7]
- The need to improve in-situ observing and forecasting capabilities for weather, sea state and sea ice conditions.
- Minimal knowledge on the behavior and detection of oil in icy environments, and development of restoration strategies after spills.
- Implementation of international standards on polar ship construction, equipment, design, and operation. The IMO Polar Code entered into force in 2017 and is mandatory under both SOLAS and MARPOL for certain categories of vessels.
- The need for a holistic integrated approach that integrates economic, security, environmental, and cultural interests.

AREAS FOR ARCTIC POLICY CONSIDERATION

- Assign the CMTS the leadership role in the coordination, monitoring and reporting on Arctic MTS priority actions and milestones.
- Accede to UNCLOS, which establishes the framework for all maritime activity including that in the Arctic region. Acceding to the Convention would be beneficial for the United States in securing rights and access to valuable surface and subsurface minerals and other resources.
- Facilitate cooperation among Arctic MTS stakeholders to improve the Arctic MTS, noting the importance of MTS informational infrastructure and response operations, such

as communications capabilities for Arctic communities and vessels and emergency response capabilities.

- Improve observation networks to aid in forecasting capabilities related to weather, oceanographic, and sea-ice conditions.
- Support continued studies on the potential risks of increased shipping on Arctic species, including ship operations (e.g. vessel noise), marine invasive species, and oil spills. These studies could consider vessel routing measures to enhance safe operations and avoidance or changes to vessel operations for areas of heightened ecological and cultural significance.
- Enhance interagency efforts related to Alaskan Native outreach and communication.

SECTION 2: RESILIENCE OF THE MARINE TRANSPORTATION SYSTEM

OVERVIEW

The U.S. relies on a fully functional MTS to move the international and domestic U.S. trade and support continued growth, jobs, and productivity. However, the system itself is vulnerable to disruption from a variety of natural and man-made hazards. These include, but are not limited to, extreme precipitation and flooding, sea-level rise, intense storms such as hurricanes, drought, temperature extremes, cyber-attacks, terrorist attacks, and pandemics (Figure 21). A disruption affecting a single part or several parts of the MTS, including ports, waterways, vessels, and supporting roadways, railways, and bridges, could potentially have national impacts. Furthermore, ports and the MTS play a key role in the recovery of the surrounding region after disruption, facilitating the mobilization of response and recovery assets and the delivery of life-sustaining commodities for impacted communities. In order to coordinate this comprehensive approach, the CMTS established the MTS Resilience Integrated Action Team (RIAT) to serve as an interagency coordinating body for coordination and dissemination of information, best practices, and opportunities to increase the resilience of the MTS.

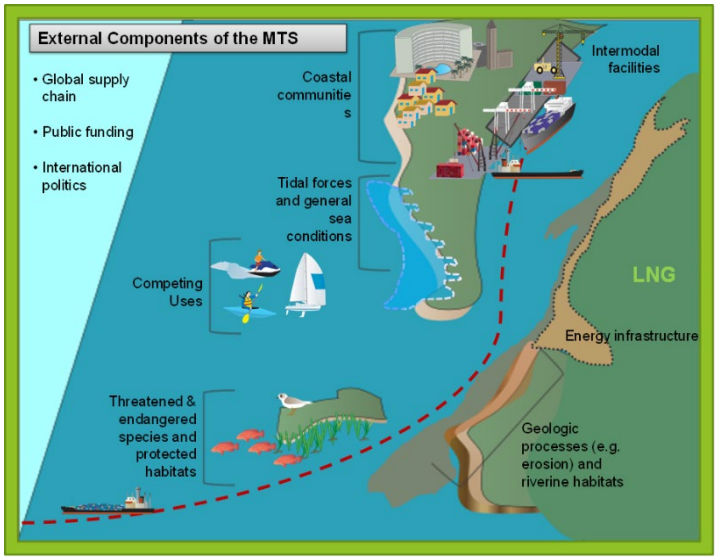

FIGURE 21 The Marine Transportation System operates within other diverse systems that include ecological processes, communities, and water resource management infrastructure. Each of these systems can impact the resiliency of the MTS. [*Touzinsky, K.F., Rosati, J.D., Fox-Lent, C., Becker, A., and A. Luscher. 2016. Advancing coastal systems resilience research: improving quantification tools through community feedback. Shore and Beach. 84(4):30-37.]*

In March 2011, the President issued *PPD-8: National Preparedness*, a document tasking DHS with coordinating resilience preparedness among Federal agencies and defining resilience as "the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies." In response to requests from several Federal agencies, the National Research Council of the National Academy of Sciences (NAS) released a document in 2012 entitled, *Disaster Resilience: A National Imperative*. The authors echoed the Administration's sentiment, but also emphasized the capacity to "more successfully" adapt rather than simply adapting and

recovering (they define resilience as "the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events"). Various definitions of "resilience" clearly emphasize the need to prepare and better adapt to disasters and other threats to the health and security of the United States. In November 2013, the President issued Executive Order 13653 entitled, Preparing the United States for the Impacts of Climate Change. The President directed Federal agencies to develop specific plans and actions related to decreasing vulnerabilities and increasing resiliency to future effects of climate change. In this EO, resilience was expanded beyond the PPD-8 definition to "the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions." This definition is visualized as a continuous cycle initiated by a disruption.

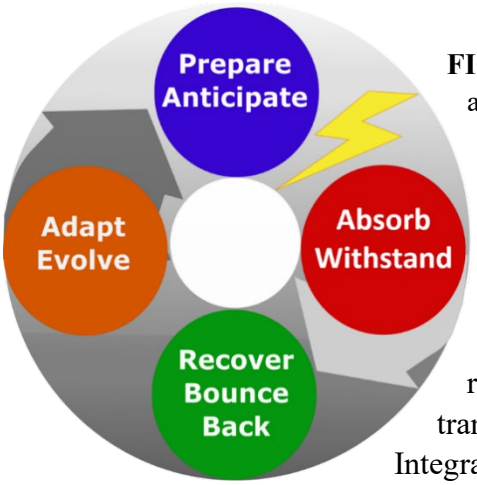

FIGURE 22 The cycle of the fundamental actions found in nearly all resilience definitions: prepare, resist, recover, and adapt.[8]

In terms of physical location, the MTS is particularly susceptible to the impacts of extreme weather, too much or too little water, and other climate-related hazards. For example, extreme weather can threaten the safety maritime infrastructure and too little water can cause draft restrictions on inland waterways inhibiting the smooth transportation of goods and services. The CMTS Resilience Integrated Action Team (RIAT) produced a report that gathered the efforts of eight member MTS agencies to define all of the present and potential hazards and constraints to the MTS. These "resilience factors" served to provide a picture of the variety of hazards that are considered and some potential overlaps between agencies for further focus. The contributing agencies identified 40 factors that pertain to non-environmental hazards (e.g., economics, labor, competing use of the MTS) and 31 factors that relate to the environment (e.g., tidal extremes, storm frequency, invasive species).[9]

Below is a table showing priority non-environmental and environmental resilience factors that have active engagement by at least five IAT member agencies. Activities included data collection and physical monitoring, ongoing research, partnerships, programs, policies, operations, etc.

Non-Environmental Factors			Environmental Factors		
Resilience Factor	*# Agencies*	*# Activities*	*Resilience Factor*	*# Agencies*	*# Activities*
Infrastructure resilience	8	37	Water level/ inundation/ surge	7	38
Emergency response capabilities	7	34	Water level extremes and long term change	7	36
Regulation/political/ budgetary	6	29	Invasive species	5	39
Hazardous materials/oil spills	5	32	Threatened and endangered species	5	39
Competing uses of land/ocean/coastal areas	5	26	Changing migration patterns	5	28
Larger vessels	5	23			

Table 6 Federal MTS Resilience Factors (CMTS 2016)

Over the past several years, the number and severity of weather- and climate-related disasters has been increasing, and as climate continues to change this pattern will likely continue. In addition, in the future, impacts are likely to be worsened by compounding factors like sea level rise and increased population and infrastructure in vulnerable areas.

New datasets, research initiatives, and collaborative efforts like Harbor Safety Committees, MTS Recovery Units, the Cybersecurity and Infrastructure Security Agency Port and MTS Resilience Assessment Guide project, the CMTS RIAT, and others are enhancing the ability of the MTS to be monitored and analyzed both qualitatively and quantitatively. These analyses and collaborations have resulted in better informed decisions that create a variety of resilience enhancements including better preparations, enhanced collaborative tools and datasets, and adaptive responses to maintain a functioning system. The CMTS RIAT has conducted several post-hoc reviews to identify the successes, challenges, and opportunities to improve resilience during the past few storm seasons.[10] Preparations to increase resilience are also needed with respect to managing weather interruptions and delays, providing real-time data, construction, maintenance efforts like dredging, human-related and management influences such as nearby community impacts, labor strikes and intermodal logistics, and computing infrastructure and software. As the infrastructure, technological, and management systems that support the MTS evolve, the best practices for the preservation of these key functions throughout disruptions must be kept up-to-date and collaborative.

With respect to major components of the MTS, infrastructure can be designed with redundancy and modularity to better adapt and maintain system-wide functioning; waterways can be designed with an appropriate balance of electronic and physical capabilities to reduce response time after natural or man-made disasters; and security of port infrastructure can be prepared to adapt when disasters arise. The amount and type of MTS investments can be proactively designed to ensure redundancy in the system, increase preparedness, and increase agility in adapting such that the MTS can remain functioning and increase overall system resilience.

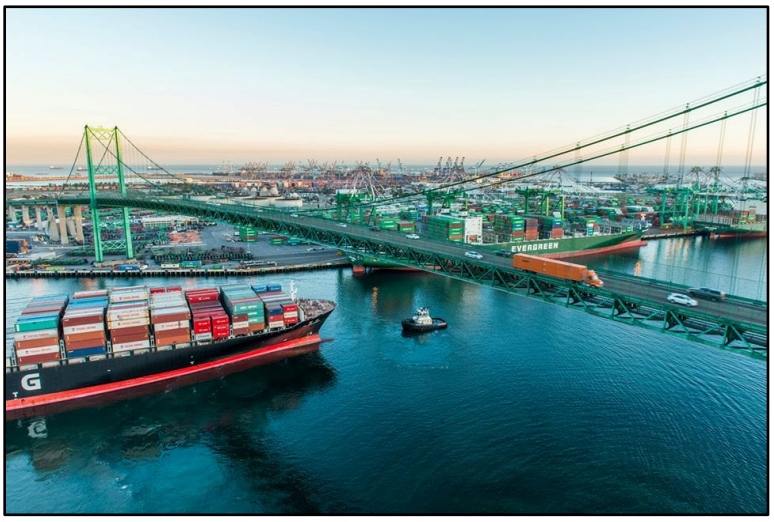

FIGURE 23 Approximately forty percent of all containerized cargo in the U.S. and nearly half of all the oil imports for the U.S. west of the Rocky Mountains arrive via the Ports of Los Angeles (above) and Long Beach. Due to the "just in time" philosophy of modern shipping, there is often just two weeks of refined fuel available to serve the entire Southern California economy. Thus, a disaster that impacts the functioning of these ports, even for a relatively short time, would have catastrophic impacts on millions of people. ***Photo Credit: Port of LA***

In summary, a culture of resilience will help Federal agencies and their partners adapt to maintain functionality of the MTS in the face of stressors, e.g., by re-routing of vessels due to a port shut-down. The MTS can adapt via a host of avenues including real-time data access, analysis, and decision-making as well as strategic innovation and investment in infrastructure projects.

CHALLENGES

- Developing qualitative measurements and assessments of performance during the four stages of resilience can be a challenge, but is an emerging field of research.
- Prioritizing resilience investment initiatives and making effective use of the many tools that exist to address resilience-related issues.
- Resilience has a broad definition that can be a challenge to operationalize across the Federal Government and partners (State and local governments, industry, NGOs, community organizations), especially between Federal agencies with differing missions.
- Coordinating efforts among agencies and ports with different priorities and different cultures.
- Changing current culture to focus more on increasing resilience through successful adaptation.

- Establishing Federal actions that facilitate resilience preparedness and agility at the State, regional, and local levels.
- Ensuring that all necessary maritime domain awareness and environmental and coastal intelligence data is acquired and made available to decision-makers. Risks must be well understood to avoid maladaptive solutions and there are perceived gaps in information especially related to uncertainty.
- Measuring and assessing performance as it relates to resilience of the MTS and identifying critical vulnerabilities, which can have cascading impacts on the regional multi-modal network.

AREAS FOR RESILIENCE POLICY CONSIDERATION

- Characterize present and future stressors that impact resilience of the MTS to develop recommended Federal actions to reduce vulnerabilities, increase preparedness and agility, and maintain functioning of the MTS.
- Encourage a culture of resilience in legislative, regulatory, and administrative actions.
- Continue to develop and recommend performance metrics and tools to assess resilience for ports and the MTS. Ensure that recommendations are intuitive to use for field personnel and inclusive for a wide variety of applications.
- Prioritize adaptive management and learning from past experiences by developing a case study handbook of past resilience assessments and best practices from past disruptions so that they are readily accessible for MTS agencies and partners.
- Coordinate both bilaterally and multilaterally with international partners to decrease vulnerability and increase resilience of the global interconnected MTS.
- Support targeted programs and incentives to upgrade, retrofit or build new infrastructure; and, where feasible, balance the costs of these programs with the estimated benefits of achieving greater resilience.
- Consider how to capitalize on opportunities to achieve co-benefits as the MTS builds resiliency. For example, improving port management information systems can increase efficiency and reduce emissions while adding system redundancy and improving response times.
- Facilitate coordination to make the MTS more adaptable and flexible (e.g., easy re-routing capabilities, redundancies, increased efficiency of communication, rapid rebuilding capabilities).
- Coordinate across agencies for sharing resilience-related activities, tools and datasets, and document post-event recovery data and findings.
- Foster interagency collaboration and communication to facilitate resilience activities on State and local levels.

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[4] U.S. Committee on the Marine Transportation System (2019). A Ten-Year Projection of Maritime Activity in the U.S. Arctic Region, 2020–2030. Washington, D.C., 118 p. Available at: https://rosap.ntl.bts.gov/view/dot/60574.

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[8] Rosati, J. D., Touzinsky, K. F., & Lillycrop, W. J. (2015). Quantifying coastal system resilience for the US Army Corps of Engineers. *Environment Systems and Decisions*, *35*(2), 196-208.

[9] U.S. Committee on the Marine Transportation System, Maritime Resilience Integrated Action Team, U.S. Federal Activities Analyzing Marine Transportation System Resilience, https://www.cmts.gov/assets/uploads/documents/2016-01-05_Resilience_Factors_Matrix_Summary_(Public_Version).pdf., January 2016, Washington, DC.

[10] U.S. Committee on the Marine Transportation System (CMTS). 2018. "The 2017 Hurricane Season: Recommendations for a Resilient Path Forward for the Marine Transportation System", U.S. Department of Transportation, Washington, D.C. https://rosap.ntl.bts.gov/view/dot/60710.

SECTION 3: ENERGY DEVELOPMENT AND THE MARINE TRANSPORTATION SYSTEM

OVERVIEW

Prior to the Shale Revolution, the U.S. had largely relied on importing its energy sources, with the exception of coal. However, that dynamic has shifted in the last decade, with the U.S. transitioning to be a net exporter of biomass since 2008, of petroleum products since 2011, and natural gas since 2017.[1] Obviously, the state of U.S. energy ports are very dependent upon the state of energy trade.

The majority (66%) of primary energy imported into the United States in 2019 was crude oil, with petroleum products and natural gas also having significant shares, according to the U.S. Energy Information Administration (EIA).[2] Small amounts of biofuels, electricity, and coal were also imported.

Exports of primary energy from the United States were led by petroleum products (42% in 2019[3]), followed by crude oil, natural gas, and coal, with small amounts of biofuels and electricity. The U.S. exported more petroleum products, coal and natural gas (supported in 2016 by lifting the 1975 crude oil export ban), than it imported, although some coal-burning power plants along the Gulf Coast and the Atlantic Ocean sometimes find it cheaper to import coal from other countries than to obtain coal from U.S. coal-producing regions.

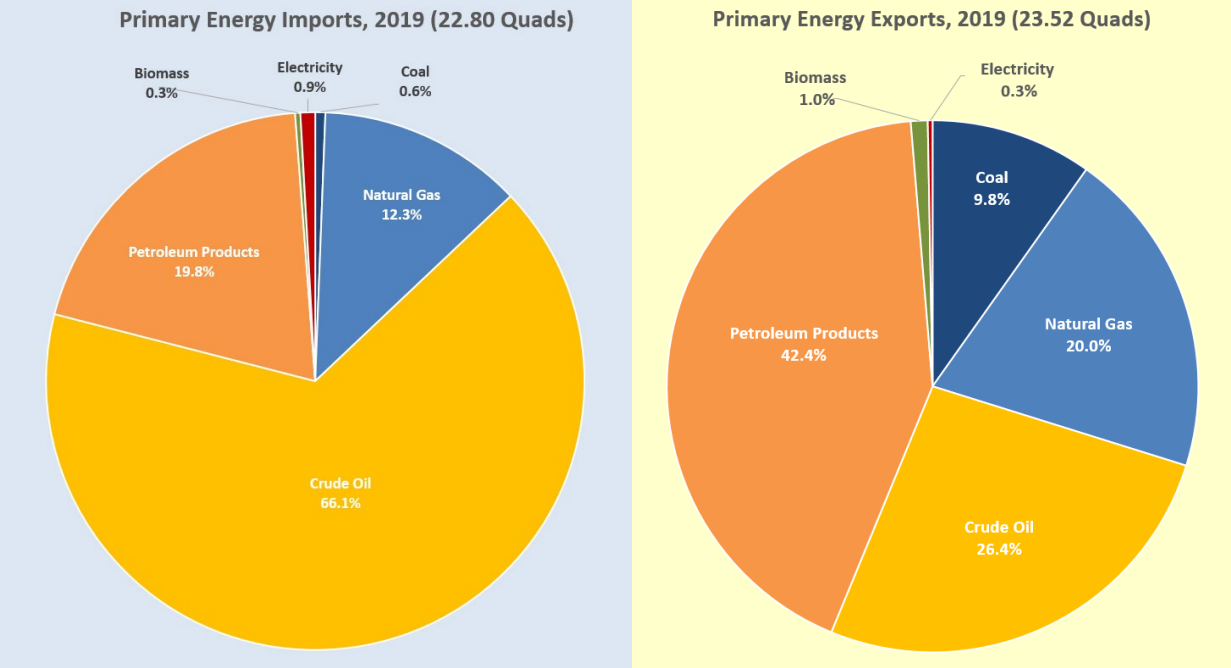

FIGURE 24 Source: U.S. Energy Information Administration, Monthly Energy Review, Annual Summaries for 2019, Tables 1.4a and 1.4b

It should be noted that the EIA projects that U.S. electricity generation from renewable sources such as wind and solar to surpass nuclear and coal by 2021 and to surpass natural gas in 2045.[4] However, EIA also reports that the growth of production will outpace growth in domestic consumption of crude oil, petroleum products, and natural gas, resulting in U.S. net exports of these fuels increasing. In the "reference case" from the Annual Energy Outlook 2020, the United States will continue to export more petroleum and other liquids than it imports, with a peak at more than 3.8 million barrels per day (b/d) in the early 2030s before gradually declining to 0.2 million b/d in 2050 as domestic consumption slowly rises. U.S. LNG exports and natural gas pipeline exports to Canada and to Mexico continue to rise through the 2020s before flattening for the remainder of the projection period.[5]

Figure 25 Barges can transport wind tower components via the MTS with greater ease than landside transportation due to the size and weight of the pieces.

The DOE estimates that U.S. offshore wind has a technical resource potential of more than 7,200 terawatt-hours of electricity generation per year[6]. This

is nearly double the Nation's current electricity use. The first offshore wind energy facility in the U.S., Block Island Wind Farm, in the State waters of Rhode Island, began operation in December 2016. A second facility, a two-turbine demonstration project, was installed off the coast of Virginia in May 2020. DOE expects a growth in offshore wind farms. On June 16, 2020, a new hub for New Jersey's budding offshore wind power industry was announced by New Jersey Governor Phil Murphy. Governor Murphy announced plans to build a new port in Salem County to support the development of offshore wind farms off the Jersey Shore.[7]

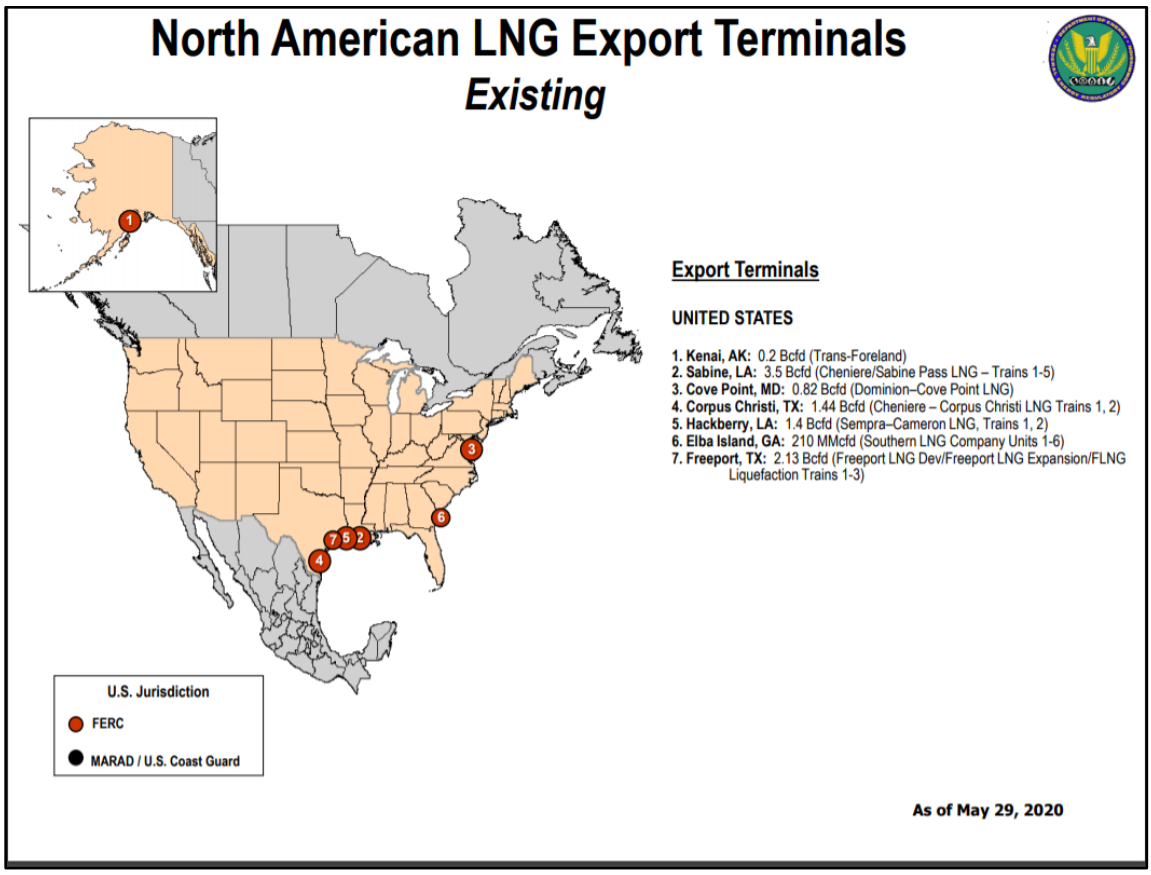

FIGURE 26 North American LNG Export Terminals[8]

The MTS has provided the necessary capacity to move energy products including raw materials, finished products, and petroleum. The MTS is a key component in the import and export of energy products. Seaports in the Gulf Coast and East Coast, for example, account for most U.S. coal exports. Six seaports accounted for 94% of U.S. coal exports in 2010, up from 63% in 2000. Over 68% of total U.S. coal exports in 2010 were coking coal, which is used in making iron and steel. Steam coal, used to generate electricity, comprised the remaining 32% of exports.[9]

In an unfortunate turn of events, a projected scramble to develop Gulf Coast ports to handle 3 million barrels of oil per day in early 2019 has been seriously tempered.[10] For example, since the 2015 ban on the export of liquid fossil fuels was lifted, the Port of Corpus Christi had dramatically expanded, creating nearly 10,000 permanent jobs and bringing in $54 billion in capital investment. Corpus Christi turned into the largest energy exporter and third-largest port in the United States by tonnage. In 2019, it handled 122.2 million metric tons of cargo, 60 percent of it exported oil. As a result of the pandemic, investment in planned projects has been halted. Demand for fuel plummeted by 40 percent compounded by a global surplus of oil.[11]

Another energy activity that impacts the MTS is active offshore energy platforms which can be over 100 miles off the coast of the U.S., putting a demand on specialty supply boats and crew, and associated landside ports. The offshore industry includes the offshore oil and gas deepwater ports under DOT's authority, offshore wind energy facilities under the authority of DOI, and other related offshore energy exploration and production facilities under various Federal authorities**.**

In accordance with the Deepwater Port Act of 1974 (DWPA), MARAD, by delegated authority from the Secretary of Transportation, may authorize the construction, operation and eventual decommissioning of offshore deepwater ports for the import and export of oil and LNG. The DWPA defines Deepwater ports as *"any fixed or floating manmade structure other than a vessel, or any group of such structures, that are located beyond State seaward boundaries and that are used or intended for use as a port or terminal for the transportation, storage, or further handling of oil or natural gas for transportation to or from any State…."* Currently, there are three offshore oil and natural gas import deepwater port facilities existing within the United States.

MARAD is responsible for determining the financial capability of potential licensees, the citizenship of the applicant, preparing the project Record of Decision (including the decommissioning analysis), and issuing or denying the deepwater port license. Other duties under the DWPA, including consultation, are shared with the USCG. For example, MARAD and USCG, in cooperation with other Federal agencies, must comply with the requirements of the National Environmental Policy Act within the established time frame.[12]

The Outer Continental Shelf Lands Act authorizes the Federal Government, through the Department of Interior's Bureau of Ocean Energy Management (BOEM), to grant leases to the highest bidder (subject to Fair Market Value Analysis of the bids) for the exploration, development and production of oil and gas contained within the Outer Continental Shelf (generally defined as the submerged lands lying around and outside three geographical miles off each State, with the exception of Texas, Puerto Rico, and Florida's Gulf Coast where state lands extend to 9 miles offshore.)

Each lease covers an area that is no more than 5,760 acres and is generally a square measuring 3 miles by 3 miles. Under a lease, a company has the right to apply for permits to explore and develop the mineral resources within that area. Before approving the permits, the BOEM carefully reviews all applications to ensure that the activities will be conducted in a safe and environmentally sound manner and that the interests of key stakeholders are effectively

addressed. There are two regions in which BOEM has been or is currently granting leases: Alaska and the Gulf of Mexico. The last lease sale in the Pacific was 1982 (there are existing, oil- and gas-producing leases offshore southern California), and the last in the Atlantic was 1983.[13] [https://www.boem.gov/oil-gas-energy/leasing/regional-leasing.]

The Bureau of Safety and Environmental Enforcement (BSEE), an agency also within the Department of Interior, reports that there are approximately 1,862 platforms in the Gulf of Mexico as of April 2019, not all of which are operating. Since the first offshore drilling began in 1942, about 6,000 oil and gas structures have been installed in the Gulf of Mexico. These structures range in size from single well caissons in 10-ft. water depths to large, complex facilities in water depths up to almost 10,000 ft. [Figure #]

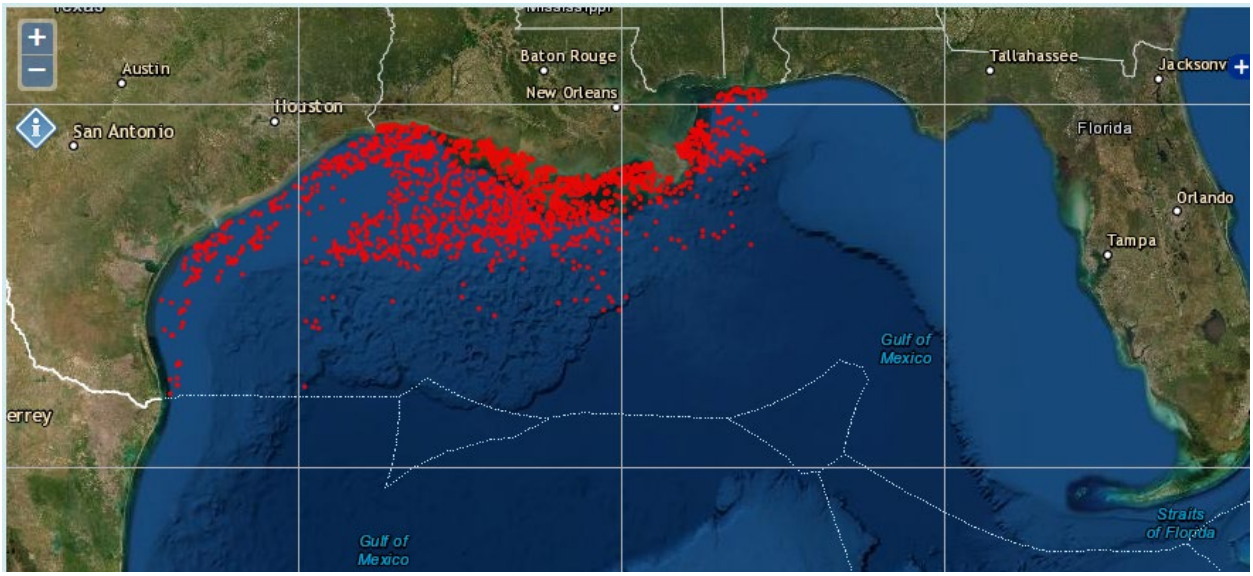

FIGURE 27 Oil and Gas Structures offshore from Mississippi to Texas[14]

As previously referenced, the authority for the issuance, transfer, amendment, or reinstatement of a license for the construction, operation and eventual decommissioning of a deepwater port rests with the Maritime Administration. Deepwater Ports are built in deeper waters off the coast of the United States in order to more readily receive or discharge petroleum and LNG from and to larger tankers with drafts much deeper than can be accommodated in nearby landside ports.

Currently, there are three operating deepwater ports: Louisiana Offshore Oil Port (LOOP) (Oil imports/exports); Neptune (LNG imports); and Northeast Gateway (LNG imports); one pending LNG Export License; and four oil export license applications under review. The Maritime Administration reports that inquiries and requests for applications has grown in the past two years. In addition, a number of LNG import applications have either been disapproved, withdrawn, or decommissioned. This has been primarily due to the overall changes within the

U.S. LNG import market over the past decade. The LOOP facility was built to handle imports but converted its operation to handle the booming export market and is the only deepwater port in the U.S. that can fill these supertankers to the brim as well as receive product from fully loaded tankers.

CHALLENGES

- There is additional scrutiny and debate about the optimal means of moving volatile yet critical cargoes. The need to ensure the safest possible movement of oil, gas and chemicals is important. The United States is transporting increasing amounts of chemicals as the cost of the basic initial raw material, CH_4, increases in production due to fracking.
- BOEM has a clearly defined regulatory process that encourages collaboration with all stakeholders. This continued collaboration, including with maritime stakeholders, is essential for the appropriate siting of offshore wind energy facilities. Additional information and data regarding existing and future uses of the OCS will be helpful to continued coordination among BOEM, the offshore wind industry, and ocean users.
- The world trade market for oil and gas has fluctuated significantly due to trade wars and policies, making plans for port development more challenging due to changes in policies and the marketplace.

AREAS FOR ENERGY POLICY CONSIDERATION

- Enhance the application of energy exports to the NEI.
- Continue dialogue with DOT/PHMSA to find common ground on oil spill response planning and response efforts in the coastal zone.
- Promote renewable and alternative energy development, including research and development, in partnership with private industry.

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SECTION 4: MTS CONDITIONS AND PERFORMANCE MEASURES

OVERVIEW

The MTS requires a quantitative understanding of its condition and performance in order to operate efficiently and to clearly identify future needs including investment and policy changes. Gaps in comprehensive understanding of MTS operations can affect the larger U.S. transportation system as well since a large percentage of freight utilizes more than one transportation mode during a cargo movement.

MTS-specific data and derived metrics on condition and performance measures range from infrastructure and investment to such diverse areas as safety, security, environmental stewardship, reliability, and resilience. In other words, the MTS infrastructure is not sound if it is not kept secure. MTS capacity is not relevant if the MTS is not resilient while undergoing stressors such as hurricanes or malicious attacks. It is necessary to continuously monitor system performance to establish a baseline with which to compare during disruption events, such as natural disasters, pandemics, or breach of security.

Presently, the MTS is at a crossroads with respect to system-specific condition and performance data and derived metrics in that there is no single Federal entity solely responsible for identifying, collecting, managing or reporting these data and derived metrics in a consistent and useable manner. However, multiple Federal entities report on relevant portions of the MTS. While the need for useful and available MTS condition and performance data and derived metrics is well recognized, there are significant gaps in the availability of authoritative MTS data and derived metrics and concerns about variances among multiple reporting entities. A report by the USACE, *Marine Transportation System Performance Measures Research*[1], identifies multiple Federal public sources that can serve as a foundation for the MTS performance measurement in key areas. This step is important to prevent duplication of effort and to take advantage of existing data currently collected by Federal agencies to fulfill their missions.

This section outlines what condition and performance measures mean to the MTS, how they are presently addressed, and areas for policy consideration going forward.

DEFINING MTS CONDITIONS AND PERFORMANCE

MTS condition and performance are two different, although complementary and highly interrelated, metrics.

Condition indicators generally provide a snapshot of the material condition of MTS infrastructure as well as anything affecting transit on relatively short timescales (e.g. a few hours to a few days). Conditions may differ between different regions of the United States or different geographic scales (e.g., a coastal city versus an inland river). Examples of condition metrics are the structural integrity of a particular lock, the number of backlogged repairs needed on a particular lock, number of lock closures, or water levels on a river.

Performance measures take into account how the MTS is performing over a particular period of time – from seconds to over years and decades. Each performance metric contributes to measuring performance on the MTS in part and whole. Whether measured at a high-level of granularity (e.g. for certain types of ports or certain types of cargo) or whether measured across the entire MTS, there is an implied understanding that the MTS is a key component of the greater U.S. and international supply chain. Because of this, MTS performance metrics that can be easily compared with those of other modes are of significant value.

CONDITIONS AND PERFORMANCE ISSUES

At present, some nationally consistent conditions and performance metrics exist for parts of the MTS (e.g. tonnage and value of cargo transported, percent availability of ATON, and average number of navigational accidents), however, conditions and performance metrics for the MTS as a system are lacking. This is in contrast, for example, to the Federal highways and transit systems, for which the FHWA regularly produces a conditions and performance report using a multitude of specific quantitative indicators.

BTS established the Port Performance Freight Statistics Program (PPFSP), in response to the FAST Act. The PPFS Program provides nationally consistent performance measures on capacity and throughput for the Nation's largest tonnage, container, and dry bulk ports. A report to Congress summarizing information from this program is compiled and published annually. As noted in the "Capacity" section under Chapter 2, the PPFSP also provides an interactive online Port Profiles dashboard that displays the capacity and throughput metrics for each of the Nation's largest tonnage, container, and dry bulk ports. [2]

A key explanation for the difference in performance measurement practices between highway and transit systems, and the MTS is that the MTS has diverse Federal agency oversight rather than a unified system under a single Federal agency. Historically, Federal agencies have tended to view (whether by policy, legislation or regulation) the MTS through a mission-specific lens and therefore collect maritime-related data to meet respective missions. This stove-piped view is further carried across transportation modes. Thus, to accurately evaluate MTS performance as part of a multi-modal transportation system it will be necessary to look across mission areas both

within the MTS and across the other modes of transportation to assess current conditions and predict future conditions within a broader multi-modal context.

A further challenge to collecting MTS conditions and performance measures is that the MTS consists of assets that are both public (channels, dams, roads) and private (ports and commercial vessels), which have influences that are external to the MTS altogether. For example, understanding truck congestion at a port (or lack thereof) may require an understanding of a diverse set of interrelated concepts, such as information on labor agreements, highway congestion factors, port capacity and performance, channel depth history, and even events such as hurricanes and associated flooding or pandemics such as COVID-19. While the issue of system diversity is not unique to the MTS, it is yet another challenge to collecting MTS conditions and performance measures.

Initial review of existing and available MTS performance measures indicates there are well-characterized elements within publicly administered components of the MTS. One example is Federal navigation channels where regular surveying by the USACE and publishing of the results is mandated by law. These data (e.g. dredged depth) convey information about channel availability and usability. In addition, basic physical conditions information that supports safe navigation (and enhanced products such as NOAA's PORTS®) is universally understood by mariners and available for analysis.

There is also a significant amount of maritime data for safety, security, operations, and predictive uses that are collected; however, access to a portion of these data is restricted and not available for wide use because it is either classified or labeled for official use only. One example of multipurpose, non-proprietary safety and operations data are the AIS signals broadcast by commercial vessels in oceans, coastal waters as well as the Great Lakes and inland rivers. AIS signals provide location and temporal information about vessels and are used to assist with maritime domain awareness. These real-time AIS signals can be archived in a dataset and used to examine the influence of channel conditions on vessel movement, lock performance, weather conditions, port conditions, and overall waterway performance. Research efforts to quantify waterway performance include the Travel Time Atlas project currently under development by USACE, a project which relies on archived AIS data from the USCG.[3] The USCG is the official steward of archived AIS data. The ability to quantify system performance would be improved with enhanced electronic public access to this historical data.

MTS condition and performance measures in the future will require several key characteristics:

- *Data will need to be authoritative* - Authoritative data is collected in a rigorous manner and trusted to be accurate. It also comes from a non-partisan, objective source. Data that cannot be trusted to a reasonable degree is akin to having no data at all and can, in some cases, have the effect of misleading rather than informing.

- *Data will need to be available and discoverable* - High quality and helpful data exists within many MTS agencies although a significant amount may not be available to the public or even to other Federal agencies due to various restrictions that have been placed upon it. Tools such as data.gov have helped make appropriate data more widely available. Moving forward, all MTS stakeholders will benefit from efforts to enhance the availability of maritime performance data. The goal should be to provide data in a manner that is easy for others to access, understand, and use. This requires metadata (i.e. background information to accompany the actual data collected).
- *Data will need to be collected as part of a strategic process* - Collecting data can be a resource-draining endeavor and therefore needs to be approached strategically. MTS data activities will need to be thought of as an iterative process with steps for deciding:

    - What data to collect;
    - What prerelease analysis should be done;
    - How that data should be disseminated;
    - What decisions should be influenced by the data; and,
    - Assessing to determine what is going well and what needs to be changed.

Robust interagency collaboration, especially to assess shared missions and goals, and if possible, collaboration with private entities is a critical component of strategic data collection.

Performance measures for public goods will not be identical to those used in non-government settings, although there are types of MTS information widely regarded as important. The measures documented in *Marine Transportation System Performance Measures* will serve as a foundation for further development and refinement of MTS-specific condition and performance measures in the future.

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[1] U.S. Army Engineer Research and Development Center, *Marine Transportation System Performance Measures* ERDC/CHL TR-16-8, Kress, M., Mitchell, K.N., DiJoseph, P., et al, 2016.
[2] https://www.bts.gov/ports.
[3] U.S. Army Energy Research and Development Center, *Marine Transportation System Travel Time Atlas,* 2016.

ADDITIONAL CHALLENGES

- Lack of:
  - Uniform institutional culture to both collect and disseminate MTS data;
  - Established open data-sharing practices built in to existing data collection workflows to allow for better integration and coordination across agencies and projects;
  - Standard processes for collection, management and distribution of MTS data
  - Standardized data organization and technical architectures that can facilitate data discovery across agencies;
  - Data quality control standards; and
  - A central data clearinghouse for MTS-related data.
- Competing priorities for setting performance measurement goals among stakeholder groups.
- Commercial or security sensitivity parameters for releasing data.
- Difficulty acquiring privately held data (e.g. from ports) and data identified for official use only or classified.
- Reliable intermodal data linking MTS cargo movement to other freight networks remaining in development stages.
- Varied data collection practices with regards to spatial and temporal scales.
- Installation and maintenance of Automatic Identification System (AIS) signal receivers in remote inland areas.

AREAS FOR PERFORMANCE MEASURES POLICY CONSIDERATION

- To the greatest extent practical, ensure that new data management policies and practices align with international policy and standards.
- Promote Federal MTS data sharing using data already collected as part of agency missions.
- Implement Executive Order 13642: *Making Open and Machine Readable the New Default for Government Information.*

SECTION 5: COVID-19 IMPACTS

OVERVIEW

The arrival of the novel coronavirus and the COVID-19 public health emergency have dramatically impacted essential activities throughout the United States in 2020. The MTS, in particular, has been challenged in myriad ways by the public health emergency, owing to the MTS's complicated and integrated nature with the supply chain. The global economic slowdown, an effect of reduced consumer and business demand due to the public health emergency and protective measures implemented to reduce the spread of COVID-19, has resulted in reduced cargo shipping activity in US and global ports. Cruise ships have canceled sailings as some cruise lines grappled with outbreaks prior to the effective shutdown of the industry. Decreased demand for petroleum products along with the near-complete utilization of mainland storage capacity led to overflow production being stored on nearly 200 tankers anchored off US coasts. MTS stakeholders and agencies responded swiftly to the challenges posed by COVID-19 by adapting policies and procedures to protect workers and the public from infection, maintain essential functions in a rapidly-changing and economically-challenging environment, and ensure the continued operation of the MTS in support of overall recovery efforts.

"While our industry, like all Americans, has been challenged by this global health crisis in profound ways, the domestic maritime supply chain has proven resilient in the face of COVID-19."

-Ms. Jennifer Carpenter, Acting President and CEO, American Waterways Operators, House Transportation and Infrastructure Subcommittee on Coast Guard and Maritime Transportation Hearing May 29, 2020

The Executive Order on Regulatory Relief to Support Economic Recovery, issued on May 19, 2020, directs agencies to address the economic emergency resulting from COVID-19 by rescinding, modifying, waiving, or providing exemptions from regulations and other requirements that may inhibit economic recovery. This EO may directly influence the recovery of aspects of the US MTS that are subject to regulations and requirements imposed by various Federal agencies. For example, the USCG has authorities for various MTS functions such as Captain of the Port orders, licensing, ballast water, etc. and is prioritizing the implementation of policies designed to maintain the efficient functioning of the MTS during the pandemic. The Federal Maritime Commission, a regulatory agency tasked with addressing competition within the maritime industry, has convened Fact Finding Innovation Teams to identify information helpful to mitigating COVID-19 impacts to the supply chain such as the identification of shipments that contain Personal Protective Equipment so that they can be prioritized over other shipments. The USACE is adapting its dredging and lock operations as needed in response to COVID-19, with minimal impacts to services and projects.

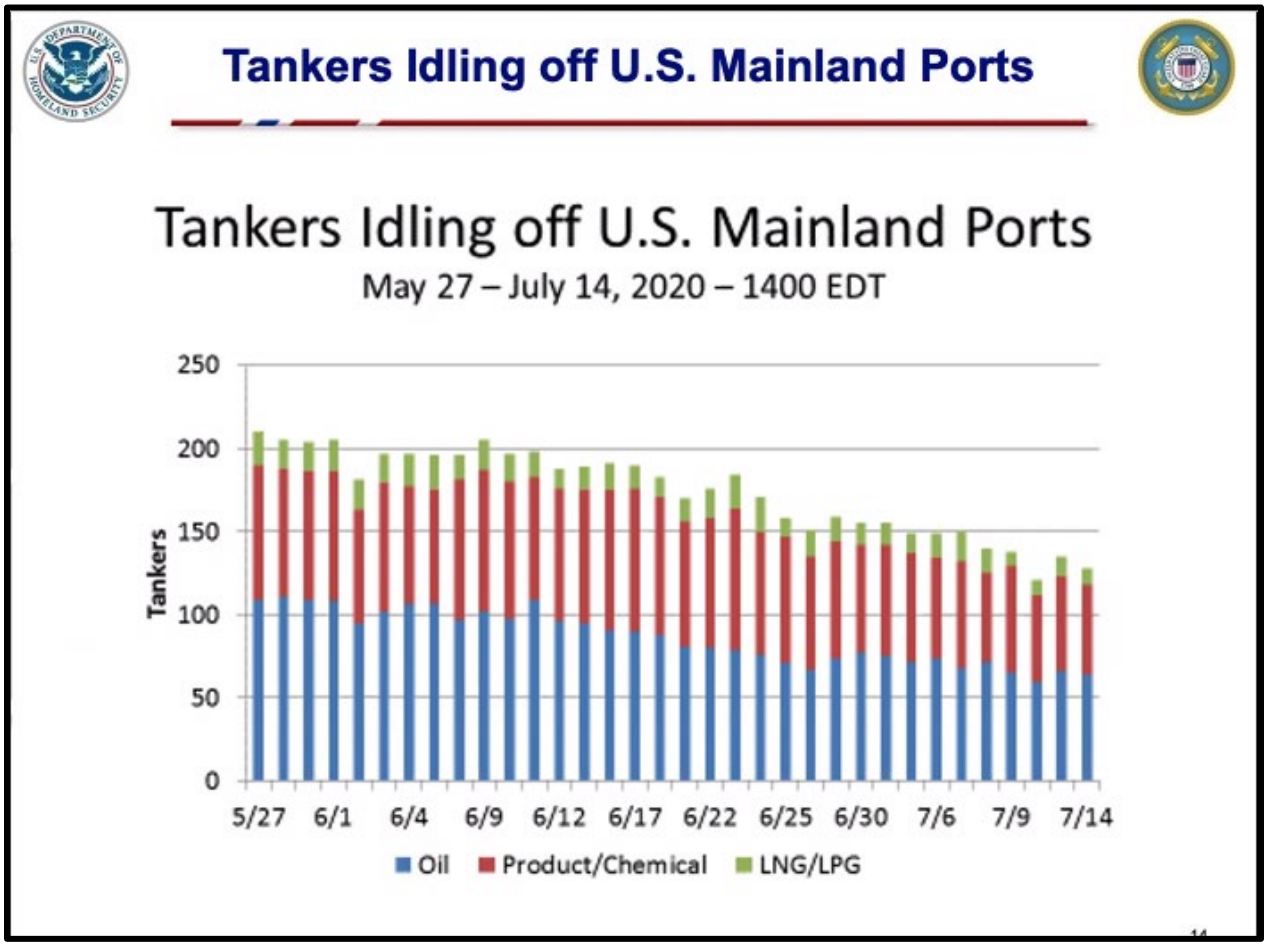

FIGURE 28 Derived from a MARAD Weekly Port Status Report.

Several agencies are responding to the impacts of COVID-19 by hosting calls and providing status reports to better communicate and coordinate with stakeholders and other agencies. MARAD produces and shares (internal to Federal agencies) a weekly coastwise accounting of combined TEU carrying capacity of all ships and energy ports, providing an essential view of the impacts of COVID-19 on capacity within the MTS for Federal agencies. Impacts to ports, such as the availability of Personal Protective Equipment (PPE) for essential workers, are reported as well. The USCG regularly convenes meetings of the Marine Transportation System Recovery Unit (MTSRU) to increase awareness of impacts to cruise ship activity, US ports, and other topline maritime issues such as crew changes. Crew changes have been an especially important focus of maritime pandemic response, with the Ship Operations Cooperative Program (SOCP) providing policy recommendations in the US Mariner Crew Change Facilitation Guidance for COVID-19 document.[1] CMTS hosts regular interagency calls to facilitate the exchange of information regarding the impacts of COVID-19 on the supply chain. The Cybersecurity and Infrastructure Security Agency continues to release updated guidance on the designation of critical infrastructure workers; more information can be found at https://www.cisa.gov/about-cisa. Agency activities that promote communication of information related to the impacts of

COVID-19 on the MTS and coordination of activities among Federal agencies help to reduce uncertainty and minimize duplication of effort during a rapidly evolving situation. A summary of various agency activities related to COVID-19 has been assembled by the CMTS Maritime Resilience Integrated Action Team and is provided in Appendix #/letter

CHALLENGES

- Response assumptions up until COVID had been centered on maritime specific events - not events that have secondary and long-term MTS recovery implications. While important to the MTS, they do not apply to FEMA standing up a regional ESF-1.
- Crew changes are essential for the efficient operation of the MTS, but they also pose a significant challenge due to the possibility of infectious spread of COVID-19 between crews.
- Reducing the possibility of transmission between crews and local agents/chandlers/stevedores has required operators to change their ship to shore communications protocols.
- The designation of maritime workers and their intermodal counterparts (port truck drivers, railway personnel, etc.) and key stakeholders as essential workers is necessary to ensure that State and local regulations do not lead to a halting of necessary MTS activities in a specific port, terminal, or region.
- Cruise ship voyage cancellations are a detriment to the economic success of the industry, result in significantly altered demand at ports and anchorages, and necessitate the resolution of thousands of disputes from affected customers. These cancellations had additional local economic impacts to businesses that typically serve cruise ship passengers in port.
- Supporting the mental health of cruise ships crews that have been impacted by serving on COVID-19-infected voyages, the loss of wages due to the suspension of cruise activities, or unexpected extended time away from home as a result of travel restrictions has emerged as a topline concern within the industry.
- Decreasing demand for petroleum products and landside storage facilities operating at full capacity has resulted in the need for tankers to be used as on-water storage vessels for excess supply. This practice is currently declining as markets self-regulate.
- Declining cargoes and cancellations (e.g. blank sailings, canceled vessel calls) are resulting in an increase in the idled capacity of cargo ships in the MTS, while also reducing demand for port and terminal services. These impacts have been uneven, with sectors such as tourism experiencing extreme declines while construction has been less severely impacted.
- Orders for new containership capacity threaten to increase the capacity of the MTS during a period of significantly decreased demand.
- Maritime Pilot access to ships has been reduced in order to protect against the threat of COVID-19 transmission.

- Virtual replacements for paperwork, inspections, and signatures are needed to reduce physical contact between essential workers in the MTS.
- Maintaining the health and safety of crews at sea and workers in ports requires the widespread availability and use of PPE and procedures such as frequent hand washing and disinfection of commonly-contacted surfaces, which can be costly and challenging.
- An airline bankruptcy in Alaska has resulted in increased demand for water-based transport of people and goods in that region.
- Historic concerns over the spread of COVID-19 by outside visitors in Alaska poses challenges to the reopening of fisheries and tourism in that region.
- The increased costs of operations in ports, terminals, and on ships, come at a time of reduced revenues, challenging the economic viability of significant portions of the MTS.
- Access to PPE for all essential workers had been inconsistent due to high demand and limited supply of these resources.
- Consistency of regulations across state boundaries is needed to ensure that critical workers in the MTS are able to efficiently maintain operations.
- The historic decline of demand in the automotive market, coupled with halted production at virtually all auto manufacturers, caused declines in RoRo cargoes of up to 90% compared to historic values.
- The U.S.-flag fleet relies on revenues from cargoes for support, and the decline of those revenues has threatened the viability of the fleet.
- COVID-19 outbreaks on vessels require consistent, predictable procedures to ensure the health and safety of crews and passengers, as well as the prevention of transmission to landside populations. Quarantining of vessels and the use of secure ports for transfer of infected crews and passengers present unique challenges during the pandemic.
- Access to 20-foot containers for agricultural products in the central US has been severely limited as a result of reduced shipping.
- An increase in abandoned cargoes in ports has resulted in increased demand for storage, potentially straining warehouse capacity in some ports and terminals.
- The prioritization of cargoes based on need, such as prioritizing PPE shipments, is necessary to support the rapid response to the COVID-19 pandemic.
- Reported inconsistencies in CBP officer compliance with PPE use and social distancing requirements at various ports may result in inefficiencies (e.g. delays) within MTS activities due to uncertainty around requirements for precautions needed due to the pandemic.

AREAS FOR PANDEMIC POLICY CONSIDERATION

- Continue interagency communication in support of broad situational awareness in the pandemic response by way of CMTS COVID-19 Working Group; Supply Chain calls; and USCG MTSRU briefings, including the national, state, and local level.
- Assess planning assumptions pertaining to coordination of large scale MTSR national/regional events related to COVID. Prior to COVID it was assumed that regional MTS equities would be addressed within FEMA ESF-1 & CG (event defined) area commands as they supported COTP MTSRU's/ CG PAC/LANT commands but secondary impacts to the MTS do not prompt a FEMA ESF-1.
- Continue to facilitate agency operations with telework policies and capabilities that support the effectiveness of agency workforces.
- Provide guidance to ports, terminals, and ship operators for best practices for acquisition and use of PPE and other COVID-19 infection prevention procedures. Work with national groups to ensure distribution of consistent policies.
- Track and disseminate indicators of MTS activity such as containership capacity, blank sailings, and other measures to raise awareness of the recovery of the MTS.
- Prioritize the health and safety of the MTS workforce through well-coordinated policies focused on testing, infection prevention, and recovery, to support the continued operations of the MTS.

CHAPTER FOUR: GENERAL OBSERVATIONS ON THE STATE OF THE MARINE TRANSPORTATION SYSTEM

The MTS is a strategic, economic engine and critical part of the national transportation supply chain. As does overall infrastructure investment strengthen our economic platform, make America more competitive, create millions of jobs, increase wages for American workers, and reduce the costs of goods and services for American consumers, so does investment in our marine transportation system. It supports millions of jobs, creating significant local, regional, and national benefits while providing safe, secure, and cost-effective and energy efficient transport. In addition, it directly facilitates international trade allowing the U.S. economy to stay globally competitive and transports commodities that are essential to America's building, manufacturing, energy and agricultural industries.

It was noted in the 1999, DOT Report to Congress: *An Assessment of the U.S. Marine Transportation System*[2], that to attain a modern MTS by 2020, the following should be performed:

- Facilitate coordination among MTS users and stakeholders;
- Address MTS funding issues;
- Achieve the vision for system mobility and competitiveness;
- Improve awareness of the MTS;
- Establish information management and infrastructure supportive of the MTS;
- Meet national security objectives; and
- Achieve safety and environmental objectives.

Federal MTS agencies, individually, and collectively, both within and outside of the CMTS partnership, have made great strides that have contributed to implementing the 1999 recommendations. In addition, industry also continues to be innovative within the MTS to meet user demand as well as aggressive with direct MTS investment, estimated in excess of $46 billion in 2017.

There has been a groundswell of events and developments that have impacted the MTS since 1999, including the 2009 recession, the expanded Panama and Suez Canals, and the unforeseen boon (and 2020 downturn) in energy exports like LNG..

The MTS is clearly a complex, strategically interconnected system – and a high performing MTS is critical to the economic, quality-of-life, and well-being of the United States. The necessary focus on the MTS to meet current and future user demand must come from both the public and private sectors. Further, recommended improvement to the MTS must include investment of thought, expertise and policy-making.

GENERAL OBSERVATIONS:

- There are over 25 Federal MTS agencies and offices, including White House offices, that engage in MTS-related activities or interests. While coordination of Federal MTS-related policy and practices across different agencies from 11 different Departments has made great advances since the 1999 MTS assessment, some challenges remain.
- Parallel to the many diverse MTS-related agencies, there are 11 Congressional committees with some jurisdiction over MTS issues. While there are related caucuses such as the House Maritime Caucus, Shipping Building Caucus, and the Port Caucus, there is no venue for whole of Congress engagement on MTS issues.
- Determining how best to prioritize MTS investment without the sense of picking winners and losers could prove challenging.
- The International Maritime Organization declared 2019 as "Year of Empowering Women in Maritime," reporting that women represent only two percent of the world's 1.2 million seafarers, and of which 94% of those are working in the cruise industry.[3] The USCG National Maritime Center (NMC) does not collect race or ethnicity information with a merchant mariner credential application. However, the NMC reported in June 2020 that almost 13% of credentialed mariners were female of which 4,729 were captains and 149 were captains with unlimited license.
- It is challenging to determine the levels of diversity within the MTS. Minorities comprised nearly 40 percent of the U.S. population, according to 2018 numbers. In the absence of real numbers, anecdotally, it is unlikely that the work force within the MTS reflects the national diversity averages.
- However, within educational maritime-related academies, the 2019 student diversity representation (also referred to as underrepresented minorities) is closer to the national diversity percentages as follows:
    - United States Coast Guard Academy – 34%
    - United States Merchant Marine Academy – 21.2%
    - United States Naval Academy – 36%
- Among the six State Maritime Academies, 2019 student diversity representation (here defined as the percentage of the student body represented by female and non-binary students) was 10.3%.
- TSA reports that there are 2.3 million active Transportation Worker Identification Credential (TWIC) cards in use and that any of the TWIC cards could be applied to the MTS environment. TSA collects some employment information which includes 80 card holders specifically reported as drayage truckers, 74 Federal employees, and 5269 reported as merchant mariners.
- There are 75 funding sources in the Federal Government that may apply to the MTS which are summarized by the CMTS in the *Federal Funding Handbook for MTS*

Infrastructure.[4] Federal programs include, but are not limited to: grants, loans, loan guarantees, scholarships, mortgage loans, insurance, and other types of financial assistance including cooperative agreements, property, technical assistance, counseling, statistical, and other expert information, and service activities of regulatory agencies.

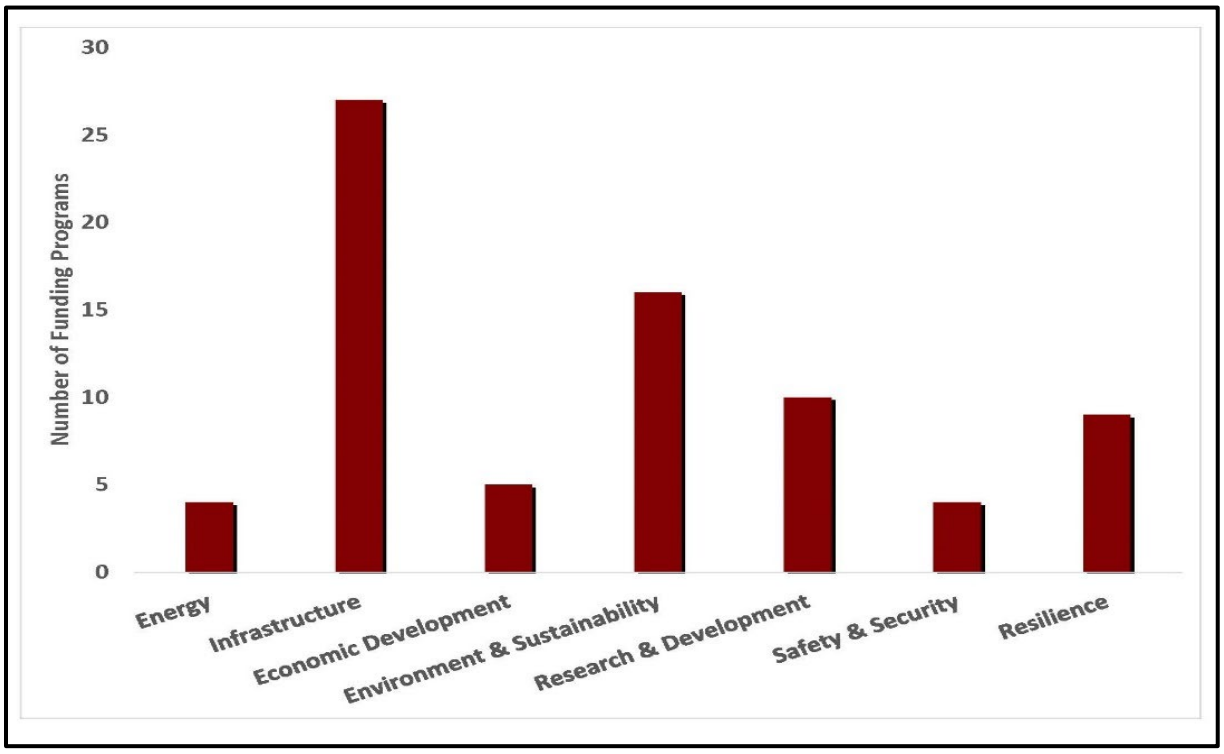

FIGURE 29 Federal funding programs which may be applied to the MTS.

- Federal agencies own, lease, or manage billions of dollars of assets, including real property, personal property, and financial assets. Improving the management of these assets – such as comprehensive inventories, accurate assessments of asset value, and improved links between acquisition and disposal plans and agency mission – is important to ensuring that taxpayer dollars are spent wisely and efficiently.[5] Under ISO 55000 through 55002: concepts, terminology, requirements and implementation guidance are provided for a management system for asset management.[6] All organizations have existing strengths and capabilities in the management of their physical, informational, and human resource assets. Understanding current capabilities is valuable for identifying what is already good, and what can be improved.
- In January 2015, a report was released highlighting public and private investments in the Great Lakes St. Lawrence Seaway navigation system[7]. The report, which was based on a survey of more than 450 U.S. and Canadian public organizations and private companies, found that $6.9 billion is being spent on asset renewal and infrastructure improvements in the Great Lakes St. Lawrence Seaway navigation system by both the public and private

sectors. Between 2009 and 2013, more than $4.7 billion had been invested in ships, ports and terminals, and waterway infrastructure, while an additional $2.2 billion in capital spending had been committed for infrastructure investments in the system by companies and governments for 2014-2018.

- There is currently a lack of consistent and uniform standards for the implementation of public-private partnerships (P3s) for MTS infrastructure investment. P3s can be complicated and the development of recommended P3 attributes and best practices organized by MTS sector could help facilitate more success in implementation.

As noted in the Focus Section regarding performance measures, the ability to provide holistic measures of the MTS is impossible at this time. However, it is the goal of the CMTS, in future assessments, to establish a baseline of measures for comparisons in five year increments.

APPENDIX A: LIST OF ACRONYMS

AASHTO	American Association of State Highways and Transportation Officials
AAPA	American Association of Port Authorities
ACSCC	Advisory Committee on Supply Chain Competitiveness (DOC)
AIS	Automatic Identification System
AMSC	Area Maritime Security Committee
ANOA	Advanced Notice of Arrival
ARD	Assessment and Response Division (NOAA)
ARRA	American Recovery and Reinvestment Act
ASCE	American Society for Civil Engineers
ATB	Articulated Tug-Barge
ATON	Aids to Navigation
ASV	Autonomous Surface Vessel
ATS	Automated Targeting System
AUV	Autonomous Underwater Vehicle
BATIC	Build America Transportation Investment Center
BLS	Bureau of Labor Statistics
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BTS	Bureau of Transportation Statistics
BTU	British Thermal Unit
CBP	Customs and Border Protection
CDF	Contained Dredge Facility
CFR	Code of Federal Regulations
CH_4	Methane
CIKR	Critical Infrastructure and Key Resources
CISA	Cybersecurity Information Sharing Act
CMTS	U.S. Committee on the Marine Transportation System
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COE	Conditions of Entry
COPT	Captain of the Port
CPT	Channel Portfolio Tool
CRM	Cyber Risk Management
CSI	Container Security Initiative
C-TPAT	Customs-Trade Partnership Against Terrorism
CWA	Clean Water Act
DGPS	Differential Global Positioning System
DHS	U.S. Department of Homeland Security

DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOJ	U.S. Department of Justice
DOL	U.S. Department of Labor
DOT	U.S. Department of Transportation
EBM	Ecosystem-Based Management
ECA	Emission Control Area
ECS	Electronic Chart System
EEZ	Exclusive Economic Zone
eMSI	enhanced Marine Safety Information
eNav	Electronic Navigation
ENC	Electronic Navigation Chart
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EWA	Energy and Water Development Appropriations
FAST Act	Fixing America's Surface Transportation Act
FASTLANE	Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration (DOT)
FILS	Federal-Industry Logistics Standardization
FINDE	Federal Initiative for Navigation Data Enhancement
FMC	Federal Maritime Commission
FRP	Facility Response Plan
FSA	Facility Security Assessment
FSP	Facility Security Plan
FutureNav	Future of Navigation (CMTS)
GAO	Government Accountability Office
GHG	Greenhouse Gas
GMCC	Global Maritime Coordination Center
GMCOI	Global Maritime Community of Interest
GPS	Global Positioning System
HFO	Heavy Fuel Oil
HMT	Harbor Maintenance Tax
HMTF	Harbor Maintenance Trust Fund
IAT	Integrated Action Team (CMTS)
ICC	Incident Command Center
ICCOPR	Interagency Coordinating Committee for Oil Pollution Research
IENC	Inland Electronic Navigation Chart

IHO	International Hydrographic Organization
IMO	International Maritime Organization
IMTS	Inland Marine Transportation System
IO	Investigating Officer
IOCS	International Outreach and Coordination Strategy
ISAC	Industry Security Advisory Center
IOOS	Integrated Ocean Observing System
ISO	International Organization for Standardizations
ISPS	International Ship and Port Facility Security
IT	Information Technology
ITS	Intelligent Transportation Systems
IWTF	Inland Waterways Trust Fund
IWUB	Inland Waterways Users Board
LCA	Lake Carriers Association
LNG	Liquefied Natural Gas
LOMA	Lock Operations Management Application
LPMS	Lock Performance Monitoring System
MARAD	U.S. Maritime Administration
MARPOL	International Convention for the Prevention of Pollution from Ships
MASS	Maritime Autonomous Surface Ship (confirm)
MCSP	Maritime Commerce Security Plan
mcy	million cubic yards
MDA	Maritime Domain Awareness
MDA-ESC	Maritime Domain Awareness Executive Steering Committee
MER	Marine Environmental Response
MIRP	Maritime Infrastructure Response Plan
MMC	Marine Mammal Commission
MOA	Memorandum of Agreement
MODU	Mobile Offshore Drilling Units
MOTR	Maritime Operational Threat Response
MOU	Memorandum of Understanding
MRSC	Mississippi River Ship Channel
MSCC	Maritime Sector Coordinating Committee
MSCI	Maritime Security Communications with Industry
MSI	Maritime Security Information
MTS	Marine Transportation System
MTSA	Maritime Transportation Security Act
MTSRU	Marine Transportation System Recovery Unit
MTSSP	Maritime Transportation System Security Plan
NAIS	National Automatic Identification System
NAS	National Academy of Sciences

NASA	National Aeronautics and Space Administration
Navy	U.S. Navy
NDZ	No-Discharge Zone
NEI	National Export Initiative
NGA	National Geospatial Agency
NGO	Non-Governmental Organization
NHFP	National Highway Freight Program
NHS	National Highway System
NIAG	National Intelligence ……
NIEM	National Information Exchange Model
NIPP	National Infrastructure Protection Plan
NMC	National Maritime Center
NMDAP	National Maritime Domain Awareness Plan
NMIO	National Maritime Intelligence-Integration Office
NMSAC	National Maritime Security Advisory Committee
NOAA	National Oceanic and Atmospheric Administration
NOC	National Ocean Council
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NRS	National Response System
NSAR	National Strategy for the Arctic Region
NSC	National Security Council
NSMS	National Strategy for Maritime Security
NSP	National Search and Rescue Plan
NTSB	National Transportation Safety Board
NVIC	Navigation and Vessel Inspection Circular
NWS	National Weather Service
O&M	Operation and Maintenance
OGT	Office of Grants and Training
OMB	Office of Management and Budget
OCS	Outer Continental Shelf
OSHA	Occupational Health and Safety Administration
OSRP	Oil Spill Response Plan
OTAQ	Office of Transportation and Air Quality
P3	Public-Private Partnership
PBWG	Pacific Ballasts Water Working Group
PHMSA	Pipeline and Hazardous Materials Safety Administration (DOT)
PORTS	Physical Oceanographic Real Time System (NOAA)
PM	Particulate Matter
PPD	Presidential Policy Directive
PSGP	Port Security Grant Program

R&D	Research and Development
RFI	Request for Information (Usually related to Federal Register Notices)
SAR	Search and Rescue
SARSAT	Search and Rescue Satellite Aided Tracking
SCC	Sector Coordinating Committee
SLSDC	Saint Lawrence Seaway Development Corporation (DOT)
snm	Square Nautical Miles
SPCC	Spill Prevention, Control, and Countermeasure
SOCP	Ship Operations Cooperative Program
SOLAS	International Convention for the Safety of Life at Sea
SONS	Spill of National Significance
SSA	Sector-Specific Agency
SSP	Sector-Specific Plan
STCW	Standards of Training, Certification, and Watchkeeping
TEU	Twenty-Foot Equivalent Unit
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIGER	Transportation Investment Generating Economic Recovery
TOTE	Totem Ocean Carrier Express
TRB	Transportation Research Board
TSA	Transportation Security Administration
TT	Task Team (CMTS)
TWIC	Transportation Workers Identification Credential
UNCLOS	United Nations Convention on the Law of the Sea
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
VGP	Vessel General Permit
VIDA	Vessel Incident Discharge Act
VTS	Vessel Traffic Services
WIFIA	Water Infrastructure Finance and Innovation Act
WRDA	Water Resources Development Act
WRRDA	Water Resources Reform and Development Act

APPENDIX B: SUMMARY OF POLICY CONSIDERATIONS

AREAS FOR MTS INFRASTRUCTURE POLICY CONSIDERATIONS

CAPACITY

- Greater collaboration and analysis among all levels of government and modal operators to identify where it is feasible to shift cargo and passenger transport from over-utilized modes to under-utilized modes (i.e. from highways to waterborne transport).
- Use of interdepartmental expertise to build upon respective flow-through modeling and operations assessments such as the USACE "Channel Portfolio Tool (CPT)," the Bureau of Ocean and Energy Management (BOEM) and NOAA multipurpose marine.cadastre.gov initiative, and the DOT Freight Analysis Framework.
- Support for enhanced communications between Federal maritime data collectors that foster efficient use of capacity to understand and fill gaps in data that are not presently being collected or tracked.
- Promote the use of freight transportation modes with high volume capability or less congested locations to enable staging, sorting, and distribution activities which would otherwise be conducted at the port.
- Create incentives for the local regulatory and transportation planning bodies to optimize freight movement between major multimodal connectors. Local rules on delivery times, evening and weekend loading and parking restrictions add complexity to the supply chain and have a negative impact on attempts to mitigate the impact of port operations. For example, the ports of Los Angeles and Long Beach development of the PierPASS program, which established off-peak hours at both the ports of Los Angeles and Long Beach, required changes in how and when the cargo was delivered to local storage and warehouse facilities in any number of local jurisdictions.

PHYSICAL INFRASTRUCTURE

- Provide interagency support for MTS application of the DOT National Freight Strategy to more effectively use appropriate resources.
- Consider the holistic review of infrastructure-related recommendations made by over thirty Federal MTS-related Federal Advisory Committees.
- Improve the usability of AIS-derived information products by establishing links to external data sources.

- Utilize investments in information technology and infrastructure to minimize the need for more-costly and disruptive physical infrastructure projects.
- Initiate a methodology to support investment decisions with plausible, accepted performance metrics that demonstrate economic, transportation, and environmental benefits.

INFORMATION AND TECHNOLOGY INFRASTRUCTURE

- Develop policies and encourage strategic investments that will facilitate the most efficient multimodal distribution of freight across the existing system through increased use of information technology.
- Support and participate in the development and implementation of data standards both nationally and internationally.
- Accelerate development of enhanced navigation safety technology such as implementing a nationwide AIS program, continued growth of PORTS® and other environmental information, and its transmission via AIS or other mechanisms and integration of multiple Federal "Notice to Mariners" by addressing interoperability and transmission hurdles.
- Share navigation technology expertise and capabilities with land-side application projects and connect and integrate technologies.
- Expand Federal Government access to improved data on port cargo flows, waterway usage, and other performance criteria to identify opportunities for making and leveraging strategic investments in both hard and soft infrastructure.
- Improve cross-modal freight movement investment by combining the Freight Analysis Framework with data from other transportation modes to identify key interchange and choke points.
- Better define and articulate the value proposition of open and easy access to AIS data across the Federal Government and public stakeholders.
- Expand options for user access to AIS data by leveraging the Federally-managed MarineCadastre.gov as a platform for enhanced accessibility.
- Identify geographic and temporal coverage gaps in U.S. AIS data and develop plans to fill them.

AREAS FOR SAFETY POLICY CONSIDERATION

REGULATIONS AND STANDARDS

- Develop new methods to promote transparency of standards development activities.
- Develop best practices and more flexible legislation to reduce the burden of updating material incorporated by reference.
- Promote continuous improvement in interagency rulemaking coordination.

- Broaden the use in the United States of emerging international standards for data and technology.
- Coordinate implementation of IMO and other international treaty provisions with rulemaking and standards development activities.
- Support the consistent implementation of the IMO Polar Code for navigational safety in polar regions.

NAVIGATION SAFETY

- The USCG, along with NOAA and USACE, are committed to designing and implementing Federal navigation safety systems that leverage the benefits of electronic technologies in order to fully meet current and future navigation requirements and bring America's waterways into the 21st century.
- Promote and enhance navigation services to expand safety information including for weather forecasting, NOAA's PORTS®, the national buoy system, notice to mariners, and hydrographic surveys.
- Ensure that proposed bridge actions meet the reasonable needs of navigation through early coordination with waterway stakeholders.
- Establish a Federal interagency data exchange framework and common policy statement to enable seamless exchange of unclassified navigational data among Federal agencies.

INVESTIGATIONS

- Continue refining and improving USCG's maritime investigation and analysis program.
- Continue coordinating investigation activities and sharing investigation information and investigation report recommendations among Federal agencies particularly for areas where multiple agencies have jurisdiction.
- Identify ways to enhance general sharing and analysis of incident information to identify trends, accident precursors, and hazards associated with OCS operations.
- Coordination of incident reporting requirements to streamline the reporting process and ensure efficient sharing of information.
- Encourage industry participation in BSEE's voluntary confidential near-miss reporting program.

SEARCH AND RESCUE

- Continue to pursue improving the U.S. and international SARSAT system.
- Expand the national suite of hydrodynamic models to be inclusive of the U.S., including the Arctic, to support SAR.

WORKER SAFETY

- Continue to pursue agreements and/or renewals of memorandums of understanding between agencies, particularly when jurisdictions may overlap.

AREAS FOR SECURITY POLICY CONSIDERATION

MARITIME DOMAIN AWARENESS

- Sustain efforts to establish new and maintain existing information sharing partnerships among the Federal and State governments and law enforcement.
- Continue ongoing efforts to enhance coordination among stakeholders and collaboration through education and outreach.
- Improve maritime domain awareness through enterprise-level access to maritime data for use by whole-of-government.

CRITICAL INFRASTRUCTURE PROTECTION

- Jointly develop priorities among stakeholders.
- Formalize, as appropriate, the interagency partnership of the Government Maritime Coordinating Committee.
- Utilize incentives to encourage private sector investment in MTS resilience and security when individual firms cannot monetize the system-wide benefits of their investments.
- Analyze infrastructure dependencies, interdependencies and associated effects.
- Identify and assess potential unanticipated infrastructure cascading effects during and following incidents such as secondary impacts from COVID-19.
- Continue to promote and support infrastructure, community, and regional recovery following incidents.
- Strengthen coordinated development and delivery of technical assistance, training, and education.
- Improve critical infrastructure security and resilience by advancing research and development solutions.
- Continue to learn and adapt during and after exercises and incidents. Develop a set of national multi-year priorities with input from all levels of government and private sector stakeholders. Develop appropriate metrics as a basis for assessment of the effectiveness of current and future protection methods which may include documented training, standard operating procedures and drills and exercises.

VESSEL AND FACILITY SECURITY

- Expand advanced electronic information to support cargo risk assessments.
- Further develop business security procedures to secure cargo at loading.
- Expand capabilities to screen for illicit cargo such as weapons of mass destruction
- Continue to assess the effectiveness of ISPS code implementation to prevent smuggling of weapons of mass destruction, other volatile materials, and/or stowaways while a vessel is in port.
- Strengthen engagement with cargo owners in AMSCs and other relevant information sharing and outreach activities.

- Review regulations for container seals and other measures to ensure cargo integrity.
- Continue to enhance in-transit visibility through improved maritime domain awareness and electronic cargo information.
- Promote effective international standards in the areas of business practices and data management.
- Examine the state of early port security-related initiatives post 9/11 such as security cameras, fencing and other physical applications for continued efficacy.

CYBERSECURITY

- Strengthen public and private sector relationships to share cybersecurity best practices.
- Assess and evaluate cyber incident response protocols and interagency relationships through exercises, drills, and assessments to increase cybersecurity incident response and cybersecurity defense.

AREAS FOR ENVIRONMENTAL STEWARDSHIP POLICY CONSIDERATION

VESSEL OPERATIONS AND ASSOCIATED REQUIREMENTS

- Promote smart speed and wake management practices through waterways with sensitive natural resources; and promote continued research into wakeless vessel design.
- Promote the use of cleaner fuels, technologies, and other emission reduction strategies to improve air quality, including by supporting collaborative efforts between government, private port operators, marine vessel operators, and near-port community groups to identify strategic clean air projects.
- Ensure that the new U.S. vessel discharge regulatory framework, and eventual new requirements, is communicated fully to both the domestic and international shipping community.
- Continue dialogue with public and private, domestic and international, stakeholders to identify improvements to vessel-based treatment technologies and management practices.
- Establish a risk assessment and response framework to identify and track aquatic invasive species, evaluate the risks, and establish emergency best management practices to respond to emerging threats.
- Support efforts to research and develop ballast water management solutions for vessels operating in the Great Lakes.
- Coordinate with State partners to develop inspection, monitoring, data management, and enforcement procedures for Federal and State enforcement of discharge requirements.

MARINE ENVIRONMENTAL RESPONSE

- Improve MER system capabilities in remote areas, e.g., the Arctic.
- Continue to develop MER proficiency, planning, preparedness capacity and policy guidance.
- Continue to support USCG's R&D initiatives through ICCOPR.
- Continue to support International multi- and bi-lateral partnerships, especially in the Arctic and Caribbean areas.
- Expand the national suite of hydrodynamic models and real-time oceanographic and meteorological capabilities to be inclusive of the United States, including the Arctic, Canadian and Western Hemisphere areas.
- Plan for deployment of Federal support to assist State and local decision makers when MER events occur.
- Commit to long term preparedness, such as advanced development and practicing of response procedures.

ALTERNATIVE FUELS AND TECHNOLOGIES

- Support and assess Federal Agency R&D activity in alternative fuels and technologies.
- Leverage new or existing funding mechanisms to promote vessel related uses of alternative fuels and technologies and associated infrastructure.
- Promulgate requirements and permitting in a timely manner regarding alternative fuels and technologies approvals and associated shore side infrastructure.
- Join with industry, as appropriate, to educate the public on the safety record of the various alternative fuels and technologies and their respective advantages and disadvantages for the MTS environmental footprint.

AREAS FOR ARCTIC POLICY CONSIDERATION

- Assign the CMTS the leadership role in the coordination, monitoring and reporting on Arctic MTS priority actions and milestones.
- Accede to UNCLOS, which establishes the framework for all maritime activity including that in the Arctic region. Acceding to the Convention would be beneficial for the United States in securing rights and access to valuable surface and subsurface minerals and other resources.
- Facilitate cooperation among Arctic MTS stakeholders to improve the Arctic MTS, noting the importance of MTS informational infrastructure and response operations, such as communications capabilities for Arctic communities and vessels and emergency response capabilities.
- Improve observation networks to aid in forecasting capabilities related to weather, oceanographic, and sea-ice conditions.

- Support continued studies on the potential risks of increased shipping on Arctic species, including ship operations (e.g. vessel noise), marine invasive species, and oil spills. These studies could consider vessel routing measures to enhance safe operations and avoidance or changes to vessel operations for areas of heightened ecological and cultural significance.
- Enhance interagency efforts related to Alaskan Native outreach and communication.

AREAS FOR ENERGY POLICY CONSIDERATION

- Enhance the application of energy exports to the NEI.
- Continue dialogue with DOT/PHMSA to find common ground on oil spill response planning and response efforts in the coastal zone
- Promote renewable and alternative energy development, including research and development, in partnership with private industry.

AREAS FOR PERFORMANCE MEASURES POLICY CONSIDERATION

- To the greatest extent practical, ensure that new data management policies and practices align with international policy and standards.
- Promote Federal MTS data sharing using data already collected as part of agency missions.
- Implement Executive Order 13642: *Making Open and Machine Readable the New Default for Government Information.*

AREAS FOR PANDEMIC POLICY CONSIDERATION

- Continue interagency communication in support of broad situational awareness in the pandemic response by way of CMTS COVID-19 Impacts to the Supply Chain calls and USCG MTSRU briefings, including the national, state, and local level.
- Assess planning assumptions pertaining to coordination of large scale MTSR national/regional events related to COVID. Prior to COVID it was assumed that regional MTS equities would be addressed within FEMA ESF-1 & CG (event defined) area commands as they supported COTP MTSRU's/ CG PAC/LANT commands but secondary impacts to the MTS do not prompt a FEMA ESF-1.
- Continue to facilitate agency operations with telework policies and capabilities that support the effectiveness of agency workforces.

- Provide guidance to ports, terminals, and ship operators for best practices for acquisition and use of PPE and other COVID-19 infection prevention procedures. Work with national groups to ensure distribution of consistent policies.
- Track and disseminate indicators of MTS activity such as containership capacity, blank sailings, and other measures to raise awareness of the recovery of the MTS.
- Prioritize the health and safety of the MTS workforce through well-coordinated policies focused on testing, infection prevention, and recovery, to support the continued operations of the MTS.

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[1] SOCP Crew Change guidance can be found at http://www.socp.us/images.html?file_id=u1Zv6r5%2FkeY%3D
[2] U.S. Department of Transportation, Bureau of Transportation Statistics, https://rosap.ntl.bts.gov/view/dot/4377, June 2020, Washington, DC.
[3] International Maritime Organization, IMO's Gender Programme, http://www.imo.org/en/OurWork/TechnicalCooperation/Pages/WomenInMaritime.aspx, 2019, London, UK.
[4] U.S. Committee on the Marine Transportation System, Infrastructure Investment Integrated Action Team, Federal Funding Handbook for the Marine Transportation System. November 2019, Washington, DC.
[5] Office of Management and Budget, Office of Federal Financial Asset Management, July 2014.
[6] ISO 55000 Standards for Asset Management, July 2014.
[7] *Infrastructure Investment of the Great Lakes St. Lawrence Seaway System,* Martin Associates, January 2015.

APPENDIX C: SUMMARY OF FEDERAL AGENCY ACTIVITIES IN RESPONSE TO COVID-19, AS ASSEMBLED BY THE CMTS MARITIME RESILIENCE INTEGRATED ACTION TEAM

Agency	COVID-19 Focus & Goals	Specific Actions
USCG	The initial focus of the USCG during the COVID-19 crisis is to provide a platform for interagency collaboration through a national-level Marine Transportation System Recovery Unit. Primarily, the MTSRU focused on the safety of the cruise industry by tracking the locations and status of US cruise vessels abroad and in US waters. As the response effort progresses, the USCG is working to provide a national view of the economic and operational impacts to ports. Simultaneously, the USCG issued Guidance (COVID-19 PLANORD) across the agency based on updates and new information about the symptoms and spread of COVID-19. The PLANORD included an enclosure entitled "Disaster Readiness During COVID-19 Pandemic" (Enclosure 11) which drew on lessons learned from After Action Reports from 2010 when the USCG simultaneously managed multiple natural disasters during the Deepwater Horizon oil spill catastrophic incident response.	-The existing Incident Command System (ICS) has established a national-level Marine Transportation System Recovery Unit (MTSRU) to serve as a platform to share information between MTS agencies -The ICS is being utilized to establish a national Marine Transportation System Recovery Unit which is used to generate status reports across multiple agencies for briefing leadership for the USCG and partner agencies. Briefings are generated through data calls from the field and include both qualitative and quantitative impacts. -The MTSRU has focused on tracking the status of the cruise industry, including locations and health status of 85 cruise ships and 50K crew members. -Secondarily, the MTSRU is evaluating the impacts of COVID-related slowdowns on USCG missions and macro-economic impacts across the US MTS. -MTSRU has produced a bi-weekly briefing for USCG and MTS agency leadership that includes a summary of both qualitative and quantitative impacts across the MTS. -Released Guidance for CG members including updated information, proper course of action, and resources regarding COVID-19.

MARAD	MARAD is providing several specific mission areas in support of COVID response. These include: supporting Federal and commercial sealift through the National Defense Reserve Fleet (NDRF) and Ready Reserve Force (RRF), workforce education, maritime infrastructure and waterways, and industrial support base. MARAD also provides national security functions when requested. These include activating necessary ships and crews to operate and support security efforts and delivering troops and equipment in times of crises and war.	- In July 2019, MARAD held a telework exercise that served as a learning experience and led to successful telework implementation in March 2020. - The NDRF and RRF have been maintained for possible deployment. Crew are regularly checked for temperatures, isolated when necessary utilizing the bubble concept or "restriction of movement (ROM) for mariners" (i.e. keeping mariners isolated prior to deployment). The fleet is subject to delays in maintenance and repair and potential restrictions of mariner movements. - MARAD is tracking port operational status and concerns (stockpile issues, storage availability and abandoned cargo). Gateway directors, MTSRU liaisons, and field liaisons have been established to local, and state, Federal partners and industry and have been instrumental in providing information to leadership. - MARAD provides significant grant opportunities for the MTS. - The U.S. Merchant Marine Academy received $1M and each SMA received approximately $167,666 in funding to prevent, prepare for, and respond to coronavirus. - MARAD has successfully participated in collaboration efforts including the MTSRU at both local and national levels, the DOT incident management system reporting tools, and escalating issues conveyed by stakeholders (e.g. clarity of essential worker designation, PPE prioritization and distribution, operational assistance) up through the department to the White House Task Force. - MARAD is presently coordinating with

		FEMA on impacts to hurricane response and recovery under pandemic constraints.
BTS (DOT)	BTS compiles, analyzes and makes accessible information on the Nation's transportation systems. During COVID-19, BTS has aimed to provide quick response transportation indicators and metrics to quantify the impacts of the pandemic to shipping and the cruise industry.	- Several new products have been developed during the COVID-19 pandemic: - Transportation Demand Early Indicators Report: an internal fact card with daily and weekly data that is being used by the agency to monitor transportation trends and predict near-term transportation demands and disruptions. Many of these numbers are released on a monthly basis, but now it's being produced internally every day. This card contains about 40 internal measures of transportation activity. Metrics include passenger and freight movements, commercial flights, highway system load factors, transit ridership, Amtrak ridership, and maritime activity around ports. - This Week in Transportation: a new webpage developed to communicate weekly updates related to COVID-19 and the U.S. transportation systems compiled using publicly available data. The change switches the BTS paradigm from reviewing and compiling comprehensive summaries before publication to releasing data as soon as it's available then review and refinement afterwards. Available at: https://www.bts.gov/newsroom/week-transportation-covid-19. - Monthly Transportation Statistics: 60 indicators pulling together lots of findings from different transportation modes all in one place. Available at:

		https://data.transportation.gov/stories/s/m9eb-yevh
DHS/CISA	CISA continues to respond to numerous requests for information, analysis, and guidance from industry and partner agencies. CISA issued and continues to maintain the Essential Critical Infrastructure Workers (ECIW) Guidance to assist Federal, SLTT, and private sector partners determine which workers are essential for the functioning of the National Critical Functions. CISA directly supports FEMA and HHS in their coordinated response to the COVID-19 pandemic, including by managing Emergency Support Function #14, providing coordination with critical infrastructure operators, and assisting with the prioritization of essential critical infrastructure workers.	- The CAT has communicated with a variety of industry stakeholders to provide assistance with the movement of PPE and to understand their outstanding needs. Protective Security Advisors in DHS regions have been central to coordination and outreach. - Task forces that stand up when services or CI sectors that fall under CISA watch are impacted by a hazard have been established to understand flow to supply chains and develop guidance for medical capacity. - The Supply Chain Stabilization Task Force is working with manufacturers, and locating PPE. - The Food Supply Chain Task Force works with critical food producers, suppliers and distributors to ensure the resilience of the Nation's food supply chain. SCTF has worked on a variety of issues, including PPE needs for food production workers, disinfectant shortages, and other commodity supply chain shortages.

		- The Community Mitigation Task Force assists FSLTT leaders to implement community mitigation (CM) strategies and make adjustments at the appropriate level and time to slow disease transmission and reduce morbidity and mortality with a particular focus on protecting individuals at higher risk for severe illness, while preserving the healthcare and public health systems, critical infrastructure and essential workforce. - The Recovery Support Function Leadership Group (RSFLG) is monitoring the pandemic spread, has been having weekly meetings, and is tracking supplemental appropriations. RSFLG is monitoring COVID-19 from a recovery perspective but have not activated and the RSFLG member agencies (USACE, DOT, etc.) have been focused on response lately. - For future planning, CISA has established a Future Cell which is looking to understand impacts to the supply chain using inputs from carriers including Port Authorities, marine shipping, and rail. The Future Cell have connected with Port Authority employees to understand pre-pandemic conditions and future concerns.

USACE	USACE has utilized the existing hazard framework to address COVID-19. Foremost, the USACE has been assigned a new mission to establish alternate care facilities while utilizing existing resources. For the MTS, mission areas that were impacted included recreation facilities, along with some regulatory actions while hydropower, navigation, and flood control all continued as mission critical.	- In addition to keeping infrastructure operational, USACE took on the new mission of designing, contracting, and constructing alternate care facilities (ACFs) in COVID hot spots. The same individuals who designed locks and managed construction of navigation projects were managing construction and contracts for ACFs. - Existing USACE teams had to pivot to new charges. The USACE contingency operations group that usually meets weekly, has now transited to national disaster phase (same structure as during hurricanes) and the group now meets twice daily, seven days a week. - The USACE headquarters has established new task teams to track budget implications nationwide and to limit requests to the field. - Dredge operators under USACE contracts usually meet quarterly to prioritize the mission and communicate USCG regulations. The meeting frequency has increased to weekly. - USACE is working to keep mariners as safe as possible with involvement from Unions, Occupational Safety and Health Administration, etc. - Functional leads of USACE mission areas have had to re-craft existing outreach both internally and externally as far as who is doing what, how are they working with stakeholders, and how they are relying on MARAD and MTSRU calls in order to minimize duplication of efforts. - USACE is relying heavily on interagency engagements and highlighted the appreciation of communications and coordination to help minimize duplication

		of efforts. - Telework has forced the organization to new platforms and adaptations. For example, the added increase in capacity for virtual private networks increased from 6K to 80K.

FEMA	In the unprecedented conditions of COVID-19, FEMA's mission of helping people before, during and after disasters remains the same. In preparation for the 2020 hurricane season, FEMA has worked to provide actionable guidance to State, Local, Tribal, and Territorial (SLTT) officials to prepare for response and recovery operations and encourages personal preparedness measures amidst the ongoing COVID-19 pandemic.	- Released a document entitled "COVID-19 Pandemic Operational Guidance for the 2020 Hurricane Season." The document summarizes the pandemic environment relative to the upcoming hurricane seasons. It provides resources and checklists to help emergency managers and public health officials' best prepare for the upcoming hurricane season during ongoing pandemic response. - Released the "Exercise Starter Kit for Reconstituting Operations" to help facilitate discussions, validate planning, and identify and address gaps. - Released the "All-Hazards Preparedness in a Pandemic Exercise Starter Kit" to help FEMA partners prepare for the hurricane season and other hazards in a pandemic environment. - Provided State, Local, Tribal, and Territorial (SLTT) Governments $100 million in Fiscal Year 2020 Emergency Management Performance Grant Program and Supplemental (EMPG-S) funds. These funds are intended to be used for the following: - Ensure adequate funding and planning for preparedness and response efforts in a COVID-19 environment. - Review, modify, and/or execute logistics and enable contracts to increase capability to stockpile and provide necessary resources needed to stabilize lifelines. - Modify plans to account for limited travel options and increased time needed for the evacuation of healthcare facilities in a COVID-19 environment. - ID mass care and shelter options that meet CDC guidance and mitigate risks. - Emphasize collection, analysis, and sharing of data in accordance with

		applicable legal protections and processes to strengthen decision-support capabilities.
NOAA	In response to COVID-19, NOAA's Office of Coast Survey Navigation Response Division's focus is on protecting its employees so that they may continue to maintain open lines of communication with stakeholders, provide support for navigation related issues and incidents, and maintain hydrographic survey response readiness to safely and quickly respond to navigation related emergencies that pose an imminent threat to life, property, or the environment, in support of ESF-1.	- Maximum telework for employees - Navigation Managers maintain open lines of communication with USCG Captain of the Port, USACE, Pilot Associations, Port Authorities, and other users of NOAA products and services in their respective regions - Navigation Response Teams hydrographic survey operations that don't address an imminent threat to life, property, or the environment were postponed to limit survey crew exposure to COVID-19 in order to maximize readiness for an ESF-1 response. As local conditions improve, routine surveys will be conducted with new administrative

		controls in place. - Administrative and engineering controls have been established for boat and vehicle operations to limit the risks of crew exposure to COVID-19 while engaged in ESF-1 related response activities. - Operational Risk Management (ORM) assessments have been updated to include COVID-19 risk evaluation criteria.
FMC	FMC is primarily a regulatory agency that addresses competition within the industry. FMC monitors issues between liners and terminal operators and produces analysis for impacts on competition. One initiative that flows from COVID situation is "Fact Finding 29," to bring industry stakeholders together to identify potential roadblocks or bottlenecks in the supply chain and resolve them proactively. Ten teams of 5 representatives each are looking for concrete solutions to support maritime operations. However, any recommendations will be related to FMC's portfolio only. FMC is also working on an interpretive rule to address detention and demurrage charges. Again, recommendations will be related to FMC's authorities.	-The Commission initiated Fact Finding No. 29, International Ocean Transportation Supply Chain Engagement, in order to identify operational solutions to cargo delivery system challenges related to Coronavirus-19. -The Commission initiated Fact Finding No. 30 to identify commercial measures passenger cruise lines can adopt to mitigate COVID-19 related impacts to this sector of the maritime industry.
BSEE	BSEE's focus during COVID-19 has been the protection of its inspectors, offshore oil and natural gas workers and staff to ensure BSEE continues its critical mission of promoting safe and environmentally sustainable production of oil and natural gas offshore. Since oil and natural gas produced offshore is vital for the country's energy, economic, and national security, BSEE's staff also	- BSEE immediately developed and issued a COVID-19-related Instructional Memorandum to staff, issued PPE guidelines and training on proper use of PPE, and developed work processes (including forms related to OCS travel) to ensure maximum safety of personnel. The Instructional Memorandum was revised 6 times and reissued to respond to the latest

	ensured inspections continued despite the challenges associated with COVID-19.	information regarding COVID-19 defenses. - BSEE changed work practices when necessary to ensure we continued to achieve our mission of promoting safety, protecting the environment and conserving resources offshore was achieved by expanding telework, increasing eRecords inspections, adding health screening and implementing multiple additional measures to protect BSEE personnel traveling to the OCS and while on OCS facilities. - BSEE staff used Center for Disease Control and Prevention guidelines to develop health screening protocols, provide personal protective equipment to inspectors and align mitigation measures with the offshore industry to provide maximum protection for all workers. - As industry protocols also evolved, BSEE coordinated efforts to prevent lapses in inspections. From March 20 through August 31, 2020, BSEE inspectors conducted 1,439 physical inspections on a total of 1,112 Gulf of Mexico oil and natural gas facilities, and 1,258 record inspections. During this same time period, no BSEE employee traveling offshore was infected with COVID-19. There were 1,439 physical inspections and 0 infections.

NGA	NGA continues to support the mission of collecting, analyzing, and distributing geospatial intelligence. During the COVID-19 pandemic, NGA has focused on transitioning production of Safety of Navigation products to an unclassified environment to reduce impact to the accuracy, quality, and timeliness of NGA support to the maritime community.	- Transitioned majority of workforce to full time telework during COVID-19 pandemic - In the process of transition to an unclassified environment to complete production of Safety of Navigation products including Digital Nautical Charts (DNC), Standard Nautical Charts (SNC), and Electronic Navigational Charts (ENC) - Ensure Safety of Navigation by providing critical updates to DNC and messages distributed through the World-Wide Navigational Warning System (WWNWS) - Notice to Mariners moved to unclassified environment and released on weekly basis - Collecting features and validating Dynamic World Coastline data to make dataset available for Public Release
CDC	CDC is focused on reducing the spread of COVID-19.	- On October 30, 2020, CDC issued a Framework for Conditional Sailing Order for cruise ships operating or seeking to operate in U.S. waters. This Order introduces a phased approach for resuming passenger cruises. Passenger operations continue to be suspended during the initial phases of this Order. The initial phase requires crew screening to determine the prevalence of COVID-19 among all crew members currently on cruise ships in U.S. waters. - -CDC contracted for a report on U.S. merchant mariner mental health. The report is available at https://deohs.washington.edu/sites/default/files/2021-11/mariner%20wellbeing%20final%20report.pdf