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VOICES FROM THE FIELD

Port Recovery in the Aftermath of Hurricane Sandy

Improving Port Resiliency in the Era of Climate Change

By Commander Linda A. Sturgis, USCG; Dr. Tiffany C. Smythe and Captain Andrew E. Tucci, USCG

Center for a New American Security

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The views expressed in this report are those of the authors and do not represent the official policy or position of the Department of Defense, Department of Homeland Security or the U.S. government.

Cover Image

The U.S. Coast Guard fuel pier and shore side facilities in Bayonne, New Jersey were severely damaged from Hurricane Sandy's storm surge.

(U.S. COAST GUARD)

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As Hurricane Sandy approached the northeast coast of the United States in late October 2012, it drove an extraordinary 14-foot storm surge into the Port of New York and New Jersey and surrounding communities. The water swelled over the piers and quays, causing oil and hazardous materials incidents, sweeping debris into shipping channels and severely damaging 180 commercial waterfront facilities. Corrosive saltwater flooded the operations centers of marine terminals, destroying computers, security cameras, power transformers and cargo control systems. Crude oil refineries, bulk-oil holding facilities, and containership and passenger vessel terminal operations all came to a halt. All told, Hurricane Sandy devastated communities in the Caribbean and up and down the eastern U.S. seaboard, causing immense human suffering and over $70 billion in damages. In the immediate aftermath of Sandy, restoring port functions to resume the flow of critical fuel and other cargo became a national security and economic priority.

This narrative provides a first-hand account of Hurricane Sandy's impact on the port of New York and New Jersey and the subsequent port recovery effort. We then offer recommendations to the public and private authorities charged with strengthening port communities and reducing the potential impact of natural disasters and human-caused events.

Improving the resilience of the nation's Marine Transportation System (MTS) is particularly important today because extreme weather may cause port recovery operations to become increasingly frequent events. Globalization and growing populations make ports the epicenters of international commerce vital to U.S. and international economic growth. As a result, the resilience of U.S. ports in the face of a changing climate is critical to protect U.S. economic vitality and national security.

Ports and coastal facilities are vulnerable to a range of manmade and natural threats. The effects of rising sea levels and extreme weather on coastal infrastructure could potentially threaten national security, as pointed out in prominent documents recently released including the 2014 Quadrennial Defense Review and the Center for Naval Analyses Military Advisory Board's 2014 report on climate change.[1] The 2014 National Climate Assessment predicts that the average global sea level may rise between one and four feet by 2100, which may result in more extreme storm surges, wave damage from storms and both temporary and longer-term flooding events.[2] Moreover, scientists predict an increase in the number of high-intensity Atlantic tropical storms, such as Hurricane Katrina.[3] Although it is difficult to attribute any one weather event to climate change, scientists indicate that changing environmental conditions are increasing the odds of extreme weather events.[4]

THE U.S. MARINE TRANSPORTATION SYSTEM

Connecting sea, land and air transportation, ports make up an integral part of the U.S. MTS that provides safe, secure and efficient transportation of people, fuel and cargo. The MTS includes over 25,000 miles of navigable channels, countless ships and barges as well as mariners, facility operators and dock workers. The MTS contributes approximately $650 billion annually to the U.S. gross domestic product and supports more than 13 million jobs across the nation.[5] Waterborne transport, including approximately 45 million cargo containers annually, accounts for 75% of the volume of all international trade and is valued at over $1.7 billion, making it the largest single contributor of all transportation modes.[6]

Port resilience and MTS security directly affect critical national defense, national security and economic interests. Many of the nation's ports include, or are located near, major Department of Defense and Coast Guard installations, such as those in Jacksonville, Norfolk, San Diego and Hawaii. Government and private-sector infrastructure mutually support military outloads for overseas contingency operations, as well as the routine transportation of materials shipped from United States defense industrial bases to locations worldwide.

THE PORT OF NEW YORK AND NEW JERSEY

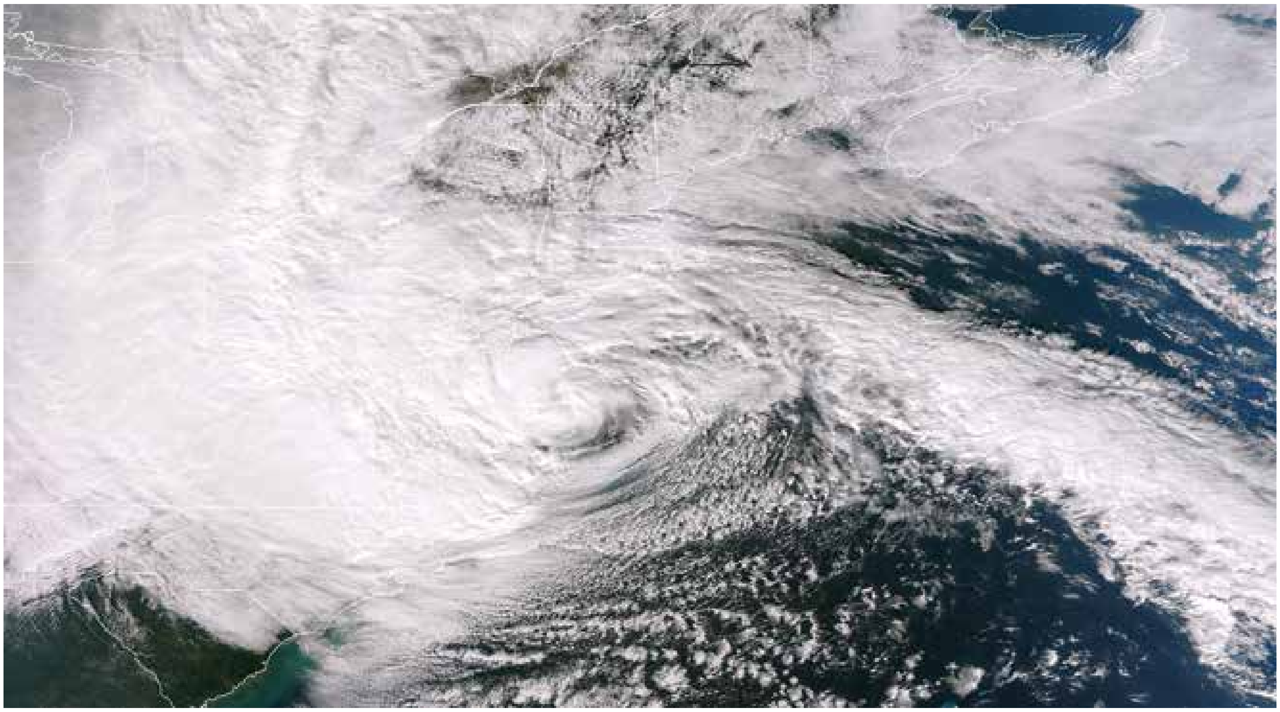
To understand Hurricane Sandy's impact on the MTS and the port recovery effort, it is important to recognize the magnitude of maritime operations in the Port of New York and New Jersey (the Port). Beyond the iconic Statue of Liberty, New York's harbor hosts the largest port on the east coast, handling over 5.4 million shipping containers, 745,000 automobiles and 37 million tons of bulk cargo annually, with a combined cargo value of $202 billion.[7] The Port and its network of shipping channels, rivers and designated anchorages is a main distribution hub for nearly all forms of international and domestic cargo and fuel stocks, and it supports nearly a half-million regional jobs.[8]

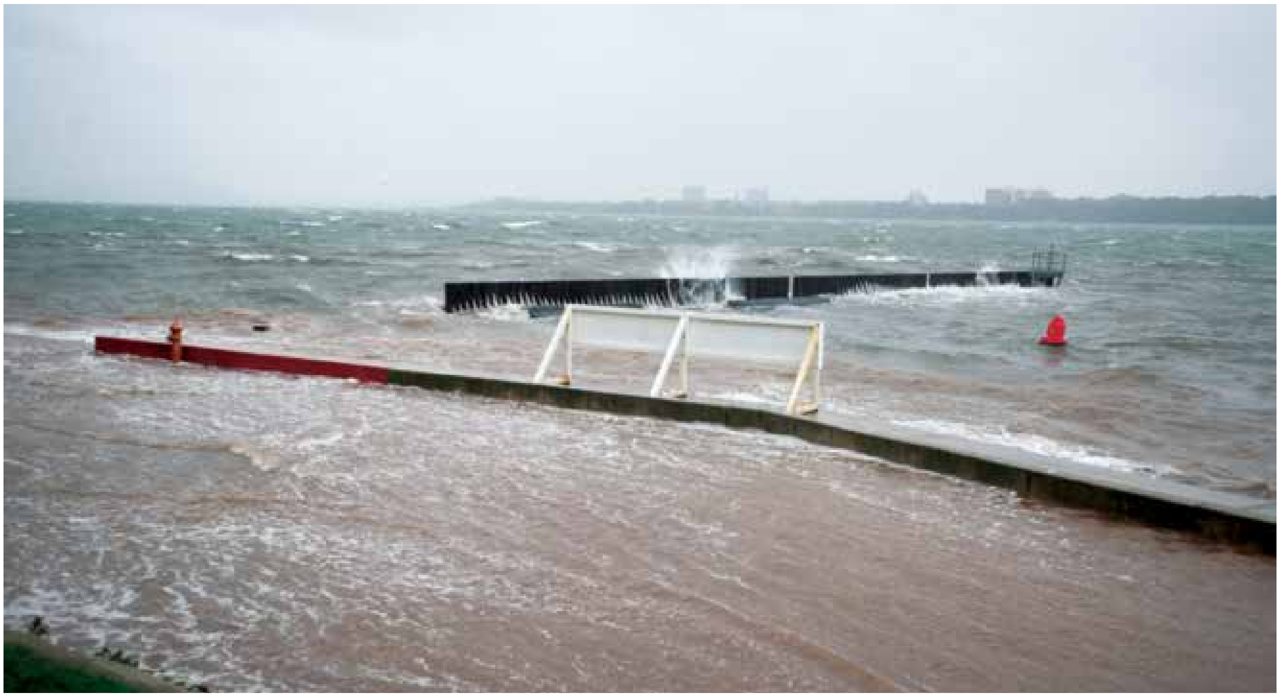
The Port is one of the largest producers of energy in the United States, as one of the busiest and most widely interconnected petroleum-chemical distribution systems in the United States. The Port receives petroleum products through two major pipelines and hundreds of large sea-going oil tankers that deliver petroleum and chemicals from all over the world. Port businesses refine crude oil and blend refined products to create gasoline, diesel and home heating oil. Trucks, railcars, barges and ships distribute these refined petroleum products to supply the greater New York-New Jersey metropolitan region, New England, parts of Canada and some overseas communities.

The Port also hosts a wide range of maritime operations and activities, including commercially owned support services that facilitate cargo operations, ship repair, recreation and the transportation of 40 million people annually who rely exclusively on passenger ferries or water taxis for their daily commute.[9]

PRE-STORM PREPARATIONS

Following the Coast Guard's *Sector New York Hurricane and Severe Weather Plan*, port operators, agencies and waterfront businesses began pre-storm preparations several days before Hurricane Sandy's predicted landfall on October 29, 2012.[10] The Coast Guard initiated port-wide communications to inform stakeholders and to ensure that its own personnel, vessels and shore-side facilities remained safe during the storm and were ready to conduct search and rescue, environmental response and port recovery operations.





TOP: Hurricane Sandy makes landfall, causing a 14-foot storm surge to wreak havoc throughout the nation's most densely populated port area. (NATIONAL WEATHER SERVICE)

BOTTOM: Water level starting to rise before Hurricane Sandy made landfall at Coast Guard Station New York on the North Shore of Staten Island. Note, picture taken approximately 4:30 p.m., but the storm surge was not until 8:30 p.m. (U.S. COAST GUARD)

Hurricane Sandy port recovery operations actually began two days before the storm, when the Coast Guard activated the Marine Transportation System Recovery Unit (MTS-RU). Formally created in 2006 as a lesson learned from Hurricane Katrina, the MTS-RU is a group of public and private representatives within a given port community with a common goal of restoring the Marine Transportation System in the event of a port-wide disruption.[11] MTS-RU members represent all facets of a port community, including waterways managers, facility operators, harbor pilots, towing-vessel owners, vessel agents and dock-worker/labor representatives. Members of the MTS-RU also share a common knowledge of port terminology, operations and regulatory requirements for their respective port area. The Coast Guard only activates the MTS-RU for actual or expected port recovery operations, but the pre-identified members hold routine meetings and calls and typically conduct an annual exercise to remain ready for actual events.

The MTS-RU for Hurricane Sandy was a model public-private collaboration, with members drawn from across both sectors. The efforts of this group in advance of the storm proved critical to the success of the recovery efforts. Public-sector participants included the Coast Guard – the lead federal agency – as well as additional federal and local agencies such as the National Oceanic and Atmospheric Administration (NOAA), U.S. Army Corps of Engineers (ACOE), Port Authority of New York and New Jersey, New York City Department of Transportation Staten Island Ferry and New York City Economic Development Corporation. The team also included private-sector leaders representing harbor pilots, oil and general cargo terminals, labor associations, shipping agents, tug and barge operators and other port businesses.

As the MTS-RU came together, the U.S. Coast Guard Captain of the Port notified Port leaders that the Port would be closed to marine traffic 24 hours before Hurricane Sandy's landfall.[12] This enabled Port facilities to make final storm preparations to minimize risk. Commercial waterfront facilities shut down all operations, secured power and evacuated personnel. Large commercial ships, including cruise ships, went to sea to weather the storm. Smaller vessels, such as tug boats, small passenger vessels and water taxis, rode out the storm with their crews onboard in the harbor or up the Hudson River to make sure their vessels were not swept ashore or grounded by heavy winds or the anticipated storm surge.

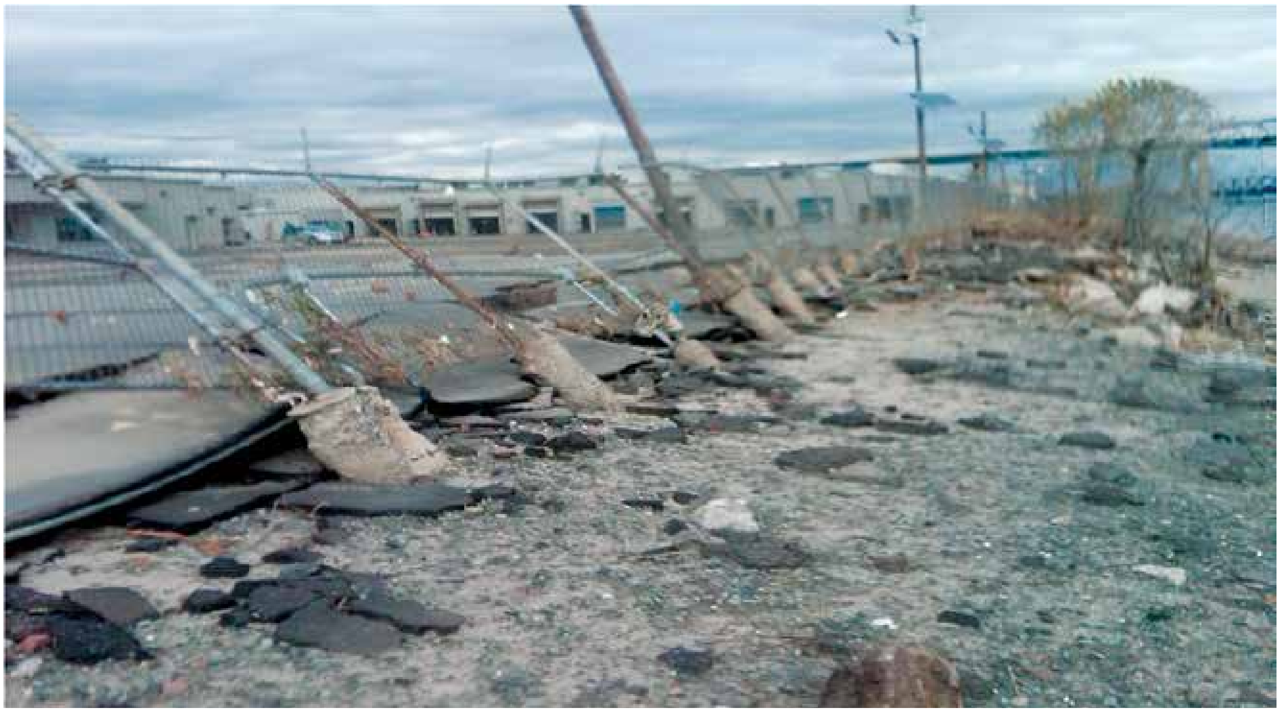
Coast Guard conducting mid-storm search and rescue coordination with New York Police Department and Fire Department, City of New York.

(U.S. COAST GUARD)

Damage to Port-Wide Facilities

With an 870-nautical-mile diameter that spanned nearly the entire length of the eastern seaboard and peak winds of 80 to 90 knots, Hurricane Sandy drove an enormous storm surge into the New York, New Jersey and Connecticut coastlines and surrounding communities at 8:30 p.m. on October 29, 2012. According to the NOAA PORTS system and tidal data sensors, storm tides reached a record 14.06 feet at the southern tip of Manhattan and 14.58 feet at Bergen Point, a critical area between New York and New Jersey along the Kill Van Kull and Arthur Kill waterways that hosts a concentration of oil refineries and petroleum-chemical holding facilities.

HURRICANE SANDY DAMAGE

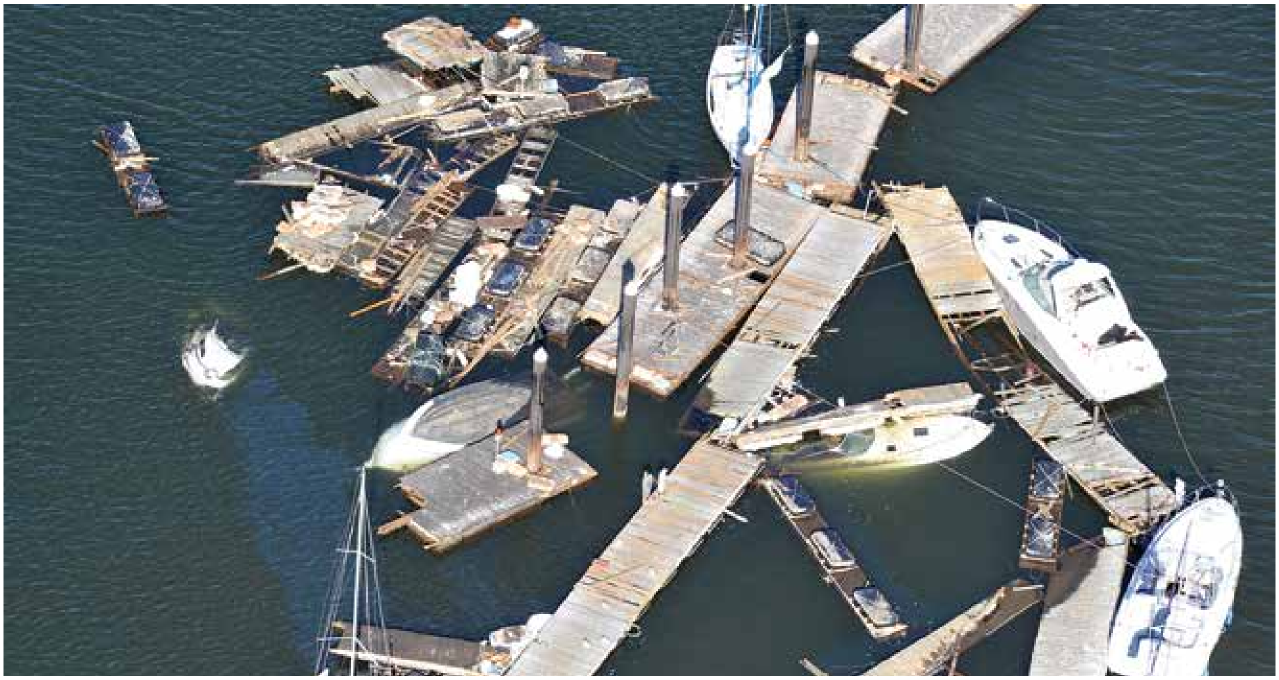


TOP: Miles of security fencing destroyed during the storm.

BOTTOM: Shipping containers in Newark during the height of the storm. (PORT AUTHORITY OF NEW YORK AND NEW JERSEY)

TOP: Pier damage.

BOTTOM: Computer servers damaged. (PORT AUTHORITY OF NEW YORK AND NEW JERSEY)



TOP: Damage to bulk fuel oil and chemical facilities in the port area.

BOTTOM: Many marinas and thousands of recreational vessels were damaged or destroyed, creating safety, pollution and navigation hazards. (U.S. COAST GUARD)

Unlike many hurricanes, in which wind is the most damaging force, Hurricane Sandy was a surge event that caused extensive flooding damage to waterfront infrastructure in areas the Port community had never previously experienced. The storm surge severely damaged or destroyed berths and pier faces, sending corrosive saltwater into electronically controlled operations centers and transformers and damaging cranes, fuel-oil pumps, security systems and transportation infrastructure, as well as response and recovery equipment.

The storm caused equally severe damage to private maritime businesses and to government buildings and infrastructure. The Sandy Hook Pilots' operations building, and the pier and boat maintenance facility on the north shore of Staten Island were completely destroyed. Damage to government facilities included the ACOE New York District waterfront facility at Caven Point (Jersey City, NJ), which supports their harbor survey and marine debris removal operations. The Port Authority of New York and New Jersey's main office complex in Newark was flooded nearly to the second floor and was under major reconstruction for several months after the storm. Although one shore-based Coast Guard unit was able to return to full operational status within hours after the storm passed, all others operated at a degraded capability for a year or more while awaiting repairs to their piers, buildings and shore-side infrastructure.

As soon as the storm passed and it was safe to launch the NOAA Navigation Response Team (NRT) boats, NOAA surveyors provided near-real-time updates on underwater object detection, which greatly assisted the Coast Guard Captain of the Port in making timely decisions about opening the Port. As NOAA and the ACOE surveyed the waterways, ACOE, the Coast Guard and professional salvage companies removed obstructions such as submerged shipping containers. Critical services, such as the New York City Department of Environmental Protection's sewage-transfer vessels and limited water taxi services, began to resume within 24 hours after the storm passed, although they did so with a calculated risk of damaging their vessels in the massive post-storm debris fields floating throughout the area.

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For tug and barge traffic, as well as deep-draft vessels, certain areas of the Port were closed to traffic for three to five days after the storm had passed until underwater surveys were complete and the waterways were verified to be clear of obstructions. Detailed underwater survey work was critical in the safe reopening of the Port to shipping, including emergency deliveries of vital petroleum fuel products. These around-the-clock surveys covered 34 square nautical miles and 100 linear nautical miles of waterways in the Port of New York and New Jersey in just five days.[13]

Fuel and Power Shortages

In the immediate aftermath of Hurricane Sandy, the media widely publicized the resulting fuel shortages. Images of long lines at gas stations seemed to feed mounting public anxiety and political

Coast Guard Cutter *Willow* placing aids to navigation back on station to mark shipping channels for the resumption of fuel and supplies in the region.

(U.S. COAST GUARD)

A large portion of the port recovery effort was coordinated with the oil spill response and clean up of 500,000 gallons of heavy fuel oil discharged into the waterway.

(U.S. COAST GUARD)

pressure. The fuel shortage, caused partly by the loss of electrical power at oil terminals and retail gas stations, affected the Port community as well. In some instances, fuel shortages delayed response and recovery activities. Although the Coast Guard opened most of the waterways within five days, many port facilities, including container and oil terminals, could not resume full operations due to facility damage and loss of power. Saltwater intrusion and other factors damaged most of the waterfront electrical infrastructure, especially on the first floor and below ground. Many emergency power generators installed at commercial waterfront facilities to provide alternate power for cargo and passenger operations were also damaged or destroyed by the saltwater storm surge.

Despite these challenges, once facility operators were able to clear debris away from their piers along the water and land access points, petroleum facilities began to drain storage tanks without mechanical power to fill available tank trucks and barges. Also, one major pipeline that normally delivered crude oil to the Port purged its lines to a Port area not affected by the storm and began transporting refined gasoline from the Gulf states to bulk oil terminals with the ability to transfer the product to barges, trucks and, ultimately, gas stations. Within four days of the storm's passing, refined fuel was again flowing within the Port, although not at a sufficient rate to meet the initial demand. Terminals and gas stations gradually came back on line throughout the region as they regained shore power. Within 10 days of the storm's passing, the Hurricane Sandy fuel crisis had been mitigated.

Other Impacts and Operations

Surveying waterways and clearing underwater obstructions was only one part of the Port recovery effort. Hurricane Sandy's storm surge also damaged oil storage tanks and piping at marine terminals, causing approximately 500,000 gallons of heavy fuel oil to be released directly into the Arthur Kill waterway, a busy and narrow shipping channel primarily used for fuel oil distribution by tank ship or tank barge. To ensure the safety of hundreds of oil-spill responders operating spill-removal equipment and to avoid disturbing the many miles of containment boom that kept the spill from spreading into adjacent waterways and New York Harbor, the MTS-RU carefully coordinated the Port recovery effort with the oil-spill

With many cell phone and radio towers damaged by Hurricane Sandy, Coast Guard Cutter *Spencer* provided command, control and communications platform for underway port recovery vessels.

(U.S. COAST GUARD)

response and established speed restrictions on ships and barges transporting fuel oil.

Hurricane Sandy also sank or severely damaged thousands of recreational boats and many marinas and demolished several historic lighthouses and waterfront establishments. Early in the Port recovery effort, the Coast Guard conducted outreach to marina owners to identify and tag damaged recreational vessels while they were awaiting removal from the water. Although few recreational vessels initially obstructed the entrance to the Port and shipping channels after Hurricane Sandy, damaged boats that broke loose from their moorings were at risk of floating into the channels during soon-to-follow nor'easter storms, which are frequent occurrences during the fall and winter months. Just nine days after Hurricane Sandy – still during the Port recovery process – a nor'easter blew through the area, bringing heavy wind, snow and reduced visibility. This caused key shipping channels to be closed for nearly 12 hours and further delayed the restoration of power in certain areas.

Like all major disasters, Hurricane Sandy was a deeply personal event for people in the immediate vicinity and adjacent areas. Nearly every first responder and member of the port recovery effort experienced direct effects of the storm, including lost homes, offices or cars; property damage; or close friends or relatives suddenly displaced from their residences. Yet the community as a whole – including many people directly involved in the post-storm recovery – took in those who needed shelter, helped to remove debris from neighbors' houses, distributed emergency supplies in sub-freezing temperatures and provided other community assistance where needed.

Relationships and Trust

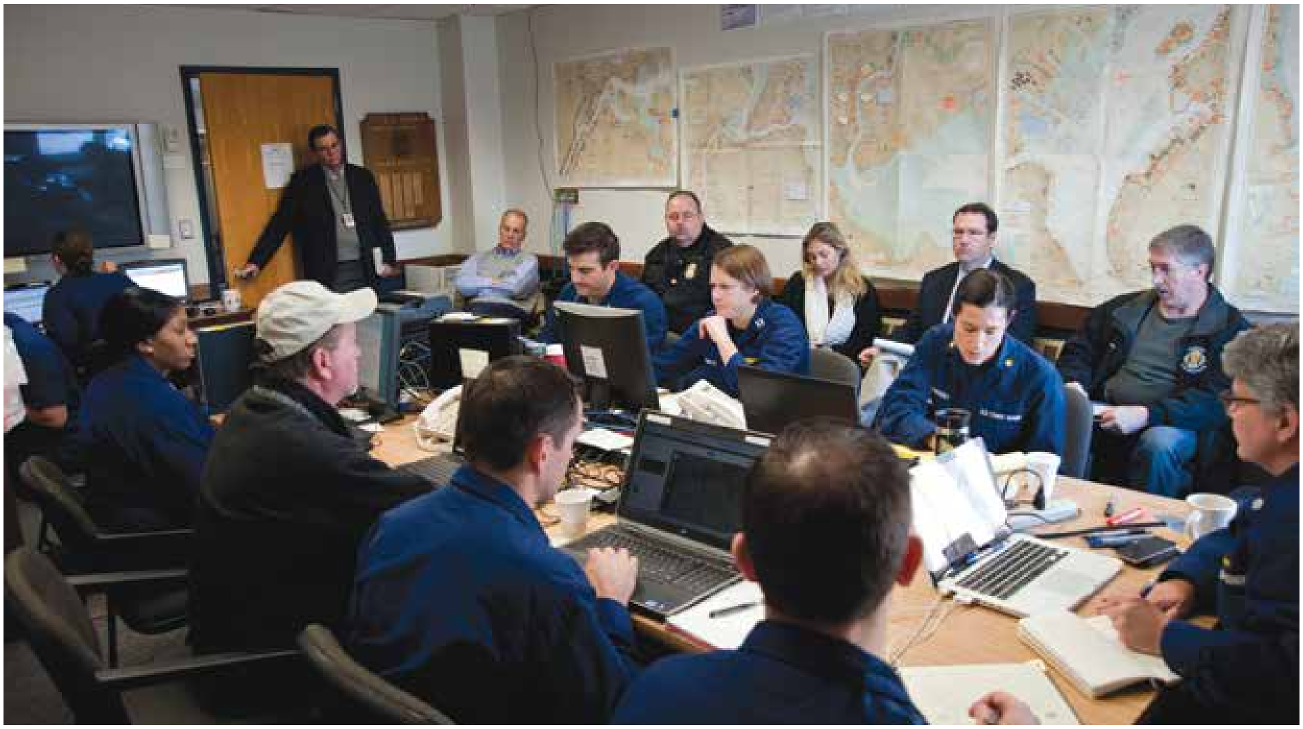
The backbone of port recovery efforts was the MTS-RU, which worked successfully during Hurricane Sandy because it relied on longstanding working relationships and trust – cultivated long before the storm – between members of the port community. To work efficiently, the MTS-RU relied on the broad web of relationships generated by two standing committees that work on emergency planning for coastal storms and other contingencies in the Port of New York and New Jersey: the Harbor Safety, Navigation and Operations Committee (Harbor Ops) and the Area Maritime Security Committee (AMSC).[14]

In interviews about a month after the hurricane, key members of the Port community cited professional relationships and the knowledge and trust they brought to the team as the most important factors in the success of the recovery effort.[15] Additional interviews conducted four to six months after the event, when port recovery primarily involved rebuilding and hardening shore-side infrastructure, corroborated this finding.[16] Although difficult to quantify, anecdotes of cooperation and trust among the entire Port community are woven throughout the recovery effort. For example, at the height of the fuel crisis, members of the Coast Guard and NOAA discussed the difficulty of finding regular-grade gasoline to re-fuel NOAA harbor survey vessels; a MTS-RU participant who represented private cargo terminals overheard this conversation and helped to coordinate a solution, allowing NOAA to continue port surveys without delay. In another example, Coast Guard Station New York, the primary unit for search and rescue and security operations in New York City, was severely damaged. The New York City fire department's Marine Unit 9, located nearby on Staten Island, invited the Coast Guard crew to moor their boats at, and operate from, their waterside firehouse. For nearly three months, the two organizations lived and worked out of the same facility.

The backbone of port recovery efforts was the MTS-RU, which worked successfully during Hurricane Sandy because it relied on longstanding working relationships and trust – cultivated long before the storm – between members of the port community.

In addition, the relationships and trust among the MTS-RU participants allowed the flexibility and quick decision making needed for success. For example, as facilities developed alternative security arrangements to address storm damage, Coast Guard facility inspectors issued on-the-spot approvals of safety and security plan amendments while conducting post-storm assessments, allowing businesses to safely resume operations.

Overcoming enormous challenges, the Port community reopened the Port of New York and New Jersey and, in doing so, demonstrated a noteworthy level of resilience. Although the relationships that were so important to this success may seem self-evident, they did not appear spontaneously, nor were they organized into action without effort. The trust, networks and cooperation had been actively cultivated by the MTS-RU participants over many years through hundreds of interactions prior to Hurricane Sandy. These day-to-day, often face-to-face, interactions occurred during Harbor Ops and AMSC meetings, training efforts and exercises, as well as actual Port-wide emergencies.



The Marine Transportation System Recovery Unit; author Commander Sturgis pictured far right. USCG, NOAA and CBP leveraging social capital with Sandy Hook Pilots, maritime industry and the port community to mutually address challenges and coordinate reopening the port.

(U.S. COAST GUARD)

DISCOVERING "BLIND SPOTS" IN THE MIDST OF A CRISIS

A wealth of federal, state, local and facility-specific hurricane and heavy weather plans are used within the Port. For the most part, these planning documents were closely followed during Hurricane Sandy, which enabled a swift recovery with no loss of life or major injury at Port of New York and New Jersey facilities. However, with any low probability/high consequence event, some areas can be identified as needing further improvement. In the aftermath of a storm like Hurricane Sandy, "blind spots" often become evident. But proactive and adaptive strategies can be used to overcome these vulnerabilities. The key success factors in any major incident recovery effort include not only the actions taken to address the event at the time but also how the event is evaluated afterward and how the lessons learned are implemented to improve plans and processes to reduce future risks.

Predicting and Planning for Storm Surge

Hurricane Sandy caused extreme flooding at many Port facilities that extended far inland, well beyond local knowledge of historical flooding and the 100-year and 500-year floodplain boundaries on the FEMA flood insurance rate maps available at the time.[17] Although some scientists had modeled storm surges of similar magnitude for the New York City region, these academic studies were not widely available and not yet incorporated into FEMA maps or other guidance.[18] Moreover, many hurricane plans for Port facilities in the region were written to address wind, not storm surge, and at the time of the storm, the National Weather Service did not issue site-specific storm surge maps to accompany hurricane warnings.[19] For these reasons, the Port community did not have the best available data and up-to-date information on storm-surge predictions in their geographic region, two necessary requirements to predict or prepare for such a large-scale storm surge.

Integrating Truck and Rail Connections into Port Recovery Planning

Within days of the storm's passing, channels were surveyed, piers were relatively clear of debris and ships were permitted by the Coast Guard to enter the Port. However, when the Port resumed operations and the gates to facilities were once again open for business, it quickly became evident that the truck and rail sectors had incurred significant losses as well. Many commercial trucks and freight trains were left parked at their facilities during the storm – often in low-lying areas adjacent to the Port – and were damaged or destroyed by the storm surge. An estimated 4,500 commercial trucks and hundreds of railcars located around the Port were lost during Hurricane Sandy. Coupled railcars disabled on critical tracks and the reduced number of commercial trucks available to transport fuel and containers slowed the movement of supplies and the Port's overall recovery. Damage to trucks and trains could have been minimized, and the loss of many family-owned trucking companies avoided, had these transportation sectors been integrated into a holistic transportation system recovery process and their fleets relocated in anticipation of the impending storm surge.

Adapting to Power and Communication Disruptions

Prolonged power outages in the region following the storm were among the worst of the problems the Port faced following Hurricane Sandy. Loss of power meant a loss or reduction in electronic communications – landlines, cell phone towers and the Internet. The Port community used personal communication devices when cell towers were working but relied heavily on face-to-face contact and liaisons to coordinate recovery operations. Loss of power also meant that the terminals were unable to handle products. Even after the waterways were open for navigation, oil terminals were unable to distribute petroleum products at pre-storm rates. At general cargo- and vehicle-loading facilities, loss of shore-side power resulted in safety and security concerns. Downed fences and electronic security systems around cargo facilities and imported-vehicle storage areas created risk of theft and nefarious activity. Facilities hired security guards and recruited volunteer police officers from around the country until they could repair fences and install new security systems.

PREPARING FOR THE NEXT STORM: PORT VULNERABILITIES AND RESILIENCY STRATEGIES

The New York and New Jersey Port community's experience with Hurricane Sandy demonstrated important vulnerabilities and suggested a number of measures that ports nationwide and internationally can take to improve their resilience. There is agreement within the scientific community that climate change will make hurricanes and storm surges like Sandy more common in the future. Lessons learned from Hurricane Sandy can lead to recommendations that will help improve responses to similar future events.

Some U.S. ports may be especially vulnerable to storms and flooding associated with climate change. The U.S. coast between Cape Hatteras and Boston, which includes major ports such as Norfolk, Baltimore, New York and Boston, has been identified as a "hotspot" for sea-level rise, with an observed sea-level increase three to four times higher than the global average.[20] A 2013 study found that Miami, New York-Newark, New Orleans, Tampa-St. Petersburg and Boston are among the 10 most vulnerable port cities worldwide based on potential annual losses as a result of flood events.[21] In addition, military installations operated by the Navy, Coast Guard and other branches of the armed services in major ports across the country are also at risk. For example, Naval Station Norfolk is particularly vulnerable to coastal storms and rising sea levels because of high subsidence rates in the immediate area.[22]

Hard port resilience strategies are designed to improve the structural integrity of infrastructure and can include elevating or redesigning facilities with electrical equipment in preparation for saltwater intrusion; designing new buildings and infrastructure to accommodate flooding; or fully elevating wharves, buildings, roadways and rail lines.

Resiliency Strategies

In the Port of New York and New Jersey, Hurricane Sandy highlighted ways in which the Port was resilient to coastal storms and other threats – and ways it could improve its resiliency. From a national security and defense readiness perspective, port resilience is critical to maintaining the flow of maritime commerce and the movement of vital products through America's seaports.

Certain problems caused by Hurricane Sandy, such as weakened or failing physical infrastructure, must be mitigated through "hard" resilience strategies. In general, hard port resilience strategies are designed to improve the structural integrity of infrastructure and can include elevating or redesigning facilities with electrical equipment in preparation for saltwater intrusion; designing new buildings and infrastructure to accommodate flooding; or fully elevating wharves, buildings, roadways and rail lines.

However, physical infrastructure improvements are often expensive, must be carefully planned and take time. The success of the MTS-RU illustrates how "soft" resilience strategies, which require minimal investment, can significantly enhance a port's response and recovery capabilities. Soft resilience strategies include ways to reduce vulnerability and improve response and recovery capacity through planning, people, partnerships and policy. Soft strategies represent lower-cost measures that can improve a port's resilience to a wide range of threats. These include: planning for response and recovery; increasing access to high quality data; and developing a web of bonds, ties and relationships across sectors – that is, building what scholars have called "social capital" through collaboration.

The MTS-RU succeeded in facilitating an efficient port recovery process for multiple reasons. By the time that Hurricane Sandy hit, the MTS-RU was already established, functional and guided by well-crafted plans. The MTS-RU leveraged informal partnerships between public and private organizations and enjoyed strong bonds with the local community and industry built over years of collaboration. Collectively, the Port community and key members of the MTS-RU worked around the clock to safely and quickly resume the flow of fuel and supplies to the region. Close coordination and open communication between individuals and agencies ensured a carefully sequenced port recovery.

RECOMMENDATIONS

The following recommendations reflect key lessons identified during the Hurricane Sandy port recovery process that can improve the resilience of ports and the MTS to significant disruptions caused by physical and cyber-attacks, industrial accidents and natural disasters. If incorporated into the national planning process, such changes could build resiliency and strengthen port communities.

Establish an Interagency Port Resiliency Task Force

The U.S. government should establish an interagency port resiliency task force to facilitate a national strategic policy discussion about port resilience planning. This task force should include, at a minimum, the Departments of Defense, Homeland Security, Transportation, Energy and Commerce and could be facilitated through the interagency Committee on the Marine Transportation System. Interagency planning is necessary to connect maritime transport with road and rail links, to identify choke points and critical paths for energy distribution, to maintain the ability to communicate and conduct operations during power and Internet outages and to distribute the most recent and relevant data to plan for the full range of manmade and natural threats.

Improve Weather and Climate Data for Use in Disaster Planning

Port communities need the best available scientific data and information on immediate and long-term weather and climate threats in order to update hurricane plans and prepare long-term strategies. There is a wealth of available research and data that is not limited to updated FEMA floodplain maps and site-specific storm-surge maps accompanying hurricane warnings.[23] Ports need access to credible, site-specific data on projected sea-level rise and other future conditions, and it should be presented in a form that is usable by non-scientists. Some ports may also need improved data on other natural or human-induced threats, such as earthquakes, tsunamis, fires or chemical explosions. This information is critical for helping ports assess their vulnerability and improve response, recovery and long-range planning.

Invest in Social Capital

Investing in the development of social capital in each specific U.S. port community – through public-private collaboration, relationship building and networks – is a cost-effective port resiliency strategy that can be adapted to all types of hazards.[24] Hurricane Sandy showed that existing activities in the Port of New York and New Jersey, such as Harbor Ops and AMSC committees and collaboration on port-wide exercises, can help to build and maintain ties and bonds within a port community, even before crisis strikes. Facilitating these face-to-face interactions by convening meetings, supporting employee attendance and encouraging broad participation is critical. It is also critical for each port community to build ties and to improve partnerships and dialogues with people and organizations outside the port community – such as power suppliers, trucking companies and climate science experts – to gain access to much-needed information and improve lines of communication.[25]

CONCLUSION

Hurricane Sandy's impact on the Port of New York and New Jersey was the largest MTS disruption since Hurricane Katrina in New Orleans and the Gulf of Mexico. There will certainly be similar future events, and the country must be prepared. The Port's safe and rapid recovery and the strong working relationships and trust within the Port community clearly illustrate how relationships build port resiliency. This resiliency serves a range of interests, from national defense to the needs of individuals, small businesses and families. In an era of climate change and ever-shrinking budgets, establishing an interagency transportation recovery task force, improving weather and climate data and information exchange for use in disaster planning, and cultivating greater connections, ties and bonds of cooperation within a port community represent some of the most powerful and cost-effective investments the nation can make.

ENDNOTES

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7. Port Authority of New York and New Jersey, "2013 Trade Statistics," panynj.gov, June 25, 2014, http://www.panynj.gov/port/pdf/2013_trade_statistics_sheet.pdf.

8. New York Shipping Association, "Delivering Jobs," nysanet.org, June 25, 2014, http://nysanet.org/delivering-prosperity/delivering-jobs.

9. CMDR Linda A Sturgis', USCG personal interviews with the largest passenger ferry and water taxi services in the New York and New Jersey port area (2012). This number is a combination of the approximate annual passenger counts for each company.

10. U.S. Coast Guard. *USCG Sector New York Hurricane and Severe Weather Plan*, July 31, 2012, https://homeport.uscg.mil/cgi-bin/st/portal/uscg_docs/MyCG/Editorial/20140508/Hurricane%20%20Severe%20Wx%20Plan_2014.pdf?id=f7c39e98ddddc6f6f388625c5014a280f6e7fc50&user_id=cc88015c899b88da75ec08018cb1b6c6.

11. The purpose and organization of the MTS-RU is outlined in U.S. Coast Guard Commandant Instruction 16000.28, "Recovery of the Marine Transportation System for Resumption of Commerce." Each local MTS-RU is specified in a port's Area Maritime Security Plan and is organized through the Area Maritime Security Committee.

12. "Captain of the Port" is a position held by a senior Coast Guard officer who has statutory authority over a defined geographic or port region. 33 C.F.R. § 1.01-30, "Navigation and Navigable Waters." This regulation states that "Captains of the Port and their representatives enforce within their respective areas port safety and security and marine environmental protection regulations, including, without limitation, regulations for the protection and security of vessels, harbors, and waterfront facilities; anchorages; security zones; safety zones; regulated navigation areas; deepwater ports; water pollution; and ports and waterways safety."

13. Brent K. Pounds, Kyle R. Ward and Dawn Forsythe, "NOAA Rapid Survey Response for Hurricane Sandy" (paper presented at the Hydrographic Society of America Conference, New Orleans, March 26, 2013), http://www.thsoa.org/hy13/pdf/0326P_10L__58.pdf.

14. The Area Maritime Security Committee is established and structured in the Maritime Transportation Security Act of 2002. 46 U.S.C. § 2101 "General definitions."

15. CAPT Andrew E. Tucci's, USCG; and staff interviews with Port partners as part of the Hurricane Sandy after-action report (November 2012).

16. Tiffany Smythe interviewed USCG staff and Port partners in January to March 2013. Smythe, "Assessing the Impacts of Hurricane Sandy on the Port of New York and New Jersey's Maritime Responders and Response Infrastructure," Quick Response Report No. 238, University of Colorado Natural Hazards Center Quick Response Grant Program (May 31, 2013), http://www.colorado.edu/hazards/research/qr/submitted/smythe_2013.pdf.

17. Federal Emergency Management Agency (FEMA) has since issued preliminary revised flood insurance rate maps for the New York and New Jersey region that show much greater flood risk for Port facilities and adjacent communities. FEMA Coastal Analysis and Mapping, "Preliminary Flood Insurance Rate Map Data," region2coastal.com, updated January 9, 2014, http://www.region2coastal.com/preliminaryfirms.

18. See, for example, N. Lin, K. Emanuel, J. Smith and E. Vanmarcke, "Risk Assessment of Hurricane Storm Surge for New York City," *Journal of Geophysical Research* 115 (September 2010), D18121; and A. Benimoff, B. Blanton, E. Dzedzits, W. Fritz, M. Kress, P. Muzio and L. Sela, "Storm Surge Modeling of Superstorm Sandy in the New York City Metropolitan Area" (paper presented at the annual meeting of the American Geophysical Union, San Francisco, California, December 9-13, 2013).

19. The National Weather Service has since designed an "Experimental Potential Storm Surge Flooding Map" program to be rolled out during the 2014 hurricane season; for further information, see http://www.nhc.noaa.gov/experimental/inundation/.

20. Asbury H. Sallenger, Kara S. Doran and Peter A. Howd, "Hotspot of Accelerated Sea Level Rise on the Atlantic Coast of North America," *Nature Climate Change,* 2 no. 12 (June 24, 2012), 884-888.

21. Stephanie Hallegatte, Colin Green, Robert Nicholls and Jan Corfee-Morlot, "Future Flood Losses in Major Coastal Cities," *Nature Climate Change,* 3 (August 18, 2013), 802-805.

22. Department of Defense, Strategic Environmental Research and Development Program, *Assessing Impacts of Climate Change on Coastal Military Installations: Policy Implications* (January 2013); and Honghai Li, Lihwa Lin and Kelly A. Burks-Copes, "Coastal Inundation due to Tide, Surge, Waves, and Sea Level Rise at Naval Station Norfolk" (paper presented at the Environmental and Water Resources Institute 2013 Congress, Cincinnati, Ohio, May 19-22, 2013).

23. As discussed above, since Hurricane Sandy, FEMA has issued preliminary updated floodplain maps for much of the Port of New York and New Jersey area, and the National Weather Service has launched an experimental program for issuing site-specific, geo-referenced storm surge warnings.

24. For more on social capital, see Daniel P. Aldrich, "Fixing Recovery: Social Capital in Post-Crisis Resilience," *Journal of Homeland Security*, 6 (June 2010); Daniel P. Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery* (Chicago: University of Chicago Press, 2012); W. Neil Adger, "Social Capital, Collective Action and Adaptation to Climate Change," *Economic Geography,* 79 no. 4 (October 2003), 387-404; and Russell Dynes, "Social Capital: Dealing With Community Emergencies," *Journal of Homeland Security Affairs*, 2 no. 2 (July 2006).

25. Experts typically distinguish between "bonding" and "bridging" social capital. Robert Putnam at Harvard University described bonding ties as "sociological superglue" and bridging ties as "sociological WD-40." Robert Putnam, *Bowling Alone* (New York: Simon & Schuster, 2000), 23.

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