



2017 Hurricane Season FEMA After-Action Report

July 12, 2018



FEMA

Letter from the Administrator to the Emergency Management Community

The 2017 Hurricane Season was a devastating experience for millions of Americans, with more disaster survivors registering for assistance than the previous 10 years combined. While the Nation responded to three major hurricanes in quick succession—Harvey, Irma, and Maria—California simultaneously suffered historic wildfires. FEMA and its partners rose to these challenges and I am incredibly proud of how we performed in extraordinary circumstances. Not surprisingly, the unprecedented scale and rapid succession of these disasters stretched response and recovery capabilities at all levels of government, and is transforming the way emergency managers prepare for and respond to disasters. The challenges we faced required that we innovate and deliver our programs differently. Looking ahead, we will take bold action to improve the Nation’s overall readiness and resiliency for future incidents.



FEMA’s *2018-2022 Strategic Plan* builds on the lessons from 2017 and an intensive stakeholder engagement process to point the way forward for our Agency and the emergency management community. First, we must build a national culture of preparedness. Second, we must ready the Nation for catastrophic disasters. Third, we must reduce the complexity of FEMA, making the Agency’s programs and services easier and more efficient.

Building a Culture of Preparedness

Building a culture of preparedness within our communities and our government will support a national effort to be ready for the worst disasters—at the individual; family; community; state, local, tribal, and territorial (SLTT); and federal levels. Those closest to the impacted areas are the true first responders during any emergency or disaster. In 2017, brave residents joined first responders, along with state and local emergency managers, non-profit organizations, the private sector, and federal staff in working together to serve survivors. Countless Texans and Louisianans took to their boats and rescued fellow residents who were stranded by rising floodwaters. In Puerto Rico, “health brigades” of local volunteers knocked on doors to identify and assist those who could not leave. We must continue to support these types of life-saving activities by private citizens. In addition, we must encourage citizens to buy insurance and be prepared for disasters. Communities must mitigate the effects of possible incidents to be more resilient.

The 2017 Hurricane Season also reminds us of the importance of preparedness of SLTT governments. While FEMA has and will continue to work with all levels of government to get much needed commodities to survivors, the hurricanes also showed that governments need to be better prepared with their own supplies, to have pre-positioned contracts with enforcement mechanisms, and to be ready for the financial implications of a disaster. Establishing “rainy day” or disaster relief funds and increasing awareness of federal procurement standards will help communities prepare for the initial outlay of expenses and ensure their eligibility for federal reimbursement.

Readying the Nation for Catastrophic Disasters

Responding to overwhelming incidents requires emergency managers to adapt, innovate quickly, and engage new partners to address unanticipated impacts and cascading effects. While plans are based on the best information available, no disaster follows the plan. Every response requires adaptation, which is why flexible authorities and programs are important.

The response to the hurricanes demonstrated the need for emergency managers at all levels to improve collaboration with the critical infrastructure sectors. These disasters demonstrate that our current organizing structures are insufficient to promote this collaboration. We need to revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across the critical infrastructure sectors. As a Nation, closer partnerships with the private sector are crucial in providing commodities and support to survivors.

No jurisdiction or federal agency has all the staff and resources it will need to respond to a catastrophic incident. During the 2017 hurricanes, state and local governments shared resources through mutual aid protocols, including the Emergency Management Assistance Compact. Efforts to streamline resource sharing, such as National Incident Management System resource typing and the National Qualification System, can create additional capacity for emergency management programs across the country. By building capacity at the state and local levels, federal financial support may not require a federal staff presence in small disasters.

FEMA and our territory and federal partners faced challenges supplying limited temporary power generation capacity, highlighting that governments at all levels and private sector owners of critical infrastructure need to further invest in resilient electrical grids and prepare for outages. Operable communications are critical to effective disaster operations. In the aftermath of Hurricane Maria, 95 percent of cell towers in Puerto Rico were out of service and outages continued in the ensuing months. As a result, local, territorial, and federal agencies faced difficulties knowing what was needed and where in the immediate aftermath of the storm. We must ensure survivable communications capability to enable coordination between government leadership and to maintain connection with the critical infrastructure sectors. We, as a Nation, have more work to do collectively to prepare for and respond to major infrastructure outages.

Reducing the Complexity of FEMA

FEMA will work with all of our partners, including Congress, to better serve survivors before, during, and after disasters. Some of these actions cannot be accomplished within existing authorities or by administrative action. Collectively, we must continue to simplify our processes and leverage new approaches and technology to reduce complexity and increase efficiency, focusing on outcome-based recovery.

The 2017 hurricanes reinforce that there is no easy or one-size-fits-all solution to housing tens of thousands of displaced survivors. FEMA needs to simplify the process of applying for assistance to make our programs easier to navigate. SLTT officials—within and beyond the emergency management community—are better able to shape the future recovery of their communities. Working together, we can build capability to better enable federally supported, state-managed, and locally executed methods to shelter and house survivors.

With this report, FEMA and the emergency management community have an opportunity to learn from the 2017 Hurricane Season and build a more prepared and resilient Nation.



Brock Long
FEMA Administrator

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Executive Summary

The 2017 Atlantic Hurricane Season was one of the most active seasons in U.S. history, causing widespread damage to, or destruction of, critical infrastructure, livelihoods, and property. The hurricane season was accompanied by devastating wildfires in California that burned for months. Between April and November there were 17 named storms, of which 10 became hurricanes (Figure 1). This After-Action Report focuses on three of these storms that made landfall as major hurricanes in the United States in quick succession. Specifically, this report focuses on the response and initial recovery from August 25 to November 30, 2017.

- On August 25, **Hurricane Harvey** made landfall in Texas as a Category 4 storm. For several days, the storm hovered near the Houston metropolitan area and set a record for the most rainfall from a U.S. tropical cyclone. Of households impacted by Hurricane Harvey, 80 percent did not have flood insurance.
- On September 6, **Hurricane Irma** became one of the strongest Atlantic hurricanes on record. The storm's center passed just north of the U.S. Virgin Islands and Puerto Rico and destroyed critical infrastructure on St. Thomas and St. John in the U.S. Virgin Islands, as well as Puerto Rico and the Florida Keys. Hurricane Irma was the first major hurricane to make landfall in Florida since 2005. The public followed evacuation orders as the storm approached Florida, resulting in one of the largest sheltering missions in U.S. history. Hurricane Irma also impacted the Seminole Tribe of Florida and the states of Alabama, Georgia, North Carolina, South Carolina, and Tennessee.
- The center of **Hurricane Maria** passed southeast of St. Croix, U.S. Virgin Islands on September 19 as a Category 5 storm, and made landfall in Puerto Rico as a Category 4 storm the next day. Hurricane Maria severely damaged or destroyed a significant portion of both territories' already fragile critical infrastructure. Maria left Puerto Rico's 3.7 million residents without electricity. The resulting response represents the longest sustained air mission of food and water delivery in Federal Emergency Management Agency (FEMA) history.

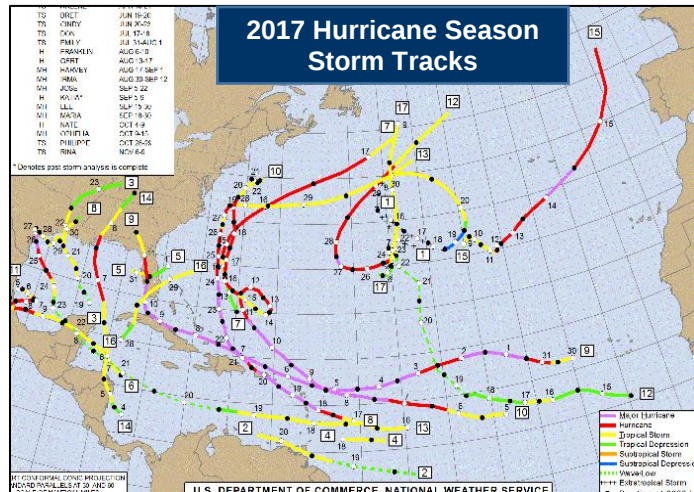


Figure 1: The 2017 Hurricane Season was exceptionally active, with 17 named storms (source: National Hurricane Center).

In addition to the three major hurricanes making landfall, Hurricane Jose threatened the Caribbean and the East Coast of the United States for nearly two weeks, requiring FEMA resources and interfering with sea transport to the Caribbean. Similarly, Hurricane Nate made landfall near the mouth of the Mississippi River, but its impacts were relatively limited. Nearly simultaneously, FEMA also supported California in responding to some of the most devastating wildfires to ever impact the state. Last year's hurricanes and wildfires came at a time when FEMA was already supporting 692 federally declared disasters and tested the Nation's ability to respond to and recover from multiple concurrent disasters.

Hurricanes Harvey, Irma, and Maria caused a combined \$265 billion in damage and resulted in widespread displacement of survivors.

From Hurricane Harvey's landfall in Texas on August 25 to the end of the 2017 Hurricane Season on November 30, the President granted 10 Major Disaster declarations and 10 Emergency declarations for communities impacted by these three storms. As of April 30, 2018, FEMA had obligated \$21.2 billion towards the impact of these hurricanes, including disaster assistance to survivors and the affected communities. FEMA coordinated large deployments of federal personnel, both before and after the storms' landfalls, to support response and initial recovery efforts across 270,000 square miles. These deployments included over 17,000 FEMA and federal Surge Capacity Force personnel, and nearly 14,000 staff from various offices of the Department of Defense (DoD) operating under DoD's Defense Support of Civil Authorities process.

FEMA Urban Search and Rescue Task Forces, comprised of state and local emergency responders, saved or assisted nearly 9,500 lives across the three hurricanes. These numbers stand in addition to the thousands of lives saved or assisted by DoD, the U.S. Coast Guard, state and local first responders, and neighbors helping neighbors. Concurrent with response operations, FEMA moved quickly to meet long-term survivor needs.

The unprecedented scale, scope, and impacts of the complex combination of hurricanes Harvey, Irma, and Maria and the California Wildfires tested the capabilities FEMA has developed and improved since hurricanes Katrina and Sandy. The 2017 Hurricane Season involved major operations across multiple incidents that required decision-makers to rapidly observe and react to unfolding events. FEMA surged and redeployed resources for incidents across a wide geographic area to support millions of survivors in their time of need.

By May 2018, nearly 4.8 million households affected by the 2017 hurricanes and California Wildfires registered for assistance—more than the previous 10 years combined.

Key Findings

Following the 2017 Hurricane Season, FEMA conducted an After-Action Review of the Agency's preparation for, immediate response to, and initial recovery operations for hurricanes Harvey, Irma, and Maria. The lessons learned from this review are driving targeted improvements within key areas of FEMA's response and initial recovery operations. Findings from the 2017 Hurricane Season are also guiding FEMA's ongoing efforts to help the whole community improve preparedness.

FEMA analyzed an extensive set of data and supporting information from across the Agency and its partners and identified 18 strategic-level key findings across five focus areas:

Focus Area 1: Scaling a Response for Concurrent, Complex Incidents

Key Findings

1. FEMA leaders at all levels made major adaptations to Agency policy and programs to respond to significant operational challenges during the hurricane season.
2. FEMA's plans guided response operations, but enhancements to the planning process and format are needed to improve usability during operations.
3. FEMA could have better leveraged open-source information and preparedness data, such as capability assessments and exercise findings, for Puerto Rico and the U.S. Virgin Islands.

Focus Area 1: Scaling a Response for Concurrent, Complex Incidents

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Leverage the new FEMA Integration Teams and technical assistance to help states build capacity
- Work with whole community partners to improve risk management and strengthen capabilities
- Create preparedness and planning products that are easily accessible, modular, inclusive, and readily executable
- Drive outcome-based recovery through expanded use of Stafford Act Section 428 Authorities for Public Assistance Alternative Procedures

Focus Area 2: Staffing for Concurrent, Complex Incidents

Key Findings

4. FEMA entered the hurricane season with a force strength less than its target, resulting in staffing shortages across the incidents.
5. The Agency has made progress on disaster workforce certification, but had not achieved its targets. Field leaders reported some resultant inefficiency in program delivery.
6. FEMA strategically consolidated ongoing disaster operations facilities across the country to reallocate personnel to the hurricane-affected field operations, which increased capacity to deliver FEMA programs.
7. FEMA augmented its disaster workforce through a combination of initiatives it has used before, as well as innovative and newly expanded methods—these initiatives met their stated intent, but can be matured.

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Support states in building a greater capacity to respond to and recover from disasters by maintaining financial support while right-sizing the federal deployment footprint
- Build and maintain a national incident workforce that includes emergency managers from state, local, tribal, and territorial governments
- Use the Urban Search and Rescue Task Force model to further build Incident Management Assistance Teams' capability
- Complete a disaster workforce review within the Agency, to include incident management, incident support, and mission essential functions
- Streamline and increase certifications across FEMA's incident workforce

Focus Area 3: Sustained Whole Community Logistics Operations

Key Findings

8. FEMA assumed a more active role in coordinating whole community logistics operations for Puerto Rico and the U.S. Virgin Islands due to these territories' preparedness challenges, geographic distance, and pre-existing, on-the-ground conditions.
9. While FEMA mobilized billions of dollars in commodities, the Agency experienced challenges in comprehensively tracking resources moving across multiple modes of transportation to Puerto Rico and the U.S. Virgin Islands due to staffing shortages and business process shortfalls.
10. FEMA provided logistical coordination to move and distribute commodities from staging areas to survivors in Puerto Rico, supplementing a role that should largely be managed and coordinated at the state or territory level.
11. In a three-month period, FEMA issued more contract actions than in an entire previous fiscal year to meet disaster requirements, which strained the Agency's contracting personnel.

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Promote federally supported, state-managed, locally executed logistics operations
- Increase FEMA readiness stocks outside the continental United States
- Increase transportation planning, management, and contract support capacities
- Broaden FEMA's capability to quickly get teams on the ground to stage and deliver key commodities to disaster survivors, even in the most remote locations
- Streamline storage and movement across multiple modes of transportation that facilitate and speed delivery
- Develop a more comprehensive understanding of local, regional, and national supply chains, as well as stronger relationships with critical private sector partners to support rapid restoration in response to catastrophic incidents
- Support state, local, tribal, and territorial governments in improving capability for disaster cost recovery, pre-event contracting and contract enforcement, and vendor-managed inventory

Focus Area 4: Responding During Long-Term Infrastructure Outages

Key Findings

12. To overcome limited situational awareness created by the loss of communications in Puerto Rico, FEMA executed creative solutions to assess the situation and prioritize response activities, including emergency repairs to infrastructure.
13. Challenged by an inoperable telecommunications environment in Puerto Rico, FEMA had to adapt field communications, program delivery, and command and control activities.
14. FEMA and its federal partners installed a record number of generators to provide temporary power to critical infrastructure while facing significant challenges in identifying generator requirements and shortfalls in available generators.

Focus Area 4: Responding During Long-Term Infrastructure Outages**Recommendations Summary**

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Establish a standing Power Task Force as a collaborative, steady-state partnership and transition it to a crisis action planning cell under Emergency Support Function #12 partners during disaster operations
- Encourage investment in redundant assets to maintain communications and supply temporary power
- Encourage critical infrastructure owners and operators, and state and local governments, to invest in more resilient infrastructure
- Include continuity and resilient all-hazards communications capabilities in plans and guidance

Focus Area 5: Mass Care to Initial Housing Operations**Key Findings**

15. FEMA supported American Red Cross and Emergency Support Function #6 partners to provide more than one million shelter nights within the first 60 days, while facing challenges transitioning survivors out of congregate sheltering.
16. In Texas and Florida, FEMA helped survivors quickly transition from congregate shelters to other options such as hotels. However, across all operations, FEMA faced challenges implementing non-congregate sheltering programs.
17. FEMA created new, streamlined housing inspection procedures to reduce inspection delays.
18. FEMA applied lessons learned from recent housing operations and exercises to expand temporary and permanent housing solutions, including supporting a state-managed housing mission.

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Build capability and empower the implementation of federally supported, state-managed, locally executed sheltering and housing solutions
- Improve the delivery and effectiveness of housing options, including exploring grant-making authority
- Clarify federal roles and responsibilities for housing programs, including approaches to long-term housing
- Evaluate and implement appropriate housing solutions, including the use of Recreation Vehicles, Direct Repair, and Direct Lease options
- Promote all-hazard insurance so that individuals can reduce their losses and speed their recovery

Next Steps

While the 2017 Hurricane Season has concluded, recovering from these devastating hurricanes will take years. FEMA is committed to supporting the long-term recovery of affected governments and survivors. In addition, FEMA has already begun acting on these recommendations to improve future disaster operations.

Introduction

In the three weeks between August 25 and September 20, hurricanes Harvey, Irma, and Maria made landfall in the United States in rapid succession. These hurricanes were followed by devastating wildfires in California. The hurricanes and wildfires collectively affected more than 47 million people—nearly 15 percent of the Nation’s population. Hurricanes Harvey, Irma, and Maria caused a collective \$265 billion in damages (Figure 2) and were each individually among the top five costliest hurricanes on record (Figure 3). The fact that these historic storms occurred concurrently and were followed by the California Wildfires presented an unprecedented scale of operations, extremely complex logistics, and numerous novel challenges across the Nation. Leaders had to determine how to allocate and subsequently redistribute limited resources across disasters. This report focuses on FEMA’s response and initial recovery efforts from August 25 to November 30, 2017.

According to the National Oceanic and Atmospheric Administration (NOAA), Hurricane Harvey resulted in 103 direct and indirect fatalities in the United States and Hurricane Irma resulted in 96 direct and indirect fatalities. The fatality count from Hurricane Maria in Puerto Rico was being reviewed by the government of Puerto Rico at the time of this report.

Hurricanes Harvey and Irma marked the first instance of two Atlantic hurricanes making landfall as Category 4 storms in the continental United States in the same season. Hurricane Harvey dropped more than 60 inches of rain east of Houston—the most rain ever recorded during a single storm in the United States. Overall, Texas experienced significant flooding that forced 780,000 survivors from their homes, of whom more than 42,000 were temporarily housed in 270 shelters in the days following landfall.

Hurricane Irma impacted the U.S. Virgin Islands and Puerto Rico, with the storm’s center passing just north of the territories as a Category 5 hurricane on September 6. The storm caused high storm surge, flooding, extensive damage to buildings and infrastructure, and widespread power outages.

Hurricane Irma continued north and made landfall in the Florida Keys as a Category 4 hurricane on September 10 and then made a second landfall on the Florida peninsula as a Category 3 hurricane later that day. Storm surge and powerful winds caused heavy damage to infrastructure across the State. Florida jurisdictions issued evacuation orders for a record-breaking 6.8 million people, contributing to one of the largest sheltering missions in U.S. history. Florida housed a peak of 191,764 people in nearly 700 shelters across the State. In addition to Florida,

Costliest Billion-Dollar Hurricanes On Record



Figure 2: The 2017 Hurricane Season is estimated to have caused \$265 billion in damages and losses (source: NOAA National Centers for Environmental Information).

Top 5 Most Destructive Hurricanes (\$ Billion)

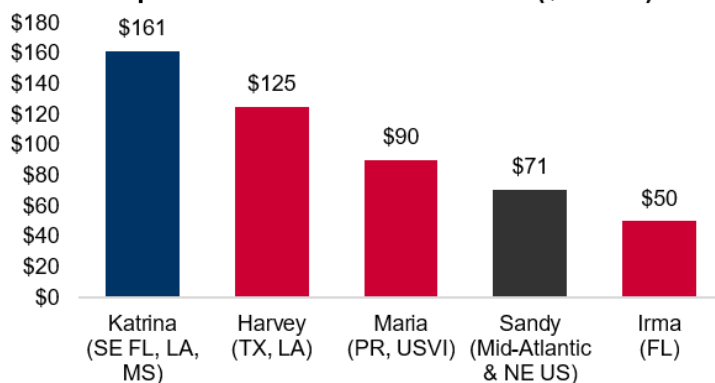


Figure 3: When adjusted for inflation, the 2017 hurricanes are among the top five costliest on record dating back to 1980 (source: NOAA National Centers for Environmental Information).

Irma also impacted the Seminole Tribe of Florida, and the states of Alabama, Georgia, North Carolina, South Carolina, and Tennessee.

On September 19, the center of Hurricane Maria passed just south of the U.S. Virgin Islands as a Category 5 hurricane and made landfall on Puerto Rico as a Category 4 hurricane the next day. Hurricane Maria was the first Category 4 storm to make landfall on Puerto Rico in 85 years. Following the storm, every airport and seaport in Puerto Rico was closed and even after reopening had limited capacity for approximately seven days post-landfall due to restrictions. Less than 12 percent of the territory's population had access to cell phone service in the immediate aftermath of the storm. The majority of the main island's power grid was down until November 17, with outages continuing through May 2018. Additionally, the storm disrupted critical supply routes from Puerto Rico to the U.S. Virgin Islands. In sum, the three storms affected diverse geographic areas of varying size and population density (Figure 4).

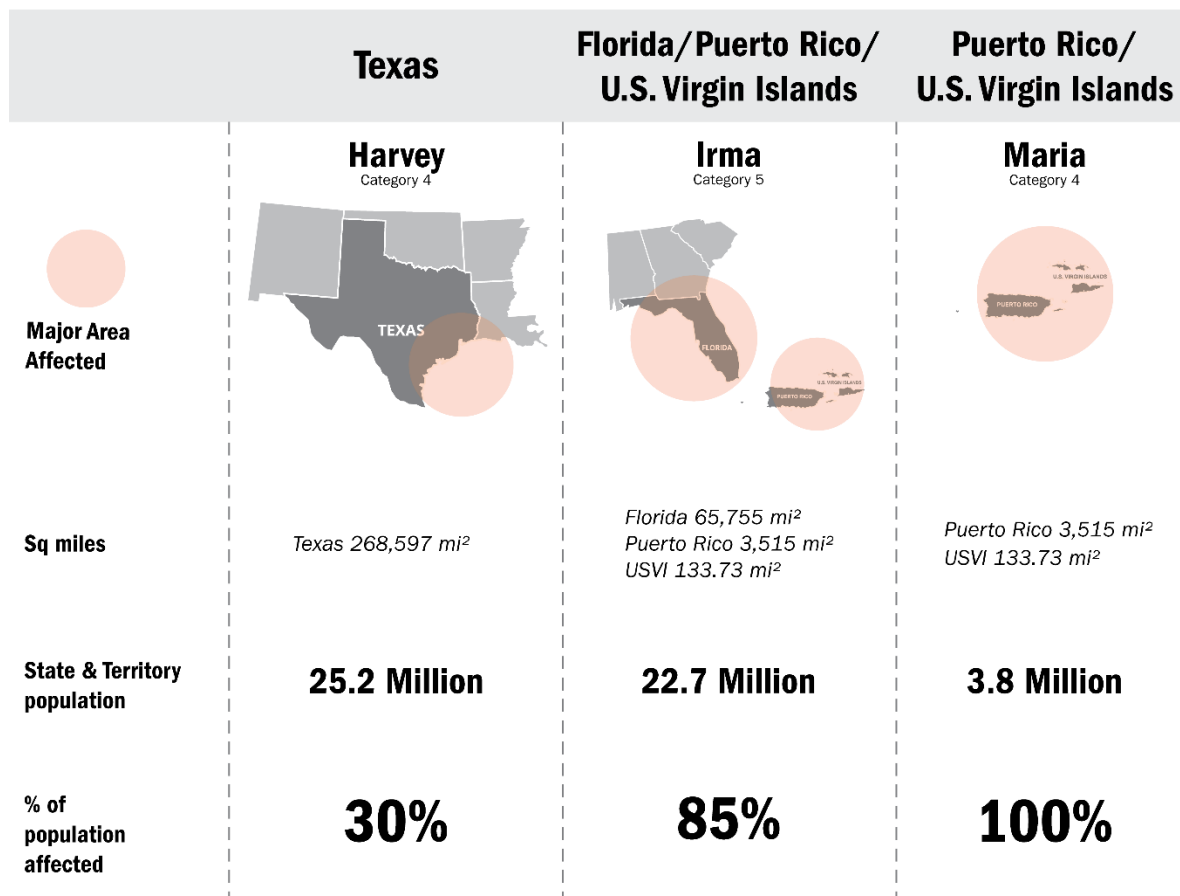


Figure 4: Hurricanes Harvey, Irma, and Maria affected more than 28 million people in Texas, Florida, U.S. Virgin Islands, and Puerto Rico.

Throughout the 2017 Hurricane Season, FEMA managed concurrent, complex incidents across geographically dispersed areas over a long duration of time. The Agency also coordinated with federal and state, local, tribal, territorial (SLTT), and whole community partners to accelerate the large-scale distribution of resources to survivors.

FEMA provided over \$2 billion worth of commodities to affected states and territories.

As part of the Federal Government's response to three near-simultaneous incidents, FEMA deployed more than 17,000 personnel, including 4,063 non-FEMA and non-Department of Defense (DoD) federal employees through the federal Surge Capacity Force (SCF) and other methods. By comparison, FEMA deployed 9,971 staff for Hurricane Sandy response operations in 2012. In addition, DoD deployed nearly 14,000 personnel to affected areas across three different FEMA regions.

Activation of National and Regional Response Coordination Centers during the 2017 Hurricane Season

On August 25, FEMA activated the National Response Coordination Center (NRCC), the multi-agency center that provides overall federal support coordination for major disasters and emergencies. The NRCC remained operational for a record-breaking 76 consecutive days coordinating concurrent operations, and operating at the highest federal response level for over 3 times longer than during Hurricane Sandy in 2012. During its activation, the NRCC maintained 24/7 operations, transitioned between day and night shifts, and rotated teams every 7 days. This extended activation confirmed that the center's staff were capable of supporting cross-Regional response operations for multiple, sequential events that vary in type, duration, and complexity.

In addition, FEMA activated Regional Response Coordination Centers (R RCCs) in FEMA Regions to coordinate overall emergency management activities with the impacted states and territories (Appendix C includes a map of all 10 FEMA Regions):

- Region II supported the U.S. Virgin Islands and Puerto Rico;
- Region IV supported Florida, the Seminole Tribe of Florida, Alabama, Georgia, North Carolina, South Carolina, and Tennessee; and
- Region VI supported Texas and Louisiana.

Between August 25 and October 16, the President issued a total of 20 disaster or emergency declarations for the three storms: Hurricane Harvey (3 declarations), Hurricane Irma (13 declarations), and Hurricane Maria (4 declarations). Through its Incident Management Assistance Teams (IMATs), FEMA provided a forward federal presence of senior-level emergency managers to support the impacted states and territories in preparing for and responding to the storms. At the height of concurrent operations, all 28 of FEMA's National Urban Search and Rescue Task Forces rapidly deployed to support life-saving operations, searching more than 30,900 structures, and saving or assisting nearly 9,500 people. By the end of the hurricane season on November 30, more than 4.7 million households affected by hurricanes Harvey, Irma, and Maria had registered for federal assistance with FEMA, more than all who registered for hurricanes Katrina, Rita, Wilma, and Sandy combined.

In addition to conducting concurrent response operations for hurricanes Harvey, Irma, and Maria, FEMA also had to take action on hurricanes Jose and Nate. The impacts from those two storms were minimal by comparison, but nevertheless required FEMA's focus and resources. While Hurricane Jose never made landfall, FEMA deployed IMATs to three states and bolstered staging areas with additional commodities. Hurricane Jose also complicated Hurricane Irma and Hurricane Maria response efforts in the Caribbean by limiting sea transport of food and water as well as transit of U.S. Naval response assets to the U.S. Virgin Islands and Puerto Rico. Hurricane Nate made landfall as a Category 1 storm on October 7, striking Mississippi and Alabama in the Gulf Coast and resulting in Major Disaster declarations in each state.

Nearly simultaneously, the response to the historic wildfires across the Western United States, including 5 of the 20 most destructive wildfires in modern California history, required the deployment of additional FEMA personnel, commodities, and equipment. As of November 30, the fires had claimed 44 lives and damaged or destroyed nearly 10,000 structures. The response to the California Wildfires required a greater amount of DoD contracts and mission assignments than the hurricane response in support of Texas and Florida combined.

As shown in Figure 5, FEMA supported 59 Major Disaster declarations and 16 Emergency declarations in 2017.

Calendar Year 2017 Major and Emergency Disaster Declarations by County

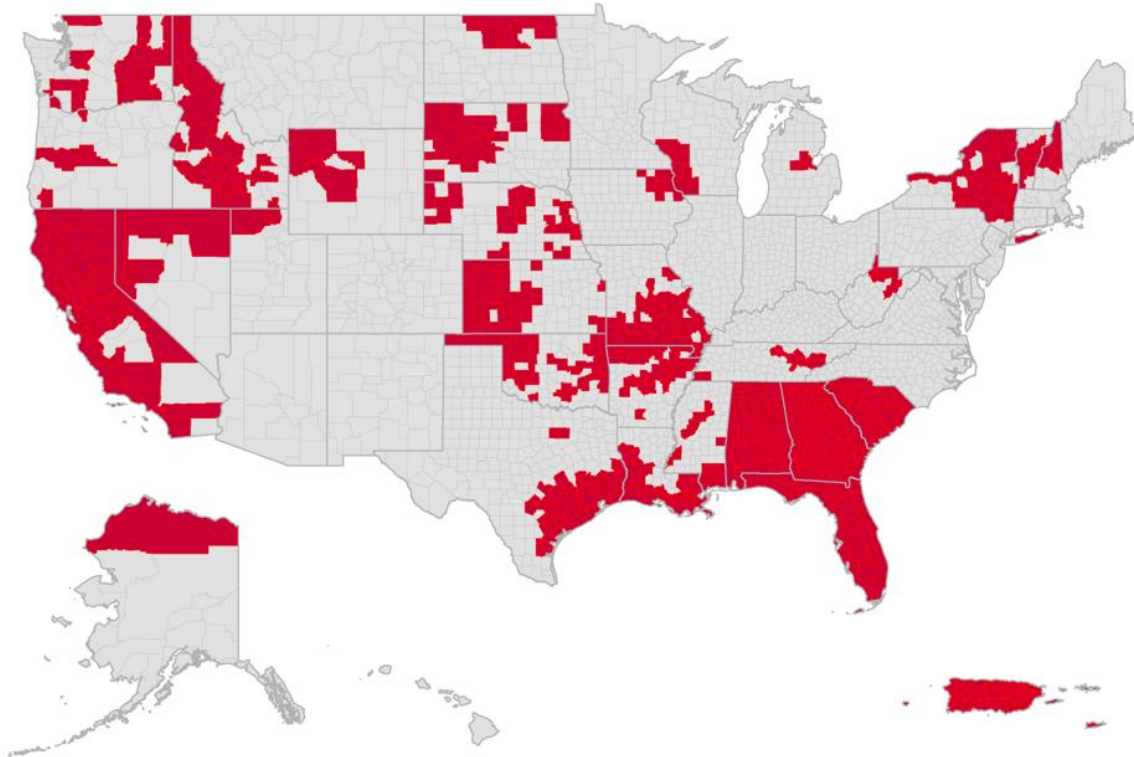


Figure 5: During the course of an exceptionally active year of disasters, FEMA supported 75 Major and Emergency Disaster declarations.

Report Scope, Methodology, and Organization

This report reviews the Agency's preparations for, immediate response to, and initial recovery from hurricanes Harvey, Irma, and Maria, focusing on the timeframe of August 25, 2017 through November 30, 2017. While hurricanes Jose and Nate and the California Wildfires affected resources that FEMA had available during the hurricane season, this report primarily focuses on FEMA's support to the states and territories most impacted by hurricanes Harvey, Irma, and Maria: Texas, Florida, Puerto Rico, and the U.S. Virgin Islands. While FEMA coordinates disaster response and recovery efforts across the Federal Government and works closely with non-federal whole community partners, this report focuses on lessons learned for several key areas of internal FEMA response and initial recovery operations. FEMA will continue to review ongoing recovery operations and is using the findings in this report as well as future reports to drive improvements across the Agency's resilience, response, and recovery programs.

The *2017 Hurricane Season After-Action Report* reflects a wide variety of input from FEMA and its whole community partners. To collect data for this report, FEMA:

- Sent teams to observe and document response and recovery operations and decision-making in Texas, Florida, Puerto Rico, RRCs, and the NRCC;^a
- Interviewed hundreds of personnel, including Agency leadership and staff in headquarters, regional, and field offices;
- Developed a hurricane season chronology with more than 4,000 unique data points on key FEMA and selected non-FEMA federal decisions and actions for hurricanes Harvey, Irma, and Maria;
- Analyzed 17 different quantitative datasets to indicate how FEMA's response efforts evolved over time;
- Reviewed 12 state, regional, and national-level plans; and
- Convened working groups comprised of subject-matter experts and stakeholders representing 13 different FEMA components, who provided data and validation for report findings.

The balance of this report is organized into five focus areas that FEMA selected based on priorities from Agency leadership at headquarters, regional, and field offices (Figure 6). FEMA developed strategic-level key findings by synthesizing the data collected from the sources listed above with a focus on operational impact. These findings directly informed FEMA's *2018-2022 Strategic Plan*. Each section also includes Agency recommendations aligned to Strategic Plan objectives. Finally, Appendix A provides disaster data that has been updated from the original timeframe of the report through May 2018.



Figure 6: The After-Action Report covers key findings in five focus areas that span FEMA's response and early recovery efforts for the 2017 Hurricane Season.

^a FEMA did not deploy Continuous Improvement Program staff to the U.S. Virgin Islands during the timeframe covered by this report. Data collection on FEMA's operations in the U.S. Virgin Islands was conducted remotely. Teams in Florida also observed operations for the Seminole Tribe of Florida.

Scaling a Response for Concurrent, Complex Incidents

The unprecedented combination of multiple, large, and complex disasters—such as hurricanes Harvey, Irma, and Maria—required FEMA to adapt to evolving disaster response and recovery needs. FEMA could not isolate one incident from the other, but rather apportioned and allocated resources based on emergency management experience in a dynamic environment. FEMA had to employ all available capacity in the most effective manner possible and re-allocate resources for newly emerging requirements (i.e., from Harvey to Irma, and then to Maria, and finally the California Wildfires). In such instances, FEMA often modified or quickly reinterpreted policies, programs, and authorities. The 2017 Hurricane Season revealed areas where the Agency was both well prepared to handle these challenges and areas where it can improve.

Key Finding #1: FEMA leaders at all levels made major adaptations to Agency policy and programs to respond to significant operational challenges during the hurricane season.

FEMA's decision-making process during the 2017 Hurricane Season is informing the Agency's approach to future concurrent, complex incidents. To address the challenges of this hurricane season, FEMA leaders adapted agency policy and programs to provide support to the impacted states, tribes, and territories. The Agency continues to assess outcomes from these decisions. This finding describes policy adaptations in five areas: (1) relocating regional staff to FEMA Headquarters; (2) state-managed survivor housing mission; (3) updated Public Assistance delivery model; (4) Public Assistance alternative procedures, and (5) addressing deferred maintenance.



Figure 7: FEMA Region II personnel convene to review hurricane operations.

Relocating Regional Staff to FEMA Headquarters

Shortly after Hurricane Maria made landfall in Puerto Rico, FEMA leadership decided to transition incident support responsibilities to FEMA Headquarters, as provided for by Agency policy. The RRCC and NRCC are the centralized locations for the Federal Government and other partners to coordinate disaster support. Typically, FEMA Regions support field operations from the RRCC; however, FEMA's transition policy allows for impacted Regions to transfer those responsibilities to the NRCC during large-scale incidents. FEMA's transition and devolution policy does not require the temporary relocation of regional staff from the RRCC to the NRCC, but findings from recent exercises had recommended it. Thus, when primary incident support and coordination transitioned to the NRCC for Puerto Rico and the U.S. Virgin Islands, a number of Region II staff from each incident support section moved from Region II to the NRCC to improve coordination by co-locating expertise and field contacts of Region II staff. Although the storm did not impact the Region II RRCC operations in New York, the transition and subsequent relocation of regional staff allowed for consolidated operations at the NRCC.

State-Managed Survivor Housing Mission

Given the magnitude of housing challenges facing Texas, FEMA recognized that it needed more ways to provide housing assistance and adapted programs to better meet the State's needs. FEMA has historically led the coordination of direct housing assistance (e.g., manufactured housing units, recreation vehicles) through its Individuals and Households Program (IHP). To address the historic

scale of housing needs following Hurricane Harvey, FEMA and the State of Texas negotiated a formal agreement to establish a state-managed housing mission, authorizing the state to provide housing services on behalf of FEMA. This agreement, created due to an absence of a grant-making authority, was intended to provide Texas with greater flexibility to use its own authorities to secure housing solutions that met State and disaster-specific objectives, as well as develop a more streamlined approach to long-term recovery. This state-managed housing mission is further discussed under Key Finding #18.

Updated Public Assistance Delivery Model

FEMA expedited implementation of an updated delivery model for the Public Assistance (PA) Grant Program. After an internal analysis in 2014 revealed PA delivery model shortfalls, FEMA began developing a revised delivery approach that could more easily adapt to the size, complexity, and cost of recovery operations. FEMA initiated pilots of this updated PA delivery model in 2016, and had planned for it to replace the legacy model in early 2018. To streamline internal operations and improve the overall experience for local communities as they worked to rebuild public infrastructure damaged during the hurricane season, FEMA leadership expedited the launch of the updated PA delivery model on September 12, 2017, amid the early responses to hurricanes Harvey and Irma. However, FEMA later determined that neither Puerto Rico nor the U.S. Virgin Islands had the capacity or the experience to effectively implement this approach.

Public Assistance Grant Program

Public Assistance is FEMA's largest grant program and accounts for, on average, 51 percent of FEMA grant funding. The program provides emergency assistance to save lives and protect property, and assists communities with repairing public infrastructure affected by federally declared incidents.

Public Assistance Alternative Procedures

On October 30, 2017, the Commonwealth of Puerto Rico elected to use alternative procedures for all Public Assistance funding for permanent work, an approach which allows for the consolidation of projects and streamlines funding by relying on fixed estimates instead of documented, actual costs. Previous pilot programs of these alternative PA procedures were optional for communities on a project-by-project basis. Under normal PA procedures, processing all project reimbursements based on documented, actual costs can take up to several years. Using alternative procedures, after FEMA and the grantee agree on a total cost estimate, funding that corresponds with that estimate can be made available before starting permanent work. The alternative procedures were intended to move FEMA and the Commonwealth toward outcome-based recovery by simplifying the funding process, reducing the time to receive federal funding, and providing greater flexibility for Puerto Rico to rebuild its infrastructure to be more effective, efficient, and resilient.

Public Assistance Alternative Procedures Authorities

In 2013, the *Sandy Recovery Improvement Act of 2013* authorized alternative procedures for Public Assistance. Alternative procedures allow FEMA to issue one consolidated grant based on a cost estimate rather than issuing individual grants for each community project.

Addressing Deferred Maintenance Challenges

In responding to the challenges posed by the impact of Hurricane Maria, FEMA recognized that it needed additional authorities to provide support for infrastructure repair in Puerto Rico and the U.S. Virgin Islands. Due to poor pre-disaster infrastructure conditions in both locations, FEMA could not determine whether some or all of post-hurricane recorded damages were attributable to the disasters. Additionally, FEMA could not make necessary repairs to damaged system components that remained connected or serviced by undamaged, outdated elements. In February 2018, Congress passed the

Bipartisan Budget Act of 2018. The law gives FEMA additional authorities under Section 428 of the *Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, as amended* (Stafford Act). Under this law, FEMA can provide assistance for critical services to replace or restore components of the facility or system that are not damaged by the disaster when those repairs are necessary to fully effectuate the replacement or restoration of disaster-damaged components to restore the function of the facility or system to industry standards. These provisions will improve the resilience of electric, communications, and other critical facilities in the territories.

Key Finding #2: FEMA's plans guided response operations, but enhancements to the planning process and format are needed to improve usability during operations.

FEMA planners collaborate with SLTT partners to develop plans before disasters. FEMA and its partners draw on a range of available data, including the Threat and Hazard Identification and Risk Assessment (THIRA) and State Preparedness Report (SPR), to inform these plans (See Key Finding #3). The plans describe how FEMA and the jurisdiction will respond to and recover from incidents, and include planning assumptions. Plans aim to align operations with their needs among interagency Emergency Support Functions (ESFs) and whole community partners. Plans provide responders with an understanding of the concept of operations, critical considerations for crisis action planning, options for adapting to unmet needs, and sufficient detail to help expedite ordering resources and moving commodities and people.

Prior to the hurricane season, FEMA had plans in place with each of the affected states and territories, and had either recently updated the plan or had committed to performing an update of all such plans.

Table 1: FEMA consulted various plans to inform disaster operations during the 2017 Hurricane Season.

Applicable Plans Consulted to Inform Operations		
National	Federal Interagency Operational Plans, Response & Recovery	Developed 2016
	Power Outage Incident Annex	Developed 2016
	Catastrophic Housing Annex	Developed 2012, Update underway
Hurricane Harvey	Region VI All Hazards Plan	Developed 2013, Update begins in 2018
	Texas Hurricane Plan	Developed 2017, Update yearly
Hurricane Irma (Florida)	Region IV All Hazards Plan	Developed 2012, Update begins in 2018
	Florida Tropical Storm Incident Annex	Developed 2015
	Region IV Hurricane Incident Annex	Developed 2016
Hurricane Irma/Maria (Caribbean)	Region II All Hazards Plan	Developed 2012, Update begins in 2019
	Outside Continental United States Hurricane Response Plan	Developed 2014, Update underway
Hurricane Irma (U.S. Virgin Islands)	U.S. Virgin Islands Earthquake and Tsunami Operational Plan	Developed 2012
Hurricane Maria (Puerto Rico)	Puerto Rico Earthquake and Tsunami Operational Plan	Developed 2012

FEMA plans are developed based on a FEMA Operational Planning Manual that provides a standard methodology and structure, while allowing flexibility for the FEMA Regions to meet the specific needs and preferences of the supported state or territory. As a result, the plans across the three Regions had varying levels of detail on the tasks to be executed and ways to address potential challenges. The extent to which plans integrated response and recovery operational tasks also varied.

The goal of the planning process and written plan is to facilitate effective unity of effort, organization, communication, and action to manage dynamic situations. In Texas, hurricane response plans reflected inter-state agreements for the disaster support Texas would receive and helped FEMA estimate how much federal support would be required to respond to Hurricane Harvey. The plans included information updated as recently as June 2016 on evacuation procedures, resource distribution networks, and logistics facilities.

In Florida, plans developed by FEMA and the State in 2015 and 2016 provided accurate estimates of disaster impacts before on-the-ground assessments were possible. The plans anticipated significant short-term sheltering needs following Hurricane Irma, and informed mass care operations to help provide basic needs for the 191,764 survivors in congregate shelters. Further, the plans accurately anticipated the loss of power to six million customers, and accounted for the state's ability to restore most communications and power within approximately one week.

Table 2: Comparison of key planning assumptions and field reports in Texas and Florida.

Disaster Impact	Planning Assumption	2017 Field Report
Texas		
Points of Distribution (POD)	Projected a need to support up to 80 PODs	41 PODs were required
State-to-State Mutual Aid Support	Anticipated states would activate mutual aid agreements to provide support	34 states and 1 territory provided mutual aid support
Florida		
Power Outages	Projected 31.3% of residents would lose power	31.8% of residents lost power
Short-term Sheltering	Projected a need to shelter 349,799 survivors	191,764 survivors sought temporary shelter
Hospitals Impacted	Projected 15% of hospitals would be impacted	16% of hospitals were impacted

The fact that the planning assumptions for the Texas and Florida hurricane plans were similar to the ultimate incidents (Table 2) illustrates how planning can help to expedite and inform decision making to quickly manage a crisis situation.

Comparison of Planning Assumptions and 2017 Hurricane Impacts in Puerto Rico

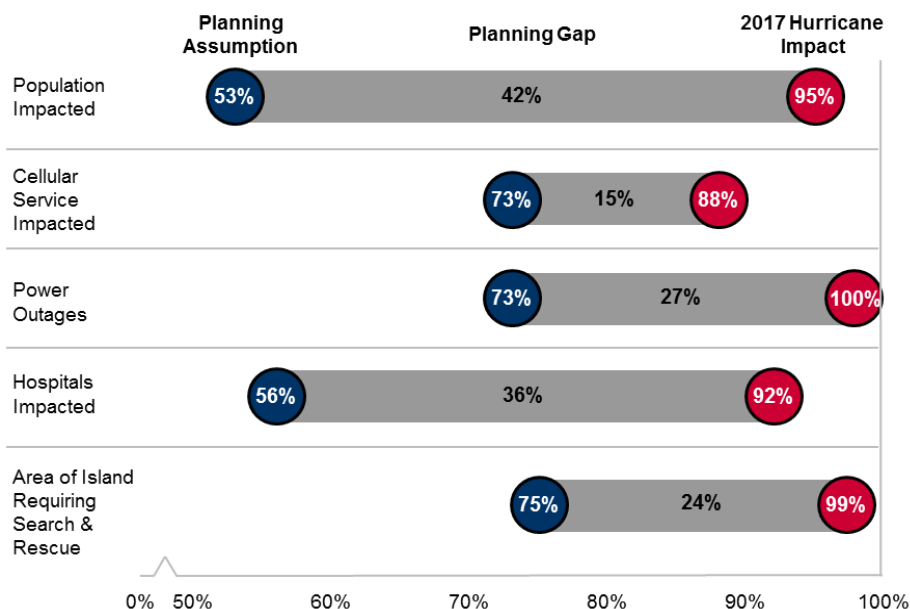


Figure 8: Planning assumptions underestimated impacts of 2017 hurricanes in Puerto Rico.

The planning assumptions for a hurricane, earthquake, or tsunami striking Puerto Rico and the U.S. Virgin Islands under-estimated the actual requirements in 2017 (Figure 8), which necessitated FEMA depend on crisis action planning (see description below) during the incident to address the shortfalls in the planning assumptions.

For example, the plans did not address insufficiently maintained infrastructure (e.g., the electrical grid), which explained some of the differences between the expected and actual impacts (see Key Finding #3). In addition, they did not address financial liquidity challenges facing the Territorial government.

Planning During Operations

As multiple, complex incidents occurred in quick succession in 2017, FEMA employed a number of planning strategies to adapt to previously unforeseen situations during the hurricane season. These strategies can inform future improvements to the planning process.

Crisis Action Planning to Address New Challenges

The Agency employed a crisis action planning process across its programs and with its interagency partners to address challenges not accounted for in the plans. For example, amid operations for Hurricane Harvey, planners looked ahead to begin estimating requirements to respond to a potential Hurricane Irma landfall on U.S. Virgin Islands, and then on Florida, and again for hurricanes Jose, Nate, and Maria.

Requirements for concurrent, complex incidents contributed to the need for crisis action planning. Existing plans were developed for the occurrence of a single incident, rather than concurrent incidents. In Puerto Rico and the U.S. Virgin Islands, the plans assumed that at least one incident support base—a commodity distribution staging area—in either Puerto Rico or the U.S. Virgin Islands would survive the impact of a major hurricane and that all commodities destined for one impacted territory would flow through the other. Hurricanes Irma and Maria affected both territories' incident support bases, forcing FEMA to find alternative ways to manage commodities during initial response operations.

Plans also did not sufficiently anticipate situations in which state or territory government officials would be unable to meet their responsibilities to manage operational or resource requirements due to a lack of communications or other capability shortfalls.

When hurricanes Irma and Maria followed Hurricane Harvey in quick succession across multiple states and FEMA Regions, the Agency responded by adapting its functions. For instance, the lack of available lodging for responders necessitated the quick identification of berthing ships to account for the lack of hotels and space for soft-sided shelters. Massive competing requirements for fuel and for transferring fuel from storage to fuel trucks necessitated the formulation of fuel truck routing, prioritizations, and sourcing additional vehicles and drivers. Private sector partners assisted FEMA in planning for an unprecedented movement of personnel and material.

Planning to Manage Time and Distance Challenges to Logistics

To better inform deployment and logistical support decision making, FEMA planners have increasingly employed the practice of pre-disaster resource phasing planning. While FEMA had committed to updating the Region II Caribbean Response Plan just before the 2017 Hurricane Season, operators

Crisis Action Planning Teams

Throughout the hurricane season, FEMA stood-up multiple Crisis Action Planning (CAP) teams—cross-programmatic groups of Agency experts—to analyze and deliver recommendations to FEMA leadership on a range of complex issues. Five CAP teams supported work in the following critical areas:

- Private sector and supply chain management;
- Power restoration;
- Responder lodging;
- Petroleum fuel;
- Survivor sheltering and housing; and
- Surge disaster staffing.

did not have an existing Resource Phasing Plan (RPP) during the response. Instead, based on lessons from other past RPP efforts, FEMA planners developed an RPP during response operations for the flow of resources into Puerto Rico and U.S. Virgin Islands following the passage of hurricanes Irma and Maria based on the maximum resources that can be shipped via air or sea. The RPP was developed in conjunction with the ESFs, used to inform the priority movements of resources through air and sea modes of transportation, and updated daily to accommodate changes in movement capability.

Understanding and Accommodating Infrastructure Interdependencies

The cascading impacts experienced across the infrastructure sectors, exacerbated by deferred maintenance issues, severely complicated the private sector's ability to return to normal operations. The interdependencies amongst the sectors also added a multitude of non-traditional operational support requirements upon federal supporting agencies. For instance, FEMA's plans did not anticipate the massive requirements to directly assist electricity, telecommunications, and fuel sector utilities with air and sea movement. Further, plans did not anticipate the need to move critical pharmaceutical supplies off Puerto Rico to meet national demands. The current federal operational planning process has begun to take into account private sector partnerships; however, the federal concepts of operations, including the National Response Framework, remain limited to federal assets in support of the states or territories. Crisis action planning and coordination with the infrastructure sectors during the incident assisted with identifying these requirements and helping to prioritize limited resources.

Key Finding #3: FEMA could have better leveraged open-source information and preparedness data, such as capability assessments and exercise findings, for Puerto Rico and the U.S. Virgin Islands.

FEMA leadership acknowledged that the Agency could have better anticipated that the severity of hurricanes Irma and Maria would cause long-term, significant damage to the territories' infrastructure. Leadership also recognized that emergency managers at all levels could have better leveraged existing information to proactively plan for and address such challenges, both before and immediately after the hurricanes.

Fiscal and Deferred Maintenance Challenges Facing Puerto Rico and the U.S. Virgin Islands

All jurisdictions face challenges in preparing for and managing large-scale incidents. In Puerto Rico, fiscal pressures limited investments and maintenance in critical infrastructure, including the electrical system, and decreased funding for emergency management. When hurricanes Irma and Maria struck Puerto Rico, the territory was \$74 billion in debt and its economy had contracted nearly 15 percent during the preceding 10 years. Likewise, the U.S. Virgin Islands reported a \$30 million budget shortfall in 2014. As both territories faced fiscal challenges, spending for emergency management declined or stagnated at relatively low levels between 2013 and 2017.

Emergency Management Assistance Compact

Emergency Management Assistance Compact (EMAC) is an all-hazards, all-discipline mutual aid compact that allows states to send personnel, equipment, and commodities to assist with response and recovery efforts in other states. EMAC was most effective this hurricane season where FEMA and states had previously included use of the compact in pre-disaster planning and preparedness activities, such as in Texas and Florida. There were some concerns regarding Puerto Rico's ability to reimburse states that provided assistance under EMAC, but EMAC Liaison Team leaders noted that some states are inclined to respond to EMAC requests without consideration of reimbursement.

Challenges with Existing Preparedness Information

FEMA collected information on jurisdictions' preparedness for responding to disasters in a variety of ways, including through exercise after-action reports, THIRA and SPR data, grant expenditure data,

and other preparedness measures. FEMA routinely analyzes this information, in part, to determine how the Agency can help build and supplement the emergency preparedness capabilities of its state and territorial partners and to inform steady-state plans (see Key Finding #2).

FEMA has used this information to inform response activities. Response planners used results from the THIRA and SPR to inform planning for hurricanes Harvey, Irma, and Maria. While some data were more helpful than others, FEMA staff at multiple levels indicated that existing preparedness data would need to be more specific to aid the Agency in adjusting its response operations and supporting actionable operational decisions. FEMA recognized this limitation before the 2017 Hurricane Season and had begun developing new THIRA and SPR methodologies to provide more actionable information, but those new methods were not in effect in 2017.

Threat and Hazard Identification and Risk Assessment and State Preparedness Report Data

Each year, states, territories, major urban areas, and tribes conduct a risk assessment, called the THIRA, to better understand their risks and set targets for their preparedness capabilities. States and territories also conduct an annual capability assessment, called the SPR, to evaluate their current preparedness capabilities against the targets set in the THIRA. Jurisdictions use the capability gaps identified in the THIRA and SPR processes to inform planning, grant investments strategies, and other decision making.

Exercises are another useful tool for jurisdictions to identify emergency preparedness capability strengths and shortfalls, which can then be used to inform future preparedness efforts and response operations. For example, by the time Hurricane Irma hit in 2017, pre-disaster training and exercises proved to be critical in Florida's ability to efficiently execute mutual aid agreements. In other instances, FEMA and its partners could have better leveraged exercise data. FEMA faced challenges in the Caribbean during the hurricane season, as discussed further in Key Finding #10, which it could have anticipated based on findings from exercises. A 2011 exercise after-action report for Puerto Rico anticipated that the territory would require extensive federal support in moving commodities, including from the mainland to the territory and to distribution points throughout the territory. An after-action report from the 2014 Alaska Shield National Level Exercise noted that resource delivery timelines were longer than expected when working outside the continental United States and that a lack of staff at resource staging areas contributed to challenges in tracking and managing commodity deliveries.

Recommendations

To enhance the Nation's capability to respond to and recover from incidents, FEMA must implement a cross-sector approach to the Agency's planning, organizing, response, and recovery operations. Complex catastrophes threaten the cross-cutting lifelines society relies on to function, such as water and power. While these lifelines span jurisdictions and public and private sector divisions, government response efforts continue to be organized along self-imposed divides that fragment the physical and social landscape of affected areas. This new approach should account for the capabilities of the private sector both before and during incidents. The critical infrastructure sectors, which the

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Leverage the new FEMA Integration Teams and technical assistance to help states build capacity
- Work with whole community partners to improve risk management and strengthen capabilities
- Create preparedness and planning products that are easily accessible, modular, inclusive, and readily executable
- Drive outcome-based recovery through expanded use of Stafford Act Section 428 Authorities for Public Assistance Alternative Procedures

Department of Homeland Security (DHS) National Protection and Programs Directorate support, and National, Regional, and State Business Emergency Operations Centers provide an operational and informational architecture, but the emergency management community collectively lacks a doctrinal foundation to organize and unify national efforts.

To codify the way forward, FEMA should work with its partners and the White House to revise the current **National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and create a cross-sector coordination emergency support function and coordinating structures** (e.g., business emergency operation centers). The National Response Framework sets the strategy and doctrine for how the whole community builds, sustains and delivers capabilities across the Response mission area. The accompanying Response Federal Interagency Operational Plan describes how the Federal Government aligns resources and delivers capabilities. The new Framework and Federal Interagency Operational Plan should prescribe unity of effort through rapid stabilization around lifelines such as power, communications, health and medical, food and water, wastewater, and transportation. The rapid stabilization of the lifelines would be the organizing principle of the doctrine.

Since these lifelines span ESFs, Sector-Specific Agencies (SSAs), and core capabilities, FEMA and its public and private sector partners should revise the current National Response Framework to create a cross-sector coordination emergency support function (ESF #14, which was formerly Long-Term Community Recovery, could be repurposed to this new mission). The revision would cement in doctrine and practice the public-private sector partnership that is essential to stabilization and unity of effort, and bring new capacity to whole community response operations.

FEMA is placing its personnel in state emergency management offices to jointly plan with states and territories to build their capabilities. FEMA is **leveraging these new FEMA Integration Teams and technical assistance to help states build their capacity**. These teams, called for in the Agency's 2018-2022 *Strategic Plan*, are working with their counterparts to increase state planning, logistics, and mitigation capabilities. By increasing direct engagement, FEMA can build a more in-depth collective understanding of capabilities, gaps, and risks; better understand the readiness of our partners and their needs during a disaster; and focus planning processes on the most consequential risks. These teams will contribute to achieving national unity of effort and the "federally supported, state-managed, and locally executed" relationship that is the backbone of our Nation's emergency management system.

In addition, FEMA is **working with whole community partners to improve risk management and strengthen capabilities** to adopt a new assessment methodology that requires all states, territories, tribes, and major urban areas to use standard, outcome based language to set objectives and assess their current capabilities against those objectives. These standardized targets reflect critical and measurable elements of managing risk, and respondents can use them to inform planning, exercises, evaluation, and continuous improvement, leading to stronger community-based capabilities. Further, before an incident, FEMA and its key public and private sector partners should improve their collective capacity to capture and organize data on critical lifelines. With more accurate data that increased collaboration will provide, FEMA should focus on **making preparedness and planning products easily accessible, modular, inclusive, and readily executable**. Finally, FEMA should review the effectiveness of the **use of Section 428 of the Stafford Act authorities to achieve outcome-based recovery**. FEMA should continue to use these authorities to better guide efficient recovery operations.

FEMA Strategic Plan Alignment

- **Objective 1.4, Better Learn from Past Disasters, Improve Continuously, and Innovate**, highlights the importance of self-evaluation and continuous improvement.
- **Objective 2.2, Enhance Intergovernmental Coordination through FEMA Integration Teams**, looks to improve how FEMA directly engages with its partners by enhancing presence with emergency management colleagues at the state.

Staffing for Concurrent, Complex Incidents

When Hurricane Harvey made landfall in Texas, FEMA already had 692^b open disasters. Of that total, it had staff deployed to 32 disasters across 19 field offices. The President approved an additional 30 declarations between August and November (Figure 9).^c The severity of three concurrent major hurricanes required FEMA to deploy a high number of staff to each affected area. FEMA leadership recognized early that the unprecedented demands for staff to support wide-scale response efforts, in addition to existing response and recovery operations to other disasters, would exceed the Agency's organic capabilities. To overcome these staffing challenges, FEMA implemented innovative methods to augment the disaster workforce. FEMA can formalize and improve many of the innovative solutions that were implemented effectively to meet this historic demand.

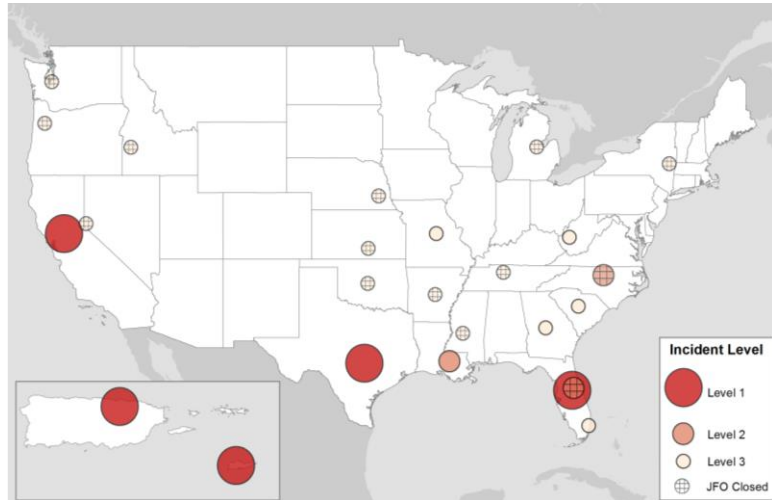


Figure 9: Open FEMA field offices between August 25 and November 30.

By November 30, FEMA had deployed more than 17,000 people, in total, to the disasters, which included FEMA's workforce (i.e., force strength, later defined in Key Finding #4) and staff augmenting FEMA's workforce. Deployments ranged from days to months. The total number of overall staff deployed on a single day peaked at 11,775 across the concurrently affected states; the number of FEMA staff deployed peaked at 5,887. The fact that FEMA deployed thousands of non-Agency staff illustrates the measures FEMA took to supplement its capabilities (see Figure 10).

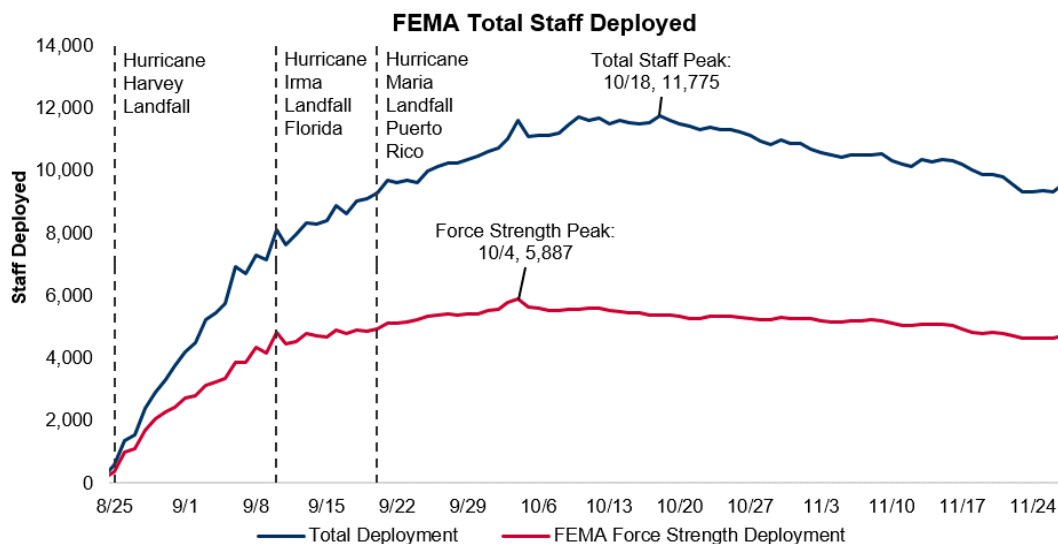


Figure 10: Total FEMA staff deployments between August 25 and November 30.

^b This total includes emergency, major, and fire management assistance declarations.

^c FEMA field offices active between August 25 and November 30. FEMA closed offices to rebalance staff to support response operations for Hurricanes Harvey, Irma, and Maria and other closures were previously planned.

Key Finding #4: FEMA entered the hurricane season with a force strength less than its target, resulting in staffing shortages across the incidents.

The Agency uses the metrics of force strength and force structure to to: (1) estimate the staffing needed to respond to incidents given certain planning factors; (2) determine the Agency's ability to respond to current and future disasters; and (3) analyze the number of disaster response personnel available against that target.

Force structure establishes the estimated incident personnel staffing requirements for FEMA. FEMA's force structure as of 2017, which was based on a 2015 analysis, estimated that the Agency required 16,305 disaster management personnel. FEMA determined that figure based on a planning assumption that would allow the Agency to respond to two Level 1 incidents, four Level 2 incidents, and three Level 3 incidents.^d Based on historical requirements, FEMA estimated that 6,630 staff were required to support one Level 1 incident, a number greater than the peak staff at any of the 2017 hurricanes. While only 10 Level 1 incidents had taken place between 1997 and 2014, FEMA responded to five Level 1 incidents in 2017.

Force strength is the actual number of personnel in FEMA's incident workforce cadres^e who have completed the administrative requirements for deployment. Force strength does not include FEMA employees who do not have a primary incident management position, FEMA employees who supported response operations from their home office, or the methods of staff augmentation covered in Key Finding #7.

FEMA has made progress in increasing its force strength, but was short of its target during the 2017 Hurricane Season. As of August 2017, FEMA's force strength was 10,683—which was 86 percent of its target for Fiscal Year (FY) 17 (see Figure 11 for a breakdown per cadre).^{f g}

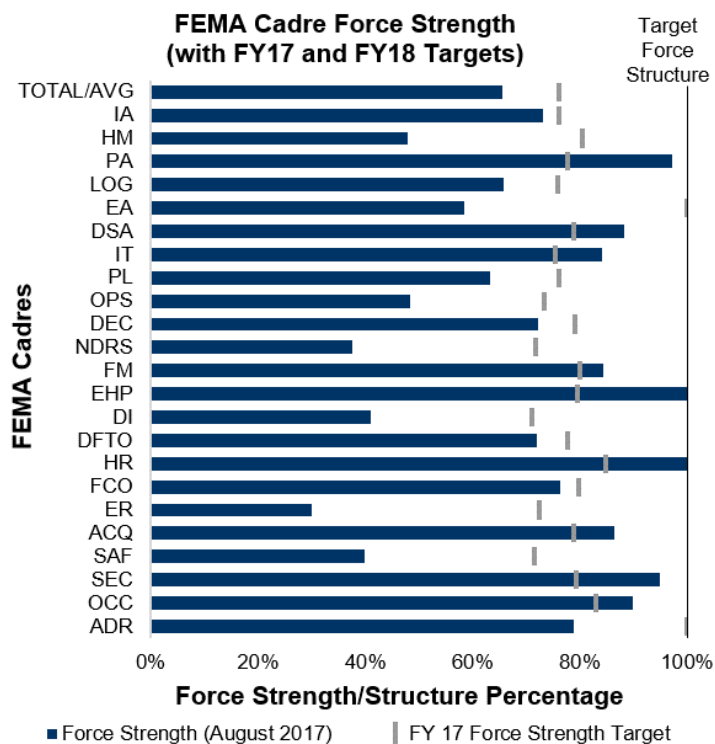


Figure 11: Cadre force strength compared to FY 17 goal.
(See footnote below for cadre definitions.)

^d Level 1: Incident requires extraordinary coordination among federal and SLTT entities due to massive levels and breadth of damage, severe impact or multi-state scope. Level 2: Incident requires a high amount of direct federal assistance for response and recovery efforts and elevated coordination among federal and SLTT entities. Level 3: Incident requires coordination among involved federal and SLTT entities.

^e Incident workforce cadres are functional organizations responsible for response and recovery operations.

^f Cadres are arranged in the graphic from largest to smallest based on force structure. The largest cadre's (IA) force structure is 2,932 and the smallest cadre's (ADR) force structure is 57.

^g ACQ- Acquisitions, ADR- Alternative Dispute Resolution, DEC- Disaster Emergency Communications, DFTO- Disaster Field Training Officer, DI- Disability Integration, DSA- Disaster Survivor Assistance, EA- External Affairs, EHP- Environmental and Historic Preservation, ER- Equal Rights, FCO- Federal Coordinating Officer, FM- Financial Management, HM- Hazard Mitigation, HR- Human Resources, IA- Individual Assistance, IT- Information

Between August 25 and November 30, FEMA deployed 73 percent of its force strength to support disaster operations. The responses to hurricanes Harvey, Irma, and Maria, in combination with the California Wildfires and other ongoing disasters, imposed an unprecedented strain on FEMA's disaster workforce. Figure 12^h shows FEMA's force strength deployments to hurricanes Harvey, Irma, and Maria.

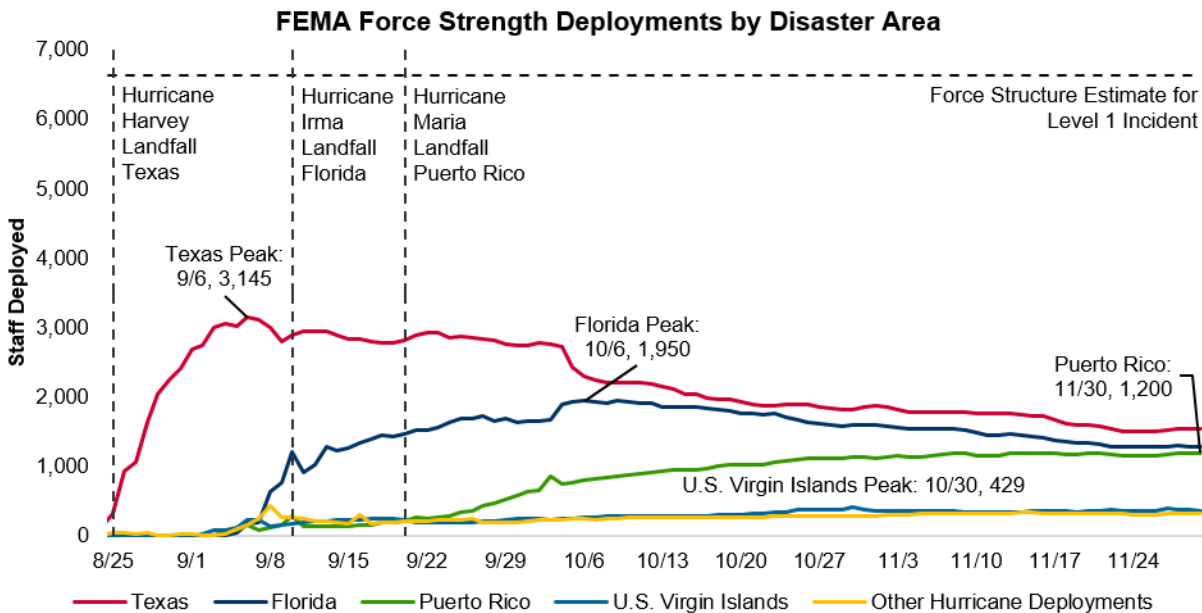


Figure 12: Peak FEMA force strength deployments between August 25 and November 30.

FEMA Cadre Staffing

The Agency expressed concern about cadre staffing levels throughout the 2017 Hurricane Season because staffing shortfalls posed potential risks to response and recovery operations. From August 25 to November 11:

- 13 of FEMA's 23 cadres were operating at 25 percent or lower staffing levels for 45 days or more
- Eight of these cadres were at less than 25 percent for approximately 70 days, including: DI, DSA, EHP, ER, HM, IA, IT, LOG, SAF, and SEC

In addition to staffing shortfalls, FEMA nearly exhausted staff for two forms of specialized response teams, the Mobile Emergency Response Support (MERS) teams and IMATs. Table 3 shows the days which had the lowest percentage of available IMAT and MERS resources. FEMA maintains three Type 1 and 13 Type 2 IMATs. FEMA deployed 12 IMATs to the hurricane-affected localities and deployed the four remaining teams to other incidents across the country. Given the number of near-simultaneous incidents, FEMA senior leadership expressed concerns regarding the shortage of available IMATs. To address the shortfall, FEMA redeployed IMATs and assembled additional personnel into ad hoc teams to fill necessary gaps.

Table 3: Percent of specialized team deployments and availability.

Team	Number of Deployed and Available Teams
Type 1 IMATs as of September 20	Deployed: 3 Available: 0 (0%)
Type 2 IMATs as of September 20	Deployed: 13 Available: 0 (0%)
MERS as of September 23	Deployed: 34 Available: 2 (5.5%)

Technology, LOG-Logistics, NDRS- National Disaster Recovery System, OCC-Office of Chief Council, OPS- Operations, PA- Public Assistance, PL-Planning, SAF- Safety, SEC- Security.

^h FEMA force strength staffing in Puerto Rico peaked at 1,221 on December 6, 2017.

Key Finding #5: The Agency has made progress on disaster workforce certification, but had not yet achieved its targets. Field leaders reported some resultant inefficiency in program delivery.

Shortly before Hurricane Sandy in 2012, the Agency implemented the performance-based FEMA Qualification System (FQS) to track and measure the knowledge and skills of its incident management workforce. Over the past five years, FEMA has implemented and refined FQS, including: (1) realigning tasks that staff must perform for certification; (2) reducing the time to achieve certification; and (3) expanding FQS functionality during complex incidents. To become certified through FQS, an employee must meet training, experience, and job skill requirements for a given FQS position. FEMA uses its Deployment Tracking System to record deployments, certification status, and field requests for personnel.

The Agency has a workforce certification target of 80 percent. On August 27, 56 percent of incident management employees were considered certified, according to all current FQS requirements. Figure 13 shows that the workforce initially deployed to Texas had a high number of certified personnel, although that number fell as the disaster stabilized and hurricanes Irma and Maria struck the United States. However, incident management employees deployed to Florida, the U.S. Virgin Islands, and Puerto Rico had lower certification rates initially due to competing demands for certified staff. Despite initial differences, the average certification rate in each incident location differed from one another and from the agency-wide average by less than seven percentage points.

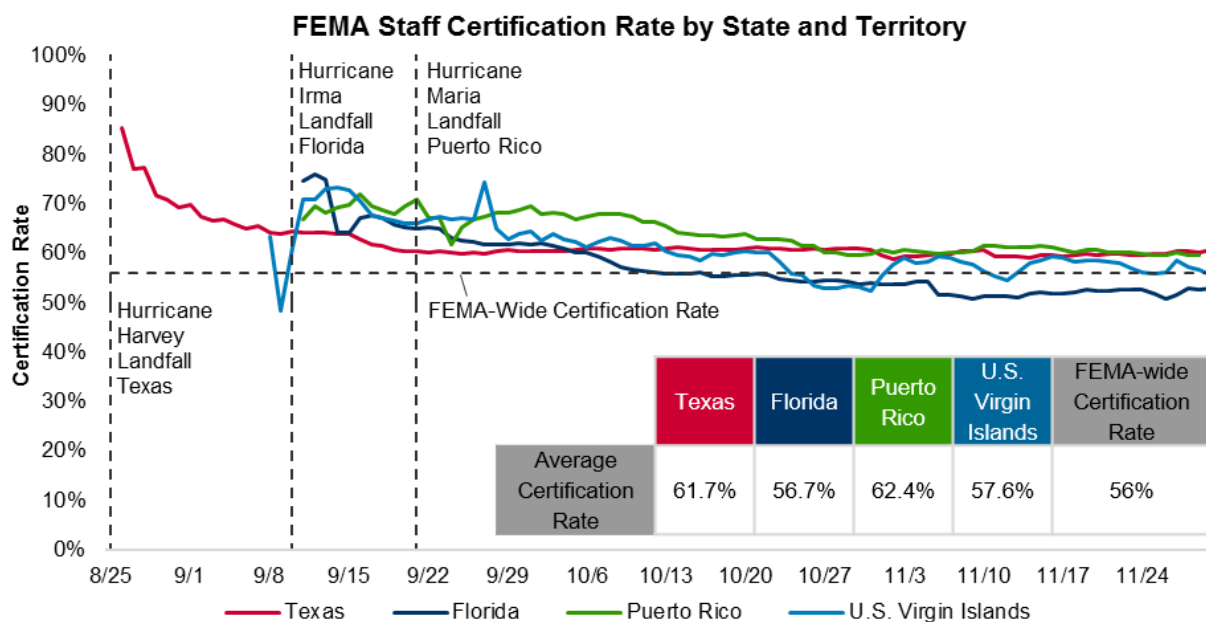


Figure 13: Certification rate of FEMA personnel assigned by Hurricane from August 26 to November 30.

As seen in Figure 14,^{i,j} 19 of the 23 workforce cadres did not meet their target certification rate for FY 17. Due to this shortage, FEMA was unable to fill crucial positions in field offices with certified staff. Historically, FEMA staff have reported that relatively low certification rates may negatively impact program delivery. For example, tasks could take longer to perform, and supervisors with limited training could be overstretched.

ⁱ The Public Assistance (PA) cadre overhauled its qualifications in 2017, which causes their qualification rate to appear artificially low.

^j Cadres are arranged in the graphic from largest to smallest based on force structure. The largest cadre's (IA) force structure is 2,932 and the smallest cadre's (ADR) force structure is 57.

In the face of these certification shortages, the Agency adapted to meet mission needs. For example, FEMA awarded some employees field promotions to fill leadership gaps. Many of these field leaders proved valuable additions to the disaster workforce and many have retained their certifications based on demonstrated performance. Field promotions, however, placed staff in positions beyond their experience and, in some instances, beyond their capabilities.

The current certification process also does not consistently reflect employees' proficiencies in performing field tasks. Field interviews indicated that numerous less-experienced and less-trained staff could perform their duties at the certified level during the hurricane season even though they were not FQS-certified. The Agency temporarily changed certification procedures during the hurricane season to more rapidly certify employees who had demonstrated their skills outside the traditional process. FEMA instituted interim changes, including certifying staff who were successfully serving in positions, waiving certain training requirements, and training personnel at the field offices.

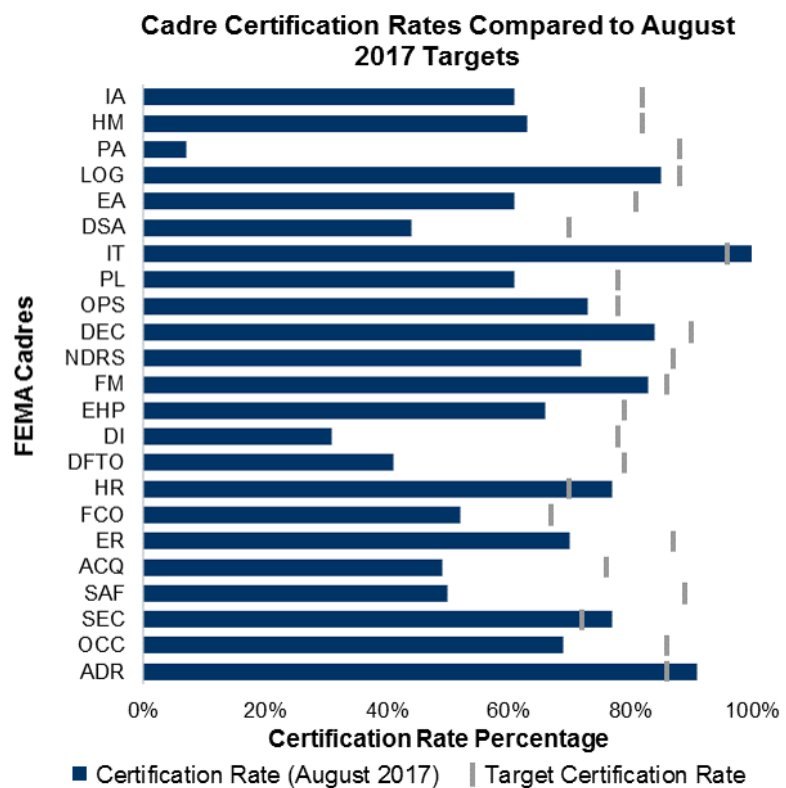


Figure 14: FEMA cadre certification rates (in blue) compared to target (in gray), as of August 21.

Key Finding #6: FEMA strategically consolidated ongoing disaster operations facilities across the country to reallocate personnel to the hurricane-affected field operations, which increased capacity to deliver FEMA programs.

In anticipation of concurrent impacts from Hurricane Irma, FEMA leadership transitioned staff in existing field offices to hurricane-affected areas. On September 4, FEMA began to transition 9 active field offices^k supporting 13 disasters to its regional offices prior to their anticipated closure date. All field offices that FEMA temporarily transitioned were performing recovery operations. While regional Agency leadership had the option to resume field office operations following the hurricane response, none did. The respective FEMA regional offices assumed responsibility for supporting these operations once the field offices transitioned.

Table 4: FEMA redeployed staff to hurricane-affected field offices.

	Within 15 Days	Within 30 days	Within 60 Days	Within 90 days
Number of Staff Redeployed to Harvey, Irma, or Maria	182	223	234	242
Cumulative Percentage of Redeployed Staff	61%	75%	79%	81%

^k A temporary coordination center established locally to manage response and recovery efforts.

A total of 298 staff demobilized from the nine transitioned field offices. Some staff remained deployed to other active field offices to support disaster operations. Of the 298 staff that were demobilized, FEMA redeployed 242 personnel (81 percent) within 90 days to support the hurricanes (Table 4).

In order to adjudicate particular staffing needs with field leadership, FEMA made every effort to redistribute these personnel equitably across the active disaster areas. Of the 242 responders transitioned to hurricane response efforts from other FEMA operations, roughly half (49 percent) were in management-level positions in existing field offices, including a highly experienced Federal Coordinating Officer. This effort allowed FEMA to provide additional management staff to support life-saving and life-sustaining efforts in the hurricane-affected areas that otherwise would have been unavailable.

Key Finding #7: FEMA augmented its disaster workforce through a combination of initiatives it has used before, as well as innovative and newly expanded methods—these initiatives met their stated intent, but can be matured.

Faced with three major hurricanes and insufficient organic staff to respond, FEMA acted decisively to supplement its disaster workforce. FEMA used a variety of conventional mechanisms to augment its workforce throughout the hurricane season, including local hires, contract staff, mission assignments, FEMA Corps, and National Processing Service Center (NPSC) surge staff. The Agency also implemented innovative staff augmentation methods using the SCF, and State Supplemental Staffing to add to its organic staff resources.

FEMA took numerous steps to counteract staffing shortfalls, including canceling Pre-Approved Non-Availability¹ for reservist employees, extending the deployments of full-time employees (who do not traditionally work in the field for extended periods), extending SCF deployments, centralizing deployment operations from field and regional offices to headquarters, and deploying new personnel directly from an abbreviated onboarding program. Figure 15 illustrates the sequence of the various staff augmentation mechanisms and policies FEMA used by date.

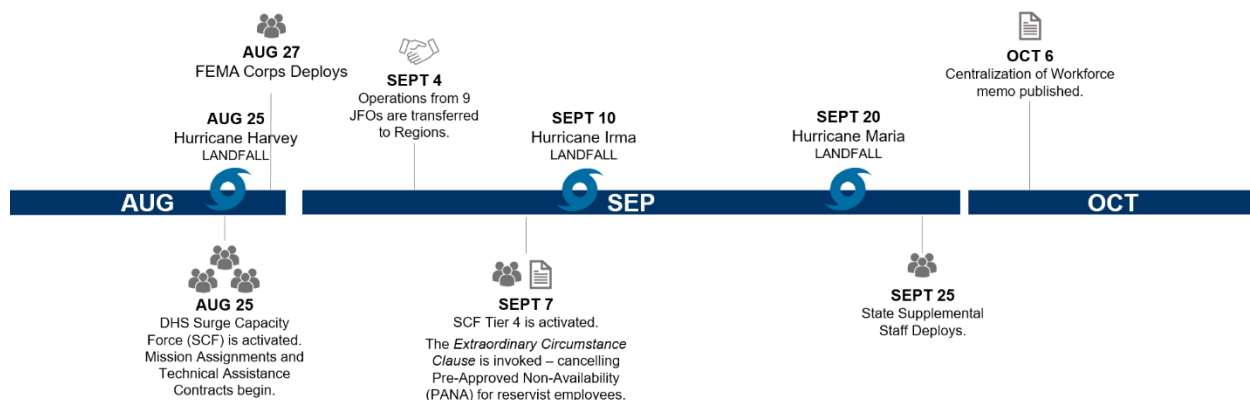


Figure 15: FEMA implemented initiatives to augment its disaster workforce during the hurricane response.

¹ A special form of unpaid time during which a Reservist is unavailable. This designation is only available to Reservists when they are not activated for deployment.

By augmenting staff, FEMA mitigated staffing shortages. Figure 16^m shows all staff deployed by FEMA field office, including the following types of augmentation staff: FEMA Corps, Local Hires, and SCF.ⁿ In addition to the staff transferred from transitioned field offices listed in Key Finding #6, FEMA redeployed 2,961 responders to an incident area to support ongoing response operations from August 21 to November 30.

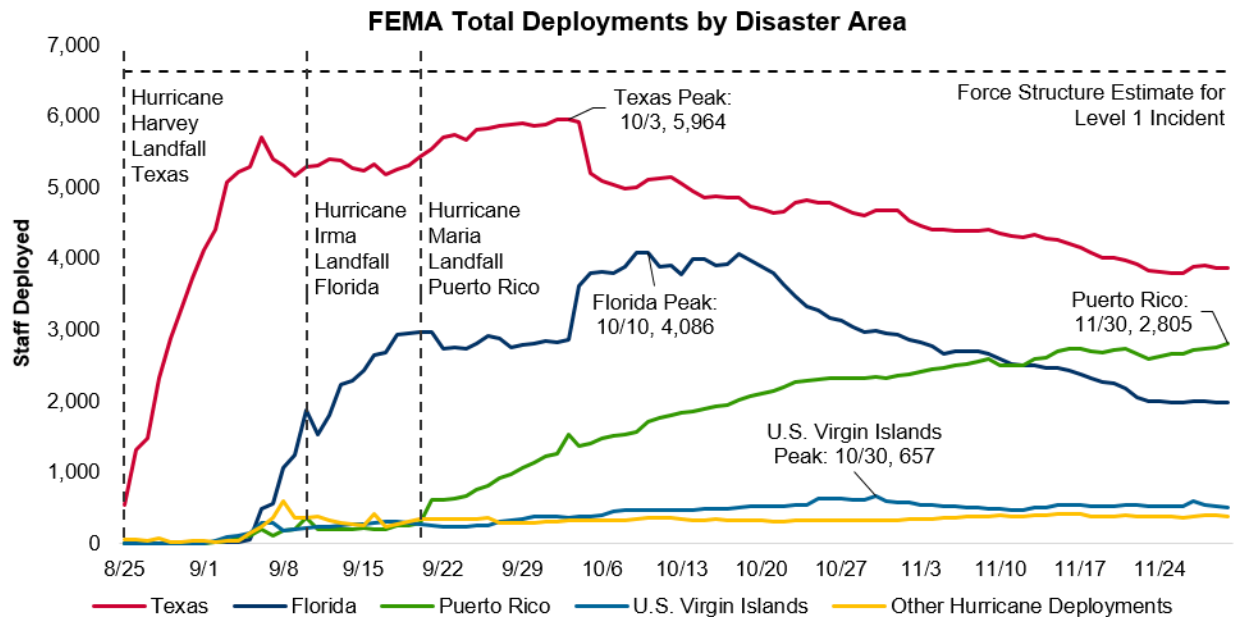


Figure 16: FEMA total deployments by disaster area between August 25 and November 30.

Conventional Augmentation Methods

FEMA relied on established workforce programs to augment its disaster workforce, and used Personnel Mobilization Centers (PMC) in Denton, Texas, and Anniston, Alabama, to equip and train staff.

Personnel Mobilization Centers

FEMA opened a PMC in Denton, Texas for Hurricane Harvey and in Anniston, Alabama, for hurricanes Irma and Maria. FEMA uses PMCs to receive, equip, and deploy emergency responders. Over 1,700 staff mobilized through the Denton PMC, and more than 5,000 mobilized through the Anniston PMC— the most ever.

FEMA deployed 63 **FEMA Corps** teams consisting of roughly 430 members to support operations in Texas, Florida, and Puerto Rico. FEMA Corps is an emergency management service program within the Corporation for National and Community Service that deploys young adults aged 18-24 over a 10-month service term. FEMA deployed FEMA Corps teams early in Hurricane Harvey, with 41 teams arriving within 15 days of the disaster declaration starting on August 27. In addition, FEMA used four ad hoc FEMA Corps teams with Spanish-speaking members to supplement staff in Puerto Rico.

^m The graph covers only FEMA-deployed personnel. Puerto Rico had a proportionately higher number of DoD and National Guard Bureau personnel (10,602 on November 9, according to FEMA field reports) than other disasters, which supplemented FEMA staff.

ⁿ On January 26, staffing in Puerto Rico peaked at 2,997; the number of staff decreased after that date.

Local Hires are residents from the affected area who FEMA hires to assist in response operations from 120 days up to one year. FEMA expedited the local hiring process in response to hurricanes Harvey, Irma, and Maria, hiring 4,095 local hires from August to November. Because of the training and experience local hires receive, they represent a future emergency management capability in affected states and territories.

A **Mission Assignment (MA)** is an order that FEMA issues to another federal agency directing the completion of a specific task. During the hurricane season, FEMA not only used MAs to support response and recovery operations through capabilities from other federal agencies, but also mission assigned other federal agencies for supplementary staff, including interpreters and external affairs experts.

National Processing Service Center (NPSC) call center specialists accept calls from survivors seeking federal disaster assistance. FEMA used **NPSC Surge** to augment its call-taking force from 590 to a peak of 7,377 through FEMA staff, selected federal agencies, contractors, and local hires. Figure 18 shows the peak staffing amount of each type of NPSC Surge during this hurricane season.

FEMA uses **Technical Assistance Contracts** to supplement and support FEMA staff and to provide technical expertise, particularly in Public Assistance (PA) and Individual Assistance (IA) program execution. FEMA faced challenges with the contracting process due to the number of newly hired contractors, inflexible job descriptions, and high turnover rates during longer deployments. Further, FEMA struggled to process the high volume of contractor security requests.

Innovative Force Augmentation Methods

In addition to conventional mechanisms to augment its workforce, FEMA implemented innovative solutions to meet the increased staffing needs during the hurricane season.

The **Surge Capacity Force** program deploys non-FEMA federal employees in the aftermath of a disaster to support response and recovery efforts. FEMA had used the SCF only once before in response to Hurricane Sandy, with a total of 1,194 members from DHS supporting operations for that storm. Across hurricanes Harvey, Irma, and Maria, FEMA deployed 2,740 individuals from eight DHS components, with 701 responders deploying for more than 45 days. FEMA also expanded SCF to agencies outside DHS for the first time, including 34 federal departments and agencies in the program, increasing SCF personnel by 1,323 employees.



Figure 17: First round of FEMA Local Hires in Puerto Rico after Hurricane Maria.

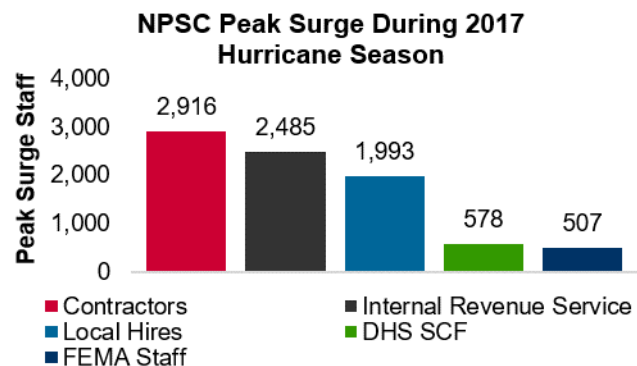


Figure 18: FEMA deployed multiple NPSC surge employee types to support disaster survivor calls.

In total, 4,063 non-FEMA federal employees, more than three times the amount FEMA surged for Hurricane Sandy, deployed to the hurricane-affected areas. FEMA rostered an additional 6,334 volunteers from various federal agencies through November 30 to support future disaster operations. Figure 19 shows the total SCF deployments by location from August 25 to November 30.

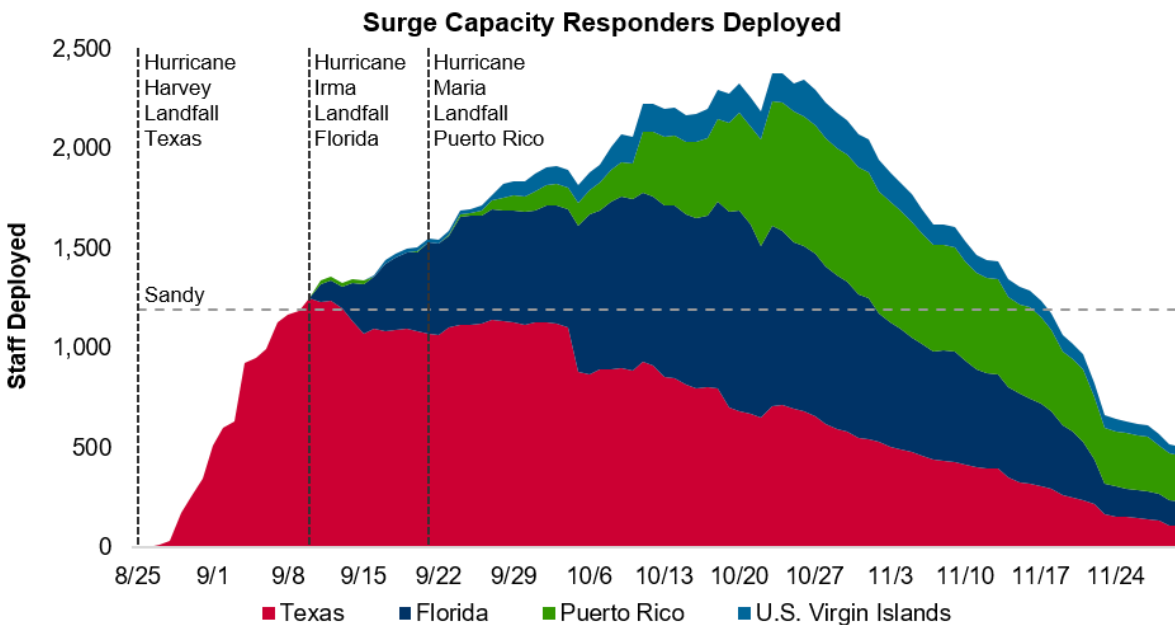


Figure 19: SCF deployments for the 2017 Hurricane Season.

While the SCF met its intent of injecting staff into operations to perform work that required little training, reports from field offices and headquarters indicated that opportunities exist for FEMA to identify needed specialized skills from surge staff and match them with field needs. Further, field interviews indicated that surge staff who have management positions in their home offices could have been better used to supplement leadership shortages.

State Supplemental Staffing augmented the FEMA incident management workforce with experienced state and local emergency management personnel from non-impacted states. FEMA deployed 30 personnel from four states (Figure 20) who were contracted for 60 days (with the option to renew for up to 120 days). The majority of the state supplemental staff deployed to Puerto Rico, with remaining staff deployed to Texas, Florida, and the NPSCs—providing much needed skills and experience to respond in challenging conditions. State supplemental staff were able to fill management roles that other types of surge employees could not. However, coordinating contracts with state and local agencies, processing security clearances, and staff recruitment procedures caused some delays and limited the number of participants. FEMA used this as a pilot program for the establishment of a National Qualification System.

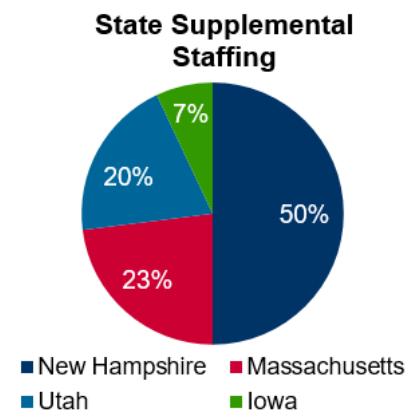


Figure 20: Representatives from four states supplemented FEMA staffing.

“This program is a game changer. It is always that the states depend on FEMA, and now this time FEMA needed the states. This opens up a whole new way to look at how we can help each other.” – State of Utah supplemental staffing participant

Recommendations

FEMA's incident workforce is historically over-committed to smaller disasters, leaving a fraction of the Agency's capacity to prepare for and respond to complex catastrophes and national security emergencies. These constraints affect the Agency's readiness to respond without unacceptable delays. FEMA began the 2017 disaster season with nearly 30 percent of its workforce deployed on smaller disasters across the country, which then required extraordinary and disruptive measures to reallocate and redistribute employees to meet the evolving requirements for hurricanes Harvey, Irma, Maria, and the California Wildfires.

FEMA's responsibilities require it to have the capacity to respond in the shortest possible time, under all conditions, to successfully accomplish its mission. FEMA needs immediate operational availability because complex, no-notice catastrophes do not provide time to maximize readiness by amassing a workforce and extracting response resources from multiple smaller-scale commitments. To be better positioned for future challenges, FEMA should **support states in building a greater capacity to respond to and recover from small-scale disasters by providing necessary financial assistance to state-managed disasters while right-sizing the federal deployment footprint.** State and territorial governments should be able to respond to small-scale disasters either organically or through collaboration with neighboring states and territories. Strengthened states and territories, in turn, allow the Nation to preserve sufficient capacity to promptly respond to complex catastrophes and national security emergencies.

During the 2017 Hurricane Season, FEMA augmented its workforce in innovative ways and newly expanded initiatives. The expansion of SCF to draw on the entirety of the federal workforce was decisive in augmenting FEMA's incident workforce. To streamline and standardize national staffing resources for future incidents, FEMA is developing the National Qualification System (NQS) to **build and maintain a national incident workforce that includes emergency managers from state, local, tribal, and territorial governments.** This will provide the ability to quickly amass and deploy qualified state, local, and tribal teams and personnel throughout the United States on short-notice. Enhanced state organic capacity, NQS, and the SCF will provide the means to manage the host of smaller-scale disasters that occur annually, while allowing FEMA to retain sufficient immediate operational readiness for complex catastrophes and national security emergencies.

To ensure the readiness of its organic staff, FEMA is **conducting a Coordinated Workforce Review of its force structure for incident management, incident support, and mission essential functions.** Further, the Agency is examining the FEMA Qualification System to **streamline and increase certifications across the Agency's workforce.**

To improve the capabilities of its key specialized teams, FEMA should **use the Urban Search and Rescue Task Force model to further build Incident Management Assistance Teams' capability.** This

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Support states in building a greater capacity to respond to and recover from disasters by maintaining financial support while right-sizing the federal deployment footprint
- Build and maintain a national incident workforce that includes emergency managers from state, local, tribal, and territorial governments
- Use the Urban Search and Rescue Task Force model to further build the Incident Management Assistance Teams' capability
- Complete a disaster workforce review within the Agency, to include incident management, incident support, and mission essential functions
- Streamline and increase certifications across FEMA's incident workforce

transformation will streamline their structure and deployment process, and focus field leader training on critical thinking and situational leadership.

Finally, **revising the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and cross-sector coordination** would provide the means to effectively and efficiently allocate the national incident workforce to the most decisive place, time, and purpose.

FEMA Strategic Plan Alignment

- **Objective 2.1, Organize the “BEST” (Build, Empower, Sustain, and Train) Scalable and Capable Workforce**, aims to strengthen the disaster workforce by renewing the focus on developing a standardized and qualified national incident workforce and maximizing the existing workforce. FEMA must build on its inherent capabilities and strengthen our partners to support the nationwide incident workforce to form a more complete, interoperable incident workforce capability.

Sustained Whole Community Logistics Operations

FEMA coordinated logistics missions for the complex combination of hurricanes Harvey, Irma, and Maria. These missions involved more than \$2 billion dollars' worth of commodities moving across multiple states and territories (Figure 21). FEMA collaborated with private industry, non-governmental organizations (NGOs), and federal agency partners to manage these disaster logistics operations.

Hurricanes Harvey and Irma impacted Texas and Florida earlier in the season and partners provided commodities via ground transportation. However, the responses to Puerto Rico and U.S. Virgin Islands introduced the complexity of supporting a logistics supply chain that stretched outside the continental United States, enduring for multiple weeks and to multiple islands. Hurricane Maria caused widespread damage to island seaports, airports, and roads. These closures increased transit times and limited the territories' capacity to receive commodity shipments. Thus, FEMA's logistics effort featured notable and persistent coordination challenges in resource prioritization, resource movement and tracking, commodity distribution efforts, and contracting processes.

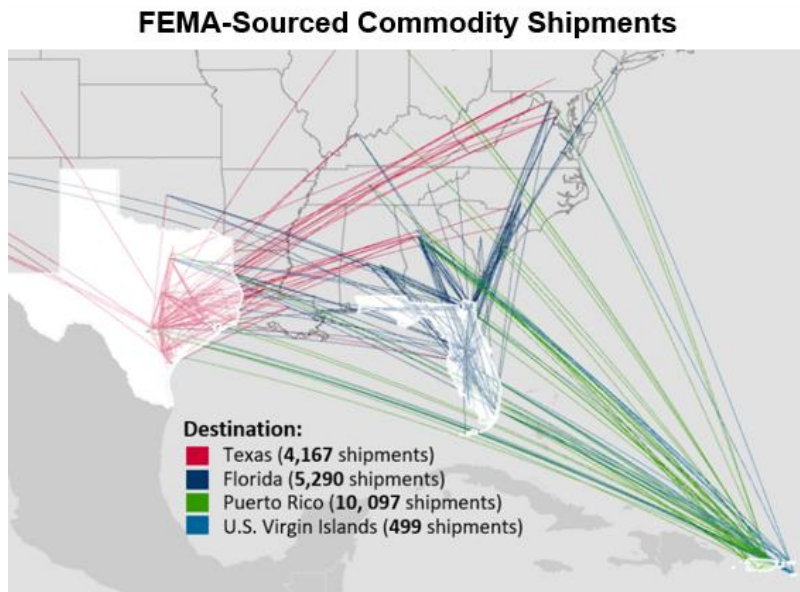


Figure 21: Commodity shipments from August 25 - November 30, 2017 directly to Texas, Florida, Puerto Rico, and U.S. Virgin Islands by air, sea, and ground transportation routes.

Key Finding #8: FEMA assumed a more active role in coordinating whole community logistics operations for Puerto Rico and the U.S. Virgin Islands due to these territories' preparedness challenges, geographic distance, and pre-existing, on-the-ground conditions.

The characteristics and impacts of each of the hurricanes posed challenges for all logistics operations, some more severe than others. For example, FEMA's logistical support of the movement of commodities differed in Florida and Texas, compared to the Caribbean islands, because of the ability to conduct land-based delivery of resources in Florida and Texas versus air and sea delivery to the islands. In Florida and Texas, FEMA provided a support function to the states whereas in Puerto Rico, FEMA took on an active role of coordinating logistics operations. The need for FEMA logistical support is also determined by SLTT preparedness (see Key Finding #10 for more details on how FEMA augmented support for Puerto Rico).

Hurricane Harvey stalled over parts of southeastern Texas, resulting in flooding and weather conditions that temporarily closed ports, airports, and roads, and prevented access to the disaster area. Hurricane Irma tracked northward along the western coast of Florida and then moved through central and western Florida. The timeline of this statewide impact prevented FEMA from immediately moving resources south to heavily damaged areas, such as the Florida Keys.

Despite these challenges, FEMA conducted logistics operations in both states without major resource coordination or movement constraints for two main reasons. First, the proximity to FEMA's two largest distribution center warehouses in Fort Worth, Texas and Atlanta, Georgia, combined with pre-

positioned commodities in Texas, Florida, and neighboring states, allowed the Agency to quickly meet resource needs. Second, because Texas and Florida are on the U.S. mainland, FEMA and its partners could move resources by relying primarily on ground transportation. In Texas and Florida, almost all interstate routes and state highways were open within a few days, enabling the private sector supply chain, as well as FEMA and whole community partners, to quickly move resources to, from, and within the states. For example, almost immediately after landfall, FEMA moved a large volume of commodities into both states. The combination of these factors enabled FEMA to coordinate logistics operations in Texas and Florida following established plans, albeit on a larger scale.

In Puerto Rico and the U.S. Virgin Islands, however, FEMA encountered significant challenges in coordinating and moving additional resources due to these territories' geographic distances from the U.S. mainland and challenging on-the-ground conditions.

FEMA maintained a stockpile of commodities at the Caribbean Distribution Center warehouse in Puerto Rico to facilitate a quick response to incidents in both Puerto Rico and the U.S. Virgin Islands. For

example, in response to Hurricane Irma, FEMA moved containers of commodities from the Caribbean Distribution Center to the Port of St. Thomas. However, distribution activities following Hurricane Irma created an immediate deficit of commodities at the warehouse (Table 5), requiring additional items to be transported in the days immediately prior to and following Hurricane Maria's landfall.

Table 5: FEMA's on-hand inventory of selected commodities at the Caribbean Distribution Center warehouse before (9/1) and after (9/15) Hurricane Irma, showed depletion of commodities prior to Hurricane Maria.

Commodity	Date: 9/1	Date: 9/15	% Change
Water (liters)	718,370	69,300	▼ 90%
Meals	250,572	97,632	▼ 61%
Cots	4,422	0	▼ 100%
Medical Kits	8	6	▼ 25%
Tarps	13,272	0	▼ 100%
Blue Roof Sheeting	15,344	180	▼ 99%
Total	1,001,988	167,118	▼ 83%

In response to Hurricane Irma impacts, FEMA distributed more than 80 percent of its inventory for selected commodities from the Caribbean Distribution Center warehouse. Hurricane Maria struck before supplies were replenished.

The Agency worked extensively with private sector entities, NGOs, and other federal agencies to procure additional commodities and then coordinated the use of air and maritime transportation assets to move them. FEMA worked closely with DoD on airlifts; contracted with commercial air carriers; and expanded its existing maritime shipping contract to transport resources from the mainland to the territories. Instances of these efforts immediately following Hurricane Maria landfall on September 20 included the following:

- **September 23:** A barge arrived at the Port of San Juan in Puerto Rico, after the port reopened, and offloaded 924,000 liters of water, 6,000 cots, and 31 generators.
- **September 23:** The first aircraft delivering commodities arrived at San Juan International Airport.
- **September 24:** A Maritime Administration ship arrived at port in St. Thomas and offloaded shipments which included 1.1 million meals, 27 General Services Administration vehicles, and 9,496 hygiene kits.
- **September 23 - October 19:** FEMA-coordinated daily flights delivering commodities to Puerto Rico.

The average transit time for resources moved by barge to the Caribbean is six to seven days, with additional time on either end for loading and offloading shipments at port. Figure 22 shows FEMA's commodity delivery data; however, due to data tracking issues (see Key Finding #9) not all early deliveries mentioned above were captured.

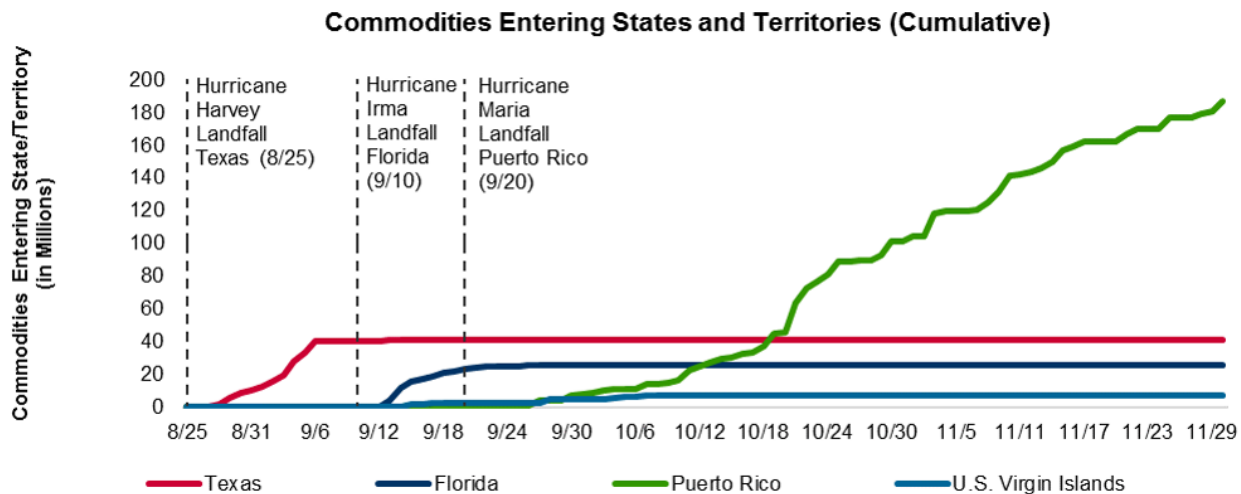


Figure 22: Cumulative commodities that entered each of the four states and territories to support the corresponding storm, i.e. Hurricane Harvey in Texas, Hurricane Irma in Florida, Hurricanes Irma and Maria in Puerto Rico and the U.S. Virgin Islands.

Operating in such a transportation-constrained environment necessitated that FEMA take the lead in coordinating the entire logistics supply chain for both Puerto Rico and the U.S. Virgin Islands, including prioritizing how and when resources moved. For example, FEMA coordinated with National Voluntary Organizations Active in Disaster partners to prioritize mass care commodities for transport to the islands since these partners could not move their own resources during the first weeks of response operations. At the request of the Governor of Puerto Rico, FEMA established and managed a warehouse in Jacksonville, Florida to receive donated items, with the intent of transporting them to Puerto Rico. FEMA also coordinated with other federal agencies and the private sector to move equipment necessary to support response operations, such as utility poles, generators, water pumps, aviation equipment, water treatment units and bucket trucks.

FEMA Moves Resources to Ensure Continuity of Medical Supply Chain

Puerto Rico typically receives its medical gases from two manufacturers on the main island, both of which lost power after Hurricane Maria. This threatened the supply of gases for healthcare and created the potential for a serious risk to public health. The Department of Health and Human Services, working with FEMA, convened a task force to identify solutions to the gas supply disruption. The solution was coordinating shipments of large containers of liquid oxygen and liquid nitrogen to Puerto Rico from the continental U.S.

Key Finding #9: While FEMA mobilized billions of dollars in commodities, the Agency experienced challenges in comprehensively tracking resources moving across multiple modes of transportation to Puerto Rico and the U.S. Virgin Islands due to staffing shortages and business process shortfalls.

FEMA's Logistics Supply Chain Management System (LSCMS) tracked the movement of millions of commodities into Texas, Florida, Puerto Rico, and the U.S. Virgin Islands. LSCMS worked well as the primary tracking system for commodities moved using ground transportation in Texas and Florida. However, LSCMS reporting was not current for commodities that required multiple modes of

transportation when shipped to Puerto Rico and the U.S. Virgin Islands (e.g., moving commodities by a combination of airplane, barge, and truck). For example, LSCMS records of meals and water delivered to Puerto Rico lagged behind the real-time shipment data tracked and reported by support staff at headquarters. This was partially due to a lack of trained personnel on the ground to record the repackaging and changes in transportation mode for shipped commodities.

The lack of reliable telecommunications connectivity in the U.S. Virgin Islands and Puerto Rico, combined with the lack of available logistics staff and business processes that should have been adjusted for the scope and scale of the incident, exacerbated these data discrepancies. However, adequate information was still available to make inbound supply chain and shipping decisions. In addition, FEMA struggled to quickly redirect and deploy trained LSCMS staff by the time Hurricane Maria made landfall; 81 percent of the total number of LSCMS-trained staff were already committed to Texas or Florida operations (Figure 23).

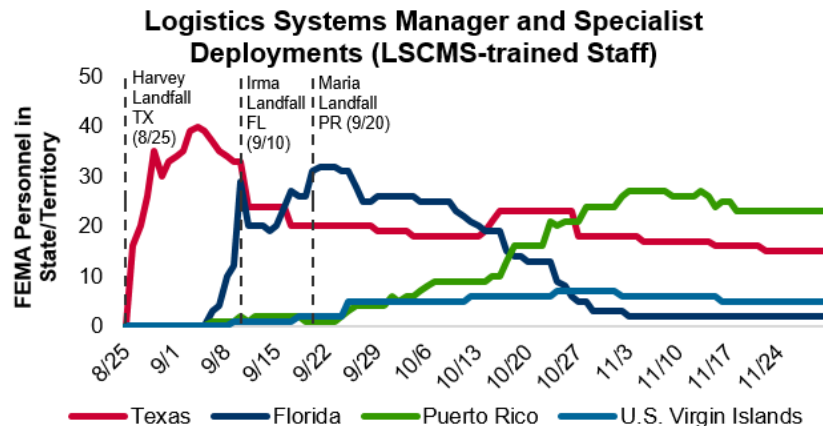


Figure 23: LSCMS-trained staff deployments in states and territories affected by hurricanes Harvey, Irma, and Maria.

FEMA's logistics business processes also complicated the Agency's ability to track commodities sourced through external partners. Though LSCMS has the capability to track resources from federal partners such as the Defense Logistics Agency, private sector partners, and other outside organizations, FEMA did not contractually require these partners to use the LSCMS vendor portal to upload shipment information. As a result, FEMA lacked real-time visibility into the supplies moved by partners and relied on other information-sharing processes to obtain accurate tracking information. Shipping containers often arrived in Puerto Rico labeled simply as "disaster supplies," requiring FEMA staff to unload and open containers to determine their contents.

Key Finding #10: FEMA provided logistical coordination to move and distribute commodities from staging areas to survivors in Puerto Rico, supplementing a role that should largely be managed and coordinated at the state or territory level.

FEMA's planning efforts typically account for the delivery of commodities from centralized FEMA warehouses to staging areas located in or near affected jurisdictions. State or territorial governments then receive the commodities from these staging areas and manage the actual distribution to survivors. FEMA strategic doctrine calls on the Agency to assume the responsibilities of SLTT governments, the private sector, and NGOs when the effects of a major incident incapacitate those organizations' ability to perform their functions effectively and efficiently until they can resume operations. However, FEMA's operational plans did not include these planning assumptions and thus did not account for continuing commodity distribution beyond the handoff to the state or territory.

Following Hurricane Harvey, the Texas National Guard managed commodity distribution. FEMA maintained visibility into distribution efforts by accessing Texas' crisis management software platform to view distribution point locations, inventory, and overall commodity burn rates. The response following Hurricane Irma in Florida was similar, although Florida's emergency operations plans and distribution operations place greater emphasis on the State of Florida to handle the distribution process.

Puerto Rico did not have the same level of preparedness to manage a commodity distribution mission. As a result, FEMA took on a more direct role in coordinating the final mile of commodity delivery. In addition to taking on this role, FEMA faced challenges moving commodities from ports to other locations. Major modes of transportation were closed and debris blocked extensive road networks across the territories, which required an in-depth assessment and clearance effort to reopen roads. Additionally, the limited number of FEMA logistics personnel on the island and the fact that most local contractors also were disaster survivors meant the Agency was not able to contract enough truck drivers to transport commodities. This issue, coupled with damaged or impassable roads, caused delivery delays.



Figure 24: Regional staging area trucks are loaded with meals to be transported to municipalities for distribution to survivors in Puerto Rico.

FEMA found alternative methods to facilitate commodity delivery, which included working extensively with federal partners on the island to move food and water from federal incident support bases to Puerto Rico's regional staging areas. At these locations, FEMA turned over commodities to the Puerto Rico National and State Guard for distribution to the 78 Puerto Rico municipalities. The municipalities, in turn, organized their own survivor distribution efforts aided by local organizations and NGOs. In some instances, FEMA delivered directly to municipalities. FEMA also partnered with DoD to airdrop commodities directly to isolated communities as early as three days after Maria's landfall.

To facilitate commodity distribution in communities, FEMA leased box trucks with drivers for each of the regional staging areas, conducted direct deliveries to municipalities, and used federal staff and NGOs to distribute food and water directly to survivors. This expanded logistics network moved commodities to more survivor-accessible locations. However, the increase and fluctuating number of delivery points and remote locations required significantly more transportation assets, personnel, and coordination than FEMA had initially anticipated. Furthermore, the large number of partners conducting distributions and the lack of a unified tracking system created difficulties in FEMA's efforts to monitor commodity consumption rates and accordingly adjust operations. While FEMA adapted and performed a more direct logistics coordination role, its normal logistics business processes were not suited to this role.

Key Finding #11: In a three-month period, FEMA issued more contract actions than in an entire previous fiscal year to meet disaster requirements, which strained the Agency's contracting personnel.

For the three fiscal years prior to FY 17, all of FEMA's annual contract obligations, both disaster and non-disaster, averaged approximately \$1.3 billion. By comparison, between August 25, 2017 and November 30, 2017, FEMA obligated more than \$3 billion across 1,464 contract actions solely for hurricanes Harvey, Irma, and Maria disaster operations. By end of May 2018, this number increased to 2,872 contract actions with FEMA obligations totaling over \$3.9 billion.

Before incidents, FEMA establishes pre-negotiated contracts for commodities and services typically required during disaster response. These contracts facilitate the rapid movement of resources and

commodities to areas most in need. Additionally, pre-negotiated contracts are meant to lessen the burden on ad hoc contract needs in the midst of disaster response. Immediately prior to Hurricane Harvey, FEMA had 59 of these pre-negotiated contracts in place (Table 6). Due to the amount of contract actions FEMA executed during the hurricane season, the Agency is considering increasing this number for future disasters.

Table 6: FEMA's pre-negotiated contracts by type.

Contract Type	Quantity
Commodities (e.g., Tarps, Water, Blankets, Meals etc.)	15
Services (e.g., Housing Inspections, Ambulances, Sheltering, Transportation, etc.)	44
Total	59

Given the unprecedented resource needs of consecutive response operations, FEMA not only exhausted commodities on hand but also exhausted pre-negotiated contracts to provide meals, tarps, water, and other resources during the responses to hurricanes Harvey and Irma. Therefore, the concurrent response for Hurricane Maria required FEMA to rapidly solicit vendors outside its pre-negotiated contracts to satisfy resource and program needs. As the Agency continued to receive requirements for meals, tarps, and water for quantities in the millions—often for delivery within days or hours—FEMA contracted with entities that were assessed as technically acceptable and committed to meeting the requirements, in accordance with the provisions of the Federal Acquisition Regulation. To protect the rights of the Government, FEMA creates contracts that clearly define the terms and conditions required for successful performance under the contract, particularly with respect to delivery schedule and quantities. Overall, FEMA executed a successful acquisitions process, with the Agency canceling just three contracts. These cancellations did not hinder FEMA's ability to deliver on its mission.

These increased contracting demands from the hurricane season severely taxed FEMA's acquisitions process and contracting personnel—both contracting officers and contracting officer's representatives. Over several months of concurrent disaster operations, FEMA staff modified and monitored existing contracts, issued new contracts, and cancelled underperforming contracts, while also scoping requirements for emerging needs. This workload—coupled with coordinating the additional oversight and review requirements for many high-value contracts (over \$500K), and executing contracting actions for other federal agency partners—challenged FEMA's procurement personnel. Several FEMA staff cited the need to leverage more contracting personnel across the Agency to build additional capacity.

As part of its disaster contracting efforts, FEMA relied upon its authorities under the *Defense Production Act* to award an unprecedented number of contracts with “priority” ratings. This rating legally obligates vendors to deliver resources by a specific date with the government contracts taking priority over all other contracts. From August 25 through November 30, FEMA issued 515 priority-rated contracts and task orders across hurricanes Harvey, Irma, and Maria operations. By comparison, Hurricane Katrina and Hurricane Sandy each resulted in one priority-rated contract award. Notably for the first time, the Department of Health and Human Services granted FEMA authority to priority-rate contracts for consumable medical supplies and durable medical equipment. The Department of Transportation granted the authority to prioritize the lease of a berthing ship for responder housing in Puerto Rico.

In addition, FEMA took action to address previously known challenges in how SLTT government and eligible non-profit organizations procure resources under FEMA grants. FEMA can reimburse SLTT governments and certain non-profit organizations for eligible contract costs. Recipients and subrecipients are required to follow federal procurement standards. Historical data, primarily documented in DHS Office of Inspector General audits issued from Fiscal Years 2009 through 2014, concluded that procurement under grants at the state and local level is subject to a number of

challenges, especially within the area of ineffective contracting practices. Deficiencies in this area include: non-compliant use of competitive procedures, inadequate contract cost and price analysis, ineffective or inappropriate use of contract types (or both), and failure to take all the necessary steps under socioeconomic contracting.

In response to these and other procurement challenges, FEMA implemented a number of measures during the 2017 Hurricane Season. FEMA provided compliance training to FEMA, state, and local government officials to achieve greater compliance with procurement under grants. FEMA also deployed personnel to Texas, Florida, Puerto Rico, and the U.S. Virgin Islands, to provide real-time procurement support. In Texas, for example, FEMA staff deployed for more than 70 days and helped establish and train the Texas State Attorney Workgroup, the first of its kind, to assist local governments with procurement issues. In Puerto Rico, Florida, and the U.S. Virgin Islands, FEMA set up processes and developed templates and tools to address contract review and technical assistance requests from recipients and subrecipients, significantly increasing the Agency's capacity to provide pre-award and post-award procurement support. Since September 2017, FEMA has provided 470 hours of procurement training to FEMA personnel, recipients, and subrecipients.

Recommendations

The unparalleled scope and scale of the 2017 Hurricane Season underscored the need for, and identified several limitations in, implementing timely national response capabilities that are fully integrated with and supportive of private sector supply chain restoration. In 2017, public and private sector response and recovery efforts were too “stove-piped” to share timely information, too slow to consult, and as a result, often too late to synchronize stabilization efforts. The public and private sector are inextricably linked and must have shared situational awareness and the ability to synchronize their respective efforts to be successful. FEMA should work with its key partners to **develop a more comprehensive understanding of local, regional, and national supply chains, as well as stronger relationships with critical private sector partners to support rapid restoration in response to catastrophic incidents.** As a result, the Agency is adopting new response principles to closely align public and private sector efforts in a unified effort focused on rapid stabilization of key lifelines.

While FEMA works to build a public and private sector coalition around the principle of rapid stabilization, the agency should also accelerate ongoing efforts to: **increase FEMA readiness stocks outside the continental United States; increase transportation planning, management and contract support capacities; broaden FEMA's capabilities to quickly get teams on**

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Promote federally supported, state-managed, and locally executed logistics operations
- Increase FEMA readiness stocks outside the continental United States
- Increase transportation planning, management, and contract support capacities
- Broaden FEMA's capability to quickly get teams on the ground to stage and deliver key commodities to disaster survivors, even in the most remote locations
- Streamline storage and movement across multiple modes of transportation that facilitate and speed delivery
- Develop a more comprehensive understanding of local, regional, and national supply chains, as well as stronger relationships with critical private sector partners to support rapid restoration in response to catastrophic incidents
- Support state, local, tribal, and territorial governments in improving capability for disaster cost recovery, pre-event contracting and contract enforcement, and vendor-managed inventory

the ground to stage and deliver key commodities to disaster survivors even in the remotest locations; and streamline storage and movement across multiple modes of transportation that facilitate and speed delivery. FEMA has reviewed and adjusted planning factors for the Caribbean as a result of lessons learned from the 2017 Hurricane Season and has significantly increased disaster commodity stock targets on the islands. FEMA is adding 300 new emergency generators to its inventory with a new contract that simplifies generator maintenance and support. FEMA is repairing and expanding its Caribbean logistics distribution center to accommodate additional commodities. Additionally, FEMA has updated the National Evacuation and Caribbean Transportation contracts in advance of the 2018 Hurricane Season.

FEMA's existing logistics capabilities must be integrated with expanded regional and state, local, tribal, and territorial logistics capabilities to **promote federally supported, state-managed, and locally executed logistics operations**. FEMA Integration Teams are important contributors to assisting states in increasing organic logistical capabilities. The Agency should **support state, local, tribal, and territorial governments in improving capability for disaster cost recovery, pre-event contracting and contract enforcement, and vendor-managed inventory**. FEMA should continue to develop a pre-event toolkit to enhance the ability of state and local leaders to direct and manage disaster resources. The toolkit will consist of: recommendations for pre-positioned contracts; emergency acquisition guidance from a regulatory, legislative, and policy perspective; commodity specific solicitation templates; guidance on staffing models to support procurement; and disaster case management capability. FEMA is also developing disaster financial management planning guidance specific to: FEMA Public Assistance and Hazard Mitigation grants, Department of Housing and Urban Development Community Development Block Grants – Disaster Recovery, and agriculture post-disaster grants; disaster finance accounting systems and management practices necessary to track, calculate and justify the costs of an emergency; and local reimbursement reconciliation.

These efforts should be fully integrated into an updated national response architecture and new “cross-sector” Emergency Support Function. **Revisions to the National Response Framework and, as required, the Response Federal Interagency Operational Plan** should emphasize the seamless integration of public, private sector, and volunteer organization actions to stabilize critical lifelines and establish the coordinating structures, communications, information exchanges and decision making that optimize getting the right capability to the right place at the right time for the disaster survivor.

FEMA Strategic Plan Alignment

- *Objective 2.3, Posture FEMA and the Whole Community to Provide Life-Saving and Life-Sustaining Commodities, Equipment, and Personnel from All Available Sources*, notes the importance of involving the whole community to quickly and fully meet all the needs of a catastrophic disaster.

Responding During Long-Term Infrastructure Outages

The Federal Government assists jurisdictions with the response to and recovery from significant power outages when utilities are unable to restore power quickly. Federal assistance may include provision of emergency funding, critical services, and equipment, including the installation of generators. In Texas and Florida, long-term infrastructure outages were isolated within the areas impacted by hurricanes Harvey and Irma. Functioning power and communications infrastructure facilitated FEMA's standard response operations. Approximately 10 days after Hurricane Harvey's landfall, 55,000 customers in Texas were without power, down from a peak of approximately 300,000 customers. In Florida, 75,000 customers were without power 10 days after Hurricane Irma made landfall, down from a peak of more than six million customers.



Figure 25: Staging area for utility truck and construction crews assisting in restoration of power to damaged areas caused by Hurricane Irma.

In contrast, the long-term and extensive infrastructure outages following Hurricane Maria in Puerto Rico required FEMA staff to think creatively and adapt operations for a longer time period. Due to the exceptional circumstances in Puerto Rico and large-scale impacts of power and communications outages, this section focuses solely on operations in Puerto Rico.

Key Finding #12: To overcome limited situational awareness created by the loss of communications in Puerto Rico, FEMA executed creative solutions to assess the situation and prioritize response activities, including emergency repairs to infrastructure.

FEMA and its partners generally rely on states, tribes, and territories to provide prioritized lists of infrastructure facilities for assessment and restoration based on local needs. Due to the severe and widespread impacts of Hurricane Maria and the limited situational awareness in Puerto Rico, FEMA assumed a more active role in assisting the territorial government with prioritizing infrastructure restoration.

FEMA and supporting federal agencies struggled to gain situational awareness and assess the status of critical infrastructure, in part due to communications outages across Puerto Rico. On September 21, one day after Hurricane Maria made landfall, FEMA (along with other federal, territorial, and local partner agencies) had little information about the status of infrastructure, including hospitals, roads, and water facilities. This diminished situational awareness continued through the first 72 hours after landfall. On September 23, a FEMA briefing noted that FEMA and the territory had not begun water and wastewater assessments, and that communications challenges inhibited reporting of road outage assessments. By September 27, one week after landfall, FEMA knew more, but still lacked key information about critical infrastructure. For example, Agency partners did not have information on the status of 24 of 52 wastewater treatment plants or 37 of 69 hospitals.

Situational Awareness

Situational awareness is the ability to identify, process, and comprehend critical information about an incident. Gaining and maintaining situational awareness requires extensive information collection and on-going monitoring of information.

Because FEMA and its partners lacked situational awareness early in the response, the Agency initially could not be certain that FEMA and interagency partner efforts were sufficient to stabilize the incident

in Puerto Rico. To address this challenge, FEMA and territorial field leadership established priorities focused on immediate needs and critical lifelines, including temporary power, water and wastewater, and healthcare. Field teams used data analysis tools to track and visualize data on these priorities, which provided situational awareness to field staff and FEMA's federal and territorial partners.

FEMA and its partner agencies, working in coordination with the Puerto Rican government, used the following methods to improve situational awareness:

- **Field Assessments:** Debris and damaged roads initially impeded access to impacted areas. To overcome these obstacles, some teams used a limited number of helicopters to visit critical infrastructure. However, they sometimes struggled to immediately report findings due to communications challenges, requiring teams to fly back with updates, and therefore delaying action.
- **Air Reconnaissance:** On September 22, two days after Hurricane Maria made landfall, FEMA conducted an air reconnaissance mission on the northeastern and southeastern portions of Puerto Rico to collect data and take photos of critical infrastructure elements. Although enough air assets were available, there were persistent challenges in communicating collected data to enhance situational awareness for decision-makers in the field.
- **Satellite Phones:** FEMA provided satellite phones to hospitals and mayors; however, the phones were not always an effective method for two-way communication due to weather impacts and user inexperience. Additionally, activating these phones often required user instructions, a line-of-sight with satellites, and implementation of a routine process.
- **Mayor Engagement:** FEMA worked with DHS and other federal agencies to provide Spanish speaking staff to the 78 Puerto Rico mayors to address communication challenges. These staff engaged mayors face-to-face several times per week to gather information from local officials on critical unmet needs and to gain situational awareness.
- **Crowdsourcing Information:** FEMA used crowdsourcing to a greater degree than it had previously to gain situational awareness on critical infrastructure. After Hurricane Maria, crowdsourcing efforts helped the Agency better understand the extent of the damage as digital volunteers collected and analyzed images of damage in Puerto Rico. Crowdsourcing volunteer networks brought together over 5,400 digital volunteers to collect information on critical information requirements such as hospital status, road and bridge closures, and food and fuel availability in Puerto Rico. Crowdsourcing was a useful strategic decision support tool, but required ground-truthing.

FEMA field leadership centralized response efforts around seven major population areas in Puerto Rico to accelerate stabilization. By the end of November, FEMA reported progress in restoring the priority infrastructure areas. For example, FEMA's daily field briefing for November 29 reported that 92 percent of customers had water service.

Key Finding #13: Challenged by an inoperable telecommunications environment in Puerto Rico, FEMA had to adapt field communications, program delivery, and command and control activities.

Hurricane Maria severely damaged Puerto Rico's communications infrastructure, which limited the ability of FEMA field personnel to leverage traditional commercial cellular and broadband communications services to coordinate response operations. Following landfall, 95 percent of cell towers were out of service, and outages continued in the ensuing months (Figure 26). The outages impeded field personnel access to key operating and management systems, including FEMA's crisis management system and the FEMA National Emergency Management Information System (NEMIS), which FEMA uses to process disaster survivor registrations. Both systems are not optimized for use

over contingency communications systems (e.g., satellite). Field personnel also often lacked training on how to prioritize use so as not to overload those contingency systems.

FEMA struggled to overcome its reliance on commercial cellular and broadband communications to execute program delivery and conduct command and control activities. For example, limited cellular service impacted the ability of disaster survivors to register for FEMA assistance. FEMA deployed Disaster Survivor Assistance teams across Puerto Rico to assist survivors, but the limited cellular service likewise hindered their efforts to register survivors for disaster assistance and conduct case inquiries and updates. These teams typically use tablets with cellular and wireless broadband access to register survivors. In the absence of mobile communications, the teams used paper registrations and forms on offline laptops and tablets. These new, non-standard processes caused inaccuracies and omissions, delaying the provision of benefits to survivors. Limited commercial communications and user unfamiliarity with contingency communications options also impacted command and control activities, including resource requests. FEMA staff used handwritten resource requests and subsequently had to review, prioritize, sign, scan, and manually enter more than 2,000 requests into FEMA's crisis management system, further contributing to delays. FEMA also experienced shortfalls incorporating the Integrated Public Alert and Warning System into the response, and could have better prioritized the transportation and use of contingency communications equipment, and trained personnel.

To overcome communications challenges in Puerto Rico, FEMA deployed its MERS resources with mobile satellite, mobile radio, and logistics support services to provide command and control communications, situational awareness, and program delivery (Figure 27). FEMA initially deployed MERS assets to Puerto Rico following Hurricane Irma and sent additional assets after Hurricane Maria. FEMA also deployed satellite phones, procured and leased satellite devices, and worked with other federal agencies, such as DoD and the U.S. Secret Service, to obtain additional resources. Still, FEMA faced challenges. Some FEMA satellite phones could not correctly operate in the Caribbean. Many staff who received satellite phones did not know how to properly use them. The demand for satellite phones and other contingency devices exceeded FEMA's pre-staged supplies both in the territory and on the U.S. mainland. Procurement and logistics challenges delayed the acquisition and shipment of additional devices to Puerto Rico.

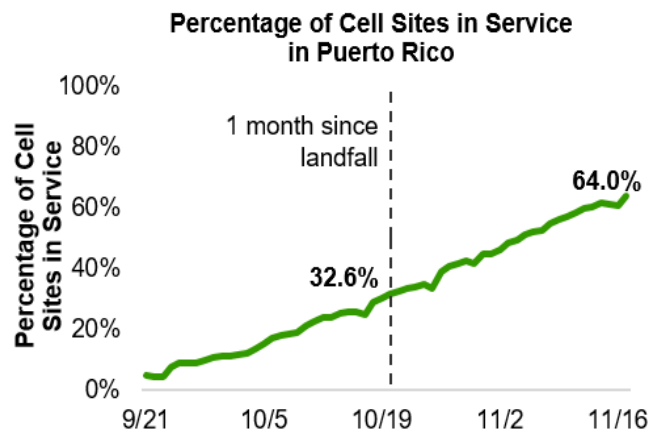


Figure 26: Cell service slowly came back online in Puerto Rico after Hurricane Maria.



Figure 27: Emergency communications vehicles in transit to support communications in Puerto Rico.

Key Finding #14: FEMA and its federal partners installed a record number of generators to provide temporary power to critical infrastructure while facing significant challenges in identifying generator requirements and shortfalls in available generators.

The extent and duration of outages in Puerto Rico were significantly greater than FEMA faces in most disasters. Typically, FEMA and its partners provide temporary emergency power to critical infrastructure facilities, such as emergency operations centers, fire and police stations, hospitals, and water facilities, with SLTT jurisdictions determining the prioritization of temporary emergency power. For example, following hurricanes Katrina and Sandy, the Federal Government provided temporary emergency power to a few hundred facilities by installing generators for usually 60 days or less.

After Hurricane Maria caused a large-scale power outage in Puerto Rico by severely damaging an already weakened power grid, many critical infrastructure facilities across the territory struggled to gain temporary power. These facilities either lacked back-up generators or had generators that failed or were non-operational. While regulations require hospitals to maintain emergency generators, the storm's impact either damaged these generators or they were otherwise inadequate to fulfill the hospitals' needs.

By the end of May 2018, FEMA and its partners completed 2,338 generator installations in Puerto Rico.

To meet the overwhelming demand for temporary power, FEMA, at the territory's request, assigned the U.S. Army Corps of Engineers (USACE) to install generators at many critical infrastructure facilities. By October, FEMA and its partners had set a record for generator installations, surpassing the previous record of 310 generators installed during Hurricane Katrina (Figure 28). By the end of November, more than two months after landfall, USACE had completed 693 generator installations; this number had increased to 2,338 by the end of May 2018. FEMA also expanded traditional approaches for providing temporary power by supporting repairs and upkeep for non-federal generators already installed at critical infrastructure facilities. FEMA and USACE provided one-time repairs and refueling of private generators. By repairing private generators, FEMA and USACE reduced the need for federally provided generators, freeing up inventory for other critical facilities.

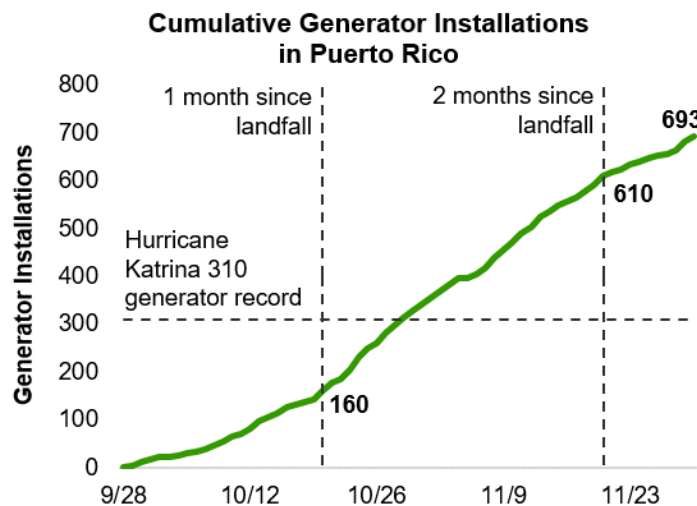


Figure 28: FEMA and its partners completed nearly 700 generator installations from late September to the end of November.

Despite the record number of generator installations and expanded efforts to provide temporary power, the number of generator requests received from the Puerto Rican government challenged FEMA and its partners. Even as the power grid came back online in some areas, FEMA and its partners were unable to provide generators to all requested critical infrastructure sites due to limited generator availability, failures due to prolonged use, lapse in servicing, and fueling issues. Additionally, extensive

storm damage and pre-existing safety conditions at some facilities created challenges for generator installation.

From late September until the end of November, FEMA received generator requests from roughly 1,400 facilities; by May 2018, the total number of requests had increased to 2,273. FEMA and its partners assessed the initial requests and determined that only a subset of several hundred facilities required generators. To meet this still high demand, FEMA augmented its inventory with generators from the Defense Logistics Agency and USACE.



Figure 29: Power generators and fuel tankers arrive to the port of San Juan, Puerto Rico.

When Hurricane Maria hit, FEMA had 695 generators in stock, ranging in size from 50 kilowatts to 800 kilowatts, including 73 already in Puerto Rico and 31 en route to the island in response to Hurricane Irma. These large-capacity generators often supported water pumping stations. While the available generators varied in size, FEMA did not have enough generators of all sizes to meet the needs in Puerto Rico, and, in particular, lacked enough small generators. To address this challenge and meet generator requirements, FEMA sometimes used generators that were larger than necessary, further contributing to overall inventory shortfalls.

Faced with unprecedented demand, FEMA and its partners conducted extraordinary prioritization of generator installations for critical infrastructure, focusing mainly on hospitals and water facilities. Still, FEMA could not fulfill every request from the priority list of facilities. For example, after providing generators to 30 critical medical facilities, including 14 hospitals and 16 diagnostic and treatment centers, FEMA had difficulty prioritizing requests from lower-level medical facilities serving disaster survivors. Ultimately, the Puerto Rico Aqueducts and Sewers Authority, which owns and operates the majority of the island's public water and wastewater systems, was the largest recipient of FEMA-provided generators. By the end of November, FEMA continued the generator mission as partners worked to bring Puerto Rico's power grid back online.

Temporary Emergency Power to National Public Warning System Station Generators

FEMA successfully maintained the National Public Warning System radio broadcast station generators in cooperation with local support, for over two months, to ensure continuous broadcasting of critical response and recovery information to residents in Puerto Rico and the U.S. Virgin Islands.

Recommendations

The private sector, states, and Federal Government all play crucial roles in the reliability, resilience, and security of critical infrastructure. To better prepare to respond during long-term infrastructure outages, FEMA should work with key partners to **revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize addressing the interdependencies and cascading impacts among critical lifelines and cross-sector coordination.** FEMA should also work with key partners to establish criteria for stabilization of communities, and **encourage investment in redundant assets to maintain communication and supply temporary power.** Power is the backbone of America's economic sectors, generating the energy that empowers its people and businesses. The lifelines of communications, health and medical, food and water, wastewater, and transportation all represent critical downstream dependencies of power. Further, power is a key interdependency and vulnerability among all sectors. The restoration of power is so consequential to

an effective response that a coordinated effort among utilities, local and state governments, the Department of Energy, USACE, and DHS is imperative. To ensure a unified national restoration effort, FEMA and these key partners are **establishing a standing Interagency Power Task Force as a collaborative partnership among key departments, agencies and non-governmental partners**. The task force will serve during steady state as a standing coordinating element and during incidents transition to a crisis planning component of ESF #12. The process for restoring power generation, transmission, and distribution systems is complex and includes immediate post-storm temporary power restoration, initial restoration of the supporting power grid, as well as solutions that can strengthen reliability and resilience over the long-term. The task force will serve as the integrating

mechanism during steady state for analysis, assessments, situational awareness, and routinized coordination. During complex catastrophes, it will conduct analysis, planning, and synchronization of assistance to support execution of the Power Outage Incident Annex, using coordinating structures such as the Electricity Information Sharing and Analysis Center.

As the 2017 hurricanes demonstrated, the impacts of long-term infrastructure outages jeopardize the ability and speed of communities and individuals to recover, and can have dire economic and social consequences. In addition to addressing lessons and best practices for operating during extended infrastructure outages, FEMA should work with and **encourage critical infrastructure owners and operators, and state and local governments, to invest in more resilient infrastructure**. These investments, including pre-disaster mitigation, will not only reduce disaster costs but also can have life-saving impacts during incidents. For example, FEMA and its partners need to capture collective investments in mitigation and their impact on risk reduction, and should encourage adoption and enforcement of modern building codes.

Resiliency is particularly important for lifelines such as communications. Every day, individuals, organizations, and government institutions provide critical services that depend on reliable access to communications systems. **Continuity planning and resilient all-hazards communications capabilities must be built into FEMA and its partners' plans and guidance for catastrophic disasters**. FEMA should assist states and local municipalities to prepare for major outages and their disruptive effects by providing expertise in continuity of government.

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Establish a standing Power Task Force as a collaborative, steady-state partnership and transition it to a crisis action planning cell under ESF #12, Energy, during disaster operations
- Encourage investment in redundant assets to maintain communications and supply temporary power
- Encourage critical infrastructure owners and operators, and state and local governments, to invest in more resilient infrastructure
- Include continuity and resilient all-hazards communications capabilities in plans and guidance

FEMA Strategic Plan Alignment

- **Objective 1.1, Incentivize Investments that Reduce Risk, Including Pre-Disaster Mitigation, and Reduce Disaster Costs at all Levels**, promotes the effectiveness of pre-disaster mitigation measures.
- **Objective 2.4, Improve Continuity and Resilient Communications Capabilities**, reinforces the importance of investing in resilient and redundant all-hazards communications capabilities as an indispensable element of an emergency management organization and highlights the fact that they must be built into catastrophic preparedness efforts. Additionally, this objective concludes that continued integration of continuity subject matter expertise and coordination into response and recovery operations is required.

Mass Care to Initial Housing Operations

Hurricanes Harvey, Irma, and Maria led to unprecedented demands on FEMA to support feeding, sheltering, and housing activities across multiple, concurrent, and geographically dispersed operations. ESF #6 (Mass Care, Emergency Assistance, Temporary Housing, and Human Services), co-led by FEMA and the American Red Cross, coordinated with federal, SLTT, and non-governmental partners to provide more than one million shelter nights and the longest feeding mission in FEMA's history in Puerto Rico and the U.S. Virgin Islands.

Impacted states, tribes, and territories (specifically Texas, Florida, Puerto Rico, and the U.S. Virgin Islands) conducted extended congregate sheltering operations as a result of widespread damage to residences and critical infrastructure. FEMA and its partners faced challenges facilitating the transition of survivors from emergency congregate sheltering to temporary and permanent housing solutions. While FEMA programs supported Texas' and Florida's efforts to move most survivors out of congregate shelters within 60 days, shelter operations in Puerto Rico and the U.S. Virgin Islands extended past 90 days. (Figure 30 provides an overview of the three classifications for sheltering and housing solutions managed under ESF #6.)

By October 9, FEMA had received more Individual Assistance registrations than for hurricanes Katrina, Rita, Wilma, and Sandy combined. By November 30, FEMA registered more than 4.7 million households, administered \$2.6 billion to applicants through the Individuals and Households Program (IHP), and provided almost 60,000 households with Transitional Sheltering Assistance (TSA) (e.g., hotel rooms). Through November 30, FEMA had provided more than 2.7 million hotel nights through TSA; this number had increased to nearly 5.3 million hotel nights by May 1, 2018. However, as a result of the concurrent incidents, the volume of applicants requiring inspections, financial assistance, and help transitioning to temporary or permanent housing necessitated innovations in FEMA's processes to expedite delivery of financial and direct housing assistance. To adapt, FEMA streamlined pre-existing processes and implemented new direct housing solutions, including piloting the first state-managed housing mission since 2000.

The aftermath of Hurricane Harvey alone left nearly 80,000 homes with at least 18 inches of floodwater, and 23,000 of those homes with more than five feet of floodwater. Almost 780,000 Texans evacuated their homes. Of the total households impacted by Hurricane Harvey, 80 percent did not have flood insurance. Initial projections showed a potential of 32,500 households needing direct housing assistance, including in the greater Houston metropolitan area. Although FEMA traditionally provides direct housing assistance in the form of manufactured housing units, the challenging circumstances that Harvey left in Texas followed by additional needs for subsequent disasters, required that FEMA implement multiple, creative solutions.

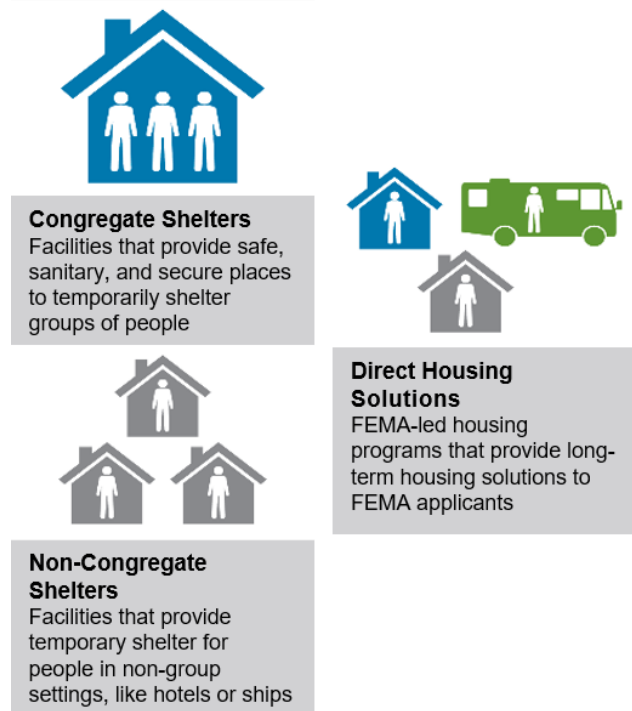


Figure 30: Types and examples of disaster sheltering and housing.

Key Finding #15: FEMA supported American Red Cross and Emergency Support Function #6 partners to provide more than one million shelter nights within the first 60 days, while facing challenges transitioning survivors out of congregate sheltering.

ESF #6 partners provided more than one million shelter nights to displaced survivors this hurricane season. Figure 31 shows congregate shelter populations in Texas, Florida, Puerto Rico, and the U.S. Virgin Islands from August 25 to October 1. Following Hurricane Irma, in Florida, 191,764 survivors transitioned from congregate shelters within 15 days.^o Relatively low levels of damage to survivor residences, available non-congregate accommodations, and a high degree of state and local preparedness mitigated the need to extend congregate sheltering operations. In Florida, all congregate shelters closed as of October 21.

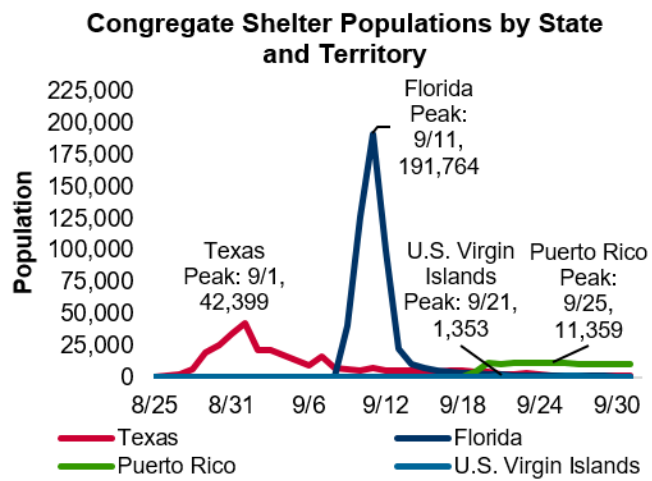


Figure 31: Peak congregate shelter populations in Texas, Florida, Puerto Rico, and the U.S. Virgin Islands.

At its peak, whole community partners in Texas sheltered 42,399 survivors in congregate shelters, with approximately 1,403 survivors remaining in shelters 30 days after Hurricane Harvey made landfall. The last shelter in Texas closed 63 days after Hurricane Harvey made landfall. In Texas, survivors remained in congregate shelters for many reasons including: unprecedented and widespread flooding, limited access to non-congregate options, and continued displacement from inaccessible or uninhabitable homes. The need to support extended sheltering operations strained whole community partners' ability to find and maintain qualified shelter staff. Recognizing that Hurricane Harvey made landfall before the peak of the hurricane season, the American Red Cross reserved staff in anticipation of additional disaster needs. Instead, the American Red Cross leveraged private sector partnerships to support congregate sheltering operations and FEMA activated staffing contracts to support a mega shelter in Dallas.

Dallas Mega Shelter



The City of Dallas opened a mega shelter three days after Hurricane Harvey made landfall and remained open for 26 days. At its peak, the shelter provided for 3,500 survivors.

Unlike congregate sheltering operations in Florida and Texas, congregate shelter operations in Puerto Rico and the U.S. Virgin Islands extended well beyond 90 days (Table 7). While FEMA registration data suggests that most survivors in both territories chose to remain in their damaged homes, those who relied on congregate facilities for an extended period were unable to access or repair their residences because of the severity of damages.

Table 7: Shelter populations over time.

State	30 Days	60 Days	90 Days
Texas	1,403	186	0
Florida	177	0	0
Puerto Rico	4,154	1,497	466
U.S. Virgin Islands	309	69	26

^o Figures do not include sheltering operations for the Seminole Tribe of Florida.

To facilitate survivor recovery and assist survivors transitioning out of congregate shelters across all disaster-affected areas, FEMA established Multi-Agency Shelter Transition Taskforces (MASTT). MASTT staff helped survivors move into non-congregate sheltering options, such as TSA, or access local, state, and NGO resources. Taskforce composition and participation, however, varied by operation. As a best practice, in Puerto Rico representatives of MASTT included disaster case management and state and Federal Government entities, including: the U.S. Department of Housing and Urban Development (HUD), the Puerto Rico Department of Family Housing, Community Services and Indigenous Affairs, and the Puerto Rico Department of Health. The MASTT in Puerto Rico took on additional roles coordinating with Puerto Rico's Department of Housing to better determine survivor needs and to identify rental properties for survivors.

Overall, whole community partners supported unprecedented mass care operations and assisted in the transition of survivors out of congregate shelters. However, partners met notable challenges in the territories because of impacts from multiple hurricanes.

Feeding Mission: Successes and Areas for Improvement in the Caribbean

As of November 30, FEMA's sustained air mission of food and water delivery was the longest in its history. This also marked the first time FEMA used non-perishable grocery and snack boxes in a feeding mission. Grocery boxes were 25-30 pounds and supplied approximately 12 meals; snack boxes weighed about 5 pounds and contained light meals including granola bars, candy, chips, fruit cups, desserts, and canned food. During the mission, FEMA distributed commodities using air drops and other innovative methods but also encountered challenges, such as:

- Puerto Rico's originally designed mass-feeding plan accounted for distributing 500,000 meals outside of congregate shelters or points of distribution, but not to the entire territory. The plan was modified to prioritize the 22 hardest hit municipalities; and
- Commodities procured through Logistics or Mass Care differed in their content requirements; more integration between the Agency's Logistics, Mass Care, and Procurement teams was necessary to coordinate feeding operations.



Key Finding #16: In Texas and Florida, FEMA helped survivors quickly transition from congregate shelters to other options such as hotels. However, across all operations, FEMA faced challenges implementing non-congregate sheltering programs.

FEMA employed a variety of non-congregate sheltering solutions to meet survivor needs, including the TSA program, a host-state agreement, the Sheltering and Temporary Emergency Power (STEP) pilot program, and the Volunteer Agencies Leading and Organizing Repair (VALOR) initiative.

Transitional Sheltering Assistance

TSA provides short-term, non-congregate sheltering through the provision of hotel and motel rooms to applicants who are unable to return to their primary residence following a disaster. The program allows hotels throughout the country to participate. In Texas, the State requested and FEMA approved the TSA program on August 27, two days after landfall. In Florida, the State requested TSA on September 10, when the storm made landfall; FEMA approved the request two days later. In Puerto Rico, the Territory requested that FEMA activate the TSA program on October 25, more than a month after landfall. FEMA approved the request three days later. The U.S. Virgin Islands did not request TSA because there was only one operating hotel on the islands. In total, approximately 2.2 million applicants were eligible for the program, and FEMA provided more than 2.7 million hotel nights to those survivors through November 30.

FEMA's use of TSA provided an option for applicants to quickly leave congregate shelters, but participation in the program varied across disasters. In addition, hotels and motels near the heavily damaged areas either were unavailable or declined to participate in TSA, requiring applicants to relocate or stay elsewhere in non-participating hotels.

Although TSA provided a non-congregate sheltering option, recovery resource providers, such as MASTT and disaster case workers, could more easily conduct outreach to survivors who remained in the congregate shelters. Additionally, applicants who moved into TSA-participating hotels away from their primary residence had difficulty accessing wrap-around services (e.g., feeding) or arranging to travel back to their residence to be present for a housing inspection (see Key Finding #17 for more information on housing inspections). As of November 30, 21,401 households remained checked into hotel rooms through TSA as a result of hurricane impacts. While TSA provides a safe sheltering option, for many survivors staying in a hotel may become more long-term than intended.

Host-State Agreement

From September to November, approximately 179,000 individuals, including hurricane survivors, left Puerto Rico for the continental United States. On October 5, FEMA entered into a host-state agreement with Florida to support Puerto Rico's evacuees. At the time, Florida whole community partners were engaged in disaster recovery operations from Hurricane Irma, which allowed state partners to readily assist evacuees from Puerto Rico. However, both Floridians and Puerto Ricans faced challenges accessing recovery resources. Survivors in Florida experienced a decreasing supply of non-congregate sheltering solutions.

FEMA Host-State Agreements

Under a host-state agreement, a state or territory provides transportation and/or sheltering support to evacuees from another state or territory that has received a Presidential emergency or Major Disaster declaration. The state may also seek reimbursement for eligible sheltering and evacuation costs through existing mutual aid agreements with FEMA.

Multi-Agency Resource Centers

States in several FEMA Regions stood up Multi-Agency Resource Centers under their own authority to assist Puerto Rican evacuees.

FEMA Region	Families Assisted
I	3,705
II	2,854
III	1,816
IV	9,141
V	982

FEMA also supported Puerto Rican evacuees by activating the Immediate Disaster Case Management (IDCM) program. IDCM provides recovery service access and case managers to displaced survivors through a mission assignment with the Department of Health and Human Services. While FEMA traditionally only allows IDCM programs to operate in the disaster-affected area, the IDCM program for the hurricane season provided services to survivors in Puerto Rico, as well as to those that evacuated from Puerto Rico to Florida and other states.

Sheltering and Temporary Essential Power

FEMA supports the ability for survivors to shelter at home through STEP, which provides interim repairs of necessary utilities, such as electricity, heat, and hot water. State and local governments implement STEP and therefore determine the program's administrative structure, which necessitates customization and can impact implementation timelines. Though FEMA created STEP during Hurricane Sandy and has used it in several large disasters since, the Agency has not established standard national policies or training for the program. In Puerto Rico, unreliable power and access to water caused additional delays to STEP implementation. The time between STEP policy approval and the date of the first STEP construction repairs is shown in Table 8.

Table 8: STEP policy approval and first STEP construction dates.

State/Territory	Sheltering and Temporary Essential Power (STEP) Policy Approval Date	First STEP Construction Date
Texas	September 15	December 23, 2017
Florida	September 24	December 16, 2017
Puerto Rico	October 19	January 22, 2018
U.S. Virgin Islands	October 14	March 3, 2018

Voluntary Agencies Leading and Organizing Repair

FEMA established a Crisis Action Planning (CAP) Team to address Puerto Rico's sheltering needs through innovative methods. The CAP Team developed the VALOR initiative, a novel approach to use voluntary agencies to execute STEP functions. The VALOR initiative provided rebuilding materials to voluntary agencies active in Puerto Rico, who then provided basic repair services to survivors' homes, making them safe and habitable. The first VALOR repairs started in January 2018.

FEMA employed a variety of sheltering, temporary, and permanent housing solutions during this hurricane season. While transitional housing programs were effective in both Texas and Florida, response operations in Puerto Rico and U.S. Virgin Islands continued to require modifications to effectively move survivors from congregate shelters to temporary or permanent housing solutions.

Key Finding #17: FEMA created new, streamlined housing inspection procedures to reduce inspection delays.

From August 25 through November 30, FEMA registered 4.7 million households for disaster assistance, more than hurricanes Katrina, Rita, Wilma, and Sandy combined. As of November 30, FEMA had informed approximately 50 percent of these applicants that a home inspection would be necessary. FEMA requires inspections to assess damages and estimate the value of property loss. The volume of inspections needed overwhelmed the Agency's capacity to complete traditional on-site inspections in a timely manner.

On October 1, FEMA advised applicants in Texas that inspection wait times could be as long as 45 days. By November 13, FEMA extended the notice of inspection delays to applicants in Florida, Puerto Rico, and the U.S. Virgin Islands as well. The concurrent disasters and the high demand for inspections created longer average wait times than those during Hurricane Sandy, although they were comparable to those for hurricanes Katrina and Rita (Table 9). Wait times for inspections can delay the delivery of financial or direct housing assistance to survivors. To meet the historically high need for inspections across all disaster affected regions, FEMA contracted additional inspectors to supplement existing inspection staff. Additionally, to reduce the time survivors had to wait for inspections, FEMA introduced new and alternate methods that streamlined and expedited the process (Table 10).

Table 9: Historical average wait time for site inspections (as of November 30, 2017).

Disaster	Number of Inspections	Avg. Wait Time (Days)
Katrina	1,385,329	35
Rita	623,635	27
Wilma	439,081	14
Sandy	343,003	7
Harvey	584,056	24
Irma	967,163	27
Maria	260,989	39

Table 10: New and alternate inspection processes implemented during the hurricane season.

New or Alternate Site Inspection Process	Description of New and Alternate Inspection Process	State or Territory Implemented
Applicant Self-Assessment Automated Outreach	FEMA delivered automated outreach via text message, phone, and email. This allowed applicants to self-report a general degree of damage for their home, which afforded FEMA the ability to triage resources to disaster survivors with the greatest needs first.	TX, FL, GA
Desktop Inspections	FEMA performed an interview with applicants to determine the extent of disaster-caused damage. The applicant's answers to the questions determined the applicable level of damage per descriptions provided. Each level of damage reflected a set amount of financial assistance for real and/or personal property disaster damage.	FL, GA
Flood Rapid Damage Assessment	FEMA developed the Flood Rapid Damage Assessment by compiling historical NEMIS data from FEMA information and data analysis reports and conducting a statistical analysis of various types of homes, foundation types, and water levels to create factors for individual inspection line items. This method was only used for rapidly assessing flood damage, but not for wind-related damage.	TX
Reduced Inspection Processes	FEMA implemented a method to alleviate the burden of inspection assignment for applicants who would not benefit from an on-site inspection. One month of Rental Assistance was expedited without an inspection for applicants that reported either inaccessibility or utility outage, without disaster-caused damage to their home or property. Initial Rental Assistance was expedited to homeowners with flood insurance and only reported flood damage, because flood insurance does not provide temporary housing assistance and applicants would be pending results from their flood insurance adjuster.	FL, GA, PR, USVI
Remote Sensing Imagery	FEMA used remote sensing imagery, in coordination with open-source housing and occupancy data, to identify applicants residing in areas damaged or destroyed by the disaster. FEMA used GIS data to identify flood depths in areas within a flooding incident. While effective in Texas and Florida, remote sensing imagery was not efficient in Puerto Rico and the U.S. Virgin Islands due to challenges related to map availability, topography, and inconsistent address conventions.	TX, FL, PR, USVI
Award Packages (Banded Inspections)	FEMA developed award packages, which provided financial assistance grants by levels of disaster-caused damage to real property and personal property, as determined by the results of an on-site or desktop inspection.	FL, GA
Inspections Triage	FEMA prioritized inspections based on responses to the Applicant Self-Assessment Automated Outreach.	FL, TX, GA
LexisNexis	FEMA leveraged LexisNexis database for identity, occupancy, and ownership verification to increase overall inspection efficiency by eliminating the need for site inspectors to verify registrant ownership.	FL, TX, GA

These alternate inspection processes, which FEMA used in different combinations across the disaster-affected areas, reduced the number of field inspections needed by approximately 146,000, saving nearly \$38 million. FEMA is evaluating the impact and effectiveness of these new and alternate inspection processes in expediting financial assistance.

Key Finding #18: FEMA applied lessons learned from recent housing operations and exercises to expand temporary and permanent housing solutions, including supporting a state-managed housing mission.

In April 2017, the Acting Administrator of FEMA issued a memorandum stating that FEMA must build “capability within the first 100 days of a disaster to register at least one million survivors for individual and other needs assistance [and] provide temporary housing to at least 20,000 displaced families.” The memo prompted the creation of the intra-FEMA ‘Housing Assistance Initiative’, which established 13 working groups to address disaster-housing challenges. Three of these working groups focused on a Recreation Vehicle (RV) study, exploring how FEMA could provide direct repairs to damaged homes, and building capacity of states to provide disaster housing. FEMA staff likewise incorporated lessons learned from the 2016 Louisiana severe storms and flooding disaster and the Agency’s response in support of North Carolina for the 2016 Hurricane Matthew to improve the agency’s processes for delivering safe and durable housing for displaced survivors. FEMA will continue to assess these programs throughout the recovery phase of these disasters.

Using Public Assistance (PA) and Individual Assistance (IA) to Provide Sheltering and Housing Programs

PA may fund the repair, restoration, reconstruction, or replacement of public facilities or infrastructure damaged or destroyed by a disaster. Unlike IA, FEMA requires that the disaster-affected state and local governments share up to 25 percent of the overall PA program costs. PA sheltering programs include VALOR, STEP, and Host State agreements.

IA provided direct assistance to individuals and families through numerous housing programs such as Direct Lease, Permanent Housing Construction–Repair, and Manufactured Housing Units.

Direct Lease Program

Due to the shortage of available housing resources to accommodate the large number of survivors requiring housing assistance, FEMA developed a new Direct Lease program. This program facilitated survivor access to property not typically used for temporary housing, such as corporate lodging or vacation rentals. In addition, Direct Lease can be a potentially safer option for displaced families with access and functional needs compared to a manufactured housing unit.

FEMA approved the maximum amount of funds under the Direct Lease program to meet survivor needs in different locations. Due to a shortage of affordable rental properties, FEMA raised the amount of money approved for acquiring properties under the Direct Lease to 300 percent above HUD’s fair market rent (FMR) rate in the Florida Keys, and to 200 percent of FMR in other Florida counties. In Puerto Rico and U.S. Virgin Islands, FEMA raised its Direct Lease cap to 200 percent of the HUD FMR, given the lack of available rental properties due to continued utility outages. Raising the Direct Lease cap increases the number of potential housing units available for disaster survivors.

Recreation Vehicles

FEMA also recognized the need to re-incorporate RVs into the menu of temporary housing options for the first time since hurricanes Katrina and Rita. FEMA-supplied RVs are certified to meet Recreation Vehicle Industry Association and California Air Resource Board standards, or are certified compliant with the *Toxic Substances Control Act Title VI* for formaldehyde emissions from composite wood products found in RVs. FEMA Housing Assistance Initiative, specifically the RV Study Group’s extensive research, influenced the decision to include RVs among the Agency’s temporary



Figure 32: FEMA staging area for MHUs, Travel Trailers, and non-motorized RVs.

housing options. A Housing Tabletop Exercise sponsored by FEMA earlier in 2017 also identified potential target populations and delivery processes for future RV use. FEMA used RVs in specific locations in both Texas and Florida because of their ability to be placed on smaller parcels of land where Manufactured Housing Units were not feasible.

Direct Repair

The Stafford Act authorizes FEMA to provide Permanent Housing Construction to disaster damaged homes in insular areas^p and locations where no alternative housing resources are available, and where temporary housing assistance is unavailable, not feasible, or not cost-effective. Direct repairs and new construction provided under Permanent Housing Construction are limited to real property components eligible under FEMA Housing Assistance such as heating, ventilating, air conditioning, walls, floors, and ceilings. Recognizing that areas in Texas impacted by Hurricane Harvey met the criteria for direct repairs, FEMA authorized this option for the first time in a non-remote location on the continental United States. The decision was intended to expedite delivery of direct housing assistance to applicants and provide equitable, cost-saving housing solutions to impacted populations.

State-Managed Housing Mission

Given the breadth of damage and diverse geography in the area of impact, FEMA recognized that it needed more ways to provide housing assistance in Texas. Both FEMA and Texas officials identified that state-managed, locally executed direct repair and lease initiatives could provide housing solutions while supporting the State of Texas, communities, and survivors. Initially, FEMA investigated the option of providing a grant to Texas to deliver direct housing. A grant for direct housing would allow Texas to manage both FEMA-granted dollars for direct housing as well as HUD-granted Community Development Block Grant Disaster Recovery (CDBG-DR) dollars in a continuum. HUD CDBG-DR grants are applied for and received by the state, and are typically received after FEMA direct housing assistance. FEMA found that under the Stafford Act, it can only provide financial assistance, or direct assistance for housing, not grant dollars. Under Section 306 of the Stafford Act, however, FEMA could enter into an Intergovernmental Service Agreement (IGSA) with the State of Texas to implement a direct housing mission. An IGSA is an agreement between a federal agency and a state to provide a given service.

Inter-Governmental Service Agreement Development Timeline

- **August 25:** President declares major disaster for Hurricane Harvey
- **September 10:** FEMA approves State of Texas request for direct housing assistance. FEMA conditioned the approval based on entering an IGSA with terms and conditions the state and FEMA agree to for implementing direct housing assistance
- **September 13:** First draft of IGSA including general contract terms and conditions and programmatic terms
- **September 14 – September 21:** Discussions within FEMA, with other federal agencies (DHS, the White House Office of Management and Budget, and HUD), and with Texas General Land Office (GLO) regarding duplication of benefits within FEMA programs and with other federal agency programs, eligibility determinations, and direct housing options offered through the IGSA
- **September 22:** FEMA and GLO sign IGSA
- **September 28:** Direct housing operations begin
- **October 7:** The first applicant moves into a travel trailer

The Texas General Land Office (GLO) implemented its first state-managed disaster housing mission by executing an IGSA with FEMA on September 22. The IGSA enabled the state to provide direct housing

^p According to the National Response Framework, insular areas include Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and the U.S. Virgin Islands.

assistance services on behalf of FEMA and was intended to allow greater flexibility in securing housing solutions as well as a streamlined approach to long-term recovery. However, FEMA and the Texas GLO required some time to execute contracting requirements per the IGSA and the Federal Acquisitions Regulations, as well as set up initial coordination and staffing structures (see the Inter-Governmental Service Agreement Development Timeline call-out box). Activities were designed to enhance state and local capacity to manage the immediate operation, and build capacity for future incidents as states have more familiarity with the needs of their residents, local laws and ordinances, and are better situated to design and administer solutions for the survivors. Although FEMA implemented a new and creative solution, the solution required time for FEMA and the Texas GLO to determine implementation methods while households remained displaced. With improved pre-event planning and coordination with partners, and more flexible authorities, FEMA and its federal partners could better support states, communities, and survivors in implementing housing assistance.

FEMA implemented innovative solutions aimed at overcoming shortages of available rental resources, expediting the delivery of direct housing assistance to qualified survivors, and supporting a unique state-led housing mission. The impact of these solutions will be assessed further in the recovery phase of the disasters.

Recommendations

Lessons from the 2017 Hurricane Season highlight the need for an in-depth and critical look at the Nation's post-disaster housing strategies. In April 2017, FEMA formed a Housing Assistance Initiative to work with its partners, industry, and academia on a new strategic vision for housing. FEMA should continue to build on that initiative and recent lessons learned to **revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across the critical infrastructure sectors**. Restoration of critical lifelines can accelerate survivors' return to habitable dwellings.

Currently, short-term sheltering programs last longer than their designed duration. For example, as of November 30, over 13,000 survivors remained sheltered in TSA in Texas, highlighting the need for a shift in the provision of post-disaster housing.

Through the State Preparedness Report, states and territories have communicated that they believe addressing housing gaps to be a responsibility of the Federal Government.

However, state and local governments are best positioned to determine housing options for their citizens, with support from the Federal Government. While 2017 saw improvements—such as the first-ever Intergovernmental Service Agreement with Texas to have its General Land Office serve as overall housing program administrator—these efforts still experienced state staffing shortfalls and information sharing challenges among partners. FEMA should work with its partners to **build capability and**

Recommendations Summary

- Revise the National Response Framework and, as required, the Response Federal Interagency Operational Plan to emphasize stabilization of critical lifelines and coordination across critical infrastructure sectors
- Build capability and empower the implementation of federally supported, state-managed, locally executed sheltering and housing solutions
- Improve the delivery and effectiveness of housing options, including exploring grant-making authority
- Clarify federal roles and responsibilities for housing, including long-term housing solutions
- Evaluate and implement appropriate housing solutions, including the use of Recreation Vehicles, Direct Repair, and Direct Lease options
- Promote all-hazard insurance so that individuals can reduce their losses and speed their recovery

empower the implementation of federally supported, state-managed, locally executed sheltering and housing solutions. FEMA could leverage technical assistance or the FEMA Integration Teams to help build this capacity to manage disaster housing programs.

FEMA and its federal, state, local, tribal, territorial, industry, and academic partners must re-examine housing and the inspection process, in a way that is unconstrained by current policy, regulatory and legislative restrictions. FEMA and its partners should pursue changes to reduce duplication and to streamline the process for inspections. Federal housing assistance can be adapted to build SLTT capacity to manage disaster housing programs on behalf of their citizens. FEMA and its partners should **work with federal partners and Congress to improve the delivery and effectiveness of housing options, including exploring grant-making authority.**

Additionally, FEMA should work with the Department of Housing and Urban Development and the other federal agencies engaged in the Housing Recovery Support Function to further clarify federal roles and responsibilities for disaster housing, including approaches to long-term housing. Changes should offer state, local, tribal, and territorial partners the flexibility to provide housing options that work for their citizens, complement local housing markets conditions, and are timely, cost-effective, and incentivize innovation. The goal will include an expeditious and smooth transition for survivors from immediate to mid- to long-term housing solutions. In parallel, FEMA should **evaluate and implement appropriate housing solutions, including the use of Recreation Vehicles, Direct Repair, and Direct Lease options.**

The 2017 Hurricane Season again reinforced that individuals with adequate insurance coverage recover faster and more fully after a disaster. In addition to closing the insurance gap through the National Flood Insurance Program, FEMA should **promote all-hazard insurance so that individuals can reduce their losses and speed their recovery.** This can help people understand how much insurance coverage they need so that individuals can reduce their losses and speed their recovery. Financial preparedness, including having an insurance policy on personal and public properties, is critical to rebuilding a home, replacing belongings, and restoring order to a family and community.

FEMA Strategic Plan Alignment

- **Objective 1.2, Close the Insurance Gap,** drives FEMA to be a catalyst to increase the public's knowledge of risk and to encourage adequate insurance coverage.
- **Objective 1.3, Help People Prepare for Disasters,** focuses FEMA on identifying ways to weave preparedness into people's everyday lives.
- **Objective 3.1, Streamline the Disaster Survivor and Grantee Experience,** challenges FEMA to create innovative and efficient solutions to provide the most effective survivor support and also increase the ability of SLTT governments to drive their own recovery.
- **Objective 3.2, Mature the National Disaster Recovery Framework,** provides coordinating structure for collaborating among stakeholders to help communities rebuild strong, reduce future risk, and decrease disaster costs.

Conclusion

The Nation faced an unprecedented 2017 Hurricane Season. The scale and rapid succession of these disasters stretched response capabilities at all levels of government, and called upon emergency managers to respond in new and innovative ways to support survivors and the affected communities.

FEMA is constantly reviewing its program delivery, decision-making processes, and responses to ensure that we can improve, minimize errors, and better serve survivors. This After-Action Report highlights a number of areas where FEMA can learn from this historic disaster season and better position the Agency for incidents to come. FEMA asks that the emergency management community as a whole to work together to create better outcomes for survivors after a disaster. FEMA calls on its federal, whole community, and SLTT partners to work to transform emergency management so that, together, we can innovate and implement new approaches and technology, reduce complexity, increase efficiency and improve outcomes for survivors and affected communities after a disaster.

Strengthening the Agency

FEMA has taken action to prepare for the 2018 Hurricane Season based on a number of the findings in this After-Action Report. FEMA has updated hurricane plans, annexes, and procedures for the states and territories. The Agency has made improvements in staffing for incidents including the creation of a standard operating procedure for a Personnel Mobilization Center, a central location for equipping and training staff prior to disaster deployments. FEMA improved its logistics operations ahead of the 2018 Hurricane Season, including increasing meal and water supplies in the Caribbean by more than six fold. FEMA has also added 300 new emergency generators to the inventory and updated high priority national level contracts, to include the National Evacuation Contract, Caribbean Transportation Contract, and National Ambulance Contract. FEMA is refining communications from land mobile radios to satellite communications. FEMA is also modernizing the housing inspections process to improve the survivor experience and lessen the inspection burden for the disaster survivor.

In addition to taking immediate action, FEMA has incorporated many of the findings from this report into FEMA's *2018-2022 Strategic Plan*. The strategic plan not only provides direction on immediate actions, but will guide implementation of long-term goals, such as building a culture of preparedness, increasing state capacity, enhancing intergovernmental coordination through our FEMA Integration Teams, improving the readiness of our incident workforce by organizing a scalable and capable workforce, and posturing FEMA and the whole community to provide life-saving and life-sustaining commodities, equipment, and personnel from all available sources. While the Strategic Plan outlines the way forward for FEMA and catalyzes change for the community, improving outcomes of disaster survivors and affected communities requires a commitment from the entire federal family, from whole community partners, and from SLTT governments.

A Call to Action for Emergency Managers and Partners

Based on findings identified in this report, FEMA calls on its federal and private sector partners to adopt a critical lifelines approach to stabilizing an incident. This approach includes revising the National Response Framework and, as required, the Response Federal Interagency Operational Plan as well as creating a cross-sector emergency support function and coordinating structures. The new Framework and Federal Interagency Operational Plan should prescribe unity of effort through rapid stabilization around lifelines such as power, communications, health and medical, food and water, wastewater, and transportation. The rapid stabilization of the lifelines should be the organizing principle of the doctrine.

As power is the foundation of America's economic sectors, FEMA charges its private sector partners in collaboration with federal partners to establish a standing Interagency Power Task Force to serve

during steady state as a standing coordinating element and transition to a crisis action planning cell under ESF #12 during incidents.

FEMA's mission is bounded by laws and regulations but, for a disaster survivor, recovery is a continuum. As partners, we need to transform the way we facilitate recovery for the Nation's citizens in the face of increasing severe weather events.

FEMA challenges its federal partners to think beyond current policy, regulatory, and legislative restrictions to determine how best to deliver post-disaster housing to the Nation's affected citizens after any given disaster. In addition, FEMA, other federal agencies, Congress, and the larger community of partners should collaborate on changes required to improve housing delivery and enable more efficient delivery of other disaster assistance.

The work of emergency management does not belong just to FEMA. It is the responsibility of the whole community, federal, SLTT, private sector partners, and private citizens to build collective capacity and prepare for the disasters that we will inevitably face. Jointly, we must continue to move forward by leveraging innovative approaches, engaging with new technology, reducing complexity, and strengthening our partnerships to improve outcomes for the Nation's affected communities and provide support for survivors.

Ultimately, the lessons learned from the 2017 Hurricane Season will contribute to FEMA's efforts to work with our partners to help people before, during, and after disasters.

Acronym List

ACQ	Acquisitions
ADR	Alternative Dispute Resolution
AAR	After-Action Report
CAP	Crisis Action Planning
CDBG-DR	Community Development Block Grant – Disaster Recovery
DC	Distribution Center
DEC	Disaster Emergency Communications
DFTO	Disaster Field Training Officer
DI	Disability Integration
DoD	Department of Defense
DRC	Disaster Recovery Center
DRF	Disaster Relief Fund
EA	External Affairs
EHP	Environmental and Historic Preservation
EMAC	Emergency Management Assistance Compact
ER	Equal Rights
FEMA	Federal Emergency Management Agency
FM	Financial Management
FMR	Fair Market Rent
FQS	FEMA Qualification System
FY	Fiscal Year
GIS	Geographic Information Systems
GLO	General Land Office
HM	Hazard Mitigation
HR	Human Resources
HUD	Department of Housing and Urban Development
IA	Individual Assistance
IDCM	Immediate Disaster Case Management
IGSA	Inter-Governmental Service Agreement
IHP	Individuals and Households Program
IMAT	Incident Management Assistance Team
IT	Information Technology
LOG	Logistics
LSCMS	Logistics Supply Chain Management System
MASTT	Multi-Agency Shelter Transition Taskforce
MERS	Mobile Emergency Response Support
NDRS	National Disaster Recovery System
NEMIS	National Emergency Management Information System
NGO	Non-governmental organizations
NLE	National Level Exercise
NPSC	National Processing Service Center
NRCC	National Response Coordination Center
OCC	Office of Chief Council
OPS	Operations
PA	Public Assistance
PL	Planning
PMC	Personnel Mobilization Centers
RRCC	Regional Response Coordination Center

RV	Recreational Vehicle
SAF	Safety
SCF	Surge Capacity Force
SEC	Security
SLTT	State, Local, Tribal, and Territorial
SPR	State Preparedness Report
STEP	Sheltering and Temporary Emergency Power
THIRA	Threat and Hazard Identification and Risk Assessment
TSA	Transitional Sheltering Assistance
USACE	U.S. Army Corps of Engineers
VALOR	Volunteer Agencies Leading and Organizing Recovery

Appendix A: Updated Disaster Data

The *2017 Hurricane Season After-Action Report* (AAR) reviews FEMA's preparations for, immediate response to, and initial recovery from hurricanes Harvey, Irma, and Maria, covering the timeframe of August 25, 2017 through November 30, 2017. This appendix provides current disaster data as of May 2018.

COMMONLY APPEARING INFORMATION			
Key Finding	Information in AAR	As of Nov 30, 2017	As of May 2018
N/A	Number of Individual Assistance registrations for Harvey, Irma, and Maria	4,700,000	4,769,000
N/A	Number of Individual Assistance registrations for Harvey, Irma, Maria, and the California Wildfires	4,736,660	4,797,906
N/A	Number of FEMA personnel deployed to Harvey, Irma, and Maria	17,000	20,300

STAFFING FOR CONCURRENT, COMPLEX INCIDENTS			
Key Finding	Information in AAR	As of Nov 30, 2017	As of May 2018
#4	Number of FEMA's force strength	10,683	11,476
#4	Peak number of FEMA force strength deployments to Puerto Rico	1,200	1,221
#5	Percent of FEMA incident management employees who are certified	56%	62%
#7	Peak number of FEMA personnel deployed to Puerto Rico	2,805	2,997
#7	Number of local hires hired for Harvey, Irma, and Maria	4,095	5,329

SUSTAINING WHOLE COMMUNITY LOGISTICS OPERATIONS			
Key Finding	Information in AAR	As of Nov 30, 2017	As of May 2018
#11	Value of obligations to FEMA contract actions for Harvey, Irma, and Maria	\$3,002,921,782	\$3,921,324,543
#11	Number of contract actions for Harvey, Irma, and Maria	1,464	2,872
#11	Number of priority-rated contracts issued by FEMA	515	574

RESPONDING DURING LONG-TERM INFRASTRUCTURE OUTAGES			
Key Finding	Information in AAR	As of Nov 30, 2017	As of May 2018
#12	Percent of customers with water service in Puerto Rico	92%	99%

RESPONDING DURING LONG-TERM INFRASTRUCTURE OUTAGES

Key Finding	Information in AAR	As of Nov 30, 2017	As of May 2018
#13	Percent of cell sites in service in Puerto Rico	64%	96%
#14	Number of generator installations completed in Puerto Rico	693	2,338
#14	Number of generator installation requests for facilities in Puerto Rico	1,400	2,273

MASS CARE TO INITIAL HOUSING OPERATIONS

Key Finding	Information in AAR	As of Nov 30, 2017	As of May 2018
#15	Total amount of IHP dollars disbursed for Harvey, Irma, and Maria	\$2,600,000,000	\$3,860,000,000
#16	Number of households provided with TSA for Harvey, Irma, and Maria	60,000	89,000
#16	Number of households eligible for TSA for Harvey, Irma, and Maria	2,200,000	2,300,000
#16	Number hotel nights provided to households for Harvey, Irma, and Maria	2,800,000	5,300,000
#17	Number of housing inspections for Harvey	584,056	608,516
#17	Number of housing inspections for Irma	967,163	1,059,212
#17	Number of housing inspections Maria	260,989	803,704

Appendix B: Progress in National Preparedness

Years of preparedness investments, incorporation of lessons from major disasters, and legislative changes to FEMA's statutory authorities have contributed to a more prepared and more resilient Nation. FEMA has adapted and improved its capabilities since Hurricane Katrina in 2005, and supported efforts to increase preparedness across the whole community—including state, local, tribal, and territorial (SLTT) governments, non-governmental organizations, and the private sector.

In response to congressional legislation, FEMA, in coordination with federal and whole community partners, implemented changes that reflect important lessons learned from major incidents (Figure 33). After September 11, 2001, Congress passed the *Homeland Security Act of 2002*, which created the Department of Homeland Security (DHS) by combining 22 different departments and agencies, including FEMA. FEMA continued to operate under the authorities of the *Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, as amended* and maintained its focus on reducing the loss of life and property and protecting the Nation from all hazards.

Hurricane Katrina revealed national shortcomings in preparing for and responding to a major disaster, including inadequate coordination with state and local partners. The *Post-Katrina Emergency Management Reform Act of 2006* addressed these gaps by clarifying FEMA's responsibilities, enhancing its regional offices, providing the Agency with new preparedness functions, and strengthening federal incident response teams. This act also clarified FEMA's authority to pre-stage initial resources in preparation for response operations prior to a disaster declaration.

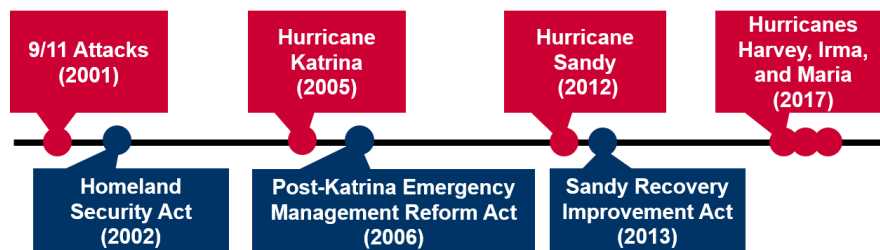


Figure 33: FEMA authorities and capabilities have evolved and improved after each major incident since September 11, 2001.

Lessons learned from Hurricane Katrina informed the development of the National Preparedness Goal and the National Preparedness System in 2011. Both the Goal and the System emphasize an all-of-Nation approach to preparing for threats and hazards that pose a significant risk to the country. This flexible and scalable structure was tested during Hurricane Sandy. FEMA pre-positioned assets and the President signed Emergency declarations before the storm made landfall in October 2012. In January 2013, only a few months after Hurricane Sandy devastated large areas of the Northeast, Congress passed the *Sandy Recovery Improvement Act of 2013*. This Act provided FEMA greater flexibility in administering assistance programs, improving the Nation's ability to efficiently respond to and recover from disasters such as hurricanes Harvey, Irma, and Maria.

This After-Action Report, as well as other efforts across the Federal Government and whole community, are important tools for identifying critical lessons learned, implementing best practices, and driving continuous improvement. Over the past several years, FEMA has worked closely with its SLTT partners across the country to develop catastrophic, worst-case scenario plans that are flexible and scalable to incidents of all magnitudes. FEMA also provides grant funding, training and exercise support, and technical assistance to help SLTT governments build and sustain their capabilities for a range of hazards, including hurricanes. Through these efforts, the Federal Government and its SLTT partners can identify areas for improvement and enhance their capabilities before the next major disaster.

Appendix C: FEMA Regions

FEMA has 10 Regional Offices located across the continental United States. Regional staff collaborate with state, local, tribal, and territorial governments; Members of Congress; other federal agencies; non-profit groups; the private sector; and other key stakeholders to administer all FEMA-related programs to protect against, respond to, recover from, and mitigate all hazards in the Region.

- **Region I:** Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
- **Region II:** New Jersey, New York, Puerto Rico, Virgin Islands
- **Region III:** District of Columbia, Delaware, Maryland, Pennsylvania, Virginia, West Virginia
- **Region IV:** Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
- **Region V:** Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
- **Region VI:** Arkansas, Louisiana, New Mexico, Oklahoma, Texas
- **Region VII:** Iowa, Kansas, Missouri, Nebraska
- **Region VIII:** Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
- **Region IX:** Arizona, California, Hawaii, Nevada, Pacific Islands
- **Region X:** Alaska, Idaho, Oregon, Washington



Figure 34: Map of FEMA Regions and Regional Offices.