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ARE WE READY FOR THE NEXT HURRICANE SEASON? STATUS OF PREPARATION AND RESPONSE CAPABILITIES FOR 2018

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

APRIL 12, 2018

Printed for the use of the Committee on Commerce, Science, and Transportation



Available online: http://www.govinfo.gov

U.S. GOVERNMENT PUBLISHING OFFICE
39–948 PDF WASHINGTON : 2020

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

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ARE WE READY FOR THE NEXT HURRICANE SEASON? STATUS OF PREPARATION AND RESPONSE CAPABILITIES FOR 2018

THURSDAY, APRIL 12, 2018

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

The Committee met, pursuant to notice, at 10:07 a.m. in room SR–253, Russell Senate Office Building, Hon. Roger Wicker presiding.

Present: Senators Wicker [presiding], Cruz, Nelson, Cantwell, Klobuchar, Tester, Peters, and Hassan.

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

Senator WICKER. Good morning. Thank you for waiting during two relatively early morning votes for the Senate. And I'm happy to chair this timely hearing after the 2017 hurricane season and Hurricanes Harvey, Irma, Maria, and Nate.

My home State of Mississippi is especially vulnerable to natural disasters, and the memory of Hurricane Katrina still remains fresh. I want to take this opportunity to remind the Committee that Barry Myers, President Trump's nominee to be the NOAA Administrator, still awaits confirmation from the Senate. I think as this hearing progresses, we should be mindful of that.

Mr. Myers' long successful career with AccuWeather, a private weather entity, provided him with expertise to lead our Federal efforts on creating the world's best weather model. Precise weather forecasting provides great safety for Americans who face the threat of hurricanes and other natural disasters. Mr. Myers has pledged to recuse himself from any conflict of interest. It is certainly past time for him and many other Trump nominees to be confirmed.

One thing we know for certain, Americans have the resolve to rebuild after hurricanes. Mississippians recovered thanks to the generosity of many heaven-sent Good Samaritans, and we rebuilt our coast after Hurricane Katrina stronger than before. The result continues to be evident in the aftermath of Hurricanes Harvey, Irma, and Maria. In this light, an important topic of this hearing is, Can we rebuild better? can we rebuild in order to withstand future storms?

Hurricane Nate, a Category 1 hurricane that made landfall twice in Mississippi showed that we can absorb the impacts from serious storms. In the past, a Category 1 hurricane would have resulted in

far worse consequences, but the investments and decisions made on the front end, learning from Hurricane Katrina, gave us the ability to prevent the worst of damages. Hurricanes like Harvey, Irma, and Maria require us to prepare. Just as we tell our coastal residents to prepare for a hurricane, it is vital to have Federal agencies, such as NOAA, the Coast Guard, and the NTSB ever at the ready.

Federal bureaucracies are not always efficient, and there is always work to be done to streamline and expedite Federal actions. We must be ready to respond to these disasters quickly and efficiently. This past hurricane season, there were successes in improved forecasting from NOAA and heroic responses by the Coast Guard and other agencies. We need to continue to plan so we can respond quickly should sequential devastating storms stretch our resources to the maximum. It is important to tap into the networks of our State emergency responders and volunteer networks, such as churches and the American Red Cross.

In the past, storms of this magnitude caused greater damage than was seen in 2017. So we're making progress. I'm hopeful that hearings like this can continue to minimize the impact to lives, property, and communities from these hurricanes. Things can be replaced, but people cannot.

So, Senator Nelson, our Ranking Member is now recognized for whatever opening statement he would like to make.

STATEMENT OF HON. BILL NELSON,
U.S. SENATOR FROM FLORIDA

Senator NELSON. Well, Mr. Chairman, here we are just about in hurricane season again, and we're still recovering from the hurricanes of last year. I imagine the Senator from Texas still has damage out there; in Florida, we do.

FEMA did a pretty good job in Texas and in Florida, but there are folks today in Puerto Rico that still do not have electricity and potable water, and that's unacceptable. And yet we continue to try to examine what's gone wrong and what's right and what can be done better. And as we're aware, there are some areas where we can and must do better, and Puerto Rico is an example. Florida is an example that local governments still are not being compensated for the debris pickup that they have advanced as a local government since they couldn't keep leaving it out on the curbside.

That is unacceptable that FEMA has not reimbursed them. But there seems to be a pattern because that was even the case in a hurricane 2 years ago when the State of Florida, which is responsible for taking local governments' requests, failed and missed the deadline, and as such, lo and behold, the local governments didn't get reimbursed, and we had to go in and plead for an amendment to that, an appeal to that.

Local governments have been financially struggling to recover from Hurricane Irma, the one I was talking about 2 years ago, was massive, and even Hurricane Hermine, which hit Florida 16 months ago. And so now 6 months after Hurricane Irma, some of those reimbursements haven't been made.

Of course, local communities are cash-strapped and in need of the Federal funds in order to continue their recovery efforts and

prepare for the one that's starting June the first. They can't keep going like we're going.

So the citrus crop in Florida is just about to be picked. The trees are laden with fruit. Senator Cruz, the King Ranch has a major citrus operation of some 40,000 acres in South Florida; it was ready to be picked. Bam, here comes the wind, and they lost almost 100 percent of the crop in South Florida. Further north, they lost 50 percent of the crop. A good number lost 75 percent of the crop.

So we went to work in the disaster assistance bill to get money to try to make them whole. It's in the USDA, Agriculture. They haven't been compensated yet, and it's 6 months, to allocate to agriculture $2 billion specifically to citrus, about 760 million for the loss of the crop, and about $200 million we appropriated to address fishery disasters, and $18 million to address the canals littered with debris in places like the Florida Keys, and it's sitting at the Department of Treasury as NOAA's plan to get it out the door awaits approval from the White House Office of Management and Budget. This is going so painfully slow. One of our witnesses here is from Marathon. He'll tell you about the debris in the canals. This funding was intended to help people not to be mired in a sea of bureaucratic red tape.

Or let's take the Army Corps of Engineers. They've reportedly been moving workers out of Puerto Rico before the power is restored. Obviously, the Federal Government has got to do a lot better. And that's why we've asked to hear directly from folks who were on the ground and those who had agencies here in Washington that are involved in hurricane assistance.

I want to welcome a couple of our witnesses from Florida. Chuck Lindsey is the City Manager for Marathon, a city working to return to normal after Irma slammed into the Keys and the folks around Marathon and a couple of Keys to the south were the ones that got it the worst because they were on the eastern side of the eye of the hurricane.

Jennifer Pipa is a Regional Chief Executive Officer of the Red Cross and lives in Tampa. She deployed to Houston following Hurricane Harvey, and then one week later they had to take them out of Texas and send them to Florida, and then she went to Puerto Rico. It's certainly rare that we have someone before us who has witnessed the devastation in all three locations and played a key role in delivering disaster relief.

Ms. Pipa, we look forward to hearing from you.

And I'm also anxious to hear from Admiral Gallaudet. He is retired Navy, Rear Admiral, now heads the part of NOAA, and hear about the next steps now that Congress has given the agency the funding to purchase the second hurricane hunter jet, because the only one that we've had for years and years does go down for maintenance, and Lord forbid that we would ever have an accident because of complete loss. Now we're going to have a backup.

And so we are also going to hear from NTSB Board Member Bella Dinh-Zarr about any progress that's been made to implement recommendations stemming from the investigation into the sinking of the *El Faro* cargo ship, which tragically was lost in a hurricane and should have never been steered into the path of that oncoming hurricane.

Rochelle Hamm is in the audience today to honor her husband Frank's memory, an *El Faro* crewmember. And since his death, Ms. Hamm and other *El Faro* families have left no stone unturned to improve maritime safety.

And like the families, I think a lot of us think we do need to do a better job of making sure ships have access to the most up-to-date weather information—they didn't on *El Faro*—and that they have the best lifeboats and lifesaving equipment—they didn't on *El Faro*. Vessels ought to properly be inspected to have that safety equipment.

So welcome, Mrs. Hamm.

And thank you to all the witnesses and thank you to Senator Wicker for holding this hearing.

[The prepared statement of Senator Nelson follows:]

PREPARED STATEMENT OF HON. BILL NELSON, U.S. SENATOR FROM FLORIDA

Thank you, Mr. Chairman. The last time we discussed hurricanes in this committee was in May of 2016.

So, here we are with hurricane season nipping at our heels again. At the same time we're still actively recovering from the busy and deadly 2017 season.

Today, we're going to examine what's gone wrong, what's gone right and what can be done better.

And as we're all very well aware, there are some areas where we can and must do better.

Delays by FEMA to reimburse local governments have been completely unacceptable.

Local governments are financially struggling to recover from Hurricane Irma, while at the same time still waiting for funds related to Hurricane Matthew and Hermine, which hit Florida over sixteen months ago.

Six months after Hurricane Irma, some counties have yet to see a dime of the FEMA reimbursements they were promised.

Our communities are cash-strapped and in need of Federal funds in order to continue their recovery efforts and prepare for the upcoming hurricane season less than two months away. They can't do that the way things are currently going.

Florida's citrus farmers, too, need to make decisions about harvesting and planting, but they're still waiting for the USDA to allocate the over two billion dollars Congress provided in February.

And the two hundred million dollars we appropriated to address fishery disasters and the eighteen million dollars to address the canals littered with debris in places like the Florida Keys is sitting at the Department of Treasury as NOAA's plan to get it out the door awaits approval from the White House Office of Management and Budget.

This funding was intended to help people, not to be mired in a sea of bureaucratic red tape.

Or, take the Army Corps of Engineers, who have reportedly been moving workers out of Puerto Rico before power is fully restored.

Suffice to say, we can do better. And we must.

That's why we've asked to hear directly from both folks who are on the ground and those who head agencies here in Washington that are involved in hurricane assistance, recovery and preparedness efforts.

First, I'd like to welcome a couple of our witnesses from Florida.

Chuck Lindsey is the city manager for Marathon, Florida—a city working to return to normalcy after Hurricane Irma slammed into the Florida Keys. Welcome, Chuck.

Jennifer Pipa is a regional chief executive officer of the Red Cross and lives in Tampa. Jennifer deployed to Houston following Hurricane Harvey—then one week later to Florida for Irma response—and then to Puerto Rico after Hurricane Maria. It's certainly rare that we have someone before us who witnessed the devastation in all three locations and played a key role in delivering disaster relief. Ms. Pipa, we look forward to hearing from you.

I'm also anxious to hear from Admiral Gallaudet on NOAA's next steps now that Congress has given the agency the funding to purchase a Hurricane Hunter replacement jet.

And finally, I want to hear from NTSB Board Member Bella Dinh-Zarr about any progress that's been made to implement recommendations stemming from the investigation into the sinking of the *El Faro* cargo ship, which tragically was lost during Hurricane Joaquin in 2015.

Rochelle Hamm is in the audience today to honor her husband Frank's memory—an *El Faro* crew member. Since his death, Mrs. Hamm and the other *El Faro* families have left no stone unturned to improve maritime safety.

Like the families, I too think we need to do a better job of making sure ships have access to the most up-to-date weather information, they have the best lifeboats and lifesaving equipment and that vessels are properly inspected.

Welcome, Ms. Hamm.

Thank you to our witnesses. And thank you to Chairman Thune and to Senator Wicker for holding this very important hearing. With that, I'll turn it over to our local impact panel.

Senator WICKER. Thank you, Senator Nelson.

Senator Cruz, I understand there is a distinguished Texan on the panel that you would like to introduce.

STATEMENT OF HON. TED CRUZ,
U.S. SENATOR FROM TEXAS

Senator CRUZ. Thank you, Mr. Chairman. It is my privilege to have the opportunity to introduce Mayor Allen Owen, of Missouri City, Texas. Mayor Owen has led a life dedicated to public service. He has served as the Mayor of Missouri City for the past 24 years, and he was a Member of the Planning and Zoning Commission and the City Council.

In addition to holding public office, Mayor Owen has worked tirelessly in the community by serving on countless boards and associations, such as the Fort Bend Literary Council, the FBI Citizens Academy Alumni Association, and the Fort Bend Women's Center, and he's a lifetime Vice President and Director of the Houston Livestock Show and Rodeo.

Mayor Owen has been so active in the community, if I were to read his entire record of community involvement, we would run out of time for the rest of the hearing. However, what brings Mayor Owen to this Committee today is August 25, 2017, the day Hurricane Harvey made landfall in Texas. Hurricane Harvey was unlike any storm we've ever seen before. It devastated our Gulf Coast and is considered one of the costliest disasters in United States history.

As Harvey became—as Harvey made landfall, roads became rivers, winds obliterated entire communities, and too many precious lives were lost.

Like many Texans, Mayor Owen didn't sit back and wait for help. Mayor Owen helped coordinate 1,300 high-water rescues, and housed and fed 60 state troopers and 17 National Guardsmen for over a week. He spent an entire week in the city's operations center with no way to get home. And even though the water has since receded, the work hasn't stopped.

Eight months since Hurricane Harvey made landfall, Mayor Owen continues to be an integral part of the rebuilding process in Missouri City. From cleaning out waterlogged houses to consoling those who were most affected by the devastation, Mayor Owen is a wonderful example of what it means to be a Texan. And I am proud that he is here today to help represent the great State of Texas before this Committee.

Welcome, Mayor.

Senator WICKER. Thank you very much, Senator Cruz. And I want to welcome my fellow Mississippian and my friend Mr. Jamie Miller, who serves as Deputy Director for Governmental Affairs and Chief Innovation Officer for the Mississippi Development Authority, MDA. He serves as disaster recovery administrator and oversees state-owned ports.

Mr. Miller lives in Gulfport, Mississippi. He responded to Hurricane Katrina both personally and professionally. And I think it's noteworthy that he served as Policy Advisor to Governor Haley Barbour's Office of Recovery and Renewal following Hurricane Katrina.

So I think it's fair to say, Senator Cruz and Mr. Ranking Member, that all four members of our first panel have been there and done that, and I can say from my own personal knowledge that Jamie Miller knows what he's talking about when it comes to this subject matter.

So we'll set the clock for 5 minutes for each witness. If there's more to be provided to the Committee, we'll, of course, take the entire statement for the record. But we'll begin down here with Mr. Miller and proceed down the table.

You are recognized, sir, and welcome.

STATEMENT OF JAMIE M. MILLER,
DEPUTY DIRECTOR FOR GOVERNMENTAL AFFAIRS
AND CHIEF INNOVATION OFFICER, STATE OF MISSISSIPPI,
MISSISSIPPI DEVELOPMENT AUTHORITY

Mr. MILLER. Thank you, sir. Good morning, Senator Cruz, Ranking Member Nelson, and good morning to my Senator, Senator Roger Wicker.

I want to thank this Committee on Commerce, Science, and Transportation for hosting today's hearing, and asking a very important question: Are we ready for the next hurricane season?

It is my honor to come before you and offer Mississippi's perspective on hurricanes, hurricane preparedness, and our ability to respond and mitigate the impacts of the next major storm.

Mississippi is a state where we value simple and practical solutions to problems. We value personal responsibility and taking care of our neighbors. As the most charitable state in the Nation per capita, we value giving.

Hurricanes have taught Mississippi some challenging lessons. They remind us of how vulnerable we are to their power, but I'm here to share with this Committee the lessons taught have not gone unlearned. Mississippi has been the beneficiary of the American people's incredible generosity when storms such as Hurricane Camille, Frederick, Elena, Georges, and Katrina made landfall in Mississippi. Mississippi was given a great responsibility to put those dollars to use to devise creative programs and policies to protect our citizens and to mitigate future damages.

When Mississippi's coastal communities were built, it was without regard for significant hurricane impact. That all changed after Katrina. With the daunting task of rebuilding roads, infrastructure, housing, and the economy from a mountain of debris, Mississippi put the necessary safeguards in place to avoid the total

devastation from future storms. Those safeguards required dramatic changes to building codes and elevation requirements.

Housing programs implemented post-Katrina included the Homeowner's Assistance Program, or HAP. HAP required grant recipients to elevate their homes, comply with building codes, and maintain flood insurance. The Homeowner's Elevation Program provided grants to residents, although they did not lose their home, to elevate structures to the base flood elevations. And, finally, Mississippi's Small Rental Assistance Program was designed to rebuild single family rentals and duplexes with the new property covenants.

Infrastructure initiatives included the Gulf Coast Infrastructure Program, which focuses on building a utility infrastructure backbone mitigated against future storm damage. The Port of Gulfport Restoration Program created a more resilient facility to withstand future hurricane damage. Efforts included elevating the port and creating an evacuation plan to ensure containers, equipment, and cargo did not wash inland. New buildings were also required to be built to the FEMA Flood Velocity Zone standards so critical structural components could withstand the storm surge.

Mississippi believes in hazard mitigation. Coupled with the housing and infrastructure programs mentioned, Mississippi has invested more than $350 million in hazard mitigation directly. We invested $230 million in public and private safe rooms, $85 million in wind retrofits for homeowners, 21 million in flood control, and 16 million to acquire properties in the floodplain.

The payoff for Mississippi's investments in preparedness and mitigation was never more evident than October 8, 2017, when Hurricane Nate made landfall along the Mississippi Gulf Coast. Nate brought sustained winds of 85 miles an hour and a significant storm surge of 12 feet. This storm, by all accounts, should have caused an estimated $100 million in damages. However, Mississippi incurred no deaths, no injuries, and not one single home or business sustained major damage. Once the water subsided and debris was cleared, Mississippians went back to business as usual in a minimal amount of time. Governor Phil Bryant said it best when he correctly stated, "Mississippi did not dodge a bullet, we took a direct hit."

As the waters of the Gulf of Mexico begin to warm, Mississippians know now is the time to put together their individual preparedness and recovery plans. We have strong leadership from a dedicated Governor, statewide Emergency Management Agency, and seasoned local emergency managers and communities that remain vigilant. And although we will never be able to completely prevent the damages caused by violent storms, Mississippi is better prepared today to withstand the effects of tropical weather thanks to our responsible use of mitigation and preparedness resources. Our structures are higher and stronger, and Mississippians are much smarter.

Thank you.

[The prepared statement of Mr. Miller follows:]

PREPARED STATEMENT OF JAMIE M. MILLER, DEPUTY DIRECTOR, GOVERNMENTAL AFFAIRS; AND CHIEF INNOVATION OFFICER, STATE OF MISSISSIPPI, MISSISSIPPI DEVELOPMENT AUTHORITY

Good morning. Thank you Chairman Thune, Senator Wicker and members of the Senate Commerce, Science and Transportation Committee for hosting today's hearing and asking an important question. *Are we ready for the next hurricane season?*

Mississippi's People and Lessons Learned

It is my honor to come before you and offer Mississippi's perspective on hurricanes, hurricane preparedness and our ability to respond and mitigate the impacts of the next major storm.

Mississippi is a state where we value simple and practical solutions to problems. We value personal responsibility and taking care of our neighbors. As the most charitable state in nation per capita, we value giving. Hurricanes have taught Mississippi some challenging lessons. They remind us how vulnerable we are to their power. But I'm here to share with this committee the lessons taught have not gone unlearned.

Mississippi has been the beneficiary of the American people's incredible generosity when storms such as Hurricane Camille, Frederick, Elaina, Georges and Katrina made landfall in Mississippi. Mississippi was given a great responsibility to put those dollars to use to devise creative programs and policies to protect our citizens and mitigate future damages.

Mississippi's Investment in Mitigation

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Hurricane Nate in 2017

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Mississippi is Ready in 2018

As the waters of the Gulf of Mexico begin to warm, Mississippians know—now is the time to put together their individual preparedness and recovery plans. We have strong leadership from a dedicated Governor, statewide Emergency Management Agency and seasoned local emergency managers and communities that remain vigilant.

Although we will never be able to completely prevent the damages caused by violent storms, Mississippi is better prepared today to withstand the effects of tropical weather thanks to our responsible use of mitigation and preparedness resources. Our structures are higher and stronger, and Mississippians are much smarter.

Senator WICKER. Thank you, Mr. Miller, for that fine statement. And it was precisely 5 minutes long. So thank you very much.

Mayor Owen, you are welcome and recognized.

STATEMENT OF MAYOR ALLEN OWEN,
MAYOR OF MISSOURI CITY, TEXAS

Mr. OWEN. Mr. Chairman, thank you, and to my favorite, Senator Cruz, for asking me here.

Monday, I was in a hearing in Houston, in the Houston area, that Chairman McCaul brought his Homeland Security Committee to Houston to talk about lessons learned from Harvey. So I guess I'm going to repeat what I said a lot on Monday, but, you know, Ranking Member Nelson forgot about the storm we called Ike.

So we've had two hurricanes recently, and nobody has talked about Ike. And the reason I bring it up is that we still have not been paid totally from the money that was owned to us from FEMA from Ike, and that was in 2010. We received payments up until 2013. We have had two floods since then. We still have not received a penny from that. We have not received a penny from Harvey either.

Harvey was different. I've been in office 32 years. This wasn't my first rodeo nor my first storm. It was different because once it hit Corpus Christi and Rockport, it moved to Houston, and it sat on top of us for 72 hours and dumped anywhere from 52 to 72 inches of rain, causing tremendous flooding throughout not only Houston, but the entire Gulf Coast. And I'm 40 miles from Galveston.

So we're typically prepared for hurricanes and storms like that. We weren't prepared for this. There was no way for us to prepare for that much water to be dumped in a short period of time. And I'm glad that Ranking Member Nelson understands what the impact is on local communities.

A point that I made Monday is that, you know, when cities have their bonding agencies come into town, they're now requiring that cities maintain a 25 percent reserve balance in our fund balance. But when disasters occur like Harvey, I paid a million dollars in overtime, I had costs for lost equipment, traffic signals. I had to write a check for that. I can't wait 3 years to get reimbursed because when I take that money out of my fund balance, and I drop below that 25 percent, and the bonding agencies come back in, they're going to look at my rating again. That affects my entire balance of budget. And I can't afford to do that.

And we emphasized to FEMA that, you know, the things that are going through the process right now of even filling out the forms. I recently hired a $24,000 consultant to tell us how to fill out the form for FEMA to make sure the i's are dotted and the t's are crossed. The money is going to the State of Texas, and I haven't seen a dime of it. They need to write the check to the people that are writing the checks and making sure that we're taking it into consideration.

I'm going to ask you a question. And I'm a former banker. When FEMA—when a house floods and you don't have flood insurance—and, by the way, 95 percent of the people who flooded do not have flood insurance because they were told they weren't in a flood zone—when they flood and they don't have flood insurance, they get paid $33,000 maximum to repair their home. I can take $15 million and prevent 2,000 homes from flooding that flooded during Harvey, with pumps that were inundated, we didn't have enough of them, drain-out ditches, taking care of things that mitigate storms that would prepare for us.

This wasn't the first flood we've had. Again, this was a flood that was all water and no wind. We didn't lose electricity. We had people that were actually flooded. And as the Senator said, we did 1,300 high-water rescues to get people out of their homes in a short period of time.

But if I had the money to do the mitigation that's necessary to prevent that from happening, those 2,000 people that lost their homes would not have had a single drop of water in them because I could have taken that water, put it across on the other side of the levy that protects Missouri City from the Brazos River, by the way, which is at 59 feet. And while I'm sitting in that operations center on August the 26th celebrating my 50th wedding anniversary, by the way, for the next 7 days, I couldn't get out of my own house, we watched the Brazos River, being told that we were going to—that it would crest at 59 feet. That levy is at 59 feet.

I have inundation maps in the city that show me what effect flooding would have at 52, 54, 56, and 58 feet. At 58 feet, I would have had water in 9,500 homes. At 59 feet or 60, I would have an entire city that was flooded, because we did not prepare for that and we did not prepare for that type of rain event.

We need to make sure that the Corps of Engineers is working with us on alternative channels with alternative holding basins. In that hearing Monday, I can tell you that the City of Houston and Harris County drilled the Corps on not having adequate protection for them.

So our part of mitigation is trying to get the funding up front to prevent what happened this past August.

Thank you, Mr. Chairman.

Senator WICKER. And thank you very, very much, Mayor Owen.

Mr. Lindsey.

Senator CRUZ. I've got to point out the Texas witness was exactly 5 minutes, too.

[Laughter.]

Senator WICKER. Absolutely. And he asked a question, and I was about to say that question was so easy, I'm going to let Senator Cruz answer it later on.

[Laughter.]

Senator WICKER. Mr. Lindsey, we're delighted to have you.

STATEMENT OF CHARLES LINDSEY, CITY MANAGER, CITY OF MARATHON, FLORIDA

Mr. LINDSEY. Thank you. Good morning, Senator Wicker, Ranking Member, and our Florida Senator Bill Nelson, and members of

the Committee. Thank you for the opportunity to be here today to speak on behalf of our residents.

We extend all of our thanks—or we extend our thanks to also all the Members of Congress for approving the disaster assistance needed during these very difficult times.

Marathon is an island community of roughly 8,900 residents. We are located in the heart of the Florida Keys, and like all Keys communities, are faced with numerous challenges protecting our economy and our environment. We support a $2.7 billion tourism-based economy, a vital commercial and fishery—or commercial and recreational fishery.

We support—and what's most important is we shoulder the responsibility to protect the third largest barrier reef system in the world, which includes the Florida Keys National Marine Sanctuary. We do this in part by relying on a unique community bond that exists from Key Largo to Key West. Following a catastrophic event like Irma, that bond was really put to the test. Last September, our local governments united, and with the patience of our residents, conducted a Keys-wide evacuation that had not been attempted in a decade, and clearly saved lives.

We readied our emergency personnel, pre-staged our equipment, and prepped our emergency operations centers awaiting Irma's arrival. Upon sunrise the first morning, it was painfully clear our beautiful islands had been devastated. When we knew our—we knew our residents, our economy, and our environment demand rapid response and recovery. We were overwhelmed with incredible support from our Senators Nelson, Rubio, and Congressman Curbelo, as well as their staffs. Governor Scott led us from the front. He, along with his staff, the City of Miami Beach, Homestead Police Department, Miami-Dade Task Force One, and hundreds and hundreds of others provided valuable support assisting Marathon and the entire Keys, and for that, we are indebted to them.

An economy that's based on tourism and a healthy environment demands rapid recovery, but this is also the most difficult thing to achieve, and Marathon really can't simply do it alone. Up until recently, our progress was evident, however, our progress has come to a crawl, placed in extreme risk with minimal reserves, and the 2018 hurricane season fast approaching, a season already predicting what I believe to be 14 named storms.

You see, as of yesterday, seven months after Irma, Marathon and the Keys communities have received no Federal reimbursement dollars. We responded as required, quickly, efficiently, and responsibly, but in doing so, depleted all of our funds set aside for hurricane response on the understanding that initial Federal reimbursement would come quickly.

It's important to note that these funds went first to the most crucial health and safety needs, initial debris removal, and force labor costs, not large projects or reconstruction of infrastructure.

We were encouraged when the President acted quickly on the declaration and approved 100 percent funding reimbursement coverage for the first 30 days, and Congress, not hesitating, provided it. However, this initial reimbursement remains frozen between you and us.

The slow-to-respond FEMA system has caused us to pull from our remaining accounts, we're having to utilize 2018 revenues, and it's forced us to secure large lines of credit. In addition, marine debris remains at crisis levels in our canals and near-shore waters. Always ready, the Coast Guard and the Florida Fish and Wildlife Commission did an outstanding job facilitating the removal of thousands of vessels; however, extreme costs, layers of Federal regulation, inflexible policies, and inefficient reimbursement make marine debris removal nearly impossible for us or our state to conduct, especially without adequate Federal funding or, at a minimum, upfront commitment that these funds will actually be reimbursed.

Cars, homes, and construction debris are creating dangerous conditions for our residents and our ecosystem. Currently, there is one partial solution that works for the entire Keys, it's an existing debris removal program in the Department of Agriculture's Natural Resource Conservation Service. Monroe County has submitted an application, and NRCS has determined that 103 of our most impacted canals are eligible for $35.4 million in reimbursement funds with a $10.5 million local match requirement. Now we need support and timely action by NRCS to award these funds to Monroe County so that local communities like Marathon can access them and begin debris removal.

In closing, you know, we've done and continue to do our part. We need the Federal system to do its part and expedite FEMA reimbursement, and we need, Marathon needs NRCS to award funding. This will allow us to recover from this last storm and prepare for the next.

On behalf of my wonderful city, it's an honor to be here today. Thank you very much.

[The prepared statement of Mr. Lindsey follows:]

PREPARED STATEMENT OF CHARLES LINDSEY, CITY MANAGER, CITY OF MARATHON, FLORIDA

Good morning Chairman Thune, Ranking Member and our Florida Senator Bill Nelson, and Members of the Committee, my name is Charles Lindsey. I am the City Manager for the City of Marathon, Florida. I want to thank all of you for the opportunity to represent the residents of Marathon and speak to you today about the conditions following the 2017 hurricane season. I also wish to thank all Members of Congress for providing the emergency disaster assistance funding needed during some very difficult times.

Marathon is a coastal island municipality of 8,910 residents located in the heart of the Florida Keys. Due to our remote geographical location, smaller population, and restricted growth we, along with all the communities of the FL Keys face numerous challenges protecting our economy and our delicate environment. We have a relatively small population but we all support a $2.7 Billion tourism-based economy attracting millions of visitors annually. We have vital commercial, charter and recreational fisheries and a responsibility to protect our unique environment which includes the third largest barrier reef system in the world and the flagship Florida Keys National Marine Sanctuary. To do all of this we rely in large part on a unique, small community bond that exists from Key Largo to Key West. Following a catastrophic event like IRMA, our situation demands it.

In September of 2017 as Hurricane IRMA built to Category 5 strength and headed toward the south Florida coast the "Keys spirit" came alive. With initial projections changing hourly we worked together to develop immediate plans to assist each community and conduct an evacuation that had not been attempted in over a decade. From Miami to Key West, in Irma's final days, an exact impact location was difficult to predict but there was no doubt we would be hit hard.

Our local FL Keys governments worked together and with the tremendous patience of our residents conducted one of the most effective evacuations in Florida

Keys history, no doubt saving many lives. We developed adaptive strategies to shelter our Emergency Management and crucial personnel in place and shifted locations as IRMA's projected path dictated. Our Marathon Team did not leave the Keys and along with the Monroe County team shifted locations slightly northeast to Key Largo where the Ocean Reef community provided us shelter. Our Marathon Sheriff with a small volunteer contingent of law enforcement officers remained in Marathon and established order for the few residents who did not heed the mandatory evacuation order.

Immediately following the destruction caused by one hundred mile an hour winds for 12 hours and a dramatic storm surge, our Marathon Fire Rescue Department and city staff responded quickly. Losing communications during the storm we immediately reestablished contact with our law enforcement team and worked throughout the night to clear our airport runway, Marathon's only lifeline to the mainland.

Upon sunrise on the first morning, it was clear our beautiful island had been devastated. Our residents were away from their homes and our economy and environment demanded a "fast" response and recovery. Immediate emergency action was necessary, essential services needed to be restored for residents to return, and recovery had to begin immediately to mitigate risk to our economy.

We were overwhelmed with incredible support from Senator Nelson, Senator Rubio, and Congressman Curbelo and their respective staffs. Quickly on scene or in direct contact, they made themselves and their staffs available 24/7, assisting in many ways. Governor Scott led from the front. He along with his staff, the City of Miami Beach, Homestead Police Department, Miami Dade Florida Task Force 1 and hundreds of others, provided valuable support, responding to and assisting Marathon and the entire Florida Keys. To all of these FL officials we are indebted.

For the Florida Keys communities who rely on a tourism-based economy, recovery is the key. Locally, we have plans to respond to crises and that planning is being improved every day to prepare for the next event. While we lacked some of the necessary tools, we made up for this after IRMA with sheer willpower and resiliency. Moving forward, we have identified what tools are needed and we are doing our best to prepare requests to access the grant funding provided by Congress. From advanced communication equipment to a hardened Emergency Operations Center that would allow Emergency Personnel to remain safely sheltered in place, we have identified our needs.

Recovery is the most crucial but also the hardest to achieve and Marathon simply cannot do this alone. We know that for our families to be encouraged to remain in the Keys, and to reboot our tourist economy, marked improvement needed to happen continuously. Up until recently, this progress was evident. Unfortunately, our progress has come to a halt without movement in Federal reimbursement. This lack of initial reimbursement is putting us at tremendous risk going into the 2018 season and has stopped further recovery operations due to lack of funding.

In Marathon alone, 4,018 homes were impacted, 1,402 severely damaged, and 392 were completely destroyed. Numerous businesses were devastated and our commercial fishing industry got hit at their most vulnerable time. Perhaps most impactful to our economy, IRMA struck only months before the start of our main tourist season.

To date, Marathon has estimated over $30M in local storm-related costs. This is six times what we had set aside for hurricane response, requiring us to pull from all fund balances and utilizing FY 2018 revenue to stay solvent. In addition, Marathon had no choice but to secure a $10M line of credit and costs are increasing every day.

We, like other Keys communities, immediately responded to emergencies and crucial life safety needs. Essential services like wastewater were restored in days and our Florida Keys Electric Co-op, with the help of others throughout the country, assessed, cleared, repaired, and replaced 834 miles of distribution/transmission lines and replaced 175 distribution poles throughout the upper and middle Keys. Their efforts miraculously restored power to the crucial 70-foot transmission life line in 12 hours and provided power to many residents in 10 days. In Marathon alone 300,000 yards of land debris were removed in only a few months, and like our cities overall response, was done so with local funding only, completely draining our reserves.

To date, Marathon and the Florida Keys communities have received no Federal reimbursement! Within weeks of IRMA we depleted all our funds set aside for hurricane response on the understanding that initial reimbursement would come quickly. We were encouraged as the President acted decisively, enacting a declaration and approving 100 percent funding for the first 30-days and Congress, not hesitating, providing it. However these funds remain frozen in the middle, somewhere between you and us.

In addition, marine debris removal remains at a crisis level in our canals and nearshore waters. The U.S. Coast Guard (USCG) and Florida Fish and Wildlife Commission (FWC) both did an outstanding job facilitating the removal of thousands of vessels. However, everything else remains—cars, homes, recreation vehicles (RV's), and construction debris still choke the canals, from the surface to the bottom.

At this time we estimate over 513 canals in Monroe County are negatively impacted with estimated cleanup costs over $52.6M. Layers of regulations and policy coupled by extreme costs make our waterways and associated debris removal nearly impossible without adequate Federal funding or an upfront commitment that costs will be quickly reimbursed. The Keys are in a unique geographic location and all our waters (*i.e.,* private, local, state and federal) affect our National Marine Sanctuary in some manner.

As a small municipality in a very complex system it is impossible to determine with any certainty why the reimbursement process has been so slow. One thing we do know with full certainty is that 7 months post-IRMA we are at risk with minimal disaster reserves and the 2018 hurricane season fast approaching. The forecasters suggest we are facing an active season, already predicting 14 named storms for 2018.

Today, Marathon has over $28M in project worksheet (PWs) submissions to FEMA and has received $0 in reimbursement. Locally, the FEMA process appears to be intact. We have FEMA representation reviewing and submitting our claims; we have contracted labor to facilitate the difficult submission process; and the online portal, providing transparency. However, without receiving reimbursement of our Category A and Category B project worksheet submissions our recovery efforts have all but stopped. Furthermore, the longer our canals and waterways remain polluted the environmental risks increase, potentially negating decades of hard work and the hundreds of millions of federal, state, and local dollars spent improving nearshore water quality. Unfortunately, this does not escape the purview of our potential tourists.

When asked what we need to be prepared for the 2018 season—the answers are simple: To respond and then recover from a Hurricane next year we need the funds that were approved by Congress to make it on the ground as quickly and efficiently as possible. I am not referring to large complex claims to reimburse the design, engineering, and repair of infrastructure such as a bridge or roadway. What I am referring to here is Federal funding for marine debris and the reimbursement of Category A and B projects that should come quickly to keep recovery efforts moving and protect us financially going into this next hurricane season. These are the funds we expended within the first 90-days responding to life safety issues, initial debris removal, and forced labor costs.

We need available Federal funding to begin removal of our extensive marine debris, including muck and sand. This is polluting, reducing flow, and creating life safety/environmental issues in our local waters. Currently, different rules for different pots of Federal funding along with FEMA reimbursement guidelines prohibit common sense solutions to removing this debris from our waters. These regulations make it cost prohibitive and nearly impossible for states and local governments, especially in an environment like ours, to address our debris removal

Currently, one potentially viable solution for Marathon and the entire Florida Keys for debris removal resides within the Department of Agriculture Natural Resources Conservation Service (NRCS). On behalf of the entire Florida Keys, Monroe County has submitted a Damage Survey Report and application to NRCS and the agency determined the 103 of the 513 canals to be eligible for $35.4M in reimbursable funds with a $10.5M local match requirement. NOAA's Florida Keys National Marine Sanctuary is supporting the Monroe County application. Now, we need support for the NRCS to move quickly to award these funds to the County so the local communities can access them.

When asked for overall process improvement recommendations for subsequent years: we need policies and procedures to be streamlined and improved with an eye on real-world scenarios. For example, FEMA's online registration sounds great, but with no Internet in a disaster situation, we had to develop local solutions to register residents.

We will need more case managers. Remarkably, within days, FEMA had representation on the ground to assist but it was not close to adequate. More FEMA case management personnel are needed to assist the thousands of displaced residents and help navigate the numerous available programs and track their assistance.

We will need to have predetermined plans in place and lines of pre-approved reimbursable funding clearly defined. Staff from the USCG volunteered to take the lead in removing vessels from our delicate waters and along with FWC, did so with incredibly efficiency. But they did as they always do: they got on scene, they evalu-

ated, and they executed. In the end, this approach works but it does so with added cost and increased risk. Having processes like vessel removal and the responsibilities for it predetermined with clear funding lines established for such reimbursement would allow agencies like the USCG & FWC to increase safety, efficiency and overall effectiveness.

We need better communication processes with clearly defined unified goals for all levels of government across all agencies. This is not just a FEMA issue, it is a national one. Increasing communication allows transparency, it increases effectiveness, and it promotes entire domain awareness.

As we move forward today we are challenged with navigating difficult processes to prepare for the next season while at the same time recover and support our displaced families and struggling businesses from this last event. To FEMA's credit, I believe the agency has accurately captured what is needed in its 2018 Strategic Plan. So, one key question is how do we help them so we are all ready for the next storm event?

I'd like to use FEMAs three strategic goals of "Build a culture of preparedness", "Ready the Nation for Catastrophic Disasters", and "Reduce the Complexity of FEMA" as a framework to help begin to answer the question. The City of Marathon has and is, continuing to develop a culture of preparedness and is doing everything at our level possible to ready ourselves for the 2018 season. We are developing strategies based on best practices and lessons learned and implementing those process improvements to our already developed Compressive Emergency Management Plan. We have identified risks and we are doing everything we can to mitigate them. We have identified gaps and are doing everything in our power to fill them, however we cannot do this alone.

To do so, we need help with what Administrator Long clearly lays out in FEMA's 3rd goal of reducing complexity. While he is referring to FEMA as a whole, we need all processes to be adaptable and flexible to get the necessary funds back in our reserves and to adjust to the incredibly unique challenges we face in the Florida Keys.

In Marathon, we are proud of our "Keys Spirit" of working together. Following IRMAs destruction, it was more evident throughout the entire Keys than ever before. Today we continue to prepare for the 2018 Hurricane season but our spirit and efforts alone will not get us there. We have done our part with the tools we have been given and the understanding we have of the processes. Marathon and the entire Keys has responded too, and began recovery following the largest storm we've seen in decades.

In closing, we need the Federal system to do its part and help expedite the reimbursement of funds already approved by the President and graciously provided by Congress; and for NRCS to award and release funds to enable us to facilitate the removal of marine debris.

It is an honor to provide this testimony and to tell Marathon's story. Chairman Thune, Senator Nelson and all the Members of this Committee—thank you for this opportunity, and thank you for all of your efforts supporting, advocating, and delivering assistance to our wonderful City, State, and this great Nation.

Senator NELSON. Mr. Chairman, a point of personal privilege. I just want to say the witness has told us that they have not seen a single reimbursement from FEMA 6 months after a major hurricane, and that just is inexcusable.

Thank you, Mr. Chairman.

Senator WICKER. This is the very reason we're having this hearing. Thank you very much for emphasizing that.

Ms. Pipa, we're thrilled to have you. Please proceed.

STATEMENT OF JENNIFER PIPA, REGIONAL CHIEF EXECUTIVE OFFICER, CENTRAL FLORIDA REGION, AMERICAN RED CROSS

Ms. PIPA. Thank you, Senator Wicker and Ranking Member Nelson.

2017 was a challenging year when we talk about disaster response for the American Red Cross. I unfortunately had the opportunity to visit both Harvey, Irma, and Maria during the disaster times. Harvey was a challenge in that people went to work that

morning, they went out to run errands that day in the City of Houston, and discovered only late in the afternoon that they could no longer return home and they needed a safe place to stay.

That's where the American Red Cross, in concert with the City of Houston and the Mayor of Houston, opened the George R. Brown Resource Center. That's where I ended up spending 7 days providing a safe haven for just over 11,000 members of the City of Houston. It was an amazing opportunity for us to provide those services, but clearly a very complicated response when you talk about the infrastructure that's compromised and the ability to move people and material resources into and out of impacted areas.

I came back to Florida for Hurricane Irma, watched that happen, watched us, as we worked with local and county emergency management, open pre-landfall evacuation centers. We saw historic numbers of people evacuate. We think that is in part due to them watching people be stranded during Hurricane Harvey, and so they took those watchings and warnings much more seriously and chose to evacuate for the safety of their family. And we saw unprecedented numbers in those centers.

Post-landfall, I had the opportunity to tour a lot of the state. One of the places I ended up was Immokalee, which is a small town in southern Florida. It is geographically isolated, and it's in the Everglades area. This is a town that had no access to power after Irma made landfall. That means their grocery stores didn't work, their gas stations didn't work. And they're an hour and a half from really any other viable resource in the area. We kept a shelter open there for an incredibly long period of time to make sure that the citizens of Immokalee were supported until that they could restore power and some infrastructure there. But that's just one town in many in Florida.

Everglades City was another one, one of the southernmost points of Florida State, absent the Keys, and they were heavily impacted, not just by surge, but by wind as well. It became an incredibly complicated area for us to get resources into, is that they were so isolated.

And then Maria. You know, it's hard enough to get items in when the infrastructure is compromised, but when you're talking about an island where the airport and the seaport are both impacted, the ability to move resources in becomes just that more exponentially challenging.

I was in Maria in February. We were still delivering generators to people without power. We're still delivering food to people who don't have access to grocery stores that have power so that they can sustain. We're still giving out water filtration systems because there is no potable water there. So there is still a long time to go.

And while we've spent a lot of time talking about response, and it may fall out of the media's coverage, recovery is a long-term gain, and that's where we sit at the table with all of our local and Federal partners, and we'll be there for the next 18, 24, 36 months with dedicated resources to help these communities continue their recovery as they move forward.

One of the things our organization did was in the beginning of 2017 was we took a nationwide readiness initiative. And in Florida specifically, we met with every single county emergency manager

in the state, and we talked about what we could do, how many people we had, how much stuff we had, how we could support if Florida were impacted by a hurricane. Those open and honest communications allowed us to form a basis of trust so that we could both deliver services to the communities that were impacted in Florida.

So now in 2018, we go back, we talk about what we talked about at the beginning of 2017, we talk about our lessons learned, and we try and figure out how we can now make that gap even smaller working together.

But this was a historic season for us. People ask me time and time again, "How did the Red Cross do it?" right? Harvey, Irma, Maria, California wildfires. We do it because we rely on mobilizing the power of volunteers and the generosity of donors, and without those two things, our organization can't deliver our services. We're a 90 percent volunteer-based organization. And so we count on the generosity of the American public and we count on the volunteers who raise their hands, who leave their families in other places in the U.S., and come down to help our impacted communities recover as we move on.

Thank you very much for the opportunity to share my stories with you today, gentlemen.

[The prepared statement of Ms. Pipa follows:]

PREPARED STATEMENT OF JENNIFER PIPA, REGIONAL EXECUTIVE OFFICER, CENTRAL FLORIDA REGION, AMERICAN RED CROSS

Good Morning Senator Wicker, Ranking Member Nelson and distinguished members of the Committee. Thank you for the privilege of testifying before you today on behalf of the American Red Cross. We applaud the Committee for holding this much-needed hearing "Are We Ready for the Next Hurricane Season? Status of Response Capabilities for 2018." My name is Jennifer Pipa and I am Regional Chief Executive Officer of Central Florida for the Red Cross. Our Central Florida Region includes communities such as Orlando, Daytona Beach, Sarasota and Winter Haven, among others. In my role, I am based in Tampa and guide a team of staff and volunteers that serve 19 counties across five chapters who work to fulfill the Red Cross mission, including responding to a variety of natural disasters. I am pleased to share the American Red Cross perspective on the extraordinary hurricane season of 2017 and the status of preparedness for 2018.

The Mission of the Red Cross and Our Role in Disaster Response

As you may know, the mission of the Red Cross is to prevent and alleviate human suffering in the face of emergencies by mobilizing the power of volunteers and the generosity of donors. As a leader in preparedness, health and safety training, the American Red Cross works every day across America to help individuals, families, businesses and schools be better prepared for life's challenges. Our purpose is to help people prevent, prepare for, and respond to disasters and other emergencies. We shelter, feed, and counsel victims of disasters at home and abroad; collect and distribute nearly half of the Nation's blood supply; teach lifesaving skills; and support military members and families. Whether the need is large or small, the Red Cross will be there.

Each year the Red Cross responds to nearly 64,000 natural disasters, including everything from single-home fires to large-scale emergencies such as hurricanes. As you are aware, under a Memorandum of Agreement (MOA) signed in 2010, the American Red Cross is the co-lead for mass care response, known as Emergency Support Function #6 (ESF–6) with the Federal Emergency Management Agency (FEMA) during large emergencies in this country.

This agreement means that the Red Cross and FEMA work together to help government agencies and community organizations plan, coordinate and provide a breadth of mass care services for people affected by disasters. Mass care services include opening shelters, feeding those affected, distributing emergency supplies and reuniting families. ESF–6 is part of the National Response Framework, a Federal guide as to how the country will respond to situations ranging from local emer-

gencies to large-scale terrorist attacks and catastrophic natural disasters. The partnership between the Red Cross and FEMA has proven to be extremely effective in helping Americans get through the initial devastation of a hurricane and on the road back to self-sufficiency. The dedication and hard work of the men and women of FEMA is very much appreciated by the Red Cross. Throughout the 2017 hurricane season and now, the Red Cross and FEMA are in constant communication and coordination on issues such as damage assessments and addressing shelter needs. In addition, any time the Red Cross responds to a disaster, we also work closely with multiple partners in the humanitarian community to ensure victims of natural disasters get the services and resources they need to get back on their feet. Those services encompass a wide variety of needs such as providing assistance with mental health care, financial assistance to cover short term needs and shelter for pets and service animals.

2017: A Look Back at a Precedent-Setting Hurricane Season

Every disaster is unique. It has its own set of challenges and circumstances and the 2017 hurricane season was no exception. Hurricane Harvey was the first major hurricane to make landfall in the U.S. in 12 years and it made landfall 3 separate times over 5 days after it stalled on the Texas coast. The resulting inundation challenged all first responders as parts of inland Texas were completely cut-off, including the interstate highway system in and around

Houston. With its erratic, unpredictable track, Hurricane Irma left almost the entire southern half of Florida under watches and warnings that shifted from the East coast to the West coast and challenged planners across the state. And then there was Hurricane Maria, which compromised the logistics and infrastructure network of an entire island. All points of entry into Puerto Rico were devastated and the island was cut-off from the mainland. The time and distance required to reopen the ports and reestablish a supply chain created a unique situation for all responding agencies and organizations. Despite these challenges, the American Red Cross was there, working alongside FEMA and our partners to deliver the mission with compassion and quality to more of those in need.

The Red Cross response to the hurricanes that made landfall in the United States and its Territories was just as record setting as were the Hurricanes Harvey, Irma, Maria and Nate. As of today, our numbers show that across these hurricanes the Red Cross:

- supported 782,592 shelter stays;
- provided 11,619,021 meals;
- delivered 7,401,854 relief items;
- served 588,622 families through casework and recovery planning.

We were able provide this momentous level of support by the dedication and compassion of the more than 18,800 volunteers who selflessly gave of their time to serve others. The level of service to those impacted by each of these storms exemplified the Red Cross mission.

And the work to address the needs of those affected by these storms continues; the Red Cross is committed to helping those impacted by last year's hurricanes get back on their feet. We continue to have long-term recovery operations in each of the affected areas to ensure that we address needs such as clean water, community health, livelihoods restoration and access to power. In areas still experiencing difficulty in getting back to at least pre-storm conditions, we will continue to work with impacted individuals to create recovery plans, navigate paperwork and determine eligibility for financial assistance. We have provided reports to Congress as updated information becomes available and we will continue to do so.

2018: Preparedness for the Upcoming Season

While the Red Cross has been able to meet needs that have arisen due to last year's storms, as we prepare for the 2018 season, it is important for us to identify areas of concern from last year's response in order to develop a successful strategy for preparing for upcoming disasters. Some top needs from 2017 which inform our 2018 planning include:

- Effectively communicating information about pre-landfall evacuation centers;
- Managing expectations about what people need to bring with them to evacuation centers and making sure people understand the difference between an evacuation center and a shelter, and;
- Recruiting volunteers

To address these needs, we meet with and maintain ongoing relationships with local and county emergency managers in order to collaborate on public service announcements and education. We work with local and county officials to identify resources currently on hand, as well as any gaps that may exist between local and county government resources and Red Cross resources and how to address those gaps. The Red Cross also continuously develops and updates communications materials that can be used in a variety of social and traditional media and translated into other languages relevant to the local population, that provide information about evacuation procedures and shelters.

An example of an ongoing Red Cross preparedness education campaign that helps families know what to bring to evacuation centers is our Pillowcase Project, which is our signature youth preparedness program and is implemented in every Red Cross region. The Pillowcase Project is for children in grades 3–5 and teaches them about personal and family preparedness for local hazards and home fires. Students receive a pillowcase to decorate and use as a personal emergency supplies kit. Students are encouraged to fill the pillowcase with items they would like to have if they need to be evacuated.

An example of a Red Cross initiative to strengthen volunteer recruitment is our Regional Diversity Boards, which are designed to, among other things, ensure that the Regional workforce (staff and volunteers) mirrors the community it serves and increases the number of volunteers and representation by key demographics.

Elements for Effectiveness: Readiness, Adaptability and Support from the American People

In 2017 we kicked-off a multi-year nationwide initiative to strengthen our Readiness. The Readiness Initiative was designed to address recurring challenges by supporting regional teams in building capacity to deliver our mission; better recruiting, engaging and retaining our volunteers; being more efficient and effective in all of our activities; and harnessing the power of technology and teamwork to meet our mission in regions every day and for major disasters nationwide. We defined readiness as "the capacity and capability needed to reliably accomplish our mission, which we do with our partners." Our vision is to get ready, be ready, and stay ready to reliably serve clients and communities impacted by the highest probability disasters in communities around the country.

In addition, there is one overarching principle to responding to disasters which is at the heart of every response strategy. At the Red Cross and throughout the disaster response community, we know that our capacity to react to natural disasters as we go forward is directly connected to our ability to adapt and evolve. And technology is a critical part of that evolution. A major aspect of the Red Cross's technological innovation in the last couple of years is the development of "RC View"—a state of the art geographic information system (GIS) and data visualization tool that provides the Red Cross and its partners with a common disaster response capability. This technology aids the Red Cross as we assess damage, formulate emergency response and evacuation plans and identify and understand relationships between areas affected by disasters and areas of social vulnerability. Because of RC View, the Red Cross is able to speed up our response time, make better resource decisions and improve our delivery of services to those most in need. With increasingly accessible data, we are better able to understand hazards and take necessary actions to mitigate, respond to, and recover from disasters when they strike.

While data and technology are essential to responding to disasters, the plain truth is that a successful disaster response operation can't happen without money and volunteers. The Red Cross does not receive Federal funding for disaster response operations, but relies on the generosity of the American people to do so. Furthermore, our volunteers are the backbone of our humanitarian efforts; nearly 90 percent of the Red Cross workforce is volunteer. Americans who give of their time and donations are why we have been able to respond to disasters for over a hundred years. 2017 was truly an extraordinary year for natural disasters. But because of the kindness of the American people, including many of your constituents, in a 45-day period late last year, the Red Cross was able to respond to back-to-back hurricanes—Harvey, Irma, Maria and Nate—in addition to the devastating wildfires in California and the deadliest mass shooting in recent U.S. history in Las Vegas. We at the Red Cross are extremely grateful to the American people for all they do to enable us to help those in need.

Conclusion

Again, thank you to this Committee for this important examination of how well America is prepared for life-threatening storms and thank you for allowing the Red Cross to share our perspective on the hurricane season that just passed and the one

coming soon. Hurricane season for the Atlantic Basin runs from June 1 to November 30 and a busier than average hurricane season is forecast, so many Americans will be facing these threats again in the very near future. At the Red Cross, we will continue to fulfill our mission of alleviating suffering and meet our obligations to provide leadership with our Federal and humanitarian partners to address whatever natural disasters occur. We look forward to partnering with the United States Congress, other branches of government, the faith-based community, non-profits and for-profits in preparing for disasters and recovering from them. We are happy to answer any questions you may have.

Senator NELSON. Mr. Chairman, may I make an additional comment about——

Senator WICKER. Unless there's an objection from any member of this——

[Laughter.]

Senator NELSON. Ms. Pipa talked about this little town of Immokalee, and it's a poor town. They're trying to do a lot of economic development out there. It's in one of the richest counties of Florida, Collier County. And so the Red Cross—the people had no place to go. There is a Catholic university, Ave Maria, that's about 7 miles from this. They opened their gymnasium, and then the Red Cross did the taking care of people in the gymnasium. But it's worth noting that there were senior citizens that were abandoned in their apartments by their caretakers. The university students went and got them and took them into their dorms with them to take care of them until somebody could be provided after the hurricane. Now, that's a good news story. That's a story about America at its best. And I wanted to make that part of the record.

Senator WICKER. Thank you, Senator Nelson. And I really appreciate you adding that to the record. There are hundreds of stories like that.

And thank you, Ms. Pipa, for pointing out the volunteer spirit of Americans and the donor community for making all of this possible.

It's clear that this panel has had real life experience—excuse me—and continue to experience the aftermath of these storms, and we very much appreciate it.

By agreement, the Committee has decided not to grill you with questions. And so we thank you very much. We'll bring on the next panel. And if you'd like to stay and have discussions with us on an individual basis after the hearing is over, we welcome that, but you're not required to stay, and we do thank you very much.

Now, as our staff is helping to set up the table for the next panel, let me tell you what we have in store. And Ranking Member Nelson has already mentioned the distinguished panel, but one of those is Rear Admiral Tim Gallaudet, the Assistant Secretary of Commerce for Oceans and Atmosphere and the Acting NOAA Administrator. He was previously a Rear Admiral in the U.S. Navy, where most of his recent assignment was Oceanographer of the Navy and commander of the Navy Meteorology and Oceanography Command, and that is a mouthful for this Mississippi boy. As you will hear today, Rear Admiral Gallaudet personally experienced Hurricane Katrina on the Mississippi Gulf Coast, and uses those personal lessons to inform his leadership at NOAA.

Rear Admiral Gallaudet will be joined by Rear Admiral Linda Fagan, who serves as U.S. Coast Guard Deputy Commandant for

Operations, Policy, and Capabilities. She is responsible there for establishing and providing operational strategy, policy, capability, and resources to meet national priorities for U.S. Coast Guard missions, programs, and services.

And then we welcome Dr. T. Bella Dinh-Zarr, a member of the National Transportation Safety Board in Washington, D.C. Dr. Dinh-Zarr has dedicated her career to working to ensure that transportation safety is a policy priority, and has been a member of the National Transportation Safety Board since 2015.

So members of the panel, thank you very, very much for joining us. And as we did at the last panel, we'll start at this end with a five-minute verbal statement from Rear Admiral Gallaudet.

STATEMENT OF RDML TIMOTHY GALLAUDET, PH.D., USN (RET.), ASSISTANT SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE; AND ACTING UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Admiral GALLAUDET. Thank you, Senator Wicker and Mr. Chairman, it's an honor to be here before you and the Committee today to talk about the great work the National Oceanic and Atmospheric Administration, or NOAA, has done and will continue to do to improve our hurricane watches, warnings, and national preparedness, and how all that work has saved lives and accelerated recovery throughout the 2017 hurricane season.

I would especially like to thank the Committee for the disaster supplemental funding in 2017 and the 2018-based appropriations funding for NOAA. This combined funding will help NOAA to continue implementation of the Weather Research and Forecast Innovation Act of 2017, or Weather Act, as championed by this Committee. We are working with the administration and Congress to develop the detailed spend plans, as requested, for these funds.

In the following, I will describe how NOAA is already accomplishing much to implement the Weather Act and prepare our Nation for the next hurricane season.

Let me begin with the 2017 hurricane season, which we all know was extremely active with 17 named storms, including three Category 4 hurricanes that made landfall in the U.S. Harvey, Irma, and Maria were three of the top five most economically damaging hurricanes in U.S. history. Despite this devastation, communities were warned very far in advance by NOAA's reliable forecasts, and the result was that five times fewer lives were lost compared to the previous record-setting year of 2005. The National Hurricane Center's Atlantic track predictions for 2017 set an all-time record for accuracy across all forecast hours, which is a 25 percent improvement on the 5-year average before.

The State of Florida used National Weather Service forecasts to declare a state of emergency 6 days before Hurricane Irma made landfall. That is unprecedented, largely due to the Weather Service efforts to improve their Impact-based Decision Support Services, as codified in the Weather Act. This long lead time allowed emergency managers to prepare and evacuate well in advance of the storm.

Hurricane storm surge is the greatest threat to loss of life and property, so NOAA began issuing storm surge watches and warnings in 2017, and our preliminary information shows that there were no storm surge-related deaths in the U.S. this year.

The same can be said for NOAA's mitigation, response, and recovery efforts. These include habitat restoration that prevented storm surge damage in the Gulf of Mexico, navigation response teams who opened dozens of ports in the Gulf, in the Southeast, and NOAA hazardous material teams that continue to assist with vessel and debris removal in the Florida Keys and the Caribbean, and NOAA's Sea Grant program that is helping local fishermen in Texas and Florida.

In your invitation letter, you asked how we are improving preparations for the 2018 hurricane season. Beginning with observations, we are advancing our satellites and reconnaissance aircraft. In just the last 2 years, three of NOAA's next-generation weather satellites have been successfully deployed. Additionally, NOAA continues to rely on U.S. Air Force C–130s out of Keesler Air Force Base in Mississippi and NOAA's hurricane hunter aircraft based in Lakeland, Florida.

One area we are rapidly advancing is using unmanned systems for observations. We have already used aerial and underwater drones to improve hurricane forecasts, and we are working with the private sector and Federal partners to evaluate other innovative and cost effective autonomous capabilities that meet NOAA's requirements.

We are also making further improvements in modeling. NOAA research is leading the Hurricane Forecast Improvement Program following the guidance of the Weather Act, with the impressive result of extending hurricane forecast skill to 7 days. I am particularly pleased with our experimental global weather model, known as the GFS FV–3, which outperformed the European models for both the three major hurricanes that struck the U.S. last year, but also the four Nor'easters that slammed into the eastern seaboard this year. We are transitioning this model to the Weather Service now, and by 2020, NOAA will have the world's leading weather model.

In conclusion, I want to thank the Committee for your continued support and for passing the Weather Act, which was the playbook we used for our truly tremendous teams to dramatically improve NOAA's hurricane predictions and warnings. The advancements NOAA has made over the last decade in environmental observations and prediction, decision support, risk mitigation, and response and recovery have saved countless American lives, protected billion dollars of property, and enabled continued growth in the national economy while providing critical support to national and homeland security.

I'll be happy to take any questions.

[The prepared statement of Admiral Gallaudet follows:]

PREPARED STATEMENT OF RDML TIMOTHY GALLAUDET, PH.D., USN RET., ASSISTANT SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE; AND ACTING UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Good morning Chairman Wicker, Ranking Member Nelson, and Members of the Committee. It is my honor to testify before you today about the work the National Oceanic and Atmospheric Administration (NOAA) has done to improve our hurricane watches and warnings, and how all that work has saved lives and accelerated recovery throughout the 2017 hurricane season. The 2017 hurricane season—with 17 named storms, including three Category 4 hurricanes that made landfall in the United States—was one for the record books. Three of the top five most economically damaging hurricanes in U.S. history occurred in 2017—Harvey, Irma, and Maria.[1] Despite the severity, communities were warned far in advance by NOAA's reliable forecasts. Based on preliminary data, the National Hurricane Center's (NHC) Atlantic track predictions for 2017 set an all-time record low position error across all forecast hours, which improved on the 5-year mean error by about 25 percent.

NOAA's mission is to understand and predict changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and to conserve and manage our coastal and marine resources. As a mission-driven, science and operations agency, NOAA is responsible for global satellite observations, atmospheric and oceanic research (both in-house and collaborative research with our valued external and government partners), operational weather and water forecasts, the delivery of critical products and services, and the stewardship of our marine resources. NOAA provides environmental information and forecasts to American citizens, businesses, and all levels of government to enable informed decisions on a range of issues and scales—local to global and short-term to long-term. Through the National Weather Service (NWS), NOAA has the sole Federal responsibility for issuing weather and water warnings to protect lives and property in communities across the country and in U.S. territories, and does so by working closely with emergency management officials on the federal, state, local, and tribal level.

This past hurricane season was "all hands on deck" for NOAA—ranging from our well-known hurricane watches, warnings, and Hurricane Hunters, to our response and recovery efforts to reopen Gulf and Atlantic ports that are economic lifelines to coastal communities, to conducting damage assessment overflights, and assisting fisheries recovery. Before, during, and after these storms—as with all major weather events that impact the United States—NOAA provides products, tools, and services used by emergency mangers (EMs), emergency responders, coastal planners, individuals, and businesses to help save lives, protect property, and mitigate damage.

Hurricane Forecasts and Warnings

Track and intensity forecasts for this past hurricane season were the best the NHC ever produced. The NHC official track forecast errors have decreased every decade since the 1960s. The average position error at 48 hours has been reduced from 260 nautical miles in the 1960s to about 75 n mi in the 2010s. The 5-day forecasts (storm location) are now better than day-and-a-half (36-hour) forecasts were in the 1970s. There has also been a 25 percent reduction of intensity errors at day-5 in 2010–2016 as compared with 2000–2009. (See Figure 1)

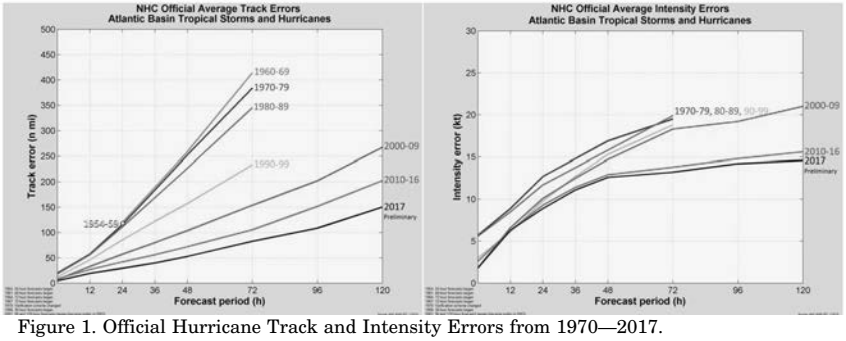


Figure 1. Official Hurricane Track and Intensity Errors from 1970—2017.

[1] *https://www.nhc.noaa.gov/news/UpdatedCostliest.pdf*

For Irma alone, the state of Florida used NWS forecasts to declare a State of Emergency six days before landfall. That, in and of itself, is amazing and is due largely to NWS efforts to provide Impact-based Decision Support Services (IDSS), as codified in the Weather Act. The storm was still east of the Lesser Antilles, yet the emergency managers had enough confidence in our forecast track (Figure 2) and intensity to begin evacuations and preparations nearly a week before the hurricane made landfall. The long lead time allows EMs to evacuate and improve preparation before the storm.

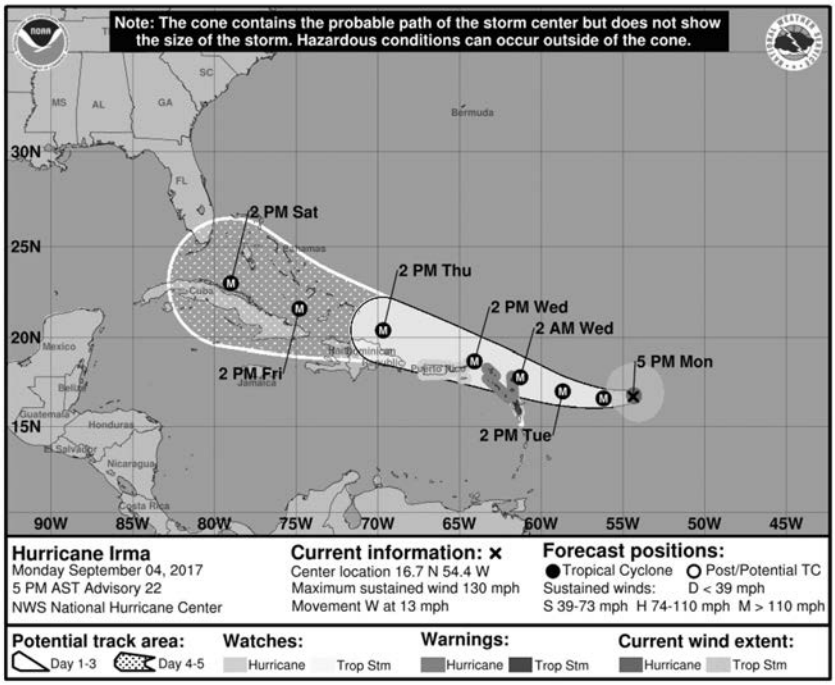


Figure 2. National Hurricane Center 5-day forecast for Irma issued at 5 PM EDT September 4, 2017.

The accurate predictions are the culmination of the ongoing process of transitioning model improvements made by the NWS Environmental Modeling Center (EMC) and NOAA's Office of Oceanic and Atmospheric Research (OAR) into production, where the sophisticated code is run operationally on the upgraded NOAA supercomputers. These high-resolution models, including multiple ensembles, provide our forecasters with the detailed probabilistic guidance they need to make accurate predictions.

Funding provided for the Hurricane Forecast Improvement Program (HFIP), and Disaster Relief Appropriations Act of 2013, referred to as the "Sandy Supplemental," along with our annual appropriation, has afforded NOAA resources for ocean observing, hurricane-related research, coastal monitoring, upgrades to the two NOAA Hurricane Hunter aircraft, accelerating our hurricane-related storm surge prediction capabilities, and providing a critical historic enhancement in operational high-performance computing, enabling these models to be run at higher resolutions with better dynamics and physics. With the Sandy Supplemental funding and our base funding, our operational computing capacity has increased from 1.6 Petaflops in 2015 to 8.4 Petaflops in 2018. We thank you for providing the resources to continue these improvements.

NOAA's hurricane forecast improvement has resulted in a narrowing of our "cone of uncertainty," increasing the confidence of emergency manager in deciding to evacuate. In addition to saving more lives, we are taking advantage of several opportunities that now enable us to take numerical weather prediction to a new level. HFIP activities were conducted to: improve the prediction of rapid intensification and track of hurricanes; improve the forecast and communication of storm surges from

hurricanes; and incorporate risk communication research to create more effective watch and warning products. The research and development in HFIP has been a joint effort between NOAA (primarily NWS and OAR) and academic partners. The result is that NOAA is meeting the five-year HFIP goal to reduce hurricane forecast track and intensity errors by 20 percent, and to extend the useful range of forecasts to seven days.

Storm surge poses the greatest threat for a large loss of life and property in a single day from hurricanes. Consequently, NWS began issuing storm surge watch and warnings in 2017 based on a collaborative process between NHC, local forecast offices, numerical guidance, and an ensemble-based probabilistic surge model. Preliminary information shows there were no storm surge related deaths in the United States in 2017. This is a significant contrast to 2012, when storm surge from Sandy took 41 lives, more than half of all the fatalities in that storm.

There was considerable attention over the 10-year development time-frame of the storm surge watch and warnings product. Storm surge watches and warnings provide vital information about where and when life-threatening inundation will occur. This includes easy-to-understand graphics, co-developed with emergency managers and social scientists, which clearly display the areas in harm's way. (Figure 3)

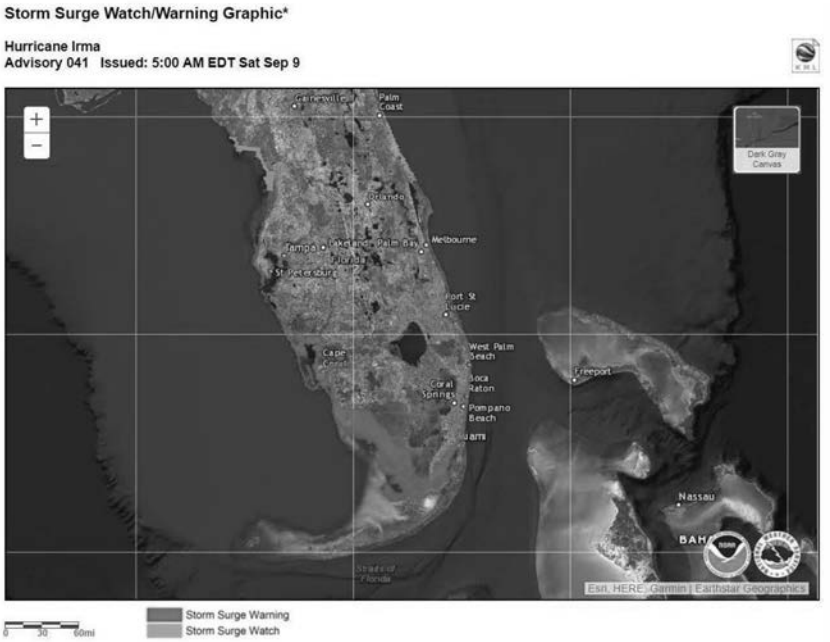


Figure 3. Hurricane Irma storm surge watch/warning graphic issued for Florida on Sept. 9, 2017.

In the days leading up to all three major hurricanes, NOAA's National Ocean Service (NOS) monitored and disseminated observations of water levels, currents, and weather information through Storm Quick Look. This product has been issued since 2004 and is initiated when NWS issues a tropical storm or hurricane warning to provide scientists and forecasters with reliable real-time observations from strategically located water level stations along the coastline to validate or adjust forecasts. Storm QuickLook ensures emergency responders and regional decision makers have actionable water level information to make critical safety decisions. (See Figure 4 depicting the paths of Harvey, Irma, and Maria.)

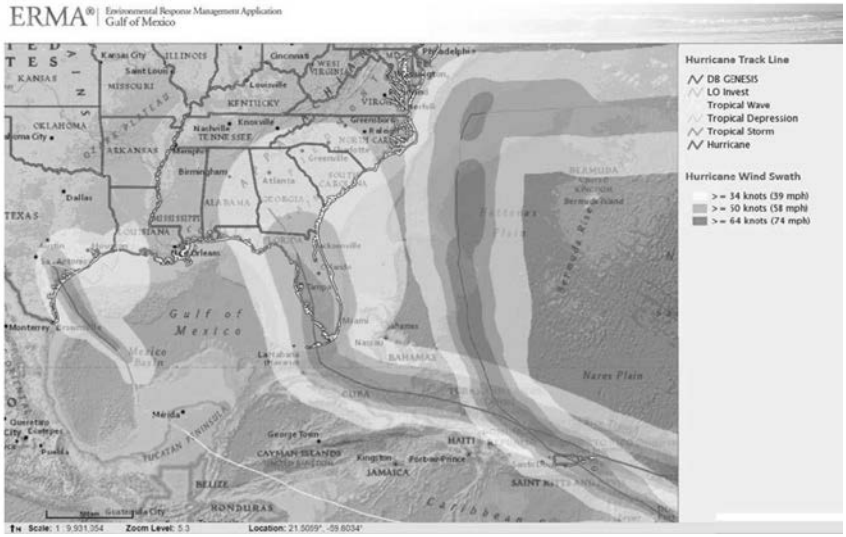


Figure 4. Tracks and wind fields for Hurricanes Harvey, Irma, and Maria.

An important contributing factor behind NOAA's forecasting success this hurricane season was our embedding with emergency managers at federal, regional, state and local levels. For example, prior to landfall of Harvey, Irma, and Maria, at the request of FEMA, NOAA (NOS) was working on-site in the FEMA National Response Coordination Center to provide critical connections between FEMA and NOS post-storm response operations.

As the storms approached, NOAA's Regional Navigation Managers—who work directly with pilots, mariners, port authorities, and recreational boaters to help identify maritime navigational challenges—were on-site at U.S. Coast Guard (USCG) Incident Command Centers to coordinate post-storm surveys, and Scientific Support Coordinators were present to assist with hazardous materials response efforts. Such utilization of NOAA by other agencies illustrate the unique value and expertise we provide to the Nation's coastal safety and sustainability.

At the same time, the U.S. Integrated Ocean Observing System (IOOS), and the regional associations, collected data used by NWS models, and provided information to inform communities before, during, and after all three storms using shore stations, moorings, high frequency radars and gliders.

Forecasting rainfall amounts from tropical systems is another area of significant improvement. Hurricane Harvey dumped an unprecedented five feet of rain over portions of East Texas. Our forecasters recognized the potential and were working directly with local EMs by providing IDSS to enable them to make evacuation decisions, and even the decision to close Downtown Houston in anticipation of the record setting rainfall. (Figure 5 is the observed 5-day rainfall from Harvey.). Emergency managers have credited NOAA with saving numerous lives. It is our dedicated workforce that makes all of this happen. NOAA forecasters stayed on the job during all of the hurricanes, working closely with EMs to provide life-saving forecasts and warnings, with full recognition that their own homes and families were under threat from the storms. Their dedication is unparalleled. Additional forecasters were deployed to the affected offices from other locations ahead of the storms, in anticipation of the work and decision support services that would be needed during the storms.

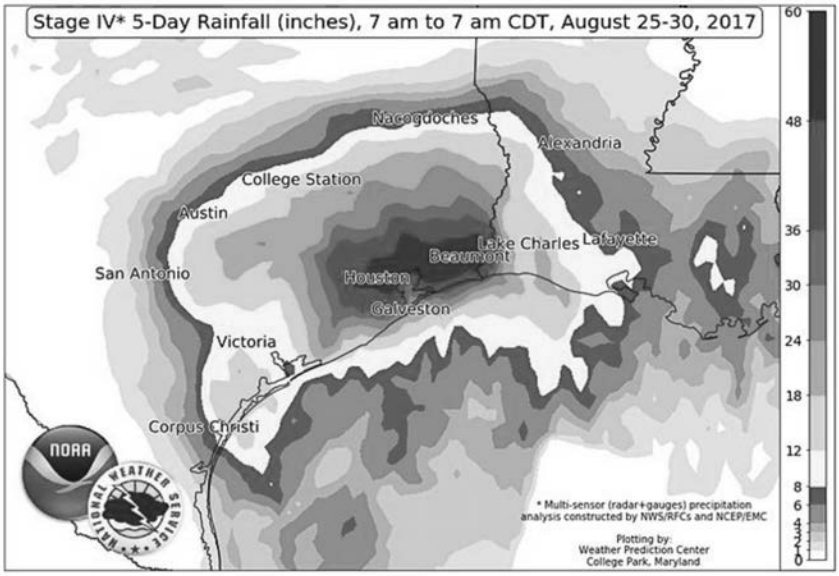


Figure 5. Five-day observed rainfall totals from 7 a.m., Friday, August 25 to August, 30.

NOAA's flood forecasting has also improved. The National Water Model (NWM), which is run at the National Water Center, provided information that was used by NOAA River Forecast Centers to issue the flood forecasts that were used by EMs during the massive flood in Texas caused by Harvey's unprecedented rainfall. It is equally important for EMs to know what areas would not be flooded, so they could position recovery assets in the right locations. This information allowed local officials and teams on the ground to quickly determine where to deploy limited resources, plan for evacuations, where to focus their recovery efforts. Improvements to the NWM will continue with one focus being inundation mapping.

NOAA Response and Recovery Efforts

NOAA has made significant advances in our response, recovery, and restoration services as well. One example is NOS's capability to rapidly survey coasts and ports to facilitate resumed operations as soon as possible. Prior to each storm, Navigation Response Teams (NRTs) from NOS mobilized immediately to provide emergency hydrographic services to affected port areas. The NRTs rely on forecasts from NHC to stage their operations close enough to be able to respond quickly, and safe enough to not be impacted by the storm. When conditions are safe again for operations, these emergency response teams conduct initial rapid surveys to detect submerged obstructions and areas of shoaling, then summarize the data into information that the USCG relies on to make critical decisions to reopen ports. For example, within seven hours of Irma's passage, a NOAA survey team traveled from Mobile, Alabama, to Florida and was in the Port of Miami conducting survey operations. Staff worked relentlessly to process and deliver data to the USCG Captain of the Port, who then approved the reopening of both the port's north and south shipping channels within 38 hours of Irma's passage. Data from NOAA's work enabled emergency supplies to be delivered, cruise ships to return to port, and for commerce to resume in southern Florida, saving Port Miami approximately $69 million a day in potential losses.[2]

In total, NOAA helped reopen over 26 ports and approaches following the three major hurricanes. Critical ports, such as Corpus Christi, Galveston, Houston, Miami, Key West, Tampa, and San Juan provide lifelines to communities for essential products like fuel, and serve as these local communities' economic engines. The estimated cumulative loss of trade for ports closed in 2017 was roughly $500 million per day. These losses would have continued over many days if NOAA's emergency

[2] NOAA estimates based upon data published by *https://www.ustradenumbers.com/ports/port/port-of-corpuschristi-texas/*

response capabilities had not been available to enable the USCG to reopen the waterways.[2]

NOAA aerial survey missions also assess damages to hurricane affected areas and help guide the incident response. Since Sandy, NOAA has made significant improvements in our ability to quickly, efficiently, and reliably provide this information. NOS and the NOAA Office of Marine and Aviation Operations (OMAO) have jointly advanced our capability to capture high resolution mapping imagery to support NOAA's emergency response and safety of navigation requirements. Aerial survey teams process the data upon landing and quickly deliver it to users, often within hours of their flying the mission. The emergency responders and coastal managers use the imagery of coastal areas, sensitive habitats, and navigation routes to help direct aid to where it is most needed, facilitate search and rescue strategies, identify navigation hazards and HAZMAT spills, locate errant vessels, and provide documentation necessary for damage assessment. These publically accessible images are typically the first views that evacuated residents have of their property after the storm. For Harvey, Irma, Maria, and Nate, NOAA aircraft flew nearly 40,000 miles for hurricane recovery support missions collecting more than 65,000 images that covered just shy of 10,000 square miles; roughly the area of the State of Maryland.

In support of the removal of HAZMAT and vessels displaced by Hurricane Irma, staff from the NOS Office of National Marine Sanctuaries and Office of Response and Restoration served in support of the Emergency Support Function 10 (ESF–10) Florida Incident Command Post Environmental Unit. This NOAA team provided concise and consistent guidance supporting pollution response and the removal of vessels/debris in the Florida Keys, while considering impacts to sensitive natural and cultural resources.

NOAA Shoreline and In-Water Restoration Efforts

According to a new study published by *Nature* in *Scientific Reports*[3], conserving and restoring coastal reefs, wetlands, and mangroves can prevent flooding and abate hundreds of millions of dollars in storm damage. This study reports that wetlands protected areas of the East Coast from more than $625 million in direct flood damages from Sandy in 2012. Wetlands reduced damages by more than 22 percent in half of the affected areas and by as much as 30 percent in some states. NOAA has an extraordinary team of environmental engineers, conservation biologists, and ecological experts who are running programs to rebuild marshes, beaches, and breakwaters and I have seen the success of these efforts first hand with NOAA's National Marine Fisheries Service (NMFS) restoring a marsh in Bayou Dupont, Louisiana that is a very effective hurricane storm surge barrier. This area was underwater four years ago.

Since 1995, NMFS and partners have implemented over 300 wetland and coastal habitat restoration projects in the Caribbean, South Florida, and Gulf of Mexico—all areas that were impacted by 2017 hurricanes. When compared to adjacent sites that were not stabilized, NOAA restoration sites mitigated further erosion which reduced additional sedimentation of coral reef habitats while also protecting adjacent infrastructure (*i.e.,* roads). For example, Texas restoration projects in the path of Hurricane Harvey generally sustained little to no damage. In Louisiana, 10 recent large-scale coastal wetland protection projects implemented through the Coastal Wetlands Planning, Protection and Restoration Act Program sustained little or no damage during Hurricanes Harvey and lesser known Hurricane Nate. The third landfall of Harvey passed over the Louisiana Oyster Bayou project during construction; however, only a small amount of material was lost and construction was able to quickly resume.

In the Caribbean, the paths of both Hurricanes Irma and Maria crossed nearly 100 watershed restoration projects located throughout the U.S. Virgin Islands and Puerto Rico. These projects are focused on stabilizing steep and eroding terrain to prevent sedimentation to nearshore habitats and generally appear to have sustained minor to no damage.

Data

The nation has made significant investments in developing, launching, and operating satellites that support the Nation's weather enterprise. For hurricanes, data from satellites and reconnaissance aircraft are critical components of NOAA's observation network.

NOAA's National Environmental Satellite and Data Information Service (NESDIS) has operated Polar-orbiting Operational Environmental Satellites (POES) since 1966, and Geostationary Operational Environmental Satellites (GOES) since

[3] *https://www.nature.com/articles/s41598–017–09269-z*

1974. The Suomi National Polar-orbiting Partnership (Suomi NPP) initiated NOAA's overall strategy for providing improved and higher resolution data to support weather forecasting. On November 18, 2017, NOAA launched the first of its four Joint Polar-orbiting Satellite System (JPSS) series, JPSS–1 (now known as NOAA–20). The substantial data collection from these satellites allows us to more precisely analyze the oceans and atmosphere, which greatly influence the development and track of hurricanes.

Data from GOES are essential for observing and forecasting the formation and track of hurricanes. NOAA launched the first satellite in the GOES–R Series, known as GOES–16, on November 19, 2016. These satellites are the most sophisticated environmental satellites ever to be launched. They collect three times more data at four times better resolution, and scan the Earth five times faster than previous geostationary environmental satellites over North America. The technological advances of GOES–16 (now GOES-East) are absolutely astounding. For decades, geostationary weather satellites have supported weather and environmental monitoring programs that are relied upon by users in the U.S. and around the world.

NWS forecasters in Corpus Christi, Texas, tracked the eye of Hurricane Harvey using preoperational GOES–16 imagery in concert with NEXRAD Doppler radar data. They worked closely with EMs who needed to evacuate people from vulnerable areas, but could not risk exposing the public to the harsh hurricane conditions. The forecasters used the information to identify a short window of opportunity to evacuate as the eye passed directly overhead. During Hurricane Maria, Puerto Rico's only NEXRAD Doppler radar was destroyed by the storm as the eye made a direct hit on the island. GOES–16 continued to provide detailed information that remained available to our forecasters. With information available every 60 seconds, forecasters could watch thunderstorms develop and were able to issue accurate flash flood warnings for the public.

On March 1, 2018, NOAA launched GOES–S (renamed to GOES–17 on March 12, 2018, when it reached geostationary orbit). Once GOES–17 becomes operational in late 2018 as GOES-West, along with GOES-East will provide superior coverage for the majority of the Western Hemisphere from the west coast of Africa all the way to New Zealand. Each satellite has six new, highly sophisticated instruments that will provide faster, more accurate and more detailed data than legacy satellites to track hurricanes and other potentially devastating events. The Global Lightning Mapper sensor on each will provide our forecasters and researchers with realtime in-situ lightning data for the first time over remote areas, such as open waters. These lightning data will help us better understand what is occurring within the storms, and it will also improve our warning capability for severe storms, including hurricanes.

NOAA continues to benefit from, and rely on, aircraft reconnaissance. Ten WC–130J aircraft are specially configured and operated by the U.S. Air Force Reserve from the 53rd Weather Reconnaissance Squadron, 403rd Wing, located at Keesler Air Force Base in Biloxi, Mississippi. The NOAA G–IV and two Lockheed WP–3D Orions (P–3) are part of NOAA's fleet of highly specialized research and operational aircraft. These aircraft are operated, managed, and maintained by OMAO, based in Lakeland, Florida. The G–IV flies at high altitudes around and ahead of a tropical cyclone, gathering critical data that depict the atmospheric steering flow, and that data feed into and result in improved accuracy from hurricane forecast models. The P–3s are NOAA's hurricane research and reconnaissance aircraft. These versatile turboprop aircraft are equipped with an unprecedented variety of scientific instrumentation, radars and recording systems for both in-situ and remote sensing measurements of the atmosphere, the earth and its environment. These two aircraft have led NOAA's continuing effort to monitor and study hurricanes and other severe storms, and other non-hurricane-related missions in their "off season." When flying a hurricane mission, military and NOAA P–3 air crews fly directly through the eye of the storm several times each flight. They collect data and transmit it in near real time by satellite directly to NHC so forecasters can analyze and predict changes to the hurricane's path and strength. The data also are transmitted in real-time for initializing the storms in operational numerical models for better analysis and forecast guidance and then used by researchers to better understand the processes contributing to intensity change.

NOAA, though NESDIS, leverages full and open exchanges of satellite data with NASA and the Department of Defense, as well as foreign National Meteorological Services to meet our observational data requirements. With Congressional support, in recent years, NOAA has been increasingly seeking opportunities for incorporating commercially acquired data into our weather models.

Improved Observation through Unmanned Systems

NOAA is working with the private sector and other Federal agencies to identify, evaluate, and transition innovative and cost-effective Unmanned System (UxS) capabilities that meet NOAA's observing requirements, and help form a comprehensive observing strategy for the future. Unmanned Aerial Systems (UASs), for example, have improved Hurricane observation. This hurricane season, NOAA joined with NASA to fly the unmanned NASA Global Hawk ahead of and above Hurricanes Franklin and Harvey, launching dropsondes that collected data to be assimilated into the operational Global Forecast System model and HWRF. This year marked the first time that Global Hawk dropsondes were assimilated in real-time into the GFS model. Scientists also launched six small "Coyote" drones from a NOAA P–3 Hurricane Hunter during Hurricane Maria to collect unique data from within the eyewall in the lower part of the storm where it gains strength from the ocean. The low-level observations of wind speed, wind direction, atmospheric pressure, temperature, moisture, and sea surface temperature provide more detail on hurricane strengthening than dropsondes that record a single point of data. These observations can provide information needed to improve intensity predictions.

NOAA researchers partnered with NOS IOOS regions to deploy underwater gliders to better understand how the upper ocean contributes to hurricane intensity. These gliders collect information in the Atlantic Warm Pool, an area of the ocean commonly associated with hurricane development and intensification that has been expanding over the past two decades. Hurricanes Harvey, Irma, Jose, and Maria, passed directly over, or very close to the gliders, providing valuable information to NOAA researchers and forecasters. The ocean data collected by the gliders totaled over 4,000 temperature and salinity profiles. Correct representation of ocean conditions during a hurricane has been shown to significantly reduce the error in intensity forecast.

We anticipate data from new UxS technologies, to include Unmanned Surface Vehicles (USVs) will contribute significantly to improved understanding of tropical cyclone processes and ultimately to improvements in track and intensity predictions.

Further Improvements

In addition to continuing the improvement cited above, we will look to transition other promising research and development work. For example, experimental models being developed at NOAA Research labs produced impressive results this hurricane season, holding out the promise for important gains in future years. These models will be further tested, refined and transitioned to day-to-day operations within the NWS. NOAA's experimental global model, or fvGFS, exceeded all other global models in forecasting the track of Hurricane Maria. FvGFS is powered by the NOAA Research-developed FV–3, which is transitioning to operations to become the heart of NOAA's next generation Global Forecast System.

The experimental, basin-scale version of the operational HWRF model, supported by HFIP, was run in real time for Hurricane Harvey. Tail Doppler radar wind data collected from the NOAA P–3 aircraft was assimilated into this system for the first time. Apart from near-perfect track predictions, the basin-scale HWRF accurately captured the rapid intensification of Harvey over several cycles in advance of the system's landfall.

The NOAA Research experimental High Resolution Rapid Refresh model, HRRRx, also showed great promise for future improvements to NOAA's only high resolution, hourly updating forecast model that can resolve weather down to the level of individual thunderstorms. Preliminary evaluations showed that HRRRx, accurately predicted the path of Hurricane Harvey, as well as the location and amount of rainfall from the storm for its range of prediction out through 36 hours.

Improvements in NOAA's hurricane prediction will continue to follow the guidelines outlined in the Weather Act. The Act expands on critical NOAA mission areas, including improvements through HFIP, improved modeling and computing capacity, working with the private and academic sectors to obtain the best possible data, improving NWS Impact-based Decision Support Services (IDSS) efforts, and using social science to better communicate critical messages and information to the public and our core partners.

Conclusion

The improvements NOAA has made over the last decade in environmental observation, prediction, decision support, response and recovery were clearly validated during the 2017 hurricane season. Nevertheless, we can and will improve further by applying the FY18 Omnibus and Disaster Supplemental appropriations to continue transitioning research to operations, strengthening our vast network of partners, and implementing the Weather Research and Forecast Innovation Act.

Senator WICKER. Thank you very much.
Rear Admiral Fagan.

STATEMENT OF REAR ADMIRAL LINDA L. FAGAN, DEPUTY COMMANDANT FOR OPERATIONS POLICY AND CAPABILITY, U.S. COAST GUARD

Admiral FAGAN. Thank you, Mr. Chairman. It's a pleasure to be here with the Committee this morning to focus on Coast Guard preparations for the next hurricane season.

As the Federal Government's maritime first responder, the Coast Guard's unique capability, capacity, and authorities allow it to play a critical role in disaster response. When responding, our primary missions are saving lives, providing security for and reconstituting commercial waterways and infrastructure, responding to environmental threats, and providing support to other agencies.

As the lead Federal agency responsible for maritime disaster response and an armed service within DHS, the Coast Guard is uniquely positioned to operate across the response spectrum and serve as a bridge between the military and civilian responders.

Coast Guard efforts during, before, and after all four of last season's hurricanes were sharply informed by our core missions and authorities. We deployed nearly 5,000 personnel to augment the permanently assigned Coast Guard persons in the impacted areas. Working from helicopters, boats, cutters, vehicles, and on foot, these dedicated professionals saved nearly 12,000 lives.

At the height of our response, approximately one-quarter of the helicopters in the service were forward-deployed. Ships ranging from the newest national security cutter to 50-year-old inland river tenders all took part in the response. We restored the safety and security of the maritime transportation system by addressing 1,200 aids to navigation discrepancies, coordinating salvage of over 4,200 damaged or sunk vessels.

Today, there are Coast Guard forces still operating out of temporary infrastructure as they continue to execute our day-to-day missions. Recovery is ongoing in these communities, and for many first response partners. Meanwhile, dozens of Coast Guard families impacted by these storms remain displaced from their homes.

We are thankful for the enduring support provided by Congress, especially the recent supplemental funding, for our hurricane response activities. This will allow us to rebuild some of our damaged infrastructure and restore some of the future readiness depleted in response to these devastating back-to-back storms.

Over the past several months, the Coast Guard examined all aspects of our response to these storms, where pre-arrival preparations and immediate response actions were taken, and how we worked to reconstitute ports and waterways in partnership with local communities to recover from their devastating effects.

Utilizing a well-established lessons-learned process, we have accelerated the implementation of several key lessons to improve future responses. We are updating policies and plans, improving capabilities, sharing best practices, and collaborating with partners to ensure the best possible whole-of-government response to the next natural disaster.

Our lessons learned highlight a common theme. With the right facilities, equipment, assets, and training, Coast Guard men and women will save American lives and preserve economic prosperity. Rebuilding our facilities in a way that make them more storm resilient and survivable is key to enabling future success. We need to continue to invest in our ongoing recapitalization of our fleet of aircraft, vessels, and boats, and we need to rebuild organizational infrastructure that support the Coast Guard's greatest asset, our people.

Coastguardsmen are among the most dedicated, selfless, and effective men and women you will find in government, and I'm proud of their efforts and success. They must have a foundation of sound training, capable equipment, which, when blended with courage, discipline, and vigilance, creates a significant benefit to the American public. They remain always ready and will continue to risk their lives to save those in distress.

Thanks to the support of the Department of Homeland Security, the administration, and Congress, we have made great strides in replacing our aging aircraft vessels and rebuilding and repairing infrastructure, and providing equipment to our Coast Guard men and women as they answer the Nation's call without fail time and time again.

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

[The prepared statement of Admiral Fagan follows:]

PREPARED STATEMENT OF REAR ADMIRAL LINDA L. FAGAN, DEPUTY COMMANDANT FOR OPERATIONS POLICY AND CAPABILITY, U.S. COAST GUARD

Introduction

Good morning Mr. Chairman and distinguished Members of the Committee. It is my pleasure to be here today to discuss the Coast Guard's preparations for the next Atlantic hurricane season, lessons learned from the 2017 hurricane season, and the demands contingency responses place on the Coast Guard.

First, let me thank you for the outstanding support this committee has given the Coast Guard (Service), especially as it relates to the supplemental funding for hurricane response activities. This critical infusion allows the Service not only to rebuild damaged and destroyed facilities, but also provides the ability to rebuild to modern resiliency standards, ensuring the best chance of withstanding future disasters.

The U.S. Coast Guard is the world's premier military, multi-mission, maritime service responsible for the safety, security and stewardship of U.S. waters and hundreds of miles seaward. At all times, a military service and branch of the U.S. Armed Forces, a Federal law enforcement agency, a regulatory body, a first responder, and a member of the U.S. Intelligence Community, the Coast Guard stands the watch and serves a nation whose economic prosperity and national security are inextricably linked to broad maritime interests.

As the Nation's maritime first responder, the Coast Guard has unique capabilities, capacity, and authorities that allow it to play a critical role in disaster response. Today I would like to discuss the Coast Guard's primary missions in disaster response, its strengths, limitations, and some issues that demand our focus as we look toward the 2018 hurricane season.

Primary Missions in Disaster Response

The Coast Guard's primary missions in domestic disaster response are:

(1) Saving lives in distress, and ensuring the safety and survivability of its own forces and assets for immediate post-disaster response operations;

(2) Security and reconstitution of ports, waterways, and critical maritime infrastructure;

(3) Environmental response operations (oil, chemical and hazardous material); and

(4) Support to other agencies in a whole-of-government response effort.

Saving lives in distress remains our first priority. During Hurricanes HARVEY, IRMA, MARIA, and NATE, Coast Guard women and men in vessels, aircraft, vehicles, and on foot rescued nearly 12,000 people and over 1,500 pets.

For each of these storms and all natural disasters along our coastline, Coast Guard crews are typically the first Federal responders to enter an impacted area, right alongside our state, local, tribal, and territorial responders, to conduct rescues and assess damage. I should note that in an average year, the Coast Guard saves 3,600 lives. The Coast Guard tripled that number during HARVEY alone in a matter of days.

In addition to search and rescue operations, the Coast Guard flows forces into the impacted regions to restore ports and waterways, respond to pollution, provide security and additional law enforcement capability where necessary, and protect offshore petrochemical platforms. Within five weeks, Hurricanes HARVEY, IRMA, MARIA, and NATE impacted over 2,500 miles of shoreline.[1] The Coast Guard responded to 1,269 aids to navigation discrepancies, handled 290 pollution cases, and targeted and assessed thousands of grounded vessels, with more than 4,200 removed to date. Coast Guard damage assessment teams were on-scene within hours determining the status of ports and waterways, documenting environmental hazards, assessing the impacts to Coast Guard facilities and capabilities, and leveraging technology, such as the employment of electronic aids to navigation, to facilitate the reopening of key ports and waterways.

The Coast Guard response during the 2017 hurricane season was historic and overwhelmingly successful. However, as an organization dedicated to continuous improvement and increased resiliency the Coast Guard inherently knows there are lessons to be learned, even after a successful contingency response. The Coast Guard has identified several strategic and over one hundred tactical-level lessons learned. The Coast Guard is tracking, and will continue to track, these issues until they have been resolved. The Service is updating policies and plans, improving capabilities, sharing best practices, and working with FEMA and state partners to improve processes. As we approach the start of the Atlantic hurricane season on June 1, 2018, the Coast Guard will conduct fifty-two natural disaster exercises at its District and Sector Commands. In addition, the Coast Guard will participate in the 2018 Atlantic Fury National Level Exercise involving a National Capital Region impact in order to test headquarters-level preparedness for hurricane response.

Our Strengths

The Coast Guard has several key strengths that enable quick and effective response to natural disasters. The first of these strengths begins with its people, whose bias for action and adaptability to rapidly changing circumstances and uncertainty never ceases to fill me with pride and admiration.

Coast Guard cutters, aircraft, and boats are built to respond to a variety of missions without the need for any significant reconfiguration. Cutters conducting counter-drug patrols in the Transit Zone can quickly divert to disaster areas to provide command and control, deliver rotary wing air capability from the sea, conduct refueling, and provide forward staging facilities. Coast Guard aircraft that normally perform law enforcement surveillance to thwart transnational maritime criminal activities can be dynamically repositioned and re-tasked to deliver disaster relief supplies, additional responders, and equipment to affected areas.

Additionally, Coast Guard forces are on station at key locations around the Nation, most of them on short-notice recall, which can respond quickly to emergent events. When a major catastrophe occurs or is anticipated, the Service can reposition forces quickly to that area to optimize the response.

The Coast Guard enjoys an agile and decentralized command and control structure, which provides operational commanders the authority to move forces quickly to respond to large contingencies. Two Area Commanders, and their nine subordinate District Commanders, can shift and reallocate forces from one region to another based on levels of risk and anticipated demand for operational capabilities.

The Coast Guard has also developed and regularly exercises Continuity of Operations Plans for relocating command and control functions out of harm's way to strategically advantageous positions to effectively conduct response and recovery operations. During the 2017 hurricanes, seven major shore commands and one District command shifted out of the path of the storms to alternate facilities, resulting in only minor disruptions and no loss of command and control.

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[1] Using CRS method of Shoreline Measurement: Texas: 367 mi, Louisiana: 397 mi, Florida: 1,350 mi, Puerto Rico: 311 mi, USVI: 117 mi

In addition to fielding flexible, multi-mission forces and effective command and control systems, the Coast Guard also benefits from a unique mix of broad standing authorities, as well as extensive experience operating within both military and other interagency response organizations.

As a military service, the Coast Guard can be a supported or supporting commander, and its forces are frequently integrated with U.S. Department of Defense (DOD) services in Joint Task Force organizations. The Service regularly provides forces in support of DOD exercises, Combatant Commander contingency plans, and theater security cooperation activities. This routinely exercised relationship develops close cooperation at the service level, enabling Coast Guard and DOD forces to integrate seamlessly during disaster response operations.

In addition to its military role, the Coast Guard routinely works with other Federal agencies, state and local governments, non-governmental agencies, and international organizations under its U.S. Code, Title 14 law enforcement and regulatory responsibilities.

The Coast Guard is the Nation's "maritime first responder" and has a leading role in executing the National Response Framework (NRF) for disaster situations. Its personnel are well-trained and experienced in response operations, which make them a sound choice to be designated for key leadership positions in the NRF structure. This ability to operate concurrently in both military Joint Task Force and civilian NRF structures enhances unity of effort during whole-of-government responses across organizations and dramatically improves the effectiveness of disaster response, which makes the Coast Guard a truly unique Federal agency.

Our Limitations

Despite the many strengths the Coast Guard brings to disaster response, the Service has limitations that must be considered.

Across the 2017 hurricane response operations, more than 3,000 Coast Guard women and men, and 200 assets or platforms from across the Service, from places as far away as Alaska, Hawaii, and Maine responded to save nearly 12,000 citizens in distress. The hurricane response had a significant impact on Coast Guard operations. The Coast Guard is small in comparison to the other Armed Services. With only 40,600 active duty, 7,000 reserve, and 8,500 civilian personnel, responding to a major natural disaster requires balancing risk in other geographic regions and mission areas in order to flow forces and capabilities into the major disaster response.

Residual risk was spread across the Coast Guard, with a keen eye towards meeting minimal mission standards in most, but not all, locations. Given the heavy demand for aviation capabilities following each of the storms, all aviation training was stopped until the later stages of recovery efforts were reached. The level of forces typically allocated to performing counter-drug, fisheries enforcement, and migrant interdiction operations in the Eastern Pacific Ocean, Caribbean Sea, and Florida Straits was reduced as well.

The Service has a limited capacity to respond to prolonged and sequential events. While the Coast Guard is well-positioned for immediate and effective first response, plans to sustain operations and hand-off responsibilities once a crisis has been stabilized are primary considerations for Coast Guard commanders responding to natural disasters. During 2017, the initial hurricane response spanned multiple months, with some response operations continuing today. The Coast Guard endured risk exposure across all 11 missions with service-wide impacts to training, personnel readiness, and maintenance of equipment. To sustain prolonged response operations, the Service had to sacrifice preparedness for the next contingency response. When discussing resiliency, infrastructure and assets immediately come to mind. However, the resiliency of the Coast Guard as an organization is equally critical to mitigating the secondary effects of responding to emergent events. The Coast Guard must be able to meet the needs of the Nation, through a resilient and well-trained workforce, while simultaneously answering the call for help during a disaster.

The age and condition of the Coast Guard's assets is another concern, and is one that the Administration, with the support of Congress, is working hard to improve. The newest National Security Cutter JAMES, working alongside several modern Fast Response Cutters, showcased its abilities after hurricane MARIA by serving as a command and control platform off of Puerto Rico. As more modern and capable cutters repositioned for hurricane response, the Coast Guard Cutter ALERT, a 48-year-old cutter, held the line in the Eastern Pacific Ocean. The crew performed admirably, including a two-week period as the only cutter operating in the Eastern Pacific.

Issues to Focus on Going Forward

Lastly, there are several areas that will require continued energy and focus in the months and years ahead in order to enhance the Coast Guard's national disaster response capacity and capability.

When the Coast Guard has the opportunity to recapitalize its facilities, it needs to make them more storm-resilient and survivable. In fact, several shore facilities that were rebuilt following Hurricane IKE suffered minimal damages along the paths of HARVEY and IRMA, a testament to modern building codes and standards.

Continued investment in recapitalizing Coast Guard resources is paramount. The need for modernized assets, such as the Offshore Patrol Cutter and Waterway Commerce Cutters, to replace an aging fleet is highlighted by the National Security Cutter's superior ability to coordinate and communicate with Coast Guard, Department of Defense, and interagency resources during contingency responses.

Investing in the Coast Guard's infrastructure supports its greatest resource: its people. Although the Service deployed approximately 3,000 additional Coast Guard women and men to support response operations, many more Coast Guard personnel from within the impacted areas responded to help those that were displaced and distressed, even as they and their loved ones were also displaced. The Coast Guard had to relocate over 700 Coast Guard members and dependents after their homes were damaged to the point of being uninhabitable.

Many do not realize the residual risk associated with surging resources to an incident. No amount of response capacity and capability will be effective without a foundation of preparedness. Having enough well-trained and properly equipped personnel, the right assets, and adequate contingency infrastructure in place prior to an event is vital to sustained success during a major disaster response, and to the reconstitution of the impacted area. It is too late to train responders, procure new equipment, or find alternate command posts when a hurricane is barreling toward our coasts. As has been shown time and again, investment in the Coast Guard pays dividends when they are needed most.

Conclusion

The Coast Guard is well-positioned to respond to natural disasters due to its unique blend of authorities, capabilities, and capacity. Flexible, multi-mission forces and agile command and control systems provide the solid foundation from which we can respond to major catastrophes. When combined with broad authorities and extensive experience operating with diverse partners, the Coast Guard provides a vital service to our Nation. As an organization that strives to better serve the Nation through continual improvement, the Coast Guard evaluates its successes and failures to optimize performance through applying both strategic and tactical-level lessons learned. The Coast Guard's dedication to ongoing self-improvement will ensure that it is best positioned to deliver the level of service the Nation expects and deserves well into the future.

Thank you for the opportunity to testify before you today and for your ongoing support of the women and men of the Coast Guard. I look forward to your questions.

Senator WICKER. Thank you very much, Admiral.

Dr. Dinh-Zarr, we're delighted to have you with us.

STATEMENT OF HON. T. BELLA DINH-ZARR, PH.D., MPH, BOARD MEMBER, NATIONAL TRANSPORTATION SAFETY BOARD

Dr. DINH-ZARR. Good morning, Chairman Wicker and members of the Committee. Thank you for the opportunity to testify today.

When we investigate transportation accidents, the NTSB tries to understand not only the human and mechanical factors, but also environmental factors, including the weather. In 50 years of accident investigations, we've seen the importance of having accurate weather information, adequate training and equipment to understand and operate in adverse weather, and suitable equipment to survive dangerous conditions. All of these issues were raised in our recent investigation into the sinking of *El Faro.*

As you know, on October 1, 2015, the cargo ship *El Faro* sank in the Atlantic Ocean during Hurricane Joaquin claiming the lives of all 33 crewmembers. I was the NTSB board member on-scene.

Our investigation into the sinking identified several major safety issues, but today I'll focus on the weather information, the survival craft, and the related recommendations about these issues. As we work to encourage adoption of our safety recommendations, our thoughts continue to be with the families.

We worked jointly with the Coast Guard to investigate *El Faro*'s sinking. Other organizations, including NOAA, provided support to recover *El Faro*'s recorder from over 15,000 feet below the surface of the ocean.

Recovering the recorder was critical to determining the probable cause because it provided audio of conversations and ambient sounds as well as parametric data, such as heading and speed. On behalf of the NTSB, I would like to thank the Coast Guard and NOAA for their support.

By all accounts, the storm was difficult to track as it made its way through the Atlantic. Our investigation determined that the forecast errors for Hurricane Joaquin and other tropical cyclones suggests that hurricane forecasting needs to be improved, and we made several recommendations to help ensure that mariners at sea better understand and are able to respond to severe weather.

In addition to the challenges of knowing where the storm was headed, the captain of *El Faro* relied primarily on weather information that was not as current as other sources of information being reviewed by the crew. There are several possible explanations for the captain's decision to continue on course into the hurricane's path, but his training does not appear to have prepared him for the conditions that the storm presented. The ship also lacked functioning critical equipment that would have helped the crew better understand their position relative to the storm.

We recommended improvements to training for mariners in heavy weather operations, including advanced meteorology and bridge resource management. And we recommended that vessels in ocean service be equipped with properly operating meteorological instruments, such as barometers, barographs, and anemometers. Once the ship had sailed into the hurricane and lost propulsion, *El Faro* was listing heavily to port in high seas and hurricane strength winds, leaving the crew with few options. It's unlikely that the life rafts or open lifeboats on board could be launched or boarded by the crewmembers, and they would not have provided adequate protection even if they had been launched.

Open lifeboats are not allowed on newly built vessels. The NTSB's recommendation is that they should not be allowed on any vessel. *El Faro* was 40 years old when it sank, and open lifeboats had been outdated for 30 years. If open lifeboats on all vessels in service are replaced with enclosed lifeboats that adhere to the latest safety standards, as recommended in our investigation, all mariners would have the same increased chance of surviving should they need to abandon ship regardless of the age of the vessel.

Finally, in recognition of continuous advances in equipment, we recommend that lifesaving equipment on vessels be reviewed at regular intervals. If enacted, this would constitute, in both senses of the word, a living requirement.

The captain's insufficient action to avoid Hurricane Joaquin due to his failure to use the current weather information and the lack of appropriate survival craft for the conditions were critical factors in this fatal accident. We hope our investigation into *El Faro*'s sinking will improve mariners' awareness of and preparation for heavy weather as well as prompt changes to improve weather forecasting and dissemination. These changes, combined with updated technology and equipment requirements, will help future mariners avoid hurricanes and other significant weather events, and in the event of extreme circumstances, will offer them the best chance of survival.

We appreciate that both the Coast Guard and NOAA have been responsive to our recommendations, and we look forward to continuing to work with them.

Thank you again for the opportunity to testify. My written testimony provides more details, and, of course, I'd be happy to answer any questions.

[The prepared statement of Dr. Dinh-Zarr follows:]

PREPARED STATEMENT OF HON. T. BELLA DINH-ZARR, PH.D., MPH, BOARD MEMBER, NATIONAL TRANSPORTATION SAFETY BOARD

Good morning Chairman Thune, Ranking Member Nelson, and Members of the Committee. Thank you for inviting the National Transportation Safety Board (NTSB) to testify before you today.

The NTSB is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation—highway, rail, marine, and pipeline. We determine the probable cause of the accidents we investigate and issue safety recommendations aimed at preventing future accidents. In addition, we conduct special transportation safety studies and coordinate the resources of the Federal government and other organizations to assist victims and their family members who have been impacted by major transportation disasters.

When we investigate accidents, we try to understand not only the human factors or the mechanical factors involved, but also the environmental factors, including weather. In over 50 years of accident investigations, we have seen the importance of having accurate weather information, adequate training and equipment to understand adverse weather conditions and how to operate in them, and suitable equipment to survive dangerous conditions. All of these issues were raised in our recent investigation into the sinking of the *El Faro.*

Investigating the Sinking of *El Faro*

On October 1, 2015, the US-flagged cargo ship *El Faro,* owned by TOTE Maritime Puerto Rico and operated by TOTE Services, Inc., sank in the Atlantic Ocean about 40 nautical miles northeast of Acklins and Crooked Island, Bahamas, during Hurricane Joaquin, claiming the lives of all 33 crew members. Our investigation into the sinking and the subsequent loss of life identified several major safety issues, including the captain's actions, currency of weather information, bridge resource management, company oversight, damage control plans, and survival craft suitability.

We served as the lead investigative agency and worked jointly with the U.S. Coast Guard to investigate *El Faro*'s sinking. Because the sunken vessel could not be physically investigated, recovering *El Faro*'s voyage data recorder (VDR) from over 15,400 feet below the surface of the ocean was critical to determining the probable cause of its sinking. We want to thank the U.S. Coast Guard, the National Oceanic and Atmospheric Administration (NOAA), and all the other organizations who provided tremendous support to recover *El Faro*'s recorder.[1]

We recovered audio of conversations and ambient sounds from the ship's bridge that began at 5:36 a.m. on September 30, two days before the accident, and contin-

[1] Organizations assisting in the VDR recovery included the Department of the Navy, Supervisor of Salvage and Diving and Military Sealift Command; U.S. Coast Guard; American Bureau of Shipping; National Oceanic and Atmospheric Administration; National Science Foundation; Woods Hole Oceanographic Institution; TOTE Services, Inc.; and University of Rhode Island, Inner Space Center.

ued until *El Faro* sank. This data—as well as parametric data from the VDR, such as the ship's heading and speed—provided information about the captain's and crew's conversations and actions throughout the voyage, the weather information available to them, and the ship's performance as it sailed into the storm. On December 12, 2017, following a 26-month investigation, we determined the probable cause of the sinking and made 53 safety recommendations. The final report and recommendations were published on February 7, 2018.[2]

For the purposes of this testimony, I will focus on the safety issues regarding the weather information available to and used by the crew, as well as the survival craft onboard the ship, and recommendations that we made to address these issues.

Currency of Weather Information

On September 29, 2015, at 9:48 p.m., *El Faro* and its 33 crewmembers departed its homeport in Jacksonville, Florida, on a 1,100-nautical-mile (nm) planned voyage to San Juan, Puerto Rico, slated to arrive in the early morning hours of October 2. However, the ship sailed directly into the path of Hurricane Joaquin, a Category 3 storm that reached Category 4 strength shortly after the sinking, at approximately 8:00 a.m. on October 1.

Approximately 3 hours before *El Faro* set sail on September 29, the National Hurricane Center (NHC) issued the first marine hurricane warning for Joaquin for a large area of the Atlantic east of the Bahamas; however, we determined that the captain's decision to depart Jacksonville was reasonable, considering the number of options he could employ to avoid the storm. As they tracked the storm the next day, the captain and chief mate diverted course slightly to the south to try to distance themselves from the storm. However, as it continued to intensify, Joaquin also tracked further south than originally predicted.

The crew onboard *El Faro* relied on two primary sources of weather information to remain aware of Joaquin's changing position, forecast intensity, and predicted track: Inmarsat-C SafetyNET (SAT–C) and the Bon Voyage System (BVS). These sources used different methods and formats to deliver weather guidance. SAT–C provided text broadcasts of NHC weather products, which were delivered to the vessel's bridge. This includes near-real-time information on Joaquin's position, forecast intensity, and predicted track, and is issued four times a day for active tropical cyclones.

BVS is a commercially available software program that provides graphic depictions of weather information via e-mail or broadband. BVS weather files were e-mailed to *El Faro*'s captain, who primarily relied on this information for storm location and forecast track. Seven BVS files were e-mailed to *El Faro* during the accident voyage. At the times the BVS weather files were e-mailed, the storm location and forecast track were not current with the information then available through SAT–C; rather, due to a delay in processing and preparing the data for distribution, BVS provided a storm position and forecast track 6 hours behind SAT–C. BVS can also send updates with current forecasts if a user specifically requests them, but during the accident voyage, *El Faro* did not request any.

The VDR audio recording from the bridge made clear that the crew had access to other weather information as well, including the Weather Channel, satellite radio, and broadcasts from U.S. Coast Guard aircraft. We found that *El Faro* was receiving sufficient weather information for the captain to make educated decisions regarding the vessel's route, but the captain did not use it. Several times throughout the night of September 30 and into the early morning of October 1, the bridge crew noted their concerns about the ship's advancement toward a strengthening storm based on information from SAT–C and other sources; however, the captain may have felt confident about the ship's route and proximity to the storm. However, he was relying on BVS weather information that was many hours older than what the bridge crew was reviewing. Based on the information obtained from the VDR, it seems most likely that the captain did not realize that SAT–C was providing more current information than BVS.

At 4:45 a.m., on October 1, the captain downloaded a BVS weather file that had been sent to him at 11:04 p.m. the night before. Joaquin's position, forecast track, and intensity given in the file were consistent with the data in the advisory that had been delivered to the bridge via SAT–C almost 12 hours before, at 4:54 p.m. the previous afternoon. At 4:46 a.m., *El Faro*'s SAT–C terminal received an advisory indicating that *El Faro* was 11 nm northwest of the storm center (*Figure 1).* By that time, the ship was experiencing a starboard list caused by increasing wind on the

[2] National Transportation Safety Board, *Sinking of U.S. Cargo Vessel SS El Faro, Atlantic Ocean, Northeast of Acklins and Crooked Island, Bahamas October 1, 2015,* Rpt. No. MAR–17/01 (Washington, D.C.: NTSB, 2017).

vessel's port side. As the ship continued to sail into the storm, the crew struggled to deal with a cascading series of events, including flooding and loss of propulsion, any one of which could have endangered the ship on its own.

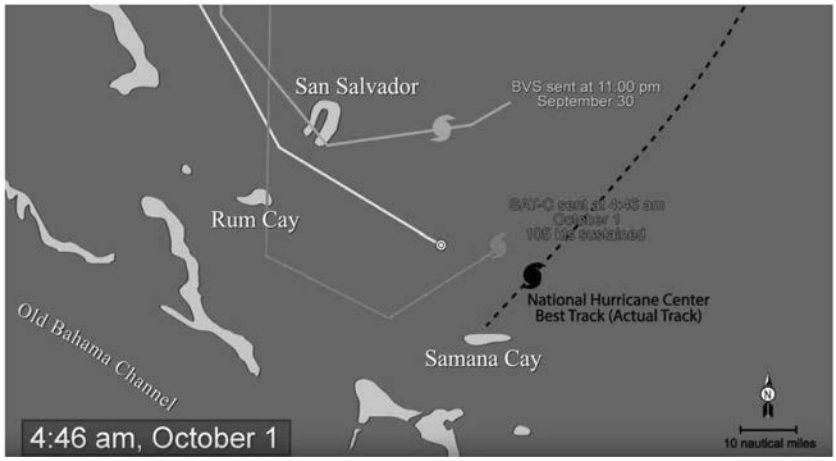


Figure 1. El Faro's location in relation to available weather forecasts and poststorm analysis at 4:46 a.m. on October 1.

Once under way on the accident voyage, the captain had opportunities to take other actions to avoid Hurricane Joaquin. There are several possible explanations for the captain's decision to continue on course into the hurricane's direct path, but his training does not appear to have prepared him for the conditions Hurricane Joaquin presented.

El Faro's captain graduated from Maine Maritime Academy in 1988, and he obtained his master's credential in 2001. Mariners who obtained their initial credential before 1998 were not required to take an advanced meteorology training course approved by the U.S. Coast Guard; thus, the captain was not required to have completed the advanced meteorology or advanced shiphandling courses. The same was true for *El Faro*'s chief mate. According to their most recent certificates, none of the bridge officers had attended the advanced meteorology or advanced shiphandling courses. We concluded that training in heavy-weather operations, including advanced meteorology and advanced shiphandling, might have provided the captain with additional information to consider while evaluating options, and may have resulted in a different course of action. We recommended that the U.S. Coast Guard require that all deck officers, at both operational and management levels, take a U.S. Coast Guard-approved advanced meteorology course to close the gap for mariners initially credentialed before 1998.[3] The recommendation is currently classified "Open—Await Response."

We also recommended that the U.S. Coast Guard publish policy guidance to approved maritime training schools offering management-level training in advanced meteorology, to ensure that the curriculum includes the following topics: characteristics of weather systems, including tropical revolving storms; advanced meteorological concepts; importance of sending weather observations; ship maneuvering using advanced simulators in heavy weather; heavy-weather vessel preparations; use of technology to transmit and receive weather forecasts (such as navigational telex or weather-routing providers); ship-routing services (capabilities and limitations); and launching of lifeboats and liferafts in heavy weather.[4] The recommendation is currently classified "Open—Await Response."

We further recommended that the U.S. Coast Guard provide policy guidance to approved maritime training schools offering operational-level training in meteorology to ensure that the curriculum includes the following topics: characteristics of weather systems, weather charting and reporting, importance of sending weather

[3] *Safety Recommendation M–17–33.*
[4] *Safety Recommendation M–17–34.*

observations, sources of weather information, and interpreting weather forecast products.[5] The recommendation is currently classified "Open—Await Response."

An accurate determination of wind speed and wind direction onboard *El Faro* would have allowed the crew to resolve the conflicting weather reports. *El Faro* was not required to carry an anemometer but did have one installed. The vessel's anemometer displayed wind data on the bridge, which was also recorded by the VDR; however, according to interviews with former crewmembers and crew discussions and wind data obtained from the VDR, the anemometer was not properly functioning. A properly working anemometer would have allowed the ship's crew to compute the true wind direction and speed. With that information, the captain would have had additional tools to use to determine the vessel's position in relation to Hurricane Joaquin. We concluded that TOTE did not ensure that *El Faro* had a properly functioning anemometer, which deprived the captain of a vital tool for understanding his ship's position relative to the storm. To ensure that vessels are equipped with properly functioning weather equipment, we recommended that the U.S. Coast Guard require that vessels in ocean service (500 gross tons or over) be equipped with properly operating meteorological instruments, including functioning barometers, barographs, and anemometers.[6] The recommendation is currently classified "Open—Await Response."

During the course of our investigation, the factual information indicated that Joaquin's track was difficult to forecast because of its moderate wind shear. The forecast errors for Hurricane Joaquin and other tropical cyclones suggest that hurricane forecasting needs to be improved. Further, our investigation revealed that critical tropical cyclone information issued by the National Weather Service (NWS) is not always available to mariners via well-established broadcast methods. The data also suggest that modifying the way the NWS develops certain tropical cyclone forecasts and advisories could help mariners at sea better understand and respond to tropical cyclones. As a result, we adopted a safety recommendation report on June 20, 2017, making ten recommendations to address these safety issues—two addressed to NOAA, seven to the NWS, and one to the U.S. Coast Guard.[7]

Among these, we recommended that NOAA develop and implement a plan specifically designed to emphasize improved model performance in forecasting tropical cyclone track and intensity in moderate-shear environments. We also recommended that NOAA develop and implement technology that would allow NWS forecasters to quickly sort through large numbers of tropical cyclone forecast model ensembles, identify clusters of solutions among ensemble members, and allow correlation of those clusters against a set of standard parameters.[8] Both recommendations are classified "Open—Await Response," although we recently received information from NOAA that these recommendations aligned with work that is in progress or planned as part of the Hurricane Forecast Improvement Program.

Collecting and disseminating meteorological and oceanographic data in near real-time is vital to supporting global meteorological authorities who aim to produce the best possible weather forecasts and advisories. Although surface-based data collection networks on land are geographically extensive and, in many cases, provide good temporal coverage, no such network exists over the world's oceans. Satellites retrieve valuable data from the ocean surface; yet, they have limitations. We found that increased reporting and improved transmission of meteorological and oceanographic data from vessels at sea would significantly improve the availability of vital information to enhance weather awareness, forecasting, and advisory services aimed at improving mariner safety.

We recommended that NOAA coordinate with the NWS, vessel operators, automatic identification system (AIS) service providers, and required onboard technology vendors to perform a "proof-of-concept" project to establish whether AIS, or another suitable alternative, can practically deliver, in a single message, meteorological and oceanographic data obtained directly from automated instrumentation and manual observation onboard vessels at sea, vessel position and time of observation, and other important metadata by satellite and land-based receivers to global meteorological authorities via the Global Telecommunication System with acceptable time delay.[9] On March 15, 2018, the NWS responded that it is establishing a proof-of-concept project under its Office of Observations to evaluate the feasibility of transmitting weather information through AIS. Preliminary discussions have been con-

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[5] *Safety Recommendation M–17–35.*

[6] *Safety Recommendation M–17–36.*

[7] National Transportation Safety Board, *Tropical Cyclone Information for Mariners,* Rpt. No. MSR–17/02 (Washington, D.C.: NTSB, 2017).

[8] Safety Recommendations *M–17–8* and *M–17–9.*

[9] *Safety Recommendation M–17–52.*

ducted among the NWS, NOAA, potential contributors to this project, and key stakeholders. This recommendation is classified "Open—Initial Response Received."

Suitability of Survival Craft

According to data from *El Faro*'s VDR, at 7:27 a.m. on October 1, after struggling to address the flooding and propulsion loss experienced on the vessel, the captain rang the ship's general alarm, and one minute later, the chief mate gave a radio command for the crew to muster on the starboard side of the ship. At 7:29 a.m., the captain ordered abandon ship, and two minutes later, he ordered that inflatable liferafts be thrown overboard and that the crew enter them. The VDR ceased recording at 7:39 a.m., with the captain and able seaman still on the bridge.

A transmission from *El Faro*'s emergency position indicating radio beacon (EPIRB) was detected by geostationary satellite at 7:36 a.m. and received by the U.S. Coast Guard. The transmission was forwarded as an "unlocated first alert" because *El Faro*'s EPIRB was not GPS-equipped, which would have allowed the unit to transmit its current position. No further communications were received by either the U.S. Coast Guard or TOTE. *El Faro*'s last known position, according to VDR data, was 20 nm north of Samana Cay, about 17 nm north of Joaquin's center.

El Faro carried five liferafts: four 25-person liferafts and a 6-person liferaft. In addition, *El Faro* was equipped with two 43-person open lifeboats, which were original equipment from when the ship was built. *El Faro*'s starboard lifeboat was discovered during the search-and-rescue operation, damaged and swamped. The damaged port lifeboat was discovered on the seafloor during the second mission to recover the VDR. There was no indication that the lifeboats had been launched. A partially inflated liferaft was discovered during the search-and-rescue operation and confirmed to be from *El Faro.* None of the remaining five *El Faro* liferafts was recovered, and none was observed in a stowed position on the wreckage.

We found that the captain's decision to muster the crew and abandon ship was late and may have reduced the crew's chances of survival. However, the severe weather, combined with *El Faro*'s list, made it unlikely that the liferafts or lifeboats could be launched manually or boarded by crewmembers once in the water, and they would not have provided adequate protection even if they had been launched. Open lifeboats, such as those *El Faro* carried, are not allowed on newly built vessels. *El Faro*'s lifeboats were inspected and surveyed in accordance with the regulations applicable to its delivery date of January 1975. A vessel is surveyed under the same regulations as long as it is in service or until it undergoes a major modification; in the latter case, the vessel must comply with the requirements current at the time of modification as far as is reasonable and practicable. In 1993, *El Faro,* then named *Northern Lights,* underwent a major modification, but the lifeboats were not required to be upgraded at that time because the lifeboats themselves were not modified in the conversion. The vessel was again substantially modified in 2005–2006 to carry load-on/load-off containers, but the U.S. Coast Guard did not classify this change as a major modification. We concluded that the 2005–2006 conversion should have been designated a major modification, which may have required the vessel to meet newer safety standards for lifeboats.

The average life of international merchant ships is roughly 20 to 30 years. The *El Faro* was 40 years old when it sank, and open lifeboats had been superseded for 30 years. Therefore, considering the average service life of these vessels, we recommended that all lifesaving appliances on inspected vessels, which would include lifeboats and liferafts, be reviewed at a maximum 20-year interval to current standards and be upgraded as required.[10] This recommendation is classified "Open—Await Response."

Survivability would be enhanced if open lifeboats on all vessels remaining in service were replaced with enclosed lifeboats that adhered to the latest safety standards, and if new cargo vessels were equipped with stern-launched freefall lifeboats where practicable. We recommended that the U.S. Coast Guard require open lifeboats on all US-inspected vessels to be replaced with enclosed lifeboats that meet current regulatory standards and freefall lifeboats, where practicable.[11] This recommendation is classified "Open—Await Response."

Conclusion

The captain's insufficient action to avoid Hurricane Joaquin due to his failure to use the most current weather information and the lack of appropriate survival craft for the conditions were critical factors in the probable cause of *El Faro*'s sinking and the loss of 33 lives. Although the ship and its crew should never have found them-

[10] *Safety Recommendation M–17–042.*
[11] *Safety Recommendation M–17–043.*

selves sailing into the storm, many other factors, including ineffective bridge resource management, inadequate company oversight and safety management, flooding, propulsion loss, and the lack of an approved damage control plans also contributed to the sinking, and there are many other lessons to learn.

As with all of our investigations, our aim is to learn from this tragedy to improve safety for current and future generations of mariners. We hope that our investigation into *El Faro*'s sinking will improve mariners' awareness of and preparation for heavy weather as well as prompt changes to improve weather forecasting and dissemination. These changes, combined with updated technology and equipment requirements, will help future mariners make better decisions in the face of hurricanes and other significant weather events. We appreciate that both the U.S. Coast Guard and NOAA have been responsive to our recommendations and we look forward to continuing to work with them.

Thank you again for the opportunity to testify, and I am happy to take your questions.

ATTACHMENT—REPORT

***El Faro* Safety Recs Status (as of 18-May-2018)**

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

#Open	#Closed	Status
5	0	OAA (Open--Acceptable Response) – NWS-4; USCG-1
43	0	OAR (Open--Await Response) - USCG intends to submit responses for all recs 25-May
14	0	ORR (Open--Initial Response Received) – TOTE-10; NOAA-3; ABS-1;
1	0	OUA (Open--Unacceptable Response) - NWS may have misunderstood M-17-14; NTSB-NWS meet 24-May
63	**0**	**TOTAL EL FARO RECS**

Rec#	Status	Closed	Subject
M-17-008	ORR		TO THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION: Develop and implement a plan specifically designed to emphasize improved model performance in forecasting tropical cyclone track and intensity in moderate-shear environments.
M-17-009	ORR		TO THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION: Develop and implement technology that would allow National Weather Service forecasters to quickly sort through large numbers of tropical cyclone forecast model ensembles, identify clusters of solutions among ensemble members, and allow correlation of those clusters against a set of standard parameters.
M-17-010	OAA		TO THE NATIONAL WEATHER SERVICE: Work with international partners to develop and implement a plan to ensure immediate dissemination to mariners, via Inmarsat-C SafetyNET (and appropriate future technology), of the Intermediate Public Advisories and Tropical Cyclone Updates issued by the National Weather Service, in a manner similar to the current process of disseminating the Tropical Cyclone Forecast/Advisory.
M-17-011	OAR		TO THE NATIONAL WEATHER SERVICE: Modify your directives to ensure, for all tropical cyclones of tropical storm strength or greater within your jurisdiction, that your facilities issue, at the 3-hour interval between regularly scheduled Tropical Cyclone Forecast/Advisories, an Intermediate Public Advisory, a Tropical Cyclone Update, or another product available (or expected to be available) to mariners via Inmarsat-C SafetyNET (and appropriate future technology), and that the product include coordinates of current storm center position, maximum sustained surface winds, current movement, and minimum central pressure.
M-17-012	OAA		TO THE NATIONAL WEATHER SERVICE: Modify your directives to ensure that the "next advisory" time in a Tropical Cyclone Forecast/Advisory clearly indicates when to expect the next update of "current" or forecast information for that particular tropical cyclone.
M-17-013	OAA		TO THE NATIONAL WEATHER SERVICE: Quantitatively define "significant change" in terms of both the track and intensity of a tropical cyclone to guide the issuance of Special Advisory packages.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-014	OUA		TO THE NATIONAL WEATHER SERVICE: Ensure that tropical cyclone graphic products issued by entities such as the National Hurricane Center, the Central Pacific Hurricane Center, the Guam Weather Forecast Office, the Joint Typhoon Warning Center, and Fleet Weather Center–Norfolk are made available in near-real time via the FTPmail service.
M-17-015	OAR		TO THE NATIONAL WEATHER SERVICE: Allow users to schedule recurring, automated receipt of specific National Weather Service products through an enhanced FTPmail service (and appropriate future technology).
M-17-016	OAA		TO THE NATIONAL WEATHER SERVICE: Develop and implement a plan for soliciting feedback from the marine user community, particularly ship masters, about the accuracy, timeliness, and usability of weather services to mariners.
M-17-017	OAA		TO THE UNITED STATES COAST GUARD: In collaboration with the National Weather Service, provide timely broadcasts of the Tropical Cyclone Forecast/Advisories, Intermediate Public Advisories, and Tropical Cyclone Updates to mariners in all regions via medium-frequency navigational TELEX (NAVTEX), high-frequency voice broadcasts (HF VOBRA), and high-frequency simplex teletype over radio (HF SITOR), or appropriate radio alternatives (and appropriate future technology).
M-17-021	OAR		TO THE UNITED STATES COAST GUARD: Revise regulations to increase the minimum required propulsion and critical athwartships machinery angles of inclination. Concurrently, requirements for lifeboat launching angles should be increased above new machinery angles to provide a margin of safety for abandoning ship after machinery failure.
M-17-022	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that design maximum operating angles of inclination for main propulsion and other critical machinery be included in damage control documents, stability instruments and booklets, and in the safety management systems for all applicable vessels.
M-17-023	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that all watertight access doors and access hatch covers normally closed at sea be provided with open/close indicators both on the bridge and locally.
M-17-024	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that on new and existing vessels, seawater supply piping below the waterline in all cargo holds be protected from impact.
M-17-025	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization to require that new cargo vessels be equipped with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-026	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization to require that existing cargo vessels be retrofitted with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.
M-17-027	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that any opening that must normally be kept open for the effective operation of the ship must also be considered a downflooding point, both in intact and damage stability regulations and in load line regulations under the International Convention on Load Lines.
M-17-028	OAR		TO THE UNITED STATES COAST GUARD: Require that information regarding openings that could lead to downflooding be included in damage control documents, stability instruments and booklets, and safety management systems for vessels subject to the intact stability criteria of Title 46 Code of Federal Regulations 170.170, regardless of the designation or treatment of such openings in intact stability calculations.
M-17-029	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that existing cargo vessels operating under the International Convention for the Safety of Life at Sea be required to have damage control plans and booklets on board that meet current standards.
M-17-030	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that damage control plans and booklets required by the International Convention for the Safety of Life at Sea be class-approved.
M-17-031	OAR		TO THE UNITED STATES COAST GUARD: Publish policy guidance to approved maritime training schools offering bridge resource management courses to promote a cohesive team environment and improve the decision-making process, and specifically include navigational and storm-avoidance scenarios.
M-17-032	OAR		TO THE UNITED STATES COAST GUARD: Require recurring bridge resource management training for all deck officers when renewing their credentials.
M-17-033	OAR		TO THE UNITED STATES COAST GUARD: Require that all deck officers, at both operational and management levels, take a Coast Guard–approved advanced meteorology course to close the gap for mariners initially credentialed before 1998.
M-17-034	OAR		TO THE UNITED STATES COAST GUARD: Publish policy guidance to approved maritime training schools offering management-level training in advanced meteorology, or in an appropriate course, to ensure that the curriculum includes the following topics: characteristics of weather systems including tropical revolving storms; advanced meteorological concepts; importance of sending weather observations; ship maneuvering using advanced simulators in heavy weather; heavy-weather preparations; use of technology to transmit and receive weather forecasts (such as navigational telex or weather-routing providers); ship-routing services (capabilities and limitations); and launching of lifeboats and liferafts in heavy weather.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-035	OAR		TO THE UNITED STATES COAST GUARD: Provide policy guidance to approved maritime training schools offering operational-level training in meteorology to ensure that the curriculum includes the following topics: characteristics of weather systems, weather charting and reporting, importance of sending weather observations, sources of weather information, and interpreting weather forecast products.
M-17-036	OAR		TO THE UNITED STATES COAST GUARD: Require that vessels in ocean service (500 gross tons or over) be equipped with properly operating meteorological instruments, including functioning barometers, barographs, and anemometers.
M-17-037	OAR		TO THE UNITED STATES COAST GUARD: Revise Title 46 Code of Federal Regulations 170.110 (stability booklet) to require (1) stability instructions, guidance, or data on wind velocity used to calculate weather criteria; (2) list of closures that must be made to prevent unintentional flooding; (3) list of closures that must be made for an opening not to be considered a downflooding point; and (4) righting arm curve (metacentric height) table to note the angle at which initial downflooding occurs; also, add a windheel table for vessel full load displacement or the condition of greatest vulnerability to windheel.
M-17-038	OAR		TO THE UNITED STATES COAST GUARD: Update the guidance in Navigation and Inspection Circular 4-77 (Shifting Weights or Counter Flooding During Emergency Situations), based on the circumstances of the El Faro accident, to include a warning that actions by ship personnel intended to correct a list can produce dangerous results if roll-on/roll-off cargo is already adrift and water has reduced the coefficients of friction for lashed cargo.
M-17-039	OAR		TO THE UNITED STATES COAST GUARD: Conduct a complete review of the Alternate Compliance Program to assess the adequacy and effectiveness of the program.
M-17-040	OAR		TO THE UNITED STATES COAST GUARD: Review and implement training of Coast Guard inspectors and accredited classification society surveyors to ensure that they are properly qualified and supported to perform effective, accurate, and transparent vessel inspections, meeting all statutory and regulatory requirements.
M-17-041	OAR		TO THE UNITED STATES COAST GUARD: Review and revise the policy for major conversion determinations to consider load line (maximum) draft as a principal vessel dimension.
M-17-042	OAR		TO THE UNITED STATES COAST GUARD: At regular intervals, not to exceed 20 years, review all lifesaving appliances on inspected vessels that are required by Title 46 Code of Federal Regulations Part 199, and require compliance with current standards.
M-17-043	OAR		TO THE UNITED STATES COAST GUARD: Require that open lifeboats on all US-inspected vessels be replaced with enclosed lifeboats that meet current regulatory standards and freefall lifeboats, where practicable.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-044	OAR		TO THE UNITED STATES COAST GUARD: To prevent future errors in converting position data such as occurred in the El Faro accident, work with manufacturers of Global Maritime Distress and Safety System equipment, communication providers, and land earth stations to remove ambiguity from the Inmarsat-C distress alert position reports.
M-17-045	OAR		TO THE UNITED STATES COAST GUARD: Require that all personnel employed on vessels in coastal, Great Lakes, and ocean service be provided with a personal locator beacon to enhance their chances of survival.
M-17-046	OAR		TO THE UNITED STATES COAST GUARD: Modify guidance and training for marine inspectors to ensure that voyage data recorder annual performance tests include the replacement of locator beacons prior to expiration and that audio used to evaluate quality is recorded while a ship is under way using its main propulsion unit.
M-17-047	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization to amend resolution MSC.333(90) to specify that "normal operations" are defined as when a ship is under way using its main propulsion unit and to assess voyage data recorder problems, including not capturing both sides of internal phone calls on the bridge electric telephone and unrecorded very-high-frequency communications, and identify steps to remedy them.
M-17-048	OAR		TO THE UNITED STATES COAST GUARD: If the actions recommended to the National Oceanic and Atmospheric Administration in Safety Recommendation M-17-52 establish that the automatic identification system (AIS) is a viable means by which to relay (with acceptable time delay) meteorological and oceanographic data and metadata from vessels at sea for use by global meteorological authorities, propose to the International Maritime Organization that vessels required to use AIS also be equipped with meteorological and oceanographic sensors?including, at a minimum, sensors for barometric pressure and sea-surface temperature?that will automatically disseminate the data at high-temporal resolution via AIS.
M-17-049	OAR		TO THE UNITED STATES COAST GUARD: Propose to the International Maritime Organization that vessels under regulations of the International Convention for the Safety of Life at Sea that are not already automatically disseminating meteorological and oceanographic data by other means be required to manually disseminate such data while at sea via the automatic identification system or the Voluntary Observing Ship program at the times of 0000 coordinated universal time (UTC), 0600 UTC, 1200 UTC, and 1800 UTC.
M-17-050	OAR		TO THE FEDERAL COMMUNICATIONS COMMISSION: Require that all US vessels required to carry 406-megahertz emergency position-indicating radio beacons (EPIRBs) immediately discontinue the use of EPIRBs that are not global positioning system enabled.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-051	OAR		TO THE FEDREAL COMMUNICATIONS COMMISSION: Reserve the designated application-specific message frequencies for very-high-frequency data exchange system use in US territories, as identified in International Telecommunications Union (ITU) recommendation ITU-R M.2092-0, and consistent with international efforts.
M-17-052	ORR		TO THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION: Coordinate with the National Weather Service, vessel operators, automatic identification system (AIS) service providers, and required onboard technology vendors to perform a "proof-of-concept" project to establish whether AIS, or another suitable alternative, can practically deliver, in a single message, (1) meteorological and oceanographic data obtained directly from automated instrumentation and manual observation on board vessels at sea, (2) vessel position and time of observation, and (3) other important metadata, by satellite and land-based receivers, to global meteorological authorities via the Global Telecommunication System with acceptable time delay.
M-17-053	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members to increase the minimum required propulsion and critical athwartships machinery angles of inclination. Concurrently, requirements for lifeboat launching angles should be increased above new machinery angles to provide a margin of safety for abandoning ship after machinery failure.
M-17-054	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members to require that design maximum operating angles of inclination for main propulsion and other critical machinery be included in damage control documents, stability instruments and booklets, and in the safety management systems for all applicable vessels.
M-17-055	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members to require that all watertight access doors and access hatch covers normally closed at sea be provided with open/close indicators both on the bridge and locally.
M-17-056	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members to require that on new and existing vessels, seawater supply piping below the waterline in all cargo holds be protected from impact.
M-17-057	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members to require that new cargo vessels be equipped with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.
M-17-058	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members to require that existing cargo vessels be retrofitted with bilge high-level alarms in all cargo holds that send audible and visible indication to a manned location.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-059	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members that any opening that must normally be kept open for the effective operation of the ship must also be considered a downflooding point, both in intact and damage stability regulations and in load line regulations under the International Convention on Load Lines.
M-17-060	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend to your members that existing cargo vessels be required to have damage control plans and booklets on board that meet current standards.
M-17-061	OAR		TO THE INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES: Recommend that your members require that damage control plans and booklets required by the International Convention for the Safety of Life at Sea be class-approved.
M-17-062	ORR		TO THE AMERICAN BUREAU OF SHIPPING: Enhance training of your surveyors to ensure that they are properly qualified and supported to perform effective, accurate, and transparent vessel surveys, meeting all statutory and regulatory requirements.
M-17-063	OAR		TO FURUNO ELECTRIC COMPANY, LTD.: Update your Global Maritime Distress and Safety System software to detect and correct user errors when entering ship positions using the global positioning system.
M-17-064	ORR		TO TOTE SERVICES: Establish standard operating procedures for heavy weather that address operational limitations and oil levels in critical machinery to ensure their continued operation.
M-17-065	ORR		TO TOTE SERVICES, INC.: Establish procedures for opening, closing, and logging all closures that make up a vessel's watertight envelope while the vessel is at sea.
M-17-066	ORR		TO TOTE SERVICES, INC.: Ensure that damage control plans and booklets are aboard all your load-lined vessels and that officers and crewmembers are trained in their use.
M-17-067	ORR		TO TOTE SERVICES, INC.: Require senior officers to receive formal training approved by the manufacturer in all functions found in installed stability programs, including damage stability modules.
M-17-068	ORR		TO TOTE SERVICES, INC.: Revise your safety management system and bridge resource management programs to contain detailed polices, instructions, procedures, and checklists to mitigate the risks of severe weather to your vessels.
M-17-069	ORR		TO TOTE SERVICES, INC.: Conduct an external audit, independent of your organization or class society, of your entire safety management system to ensure compliance with the International Safety Management code and correct noted deficiencies.
M-17-070	ORR		TO TOTE SERVICES, INC.: Require your vessels to be equipped with properly operating meteorological instruments, including functioning barometers, barographs, and anemometers.

El Faro Safety Recs Status (as of 18-May-2018)

(Wx Recs M-17-008 through M-17-017; Report Recs M-17-021 through M-17-073; NTSB Accident ID: DCA16MM001)

M-17-071	ORR		TO TOTE SERVICES, INC.: Institute a formal company process to provide independent weather routing, passage-planning assistance, and vessel position monitoring.
M-17-072	ORR		TO TOTE SERVICES, INC.: Provide formal and recurrent training to your deck officers on the public and commercial weather information systems provided on board each vessel to ensure that the officers are fully knowledgeable about all weather information sources at their disposal and understand the time delays in the information provided.
M-17-073	ORR		TO TOTE SERVICES, INC.: Provide shoreside management and vessel senior personnel with training in the Rapid Response Damage Assessment program and standard operating procedures, to include requirements to conduct annual drills and submit departure stability conditions for each vessel on each voyage.

Senator WICKER. Well, thank you to all members of the panel.

Dr. Dinh-Zarr, the report really points to human error on board the ship, is that correct?

Dr. DINH-ZARR. Yes, Chairman, Chairman Wicker. The report points that—to the fact that the captain did not use the most currently available weather information, and because of that, he made errors in not removing the ship from a course that led to this disaster.

Senator WICKER. He should have turned the ship in a different direction.

Dr. DINH-ZARR. Correct. He could have made a different route had he made the decision earlier. But once he had realized the situation, it was too late to avoid the hurricane.

Senator WICKER. Was there a minority view in that regard, or was this unanimous, that particular conclusion?

Dr. DINH-ZARR. Among the crew, sir?

Senator WICKER. No, on the Board, among the people who wrote the report.

Dr. DINH-ZARR. Oh, among—among our investigators, among the——

Senator WICKER. Yes.

Dr. DINH-ZARR. Yes, there was a—we analyzed the factual information. We reviewed many hours of the voyage data recorder, which showed the conversation of the crew, including the captain, who was part of the crew, and it was determined that——

Senator WICKER. The investigators were unanimous in this conclusion.

Dr. DINH-ZARR. That is correct.

Senator WICKER. And I think you said the—that this particular captain's training at Maine Maritime Academy could—if it had been—if he had been trained in the more modern procedures, a different conclusion might have been reached by the captain earlier on, is that correct?

Dr. DINH-ZARR. The captain was—obtained his initial credentialing before 1998, and they were not required to take an advanced meteorology course. And so our report found that perhaps had he been required to take that, he might have had more knowledge and been able to make a better decision. So one of our recommendations is actually to close that gap among those who did not receive that training who are still in service.

Senator WICKER. Are there people still out there who don't have that training——

Dr. DINH-ZARR. Yes, there are.

Senator WICKER.—as captains of ships? OK. Well, it's just an awful tragedy. And you hate to bring up these matters of human error, but we might as well talk about them.

Thank you all for your testimony.

Let me see. Admiral Fagan, let's talk about the national security cutters. Is that OK? We've got some in service that have yielded record results in drug interdiction, but I'm told the modernized versions of the cutters can do a lot more and help us in the subject matter that we're talking about today. So would you explain that to members of the Committee and to the public who are listening to us today?

Admiral FAGAN. Yes. Thank you, Mr. Chairman. The national security cutters are incredible, incredibly capable, new assets that we've been thankful for the support that we've been able to deploy into multimission sets, and you talked about the counternarcotic mission set. Specific to the topic at hand, the National Security Cutter JAMES was forward-deployed to provide secure interoperable communications and assist in bringing the whole-of-government response to the hurricanes. The JAMES was sailed—sailed to Puerto Rico, provided command and control and communications for the multitude of first responders and local responders that flowed into that event. It serves as an afloat command, known interoperable coms, it has exceptional capabilities with regard to just intelligence and other communicating, and was really a force multiplier and critical to the success——

Senator WICKER. When was it built, the JAMES? Do you know?

Admiral FAGAN. When—when was it built, sir?

Senator WICKER. Yes. How new is the——

Admiral FAGAN. It's a year, no more than 2 years. But it's—they're quite new, sir.

Senator WICKER. OK. And so how many of those are we going to have altogether? Can you tell us?

Admiral FAGAN. So the program of record was originally eight. We are—we currently again appreciate the support of Congress and our overseers, and look to be moving toward a tenth national security cutter, sir.

Senator WICKER. Thank you. And I'm going to go a minute or two over my time just to say this. Rear Admiral Gallaudet, thank you for your service. You mentioned your appreciation to Congress for helping with some deficiencies we previously had with funding. What department did this funding come through? Do you know?

Admiral GALLAUDET. Are you talking about the supplemental——

Senator WICKER. Yes.

Admiral GALLAUDET.—or the appropriations, sir?

Senator WICKER. Well, the appropriations.

Admiral GALLAUDET. Well, ours, of course, will be the Department of Commerce.

Senator WICKER. OK. You know, the point I want to make is sequestration had not only been devastating to DoD, but it had been devastating to programs like this, that really are also very much involved in the security of Americans, safety of Americans. And so I just wanted to—I wanted to drive that point home. Thank you for acknowledging that we did something that was much more ade-

quate to get the job done this year, but there is much in the so-called non-defense discretionary budget that has everything to do with making Americans safe abroad and making Americans safe at home. So thank you for making that point.

And I have filibustered—yes, you can—someone asked to be recognized? I have filibustered long enough that Senator Nelson has returned and can be recognized for the next question.

Senator NELSON. Thank you, Mr. Chairman. Both the Coast Guard and the National Transportation Safety Board have made a number of recommendations to address the *El Faro* sinking. Obviously, as I said earlier this morning, it traveled right into the path of an oncoming hurricane. From the recommendations, what do you believe are the most important issues to address? Any one of you.

Admiral GALLAUDET. I'll start off, Senator Nelson. Thank you for your question and your support of NOAA. As we discussed yesterday, part of it is improving our hurricane forecasts and our predictions of intensity and tracks, and we have been—we've made great strides, as I made—said in my opening statement, at NOAA and the National Weather Service in doing that. And I recall about our track accuracy being the most accurate for hurricane track forecasts by about 25 percent over the last 5 years.

So since the *El Faro* went down in 2015, we've really looked hard at our forecast—Hurricane Forecast Improvement Program, that is codified in the Weather Act, and we're going to continue to move forward and improve in that lane.

Senator NELSON. Ms. Dinh-Zarr, tell me, the problem with *El Faro,* as I understand your report, is that it didn't get the most up-to-date weather information, and it certainly didn't have the best safety equipment, which I guess would involve the Coast Guard. I mentioned earlier the enclosed lifeboats. They were not there. So what do you think?

Dr. DINH-ZARR. Thank you, Senator Nelson, for that question. Yes, one of our recommendations from the NTSB is that all lifeboats—all seafaring vessels of this size be equipped with enclosed lifeboats. These—the *El Faro* was 40 years old, and the lifeboats that were on it were already out of date as of 30 years prior. But because there was not regular review of that part of the vessel, they were not able to make use of the latest lifeboat equipment that was required by the Coast Guard.

Senator NELSON. Well, either you or Admiral Fagan, what about the fact that the *El Faro* was getting dated weather reports? They were not up-to-date reports. What do we do about that?

Admiral?

Admiral FAGAN. So thank you, Mr. Chairman. I would like to just compliment the NTSB with regard to how thorough and transparent the investigation into the *El Faro* was. It's certainly a tragedy for the families who lost—lost their family members.

The lifeboats on the *El Faro,* while dated, were in compliance with the regulation that applied to the vessel. Because of the age of the vessel, the lifeboats would have been grandfathered. Lifeboats are, as other safety equipment, are very much a part of the inspection and oversight that the Coast Guard oversees with regard to U.S. vessels.

The totality of the report and the recommendations, there are a number of key recommendations in the report. The Coast Guard and NTSB and others are taking that report seriously and moving to ensure that we've increased—we've implemented recommendations and then ensured safety for our dedicated mariners at sea.

Senator NELSON. What about the up-to-date? How are we going to ensure that ships that sail when there's a storm brewing are getting the up-to-date information, unlike the *El Faro,* which did not?

Dr. DINH-ZARR. May I, Senator Nelson?

Senator NELSON. Please.

Dr. DINH-ZARR. The information that the Captain—our investigation found that the Captain actually had the information when he set sail, and his decision was reasonable. Where the problem came into play was that as he was progressing, he was using a certain weather forecasting, the BVS, and it was several—it was hours behind, up to 6 hours behind. And the way it is transmitted is not done immediately. So we did make recommendations to encourage this type of weather forecasting to be transmitted in a more regular and timely manner.

I think that the important point here is that the Captain made a decision based on old weather information, and that's why he sailed into the path of the storm.

Senator NELSON. And the avoidance of that in the future is?

Dr. DINH-ZARR. To ensure that there is more timely and accurate weather information and that it's provided in a way that cannot be missed by the crew.

Senator NELSON. OK. Admiral Gallaudet, you are now getting the second jet that can fly above the hurricanes so that we can get more accurate data. NOAA didn't do that last year. The aging Gulfstream was grounded for emergency repairs, so we were able to get millions for the aircraft recapitalization in the omnibus appropriations to require a replacement and a backup. And so the question is, when are you getting this new jet now that the funds have been appropriated?

Admiral GALLAUDET. Well, thank you for your support, Senator Nelson. We're very excited to get that new aircraft aloft. We will be contracting or doing a request for proposals this year, and we'll be applying that 2018 money as quickly as we can.

Senator NELSON. Will it be in time for this hurricane season?

Admiral GALLAUDET. It might not be aloft by the hurricane season starts, but we think we can execute it sometime midcourse this year.

Senator NELSON. OK. The big boys usually come in August and September, so see if you can get it by then.

Admiral GALLAUDET. Yes, sir.

Senator NELSON. And when is NOAA going to release its spending plans for supplemental appropriations?

Admiral GALLAUDET. We have two in the works, sir. We have already completed both, one for fisheries disasters and one for the weather-related disasters and requirements to improve our forecasting. Both the weather-related pieces for $200 million is at OMB right now, and they're chewing through it. We hope that will be released in the next week or two to the Congress. And then the fisheries disaster spend plan is under review right now at the Depart-

ment of Commerce, and we are hopeful that that will be sent to OMB fairly soon, possibly next week.

Senator NELSON. Thank you.

Senator WICKER. Thank you.

Dr. Dinh-Zarr, just to see, make sure that Senator Nelson and I understand exactly the information, your report concluded that there was adequate information being made available to the captain, but he was really focused in on the wrong information. The SAT–C and the Weather Channel were giving information that was more accurate and more timely, is that correct?

Dr. DINH-ZARR. That is correct. The crew was looking at the SAT–C information. The captain was focused primarily on BVS, which was delayed. And the way it's transmitted to the captain, the BVS information was out of date by many hours by the time he received it. But the—in answer to Senator Nelson's question, when the captain left port, the information that he had, he made a reasonable decision based on the weather at that time to leave port.

Senator WICKER. Indeed. And are you saying there was a discussion onboard the ship among crewmembers and between them and the captain as to which service to be more mindful of?

Dr. DINH-ZARR. There was a discussion about the weather, sir, but the captain ultimately makes the decisions.

Senator WICKER. Crewmembers were recommending the SAT–C.

Dr. DINH-ZARR. They were asking the captain to make a decision about—or asked him whether the ship should be taking an alternate route.

Senator WICKER. But did they——

Dr. DINH-ZARR. I don't know if they were specific——

Senator WICKER. Did they mention that they were listening to other information?

Dr. DINH-ZARR. He—they did talk about other sources of information. I don't know if they said specifically the word "SAT–C" or the names of the sources.

Senator WICKER. OK. Well, thank you for——

Senator NELSON. That sounds like a communication problem between the captain and the crew. Is that what you thought, Ms. Dinh-Zarr?

Dr. DINH-ZARR. It's a choice of the crew to use different sources of information. And one of our recommendations is that because SAT–C comes directly to the bridge, the BVS information has to be e-mailed, and if you would like it more regularly, you have to make that request to have more rapid information, which the captain did not do. So, yes, there was a discrepancy in the type of weather information that they received, and when they communicated about it, the captain chose an alternate course.

Senator WICKER. Thank you very much.

Senator NELSON. I think that's tragic. I think that's just very tragic.

Senator WICKER. Senator Hassan.

STATEMENT OF HON. MAGGIE HASSAN,
U.S. SENATOR FROM NEW HAMPSHIRE

Senator HASSAN. Thank you very much, Mr. Chair and Ranking Member Nelson, for holding this hearing.

And thank you to all of the witnesses, not only for being here today, but for what you do for our country. We are very, very grateful.

I come from a state with a relatively short shoreline, approximately 18 miles, but it is used for a range of important and often competing interests, such as residential areas, agriculture, tourism, recreation, fisheries, and harbors. The need to both improve and conserve these areas is naturally high. With the increasing severity and number of storms, there's a growing consensus that climate change plays a pivotal role.

So, Admiral Gallaudet, I wanted to start with you. Have you been directed to eliminate or adjust the mention of climate change from reports? And do you believe climate change needs to be considered in hurricane preparedness?

Admiral GALLAUDET. Thank you, Senator Hassan, for your question and interest and support of NOAA. And I should mention that the University of New Hampshire is the world leader in hydrographic studies. And we have a great partnership with that institution, and I hope to be visiting sometime soon.

Senator HASSAN. Great.

Admiral GALLAUDET. Regarding climate change and direction to remove or eliminate mention of that, no, I've been given no such direction. And, in fact, I testified yesterday about the fact that I am working with the White House's Office of Science and Technology Policy, and they're supporting much of our Arctic-related research that is driven primarily by climate forcing and changes.

Senator HASSAN. And do you believe that climate change needs to be considered in hurricane preparedness?

Admiral GALLAUDET. Yes, sir—yes, ma'am. Pardon me.

Senator HASSAN. That's fine.

Admiral GALLAUDET. I do. I do. In fact, I have experience about this in the Navy——

Senator HASSAN. Yes.

Admiral GALLAUDET.—where I directed the Navy's Climate Change Task Force. And so—and we are continuing to do active climate research and climate support. If you go to *climate.gov,* you'll see, and *drought.gov,* that NOAA maintains a fairly robust climate services mission, and I do believe that needs to be factored into any kind of weather-related preparedness.

Senator HASSAN. Thank you. Along the same lines, as we think about the impact of climate change, what are some of the best practices for coastal cities to strengthen their infrastructure to combat these mounting risks?

Admiral GALLAUDET. There are a range of activities, and NOAA is involved in them. We work closely with communities for resilient type of efforts. I'll give you one example. It's not New Hampshire, but I happened to visit Bayou Dupont in Louisiana this last year, and this is a marsh that we restored that had been under water for 4 years. And so working with Louisiana, we diverted some of the sediment from the Mississippi, and I walked on this—I walked on this marsh at low tide and I didn't get wet. So that served as a very effective storm surge barrier during the hurricanes that hit the Gulf Coast this year.

Senator HASSAN. Excellent. So I wanted to give you the opportunity, too, just to let us know if there are Federal obstacles that may hinder your ability to prepare for and respond to challenges that our coastal communities are facing and their need to be resilient.

Admiral GALLAUDET. There are some obstacles, but we're overcoming them. For example, I think one of the administration's priorities is regulatory reform. And so, for example, permitting has been and Endangered Species Act consultation has always been very difficult for people on coasts who either want to develop or conduct resiliency type projects.

A case in point is Department of Energy's—Department of Energy—pardon me—Department of Interior and us, and we both—we both have recently—we are in the final stages of revising our joint regulations on the consultation of Sections 4 and 7 of the Endangered Species Act. It was difficult for any given customer, if you will, because we kind of had one interpretation, and Interior had another, and so it was sort of like in a computer, a do loop, where no one was ever getting work done.

Senator HASSAN. Yes.

Admiral GALLAUDET. We now are on the same page. I told my—the Deputy Secretary of Interior, we will have no daylight between our agencies, and that's what this new rule will effect.

Senator HASSAN. Excellent. Thank you for that. We will also give you an opportunity to elaborate if there are other things you think of on the record.

Rear Admiral Fagan, I wanted to ask you, the 2017 Atlantic hurricane season was by far the most expensive season on record with a preliminary total of over $206 billion in damages. It included 17 named storms and 10 hurricanes. We know how important it is to make critical investments in coastal- and ocean-observing infrastructure in order to protect our families and mariners, whether they're on land or sea.

The wind and wave observations that are conducted by the buoys off the New Hampshire coast help mariners know the conditions that they're going to face before they go out to sea. How important is ocean information in predicting hurricanes and other storms? And how does information from tools like buoys help you provide information to mariners and respond to emergencies?

Admiral FAGAN. Thank you, Senator. Predictive tools that allow mariners to manage risk and the environment that they're operating in are absolutely essential to the safety and well-being of our maritime commerce as it trades and applies to the waters of the United States. And, you know, the Coast Guard operates a navigation role in working with NOAA and others to ensure that we've got those best tools and information flows out there are, again, just absolutely critical to ensuring mariners have a safe experience at sea.

Senator HASSAN. Well, thank you.

And I appreciate the Chair letting me go over. I'll have some additional questions in follow up for you on the record.

Senator WICKER. Thank you very much, Senator Hassan.

Senator Peters.

STATEMENT OF HON. GARY PETERS,
U.S. SENATOR FROM MICHIGAN

Senator PETERS. Thank you, Chairman Wicker. And thank you for holding this hearing. I would like to thank both you and Ranking Member Nelson. Your states certainly have endured some pretty tough storms, and you both have been real leaders in trying to improve our preparedness and resilience to these storms, and I appreciate your leadership in that area.

Senator WICKER. Thank you.

Senator PETERS. And also to our witnesses, I would also like to thank you for your service and for your testimony today. And while today's hearing appropriately focuses on hurricane preparation, given that we're at the start of the season, the very same disaster response machinery from NOAA's scientific modeling to the Coast Guard's emergency authorities all too often must be employed to respond to human-caused risk and disasters as well, and, in particular, oil spills.

Rear Admiral Fagan, I'm going to ask you a few questions related to the Coast Guard's ongoing investigation and leadership of the unified command around a recent Straits of Mackinac oil spill that has many of us in my state very, very concerned. On April 1, a suspected vessel anchor-drag in the Straits of Mackinaw damaged two 138-kilovolt American Transmission Company cables and also dented the Line 5 pipeline owned and operated by Enbridge. Line 5, as you know, is an aging pipeline that would never be built today. The 65-year-old Line 5 is a major oil pipeline conveying upwards of a half a million barrels of oil per day through the Straits. It is known to be corroded and it has been previously compromised.

From a human health and ecological perspective, the rupture of this line would be absolutely catastrophic in the Great Lakes. Modeling from Michigan Tech and the University of Michigan, based on NOAA's data, shows the oil would quickly spread, given the swift currents in the Straits, and the harsh reality is that these waters are currently under one and a half feet of ice, rendering any kind of recovery efforts difficult at best. The waters of the Great Lakes also provide drinking water to over 40 million Americans and empower billions of economic revenue as well. So the threat of an oil spill from Line 5 is exactly why I have worked in this Committee with the help of my colleagues to pass some improved pipeline safety regulation, and we need to do more.

But just 3 weeks ago I met with Commander—Commandant Nominee Admiral Schultz in my office to press him on improving the Nation's freshwater oil spill response capabilities. I certainly stressed that it was a top priority of mine, and I asked for his personal commitment to focus on this issue as well.

So, Admiral Fagan, my question is, Under the current unified command that has been established for the Straits spill, the Coast Guard has informed our office that the State and PHMSA have decided to keep Enbridge Line 5 operational for now while the ongoing inspection of damage continues. Is that accurate?

Admiral FAGAN. I believe it is; yes, sir.

Senator PETERS. As the lead for the unified command, is the Coast Guard fully confident in the State and PHMSA's judgment that the pipeline presents no risk as a result of the recent breach?

Admiral FAGAN. So thank you, Senator. The pipeline oversight is in the State's and PHMSA's purview. You mentioned the ongoing investigation which the Coast Guard is conducting into the cause of the—the cause of the incident. Our role in the unified command, you know, focuses on the response and the oil spill, spill mitigation, to ensure that we've got appropriate entities and resources brought to bear in this spill and should other spills occur. The Coast Guard takes oil spill response, frankly, disaster or just response in general, quite seriously. We've got very extensive training, planning, exercising programs that are designed to ensure we've got the most effective means to support the state and other entities in a spill such as the dielectric spill that you're referring to, sir.

Senator PETERS. So you're the lead in the unified command. But, so please explain to me why the Coast Guard would defer to the State's judgment to reopen Line 5 in advance of any visual underwater inspection?

Admiral FAGAN. So, sir, I don't have specifics on what—what the—what information the Coast Guard has that they're using to make that determination in conjunction with PHMSA. I'm not privy to it. I'll have to get back to you, sir.

Senator PETERS. So we're 11 days into this investigation and we still don't have any visual confirmation of the damage, is that correct? Do you know?

Admiral FAGAN. I don't know, sir. I know visual verification is key in a response such as this. I'm certain the team is working to do that, but I don't know the timeframe that that's on, sir.

Senator PETERS. It would be my belief that the Coast Guard would want to know, is that correct? You'd want to know exactly what's happening? You will be responsible for coordinating a spill should it occur, and if there has been damage to this pipeline that leads to that spill, you're going to be intimately involved, I would hope——

Admiral FAGAN. Yes, sir, we——

Senator PETERS.—that the Coast Guard has been monitoring this closely. Is that accurate?

Admiral FAGAN. Yes, sir. A unified command is indication of how closely we are monitoring and how seriously we are taking the threat and concern with regard to a spill. Having situational awareness, eyes on-scene, are a key part. It's one of our main operating doctrine. Again, in this case, I just don't have the timeline or know what the challenge is or why that may not have happened at this point with regard to this particular incident, sir.

Senator PETERS. But someone at the Coast Guard would have that information?

Admiral FAGAN. Certainly, the local unified command, the local commander, who has purview over the spill, all of the resources that are brought to bear, would have that specific. I just don't have it, sir.

Senator PETERS. So I would like those answers today. Is it possible to get those today, those answers?

Admiral FAGAN. Yes, sir, we will. We will provide that to you, sir.

Senator PETERS. Because this has gone on for a number of days, and not to have visual inspections to have any kind of understanding of what happened and to be relying on the State and

PHMSA without knowing exactly what they have looked at I think is irresponsible, that we need to get to the bottom. I'm not saying you haven't done that, but I want to know whether or not that's occurred. We need to know.

A lot of people in Michigan are asking questions. Folks are very concerned. As you know, the Straits of Mackinac are vitally important, as I mentioned earlier in my comments. The amount of water that goes through there is equal to 10 times that of Niagara Falls, and it's right next to our number one tourist attraction, Mackinac Island. The economic environmental impact would be devastating.

So I'm going to be seeking another meeting with Admiral Schultz in the next few days. I also hope that we might have an oversight hearing of this. But I would certainly appreciate if the Coast Guard get back to my office as early as possible, by today at some point, so that we can get a full accounting of where we are. I'd appreciate that, Admiral.

Admiral FAGAN. Absolutely. Yes, sir; we will do that.

Senator PETERS. I appreciate it. Thank you.

Senator WICKER. Thank you very much, Senator Peters.

Senator Cantwell.

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

Senator CANTWELL. Thank you, Mr. Chairman, and thanks for holding this hearing today. I notice that we are not having a NOAA budget hearing this Congress, and so a lot of questions to ask. So I might have to file some for the record as it relates to various issues. Thank you for bringing up the discussion you and your colleague—did you want to say something?

Senator WICKER. No, no.

Senator CANTWELL. OK—you and your colleague on the *El Faro,* and I appreciate the questions being asked. I think it points to the fact that we need to make more investment in our weather information. No one should die because someone didn't read an e-mail. I have long thought that our investment from NOAA lags behind what we often get from our European counterparts. People will routinely on the news say, "Well, this is what we're predicting in the U.S., but here is what the European model predicts for the U.S." Why do they even comment on it? Because they think that we're further ahead.

So as weather changes, I want to make sure that we have the latest and greatest technology and that that technology is being deployed and used in a way that is cost effective. So I appreciate everyone's comments so far and questions on that. And I definitely think the fact that the NOAA budget would be cut from both the forecasting and the programming, and larger cuts on the weather data, is something that we need to revisit. It is very, very important that we keep moving forward on important technology information here.

Rear Admiral Gallaudet, I wanted to talk to you about the halibut fishery in Washington. A number of Tribes in the Pacific have sent letters to the Department of Commerce requesting a formal government-to-government consultation regarding halibut cuts. Are you aware of Executive Order 13175?

Admiral GALLAUDET. Yes, I am, Senator.

Senator CANTWELL. So you know that it means that you're supposed to have regular consultation with Tribes and collaboration with them on the Federal implications of policy.

Admiral GALLAUDET. Yes, I am. I'm well aware of that, Senator.

Senator CANTWELL. OK. So have you done that?

Admiral GALLAUDET. Well, I had a great discussion with Congressman Kilmer on this, and I've done quite a bit of homework. And here's the issue. Six of the seven Tribes for this Area 2A are the ones that requested formal consultation 2 weeks prior to the opening of the season. And as I looked into the matter, what they're concerned about is not allocation, but the catch limit that the Fisheries Management Council—or Commission—pardon me—the International Pacific Halibut Commission had proposed. And it's only 11 percent lower than the previous year. The science—the Commission report that they issued was recommending a 65 percent catch limit decrease. So I really feel the Commission is yielding quite a bit to the Tribes, and not—not—and that—this—if you——

Senator CANTWELL. I'm not interested in what you're saying. I'm interested in you complying by talking directly to the Tribes.

Admiral GALLAUDET. OK.

Senator CANTWELL. I'm interested——

Admiral GALLAUDET. In fact, we had consulted with them at least 18 times, not formally, prior to their letter. And the time—and the process is typically for the Tribes to ask for formal consultation after the November midyear meeting where we announce—propose the draft catch limits.

Senator CANTWELL. They've asked for consultation, correct?

Admiral GALLAUDET. They have.

Senator CANTWELL. OK. And you haven't met that yet.

Admiral GALLAUDET. We—we—they asked for formal consultation 2 weeks prior to the season, Senator, and we didn't want to have—we didn't want to delay opening the season. And so I fully welcome conducting formal consultation with them now for next year's season, 2018—or 2019, pardon me. We've communicated with them as often as they wanted to informally.

Senator CANTWELL. My guess is no. My guess is that didn't happen. Formally, you should have told them, "This is what we're proposing," and have that conversation. You're right, people want science to win the day and people want seasons to be open and based on science.

I think the issue here is you have to talk a lot sooner about your proposal and give people the ability—the one thing that holds the Northwest together, I guarantee you, is science. I guarantee you we don't agree on a lot of things, but out there, we agree on science, and people will live up to that science. So please make sure that you're living up to the Executive order on consultation.

Admiral GALLAUDET. Thank you, Senator. We are. I visited our science centers in your great state, and we certainly agree with you on that.

Senator CANTWELL. Thank you.

Can I ask, Rear Admiral Fagan, about derelict vessels and what more we need to do to coordinate with State and local governments

on removing of derelict vessels? I feel like we have a process, but yet at the same time, you have the authority to remove substantial oil spill risks from the vessels before it happens. And, you know, we have this "Davy Crockett" situation where spills continue to happen. So how do we prevent—how do we prevent that in derelict vessels? How do we get better coordination?

Admiral FAGAN. So derelict vessels that propose a risk of oil spills are—you know, the Coast Guard does have authority to remove that spill risk from the vessel. We are involved in the port communities where these vessels, you know, are found, and continue to collaborate and coordinate to ensure that that authority is initiated and acted on when appropriate with regard to oil spill risk.

Senator CANTWELL. And so who's in charge?

Admiral FAGAN. If it is a threat—if it's an oil spill threat from a derelict vessel, the Coast Guard oversees or works to mitigate the threat of the oil spill, but in a lot—it's very situational, dependent where the vessel is, but, again, the Coast Guard oversees the mitigation or elimination of the threat of a spill from a derelict vessel.

Senator CANTWELL. Well, in that instance, we had $22 million and took 10 months to clean up the spill. And so what I think we're looking for is, are we missing something here on the coordination between the State and local and Feds on how to respond and prioritize?

Admiral FAGAN. So the State, Federal, and local interplay and discussion are critical in oil spill mitigation. I know the area maritime committees and the forums there were used to bring all those key stakeholders together are very much alive and well and well collaborated and communicated in your state and in all of the states in the country, and it's that collaboration that brings the greatest strength to ensure that we're as effective and efficient in mitigating spill threat as possible.

Senator CANTWELL. Well, I think what we should do is go back and review the recommendations from the GAO report and think about better ways to improve coordination and timing.

So thank you, Mr. Chairman.

Senator WICKER. Thank you, Senator Cantwell.

Admiral Gallaudet, let me talk about my legislation that was enacted in 2012, the COASTAL Act, which dealt with the question of whether hurricane damage was caused by wind or water, whether it is, therefore, covered by wind insurance or flood insurance.

Storm data currently collected by NOAA, academic institutions, and private entities to allocate property damage following storms is the subject matter here. During the storm event model developed through my COASTAL Act, damage would be determined by its source and attributed to either wind or water peril. NOAA would certify the accuracy of its data and provide a highly detailed post-event assessment to the Secretary of Homeland Security for every named storm. The Secretary would then establish a formula to allocate losses, wind or water, for total-loss properties.

NOAA was kind enough to come forward and give some technical assistance regarding amendments to actually make this work when it's fully implemented. And so, as such, I have introduced S. 2242, the COASTAL Implementation Act of 2017.

Admiral Gallaudet, I hope this is something you've paid attention to.

Admiral GALLAUDET. Yes, sir.

Senator WICKER. And so, if you could, give us your take on whether this COASTAL Implementation Act would provide the necessary simple technical changes to actually make this work and accelerate the implementation.

Admiral GALLAUDET. Thank you, Mr. Chairman, I'd be happy to comment on that. And as you know, I very much applaud your intent to make it easier for Americans who have total losses of their homes to get the right answer in terms of the insurance claims, whether wind or water damage was the cause of loss of property.

You know, myself, I was one of those "just a slab" type of people after Hurricane Katrina, and so I think—I applaud your efforts and have been very happy that NOAA has contributed technical drafting assistance to your staff.

I think we're already underway in many things to implement the intent of that Act. We have updated what they call "vertical elevation models." We have established a protocol with the USGS and the Army Corps of Engineers on data collection so that we can all have, see, the same thing on our data bases, and there's not going to be confusion whenever given someone who suffers from damage is trying to make a claim. And so those databases are set.

The models for local area storm surge and wave inundation, we've advanced those.

And then, as required by the Act, there is also a named storm event model that we are developing and we'll be validating soon as well as a database for wind and water. And so we've made great strides already, and I believe—I have not reviewed the draft legislation, but I know our support to it has been such that, if passed, we'll be—we'll already have results underway to ensure that our data allows the Act to achieve its effect.

Senator WICKER. Thank you very much.

Now, are there certain words I have to say to close this hearing out? How long are we supposed to leave the——

VOICE. Two weeks for questions.

Senator WICKER. We're going to leave—we're going to allow members two weeks to submit questions for the record.

And unless my expert staff tells me to say something else, I think we can——

VOICE. "This hearing is adjourned."

Senator WICKER. Oh, OK. I'm advised that I should announce that the hearing is adjourned. Thank you very much.

[Whereupon, at 11:49 a.m., the hearing was adjourned.]

A P P E N D I X

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. ROGER F. WICKER TO RDML TIMOTHY GALLAUDET

Question 1. How vital is the U.S. Integrated Ocean Observing System (IOOS) for obtaining accurate forecasts? What is NOAA doing to enhance IOOS and its observing capacities to improve forecasts for storms? After a hurricane, does NOAA have the ability to quickly replace lost or damaged IOOS assets?

Answer. The U.S. Integrated Ocean Observing System (IOOS) is essential for providing real-time and historic physical oceanographic data to inform weather forecasts. As a national-regional partnership, U.S. IOOS works to provide new tools and forecasts to improve safety, enhance the economy, and protect our environment. Easier and better access to this information is improving our ability to understand and predict coastal events—such as storms, wave heights, and sea level change. For example, U.S. IOOS partners with the National Weather Service (NWS) to make surface current data from High Frequency radars accessible through the NWS Advanced Weather Interactive Processing System (AWIPS) and National Centers for Environmental Prediction data tanks to inform forecasts.

NOAA enhancing IOOS

With FY18 funding and hurricane supplemental funding, the U.S. IOOS program is working with NOAA and regional partners to deploy additional gliders in the Atlantic to improve hurricane forecasting. U.S. IOOS also is working with the National Data Buoy Center to make glider data more accessible so that they can be used to validate forecasting models. Finally, U.S. IOOS is working with Navy to facilitate sharing glider data from their unclassified deployments around the coastal United States. This would substantially increase the amount of subsurface glider data available to the NWS for use in its forecasting models.

Post-storm recovery

U.S. IOOS constantly monitors observing assets; before storms, to the extent it is safe to do so during storms, and after storms. The Regional Associations leverage resources to the greatest extent possible to maintain the services their stakeholders rely on.

U.S. IOOS is preparing a report to Congress pursuant to Departments of Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2018 Senate Report (115–139) accompanying the Consolidated Appropriations Act, 2018 (P.L. 115–141) that assesses the regional spending practices for resources that became damaged or unworkable, as a result of hurricanes of other significant storms, using a cost-benefit analysis. This report will provide a better understanding of the U.S. IOOS regional component's contribution, laying out the value chain of observations in storm forecasting, providing an analysis of asset maintenance/protection practices across the U.S. IOOS regions and examples of how the Nation benefits by this information.

Question 2. With an authorizing provision enacted in the FY18 budget along with appropriations to support it, what is NOAA's strategy for recapitalizing and acquiring a backup Hurricane Hunter aircraft, as per the Congressional intent?

Answer. NOAA is developing a plan to acquire an aircraft to supplement our current hurricane surveillance capabilities. Upon approval of that plan, NOAA will follow the Federal acquisition process to acquire a new high-altitude aircraft to meet the requirements of the Weather Research and Forecasting Innovation Act of 2017.

Question 3. How important is the need for more research using supercomputing for protecting our coastal communities and improving our future storm resiliency, and how important are university partnerships for advancing this technology and creating new developments?

Answer. NOAA relies on High Performance Computing (HPC) to meet its mission and drives its innovation. NOAA's work is highly sophisticated and resource-intensive because it includes the complex interactions of the atmosphere, ocean, land sur-

face, cryosphere, chemically active atmospheric constituents, biogeochemical cycles on land and in the ocean, and terrestrial and oceanic ecosystems. The applications must address local to global spatial scales and timescales from seconds to centuries.

NOAA's mission requirements will continue to require additional HPC research and capacity. Higher resolution and more complex models that capture the realism of the Earth System combined with the use of ensembles (a set of computer models working together) will require significantly enhanced HPC capabilities. These capabilities will also require new approaches in data management, transmission, and storage.

University partnerships have proven valuable to NOAA in the past as a source of HPC innovation and skill. NOAA received $15 million above the President's budget request for HPC resources in FY18. NOAA will make those funds available to university partners through a follow-on grant to the Northern Gulf Institute (NGI) in Mississippi. This will provide HPC capacity to run larger, more complex, and more detailed environmental models, while advancing the historical and ongoing relationships between NGI scientists and personnel in NOAA Labs and other Cooperative Institutes.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DAN SULLIVAN TO RDML TIMOTHY GALLAUDET

Question 1. Is NWS going to stop reporting the weather via weather radio?

Answer. The NWS has no plans to stop any NOAA Weather Radio All-Hazards (NWR) broadcasts, which provides Very High Frequency broadcasts to Alaskan communities. These broadcasts will continue to provide continuous 24x7 forecasts, warnings, and observations. In October 2017, two additional transmitters were installed, in partnership with U.S. Coast Guard (USCG), for expanded NWR coverage of the Duffield Peninsula and Middle Cape in Alaska. However, the NWS did stop providing High Frequency broadcasts in November 2017 because this service was redundant to the service already provided by the USCG. The USCG broadcasts NWS weather information on High Frequency radio to meet the United States' obligation under the Safety of Life at Sea Convention.

Question 2. If so, what is the rationale associated with this decision, and what will replace this service? Does this decision take into account that in remote and rural areas of Alaska—where many Alaskans live and subsistence hunt—there is no access to broadband and alternative sources of weather information, and residents depend on the weather reports to know when it is safe to travel?

Answer. The NWS will continue to provide weather information via the NWR, which provides Very High Frequency broadcasts to Alaskan communities. As stated above, the NWS did stop providing High Frequency radio broadcasts in November 2017 because it was a redundant service duplicating the High Frequency broadcasts from the USCG.

Question 3. My office understands that NWS removed all of the associated equipment for weather radio broadcasts in the Fall of 2017. What is the status of these radio reports and the capability for the reports to be reinstated?

Answer. There have been no removals of NWR transmitter sites in Alaska. As stated above, there have been two additional NWR sites added, in partnership with USCG, for expanded coverage of the Duffield Peninsula and Middle Cape. There is a total of 52 NWR transmitters in Alaska. The equipment in question serves High Frequency weather broadcasts. The NWS High Frequency broadcast was a redundant service duplicating the High Frequency broadcasts from the USCG.

Question 4. Does the National Weather Service plan on consolidating its Tsunami Warning Centers in Hawaii and Alaska? If so, where and how would this occur?

Answer. The NWS does not plan to consolidate the Tsunami Warning Centers in FY18, in accordance with Congressional direction. The President's FY19 Budget prioritizes rebuilding the military and making critical investments in the Nation's security. It also identifies savings and efficiencies needed to keep the Nation on a responsible fiscal path. To meet these goals, some difficult decisions needed to be made, including a reduction to the Tsunami Warning Program. However, NOAA would continue to fund critical tsunami program components to ensure high-quality tsunami watches, warnings, and advisories. Should the FY19 proposal be approved, NOAA would seek to merge the Tsunami Warning Centers or co-locate them with other institutions/centers.

Question 5. Alaska has very localized weather systems. How does an auto-launcher, or remotely monitored video device effect NWS' ability to deliver accurate, up-to-date weather information for all rural Alaskans? How does this benefit an Alas-

kan bush pilot's ability to get critically important, area accurate weather information when flying into a remote airport with no one on the ground?

Answer. Autolaunchers will not degrade NOAA services in Alaska. To the contrary, autolaunchers would allow NWS to improve our science and service delivery to the whole state. In fact, autolaunchers are a proven technology used at more than 70 locations around the world over the last 10–15 years. It uses the same sensors used in manual launches. Initial assessments done through a demonstration project in Kodiak and Fairbanks, Alaska are showing launch success rates on par with manual launches. If fully implemented, autolaunchers would improve launch success rates. Harsh conditions and vast distances between sites make manual radiosonde releases particularly difficult and time-consuming in Alaska.

Question 6. What is NWS doing to alleviate the 30 percent staffing shortage in rural Alaska? And is it true that many of these positions have been downgraded from GS–10 positions to GS–7 thus making it all the more difficult to attract applicants to these rural areas?

Answer. As of June 4, 2018, there were eight Weather Service Offices (WSO) across rural Alaska with staffing deficiencies (*i.e.,* offices with empty billets that the region does not have sufficient personnel available to temporarily detail qualified employees into). Assuming no additional attrition occurs prior to summer's end, staffing deficiencies at each of the eight WSOs will be resolved via a combination of hiring actions and the demonstration project automation of weather balloon launches at five of the 11 WSO locations. Automation of weather balloon launches would allow for the reallocation of mobile meteorological technicians that were hired explicitly to allow the NWS to fill staffing gaps frequently experienced in rural Alaska. Reallocation would provide greater opportunities for these employees and allow them to be employed to provide enhanced services to customers in Alaska.

Due to advances in technology and science, the major duties and responsibilities at rural Alaska WSO locations have changed dramatically over the past five years. As a result, NOAA Workforce Management reclassified WSO positions to appropriately reflect current duties and responsibilities. For Meteorological Technicians hired after May 2015, NOAA Workforce Management reduced the grade of those positions from GS–10 to GS–7 pay plus Cost-of-Living Adjustment and Locality Pay.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. BILL NELSON TO RDML TIMOTHY GALLAUDET

Forecasting Hurricanes

Significant advances in hurricane forecasting in recent decades allowed for a state of emergency to be declared in Florida a record six days before landfall of Hurricane Irma. But accurately forecasting hurricane intensity remains a challenge. One of my priorities, along with Senator Rubio, in the 2017 Weather Act was to direct NOAA to improve hurricane forecasting including the prediction of rapid intensification and track of hurricanes.

Question 1. How is the NOAA budget reflective of the need to improve hurricane tracking and intensity forecasts? Can you specifically give us an update on progress regarding breakthrough hurricane tracking technologies like Airborne Phased Array Radar (APAR), and is it possible to find more resources in the future to support this critical initiative?

Answer. The President's FY 2019 budget request prioritizes reducing the impacts of extreme weather and water events. This budget includes providing the observational infrastructure and personnel to develop timely and accurate weather forecasts. The budget would also invest more than $1.1 billion in weather forecasting capabilities, including an increase to the Advanced Weather Interactive Processing System, which is the cornerstone of our field operations at the National Weather Service. Finally, this budget would invest $878 million in our polar orbiting satellites, and $408 million in our geostationary weather satellites that are essential for our weather forecasts and warnings. Furthermore, using FY 2018 Supplemental Appropriations for Disaster Relief, NOAA will support activities to move toward meeting the goals of the next generation Hurricane Forecast Improvement Program (HFIP).

In FY18 and FY19 NOAA will continue to partner with the National Science Foundation to advance the understanding of high-impact weather events by supporting the development of an Airborne Phased Array Radar (APAR). APAR is being developed to study weather and related hazards, especially over rugged terrain or the open ocean, where ground-based radars can have major limitations. Because APAR will gather much-improved observations of dynamics and microphysics from

within storms, its development holds the potential to make significant improvements in understanding, tracking, and forecasting many types of high impact weather. The development of this technology is supported jointly through NSF base funding and NOAA grant funding provided to the National Center for Atmospheric Research Earth Observing Laboratory. The currently funded APAR project has focused on critical tasks that will have major positive impacts on clarifying radar system design and reducing key risk factors already identified in the development. One significant deliverable will be the design and implementation of the 64-element Line Replaceable Units (LRUs) demonstrator that will serve as the heart of the eventual fast scanning radar array. Given the unique operating environment, another key deliverable is the suite of studies that will assess the vibrations that the APAR will be subjected to in flight on the C–130 aircraft.

Question 2. The Weather Act of 2017 also contained an April 18, 2018 deadline for NOAA to submit a plan to implement the Hurricane Forecast Improvement Program. Will NOAA meet that deadline?

Answer. The Weather Act requires development of a project plan for the Hurricane Forecast Improvement Program (HFIP), with focus on improving prediction of rapid intensification and track of hurricanes, forecast and communication of storm surges, and incorporating risk communication research. NOAA did not meet the deadline, but the plan has been drafted and is in the clearance process. Extensive planning and coordination with the HFIP community was conducted to update the program plan, while remaining consistent with goals outlined in previously developed HFIP plan. A preliminary strategic plan was shared at the Annual HFIP Community Workshop in November 2017. Community feedback was collected through December 2017.

Hurricane Hunter

I helped secure a requirement in the Weather Act that NOAA maintain reliable backup capabilities for its Hurricane Hunters—both the P3 and the jet. NOAA didn't do that last year, and the aging Gulfstream was frighteningly grounded for emergency repairs on several occasions. So I worked to secure $133 million for aircraft recapitalization in the FY 18 omnibus spending bill, including $121 million to acquire a replacement and backup for NOAA's aging Gulfstream-IV hurricane hunter jet, which is over 20 years old.

Question 3. How will having two hurricane hunter jets improve forecasting capabilities?

Answer. Two Hurricane Hunter jets provide redundancy and reliability necessary to ensure critical hurricane data collection and mission accomplishment. Pending the availability of funding for operating and maintaining the second hurricane hunter jet, two high altitude jet aircraft could also enable NOAA to increase the sampling of storms both temporally and spatially, leading to improved track and intensity forecasts.

GPRSO Gap

At this past year's American Meteorological Society meeting in Austin, TX, the head of the NOAA satellites office, Dr. Stephen Volz, told colleagues that private sector GPS Radio Occultation data was not of sufficient quality to go into NOAA's weather models. He said this after he had cancelled NOAA's participation in the deployment of the polar constellation that would have provided data over the United States—called COSMIC 2B. He was then asked what NOAA's plan was to address the "GPSRO gap," to which he had no answer. And the Weather Act required NOAA to complete this important mission.

Question 4. Does NOAA have a plan to close the GPSRO gap and if not, when will you have a plan?

Answer. NOAA is actively working with its interagency partners, the international community, and the commercial sector to source radio occultation (RO) data sets needed to meet the National Weather Service numerical weather prediction modelling requirements. Furthermore, NOAA is also assessing the feasibility of RO payloads as part of future NOAA satellite constellations.

Weather Forecasting

The Weather Act is also intended to help restore and maintain U.S. leadership in numerical weather prediction and forecasting. But in 2017 the U.S. model did not fare as well against the European model in predicting Irma's track.

Question 5. What areas will you be focusing on in this regard when it comes to improving hurricane prediction? Are you considering re-organizing NOAA research's approach and bringing in more extramural partners to improve hurricane forecasts by creating a "European-like" approach?

Answer. NOAA is implementing the Next Generation Global Prediction System (NGGPS), based on the finite volume cubed sphere dynamical core (FV3), which was developed at NOAA's Geophysical Fluid Dynamics Laboratory and selected via open competition. The FV3 is designed to upgrade the current operational Global Forecast System (GFS) to run as a unified, fully-coupled system in NOAA's Environmental Modeling System infrastructure. With this decision, NOAA has changed the way it develops and improves the weather forecasting computer models by actively involving not only NOAA research efforts, but leveraging the full research community—other Federal agencies, universities, and the private sector, in building the Unified Forecast System under NGGPS. Experimental runs with a new version of the GFS developed under this program using FV3 dynamic core have been promising, and provided track forecasts for Hurricane Maria that performed better than the European model. NOAA will continue to improve the representation of physical processes in the model as well as operational data assimilation and data processing system to provide more quality controlled observations to be used by the forecast models. We believe this approach will lead to further integration of extramural research partners' efforts.

The Weather Act of 2017 also directs the NWS to improve risk communication research to create more effective watch and warning products.

Question 6. Has the National Weather Service provided improved watch and warning products, and how will these products be used in the upcoming hurricane season?

Answer. NWS continues to work with social, behavioral and economic scientists to refine our communication approach for all NWS products. For the hurricane program, there are new operational products that directly address improved communication of the storm surge threat. These products include the Potential Storm Surge Flooding map and the Storm Surge Watch and Warning products. These products help to more effectively communicate the potential impact from storm surge, and we believe had a very positive impact on reducing the loss of life during both the 2017 hurricane season as well as the ongoing 2018 hurricane season. By request, NWS provided an update briefing on our work in this area to Committee staff on June 27. We will continue to keep the Committee updated as we implement these provisions of the Weather Act.

Public Consumption of Warnings

Research by Baker and Lindell has shown that most people get their news about hurricanes and other weather emergencies from local news sources as opposed to national services like the NWS.

Question 7. What is NOAA doing to work with local meteorologists and emergency officials to ensure accurate and timely warnings be issued?

Answer. The NWS provides test guidance and participates in numerous state hurricane table top exercises annually. These exercises are important training for decision makers and provide them a preview of improvements to NWS tropical products and services for the upcoming hurricane season. The NWS was also engaged in the planning and execution of the FEMA National Level Exercise which was focused on a tropical cyclone landfall scenario for 2018.

In addition, as codified in the Weather Act, there are Warning Coordination Meteorologists in every NWS Weather Forecast Office. These individuals reach out to the local media and emergency managers to improve message communication. Building these relationships is key to the successful communication of potentially life-saving watches and warnings.

National Weather Service

The dedicated employees of the National Weather Service provided quality forecasts and decision support services during the hurricanes and wildfires of 2017. And yet, the Administration's Fiscal Year 2019 Budget dangerously proposes slashing positions at the agency.

Question 8. What is the reasoning behind the proposed cuts to the NWS staff positions and how does the NWS plan to continue delivering quality and timely forecasts and services?

Answer. The funding levels provided in the 2018 Consolidated Appropriations Act did not require cuts in NWS staff positions.

Climate Change and Hurricanes

Science shows there are links between global warming and increased storm intensity.

Question 9. How does a warming climate affect hurricanes and what can we expect future seasons to look like?

Answer. There have been several studies and reports that have assessed the impact of a warming climate on hurricanes, including the United Nations' Intergovernmental Panel on Climate Change Assessment Report Five (2013) as well as Chapter 9 of the U.S. Global Change Research Program's Climate Science Special Report (2017).

Florida is ground zero for the impacts of climate change such as sea level rise.

Question 10. You assured me during your confirmation process that you would take any effort to politically interfere with NOAA scientists seriously. Since you've been at NOAA, what steps are you taking to make sure the employees know they can continue their work free from censorship or undue pressure?

Answer. I am committed to promoting scientific integrity within NOAA. NOAA already has a strong Scientific Integrity Policy (NOAA Administrative Order NAO 202–735D) that provides best practices to promote a continuing culture of scientific excellence and integrity.

Disaster Supplemental Funds

In October 2017, I joined the Florida delegation in a bipartisan, bicameral letter to the House and Senate Appropriations Committee leadership requesting $27 billion in emergency funding following Hurricanes Irma and Maria to address the significant impact that the hurricanes left on our Nation. The Supplemental Appropriations for Disaster Relief and Recovery provided $200 million for fishery disasters, $18 million for NOAA marine debris removal, and $40 million for mapping and charting at NOAA.

Question 11. When is NOAA going to release its spend plans for supplemental appropriations?

Answer. DOC provided the spend plan for supplemental funding within the Bipartisan Budget Act of 2018 for Hurricanes Harvey, Irma, and Maria to appropriations staff for non-fishery disaster funding on April 20, 2018, and the fishery disaster allocation plan on May 10, 2018.

Question 12. How is NOAA going to use the $200 million appropriated for the declared fisheries disasters? More than a dozen declared fishery disasters qualify for the supplemental funding.

Answer. DOC provided the fishery disaster allocation plan to appropriations staff on May 10, 2018. The plan includes funding for all fishery disasters declared by the Secretary of Commerce in calendar year 2017 and for fishery disasters declared in Florida, U.S. Virgin Islands, Puerto Rico, and Texas resulting from Hurricanes Maria, Irma, and Harvey. NOAA is working expeditiously with the constituents to develop detailed proposals tailored to priority needs in accordance with the Magnuson Stevens Fishery Conservation and Management Act and the Interjurisdictional Fisheries Act.

Question 13. How does NOAA plan to use the disaster supplemental funds for marine debris removal?

Answer. The NOAA Marine Debris Program will work with partners to identify marine debris hot-spots through assessment of debris abundance and distribution using satellite and airborne imagery, sonar, and partner agency reports. NOAA will use spatial data portals, in person meetings and local partner engagement to prioritize objects for removal. NOAA will provide staff support to assist with assessment, removal, disposal and environmental compliance. NOAA will ensure agencies and groups conducting removal operations have access to the most up-to-date locations, descriptions and priority of debris objects. Finally, to the extent feasible, the NOAA Marine Debris Program will fund marine debris removal and disposal activities through cooperative agreements with state partners. These funds will fill an important niche for restoring economic activities and protecting economically significant natural resources where other funds, such as FEMA disaster assistance, have not been available for debris removal.

Coastal Resilience

Florida has natural defenses against hurricane damage, including mangroves and coral reefs, which significantly reduce storm surge and wave action from hurricanes. Florida has the third largest barrier reef in the world, but it is facing significant threats: warming waters, bleaching, climate change, and coral disease.

Question 14. How can NOAA help to build resiliency of natural systems like beaches, coral reefs, and mangroves as well as coastlines and coastal communities?

Answer. NOAA is taking a comprehensive approach to strengthen the Nation's coastal communities, ecosystems, and economies to minimize current and future im-

pacts from natural hazards. NOAA provides funding and technical assistance to implement coastal resilience and habitat restoration projects that reduce the vulnerability of coastal communities and infrastructure from the impacts of extreme weather events, climate hazards, and changing ocean conditions. NOAA helps identify sites where restoration of coral reef, mangroves, beaches, and marshes can be successful and where options that integrate hybrid natural and build infrastructure may be required in order to offer protection. NOAA also offers opportunities for planners and decision-makers to connect with natural infrastructure experts, learn about different types of natural infrastructure projects Finally, NOAA supports state planning, policies, and trainings to minimize risks from coastal hazards such as storms, flooding, erosion, and sea level rise. For example, through the Digital Coast, users have access to a range of data and decision-support tools, such as the Coastal Flood Exposure Mapper and the Sea Level Rise Viewer, and trainings, such as those focused on adaptation planning.

Proposed Offshore Oil Drilling

As you know, the Gulf Coast of Florida is off limits to oil drilling by law. And there are good reasons not to drill in the Florida Straits and the Atlantic Coast, too. You've got the Florida Keys National Marine Sanctuary, NASA launches, DOD launches, threatened and endangered corals, manatees, and sea turtles, not to mention the calving grounds of the critically endangered North Atlantic Right Whale.

Question 15. Can I have your word that you will act in the best interest of the resources in NOAA's trust in considering proposals by this Administration to ease restrictions on offshore drilling?

Answer. Our country has a strong record of facilitating offshore energy development while ensuring sustainable populations of marine life. I assure you that NOAA will continue to fulfill its legal obligations with respect to all its statutory authorities while continuing to facilitate offshore energy development and maintain marine life.

El Faro Recommendations

Both the Coast Guard and the National Transportation Safety Board have made a number of recommendations to address the El Faro cargo ship, which sunk after traveling into the path of Hurricane Joaquin.

Question 16. From the recommendations, what do you believe are the most important issues to address?

Answer. The NWS is working closely with the National Transportation Safety Board (NTSB) and the U.S. Coast Guard (USCG) on the safety recommendations in the aftermath of the *El Faro* incident. NWS staff met with NTSB principals on May 24, 2018, and discussed some of the most important safety improvements which include increasing the number of hurricane advisories when forecasts significantly deviate from predicted track or intensity—and to make these products available via satellite communications for ocean going vessels. Status on the progress on recommendations can be found at the NTSB site: *https://www.ntsb.gov/investigations/Pages/2015_elfaro_jax.aspx.*

Question 17. How can we make sure that all vessels are getting the most up-to-date weather information and have the best safety equipment—like enclosed lifeboats—onboard?

Answer. International standards and requirements exist for shipboard communications equipment [1] to ensure the receipt of weather warning and forecast text bulletins from authoritative sources. The NWS contributes to maritime safety by providing the authoritative weather warnings and forecasts for the western North Atlantic and eastern and central North Pacific. Text warning bulletins are supplemented with graphical and digital products. In addition to preparing graphical charts for USCG weather radiofacsimile broadcasts, NOAA is working with international partners to develop the standards for the display of critical weather information in shipboard Electronic Chart Display and Information System (ECDIS).

Timing to Complete Recommendations

The NTSB made dozens of recommendations to the Coast Guard and NOAA.

Question 18. Which of those recommendations have been completed? What is your plan to make sure all of the recommendations are completed?

Answer. NWS staff met with the NTSB *El Faro* investigation team at NTSB HQ on May 24, 2018. All of the *El Faro* safety recommendations were reviewed.

[1] Safety of Life at Sea (SOLAS) Chapter IV, Regulation 7—Radio equipment: General—.4 and .5 and SOLAS Chapter V, Regulation 5—Meteorological Services and Warnings 2.1 and 2.2.

Progress on all recommendations can be viewed at *https://www.ntsb.gov/investigations/Pages/2015_elfaro_jax.aspx.*

NWS has concurred and is implementing recommendations M–17–12, 13, 16 and 52. The remainder of the recommendations will be implemented during the 2018 and 2019 hurricane seasons. One exception includes M–17–008 and 009, which involves improving model predictions of hurricane intensity and track. These NTSB recommendations have been specifically included in the Hurricane Forecast Improvement Project implementation plan.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. RICHARD BLUMENTHAL TO RDML TIMOTHY GALLAUDET

As you know, on March 23, 2018, the President signed into law omnibus appropriations legislation for Fiscal Year 2018, securing vital funding for NOAA, U.S. Coast Guard, and NTSB.

Reports have shown President Trump and congressional leaders have discussed legislation to give rescission authority to the president for investments included in the omnibus. These rescissions would create tremendous financial uncertainty for programs dedicated for safeguarding our coasts, bodies of water, and transportation systems. Even the threat of rescissions are enough to disrupt efforts to carry out Agency directives.

The power to propose budget rescissions is essentially the power to conduct line-item vetoes, an act deemed unconstitutional in 1998. Attempting a do-over on the Fiscal Year 2018 omnibus should not be prioritized over more pressing matters.

Question 1. Has the White House contacted you about a rescission package?

Answer. The Administration continues to explore its rescissions authority under the Impoundment Control Act of 1974 (ICA) to see what can be done to control unnecessary and wasteful spending. NOAA has been informed by the Office of Management and Budget that a rescission package could include NOAA programs.

Question 2. Has anyone at your Agency contemplated what a rescission would look like for your Agency?

Answer. The impacts of a rescission would be highly variable depending on the programs and expiration dates of the affected funds.

NOAA is critical in the response and recovery of hurricane disasters. Yet, the President's Fiscal Year 2019 budget proposes to cut NOAA funding by more than one billion dollars. Two important programs on the chopping block include grants for coastal zone management and grants for coastal resilience, both critical for development of adaptation strategies and bolstering hurricane resiliency.

Additional cuts include programs that support forecasting and observation technology. Cuts to these programs will decrease accuracy of hurricane path prediction and potential flooding impacts caused by storm surge.

In other words, it will now be even harder to predict and protect the Nation from catastrophic hurricane damage.

There has been great advancement in the technology used in predicting and tracking hurricanes, and I am concerned that these cuts may halt additional progress.

Question 3. Would you agree that bad forecasts cost us far more than investments these programs require?

Answer. NOAA does not provide "bad" forecasts. The NWS uses the best, most actionable data and information to generate the most accurate, consistent weather forecasts possible. The President's FY 2019 Budget provided adequate funding to ensure that that the NWS' forecasts would not be impacted and the 2018 Consolidated Appropriations Act provided further funding to ensure the continued excellence of NWS forecasts.

Question 4. Do these proposed cuts harm the Nation's ability to be hurricane-ready?

Answer. There are many aspects for the public to be hurricane-ready. Each year NOAA conducts extensive public outreach and education to ensure that people are aware of the potential impact of hurricanes and tropical systems and that they know how to respond and take action, should a storm be headed their way. We do not expect an impact to this effort.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. EDWARD MARKEY TO RDML TIMOTHY GALLAUDET

According to hazard mitigation experts, every single dollar invested in pre-disaster resilience saves $4 in rebuilding costs in the aftermath of a storm. It is clear that we need to rebuild smarter, stronger, and better equipped to adapt to the demands of a changing climate.

Question 1. How can NOAA help local and state planners invest in pre-disaster resilience?

Answer. NOAA appropriations support several programs to assist local and state planners with pre-disaster planning. For example, NOAA provides comprehensive evaluation mapping data, observations, modeling, and prediction services for communities to conduct pre-disaster planning. By maintaining these historical data sets, NOAA is able to advise planners about environmental trends and impacts of hazard mitigation efforts. Through the NOAA's Digital Coast, planners have access to a range of data and decision-support tools, such as the Coastal Flood Exposure Mapper which creates user-defined maps to show the people, places and natural resources exposed to coastal flooding, and Coastal County Snapshots, which provide easy to understand charts and graphs to understand flood exposure at the county level.

Question 2. Could an interagency oversight council help NOAA and the Federal government be more prepared and resilient for the next natural disaster? How?

Answer. The National Planning Frameworks under FEMA's National Preparedness System are existing interagency forums to help NOAA and the Federal government be more prepared and resilient for the next natural disaster. Specifically, the National Mitigation Framework and National Disaster Recovery Framework establish a common platform and forum for federal, state, and local agencies, plus private sector organizations, to coordinate delivery of mitigation and recovery capabilities.

Question 3. What percentage of the Promote and Develop Fisheries Product Account was directed towards the Operations, Research and Facilities Account? Please describe how these monies are used, and include a list of all specific programs and amounts allocated to each.

Answer. The Congressionally directed $144 million transfer to the Operations, Research, and Facilities (ORF) account is approximately 93 percent of the $155 million available from the transfer from the Department of Agriculture into the NOAA Promote and Develop Fisheries Account (P&D). NOAA will use the funds transferred to ORF in accordance with the Consolidated Appropriations Act, 2018 (Public Law 115–141) language:

> "Provided further, that in addition, $144,000,000 shall be derived by transfer from the fund entitled "Promote and Develop Fishery Products and Research Pertaining to American Fisheries," which shall only be used for fishery activities related to the Saltonstall-Kennedy Grant Program, Cooperative Research, Annual Stock Assessments, Survey and Monitoring Projects, Interjurisdictional Fisheries Grants, and Fish Information Networks. . ."

NMFS will use $141.0 million to support Fisheries Data Collections, Surveys, and Assessments. Funding within this budget line includes Expand Annual Stock Assessments, Fisheries Statistics, Fish Information Networks, Survey and Monitoring Projects, and Cooperative Research. Funds support data collection, data management, and fisheries stock assessment production. NMFS will use $3.0 million for Interjurisdictional Fisheries Grants, a formula-based financial assistance program provided to coastal states to support science and management of interjurisdictional fisheries resources.

Question 4. What percentage of the Promote and Develop Fisheries Product Account was directed towards the Saltonstall-Kennedy Grant Program?

Answer. After the Congressionally directed $144 million is transferred to the Operations, Research and Facilities Account, the remaining funds of approximately $10.7 million, will be available for the Saltonstall-Kennedy Grant Program.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. CATHERINE CORTEZ MASTO TO RDML TIMOTHY GALLAUDET

Issues with Health Care Ships

After the devastation on Puerto Rico, there were many news reports of a Navy medical ship, known as the USNS Comfort, sitting on the island ready to help but only treating a small number of patients. I actually had heard some concern from Nevad-

ans about friends not being able to reach the ship and access the medical care it provided.

Question 1. Can you give examples of any similar experiences you had during your time at the Navy and what can be done to overcome them?

Answer. I am not familiar with the circumstances regarding the USNS Comfort off of Puerto Rico, and defer to the U.S. Navy.

Question 2. How is medical care coordinated with local and state agencies?

Answer. I am not familiar with the circumstances regarding the USNS Comfort off of Puerto Rico, and defer to the U.S. Navy.

New Technology in Response and Preparation

Some really exciting things are happening in Nevada with drones and the state is quickly emerging as a leader in this technology. The Nevada Institute for Autonomous Systems is working with UAV companies to develop new applications for these exciting machines. These have a number of potentially lifesaving applications during disasters as well, including being used to help prepare for and respond to hurricanes.

Question 3. Is NOAA using UAV technology in any way for disaster response and if so, how?

Answer. NOAA is using unmanned aircraft in a variety of ways related to disaster response, including post-storm surveys and oil spill response.

The National Weather Service (NWS) is exploring the utility of Unmanned Aircraft Systems (UAS) for post-severe storm damage surveys to determine cause, intensity, and extent. Rapidly accessible aerial imagery has been shown to increase survey accuracy and save on time, especially when coordinated with local emergency management partners. This innovative data acquisition strategy supports NOAA's Weather-Ready Nation and is readily applicable to other regional hazards, such as flooding, wildfire burn scar assessment, oil spill response, ice jam detection, and many others.

NOAA's UAS Program and U.S. Coast Guard Research and Development Center teamed up to evaluate several airborne systems as part of an Arctic Technology Evaluation conducted during the warm seasons of 2013–2016. NOAA's Office of National Marine Sanctuaries, the Office of Response and Restoration, and the UAS Program have continued inter-agency research, development and operational assessments for UAS oil spill testing with industry partners, including this month in the Gulf of Mexico with Chevron. UAS deployment evaluations have focused on increased situational awareness in hard to access areas, target identification, and near real time image processing to assist in response operations.

NOAA is investigating use of UAS for oil slick identification, oil thickness measurements, and for obtaining aerial imagery for emergency response. Most promising has been the ability to collect and process georeferenced imagery of a 30-minute flight onsite within hours. This capability would be immensely useful for response and assessment requirements for tornadoes, minor flooding events, minor hazmat events, focused areas of a larger event (critical infrastructure, dams, bridges, etc.), and clearing roadways.

Question 4. How is drone technology advancing to help predict the impact of storms and identify vulnerabilities?

Answer. NOAA is investigating how data obtained with unmanned systems can be used to better predict storms and their impacts. For example: NOAA's National Severe Storms Laboratory has been investigating the utility of small Unmanned Aircraft Systems (UAS) to obtain meteorological observations in the lower atmosphere for enhanced operational forecasting of severe weather. Additionally, this group also seeks to address a number of issues concerning deployment logistics, utilization, and coordination of multiple drones that might eventually operate in a semi-autonomous manner. A recent project funded by the UAS Program showed that UASs launched frequently prior to severe storm development can obtain highly accurate profiles and horizontal transects of temperature, moisture, and wind speed/direction. Initial results look promising, yet much work remains to retrieve some observations, which will require enhanced coordination with the Federal Aviation Administration and advanced testing and integration of Sense and Avoid safety mitigation applications during UAS operations.

Climate Change

Western Regional Climate Center in Reno, Nevada, is one of six regional climate centers in the United States that delivers high-quality climate data services in conjunction with NOAA and national climate and weather partners. We don't deal with hurricanes but climate change impacts us through fires and droughts.

Question 5. How well is it understood from current scientific research the potential future changes in hurricane frequency and intensity?

Answer. There have been several studies and reports that have assessed the impact of a warming climate on hurricanes, including the United Nations' Intergovernmental Panel on Climate Change Assessment Report Five (2013), as well as Chapter 9 of the U.S. Global Change Research Program's Climate Science Special Report (2017).

Question 6. Storms can impact roads and other modes of transportation, how well can we predict where vulnerabilities are with respect to transportation?

Answer. It is outside the scope of NOAA's mission to predict vulnerabilities in transportation infrastructure. However, NOAA contributes to a variety of tools and resources that can aid other Federal agencies, state and local governments, and private parties in understanding vulnerabilities and planning for the future. The NWS provides weather, hydrologic, and climate forecasts and warnings that support those entities in charge of infrastructure, such as transportation, and for them to make informed decisions. For example, the NWS routinely provides impact-based decision support services for hazardous weather events to state Departments of Transportation (DOTs). It also has partnered with the Federal Highway Administration on a project called Pathfinder. Pathfinder is a collaborative effort between the NWS, state DOTs, and state DOTs' support contractors who provide road weather information to share and translate weather forecasts into consistent transportation impact statements for the public.

There are also a variety of tools available to help with transportation impact analysis at *www.data.gov*. NOAA programs such as the Regional Integrated Sciences and Assessments program conduct targeted research and collaborate with regional stakeholders to understand current and future risk to infrastructure, including transportation networks. High profile examples of this NOAA-supported research include coastal flood vulnerability assessments for the Port of Houston, Texas, and the City of Beaufort, South Carolina. NOAA-supported research is underway in the Southwest on the relationship between drought, monsoon season winds, and dust storms and impacts particularly for the trucking industry in areas frequented for freight transportation.

In another example, NOAA's National Integrated Drought Information Service supports research focused on reliably transporting the approximately 650 million tons of cargo valued at over $75 billion in U.S. inland waterways annually. The researchers are using the lens of drought and its impact on moving agricultural goods along the Mississippi River.

Question 7. How well can we predict vulnerabilities for "cascading failures," when modes of transportation are disrupted, causing responders and victims to be stranded?

Answer. It is outside the scope of NOAA's mission to predict vulnerabilities in transportation infrastructure. The NWS does provide weather, hydrologic, and climate forecasts and warnings that support those entities in charge of infrastructure, such as transportation, and for them to make informed decisions.

Telecommunication Systems

As you know Puerto Rico's power grid and communications systems were completely devastated by the storms there. In the modern world, almost everyone is completely reliant on these networks for communication with loved ones and to access government services. One of the challenges is rebuilding this infrastructure in the aftermath of a storm, because you essentially have to start from scratch. We have testing being done in Nevada on projects to extend telecommunication service via launching balloons, including in Puerto Rico.

Question 8. How well can we predict vulnerabilities in our telecommunications systems?

Answer. It is outside the scope of NOAA's mission to predict vulnerabilities in telecommunications systems. However, the NWS provides weather, hydrologic, and climate forecasts and warnings that support those entities in charge of infrastructure like telecommunications systems. NWS does plan for any telecommunications outages by implementing mitigating solutions such as geographically and physically diverse circuits for high impact sites.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MAGGIE HASSAN TO
RDML TIMOTHY GALLAUDET

Question. Will you commit to advocating for NOAA's budget to continue to cover cost of at-sea monitors?

Answer. NOAA recognizes that an effective and affordable monitoring program is essential to the success and sustainability of the New England groundfish fishery, and we appreciate Congress' funding support in the Consolidated Appropriations Act of 2018. NOAA is funding at-sea monitoring costs for the groundfish fishery for the 2018 fishing season. We will continue to keep Congress apprised of monitoring needs for the 2019 fishing season, and anticipate supporting these costs.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. JOHN THUNE TO
HON. T. BELLA DINH-ZARR

Question. One of your recommendations from the Board's report on *El Faro* is for the American Bureau of Shipping (ABS) to enhance their training of surveyors to ensure they are properly qualified and supported to perform effective, accurate, and transparent vessel surveys, meeting all statutory and regulatory requirements.

a. Do the Board's finding support that ABS could have conducted more thorough inspections and surveys of vessels?

Answer. Yes. The NTSB's final report recommended a complete review of the Alternate Compliance Program (ACP) program to assess the adequacy and effectiveness of the program, and that the American Bureau of Shipping (ABS) should enhance its training for their surveyors to ensure that they are properly qualified and supported to perform effective, accurate, and transparent vessel surveys, meeting all statutory and regulatory requirements.

b. What role did ABS's failure to properly assess the vessel's stability booklet play in the safety of the *El Faro*?

Answer. The stability booklet carried on *El Faro* at the time of the accident was dated February 14, 2007 and was approved by ABS on behalf of the Coast Guard on May 31, 2007. ABS representatives stated that they reviewed and approved the stability booklet based on guidance in the Coast Guard regulations and navigation and vessel inspection circular (NVIC) 3–89, but that the items listed in the Code of Federal Regulations directing the development of stability books (46 CFR 170.110) were considerations only and not required to be included in the booklet.

As stated in NTSB's final report, a more comprehensive stability booklet may have changed the course of events. *El Faro*'s stability booklet did not contain any information on down flooding angles and lacked information of the effects of wind-driven heel. If the vessel's stability booklet had contained this specific information the captain might not have taken the route that brought him close to strong winds or taken the actions that placed the vessel in danger.

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