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EMERGENCY PREPAREDNESS: ARE WE READY FOR A 21ST CENTURY HUGO?

HEARING

BEFORE THE

SUBCOMMITTEE ON OVERSIGHT AND MANAGEMENT EFFICIENCY

OF THE

COMMITTEE ON HOMELAND SECURITY HOUSE OF REPRESENTATIVES

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EMERGENCY PREPAREDNESS: ARE WE READY FOR A 21ST CENTURY HUGO?

Friday, November 21, 2014

U.S. HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON OVERSIGHT AND
MANAGEMENT EFFICIENCY,
COMMITTEE ON HOMELAND SECURITY,
Clemson, SC.

The subcommittee met, pursuant to call, at 1:02 p.m., in Tillman Hall, Clemson University, 101 Gantt Circle, Clemson, South Carolina, Hon. Jeff Duncan [Chairman of the subcommittee] presiding.

Present: Representatives Duncan and Meadows.

Mr. DUNCAN. I appreciate the effort taken on behalf of all of those involved to have this important field hearing. This is an official Congressional hearing, as opposed to a town hall meeting. As such, we must abide by certain rules of the Committee on Homeland Security and of the United States House of Representatives.

I kindly wish to remind our guests today that demonstrations from the audience, including applause and verbal outbursts, as well as use of signs or placards, are violations of the rules of the House of Representatives. It is important that we respect the decorum and the rules of this committee. I have also been requested to state that photography and cameras are limited to accredited press only.

I ask unanimous consent that the gentleman from North Carolina, Mr. Meadows, be allowed to sit on the dais and participate in today's hearing.

Without objection, so ordered.

I now recognize myself for an opening statement.

September 21 marked the 25th anniversary of Hurricane Hugo, the most devastating disaster to affect South Carolina in the past century. The storm hit the Lowcountry with an unprecedented ferocity. It was responsible for 49 deaths and the equivalent of over $13 billion in damage, adjusted for 2014 dollars, and displacing 60,000 people from their homes.

Hugo required a major response, for which South Carolina was unprepared. However, the ordered evacuation of 250,000 would pale in comparison to what would be needed today. Over 1 million now live in the area that Hugo threatened.

Fortunately, South Carolina State and local first responders are better prepared and equipped to handle a variety of emergencies today. For example, just last month, the South Carolina Emergency Management Division organized a major drill to prepare for the threat of earthquakes in the State. Over 277,500 people signed up

to participate in what was called the Great SouthEast ShakeOut Earthquake Drill.

Such events are an important way for our citizens to become better prepared and develop plans needed to respond to potential disasters.

Major General Robert Livingston, who we are honored to have as a witness at our hearing today, has said that South Carolina's National Guard has much more advanced tools at its disposal to respond than when Hugo made landfall 25 years ago. Specifically, the Guard has increased aviation assets and engineering capabilities.

South Carolina's Emergency Management Division has also increased its planning efforts to be more proactive than we were in the days of Hugo.

Today, our first responders face an array of new threats, however. The days of only preparing for natural disasters like hurricanes, floods, and earthquakes are behind us. Most recently, we have seen disturbing images from the State of Texas of local law enforcement quarantining homes to prevent the spread of Ebola. The administration's failure to effectively stop the spread of Ebola to the United States has put a significant amount of pressure on State and local responders to ensure that they have plans and training in place to deal with possible public health threat emergencies.

Yet, even the Department of Homeland Security, the agency responsible for screening foreign travelers entering the United States, has failed to effectively manage pandemic preparedness supplies for its workforce, such as personal protective equipment and antiviral medical countermeasures, according to a recent Inspector General report.

The Federal Government's ineptitude has shown that our State and local first responders must be prepared to handle threats even half a world away, like Ebola.

In addition to living in a world where foreign viruses are only a flight away, we are increasingly interconnected through the internet. The director of FBI, James Comey, recently called the cyber threats facing our Nation "an evil layer cake" of nation-state actors, organized cyber syndicates, hacktivists, criminals, and even pedophiles.

How does this involve emergency preparedness? As the number of cyber attacks impacting Americans increase, Federal, State, and local officials need to be prepared to respond to the virtual aftershocks that follow.

There is a CNN story that came out yesterday, "The U.S. Government thinks China could take down the power grid." It was quoted that the director, Admiral Michael Rogers, the director of U.S. Cyber Command, said the United States has detected malware from China that enables you to shut down very segmented, very tailored parts of our infrastructure that forestall the ability to provide that service to us as citizens.

I would like to enter this in the record.

Without objection, so ordered.

[The information follows:]

ARTICLE SUBMITTED FOR THE RECORD BY CHAIRMAN JEFF DUNCAN

THE U.S. GOVERNMENT THINKS CHINA COULD TAKE DOWN THE POWER GRID

By Jamie Crawford, National Security Producer, updated 6:57 PM EST, Thu November 20, 2014, CNN.com

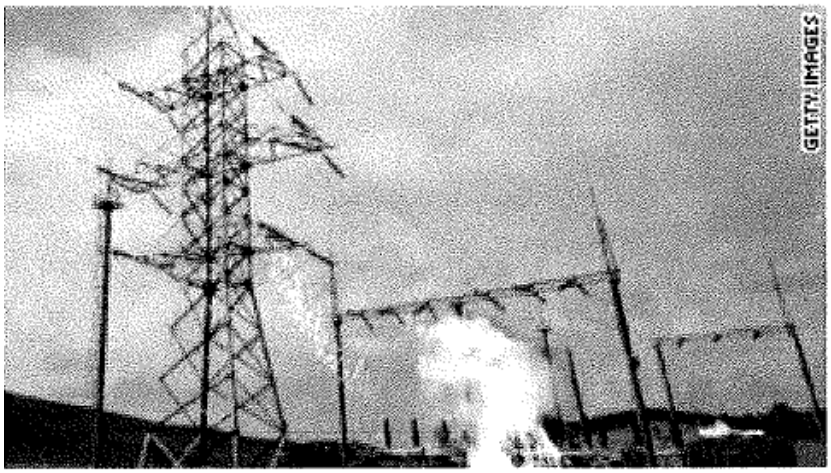
Washington (CNN).—China and "probably one or two other" countries have the capacity to shut down the nation's power grid and other critical infrastructure through a cyber attack, the head of the National Security Agency told a Congressional panel Thursday.

Admiral Michael Rogers, who also serves the dual role as head of U.S. Cyber Command, said the United States has detected malware from China and elsewhere on U.S. computers systems that affect the daily lives of every American.

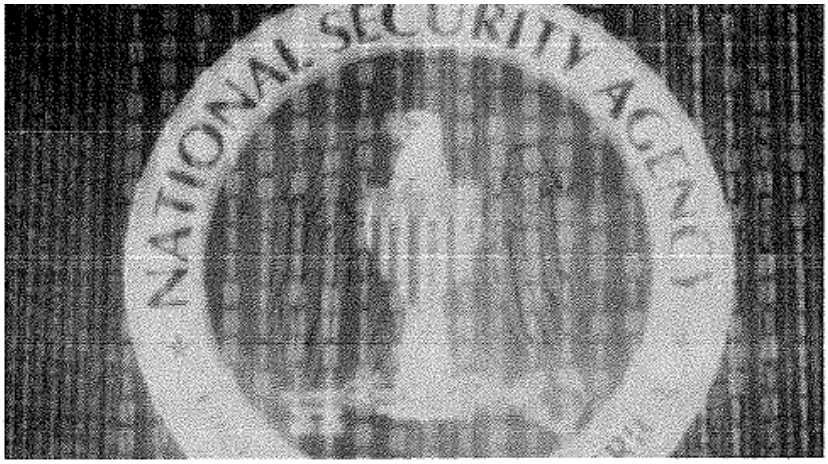
"It enables you to shut down very segmented, very tailored parts of our infrastructure that forestall the ability to provide that service to us as citizens," Rogers said in testimony before the House Intelligence Committee.

Rogers said such attacks are part of the "coming trends" he sees based on "reconnaissance" currently taking place that nation-states, or other actors may use to exploit vulnerabilities in U.S. cyber systems.

Cyber attacks hit State Dept. email, web



Snipers attack U.S. electrical grid



NYT: NSA bugged devices without internet

A recent report by Mandiant, a cyber-security firm, found that hackers working on behalf of the Chinese government were able to penetrate American public utility systems that service everything from power generation, to the movement of water and fuel across the country.

Related: Mandiant—China is sponsoring cyber espionage

"We see them attempting to steal information on how our systems are configured, the very schematics of most of our control systems, down to engineering level of detail so they can look at where are the vulnerabilities, how are they constructed, how could I get in and defeat them," Rogers said. "We're seeing multiple nation-states invest in those kinds of capabilities."

Admiral Rogers declined to identify who the other countries, beside China, because of the classified nature of their identities. Russia is generally regarded as also having an aggressive cyber program.

In addition to nation-state actors, Admiral Rogers noted the increasing presence of "surrogate" criminal actors in cyberspace that serve to obscure the hidden hand of criminal activity done on behalf of formal nation-states.

"That's a troubling development for us," Rogers said.

Rep. Mike Rogers, R–Michigan, the retiring chairman of the committee, called the groups "cyber hit men for hire" for nation-state actors in cyberspace.

The testimony also comes in the wake of a report from the Pew Internet and American Life Project that cited a prediction by technology experts that a catastrophic cyber-attack that causes significant losses in life and financial damage would occur by 2025.

Related: Catastrophic cyber attack looms

Admiral Rogers told the committee he did not disagree with the assessment.

In addition to the threats from specific nation-states, Admiral Rogers said there are already groups within the U.S. cyber architecture who seek to cause major damage to corporate and other critical sectors of the American economy.

"It is only a matter of the when, not the if, that we are going to see something traumatic," he said.

Mr. DUNCAN. In South Carolina, we have experienced a hack and theft of personal information from the South Carolina Department of Revenue. These cyber threats don't simply threaten businesses and individuals that use the internet. When increasingly everything is connected to information systems and the internet, even the protection of facilities is at risk to cyber attacks.

Energy, the U.S. energy infrastructure is divided into three interrelated segments: Electricity, petroleum, and natural gas. Virtually

all industries rely on electric power and fuels, and much of our daily lives depend on a safe, stable, and resilient cyber space of networks to communicate and travel, run our economy, power our homes, and provide Government services.

Specifically, facilities containing building and access control systems, such as heating, ventilation, air-conditioning, electronic card readers, and closed-circuit camera systems, could be vulnerable due to their connectivity to other networks and the internet.

For example, in 2009, a Dallas-area hospital security guard loaded a malicious program into the hospital system. Court records show that this breach could have affected patients' medications and treatments.

The Department of Homeland Security needs a strategy to prepare for unforeseen threats like these. When the Federal Government fails to effectively prepare, State and local officials must pick up the slack.

I am very excited to hold today's hearing here at Clemson University, and I am grateful to the distinguished witnesses for testifying.

We can't predict when or where a 21st Century Hugo might hit us, but I am confident that the testimony from today's panels can help us become more prepared for a variety of emergencies that we face.

So we are pleased to have two distinguished panels of witnesses today. What I would like to do is introduce each of the witnesses, and then I will come back and recognize them in order for their opening testimony.

I am going to recognize Mr. Meadows for an opening statement.

Mr. MEADOWS. I wanted to just say thank you, gentlemen, for being here. I truly thank the Chairman for his leadership on this particular issue. It is not one that makes headlines, as I shared with you earlier. When you prepare for things, that is how you make sure that you don't make headlines.

So I applaud each of you for being here, for the effort that is really from Federal down to local, whether it is with the Federal level with NOAA or FEMA; or the State level with our National Guard or, certainly, from a State EMS point of view; to the local level sheriff, where you actually have to make sure it gets implemented and coordinated here.

The American people don't know the difference. When something happens, they just want help, and they will reach out to whomever. When you get in turf battles at times, when you get in deployment battles, how do we best handle this, proper preparation right now will make sure that the American people are served much better later.

So I thank each of you.

I thank the gentleman for yielding, and I yield back.

Mr. DUNCAN. Okay. Thank you, Mr. Meadows, for participating. Other Members are reminded that opening statements may be submitted for the record.

[The statement of Ranking Member Barber follows:]

STATEMENT OF RANKING MEMBER RON BARBER

NOVEMBER 21, 2014

Thank you, Chairman Duncan, for holding this field hearing to examine the status of emergency preparedness in South Carolina and the surrounding region.

Given South Carolina's experience with Hurricane Hugo in 1989 and the State's extensive coastal regions, it is critical that attention be paid to how effectively Federal, State, and local emergency preparedness agencies are coordinating their efforts before potential hurricanes and other disasters occur.

I hope that the witnesses will address how well FEMA has progressed in implementing the reforms contained in the Post-Katrina Emergency Management and Reform Act of 2006, and will discuss the impact of this legislation on South Carolina.

Also, I am interested to learn more about NOAA's efforts to proactively engage South Carolina's emergency preparedness agencies in fostering resilience, and in developing "pre-covery" strategies to assist communities at risk from hurricanes and other potential disasters.

In 2014, FEMA released the *National Preparedness Report* containing 31 core capabilities identified as being critical to Congress' evaluation of compliance with the Post-Katrina Emergency Management and Reform Act of 2006.

Unfortunately, for the third consecutive year, the *National Preparedness Report* has identified disaster housing, infrastructure systems, and health and human services to be among the lowest-ranked capabilities in surveys completed by States.

I look forward to hearing the witnesses discuss what actions the Federal Government and its State partners are taking to address these capability gaps, and any barriers that exist to improving recovery-related capabilities.

Thank you and I yield back the balance of my time.

Mr. DUNCAN. Our first witness today on Panel One is Mr. Robert Fenton. He currently serves as the acting deputy associate administrator in the Office of Response and Recovery at the Federal Emergency Management Agency, or FEMA. Previously, Mr. Fenton served as the assistant administrator for response and was responsible for coordinating the Federal response in support of States during major disasters.

Our second panelist is Dr. Jeffrey Payne, acting director of the National Oceanic and Atmospheric Administration's Office for Coastal Management. Dr. Payne previously served as the deputy director of NOAA's Coastal Services Center, where he led the Southeast and Caribbean regional team, which provided NOAA services to the Southeast Region States.

Our third panelist is Major General Robert Livingston. He is the Adjutant General of South Carolina. In this position, he is responsible for raising, training, and administrating South Carolina Army and Air National Guard. As a senior military adviser for the Governor of South Carolina, he is responsible for military operations within the State of South Carolina and State emergency management.

Our next panelist, Mr. Kim Stenson, was named director of the South Carolina Emergency Management Division in 2013. Under his direction, the division provides oversight and coordination for emergency and disaster consequence management planning and response and recovery operations for the State of South Carolina. Mr. Stenson is also responsible for coordination with emergency managers at the local and National level.

The last witness is Sheriff John Skipper. He serves as the sheriff of Anderson County, South Carolina. In this capacity, Sheriff Skipper is an elected constitutional officer and the chief law enforcement officer for Anderson County, operating one of the largest sheriff offices in South Carolina.

As a side personal note, Sheriff Skipper is sporting a beard for No-Shave November in support of prostate and pancreatic cancer awareness. He and—how many officers?

Sheriff SKIPPER. One hundred and thirty.

Mr. DUNCAN. He and 130 officers within the Anderson County Sheriff's Department are also doing that.

Last year at this time, I sported a beard for the same reason, and I thank you for that. I had a sister-in-law that died of pancreatic cancer. A lot of my dear friends have suffered with prostate cancer, so thank you for supporting those efforts.

So I want to thank all of you for being here today, and the Chairman will now recognize Mr. Fenton to testify for 5 minutes.

You will notice lights on the table that will indicate the end of the 5 minutes. If you can get to a wrap-up, we will appreciate it.

Mr. Fenton.

STATEMENT OF ROBERT J. FENTON, JR., ACTING DEPUTY ASSOCIATE ADMINISTRATOR, OFFICE OF RESPONSE AND RECOVERY, FEDERAL EMERGENCY MANAGEMENT AGENCY, U.S. DEPARTMENT OF HOMELAND SECURITY

Mr. FENTON. Chairman Duncan, Representative Meadows, and colleagues, thank you for the opportunity to testify today on behalf of the Department of Homeland Security Federal Emergency Management Agency. I am Robert J. Fenton, and I am the deputy associate administrator for FEMA's Office of Response and Recovery. I have been in FEMA for 18 years, spending about 75 percent of that time working in the field closely with State, local, Tribal, and territorial governments across the country.

Having responded personally to over 50 disasters, including 9/11, Hurricane Katrina, and Sandy, I have learned that whether we are responding to devastating effects of hurricanes like Hugo or responding to other natural or man-made disasters, such as cyber attacks, the resiliency of our Nation and its ability to respond to and recover from disasters begins with not only resiliency but the whole community preparedness.

With that in mind, FEMA is a very different organization today than it was 25 years ago. With implementation of legislation such as the Stafford Act, Homeland Security Act, Post-Katrina Reform Act, and Sandy Recovery Improvement Act, as well as Executive Orders and direction from Presidential Policy Directive 8, FEMA has been given authorities to ensure a better-qualified and ready workforce.

We are now better able to support the whole community, including providing direct support to our State and local partners to better mitigate, prepare for, respond to, and recover from all hazards.

Today, I will discuss the progress FEMA has made in supporting National preparedness capability of State and local governments through our grants program; the joint development of plans to ensure ability to respond to all hazards; and the validation of those plans through exercises, as further explained in my written testimony.

Over the last 10 years, DHS has provided State, local, Tribal, and territorial governments with billions of dollars in grant funding, and much progress has been made, thanks to the leadership

at the State, local, Tribal, and territorial government levels who have utilized FEMA's grant programs. These grants have helped the Nation build and enhance capabilities by acquiring needed equipment, funding for training opportunities, developing preparedness and response plans, and conducting exercises that build relationships across city, county, and State lines.

A key element of the National preparedness system is planning. Under Presidential Policy Directive 8, FEMA is mandated to maintain the National response plan and the National Disaster Recovery Framework, as well as developing and coordinating operational plans to execute those frameworks.

FEMA does this by coordinating jointly with States and Federal partners to align our concepts of operation for all hazards. The Federal Interagency Operational Plans, referred to as FIOPs, at the National level and the regional hazard plans outline how the Federal Government executes the National response and recovery frameworks. These all-hazard plans are structured to address the maximum planning factors for the Nation or any given region.

When necessary, instance-specific answers describing the unique capabilities, requirements, coordination constructs required to address specific risks that are not otherwise addressed in those plans—such as nuclear, radiological, oil, chemical, or biological incidents—are developed.

An example of a planning effort that FEMA has worked with the State of South Carolina is 2012 Region IV's operational plan. This plan identified the critical actions and tasks to be undertaken between FEMA and our State counterparts and other Federal agencies if an actual or anticipated tropical cyclone would occur.

FEMA designs, develops, conducts, and evaluates exercises intended to help ensure FEMA's operational readiness and validate FEMA interagency plans and exercises in support of FEMA's ability to accomplish its mission by evaluating and maintaining readiness of Federal capabilities to successfully respond to all hazard incidents and providing objective base results to core capabilities.

FEMA exercises must be able to validate our capabilities to respond to any hazard. An example of FEMA's participation is that July 2015 Southern Exposure Exercise taking place in Florence, South Carolina. This scenario involves a nuclear power plant incident resulting in a release of radiological material and provides the opportunity to validate nuclear radiological incident and acts in support of the State of South Carolina during and after a nuclear power plant incident.

To conclude, while FEMA has made important strides and progress since Hugo, we still have much work to do. I am confident with the additional authorities Congress has provided, and the emphasis on whole community approach to emergency management, a growing and more skilled workforce, and lessons learned from disasters over those years, FEMA will continue to be an agile, innovative agency for many years to come.

Again, thank you, Chairman Duncan, for providing me the opportunity to appear before you today to discuss emergency preparedness for the 21st Century, and I look forward to answering questions from you or other Members as we go forth. Thanks.

[The prepared statement of Mr. Fenton follows:]

PREPARED STATEMENT OF ROBERT J. FENTON

NOVEMBER 21, 2014

INTRODUCTION

Chairman Duncan, Ranking Member Barber, and other distinguished Members of this subcommittee, thank you for the opportunity to testify today on behalf of the Department of Homeland Security's (DHS) Federal Emergency Management Agency (FEMA). I am Robert J. Fenton, and I currently serve as the acting deputy associate administrator for FEMA's Office of Response and Recovery.

Over the years, FEMA Headquarters and its regional offices have worked closely with State, local, Tribal, and territorial governments across the country, and with faith-based organizations, to develop catastrophic, worst-case scenario plans that are flexible and scalable for incidents of all magnitudes. FEMA's on-going partnerships with States allow coordination and collaboration with the "whole community" to plan and prepare for a range of disaster events.

As this subcommittee is aware, this year marks the twenty-fifth anniversary of Hurricane Hugo. Its impact on the State of South Carolina and surrounding States was a harbinger for even more destructive and costlier hurricanes to hit our shores—including Hurricanes Andrew, Katrina, Rita, Wilma, and Sandy. When Hurricane Hugo hit the Southeastern region of the United States, FEMA was a relatively young agency—10 years in existence—with limited experience, exposure, and practice with catastrophic disasters.

Today, FEMA is a very different organization than it was 25 years ago. With more statutory authorities, a better skilled, experienced, and agile workforce, a keen focus on a whole community approach to emergency management, and the advent of social media and other technologies, FEMA is transforming the way in which our Nation prepares for, responds to, and recovers from all hazards.

HURRICANE HUGO

Hurricane Hugo made landfall just north of Charleston, South Carolina, at midnight September 21, 1989, as a Category 4 hurricane with 135 mph winds, and rolled through South Carolina on a northwest path. The storm's strong winds extended far inland and storm surge inundated the South Carolina coast from Charleston to Myrtle Beach. Hours later, the storm tore through much of North Carolina. It was the strongest hurricane on record to hit South Carolina, and the second-strongest hurricane—since reliable records began in 1851—to hit the Eastern seaboard north of Florida.

More deadly and destructive than Hurricane Hugo's 135 mph winds were the surging tides accompanying landfall. The combination of high tide, the tidal surge preceding Hugo and waves generated by the storm inundated a wide area of coastal plain. In Charlotte, North Carolina, hundreds of miles inland, residents lost power for up to 18 days as thousands of trees, broken limbs, and debris severed power lines. In South Carolina alone, FEMA provided $70 million to individuals and families for housing and other disaster-related expenses and $236 million for debris removal, public utility and infrastructure repair or replacement, and emergency protective measures. According to the National Weather Service, Hurricane Hugo was the costliest hurricane on record to hit the United States at the time.

HOW FEMA IS TRANSFORMING IN THE 21ST CENTURY

I. Whole Community Approach to Emergency Management

Hurricane Hugo, like many other disasters, draws our communities even closer together and catalyzes the actions of not only our Federal, State, and local governments, but also the private sector, ordinary citizens, and many other sectors of society. Thus, preparedness is a shared responsibility, and it calls for the involvement of everyone in preparedness efforts. The three core principles of whole community—understanding and meeting the actual needs of the whole community, engaging and empowering all parts of the community, and strengthening what works well in communities on a daily basis—provide a foundation for pursuing a whole-community approach to emergency management through which security and resiliency can be attained.

In 2007, FEMA created a Private Sector Division in the Office of External Affairs and put private-sector liaisons in each of the FEMA 10 regions. Private-sector specialists at headquarters, the regions, and joint field offices serve as a gateway to private-sector engagement and integration.

Furthermore, the division also runs the National Business Emergency Operations Center (NBEOC), to facilitate public-private information sharing and situational awareness with operational partners during major disasters. The NBEOC is a virtual organization and currently has 377 members from both the private and public sectors.

Building on our whole-community efforts, in 2012, FEMA created a "seat at the table" for the private sector through our Private Sector Representative Program. To date, we have had representation from 9 companies, 1 academic institution, and 1 non-governmental organization (NGO). FEMA regions have begun implementing the program as well—including Region IV which supports the Southeastern region, including the State of South Carolina.

In July 2013, FEMA launched a new program known as Tech Corps. The Tech Corps Program is the product of Senator Ron Wyden's vision for a way to integrate trained, corporate technology volunteers into disaster response at the State, local, Tribal, and territorial levels—whom they support directly.

In short, by engaging and working with the whole community, everyone can make the Nation safer and more resilient when struck by hazards, such as natural disasters, acts of terrorism, and pandemics. Collectively, our Nation can achieve better outcomes in times of crisis, while enhancing the resilience of our communities.

II. Building on National Preparedness Efforts

FEMA's planning efforts are centered on our preparedness policy and doctrine, which leads to coordinated catastrophic planning that relies on a shared understanding of threats, hazards, capabilities, processes, and ultimately, the value of being prepared.

This administration remains steadfast in its commitment to strengthening the security and resilience of the United States; and, we continue to become more secure and better-prepared to prevent, protect against, mitigate, respond to, and recover from the full range of threats and hazards the Nation faces. We plan, organize, equip, train, and exercise better, resulting in improved National preparedness and resilience.

Much of this progress has come from leadership at the State, local, Tribal, and territorial levels, fueled by FEMA's grant programs. Over the past 10 years, DHS has provided State, local, Tribal, and territorial governments with billions of dollars in grant funding. As a Nation, we have built and enhanced capabilities by acquiring needed equipment, funding training opportunities, developing preparedness and response plans, and continuing to conduct exercises that help build relationships across city, county, and State lines. For instance, in the last 4 years alone, FEMA has awarded approximately $313 million for hurricane/high wind mitigation projects. These project types include safe rooms for first responders and critical staff, and structural retrofits that provide high wind protection for vulnerable buildings and critical infrastructure.

In addition, FEMA has provided funding for emergency power generation at critical facilities; weather warning system enhancements; training and other support for building code officials; and community education efforts.

Although FEMA's grant funds represent just a fraction of what has been spent on homeland security across the Nation, these funds and the development of capabilities they have made possible, have helped change the culture of preparedness in the United States.

Presidential Policy Directive 8 (PPD–8)

In March 2011, President Obama signed PPD–8, which describes the Nation's approach to National preparedness. PPD–8 aims to strengthen the security and resilience of the United States through the systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber incidents, pandemics, and catastrophic natural disasters. PPD–8 defines five mission areas—prevention, protection, mitigation, response, and recovery—as part of a continuum of interrelated activities and requires the development of a series of policy and planning documents to explain and guide the Nation's efforts in helping to ensure and enhance National preparedness.

PPD–8 created the National Preparedness System (NPS), a cohesive approach that allows us to use the tools at our disposal in the most effective manner and to monitor and report on progress being made in National preparedness. Moreover, the NPS was designed to help guide the domestic efforts of all levels of government, the private and nonprofit sectors, and the public to build and sustain the capabilities outlined in the National preparedness goal. Finally, NPS helps to articulate how well-prepared we are by setting a goal, establishing baseline capabilities, setting

common and comparable terminology, measuring capability gaps, and assessing our progress toward filling them.

III. Catastrophic Planning and Preparedness

Understanding the critical importance of catastrophic preparedness, FEMA is also leading substantial response planning, including the development of plans across the Federal Government for catastrophic incidents; future operations for potential/actual incidents; regional planning for all-hazards events; and evacuation and transportation planning. There are also special programs focused on planning for chemical, biological, radiological, nuclear, and explosives (CBRNE) hazards to communities throughout the Nation.

In addition to these planning efforts, FEMA coordinates closely with our Federal partners in many ways on other efforts in preparing for disasters, including the development of pre-scripted mission assignments, interagency agreements, and advanced contracts for commodities. These partnerships are essential to FEMA's ability to carry out its mission by leveraging the full capacity of the Federal Government.

IV. Critical FEMA Authorities Post-Hurricane Hugo

Post-Katrina Emergency Management Reform Act (PKEMRA) of 2006

In addition to building on our whole-community efforts over the years and creating more robust and better-informed catastrophic plans, Congress has also played an instrumental role in transforming FEMA into a more effective and efficient agency. The importance of PKEMRA to the emergency management community is significant. PKEMRA provided FEMA clearer guidance on its responsibilities and priorities, and the authorities and tools we needed to become a more effective and efficient agency, and a better partner to State, local, territorial, and Tribal governments.

PKEMRA also continues to give us the authority needed to lean forward and leverage the entire community in response and recovery efforts. This whole-community approach emphasizes the importance of working with all partners to successfully prevent, protect against, respond to, recover from, and mitigate all hazards.

Sandy Recovery Improvement Act of 2013 (SRIA)

In January 2013, Congress passed and President Obama signed SRIA into law, authorizing several significant changes to the way FEMA delivers disaster assistance. SRIA is one of the most significant pieces of legislation impacting disaster response and recovery since PKEMRA and builds upon the Robert T. Stafford Emergency Relief and Disaster Assistance Act.

SRIA, and the additional authorities it provides, is aiding recovery efforts associated with recent disasters such as Hurricane Sandy and the floods that impacted the State of Colorado. SRIA's various provisions are intended to improve the efficacy and availability of FEMA disaster assistance and make the most cost-effective use of taxpayer dollars.

One clear example of SRIA's effectiveness in use of taxpayer dollars is the Public Assistance Permanent Work Alternative Procedure provision which provides substantially greater flexibility in use of Federal funds for Public Assistance applicants and far less administrative burden and costs for all parties—if applicants accept grants based on fixed, capped estimates. To date, FEMA has agreed to fund billions in public assistance permanent work alternative procedure projects in States such as New York and Louisiana.

Another SRIA provision, National Strategy to Reduce Costs on Future Disasters, called on FEMA to submit recommendations for the development of a National strategy for reducing costs, loss of life, and injuries associated with extreme disaster events in vulnerable areas of the United States.

As such, on September 6, 2013, FEMA submitted this National Strategy report to Congress recommending ways in which multiple areas could be further explored during the development of a National strategy within the following themes: (1) Engage in a Whole Community Dialogue and Build upon Public-Private Partnerships; (2) Enhance Data-Driven Decisions; (3) Align Incentives Promoting Disaster Cost Reduction and Resilience; (4) Enable Resilient Recovery; and (5) Support Disaster Risk Reduction Nationally.

All told, these recommendations offered examples of areas that would need much greater discussion and research to develop into a strategic and actionable path forward. The implementation of cost reduction and cost avoidance strategies will require commitment and investment by the whole community to achieve the potential long-term savings and impact.

V. The Power and Promise of Social Media and Other Technologies in Emergency Management for the 21st Century

The advent of social media and other technologies has helped to transform FEMA into an agency that is more in tune with the needs of our citizens, especially during times of crisis. FEMA's approach to emergency management recognizes that individuals, families, and communities are our greatest assets and the keys to our success. In order to fulfill our mission, we must work together as one team—this notion is, again, at the heart of our whole-community approach to emergency management.

Social media is imperative to emergency management because the public uses these communication tools regularly. Rather than trying to convince the public to adjust to the way we at FEMA have traditionally communicated, we have adapted to the way the public communicates, leveraging the tools they use on a daily basis. Millions of Americans use social media every day to check in on friends and family, learn about current events, and share their experiences. FEMA uses social media to be part of this on-going dialogue and meet people where they are, using tools and platforms with which they are already familiar.

FEMA also uses social media and other digital methods to communicate because as we have seen, information can lead to action. Our goal is for our safety-related information to have a real-world impact—to inspire actions that lead to more resilient families and communities. If someone sees a preparedness or safety tip from FEMA, the goal is that it will inspire them to prepare themselves as well as empower them to tell a friend how to be more prepared or where to find help.

Lastly, social media and emerging technologies allow us to reach more people more quickly during disasters, when they need accurate, timely, and authoritative information that helps ensure the protection of their life or livelihood. With one click of the mouse, or one swipe of the smartphone screen, FEMA and its whole community partners can share a message to thousands of people and have a tangible impact. These capabilities did not exist 25 years ago when Hurricane Hugo hit the Southeastern coast of the United States.

CONCLUSION

Finally, although FEMA has made important strides and progress over the years since Hurricane Hugo, we still have much work to do.

I am confident that with the additional authorities Congress has provided, an emphasis on a whole-community approach to emergency management, a growing and more skilled work force, social media, and lessons learned from disasters over the years, FEMA will continue to be an agile and innovative agency for many years to come.

Again, thank you Chairman Duncan for providing me this opportunity to appear before you today to discuss emergency preparedness for the 21st Century. I look forward to answering questions you or other Members of this subcommittee may have.

Mr. DUNCAN. Thank you for your testimony.

The Chairman will now recognize Dr. Payne.

STATEMENT OF JEFFREY L. PAYNE, PH.D., ACTING DIRECTOR, COASTAL MANAGEMENT, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. PAYNE. Good afternoon, Chairman Duncan, Congressman Meadows. My name is Jeffrey Payne. I am the acting director of the National Oceanic and Atmospheric Administration's Office for Coastal Management. Thank you for the opportunity to testify today about the issue of coordinating communications among Federal, State, and local emergency preparedness partners as communities consider how to deal with the impact of hazards.

Since 1980, the United States has experienced 144 extreme events in which overall damages reached or exceeded $1 billion each, with total losses of $1 billion disasters exceeding $800 billion. On the East and Gulf Coasts of the United States alone, the insured value and cost to replace residential and commercial structures tops $8.9 trillion.

Population growth and aging, increased urbanization, and other factors have made our society more vulnerable to high-impact events. Social vulnerability looks at indicators such as demographics, race, class, age, ethnicity, plus density, and determines where targeted response efforts may be necessary to address the needs of the elderly, the young, or those without access to transportation in the case of evacuations.

Communities living below the poverty line will face significant challenges, as we saw with Hurricane Katrina. To consider social aspects, NOAA partnered with the University of South Carolina to apply social science methods to evaluate Census data for all coastal States and provide a detailed look at social vulnerability for improved disaster preparedness.

Regarding our vulnerable infrastructure in South Carolina, there is evidence that the frequency of what is called nuisance flooding, types of coastal flooding, will increase with rising sea levels and that this will have a significant cumulative impact on our built and natural systems. As result, municipalities, businesses, and planners are looking for ways to increase their resilience now.

The preparedness challenge is essentially the same across all hazard events. Public awareness, education, and plans of action to mitigate and recover from impacts provide the best protection. NOAA has demonstrated success in predicting hurricanes and storm surge, communicating risk, and providing data, information, technology, decision support tools, and services to reduce the impact of hazards.

We have established ties to emergency managers and communicators through State, local, and Tribal officials and the private sector to ensure appropriate action in protecting communities.

NOAA works with these partners to determine their needs for information, training, and other services packaged in a way that saves time and resources. NOAA and the National Sea Grant Network, including South Carolina's Sea Grant Consortium, employ research, training, and technical assistance to enhance the ability of communities to prepare for disasters.

NOAA has worked with Sea Grant on the application of nature-based infrastructure solutions for protection from storms and on a community resilience index widely employed in the Gulf and Southeast.

NOAA ensures that operational weather, ocean, climate, and space weather data, as well as tides, water levels, geodetic positioning, and nautical charts, are available to meet needs for timely and accurate forecast and warnings, and to ensure the efficient flow of commerce and, most importantly, the safety of lives and property.

Our agency is the official voice for issuing warnings during life-threatening weather events. After a coastal disaster, NOAA and sister agencies use aircraft and ships to survey affected areas. This information facilitates assessment of damages and certification of critical safety products, like nautical charts that allow the Coast Guard, relief ships, and cargo vessels to move in and out of our ports.

NOAA also offers easy-to-use interactive products that enable users to visualize their risks and vulnerabilities specific to their ge-

ography, empowering managers to make informed decisions to address vulnerabilities in advance of hazard events.

For example, NOAA recently released a potential storm-surge flooding map that provides information on surge-related water levels to be expected in zones affected by an approaching storm. NOAA is also working with other Federal partners, including the U.S. Geological Survey, the Army Corps of Engineers, the Environmental Protection Agency, the Federal Emergency Management Agency, and the U.S. Coast Guard, to improve how Federal efforts are coordinated with States and partners at the community level so that response and recovery plans, working relationships, and resources are in place before disaster strikes.

In response to events, NOAA embeds specialists in centers of command. Meteorologists work with FEMA, National Security staff and at the Department of Homeland Security Operation Center during emergency weather events. Maritime traffic resumes more quickly with the participation of regional navigation managers, and coastal management and fisheries specialists provide options for restoration of damaged natural resources and long-term community recovery needs.

Developing lines of communication and cooperation, and facilitating community planning and capacity-building with partners now, will enhance pre-disaster planning efforts. The goal should be to ensure that coordinated and informed decision making can begin in the immediate wake of a disaster, enabling communities to respond effectively while recovering and rebuilding in a resilient manner.

Wise decisions now will ensure that we are more resilient in the face of future events, from the next spill to the 21st Century Hugo.

Thank you for your leadership, Mr. Chairman, Mr. Meadows, and for the opportunity to appear before you today. I will be happy to answer any questions as well.

[The prepared statement of Mr. Payne follows:]

PREPARED STATEMENT OF JEFFREY L. PAYNE

NOVEMBER 21, 2014

Good afternoon Chairman Duncan, Ranking Member Barber, and Members of the subcommittee. My name is Jeffrey Payne, and I am the acting director of the National Oceanic and Atmospheric Administration's (NOAA) Office for Coastal Management. Thank you for the opportunity to testify today about the cooperation and coordination of communications between Federal, State, and local emergency preparedness partners as communities consider how to better prepare for the impacts of natural hazards and other emergencies. My testimony today will cover: (1) An understanding of our vulnerability to storms like Hugo, (2) NOAA's collaborations in support of communities in South Carolina and the rest of the Nation as we prepare for, respond to, and recover from hazardous events and the potentially compounding effects of longer-term changes, and (3) the importance of coordinating effectively after an event, during the response and early recovery phase, to promote wiser long-term recovery and resilience decisions. This final point is critical to how we as South Carolinians, and Americans, are able to become more resilient in the face of future events, from small accidents to major disasters.

A 2005 study by the National Institute of Building Sciences on Federal hazard mitigation grants estimated that $1 spent on hazard mitigation potentially saves $4 in disaster relief costs and lost Federal tax revenue. A community that spends its recovery dollars on investments designed to provide resilience, rather than simply plugging a hole or building back to the same level of vulnerability, will be better poised both economically and socially to withstand another hazard event.

HURRICANE HUGO: UNDERSTANDING WHY WE ARE STILL VULNERABLE

Twenty-five years ago, between September 10 and 22, 1989, Hurricane Hugo made its way across the Caribbean Islands and up the southeastern coast of the United States. Hurricane warnings for coastal South Carolina, issued at the then-standard 3 days in advance, led to the safe evacuation of more than 250,000 people. By the time the storm had passed through Canada and into the North Atlantic, it had resulted in 49 deaths and wide-spread damages and losses estimated at $7 billion in the United States. At the time, Hugo was the strongest storm to strike the United States in the previous 20-year period, and it was the Nation's costliest hurricane on record in terms of monetary losses (~$7 billion in damage). A week after Hurricane Hugo hit, nearly 60,000 people were homeless, as 5,100 homes were destroyed and 12,000 homes deemed uninhabitable.

Since Hurricane Hugo, NOAA has improved its hurricane forecasts: The 2012 Hurricane Sandy track was more accurate 5 days out than the Hugo forecast was at 3 days. Coastal South Carolina has been rebuilt and continues to be a popular place to live, work, and vacation. The Port of Charleston is the fourth-largest U.S. Atlantic port and generates over a quarter of a million jobs in South Carolina alone. This area is a strong economic driver in the Southeast region of the United States, including the very significant positive economic impacts of tourism and recreation. However, the long recovery from Hugo is a reminder of the region's vulnerability, as population grows and new structures in the coastal zone continue to be built. The South Carolina Emergency Management Division has estimated that had a similar storm struck in 2009, there would have been $8 billion in damage, and more than 4 times the number of homes destroyed.

Since 1989, the United States as a whole has weathered 17 tropical cyclones and 6 drought events with at least $7 billion in estimated damage, as well as wildfires costing up to $6 billion in damages and up to 28 lives lost. Nearly 90 percent of all Presidentially-declared disasters are weather- and water-related, and our vulnerability to the impacts is increasing as our population grows. Demographic trends, population growth, and an increased reliance on technology, coupled with extreme weather events, have made our society more vulnerable to high-impact events. There is growing recognition that the frequency of (low magnitude/high probability) "nuisance" types of coastal flooding events will increase dramatically with rising sea levels (e.g. Firing and Merrifield, 2004; Sweet et. al., 2014), and that these events are likely to have the greatest cumulative impacts on built, social-human, and natural systems over the coming decades. As a result, many agricultural, business, and urban planners are looking for ways to increase community resilience now. For instance, in the Hampton Roads area of Virginia, where "nuisance" flooding now happens monthly, Old Dominion University is working with the community and its largest Federal partner, the Department of Defense and Naval Station Norfolk, to develop a whole-community approach to sea-level rise preparedness and resilience planning. Norfolk, among many other cities, recognizes the need to understand changes and trends in weather patterns, and to apply this to planning that may reduce vulnerability to high-impact natural or man-made hazard events. Their recognition for the need to reduce their vulnerability is an important first step.

Not only is our coastal infrastructure vulnerable, but our population is as well. Social vulnerability looks at indicators such as population demographics (race, class, age, ethnicity, etc.) and density, and determines where additional or targeted response efforts may be necessary to address the needs of the elderly, the young, or those without access to transportation in case of evacuations. Communities already living below the poverty line will face different challenges than wealthier communities, as we saw in the aftermath of Hurricane Katrina. Through a partnership with the University of South Carolina (USC) and funding via NOAA's South Carolina Sea Grant Program and the NOAA Office for Coastal Management, the Social Vulnerability Index (SOVI) method of measuring the social vulnerability of U.S. counties to environmental hazards has now been applied to Census 2000 block groups and Census 2010 tracts for all coastal States, providing a more detailed look at a community's social vulnerability for improved disaster response preparedness.

While these efforts and others are providing the groundwork for addressing vulnerability, there is much more that needs to be done in other sectors of our economy and with the general public to comprehensively increase our resiliency to the impacts of these events.

A BIG JOB: WE CAN'T DO IT ALONE

NOAA is one of many Federal agencies that has a critical role in preparing for and responding to disasters. The Department of Commerce Strategic Plan includes a significant coordinated effort amongst NOAA, the National Institute of Standards

and Technology (NIST), the U.S. Economic Development Administration, and the Small Business Administration to enhance the resilience of communities. For example, NOAA has been engaged with NIST's disaster resilience framework, which will provide local communities with a systematic approach to plan for disasters and other disruptive events. NOAA also works collaboratively with other agencies, including the United States Geological Survey (USGS), the United States Army Corps of Engineers (USACE), the Environmental Protection Agency (EPA), and agencies within the Department of Homeland Security, primarily the Federal Emergency Management Agency (FEMA) and United States Coast Guard (USCG) to ensure a coordinated approach to preparedness. An example is the Partnership for Sustainable Communities, where NOAA is working with FEMA, DOT, EPA, and HUD through the Partnership for Sustainable Communities to provide information and services to States for State Hazard Mitigation Plans. The Hazard Mitigation Plans identify risks and risk reduction measures in a State—and in communities—and is an all-hazards preventative approach designed to prevent loss of life and damage from future disasters.

Furthermore, NOAA's role in Presidential Policy Directive 8 on National Preparedness supports science and technology in disaster mitigation, as well as promoting coordination of pre-disaster preparations and investments at the Federal level to support community resilience efforts. In this effort, NOAA works with both Federal agencies and representatives from States, localities, territories, and Tribes to help encourage and coordinate a shift in the culture of disaster preparedness, to embed risk management and mitigation in all planning, decision making, and development to the greatest extent possible.

As a part of this National Preparedness work, NOAA also worked with FEMA to develop a National Disaster Recovery Framework (NDRF) which is implementable at the regional or community level. An interagency group is looking at how Federal efforts can be better coordinated with partners at the community-level in advance of disasters, so that plans and working relationships are in place before a community is threatened. This type of planning will allow response efforts to move towards more efficient "precovery," where planning for the next event is taken into consideration during the response phase of the past event.

The Silver Jackets Program for South Carolina works to increase coordination and efficiency between State and Federal governmental agencies in developing comprehensive and sustainable solutions to flood and coastal risk management in South Carolina. It serves as a catalyst in developing comprehensive and sustainable solutions to flood hazard issues, including mitigation planning, flood hazard mapping, risk reduction activities, and response and recovery planning.

In addition to its support of National-level science and technology policy, NOAA also works with State and local officials, emergency managers and other partners to determine their needs for data, information, tools, training, and other services that lead to better understanding and communicating risk, and strengthening a community's resilience. NOAA and its partners, such as the National Sea Grant network, use integrated research, training, and technical assistance to enhance the ability of communities to prepare for, respond to, and rebuild after disasters strike. For example, we are developing a Coastal Resilience Index that provides a tangible way for communities to identify gaps and examine how prepared they are for storms and storm recovery, and provide guidance on how to increase resilience through measures including strengthening infrastructure or adopting stricter building codes.

Since Hurricane Hugo struck, NOAA has worked with the U.S. Army Corps of Engineers and FEMA to update the South Carolina Hurricane Evacuation study twice, most recently in 2012. NOAA used enhanced elevation data using LIDAR and updated the SLOSH (Sea, Lakes, and Overland Surges from Hurricanes) models. New storm surge evacuation zones were created and used for hurricane evacuation planning. The South Carolina Emergency Management Division promotes community understanding of these new plans through their Know Your Zone campaign.

The *Potential Storm Surge Flooding* map is an experimental NOAA National Weather Service (NWS)/National Hurricane Center product being used to show areas that could be affected by storm surge and potential water depths during a land-falling tropical storm or hurricane. Social science research was conducted with key partners and customers (broadcast media, emergency officials, and the public) to develop the map and inform outreach efforts. A marketing plan, videos, and tipsheets developed based on risk communication best practices are helping to ensure a consistent message about the map across the weather enterprise.

Effective risk management and forward-thinking resiliency requires a broad coalition of vested and knowledgeable Federal, State, non-governmental organization, and industry partners. It is critical that these sectors continue to engage and build

partnerships to better manage risk moving forward. The time is now to forge sustainable partnerships.

PREPARING AND RESPONDING

Communicating

As the Federal Government's sole official voice for issuing warnings during life-threatening weather events, and as an established reliable and trusted source, NOAA provides the Nation's alerts and warnings for severe weather and other near-term hazards (tornadoes, hurricanes, severe thunderstorms, winter storms, most floods, chemical spills, volcanic ash, tsunami, space weather, etc.). These messages are delivered through multiple mechanisms, including: NOAA Weather Radio, which triggers the Emergency Alert System; NWSChat, which focuses on real-time coordination with local core customers in the broadcast media and emergency management; the Emergency Managers Weather Information Network (EMWIN), a system for distributing a live stream of weather information in the United States transmitted over NOAA Geostationary Operational Environmental Satellites (GOES); the internet; and, through our private-sector partners, commercial television and radio, which communicate critical information to much larger audiences and effectively inform those in harm's way to take appropriate action. Emergency messages are also transmitted by cellular phone companies via text messages through the Wireless Emergency Alert system, which uses warning and emergency information from the NWS, FEMA, and others.

Coordination of science and technology

NOAA's mission to provide science, service, and stewardship to the Nation in support of community resilience is fundamentally dependent on observations of our environment. These observations are the backbone of NOAA's predictive and service capabilities. NOAA must ensure operational weather, ocean, climate, and space weather data, including tides, water levels, geodetic positioning, and accurate nautical charts, are available at all times to address our Nation's critical needs for timely and accurate forecasts, warnings of solar storms and severe weather including hurricanes, flash floods, tsunamis, and wildfires, and to ensure the flow of commerce and the safety of lives and property.

NOAA partners with other Federal and international agencies to support satellite observations, including NOAA's Polar-orbiting Operational Environmental Satellite (POES), Suomi National Polar-orbiting Partnership (Suomi NPP) satellite, NASA Earth Observing Satellites (EOS), and the European Metop satellites. GOES satellites, along with Doppler Radar, assist operational weather forecasters with current and short-term forecasting abilities and severe weather warning forecasts. NOAA also participates in regional ocean observing networks. For example, the Southeast Coastal Ocean Observing Regional Association (SECOORA) supports the Governors' South Atlantic Alliance priorities in providing ocean observations to NOAA and other regional researchers to improve forecasting of storm surge, inundation, and coastal circulation. This modeling component provides real-time forecasting to support operational management of water control structures and utility infrastructure, and to support emergency managers during hurricane season.

Often after a coastal disaster such as a hurricane or other incident, new mapping data is essential for situational awareness both on land and off-shore. NOAA and its sister agencies use aircraft and ships to survey and map the impacted area in order to support response partners such as the State and FEMA, as well as to update critical safety products like nautical charts and notices to mariners to allow the USCG, relief ships, and cargo vessels to move in and out of ports. We work closely with our mapping partners such as the USACE and USGS to coordinate mapping efforts using an Integrated Ocean and Coastal Mapping approach, where we strive to map once and meet multiple missions with the same datasets. These datasets help the State and our partners with recovery from an event and to begin preparing for the next one. For example, seafloor sonar surveys completed and charted by NOAA ships and small boats helped reopen Baltimore and the Virginia ports after Hurricane Sandy, quickly restarting commerce and allowing Navy ships to return to port. Similarly, NOAA assisted in rapidly reopening New York and New Jersey ports so that emergency fuel and other crucial supplies could reach some of the hardest-hit areas. Hours after the storm, NOAA planes and scientists conducted aerial surveys of the affected coastlines, and published the photos on-line immediately, allowing emergency managers and residents to examine the damage even before ground inspections were permitted. These surveys are also vital to FEMA assessment teams and other on-the-ground responders and those managing oil spill clean-up and damage assessment.

After any large natural disaster, the scientific community comes into the impacted area from all over the world seeking to collect rare and time-sensitive post-disaster data and information, before the evidence disappears or degrades over time. This data is essential to understanding physical and socio-economic causes and impacts of the event, and developing better response, recovery, and mitigation plans. Recognizing the strain that an influx of scientists can have on the State and local governments and emergency response agencies, NOAA and USGS, through the Pacific Risk Management 'Ohana (PRiMO), helped develop a joint scientific protocol to coordinate the collection and sharing of physical, engineering, social science, and other data and information and promotes coordination, communication and respect in regards to the community, the emergency managers and impacted region. The protocol helps keep data and information flowing, and the community focused on recovery.

NOAA also monitors chemical safety threats to our community and environment. We are upgrading tools used by local, State, and Federal responders to safely and effectively respond to such emergencies. The CAMEO (Computer-Aided Management of Emergency Operations) software suite delivers critical information for emergency responders and planners about chemicals that are stored and shipped in their local communities. These tools are often used as a common platform to help facilitate the exchange of information between first responders, emergency planners, industry, environmental groups, and academics. The CAMEO program has a long history of close contact with our end-users both emergency responders (firefighters) and State and local planners.

Much like the train derailment in Abbeville, South Carolina, several real-world incidents over the last year have highlighted emerging risks from transportation of hazardous materials by rail. NOAA, working with the Department of Homeland Security, is also in the final stages of integrating a new chemical source estimation model, called Railcar, into NOAA's chemical air dispersion model, ALOHA (Areal Locations of Hazardous Atmospheres). Railcar was developed by the U.S. Navy, based on large-scale field tests of chlorine and ammonia releases from tanks. ALOHA models chemical releases for emergency responders and planners. It can estimate how a toxic cloud might disperse after a chemical release, and estimates a threat zone, where a hazard has exceeded a user-specified Level of Concern (LOC).

In the aftermath of Hurricane Sandy, NOAA's Atlantic Environmental Risk Management Application (ERMA) served as the common operational picture for the Hurricane Sandy pollution response. ERMA is an on-line mapping tool for U.S. coasts and the Great Lakes that integrates static and real-time data in a centralized, easy-to-use map for environmental responders and decision makers. Atlantic ERMA integrated these response efforts with environmental data to give responders a better idea of how to deal with pollution threats while minimizing environmental damages. As the common operational picture, ERMA provided a single platform for responders to view all of the storm-related data and imagery as well as various clean-up efforts by the States and other Federal agencies. Our team of Geographic Information Systems (GIS) specialists working on ERMA helped provide data management support in tracking the progress made by the pollution response field teams, allowing State and local environmental and emergency managers to make informed decisions.

NOAA's Gulf of Mexico Disaster Response Center (DRC) also brings together NOAA-wide resources to improve preparedness, planning, and response capacity for natural and man-made disasters. Intended to serve as a safe and ready command center during major disaster responses in the Gulf, the DRC also hosts drills, trainings, workshops, and planning activities. For example, last spring the DRC partnered with the National Weather Service to assess the capabilities of NOAA partners in the region with a hurricane response exercise.

On-the-ground coordination

In order to better coordinate with Federal and State partners and customers, NOAA has begun to embed its specialists in the centers of command during events. National Weather Service meteorologists now work side-by-side with FEMA, National Security Staff, and at the Department of Homeland Security Operations Center during emergency weather events and maritime traffic resumes more quickly when NOAA regional navigation managers work within command centers. In the wake of Hurricane Sandy, as the extent of the storm impacts became clear, NOAA meteorologists were assigned to regional and municipal emergency operations centers and coastal management specialists worked in post-Sandy Joint Special Operations Command centers, alongside interagency and State partners, including representatives from Governors' offices and State emergency management divisions. These working relationships will strengthen future coordination efforts and helped streamline communications during and after Hurricane Sandy, including for the im-

portant accurate assessment of damages and development of strategies for long-term recovery.

These tools, information, and close working relationships allow Federal, State, and local officials and managers to make critical decisions when faced with realistic exercises and real-time events. To take preparation and response to the next level, where communities can become resilient, NOAA is helping support interagency and community-level "blue skies planning," or considering mitigation in all aspects of recovery and to do so before an event, essentially working on the elements of "precovery". This forward thinking can lead to wise investments of time and resources, seeking to keep the impacts of a hazard from becoming a disaster, or recovering more effectively and quickly should a disaster occur.

"PRECOVERY" THINKING: BEING READY FOR NEXT TIME

NOAA is focused on providing services to enhance community resilience. Our prospects for success in this role, and of achieving our vision of resilient communities, lie in our unique enterprise capabilities. The goal of disaster resilience is to enhance the capacity of a community exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. The preparedness challenge remains essentially the same across all hazard events: Public awareness, education, and plans of action to mitigate impacts on the personal, community, and regional scales provide the best protection against potential disasters. NOAA has long-held and strongly established ties to the emergency management community, through State, local, and Tribal officials, which help ensure appropriate action is taken to prepare communities for weather and water events.

Community Preparedness

NOAA's Coastal Storms Program (CSP) is a Nation-wide effort to reduce loss of life and mitigate impacts of storms on coastal communities and the environment. CSP provides dedicated resources and expertise from across NOAA to deliver capacity-building tools, training, data, and other products and services to enhance hazard resilience in coastal communities in particular. For example, NOAA has worked with communities along the Gulf of Mexico to provide a simple, inexpensive method for leaders to perform a self-assessment of their community's resilience to coastal hazards. The results help communities prioritize what needs to be addressed before the next extreme event. Through these various community resilience efforts, NOAA is placing an increased focus on social science to better understand how and why decisions are made at the State and local levels and how NOAA can improve its efforts to communicate risk and uncertainty to the public at large.

Through the NOAA Climate Program Office's Carolinas Integrated Sciences and Assessments (CISA) team at the University of South Carolina, researchers are engaging local stakeholders in resilience planning in the coastal Carolinas. CISA works with South Carolina Sea Grant to develop science-based, participatory planning exercises for South Carolina communities to plan for sea-level rise and climate adaptation. For example, CISA and Sea Grant partnered with the Beaufort County, SC Planning Department to produce a report containing recommended adaptation actions. While this project was originally intended to help inform Beaufort County's update of its Comprehensive Plan, several other opportunities have arisen from this work. For example, the county's Disaster Recovery planner has asked for help in updating the Disaster Recovery Plan with sea-level rise projections. The county is also creating a list of Capital Projects they will prioritize and fund.

On September 5, 2014, the National Academies' Resilient America Roundtable announced its first two American communities that will be the focus of pilot projects to develop a community disaster resilience strategy, based on the Research Council report *Disaster Resilience: A National Imperative.* The two communities are Charleston, South Carolina, and Linn County/Cedar Rapids, Iowa. Over an initial 2-year period, Resilient America Roundtable teams will work with decision makers, local organizations, businesses, and citizens in Charleston and Cedar Rapids, along with Federal partners, to better understand the risks each community faces and design strategies to bolster resilience to these risks. Lessons learned in each of the pilot communities will be shared broadly with other communities across the Nation.

A complementary effort kicked off this summer in Charleston. The Department of Homeland Security's Office of Infrastructure Protection, FEMA and NOAA piloted a Climate Change Adaptation Exercise in June 2014. This exercise was an important first step in developing strategies and coordinating stakeholder planning efforts related to climate preparedness and resilience for critical infrastructure in the Charleston area. State and local partners, including the S.C. Sea Grant Consortium, the S.C. Department of Health and Environmental Control's Office of Ocean and

Coastal Resource Management, the SC Emergency Management Division, the City of Charleston's Emergency Management, and the College of Charleston, took part in the planning and implementation of this exercise.

While the topic of this exercise was climate change, the benefits will be reaped in the aftermath of another Hurricane Hugo or other hazard event that has the potential to strike at the heart of the South Carolina economy including our businesses, lives, and livelihoods. A core group of partners has formed an after-action committee to develop a Charleston Resilience Network. While the scope of this network is still being refined, the overall goal will be to create a defensible and repeatable decision-making process that will support the region in making smart decisions and investments during times of response and recovery. Components will include identifying hazard vulnerabilities and consequences, assessing the costs of risk mitigation action and inaction, identifying investment opportunities and developing the plans in which to make those investments. This effort and the Resilient America Roundtable pilot will complement one another with a strong network of Federal, State, Tribes, and local partnerships, and serve as a model for other community resilience networks.

NOAA has also been active in working alongside the DHS/FEMA-funded National Domestic Preparedness Consortium's National Disaster Preparedness Training Center (NDPTC) at the University of Hawai'i. This effort, which is National in scope, is providing a wide range of training to thousands of emergency and disaster managers, community planners, and other officials to improve their level of preparedness and capacity to deal with events. NDPTC develops and delivers FEMA-certified training courses, and a partnership with NOAA has resulted in the co-development and delivery of several course offerings. The overall focus is on disaster preparedness, response, and recovery, with a specific focus on natural hazards, coastal communities, and the special needs and opportunities of Tribes, islands, and territories.

SUMMARY

Although nothing can eliminate the physical threat that severe weather and natural hazards pose, NOAA has demonstrated success in better predicting hurricanes and storm surge, communicating the impacts of weather and other hazards, providing science and technology data, information, tools, and services to reduce the impacts of hazards, and helping vulnerable communities become more resilient to their devastating effects. Such hazards include those that are episodic, such as extreme events, but also those that tend to be chronic and will affect future risk considerations, such as rising sea levels leading to more common (nuisance) flooding in low-lying coastal areas and cities.

Presidentially- and State-declared disasters trigger vast amounts of available funding to help Federal agencies deliver critical data, information and services to impacted States, finance small business loans to keep the economy afloat, and allow communities to clean up destroyed areas, rebuild damaged infrastructure, and provide housing for displaced families. However, to spend such funds wisely, it is critical to understand the complete nature of damages and to consider how well-developed recovery strategies can inform both the necessary community rebuilding efforts as well as actions to improve resilience to future events.

Developing lines of communication and cooperation with partners now will enhance pre-disaster planning efforts. Once a disaster strikes, it is too late if such advance work has not been accomplished. The goal should be to ensure that coordinated and informed decision making can begin in the immediate wake of a disaster, enabling States and communities to respond effectively and rebuild in a more resilient manner. To ensure that fiscally-wise and economically and environmentally sound decisions are made, the Federal Government and its State and local partners need to continue coordinated pre-planning efforts at the National, regional, and State levels. Wise "pre-covery" decisions will ensure that we are able to remain resilient in the face of future events, from the next chemical spill to the 21st Century Hugo.

Thank you for the opportunity to appear before you today. I would be happy to answer any questions you may have.

Mr. DUNCAN. Dr. Payne, thank you so much.

The Chairman will now recognize General Livingston, Adjutant General of South Carolina.

STATEMENT OF MAJOR GENERAL ROBERT E. LIVINGSTON, JR., ADJUTANT GENERAL, STATE OF SOUTH CAROLINA

General LIVINGSTON. Mr. Chairman, Mr. Meadows, thank you so much for the opportunity. I am Major General Bob Livingston. I am the adjutant general for the State of South Carolina, responsible to the Governor for disaster recovery in the State of South Carolina.

My role during Hugo was I was an engineer company commander and also an operations manager for South Carolina Electric and Gas. As such, I was responsible for the restoration of power along the coastline following Hugo.

What I saw in Hugo was a very resilient community that banded together, absent of a lot of Governmental involvement, and at the time, this was one of the shining moments in South Carolina's history, our recovery. The State efforts, the local efforts, were very well done for the time.

What we have seen since then is our environment has changed. A couple things with the changing of the environment, the expectations of Governmental involvement is much higher by our local populace, from the local level through the State level to the Federal level. The density of the population is much greater on the coastline, so evacuation and safeguarding of property and life is much more difficult.

In addition, we have emerging threats, or we have threats that may choose this opportunity to cause additional problems for our Governmental agencies and also our private industry.

You mentioned vulnerability to the electrical grid system. Back during Hugo, we dealt with electromechanical. Today, we have electronic that are all interconnected and are subject to cyber attacks. The same is true in our command-and-control systems that will be used in the future.

We also have a physical threat for nonstate actors to attempt to cause problems for our citizenry or to enhance the disaster results.

Some of the things that we are doing better today, interagency planning, planning at all levels of government. Disaster recovery starts at the local level and builds up, unlike most operations that start at a central level and go down. The exercises that we do, the coordination, the planning that we have done, is much greater than we had during Hugo. Our ability to have situational awareness is much better.

Our agreements with the surrounding States through an Emergency Management Assistant Compact, EMAC, is much stronger than it was during Hugo, and we are much more proactive.

The dual status command where we can bring in Title 10 forces increases our flexibility and also our breadth of operation within South Carolina.

As you mentioned, our force structure changes have brought us enhancements in aviation, communications, and to a certain extent, our engineer structure.

Some of the things that concern me as we look at the 21st Century: First off, infrastructure vulnerability. That is subject to attack by state actors, peer actors, Third-World countries, and individuals that just want to cause havoc.

Within South Carolina, we have had a reduction of troops from 11,000 to 9,000, and a loss of a major command headquarters. That will affect our ability to respond internally. We have mitigated that with ad hoc headquarters, along with the professionalizing of our great State Guard.

Our coordination with our Title 10 forces is continuing to develop, but it still has missed results. If you look at other disasters, the coordination of all the resources coming into the State is not as good as you would want it to be.

Then the use of Federal money for pre-positioning State forces to either assist within a State or to assist other States, that money is not available and really causes some issues when we try to preposition, like when we were helping Vermont during the flooding and pre-position several States away.

In summary, we are better prepared command-and-control, force readiness, and abilities, but the threats and expectations have risen in line with our better preparation, and then the funding issue always is a concern.

Thank you for the opportunity to talk to you about our preparedness here in South Carolina. I am prepared to answer any questions.

[The prepared statement of General Livingston follows:]

PREPARED STATEMENT OF ROBERT E. LIVINGSTON, JR.

NOVEMBER 21, 2014

During Hugo, I was company commander of A Company, 122nd Engineer Battalion and the Columbia operations manager for South Carolina Electric and Gas. During the electrical restoration efforts, I was responsible for electrical restoration in Columbia, SC. In less than a week we restored Columbia and I moved to the coast where I was responsible for Folly Beach, Sullivan's Island, Isle of Palms, Awendaw, and McClellanville. My company headquarters was in the shadow of the Ben Sawyer Bridge. My military company was commanded by my executive officer but I had extensive contact with the National Guard concerning access, clearance, and security. Today, I am responsible for the S.C. Emergency Management Division, the S.C. National Guard and the S.C. State Guard. Similarly, a majority of the senior staff and command elements of the S.C. National Guard were present as company-level officers during Hurricane Hugo 25 years ago.

As we examine our ability to respond to another major Hurricane like Hugo, we must do a thorough assessment of how the environment, urban and business development and landscape have grown since 1989. Our main concern is always the protection of life and property. The population density on our coast has increased 40% since Hugo and represents 20% of our State population equaling almost a million people, almost double the 600,000 present during Hugo. Much of this growth is in the Grand Strand Area and Beaufort.

This population must be evacuated prior to a major storm. The road systems are largely unchanged except for some widening efforts. Our ability to communicate with the population has improved greatly due to the density and expansion of social media. Recent exercises and smaller events indicate that the road systems are sufficient as long as the evacuation order is given in a timely manner. This is a critical element.

The housing construction and zoning codes are more oriented to resisting the effects of a major hurricane. We would not expect as much property damage per capita as Hugo, but the density is certainly greater. Our electrical grid and communications grid are much more robust due to growth and redundancy efforts.

Hugo was a source of distress but our ability to overcome is a source of pride for South Carolina residents. We prided ourselves on being able to recover internally and with independent action. Security was not a serious issue. The expectations of creature comforts were not as great as those expressed by the U.S. population in later disaster scenarios. We can expect a higher level of expectations of our Government intervention to provide security and nonessential services. The level of unorganized self-service to include amateur radio seems to have decreased while the level

of organized community service has increased. Hurricane Katrina illustrated the magnitude and immediate feedback from residents on their situations through real-time media reports and social media. We did not face this during Hugo and in today's environment, we must be prepared.

In addition to the evolution of our population, construction, and infrastructure, our outside threats have evolved. The United States is involved with non-state threats that are stationed externally and internally. These threats may use a major storm as a shaping event to cause harm to our population and infrastructure. Therefore, we must be prepared for physical and cyber attacks. Our electrical infrastructure and communications networks are especially vulnerable to cyber attacks.

The organization of local resources have improved for a major storm. All disaster relief begins locally and this is especially true in South Carolina. The cities and counties in South Carolina have organized themselves to respond to major disasters. They have incorporated a combination of dedicated relief workers, repurposed Governmental workers, and an array of volunteer workers organized as Community Emergency Response Teams (CERT). Many of the volunteer responders have extensive training provided by the Federal Emergency Management Agency (FEMA). This is the same training that full time emergency workers receive. All of the major cities in South Carolina and the counties participate at some level at least yearly in a State exercise to test the communications between Governmental entities.

The State's ability to respond with an interagency effort is greatly improved. Not only has each agency improved its internal organization and capabilities but also the coordination between agencies is exercised at least twice a year to include the involvement of the executive branch. South Carolina has strongly embraced the National Response Framework which has the chain of command flowing from the Governor allowing the system to be more responsive in support of the local governments. Experience has taught us that it is better to get out in front of a pending disaster than to try and play catch-up. Although this approach may incur some up-front costs (possibly significant) and political risks, the value of mobilizing and pre-positioning needed assets at critical times and locations has proven to be a successful strategy.

The ability of our State and local governments to amass, process, and share information is a model for the Nation. Using a common internet-based Emergency Management Common Operating Picture (EMCOP), along with the South Carolina Common Operating Picture Enhanced (SCOPE) enables military and civilian organizations at all levels of response to see a common picture. These systems allow us to integrate information without regard to the source. Examples include traffic cameras, streaming video from a military platform and database information on the readiness of a potential unit from another State. With this information we are able to target areas for emphasis and to project resourcing. At the same time, we must be careful of information overload, along with our vulnerability to a cyber threat.

The S.C. National Guard has emerged from 13 years of war as the most ready National Guard in the history of our State. While our Army force structure has been reduced from 11,000 to 9,000, our abilities to deploy the force in a timely and effective manner are increased. We have an excellent combination of the 10 essential capabilities determined by the National Guard Bureau needed for State emergencies. These capabilities are Command and Control, Logistics, Aviation, Security, Engineering, Transportation, Medical, CBRN (Chemical, Biological, Radiological, and Nuclear), Maintenance, and Communications. Our internal aviation lift and utility capabilities are much more robust than in 1989. In 1989 we had three UH–1 Huey Helicopters. Today we have 11 UH–60 Black Hawk Medium Utility Helicopters, 4 UH–72 Lakota Light Utility Helicopters, and 6 CH–47 Chinook Heavy Utility Helicopters. We also have access to additional aviation assets located in neighboring States. Our security force structure is similar to 1989 along with our maintenance, logistics, and medical. Communications is greatly enhanced because of force structure changes and technology. Transportation is enhanced due to the addition of a Transportation Battalion. CBRN is greatly enhanced due the training of our Civil Support Team and the addition of a Chemical Company.

Command and Control has been degraded based on the loss of our Brigade Combat Team (BCT), but that loss has been mitigated by the addition of a Maneuver Enhancement Brigade (MEB). The MEB is a capable organization but does not have the full planning or reconnaissance capability of a modern BCT.

We have added an engineer battalion to the State since Hugo, but total engineering capability has increased only slightly due to today's battalions being significantly smaller than battalions in 1989. Our current battalions are very modern but the equipment is very specialized. In 1989, engineer battalions consisted of companies of Sappers who were multi-purpose. Today the companies are specialized with route clearance, vertical construction, horizontal construction, and bridging equip-

ment. These engineers will be harder to repurpose to domestic relief than the engineers of 1989 based on the equipment. The flexibility and sense of commitment of our soldiers remain the same.

With the reduction in manpower, the Military Department has fully incorporated the capabilities of the Air National Guard. The Air National Guard brings command and control, airfield management, transportation, and engineering capabilities. Additionally, the S.C. Air National Guard has a program called Eagle Vision that was not available during Hurricane Hugo. Eagle Vision consists of five DoD-deployable, commercial satellite ground stations that are located in South Carolina, Alabama, California, Hawaii, and Germany. They each provide users with near real-time commercial satellite imagery of locations within their 1,300-mile visibility circle. Eagle Vision Stations are used to collect and disseminate imagery to various Government agencies such as FEMA and USGS during natural disasters. They also support mission planning, time-critical targeting, and non-war-related operations.

The State Guard has been professionalized and brings about 600 general-purpose troops for tasks like debris clearance and search-and-rescue. The organization also has sections that consist of professional engineers, lawyers, medical personnel, and volunteer deputies. These specialized sections can be employed in the support of a local agency while being protected under State law.

Overall our National Guard capabilities have improved especially in the areas of aviation, transportation, and command and control. Our loss of a BCT puts us behind our neighboring States in organic command-and-control capabilities, but we have compensated using our MEB and ad hoc augmentation. Our ability to collect and analyze data greatly enhances our response effectiveness but it also creates vulnerability.

Our Emergency Management Assistance Compact (EMAC) agreements are greatly enhanced due to increased capabilities and stronger partnerships with our neighboring States. Additionally, the coordination of these resources through National Guard Bureau increases the reliability of commitments; however, the formalizing of these EMAC requests has slowed the "leaning forward" response by neighboring States. In 1989, States would send assets without assurance of payment for services. Today that response is a slower.

Use of Federal capabilities is more formalized than during Hugo and provides the opportunity for better coordination. Significant improvements have been made in the last few years to build/enhance relationships with our local, State, and Federal partners especially at the Federal level with FEMA, NORTHCOM (Northern Command), and DHS (Department of Homeland Security). These partnerships have allowed the valuable experience gained from minor storms/events in South Carolina and major storms (Hurricane Andrew, Katrina, and Superstorm Sandy) on the National level to be shared and exercised in various training events to include Vigilant Guard.

The use of a dual status commander within a State ensures unity of command and effort. Recent disaster response in other States using Federal forces has had mixed results. These forces have the potential to fill capability gaps or shortfalls within a State. The request process is burdensome, although it is being streamlined. Often because of political pressure or relevancy issues, Federal forces are prepositioned or employed without a request from the affected State. These actions can inhibit restoration efforts and waste a tremendous amount of money.

Federal funding is a big issue. Federal forces are positioned without cost to the State, however, the Federal Government does not fund EMAC repositioning which is quicker and less expensive. This disparity creates false economies and wastes valuable resources. Legitimate requests for Federal forces can be labor-intensive. Reform efforts are on-going but are dependent on leadership and the commitment to State sovereignty. While the dual status commander position is a great start, there needs to be a legal commitment to State sovereignty, funding for EMAC positioning and responsiveness of Federal forces.

FEMA is very responsive to the needs of a State during a crisis. They take a very proactive and cooperative approach. The approval of Federal funds is still a very laborious process and is time-consuming. It is frustrating to a State that Federal funds being sent to a State are delayed by bureaucracy while Federal assets are free to reposition with little or no cost consequences. These dynamics are outside of FEMA's control but should be addressed to increase a State's ability to cooperate and respond with other States within a region.

South Carolina is better-prepared to respond to a storm like Hugo than we were in 1989. Our level of training, common situational awareness and ability to command and control are integrated at every level. Aviation is much more robust enhancing our search-and-rescue efforts. The ability to collect and merge real-time data enables us to focus our response efforts. All State agencies are much more

aware of their responsibilities and are more prepared. At the same time we have to be aware of the increased expectations of the public and the threat of our enemies taking advantage of a crisis. The integration of Federal assets is still being developed and has not advanced as much as our State capabilities. Funding for Federally-declared disasters is still slow, inconsistent, and unwieldy. Hugo was a defining moment for South Carolina Emergency Management. After this devastating storm, South Carolina leaders and our citizens proved their ability to deal with such a catastrophe and their resiliency. It is clear a similar storm could have a greater impact due to population growth, increased expectations and increased threats; however, we are confident South Carolina is much better prepared than we were in 1989 because of increased capabilities, preparation, planning, and partnerships.

Mr. DUNCAN. Thank you, General. Thanks for your service.

The Chairman will now recognize Mr. Stenson for 5 minutes.

STATEMENT OF KIM STENSON, DIRECTOR, EMERGENCY MANAGEMENT DIVISION, STATE OF SOUTH CAROLINA

Mr. STENSON. Good afternoon, Chairman Duncan, Congressman Meadows.

Mr. DUNCAN. Kind of swing that mike around. It might help. Thanks.

Mr. STENSON. It disappeared for a second.

Thank you for this opportunity to discuss where we are in preparing for the next Hurricane Hugo. State Emergency Management has done much in the last 25 years to prepare for the next Hugo.

We do know that the State's coastal population has continued to grow rapidly. According to our own estimates, if a storm of similar intensity on the same path as Hugo were to hit the State today, it would cause more than $16.6 billion in damages and destroy more than 21,000 homes State-wide.

So much was learned from Hurricane Hugo, and we put to practice many lessons that Hugo taught. Day-to-day, neither citizens nor government in South Carolina is ready to deal with major disasters. To prepare State Government for the inevitability of just such an event, the State Emergency Management Division has coordinated and drawn up a series of elaborate plans to deal with all hazards, including hurricanes that might affect the State. The plans have been refined and tested through the years and are better than ever before.

Key among them is a South Carolina Emergency Operations Plan, which assigns missions for agencies and volunteer organizations all working together as the State emergency response team. Further, it establishes which agencies are responsible for what actions following a disaster.

Additionally, the State has developed and refined a comprehensive hurricane plan. Such a plan did not exist 25 years ago, and it now includes storm-affected areas and shelter locations based on scientifically-drawn information matrices for evacuation decision making, and extensive and excellent traffic management and lane reversal provisions.

Prior to Hugo, few exercises had been conducted at the State level. Today, the State exercise program has never been stronger, and State-wide exercises are conducted yearly.

In June of this year, EMD conducted an unprecedented 4-day State-wide exercise in concert with Hurricane Awareness Week. The exercise tested the response and recovery plans and operations State-wide.

Organizationally, key members of the State emergency response team have worked together productively for many years. That combined with the process of planning, training, and working together hones skills and builds a solid team in a far more advanced way and far more extensively than ever before.

Ultimately, the process results in strong and diverse relationships, which we think are crucial for success when disasters occur.

Affirmation of the increased professionalism and notable progress in South Carolina emergency management became evident when it attained full National accreditation by the Emergency Management Accreditation Program. South Carolina's emergency management system has demonstrated through program assessment that South Carolina's program meets National standards.

Annually for the past 15 years, the division has produced and published the official State hurricane guide as part of the overall campaign to increase public awareness in dangers.

When disasters occur, the division utilizes contemporary and traditional media to provide timely and accurate information to the public and interacts extensively through social media. Such public outreach and interaction did not exist when Hugo arrived 25 years ago.

The world of technology that exists today is radically different from the technology in 1989. It includes computers, smartphones, internet, social media, GPS, high-definition video, and live inter-State traffic cameras.

Two important technological improvements are the 800 MHz radio system, which provides State-wide communications interoperability, and the Emergency Management Common Operating Picture, a situational awareness tool that provides a common view of the situation, which is vital to the coordinated response.

Are we ready for the next Hurricane Hugo? The answer is yes, but it is important to note that regardless of how much planning and preparation take place, a Hurricane Hugo today will still leave people without power, away from their homes, and roads impassable for extended periods of time.

Perhaps a better question is: Are we prepared for the next Hurricane Hugo? Yes, we are. We have made much progress, but much remains to be done. Our never-ending challenge is to build upon the progress made in the last 25 years and continue to mitigate the overall effects of the next Hurricane Hugo.

Thank you for the opportunity to testify, and I look forward to any questions you might have.

[The prepared statement of Mr. Stenson follows:]

PREPARED STATEMENT OF KIM STENSON

NOVEMBER 21, 2014

Good afternoon Chairman Duncan, Members of the committee, and colleagues. On behalf of the South Carolina Emergency Management Division, thank you for this opportunity to discuss where we are in preparing for the next Hurricane Hugo.

THE HUGO LEGACY

Hurricane Hugo slammed into The Palmetto State north of Charleston just before midnight on September 21, 1989. By early the next morning, it had changed the lives of 1.8 million people, in one way or another, and in its wake had left damages that marked it as South Carolina's "Storm of the 20th Century."

The human suffering associated with Hugo is compelling:

- 35 deaths (13 directly related, 22 indirectly related) and hundreds of injuries;
- $6.5 billion in damages (not adjusted for inflation);
- 264,000 evacuated from their homes in 8 counties;
- 270,000 unemployed;
- 60,000 homeless;
- 54,000 sought disaster assistance;
- Almost 90,000 people took refuge in 191 Red Cross shelters at the height of the evacuation;
- For 30 days, the American Red Cross fed people in shelters and on mobile feeding routes;
- $62 million in food stamps was issued to more than 200,000 households;
- $3.8 million was spent initially to rebuild dunes;
- 3,000-plus active-duty service members were deployed to help;
- 30 assistance centers got applications for loans, grants, housing, and other needs;
- More than 6.7 billion board feet in timber valued at $1.04 billion was lost. The damaged timber, concentrated on 4.5 million acres, represented 36 percent of the State's woodlands.
- $55.6 million in damages to primary and secondary schools.
- More than $2 billion in crop damages.
- Presidential disaster declarations were issued for 24 counties seeking Federal disaster assistance.

PREPARING FOR THE NEXT HURRICANE HUGO

State Emergency Management has done much in the last 25 years to prepare for the next "Hugo." We know it will happen; we just don't know when. We do know that the State's coastal population has continued to grow rapidly, and according to our own estimates, if a storm of similar intensity on the same path as Hugo were to hit the State today, it would cause more than $16.6 billion in damages and destroy more than 21,000 homes State-wide. So our preparations are on-going and evolving.

In the past quarter-century, emergency management in general has moved light years ahead, and South Carolina has gained significant ground because those advances have been integrated into our facilities, our technology, our staff, and our process of planning, testing plans through exercises, and dealing with real-world events. The process is crucial, we believe, not only for the tangible products but for the relationships and team-building that occur as a result of it. We have put to practice many lessons that Hugo taught. Here are a few:

1. Comprehensive Planning.—Day-to-day, neither citizens nor government in South Carolina is ready to deal with major disasters. To prepare State government for the inevitability of just such an event, the State Emergency Management Division has coordinated and drawn up a series of elaborate plans to deal with all hazards—including hurricanes—that might affect the State. The plans have been refined and tested through the years and are better than ever before. Key among them is the South Carolina Emergency Operations Plan, or SCEOP, which assigns missions for agencies and volunteer organizations all working together as the State Emergency Response Team. Further, it establishes which agencies are responsible for what actions following a disaster. The plan is organized according to Emergency Support Functions or ESFs, similar to Federal ones, which emergency managers believe facilitate coordination between State and Federal agencies. Additionally, as an appendix to the overall SCEOP, the State has developed and refined a comprehensive hurricane plan. Such a plan did not exist 25 years ago. It evolved and grew through the ensuing years, and now includes storm-affected areas and shelter locations based on scientifically-drawn information, matrices for evacuation decision making, and—as a result of experiences in 1999 with Hurricane Floyd—extensive and excellent traffic management and lane-reversal provisions developed by the Department of Public Safety. The State also has developed a recovery plan, which sets forth in detail many of the contingencies that had not been provided for when Hugo hit, including methodology for management of donated goods, an issue that was a source of harsh criticism following Hugo. Additionally, the State has put into place a logistics plan and manager, a functional element nonexistent in South Carolina in 1989, but now considered vital to successful disaster response.

2. Full-Time Hurricane Program Management.—SCEMD now has a full-time hurricane program manager, a position that did not exist when Hugo hit. The manager works with representatives from local, regional, and National levels to address hur-

ricane issues. Meetings coordinated by the manager occur regularly with Hurricane Task Force members to identify and resolve issues.

3. Exercises.—Prior to Hugo, few exercises had been conducted at the State level. Today, the State exercise program has never been stronger, and State-wide exercises are conducted yearly. In June, EMD conducted an unprecedented 4-day State-wide exercise in concert with Hurricane Awareness Week. The exercise tested response and recovery plans and operations State-wide.

4. Maturity and Experience.—Organizationally, key members of the State Emergency Response Team have worked together productively for many years. That, combined with the process of planning, training, and working together, hones skills and builds a solid team in a far more advanced way and far more extensively than ever before. Ultimately, the process results in strong and diverse relationships, which we think are crucial for success when disasters occur.

5. Professionalism.—Emergency management is an emerging profession in the Nation and in South Carolina. In recognition of its importance within the realm of public service, several universities including Lander, Anderson University, Columbia College, and Clemson, have begun offering emergency management curriculum. Those offerings are improving the quality of emergency management practitioners State-wide. Affirmation of the increased professionalism and notable progress in South Carolina emergency management became evident when it attained full, National accreditation by the Emergency Management Accreditation Program (EMAP). The accreditation was first granted in 2008, and re-accreditation was awarded in 2013. The accreditation process rigorously examined the ability of South Carolina State and local government to respond to and prepare for disasters. EMAP sets National standards for all aspects of a qualified emergency management program. SCEMD's abilities to plan for a disaster, to reduce the impacts of a crisis, and to assist in the State's recovery from devastation were all examined to ensure 63 National standards were met by the State's Emergency Management Division. S.C.'s emergency management system has demonstrated, through program assessment, documentation, and on-site assessment by an independent team, that South Carolina's program meets National standards.

6. Increased National Guard Capabilities.—While the S.C. National Guard made major contributions to the response and recovery effort during Hurricane Hugo, Maj. Gen. Robert Livingston, the State's Adjutant General, recently noted the State's 11,000 Army and Air National Guard are much better equipped now than when Hugo hit. The S.C. National Guard has more capability in several areas to include aviation, engineering, mobile air traffic control, communications, imagery, and streaming video. Further, repeated Guard deployments to Iraq and Afghanistan have produced a trained cadre of men and women who are familiar with working under difficult conditions.

7. Public Awareness.—Annually for the past 15 years the Division has produced and published the official State Hurricane Guide as part of an overall annual campaign to increase public awareness of hurricane dangers. The guide, which is distributed State-wide via the internet and along the coast as a newspaper insert, provides information to the public that is critical to life safety before, during, and after storms. In addition, the Governor of South Carolina issues annual proclamations for Hurricane Awareness Week and makes coastal media tours to emphasize the storms' importance. Furthermore, the Division participates in numerous awareness events in all coastal counties. When disasters occur, the Division utilizes contemporary and traditional media to provide timely and accurate information to the public, and interacts extensively through so-called social media. Such public outreach and interaction did not exist when Hugo arrived 25 years ago.

8. State Emergency Operations Center.—The current location of the State Emergency Operations Center, which also houses the State Emergency Management Division, did not exist when Hugo came to call. In 1989, the Division was located in a poorly-staffed, highly-inadequate, technologically-insufficient location in downtown Columbia, in the basement of the Rutledge Building. The facility did not have a dedicated and adequate State Emergency Operations Center, and much of the available technology was antiquated and insufficient. In the year 2000, the Division moved into its current location after retrofitting a former National Guard armory to contemporary standards for State emergency operations and management. The facility greatly enhances the Division's ability to function properly. The move would not have been possible without the assistance of Emergency Management Performance Grant funding.

9. Technology.—When Hurricane Hugo hit South Carolina, some county emergency management offices did not even possess fax machines. In the Emergency Management Division there were only three computers, but they were not connected by a network and they were rarely used; most business was conducted on paper.

The world of technology that exists today is radically different from the technology available then. The new technology includes ubiquitous computers, smart phones, the internet, social media, Geographic Positioning Systems, high-definition video and live inter-State traffic cameras. None of the technological advances the Division has made to keep up with new technological demands would have been possible without assistance through Emergency Management Performance Grants. Two recent and important technological improvements are the 800-MHz radio system and a system that provides a common operating picture to responders. The 800-MHz, trunked, two-way radio system is a redundant communication system that allows for communication among State and local government entities State-wide. Most of the towers integral to the system have backup generators, and the Civil Air Patrol provides airborne repeaters when ground systems fail. The Emergency Management Common Operating Picture (EMCOP), a situational awareness tool, can be accessed anywhere on-line, and it provides a common view of the situation, which is vital to a coordinated response.

10. Assistance Requests.—The Emergency Management Division was harshly criticized post-Hugo for its inability to effectively manage requests for assistance from counties, organizations, and individuals. The Division was not equipped to efficiently handle the vast number of requests. Today, the Division uses computer technology to receive and track requests, and the system is also utilized in counties. It is far superior to paper, handwritten forms, and tracking methods used when Hugo happened.

11. Specialized Teams.—State or regional Urban Search and Rescue, Incident Management, and Medical Assistance Teams were not available in 1989. South Carolina now has 5 Urban Search and Rescue Teams, 5 Incident Management Teams, and 4 Regional Medical Assistance Teams to back-up local resources.

12. Consistent Evacuation Signage.—When Hugo came, evacuation signage on the coast was varied or non-existent. Since then, the EMD worked with the State Department of Transportation to install 500 standardized evacuation signs in 19 South Carolina counties that mark the evacuation routes.

13. County Improvements.—All 46 South Counties have a dedicated emergency manger and emergency operations center, which SCEMD supports financially through the Emergency Management Program Grants. The majority of Federal funds SCEMD receives pass directly to local emergency management program, although EMD keeps a portion for basic operating costs.

CONCLUSION

Much progress has been made in planning for the next Hurricane Hugo and much of that planning has been supported by Emergency Management Performance Grants, Pre-disaster Mitigation Grants and other Homeland Security grants. These resources have been integral to supporting many of the initiatives discussed and their continued support is key to maintaining and sustaining our efforts in preparing for the next Hurricane Hugo in South Carolina.

While many things have changed in emergency management since Hugo, a primary one has not: No force wielded by human beings can equal the catastrophic ferocity of nature, and a major hurricane is still a tremendous challenge. Many changes have been made in response to the demands of Hurricane Hugo, and those changes have universally improved the State's ability to respond to not only hurricanes but to any disaster—natural or man-made—that the State might encounter. Are we ready for the next Hurricane Hugo? The answer is yes, but it is important to note that regardless of how much planning and preparation take place, a Hurricane Hugo today will still leave people without power, away from their homes, and roads impassable for extended periods of time. Power will not be instantly restored, people will not be able to immediately return to their homes, and roads will not instantaneously be cleared. Perhaps a better question is are we better prepared for the next Hurricane Hugo? Yes, we have made much progress but much remains to be done. Our never-ending challenge is to build upon the progress made in the last 25 years and continue to mitigate the overall effects of the next Hurricane Hugo. We will continue to move forward with your continued support.

Thank you for the opportunity to testify and I look forward to any questions you may have.

Mr. DUNCAN. Thank you so much.

The Chairman recognizes Sheriff Skipper.

STATEMENT OF SHERIFF JOHN S. SKIPPER, JR., SHERIFF, ANDERSON COUNTY, SOUTH CAROLINA

Sheriff SKIPPER. Thank you, Mr. Chairman and Representative Meadows.

Mr. DUNCAN. If you could turn the mike around, it just helps for this room.

Sheriff SKIPPER. Again, Mr. Chairman and Representative, thank you for the opportunity to be here. Being the last on the list, I have a lot of stuff in my statement they have already said, so I am going to jump on a little bit and expound to tell you and elaborate on from the county level everything these folks have already said is true.

With the cooperation of work and effort along with everyone, the numbers show—I was surprised on some of the numbers. There has never been a Category 5 hurricane hit South Carolina. It has always been 4s and 3s and things like this.

So with that said, and Mr. Stenson said that about the exercises we have been having since Hurricane Hugo, I would just like to go through the list, because I think it is important to tell everyone who has participated in that, when they set these examples up and exercises around the State, you are talking about the Emergency Management Division along with State Law Enforcement Division, the South Carolina National Guard, the South Carolina Highway Patrol, the South Carolina Department of Natural Resources, plus many local agencies such as sheriff offices, fire departments, local, county, and city fire departments, and the police chiefs within their local departments, and with the county emergency management along, in the up-State, and I can speak to this because I am from the up-State in Anderson County, our public health entities and hospitals all participate in these exercises.

We look at it, as you have already heard from these folks, from the whole-community approach, that it is all part of the community. It is not just individual silos that happen. We have to be out there communicating with each other.

Interestingly enough, it doesn't take a direct hit from a hurricane to actually cause us problems. Examples of those are Andrew, when those came through Florida and ended up coming up through the up-State and causing mostly flooding and spawning tornadoes, which causes us problems. So it is not just a direct hit from a hurricane. That was in 1992. Also, Hurricane Ivan, Hurricane Katrina, still caused us a lot of problems.

The reality is that all disasters, whether natural or man-made, are local and regional in nature. They come to us at the local level to be able to have to approach it. So we have been training with that concept on the all-hazards approach.

My daddy always told me it is always good to know where you come from to know where you will be going. So with that, I give an example of the Superstorm Sandy in 2012. One thing that came out of that was the media aspect.

They set up some media levels where people were texting and grabbing those texts and being able to go out there and outsource—crowdsourcing, as you call it in the computer world. I think the technical guys are going to talk to us later from Clemson.

But when you grab that information, it actually gave them a better intel-driven support on where needs were, rather than everybody trying to figure out where it was. So that was good input from there.

The local FEMA and when we deal with local issues when FEMA comes about—and we need to look at them, I think, as a good Federal partner, because as we have seen as from other disasters, within the first 48 to 72 hours, we are kind of there. It is us waiting for those assets to get there. So we need to be prepared. I think the up-State is being prepared, and I am going to give you some examples.

A quick example is February of this year. We had an ice storm in Barnwell County. Small Barnwell County had a disaster. They had one emergency manager, one or two people in the office. They had trees down. Power lines down. Duke Power was out all over the State trying to do those things.

We have a group, and I am going to talk about it in a minute, in the up-State that reached out to them. David Porter is actually here in the audience. He is the emergency manager and Abbeville County. He reached out to them and said, if you need any help, because we actually survived part of that storm in the up-State.

So we sent people down there and ended up being Anderson County, Abbeville County, and Jasper County sent folks down there to help them mitigate the plan and let the manager go home and get some rest. With that, they helped do the disaster plan that the Governor was needing to put in for the FEMA request.

So that all comes out from a thing that we started in Anderson County back when I was a captain. It is called the Western Piedmont Regional Emergency Managers Task Force. That is the five counties around me. That is Pickens County, Oconee County, Anderson County, Abbeville County, and Greenwood County.

We put this group together years ago because we found out that we were putting in for grants—we, the sheriff offices and emergency managers in Anderson County. Come to find out, these other counties were putting in for the same grants for the same stuff. So we formed this group to put our heads together to say we can go forth, and let us get some equipment and let you get some equipment, and we can all share, so we won't all be competing for the same thing.

There is a 1033 program out there that the Government supplies to us. That equipment is very good for us, especially people that have small budgets. About the only issue I have seen negative come out of it is some of our community sees it is as kind of the Federal Government coming in and wanting to take over the local assets. But as we know, that is not true.

There are other programs that we have already mentioned here. I think it is important to understand and know that, in Anderson County, we realize that when something happens, it could very well be it is going to be on us for a while. We are going to have to sustain those assets, and, like I always say, wait for the cavalry to arrive. We, certainly, appreciate when they do.

I can't express enough from our State partners that when we are in trouble or we need assistance, they are always there, and they are always in the planning.

I will give you this quick example in closing. We just went through accreditation at the 9–1–1 center and hopefully will be accredited in March. One of the managers came in from Mississippi, and he started in law enforcement in 1962, so he has been around a little longer than me. So with that said, he said, I go all over this country doing accreditations, and in looking at what we were doing in our 9–1–1 center, because we have the plans in place that include Pickens County, Oconee County, Abbeville County, and Greenwood County, and our responses as part of that task force, he said, I have never seen any county that I have been to that coordinate and communicate better than this county and those counties with us.

So with that, we appreciate your having me here, and I will be glad to answer any questions.

[The prepared statement of Sheriff Skipper follows:]

PREPARED STATEMENT OF JOHN S. SKIPPER, JR.

NOVEMBER 21, 2014

It has been over 25 years since Hurricane Hugo slammed into the city of Charleston, SC, around midnight on the 22nd of September in 1989. The hurricane, a Category 4, made landfall near Sullivan's Island. The hurricane caused 13 directly related deaths and 22 indirectly related deaths, and it injured several hundred people in South Carolina. Damage in the State was estimated to exceed $7 billion, including $2 billion in crop damage. Not even including the expansive growth of the South Carolina Coastal region since 1989 that would be closer to $15 billion in today's economy. Add to that the negative economic impact if the recent Boeing manufacturing facility were to sustain damage or delays in filling orders.

According to the South Carolina Department of Natural Resources, hurricanes and tropical storms are infrequent visitors to coastal South Carolina. In the period, 1901–present, only 27 tropical cyclones have made landfall on the South Carolina coast. Of these, only 8 were of Category 2 to Category 4 intensity. Since 1900, no Category 5 hurricanes have hit South Carolina. There have been 2 Category 4 hurricanes, Hazel in 1954, and Hugo in 1989 and 2 Category 3, an unnamed storm in 1945 and Gracie in 1959.

Since Hugo, the State of South Carolina has worked to improve its readiness and response to a direct hurricane hit. Almost annually the State Emergency Management Division, along with other State agencies such as the State Law Enforcement Division (SLED), the South Carolina National Guard, the South Carolina Highway Patrol, the South Carolina Department of Natural Resources, (DNR) plus many local agencies, such as county sheriff's offices, police chiefs and their local departments, county emergency management, along with public health agencies and hospitals, participate in intensive drills and exercises to train first responders on how to mitigate the potential damage, and to preserve lives. These exercises are conducted using a "whole-community approach" to maximize recovery and resiliency efforts, and test and improve the Emergency Management (EM) System. It should be noted, it does not take a direct hit from a hurricane, such as Hurricane Hugo, to negatively impact the State of South Carolina. Most of the deaths and injuries from tropical cyclones are not from the wind, but from flooding and frequently spawned tornadoes.

Recent hurricanes, that did not directly hit South Carolina, caused wide-spread damage within the State, and in up-State South Carolina. Here are just a few of many examples. Hurricane Andrew hit the greater Miami area of Florida in August 1992. The storm tracked into the Gulf of Mexico and inland again, making its way toward the up-State of South Carolina. The remnants of this storm left a large amount of rain and flooding, even spawning tornadoes. The same is true with Ivan in 2004 and Katrina in 2005. Even though these storms did not hit South Carolina directly, their impact and damage was felt in South Carolina.

The reality is this, most all disasters, whether natural or man-made, is either local or regional in nature. A local response, using an all-hazards approach, is the most effective and most efficient method of dealing with these situations. Superstorm Sandy, which struck the northeast in October 2012, impacted a large area, but for the most part, was handled by local authorities in the areas hit.

Superstorm Sandy also demonstrated the value of using social media in ascertaining where to best deploy resources in the recovery efforts. Crowd-sourcing became an effective tool in assessing need. Crowd-sourcing, using open-source tools, allows Emergency Operation Centers (EOC's) two-way communication with the public, providing validated "intel-driven" solutions and responses for effective actions to any given situation or disaster. While, as in the case of Superstorm Sandy, FEMA played a significant part. The primary mitigation and recovery efforts were handled at the local and State level. Local and State governments should not look at FEMA as the primary responder in any given disaster, as that would be logistically impossible. FEMA needs to be viewed as a valued Federal partner providing additional resources in the recovery and rebuilding efforts. FEMA's advance support of local agencies provides those agencies with the needed tools to be able to respond quickly and effectively.

In February of this year South Carolina experienced a significant winter storm. Many counties were affected to varying degrees. One county, Barnwell County, experienced major damage from an unprecedented ice storm event. This storm knocked out power, and took down numerous trees, blocking roadways. It became more than the local emergency staff could handle on their own. However, rather than reaching out to the Federal level for help, Barnwell was helped by their regional neighbors in dealing with that situation. Staff from Anderson County assisted Barnwell County, as did Abbeville and Jasper Counties.

One of the great changes in recent years, at least in the up-State of South Carolina, is mutual cooperation across county lines. Several years ago several counties got together to form the Western Piedmont Regional Emergency Management Task Force. This regional organization, which currently consist of 5 counties, has been working and training together to help each other in times of disasters. By shedding old territorial boundaries, we have found a way to maximize limited resources during tough economic times.

The Federal 1033 program administered by the Department of Defense, has been a major help for local agencies. The U.S. Department of Defense (DoD) 1033 Program permits the Secretary of Defense to transfer excess DoD supplies and equipment to State and local law enforcement agencies for use in their law enforcement duties. This property is procured at no cost to the agency with the exception of any shipping or transportation costs.

The type of property available includes but is not limited to tactical and riot gear, vehicles, watercraft, weapons, and night vision. All equipment must be strictly accounted for. It has been a great benefit at the local level in being able to procure materials that otherwise might not be obtainable by limited local budgets. In Anderson County we have used some of these assets in recent winter storm events in 2005, 2010, 2012, and this year of 2014. The Boston bombing event in April 2013 reminds us how such assets can be deployed for the benefit and safety of the public at large on the local level. However, the only negative aspect of the program has been the public perception that this is nothing more than the Federal Government trying to leverage control or takeover of local law enforcement and their associated emergency management agencies.

In addition, Defense Support of Civil Authorities (DSCA) the process by which National Guard, Army Reserve, and other military assets and personnel can be used to assist in missions normally carried out by civil authorities, such as responses to natural and man-made disasters, law enforcement support, special events, and other domestic activities, has been an additional asset for local agencies. In Anderson County our Emergency Management has been under the Sheriff's Office for 5 years. For us, this has proven to be an effective partnership, as in times of disasters and emergencies, both agencies must work together. Being under the same umbrella has proffered a good working relationship and understanding, which benefits our entire community.

In looking at how we would deal with a Hurricane Hugo-type event in the 21st Century, the lessons learned since that time are invaluable. Local preparedness and local incident management are vital in resiliency. Using technology to better inform the public and media are essential in putting forth an accurate message. Developing partnerships with fellow stakeholders, rather than working in individual silos is imperative. By working off a common operating platform and unified command, duplication of efforts is avoided, and a more effective response can be engaged. In times past, agencies working without coordination with other agencies often tended to either duplicate, or get in the way of other agencies efforts.

Emergencies, at the local level, are best responded to at the local level. This is easy to understand, as local emergency management knows their capabilities and resources. They also know their regions and their unique risks. These agencies have also established local and regional partnerships, and have built long-standing rela-

tionships, invaluable during times of disaster. For example, in Anderson County, we are located on a major Interstate corridor, Interstate 85, which is the commerce link between Atlanta and Charlotte, and a large part of the United States. Critical infrastructure is in our region, including major nuclear power generating facilities, and major vital industry. The loss of any of these would not just impact the local region, but would have a domino effect over a far larger region. Our well-established relationships and partnerships give us an edge on our initial response to any given situation, and can help sustain those efforts during those critical first 72 hours; the time frame that additional outside assets may need to prepare and arrive.

Other lessons learned are to use creative methods to share information with the public. Superstorm Sandy demonstrated the power of crowd-sourcing and social media. Social media can be a two-way street to learn from the public where the problems are, and to best deploy the most effective response. Recent innovations, some that have been initiated at the Federal level include the IPAWS system. IPAWS, or the Integrated Public Awareness System, allows local emergency managers the ability to send timely and accurate information via multiple platforms, including text messaging, the Emergency Alert System at local radio, television, and cable outlets, and NOAA Weather radio from one common platform, just to name a few. Anderson County is a participant in the IPAWS program, one of the very first in South Carolina, and among a small number Nation-wide.

Anderson County has also developed its own set of applications to better serve the public. Anderson County was the first to deploy Safetown. Safetown is a website and phone application that can be used as a two-way street with the public. Websites and the extensive use of social media, including Facebook and Twitter in maintaining an on-going dialog with the public.

In Anderson County we have the concept of "Anderson Strong." We are working to inform the public, and even train the public to handle a variety of potential threats, including things the public can do when faced with workplace violence, active shooters, and even a school intruder event. Hundreds of people have gone through this training program to date, with many more training events planned.

In Anderson County we realize that when something happens, we may very well be on our own for a substantial amount of time before other assistance, whether at the State or Federal level can arrive. Waiting on the Federal Government to handle a local matter is not an option for us, or any local emergency management agency. Emergencies are best administered from the ground up, not from the top down. When a crisis arrives, time is of the essence. In addition, local emergency management personnel know their local assets, resources, and have built established relationships to help in the mitigation and recovery efforts. The most efficient response, particularly at the Federal level, is to be a valuable resource and valued partner, but not to run the day-to-day aspects of any particular incident.

Hurricane Hugo demonstrated the need for a stronger emergency management community. However, the lessons learned, and actions taken during this time, have a more far-reaching effect. Hurricane Hugo was not simply a coastal event. Its affect could be felt hundreds of miles away. Since 9/11/2001 the focus has been on an "all hazards" response to emergencies. While it is true that we are far more able to deal with the aftermath of a Hurricane Hugo, our agency is far better prepared to deal with any type of emergency that may come our way. When it comes to any type of disaster, natural or man-made, it's not a matter of if, it's simply a matter of when.

Mr. DUNCAN. Sheriff, thank you.

I want to thank all the gentlemen on behalf of the subcommittee. A lot of insight.

So I want to recognize myself for a period of time for questions. What I would like to do is I will ask some questions for the first 5 minutes, and ask Mr. Meadows to ask some questions, and then we may have another round of questions with this panel seated.

One question we have is: Why come to Clemson? Why bring a Congressional hearing into the State? No better place to focus on the things you heard about today on local, State, and Federal response to natural disasters, but also other type of events that could affect our safety and security.

Let me start with Mr. Stenson. One of the lessons that we had after 9/11, and I think we experienced some of this after Hurricane Hugo, was just the ability for multiple agencies to communicate,

whether it was local law enforcement, or whether it was first responders, or whether they were communicating with the folks at the Federal level. So if you could tell me what the State has done, working with the Federal Government, because I know there has been a lot of FEMA grants and Homeland Security grants to help.

I remember 800 MHz radios when I was the State Legislature, but I think we have evolved even beyond that. So communication is vitally important. Can you tell me what we have done on that, in that regard?

Mr. STENSON. Yes, sir, a couple things kind of at the broader level. I mentioned before about the Emergency Management Common Operating Picture. That also includes a program we call Web EOC. It is a Web-based Emergency Operations Center management system, basically.

Basically, everybody that wants access to it in the Government sector can access that information. It is not only just physical information, like the number of shelters that are available or open roads, that sort of thing. But now we have a system here that we fielded about a year ago, EMCOP, Emergency Management Common Operating Picture, which allows us to look at it visually as well.

Then you can look at different layers. If you want to just look at roads, you can look at roads. If you want to look at fire stations, all those things.

So being able to do that and getting that common picture is critical, so that everybody knows, at the Anderson County level, at the State level, at the Federal level, we are all looking at the same picture.

So at that larger level, that is very, very critical. A lot of that didn't exist even 10 years ago. But most States are working on that right now and have done something.

I guess on the other piece of it, I also want to mention, in terms of the communications piece, is interoperability. You mentioned the 800 MHz. South Carolina is very fortunate. We have a very built-out 800 MHz system. It is trunked. The repeaters have generators. It works very well on a day-to-day basis. We think it has fairly high survivability, in terms of being able to operate.

For those areas that may become affected, where the repeaters are not working, we do have a system where we use the civil air patrol as airborne repeaters and send them up in the air.

For those folks on the ground who do not have 800 MHz capability, our budget control board, their information technology folks have a cache of 800 MHz radios that they can basically deploy to the field and pass out. They have done that on many smaller events.

So I think those are some of the bigger things we have done in terms of communications interoperability and making sure that everybody is on the same plane. We are looking at——

Mr. DUNCAN. Not to interrupt you, but during your emergency training, do you all practice on redundancy? Do you make sure in all eventualities that there is some form of communication?

Mr. STENSON. Yes, sir. We do that. One of the things I didn't mention is one of the things we do on almost every major exercise

is we bring down the communication system and work with the amateur radio folks.

They have a presence in most counties, and they have proven to be, I won't say invulnerable, but they have a high level of capability, because it is fairly low-tech point-to-point communications. It is not very vulnerable. So those type of things.

We also have a local Government radio system that we run that also does the same thing.

So we do exercise those pieces during our exercises to make sure that we can use mobile repeaters and that sort of thing.

Mr. DUNCAN. Just a couple follow-ups on that line of questioning. With Oconee Nuclear Station here, how well do you communicate with North Carolina?

I know that is interesting to my friend from Western North Carolina.

Mr. STENSON. We do very well, actually, and especially with the Catawba plant actually up in York. That is even more important in terms of that. We work very closely with North Carolina.

Mr. DUNCAN. Are they comparable in the event of an emergency, the systems?

Mr. STENSON. Yes, sir. We have a good relationship there.

I think everybody knows that disasters do not know boundaries, so you are going to have to be able to work with the people in other States and across other counties and across those State boundaries. That is very critical.

So yes, in fact, we do that. They will be part of the whole process. They will be on the conference calls. We will be consulting them. Yes, sir.

Mr. DUNCAN. All right, I am going to continue down that line. Everybody in here probably has a smartphone in their pockets. Social media is such an important aspect of how we communicate with citizens.

I know, Sheriff Skipper, the Sheriff's office has been using Facebook and social media to communicate about events within Anderson County. Let's expand that.

How is South Carolina emergency management using social media to communicate with the citizens? Then I want to go beyond that and ask the folks at the Federal level how you integrate social media and how at the National level, for emergency response, we are communicating with folks in the Nation.

So I want to start with you. Sheriff, if you want to chime in after that.

General Livingston, this may not apply to the military. We will come back to you with some questions in a minute.

But let's start with South Carolina.

Mr. STENSON. Sir, that is something that we started up a couple years ago, getting very actively involved in that. Fortunately, we have some talent in-house that can do that. We routinely use that and use it both during disasters and day-to-day.

A lot of the information that push out—I am sure right now, as we are speaking, this is being pushed out through our social media channels. There is no doubt in my mind.

Mr. DUNCAN. That is happening immediately?

Mr. STENSON. Pretty real-time. Yes, sir.

I have no doubt. I didn't check before I left, but I have no doubt that there is something out there right now on that.

Then we will also do it during actual events. One of the things that we are working on, though, is we are working on a system of being able to effectively mine that data as it comes in.

Right now, we are using it a lot in terms of pushing out the information. But there is also some intelligence value on what is going on out there in those different places that we should be able to get. But we have to be able to mine it and manage it. It is almost like a military intelligence operation.

I will be honest with you, we are still working on that. We are going to see where we need to go with that piece of it.

Mr. DUNCAN. Sheriff, if you will let me know what you are doing on the county level.

Then I want to hear from the Feds.

Sheriff SKIPPER. Sure. We participate, I don't know if you are familiar with the IPAWS software out there, the Integrated Public Awareness System. It is put up around, especially on the interstates. We were one of the first, I think I am correct on this, one of the first in the State to integrate that within our area.

So when you sign up on your phone to get those alerts, you will be going down the road and when you get in a zone of 15 miles, 20 miles, whatever that zone is, you will be alerted of a situation going on. Your phone will go off and give you that.

We are also doing text messaging and emergency alerts, all those things that go with NOAA.

We have a program that we started and was the first in the country called Safe Towns. Safe Towns allow people to call in our 9–1–1 center or go on our website and sign up and put stuff in about them.

There was little bit of a first response of big brother watching you, but we told them the process is, you put that in the system and it is stuff that you want to come up, if you have an incident. So you can put stuff in there about your home, if you have two dogs in the basement, so when the fire alarm comes in and the fire truck is on the way, when they put that address in the 9–1–1 system, a little box pops up and gives that information that you as a homeowner want them to know about, with your relatives that are there, things about your house.

We also have an opportunity where folks can access real-time calls, when a call is being put out in the 9–1–1 center. Now, we do screen some of those. We don't put every single one on there, because there is some sensitive stuff going on.

But if you wake up at 3 o'clock in the morning, if our citizens hear a siren going through your neighborhood, if you want to get up out of bed and turn you computer on, you can see what is going on in your neighborhood.

So those are just some of the things that Safe Town can take can do in pushing it out, much less the alerts we send out to our officers and all the surrounding counties around us.

Like I said, these folks, many of them are here with me, behind me with the Western Piedmont Task Force. It is all connected to that, and we are integrating it as best we can.

Mr. DUNCAN. I think it is awesome.

Congressman Meadows and I both serve on the Foreign Affairs Committee. We were meeting in June or July with Israeli Ambassador Ron Dermer. While we were sitting at the table, his phone went off with an air raid siren sound.

The first time, he just kind of deafened it. The second time it went off, he looked kind of embarrassed, and he told us what it was. It was a red alert app he has on his phone. It alerted him every time a missile or rocket fell somewhere in Israel shot from Gaza.

I downloaded the app while I was sitting there and his phone went off seven or nine times in that 15-minute meeting. It burned my battery up. I had to take the app off or cut it off, because of the number of missile attacks that were going on.

I tell you that story because it alerted me to the possibility of having an app on a phone that would alert us to a natural disaster, a 9/11-style attack, or what-not. I think that ties in with this so well.

Sheriff SKIPPER. If I could interject, I will tell you that I turned mine off because it buzzes. So I am sitting here a little anxious that something may be going on.

Mr. DUNCAN. The thing is, I had to download an app, so I think the challenge that we may have is that you would have to have something, you would have to subscribe to something. I have to be a friend of yours on Facebook. I would have to sign up. How do we get that message out to the people?

So I want to turn to the Federal side and ask what sort of capability is out there? What are you looking at? How are you using social media and the new communication tools that we have?

I will start with Dr. Payne and then Mr. Fenton.

Mr. PAYNE. Thank you, Mr. Chairman.

Yes, this is a fascinating area of social science right now as well. NOAA's mission is fundamentally to observe the environment and then to translate what we observe into actionable information. That is really what we are there for. So when we are talking about accuracy and reliability in forecasts and warnings, that is really the bottom line.

If you think about communications, that also is the bottom line. You can have the best observing systems in the world, you can come up with the best modeling of an approaching storm, but without a way to communicate it accurately, reliably, and with confidence to the public, it is not likely that the public is going to be able to respond in a way that we would hope.

So there has to be trust in the system itself.

We have basic communication tools and techniques that we use, everything from NOAA weather radio on to cell-based emergency alerts. People can download these apps as part of the uniform distribution of this kind of information, based on what the taxpayer provides and the Government provides.

We work as well very closely, obviously, with the private sector, the private-sector meteorological community, in getting that information out.

I guess what I find fascinating, perhaps to express a little bit of a note of caution, is that sometimes there is too much information. There is nothing like an approaching hurricane in the Atlantic

basin, where in fact it looks like it may be coming to the Southeast and you see the multiple models and see the cone and you see the amount of chatter that is occurring out there in the social world.

But I come back to that point about the importance of reliable sources, accurate sources of information.

So social media has a role. In the way that we are connected today, it is not like anything we have ever seen. At the same time, it can sometimes be too much, and we have to be very careful and very cognizant that we do not find ourselves providing too much information that, for example, cannot be actually digested by the public. It is confusing. It has to be clear. It has to be convenient. It has to arrive on time.

So social media has a role, but I think from the social science standpoint, we need to monitor how this is going and understand its best attributes.

Mr. MEADOWS. What are two examples of where there has been too much information? Normally, that is not the case, at least, the American people would not think that is the case. So give me two examples of where we have had too much information.

Mr. PAYNE. I think in the case where we have different voices that are conjecturing about what a storm may or may not do, is it the official voice or is it another voice? That is really what I am talking about here, because social media allows people to go ahead and do that very thing.

There is nothing wrong with that. That is human nature. But I think that we need to understand and be able to communicate to the public that when NOAA provides an X number of days' advance notice of a hurricane's impending arrival at the coast, its position, its strength, frequency, or intensity of the storm itself, that we be able to continue to come back to that information, and recognize that that is the reliable source.

So it is not an example, really, but it is just trying to provide a little more context for that.

Mr. DUNCAN. Mr. Fenton, FEMA has such a broad responsibility, unlike hurricane events or things NOAA may be involved in, so how would you all use social media?

Mr. FENTON. Yes, we have been using social media at FEMA for the last couple years pretty heavily in a number of aspects. Some of them have been talked to already.

I think the first aspect that we use it as is a common operating picture, so to be able to look over social media and what the public is saying, especially with regard to the preparedness of disasters.

Are people listening to the messaging that we are giving prior to the hurricane and taking the necessary actions? That allows you to understand the preparedness of the communities out there, especially with regard to maybe if evacuation is part of that. So it allows you to get a common operating picture, all the way to the impact of the event and what they are reporting with regard to the impacts.

I would agree with some of my colleagues that, right now, we really need to pay attention to the accuracy of that sometimes. During Hurricane Sandy, we worked through a couple issues with regard to the accuracy.

Another way we use it at FEMA, mentioned earlier, is to push information. So we alert some warnings in the IPAWS system and whether it is the alert going out from the Weather Service you mentioned earlier. Those kinds of things all push through the system out.

The other thing we do is we push information to the public, information as far as being prepared on what to do, with regard to what the type of event is, through social media, and get it out there to large groups, either by tweeting or through the FEMA Twitter account or through other social media vehicles that we have.

We have a number of apps and ways the public can participate within FEMA. One of the ways is they actually can take a picture and put it into our system so we can actually geocode it and see what the damage is there, so it gives us a really a quick assessment of what is happening without actually going out there and physically doing it, but by allowing the whole community, back to my comments earlier, to participate in that common operating picture.

Then there are other agencies that are going down other avenues to help get that common operating picture. After Sandy, the Department of Energy looked at doing apps to go ahead and look at fuel levels at gas stations, to what gas stations have fuel and don't. They have an app now that does that, that helps get a better situational awareness on that.

Last thing I would say is that we are using it to register for FEMA assistance right now. See you can use smartphones. You can use your smartphone to register for FEMA assistance, if there is a declared disaster and you are an individual whose home has been damaged or you don't have a place to go.

Not only is it able to provide you information of where shelters are at, or where you can go to a FEMA center to register, but also, you can actually start the registration process on here, so literally within 15 minutes, you could register for assistance from FEMA. It is a pretty quick process that within a week, someone could be out there to assess the damage and literally have a check to your account from doing that, whereas if you went back 25 years ago, we were doing paper and pen and getting applications, to maybe just 3 or 4 years ago, all doing it by phone. Now, probably 30 percent to 40 percent of our application process is now coming through the internet, smartphones, and those kind of things.

Mr. DUNCAN. So you are saying you could get a check within a week?

Mr. FENTON. If it is that fast, if you get all the information right in here, you register and provide all the necessary information, it can be a pretty quick process. I have seen it go less than a week, yes, sir.

Mr. DUNCAN. My time is expired. I am going to recognize Mr. Meadows for some questions, and then come back.

Mr. MEADOWS. General, let me come to you, because you get to wear a lot of different hats. I had the pleasure of visiting outside of Columbia, South Carolina, at the invitation of Lieutenant Colonel Fidler and Captain Matt Summey. I got to see unbelievable preparation, in terms of Apaches. They were coming in, and I was impressed.

But I was also further impressed with the experience level with so many of our National Guard men and women, who have, many of them, other jobs, who come in and they are prepared.

How do you prepare them for combat, prepare them for Ebola, prepare them for hurricane response, prepare them for a nuclear event? How do we adequately do that, so that when it happens, they are there? I mean, certainly, there is a limitation on resources, on time. How do you do that?

General LIVINGSTON. Congressman, it is a combination of a lot of things, but it goes back to the basis of our country, and that is the common citizen who is very successful in their private lives willing to share their experience from their private lives. There is also professional training to serve the people of their community, their State, and their Nation.

Emergency preparedness is very similar in everything that we do. If you are talking about responding to a hurricane here in South Carolina, it requires a certain amount of organization, tasking, putting the right units at the right place. So there is a common thread in that to what we would do, say, in a counter-insurgency fight in Afghanistan, because, again, we have a security element dealing with the hurricane. We have a security element dealing with the mission in Afghanistan.

We have a citizen support piece that deals with both of those. We have a communication piece that gets information out to the citizens, brings information back in. We have an intelligence piece.

This is something that is overlooked so many times, the analysis of data. We talk about a lot of data flowing back and forth, but it is being able to analyze that data and properly apply it.

So the skill sets that our citizen soldiers develop either on the civilian side or on the military side, quite often you find it is on both sides of their careers, is able to be applied across this spectrum of events. If we are going to deal with Ebola, now we take this set of skill sets and planning capabilities and we apply the very specific threat of Ebola and how you respond to that specific threat. That is a train-up mission.

But what I would say is, our mission of responding across a broad spectrum to include civilian challenges actually makes us stronger in every mission that we are engaged in. This has been well-proven with our soldiers in combat who came back and immediately responded to a hurricane in their home State.

Mr. MEADOWS. Well, thank you for your service. I would ask, I guess, one follow-up question.

On a scale of 1 to 10, with 10 being most prepared, where would you place the men and women who serve here in South Carolina, in terms of their——

Mr. DUNCAN. You are talking about the South Carolina National Guard. They are going to be up there.

Mr. MEADOWS. They are going to be up there.

Where would you put them on a scale of 1 to 10? If it is not a 10, what is the one area that you either need additional funding for or additional time to train?

General LIVINGSTON. Well, I will be modest. I will say 9.9.

[Laughter.]

Mr. MEADOWS. Good answer.

General LIVINGSTON. As we look at the funding streams, it is flexibility of funding as it comes into the State to train our men and women. The other piece that we are dealing with are the force structure issues that you are very familiar with. As we talk about how we defend our country, so many times we forget about how we are going to defend this homeland and what the State's role is in the defense of the State borders and then the assistance within the local municipalities and counties, and then how that feeds back into the Federal defense.

So I guess the two biggest challenges that we have are flexibility of funding and then the degradation or the loss of force structure within our National Guard that prevents our ability to respond as well as we need to within the borders of the United States.

Mr. MEADOWS. If the Chairman would just allow one last closing question, which actually goes really more across the gamut, most of you are involved with agencies that you are called for one particular purpose, and that is to serve your fellow man, and to serve the people not only of this State but of this country.

I have never found those who are first responders, whether it be in the National Guard or anywhere else in any of these agencies, who don't feel that sense of calling. I look up and there is a chief from Belton Fire Department here. Just having met him, I know that I could call on him in my community and he would serve.

But there are logistical challenges that come into play, whether it is a sheriff or fire chief or the National Guard, that when these major events happen; it is who is in charge, who disseminates information, where does that desire to help get focused and channeled in the right way?

So I would ask each one of you to give me one example of an area we need to address with regard to that coordinating effort.

I will start with you, Mr. Fenton.

Mr. FENTON. I guess one area that I would say is, obviously, the systems are out there. The National Response Framework is our Nation's system on how we respond. The National Incident Management System is a system by which State and local governments respond to events, especially at the incident command level using ICS. Those are out there. There are institutions that provide that training.

I think it is really institutionalizing those across Government to a very high level that allow for when there are complex events and resources come from out of areas to ensure that we have a unified system that works toward unity of effort of saving Americans and helping survivors.

Mr. MEADOWS. So by institutionalizing, you are saying so you don't have to open your handbook and say, well, who is in charge of this particular thing?

Mr. FENTON. Right. I think that it is something that we continue in this country and work for. We worked at it for over 10 years. It is a constant process that we are working across the country, to continue to improve it. I think it is an on-going thing.

I think by doing that, it allows for common command-and-control and systems to work in those complex environments.

Mr. MEADOWS. Dr. Payne.

Mr. PAYNE. Yes, thank you. I think it is a really important question. I would like to give two examples. The second one will be very fast.

The first one is I would like to talk a little bit about another framework. My colleague here from FEMA just mentioned mitigation framework. Another one is the National Recovery Framework.

The way in which that is expected to occur is that agencies will be working with States and localities after an event occurs to go through those paces of recovery. I think that one of the things that we really need to be paying more attention to is what it is that communities, States, and the Federal Government are doing in the pre-disaster mode to address recovery.

When you are in the heat of the response, that is about survivability. That is about the initial ability, as General Livingston has said, of people to come and make things happen that will help, especially with survivability and getting the systems back up and running, getting sewer running, getting energy running, making sure there is clean water and food, so that people can survive.

So what we find ourselves trending toward is, as the response proceeds, then recovery becomes the next step we have to take. But we recognize that recovery is a long-term process.

So the initial responders are absolutely critical. We are all initial responders. I think that we as communities need to be able to understand how it is that we can put ourselves into a mode of personal accountability and survivability.

When the cavalry comes, that is great. But in the mean time, we have to get past that step.

The second thing is, we did some work out in American Samoa, following the tsunami that they experienced several years ago. In that circumstance, what occurred, because there were damages to natural resources, especially coral reefs and nearshore areas, there was a deluge of scientific interest coming in and wanting to do initial assessments on what the damages were to those resources. The problem with that is that no one was in charge. It was really kind of a cluster for a while.

So recognizing this and then going back to American Samoa 2 years later and working with communities, working with the Tribal elders, we talked about the implications of that. Then we decided that we, NOAA and the USGS, the Geological Survey, in particular, and a couple other agencies, would actually get together and develop a protocol that would provide for clear lines of communication and coordination and purpose in how it is that the scientific community in arriving and taking those tasks on would be able to do a better job, a cleaner job. That protocol is now in place.

Mr. MEADOWS. General.

General LIVINGSTON. Congressman, when you look at disaster response and disaster recovery, it all occurs at the local level. That is your initial responder. Those are the people who are in charge, even as we go into the recovery, through the recovery process. It is very important that we set that stage for economic recovery by using resources as close to the disaster as possible.

So that means that you start at the county level. You start in the cities and counties, and then you move up to the State. We

don't have any question about who is in charge of our State. It is our Governor.

But what we do have a question is, where do we get the money from? When we are positioning, when South Carolina chooses to assist Vermont with dump trucks or aviation during their flooding, and we need to reposition assets to that area, if that flooding does not occur, nobody is going to pay for those resources.

The Federal Government has the reserves to be able to pay for disaster response. State and local governments do not have those large reserve funds, especially when it involves helping your neighbor, North Carolina, Georgia, somebody like that.

So pre-disaster repositioning of equipment and people, if that disaster does not occur, we would prefer to turn to the Federal Government, since they have those disaster reserves and say, can you pay for our pre-positioning? That is not the case at this point. We reposition on somebody's dime within the Government.

So it is really using those Federal fund resources to apply to the State and local government pre-disaster or in preparation for a disaster.

I will give you an example that is very frustrating. We were repositioning aviation assets to assist in Superstorm Sandy. We could not find a way to fund moving aviation assets closer to New Jersey and New York, so that was an issue. However, we had plenty of funds to redirect an aircraft carrier to head that way. The State is going to be a lot more responsive, it is going to bring a lot more germane assets, than a combat aircraft carrier.

Mr. MEADOWS. I am going to have to ask you to shorten the answers up.

Mr. Stenson.

Mr. STENSON. Certainly. I think it fits nicely with the question. Many of us think success in emergency management is based on two factors. One is the number of relationships you build with those organizations and individuals before an event, and then the number of interactions that you have with us folks. So the planning piece is very critical there.

A couple quick examples, every year within the functional areas we bring in all the players at the State level and make sure that they understand their roles and responsibilities, and we understand that.

We also have a task force approach for certain areas. We have a hurricane task force, a recovery task force. We bring in all the partners, State agencies, local folks, and the Federal folks, in some cases, to work those issues.

So if you plan all that out in advance before you have to do it, the chance of being successful are much greater.

Mr. MEADOWS. Sheriff.

Sheriff SKIPPER. The quick answer to that is, I am the elected official. I am always in charge. With that said, we in the up-State work off of a unified command so that, in any given situation, whatever the situation is, that person is in charge.

I will give you an example. I was talking with a lady at lunch. We had an exercise a couple years ago, a real-time exercise, where we were dealing with terrorists and things like this. It was a law enforcement function. But we got in and there ended up being some

fire issues, so the fire chief, it immediately became his. Then when we found out what was going on, my DHHS representative was behind me, he was in charge because it had to do with bacteria.

So I think, as I said earlier, nobody is an individual silo. It all has to do with taking care of the situation and how we need to take care of it.

One of your questions about my folks, being at the local level, I have so many deputies. Obviously, when it goes bad, I am hoping all of them are going to come to work. But we were always concerned about what they are going to do with their families. You have a mom and child at home, and you are expected to come in and take care this big thing.

We set up, several years ago, when I was a captain, a process where our deputies know, when that gets to that point, there is a place to bring the family. We are going to house them, have people there to secure them and take care of them, while they are out doing their jobs. We extend that to our whole emergency service. My daddy was a volunteer fireman, so I was a fireman before I was deputy.

Mr. DUNCAN. I want to thank you. We are going to have to wrap up Panel One, but I really hate to, because there are so many more questions that we all have.

Members of the committee who are here today and Members of the Homeland Security Committee may have additional questions for you after this is reviewed. I just ask that the panel respond to those in writing, if you will.

So now I will adjourn the first panel, and we will take a brief pause as we set up for Panel Two.

[Recess.]

Mr. DUNCAN. Okay, we are ready for our second panel. Thank you for bearing with us for a little bathroom break. TV stations were on deadline, and we wanted to make sure that we got some of our panelists an opportunity to talk with them.

Our second panel is quite distinguished. I will introduce them. We will go through the same format of introductions, and then we will go into opening statements.

Our first panelist is Dr. Clifton Lacy, director of University Center for Disaster Preparedness and Emergency Response in New Brunswick, New Jersey. The center is a collaborative initiative, bringing together subject-matter experts from Robert Wood Johnson Medical School, Robert Wood Johnson University Hospital, and Rutgers University.

Mr. Jim Bottum was named vice provost and chief information officer for computing and information technology here at Clemson University in 2006. Mr. Bottum leads Clemson's effort to build a state-of-the-art cyber infrastructure for education, research, and service.

Major Thomas Louden is the general secretary for the North and South Carolina Division of the Salvation Army. The Salvation Army is a disaster services organization that maintains representation in the emergency operations center set up for each disaster, working with other relief organizations like State Emergency Management, FEMA, and volunteer organizations active in disasters.

Dr. Jason Hallstrom is an associate professor in the Computer Science Division of the School of Computing at Clemson University, and serves as the deputy director of technology for the Institute of Computational Ecology. His current research focuses on using data and computers that compile environmental information to manage water resources to be sure that water is being used in the right quantity and the right quality level.

The Institute of Computational Ecology. That is a mouthful, and I look forward to finding out what that is.

Ms. Emily Bentley is an associate professor and coordinator of the Homeland Security and Emergency Management Program at Savannah State University and a consultant in disaster preparedness. Ms. Bentley previously served as executive director of the Emergency Management Accreditation Program and National Standards and Assessment Program for State and local government emergency management.

So I want to thank all of you for being here, and the Chairman will recognize Dr. Lacy for an opening statement.

We will adhere as closely as we can to the 5-minute rule.

Dr. Lacy.

STATEMENT OF CLIFTON R. LACY, M.D., DIRECTOR, INSTITUTE FOR EMERGENCY PREPAREDNESS AND HOMELAND SECURITY, RUTGERS UNIVERSITY

Dr. LACY. Chairman Duncan and Congressman Meadows, good afternoon. My name is Dr. Clifton Lacy. I am the director of the Rutgers Institute for Emergency Preparedness and Homeland Security. I am the former commissioner of the New Jersey Department of Health and Senior Services, and the former president and CEO of Robert Wood Johnson University Hospital and Health System, and a practicing physician for over 30 years.

I want to thank you for the opportunity to present to you some of my thoughts and observations regarding disaster preparedness and to introduce you to the Institute for Emergency Preparedness and Homeland Security at Rutgers University, and the University Center for Disaster Preparedness and Emergency Response at Robert Wood Johnson University Hospital.

These are my personal and professional thoughts and observations regarding disaster preparedness. They do not represent official positions or policies of any organizations or entities.

In many respects, disaster preparedness in the United States is significantly better today than before 9/11, the anthrax bioterrorism, Hurricane Rita, and Superstorm Sandy. However, many gaps in preparedness still exist that need to be addressed.

There is urgency to enhance preparedness to respond to threats in advance of the next major incident.

In the interest of time, I will address biological, chemical, and explosive threats in my oral remarks. Please refer to my written testimony for additional commentary.

Biological threats include naturally-occurring emerging and reemerging infectious diseases such as the Ebola virus disease, which has been spreading out of control in West Africa, and MERS, the Middle Eastern Respiratory Syndrome, which emerged in the Ara-

bian Peninsula, both of which are associated with high mortality rates among victims.

The Ebola virus disease is a form of hemorrhagic fever, which is taking a terrible toll in West Africa, with an approximately 70 percent mortality rate. The disease is not readily transmissible in humans by the airborne route and does not become contagious through contact with bodily fluids until signs and symptoms appear.

MERS is a coronavirus infection, a recently-emerged infectious disease with about a 40 percent mortality rate. It has spread to 22 countries, and it is fortunate that person-to-person transmission has thus far been limited.

Now some points of concern. No. 1, diseases like MERS or H5N1 avian influenza may gain the ability to be easily transmitted person-to-person, resulting in a world-wide pandemic of enormous proportions and grave effect.

In addition to the naturally-occurring infectious diseases, laboratory accidents and errors have resulted in exposures, infections, and deaths involving most of the dangerous select agents. Even the most highly-regarded biosafety level III and biosafety level IV laboratories have experienced mishaps with highly hazardous biological organisms.

In addition, laboratories in the United States and around the world are creating new biothreats, either through modification of existing biological agents or through creation of novel organisms. The genetic sequences for these synthetic biothreats are shared world-wide through scientific publications and presentations, and may serve as blueprints for development of devastating infectious threats by those who would wish to do us harm.

Scientists today are performing so-called gain of function studies. These experiments ascertain which genetic modifications would enable infectious disease organisms to become more lethal, more transmissible, and resistant to existing countermeasures. Inadvertent release of one of these agents could cause a world-wide health crisis.

In chemical threats, these continue to be a major concern as well, especially those that involve extraordinarily hazardous substances and are located in populous areas of our Nation. There continue to be chemical containment facilities within urban areas that have yet to convert to inherently safer technologies that use feasible alternatives to reduce the potential harm that would result from accidental release or terrorist attack.

Another on-going concern involves the transport of hazardous substances through populated areas. Tanker cars of crude oil, chlorine, and other dangerous substances pass through urban and suburban areas of our Nation on a daily basis. Notification of States, counties, and municipalities is only mandated if certain conditions are met.

Disaster planning must include an understanding of these risks, the mitigating factors, countermeasures, and strategies for in-place sheltering and/or evacuation.

Explosive threats have been the weapon of choice in both military and civilian settings. These can be caused by improvised explosive devices or manufactured explosives. These threats are

among the least difficult to carry out. As was observed in the aftermath of the Boston Marathon bombings, multidisciplinary planning and the immediate involvement of the general public as first responder can mitigate harm and save lives and limbs.

As one of my colleagues recommends: Don't just see something and say something, do something.

Now, what are the approaches to these threats? The approaches must be evidence-based, comprehensive, and multidisciplinary. It starts with effective command-and-control communications. All-hazard generic readiness must be enhanced with the threat-specific preparedness. A major focus must be the increase in understanding of the interdependencies between critical infrastructure sectors with special protection of the lifeline sectors.

There needs to be more consistent and effective incorporation of lessons learned from real-world situations and from simulations and exercises. Organizational silos must yield to crosscutting collaboration. Information sharing is critical to at all levels, both horizontally and vertically. Interoperability of equipment is a necessity for situational awareness and for coordinated response.

Evidence-based responses require research to establish the best practices. Planning, training, and the conduct of exercises in advance of a disaster are critical to effective management of the event.

Greater engagement and inclusion of the private sector, which owns and operates the majority of critical infrastructure in this country, is necessary for effective preparedness and response.

The public health system, which has been significantly stressed by the increasing presence of communicable diseases, needs to be reenergized and infused with funding.

There needs to be a better understanding of the inevitability of the occurrence of major threats and hazards, and a greater focus on resiliency, continuity of operations, and return to full functionality.

Finally, there needs to be an increased involvement of subject-matter experts in the public and private sectors, especially tapping the expertise and experience of our colleges, universities, and academic health centers to enhance National preparedness and response to the vast spectrum of existing and emerging threats.

I look forward to answering your questions and telling you more about our institutes and the great work we have done.

[The prepared statement of Dr. Lacy follows:]

PREPARED STATEMENT OF CLIFTON R. LACY

NOVEMBER 21, 2014

Chairman Duncan, Ranking Member Barber, and Members of the subcommittee, good afternoon.

Thank you for the opportunity to present to you some of my thoughts and observations regarding disaster preparedness and to introduce you to the Rutgers Institute for Emergency Preparedness and Homeland Security and the University Center for Disaster Preparedness and Emergency Response.

These are my personal professional thoughts and observations regarding disaster preparedness and do not represent official positions or policies of any organizations or entities.

TYPES OF DISASTERS

Disasters can be categorized as caused by natural hazards, technological hazards, or intentional threats.

Natural hazards are naturally-occurring disasters of geophysical, hydrological, climatological, meteorological, and biological origin that occur with or without warning. These hazards include earthquakes, wildfires, hurricanes, tornadoes, storm surges, and disease epidemics, among others.

Technological hazards are caused by humans and include, among others, industrial accidents, transportation mishaps, infrastructure failures, power service disruptions, and blackouts.

Intentional threats are deliberate and purposeful hazards caused by humans and include, among others, biological, chemical, radiological, nuclear, explosive, and cyber threats.

In many respects, disaster preparedness in the United States is significantly better today than before 9/11, the Anthrax bioterrorism, Hurricane Rita, and Superstorm Sandy. However, many gaps in preparedness still exist that need to be addressed. There is urgency to enhance preparedness to respond to threats in advance of the next major incident.

With respect to weather events, although prediction capabilities have markedly improved, there is still a great need for more granular information by specific location to be able to prepare, mitigate, and respond to local effects. For example, more accurately prediction of the extent of local storm-related tidal surge would allow municipalities and their residents to institute effective strategies to minimize adverse consequences from extreme weather events.

With respect to technological events, deterioration of infrastructure can lead to building and bridge collapses, dam failures, power service disruptions, among other incidents. Some U.S. infrastructure has aged more than twice its expected lifespan. Some thoroughfares built many decades ago now carry 5 to 10 times the traffic originally anticipated. Infrastructure failures continue to occur, but catastrophic events fortunately remain quite rare. Attention and funding need to be increased to support the physical infrastructure that allows continuity of operations and society.

Biological threats include naturally-occurring emerging and re-emerging infectious diseases, such as Ebola Virus Disease (EVD), which is currently spreading out-of-control in West Africa, and Middle East Respiratory Syndrome (MERS), which emerged in the Arabian Peninsula—both of which are associated with high mortality rates among victims. Although Ebola Virus Disease, a form of hemorrhagic fever, is taking a terrible toll in West Africa with approximately 70% mortality rate, it is fortunate that the disease is not readily transmissible in humans via the airborne route and does not become contagious through contact with body fluids until signs and symptoms appear. MERS, a coronavirus infection, is a recently-emerged infectious disease, with approximately 40% mortality rate. Although the disease has spread to 22 countries, it is fortunate that person-to-person transmission has been limited. Of major concern is that diseases like MERS or H5N1 Avian Influenza may gain the ability to be easily transmitted person-to-person, resulting in a world-wide pandemic of enormous proportions and grave effect.

In addition to naturally-occurring infectious diseases, laboratory accidents and errors have resulted in exposures, infections, and deaths involving most of the dangerous Select Agents. Even the most highly-regarded Biosafety Level 3 and Biosafety Level 4 laboratories have experienced mishaps with highly hazardous biological organisms.

Also, laboratories in the United States and around the world are creating new biothreats, either through modification of existing biological agents or through creation of novel organisms. The genetic sequences for these synthetic biothreats are shared world-wide through scientific publications and presentations and may serve as blueprints for development of devastating infectious threats by those who wish to do us harm. Scientists today are performing so-called "gain-of-function" experiments to ascertain which genetic modifications would enable infectious disease organisms to be more lethal, transmissible, and resistant to existing countermeasures. Inadvertent release of one of these agents could cause a world-wide health crisis.

Chemical threats continue to be a major concern, especially those that involve Extraordinarily Hazardous Substances (EHS) and are located in populous areas of our Nation. There continue to be chemical containment facilities within urban areas that have yet to convert to Inherently Safer Technologies (IST) that use feasible alternatives (such as replacement of chlorine with sodium hypochlorite) to reduce the potential harm that would result from accidental release or terrorist attack.

Another on-going concern involves the transport of hazardous substances through populated areas. Tanker cars of crude oil, chlorine, and other dangerous substances pass through urban and suburban areas of our Nation on a daily basis. Notification of State, county, and municipality is only mandated if certain conditions are met. Disaster planning must include an understanding of these risks, mitigating factors, countermeasures, and strategies for in-place sheltering and/or evacuation.

Radiological threats are another major concern. I will defer remarks on improvised nuclear devices and the effects of electromagnetic pulse, since these can result in catastrophic impact of immense scale. It should be noted, however, that catastrophic planning activities for these threats are being carried out.

On a smaller scale, accidental releases and exposures to radioactive isotopes continue to be reported, sometimes related to improper disposal of medical equipment. In addition, some radiological sources are not well-secured. Numerous instances of theft or loss of isotopes occur each year. Exposure to these substances can be extremely harmful to health. The addition of radioactive material to conventional explosives creates radiological dispersion devices (ROD), weapons of mass disruption and fear, that can affect involved areas for long periods of time and at great cost.

Explosive threats have been weapons of choice in both military and civilian settings. These events can be caused by improvised explosive devices and manufactured explosives. These threats are among the least difficult to carry out. As was observed in the aftermath of the Boston Marathon bombings, multi-disciplinary planning, and the immediate involvement of general-public-as-first-responder can mitigate harm and save lives and limbs. As one of my colleagues recommends, "Don't just see something and say something, do something."

Active shooters is another threat that is difficult to prevent. Efforts to refine behavior assessment, predictive accuracy, and early intervention may avert some of these incidents. It is critical to be prepared and alert. Tactical EMS, providing medics with the skills and training to support tactical law enforcement teams, creates a multi-disciplinary capability to intervene in an effective and timely fashion in instances of active shooters or explosive incidents.

Cyber threats continue to grow internationally in scale and intensity. State and non-state actors are breaching the security of Government agencies and private businesses resulting in denial-of-service and theft of money and intellectual property. Of great risk are cyber threats to Industrial Control Systems (ICS) including Supervisory Control and Data Acquisition (SCADA) systems providing control of remote equipment and also threats to health care-related computer systems and electronic medical devices.

APPROACH TO THE THREATS

The number, magnitude, and complexity of threats and hazards can be quite daunting. The approach to these issues must be evidence-based, comprehensive, and multidisciplinary. It starts with effective command, control, and communications. All-hazards generic readiness must be enhanced with threat-specific preparedness. A major focus must be the increase in understanding of interdependencies between critical infrastructure sectors, with special protection of lifeline sectors. There needs to be more consistent and effective incorporation of lessons-learned from real-world situations and from simulations and exercises. Organizational silos must yield to cross-cutting collaboration. Information sharing is critical at all levels, both horizontally and vertically. Interoperability of equipment is a necessity for situational awareness and coordinated response. Evidence-based responses require research to establish best practices. Planning, training, and the conduct of exercises in advance of a disaster are critical to effective management of the event. Greater engagement and inclusion of the private sector, which owns and operates the majority of critical infrastructure, is necessary for effective preparedness and response.

U.S. Department of Homeland Security and FEMA funding need to be restored to prior levels. The public health system, which has been significantly stressed by the increasing presence of communicable diseases, needs to be re-energized and infused with funding.

In addition to nurses and pharmacists, one health care provider group that has not been fully engaged to date is the practicing physician, a vital resource for surveillance, detection, identification, and response to health threats. More continuing medical education should be devoted to disaster medicine and the entire health care team must participate in planning, training, and exercises. There needs to be better understanding of the inevitability of the occurrence of major threats and hazards and a greater focus on resiliency, continuity of operations, and return to full functionality.

Finally, there needs to be increased involvement of the subject-matter experts in public and private sectors, especially tapping the expertise and experience of our colleges and universities to enhance National preparedness and response to the vast spectrum of existing and emerging threats.

NEW JERSEY ACADEMIC INSTITUTIONS ACTIVE IN PREPAREDNESS

Rutgers University and its partner Robert Wood Johnson University Hospital in New Jersey play major roles in the disaster preparedness and response arena.

The Rutgers Institute for Emergency Preparedness and Homeland Security was recently established to play a National and international leadership role in developing and implementing initiatives to protect the lives, health, and well-being of individuals and populations, through collaboration in research, education, community outreach, and practice.

The Institute brings together experts from the broad spectrum of disciplines, schools, departments, and centers that exist across the State-wide campuses of Rutgers, The State University of New Jersey—and with Federal, State, National, and international partners in the public and private sectors—to address all aspects of emergency preparedness, disaster response, and homeland security.

The multidisciplinary subject-matter experts work together to optimize prevention, protection, preparation, mitigation, response, recovery, and resiliency for all-hazards emergencies, disasters, and terrorism—whether of natural, accidental, or intentional origin.

The experts span the spectrum of disciplines including health care, behavioral health, public health, biosafety and biosecurity, emergency medical services, emergency management, law, public safety, criminal justice, homeland security, transportation science, engineering, pharmacology and drug development, computer science and cybersecurity, mathematics, environmental and exposure science, business, and public policy, among other areas having a nexus to preparedness and response.

The Institute is a single point of entry to a wide spectrum of experts and a one-stop portal to address educational, clinical, research, and community outreach needs.

The Institute's major features include: Fostering collaboration among Rutgers faculty, students, and staff; developing collaboration between Rutgers University and outside public and private entities; serving as a single portal to connect with Rutgers experts; and featuring a one-stop capability for access to the full breadth and depth of expertise in the relevant subject matter.

The University Center for Disaster Preparedness and Emergency Response (UCDPER) is a collaborative initiative of Robert Wood Johnson University Hospital, Rutgers Robert Wood Johnson Medical School and Rutgers, The State University of New Jersey.

The Center's mission is to develop and implement initiatives to advance preparedness and response to all-hazards emergencies, disasters, and terrorism.

Areas of expertise include: Mechanisms of action of chemical warfare agents; development of countermeasures to chemical threats; safety and security of bridges, roads, and related transit systems; security of pipeline and energy distribution systems; port security; plume modeling; analysis of big data; triage; decontamination; mass casualty management; trauma care; disaster medicine training; economic analysis of preparedness initiatives; survey research; risk communication; victim tracking; public and private sector policy development; information assessment and analysis; clinical and health care preparedness; research and development; education; training; exercises; and service and outreach to the community.

Robert Wood Johnson University Hospital (RWJUH) is a 965-bed academic health center in Central New Jersey. RWJUH is the core hospital of Robert Wood Johnson Health System, which currently has more than 10,000 employees, 3,200 medical staff members, and over 1,700 beds.

RWJUH New Brunswick is the flagship cancer hospital of the Rutgers Cancer Institute of New Jersey and the principal hospital of Rutgers Robert Wood Johnson Medical School. Its Centers of Excellence include cardiovascular services, cancer care, and women's and children's services at the Bristol-Myers Squibb Children's Hospital at Robert Wood Johnson University Hospital. The hospital is a Level 1 Trauma Center and a Tier 2 Ebola Facility. It serves as a National resource for ground-breaking approaches to emergency preparedness and mass casualty management through the University Center for Disaster Preparedness and Emergency Response, International Center for Terror Medicine, State of New Jersey Regional Medical Coordination Center, Regional EMS Communication Center, EMS Education and Training Center, participation in preparedness exercises including the highest level of play in TOPOFF–3 (the Nation's largest bioterrorism exercise), and

major educational conferences on disaster management. The hospital functions as a laboratory to study innovative preparedness and response strategies, especially with respect to surge volume and mass casualty management.

The hospital has received Department of Defense funding through the U.S. Army Medical Research and Materiel Command (USAMRMC)—Telemedicine and Advanced Technology Research Center (TATRC).

A major funded project is "Evidence-based Best Practices for Explosive/Incendiary Incidents: Translating the Israeli Experience for Use in U.S. Military and Civilian Pre-Hospital Health Care Systems." In this project, approximately 50 National and international subject-matter experts participated in a working group to identify best practices for management of blast incidents from the U.S. and Israeli military and civilian experience. Scientific journals articles are currently under review for publication.

Another major funded project is the "Use of Real-Time Locating Systems (RTLS) Optimize Response During Disasters and Other Mass Casualty Events and During Routine Hospital Operation" which evaluated the use of real-time locating systems (RTLS) to optimize the efficiency and effectiveness of patient management and disaster response under conditions of markedly increased patient surge volume (during simulated full-scale mass casualty events) and in periods of usual patient volume (during routine hospital operation). The hospital was outfitted with RTLS technology, 6,000 pieces of equipment were tagged, and four Full-Scale Dress Rehearsals and Full-Scale Exercises/Experiments were performed with participation of a total of 2,000 role players (volunteer-simulated blast victims and staff personnel). Data analysis is currently in process, to be followed by publication of results in scientific journals.

CONCLUDING REMARKS

It is inevitable that hazards and threats will evolve and incidents will occur. Our preparedness and response must evolve as well. Tapping the robust expertise and experience of university partners will greatly benefit the ability to effectively address these threats. The Rutgers Institute for Emergency Preparedness and Homeland Security and its collaborating schools, centers, programs, and experts stand ready to assist Federal, State, county, and local public and private entities in optimizing our Nation's preparedness and response.

Thank you for the opportunity to make this presentation today.

Mr. DUNCAN. Thank you.

Mr. Bottum.

STATEMENT OF JIM BOTTUM, CHIEF INFORMATION OFFICER AND VICE PROVOST, COMPUTING AND INFORMATION TECHNOLOGY, CLEMSON UNIVERSITY

Mr. BOTTUM. Mr. Chairman, I would like to thank you and the Members of the subcommittee for the opportunity to testify here today. I currently serve as Clemson's chief information officer, and I have been in that capacity since 2006. Before coming to Clemson, I was Purdue University's first CIO, and before that, the executive director at the National Center for Supercomputing Applications, the University of Illinois at Urbana-Champaign.

Today, I would like to focus my remarks on the potential impact of these type of disasters and comparable events on information technology.

As we know, as we have heard today, on September 22, 1989, Hurricane Hugo made landfall off the coast of South Carolina, with estimated winds of 135 mph. A more recent test of our emergency preparedness for a large-scale natural disaster's impact on IT infrastructure occurred with Hurricane Katrina's landfall in 2005.

Tulane University in New Orleans sustained severe damage as a result of the storm, and the disaster forced Tulane to cancel classes for the remainder of the fall 2005 semester. It also impaired

its ability to facilitate payroll or run the university's communication systems.

This event showed the higher education community that traditional notions of disaster planning and business continuity were false. A campus could not effectively operate remotely on-demand.

It is of paramount importance that our localities, States, and Nation are adequately prepared from not only an evacuation emergency preparedness standpoint but from an infrastructure point of view as well.

There are other considerations outside of natural disasters that have the potential to be even more catastrophic in their impact, not necessarily through physical damage, but rather potential economic and societal damage that could be associated with the hacking of our Nation's infrastructure. In today's environment, this threat is more prevalent than ever with our increased reliance upon technology.

Those who remember 1989 likely remember it was much devoid of common technology. Computers were slow, expensive, and applications left mostly to large corporations and the Federal Government. Networks were in their infancy with TCP/IP, the eventual protocol standard first adopted by ARPANET in 1983. Mobile communications were virtually nonexistent in this era, and mobile devices were far from a consumer good.

Technology has become the backbone upon which the most basic functions of society depend. We call this cyber infrastructure.

According to the U.S. Census Bureau, in 2013, 84 percent of all households in the United States reported owning a computer and 74 percent of all households reported using the internet. In this new paradigm, protection of and access to high-speed, high-availability networks is necessary not only for corporations, Government agencies, and utility providers but also for the average consumer. With this comes the notion that we are far more reliant upon cyber infrastructure today than we have ever been, and this necessitates resilient, reliable, and high-performance cyber infrastructure.

Our Nation's infrastructure, including power, water, and telecommunications, is now also heavily dependent on cyber infrastructure for the delivery of services to the population. The 2003 Northeast blackout initially caused by a software failure proved how sensitive our Nation's power infrastructure can be to technology-driven issues.

Another threat, in addition to the hacking threat, is our Nation's cybersecurity expertise gap, one that has implications for our ability to defend our Nation's critical infrastructure assets against these attacks. In order for our Nation to be prepared to defend against cyber disasters and other cyber threats, we must invest in the future of cybersecurity research, education, and training to prepare the next generation workforce.

One of Clemson's industrial partners told us that there are points in time where they will have up to 300 open cybersecurity-related positions without enough qualified applicants to fill them. I fear our Nation faces an upcoming crisis in the cybersecurity workforce if investments are not made to encourage this career path and to ensure robust education and training programs at our Nation's universities.

I believe we as a Nation have progress to make if we are to be prepared in terms of emergency planning, especially for cyber disaster, but also in terms of our long-range strategic efforts to ensure a robust and competitive cybersecurity workforce.

One thing that came up in the last discussion that is not in my notes, but the panel discussed social media. Clemson has opened up two social media listen and command centers. We are in the process of standing up a third inside of our security operations center. There is a lot of business intelligence and data mining to be had out of this particular form of data.

[The prepared statement of Mr. Bottum follows:]

PREPARED STATEMENT OF JIM BOTTUM

NOVEMBER 21, 2014

Mr. Chairman, I would like to thank you and the Members of the subcommittee for this opportunity to testify here today. I would like to begin by taking a moment to briefly acquaint you with Clemson University and my own background.

Located in Clemson, South Carolina, Clemson University is a Nationally-ranked, science and technology-oriented land grant public research university founded in 1889. Clemson is known for its emphasis on collaboration and a culture that encourages faculty and students to embrace bold ideas. With an enrollment of 21,857, Clemson is a high-energy, student-centered community dedicated to intellectual leadership, innovation, and service to the community.

As for myself, I currently serve as Clemson's vice provost for computing and information technology and chief information officer, and have served in that capacity since 2006. During my tenure here at Clemson, we have undergone a massive transformation of our cyberinfrastructure environment—to include our networking, storage, computational capabilities, and our data center—and have fashioned this environment to provide state-of-the-art services for research, education, and public service. Our high-performance computing infrastructure is ranked as the 66th-fastest supercomputer in the world, according to the June 2014 Top500 list,[1] and we have been Nationally-recognized for building models that assist faculty, staff, and students in utilizing this infrastructure for research productivity.

Before coming to Clemson, I was the first chief information officer at Purdue University, where I forged a new model for partnering with research (as recognized in a publication by the EDUCAUSE Center for Analysis and Research, 2005).[2] Prior to this, I was the executive director at the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign. I currently serve or previously have served on a number of National committees, including the National Science Foundation's Advisory Committee on Cyberinfrastructure and the Internet2 Board of Trustees. I also currently serve as Internet2's inaugural presidential fellow.

INTRODUCTION

On September 22, 1989, Hurricane Hugo made landfall on the coast of South Carolina just north of Charleston, as a Category 4 storm with estimated winds of 135 miles per hour or higher.[3] In addition to the impact of the high winds brought onshore by the storm, Hugo produced the highest storm tide ever recorded along the East Coast, and was the strongest storm to make landfall in the United States compared with the previous 20-year period.[3] Mainland damages from this storm were estimated at approximately $7 billion, and impacts were felt from Puerto Rico all the way through Pennsylvania.[3]

In this, or even with storms not as powerful as Hurricane Hugo, it is of paramount importance that our localities, State, and Nation are adequately prepared from not only an evacuation and emergency preparedness standpoint, but from an

[1] Top500.org (June 2014). Top500 List—June 2014. Retrieved from *http://www.top500.org/list/2014/06/*.

[2] Spicer, Donald & Metz, Bruce (July 25, 2005). A New Model For Supporting Research At Purdue University. *Educause Center for Analysis and Research (ECAR), Case Study 7*. Retrieved from *https://net.educause.edu/ir/library/pdf/ers0605/cs/ECS0507.pdf*.

[3] National Weather Service—National Oceanic and Atmospheric Administration (n.d.). Hurricane Hugo: 25th Anniversary. Retrieved from *http://www.weather.gov/chs/Hugo25thAnniversary*.

infrastructure point of view. However, there are other considerations outside of natural disasters that have the potential to be even more catastrophic in their impact—not necessarily through withstanding physical damage, but rather potential economic and societal damage that could be associated with a hacking of our Nation's infrastructure.

This presents a significant threat to our National security, our ability to serve citizens with basic services, and our economic status. In today's technology environment, this threat is more prevalent than ever with our increased reliance upon technology and its associated infrastructure. Another threat, in addition to the offensive nature of the hacking threat, is our Nation's cybersecurity expertise gap—one that has implications for our ability to defend our Nation's critical infrastructure assets against these attacks. Our preparedness for the future depends upon our conscious planning for capacity in cybersecurity research and education, and in equipping the next generation of cyber practitioners with the tools, techniques, and learning opportunities needed to ensure we have a cyber-ready workforce.

A shift from the notion of natural disasters to one of man-made origins also requires a broadening of our understanding and planning for such emergencies. Rather than following the traditional model found with hurricanes—one that often relies upon advance public notice and evacuation plans—cyber attacks that take down infrastructure can come with little to no advance warning, and with little to no time to deploy real-time emergency management plans. Natural disasters also generally have the most significant damages confined to a single, relatively small geographic area, whereas a cyber attack on critical infrastructure has the potential to affect the entire Nation simultaneously. It is imperative that we understand the shifting paradigm from known threats to potentially unknown threats, and their ability to affect the way we prepare and respond to disasters.

STATE OF INFORMATION TECHNOLOGY IN 1989

Those who remember 1989 likely remember it much devoid of common technology—or at least to those who were not involved in its development at this point in history. Computers were slow, expensive, and applications were left mostly to large corporations and the Federal Government. Networks were in a far different paradigm, with TCP/IP—the bedrock of modern internet communications protocols—becoming the protocol standard for the ARPANET in 1983.[4] Mobile communications were virtually non-existent in this era, and mobile communication devices were far from a consumer good.

In 1989, technology was far from ubiquitous as it is today, and was primarily in the background of everyday life. During this year, Intel released the 80486 microprocessor which boasted a 64-bit floating-point unit with a clock rate of 33MHz[5]—this compared with Intel's latest processor (the Intel Xeon Phi) with a clock rate of an individual core reaching 1.238 GHz.[6] In this, we've witnessed a massive scaling concurrent with Moore's Law,[7] which states that the overall processing power of computers will double approximately every 2 years.

Aside from computing capabilities in 1989, the internet as we know it today did not exist. In 1985, the National Science Foundation funded the NSFNet, a 56 kilobit-per-second link between the San Diego Supercomputer Center, the National Center for Atmospheric Research, the National Center for Supercomputing Applications, the Pittsburgh Supercomputing Center, the Cornell Theory Center, and the John von Neumann Computer Center. This network was originally intended to be a backbone for other networks rather than used for connecting individualized systems, and in 1989, this backbone was upgraded to T1—or 1.544 Mbps.[8] The average citizen in 1989 had no home network access and was much more likely to not have a device that had the ability to connect to any communications network.

Mobile devices were also not prevalent in 1989. Qualcomm, a leading mobile device manufacturer during the 1990s, made its first CDMA-based phone call during a demonstration in San Diego, California on November 7, 1989.[9] Prior to this, CDMA technology had been primarily used by the United States military for secure

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[4] TCP/IP (n.d.). In *Encyclopaedia Britannica on-line.* Retrieved from *http://www.britannica.com/EBchecked/topic/602945/TCPIP*.

[5] Computer History Museum (n.d.). Timeline of Computer History—1989. Retrieved from *http://www.computerhistory.org/timeline/?year=1989*.

[6] Intel Corporation (n.d.). Intel Xeon Phi Coprocessor 7100 Series. Retrieved from *http://ark.intel.com/products/series/75809*.

[7] Moore, Gordon, Intel Corporation (n.d.). Moore's Law and Intel Innovation. Retrieved from *http://www.intel.com/content/www/us/en/history/museum-gordon-moore-law.html*.

[8] Kessler, Gary (August 5, 1994; Updated November 13, 2014). An Overview of TCP/IP Protocols and the Internet. Retrieved from *http://www.garykessler.net/library/tcpip.html*.

communications.[9] Mobile technologies until this point had been proprietary or protected, and this move marked the beginning of a shift toward more open mobile communications. However, in 1989, virtually all telecommunications were done through a wired device—making mobile communications an effective unknown to the general population at the time.

From a cursory glance at the history of computing and networking, one can deduce that in this time, cyber infrastructure, and the relevant technologies that make up such a term, was not as heavily relied upon as it is today for critical functions such as banking, public services, emergency management, and communications. This has far-reaching implications in that we as a Nation today are far more reliant upon technology and communications infrastructure than we ever have been, and this necessitates resilient, reliable, and high-performance cyber infrastructure.

STATE OF INFORMATION TECHNOLOGY IN 2014

In our time, technology has become the backbone that even the most basic functions of society depend upon on a daily basis. According to a study by Javelin Strategy & Research in 2012, only 27 percent of all retail point-of-sale purchases were made with cash, versus an estimated 66 percent of purchases being made with a credit or debit card.[10] These credit or debit card transactions depend upon secure networks for processing, whereas with cash payments, only a secure cash repository was required.

Further, according to the United States Census Bureau in 2013, an estimated 83.8 percent of all households in the United States reported computer ownership, and 74.4 percent of all households reported using the internet.[11] This is in stark contrast to the state of technology proliferation in 1989, and has profound impacts on the way technology has integrated into our daily lives. Individuals are now reliant upon personal computers and a connection to the internet for activities such as on-line banking, tax preparation, bill payment, e-mail communications, and news. This shift effectively dictates that our Nation's emergency preparedness depends upon, in large part, to the availability and security of communications infrastructure components that enable access to the internet.

Our Nation's network backbone has grown in sharp contrast to the capabilities found in 1989, with the US–UCAN and Innovation Platform project currently delivering up to 100 Gb/s connectivity to research and education sites around the Nation through Internet2.[12] [13] Also, unlike the network of 1989, millions of personal devices are now connected to the internet, and range from personal desktop and laptop computers to mobile phones, automobiles, and even refrigerators. In this new paradigm, protection of and access to high-speed, high-availability networks is necessary not only for corporations, Government agencies, and utility providers, but for the average consumer in order to meet the demands of today's world.

Mobile devices have now become the norm for point-to-point communications. According to CTIA, a communications industry trade group, nearly 90 percent of households in the United States use wireless service, and an estimated 40% of adults in the United States live in a wireless-only household.[14] This, coupled with the recent revelation that the number of mobile phones in the United States recently eclipsed the totality of the U.S. population, reveals that the general population is heavily reliant upon mobile devices for communication with the outside world. A recent exposé by NBC's *The Today Show* captured in photographs what amounts to a monumental shift in the adoption and use of mobile technologies through a visual depiction of the differences from a papal event in 2005 to another in 2013.[15] These photos are referenced as Appendix A.

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[9] Qualcomm Corporation (n.d.). History—Qualcomm. Retrieved from *https://www.qualcomm.com/company/about/history*.

[10] Javelin Strategy & Research, Greenwich Associates LLC (June 6, 2012). RETAIL POINT OF SALE FORECAST 2012–2017: Cash is No Longer King; Cards and Mobile Payments Likely to Rise. Retrieved from *https://www.javelinstrategy.com/brochure/251*.

[11] File, Thom and Ryan, Camille (November 2014). Computer and Internet Use in the United States: 2013. U.S. Department of Commerce Economics and Statistics Administration, U.S. Census Bureau. Retrieved from *www.census.gov/prod/2013pubs/p20-569.pdf*.

[12] Internet2 (n.d.). Innovation Platform. Retrieved from *http://www.internet2.edu/vision-initiatives/initiatives/innovation-platform/*.

[13] Internet2 (n.d.). U.S. UCAN. Retrieved from *http://www.internet2.edu/vision-initiatives/initiatives/us-ucan/*.

[14] CTIA—The Wireless Association (n.d.). Wireless Quick Facts. Retrieved from *http://www.ctia.org/your-wireless-life/how-wireless-works/wireless-quick-facts*.

[15] Dellaverson, Carlo. (March 14, 2013). Witnessing Papal history changes with digital age. *NBC News Photo Blog.* Retrieved from *http://photoblog.nbcnews.com/__news/2013/03/14/17312316-witnessing-papal-history-changes-with-digital-age*.

Our Nation's infrastructure is now also heavily dependent upon computerized systems and network interconnections for the delivery of basic services to the population. This dependency comes with the risk of vulnerabilities to the communications components of these systems, and the risk of unauthorized entities gaining access to the control mechanisms found within these systems. The U.S. Government Accountability Office, in its 2012 report entitled "Cybersecurity: Challenges in Securing the Electricity Grid," said that the Nation's power infrastructure suffers from a lack of security features consistently built into smart grid systems, and that the electricity industry as a whole did not have metrics for evaluating cybersecurity.[16] This, coupled with an inevitable rise in computerized systems for oil and gas delivery, water and sewer services, and traffic control mechanisms makes a clear case for the need for comprehensive planning with regard to protecting the computer systems that our National infrastructure relies upon.

With this increased reliance upon technology and computer systems to drive our country's critical infrastructure, the next major disaster we face may not be a natural disaster, but rather a cyber disaster as a result of a catastrophic cyber attack. For that, Mr. Chairman, I believe we as a Nation are not adequately prepared. Fundamental shifts in both the way we prepare for a cyber disaster and the way we defend against such an attack are needed for us to better protect our National security interests and ensure our systems, networks, and overall population are prepared for the potential occurrence of such an event.

CASE STUDY: HURRICANE KATRINA'S EFFECT ON IT INFRASTRUCTURE

Perhaps the greatest test of our emergency preparedness for a large-scale natural disaster's impact on information technology infrastructure occurred with Hurricane Katrina's landfall in New Orleans in 2005. Flooding quickly became the paramount concern as the levees around New Orleans could not withstand the storm surge, and one representative from the American Society of Civil Engineers called this "the worst engineering catastrophe in U.S. history."[17] Exposure to water causes most IT components to cease to function, and this was the case with many computing and networking centers across the greater New Orleans area during the aftermath of Katrina. In addition to the impacts on the computing infrastructure, Hurricane Katrina virtually shut down transportation networks and reliable telephone communications within the 504 (New Orleans) area code.[18]

According to a study released in the *American Behavioral Scientist* journal on the sociological implications of a post-Katrina New Orleans, the study cited that "in the confusion of the massive evacuations from the New Orleans area, families and friends lost track of one another. Few evacuees had expected to be gone for more than a day or two. They did not make arrangements to contact one another, and they had no information on the whereabouts and well-being of their families and friends for days afterward."[19]

Tulane University in New Orleans sustained an estimated $200 million in damages associated with the disaster, and was forced to cancel classes for the remainder of the Fall 2005 academic semester.[20] This proved for the higher education community that traditional notions of disaster planning and business continuity were false; a campus could not effectively shift its entire operation to a remote-access system for distance learning and maintain normal business operations "on-demand." The disaster affected Tulane's ability to not only serve its students in an academic context for the remainder of the semester, but to facilitate payroll or run their email system.[21]

Health care infrastructure also sustained critical damage—outside of primary damage to physical medical facilities, some systems containing electronic medical records (EMRs) also became inoperable (due mainly to either flooding or lack of

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[16] Wilshusen, Gregory (July 17, 2012). Cybersecurity: Challenges in Securing the Electricity Grid. Retrieved from *http://www.gao.gov/assets/600/592508.pdf*

[17] Roth, Lawrence (n.d.). The New Orleans Levees: The Worst Engineering Catastrophe in U.S. History—What Went Wrong and Why. Retrieved from *http://biotech.law.lsu.edu/climate/ocean-rise/against-the-deluge/01-new_orleans_levees.pdf*.

[18] Morrow, J.J. (n.d.). Hurricane Preparedness After Action Review. Retrieved from *www.tulane.edu/.../Hurricane_Katrina_After_Action_Critique.ppt?*.

[19] Shklovski, Irina; Burke, Moira; Kiesler, Sara; and Kraut, Robert. (February 18, 2010). Technology Adoption and Use in the Aftermath of Hurricane Katrina in New Orleans. *American Behavioral Scientist, XX(X)–I–19.* Retrieved from *http://www.cs.cmu.edu/kiesler/publications/2010pdfs/2010Shklovski.pdf*.

[20] Pinto, Barbara (December 9, 2005). Katrina Wallops Tulane University. *ABC News.* Retrieved from *http://abcnews.go.com/US/HurricaneKatrina/story?id=1390382*.

[21] Cowen, Scott (September 3, 2005 and August 30, 2005). Previous Messages from President Cowen—Tulane University. Retrieved from *http://www.tulane.edu/past.html*.

power) and many Katrina evacuees did not have paper copies of their medical records when they left the city. This presents a major challenge in health care delivery in a major disaster, and efforts are underway to ensure more seamless exchanges of health information to better prepare for disasters in the wake of Katrina's lessons.[22]

Katrina taught us many lessons on the impact a disaster can have on our technology-dependent world, and these impacts are still being studied and modeled today. What Katrina did show our Nation, however, is that we still have strides to make in our disaster planning and emergency management efforts.

CYBER DISASTERS—HOW DO WE PREPARE?

Natural disasters, such as the one experienced with Hurricane Katrina, can often be scoped in advance of their arrival to assess the potential impact of the event, and to deploy the proper evacuation and emergency protocols necessary to prevent loss of life. However, with cyber disasters, the scope can be unknown, and with this, the scale of the impact unknown. This leads to a need for a greater understanding of the potential impacts of such a disaster, and how the Nation's emergency management divisions develop plans for maintaining order and facilitating recovery.

Mr. Chairman, I would submit that in the most hurricane-prone areas of our Nation, most residents understand the implications of an evacuation plan and emergency managers in these areas are well-versed in the procedures that are associated with ensuring the area is adequately prepared for a storm. However, I do not believe this Nation is adequately prepared for a potential cyber disaster that affects the operation of infrastructure such as power, banking, or telecommunications.

One primary example comes to mind—our power infrastructure—that demonstrates our need to become more vigilant in defending against the potential for a large-scale attack in these areas.

POWER INFRASTRUCTURE

The state and security of our power infrastructure has perhaps been the most researched of these topics, and with that comes some startling revelations about our state of preparedness for a large-scale attack in this area. According to a National Research Council report, entitled *Terrorism and the Electric Power Delivery System,* "if carried out in a carefully planned way, by people who knew what they were doing, such an attack could deny large regions of the country access to bulk system power for weeks or even months."[23] While the report goes on to say that a cyber attack on the grid would be unlikely to cause extended outages, this is not to say that such an outage could not occur, and could potentially be coupled with a physical attack on the power infrastructure.

In a study done for Bloomberg in 2012 by the Ponemon Institute, utility and energy companies surveyed said that they would need an average annual budget of $344.6 million to reach a level where they could successfully combat 95% of their cyber threats.[24] This represents a nearly 10-fold increase from the current level of $45.8 million.[24] Lawrence Ponemon, Chairman of the Ponemon Institute, a firm that conducts independent research on privacy, data protection, and information security policy,[25] stated in an 2012 interview with Bloomberg that, "the consequences of a successful attack against critical infrastructure makes these cost increases look like chump change," and that "it would put people into the Dark Ages."[24]

One example of the impact of a power system failure is the blackout that occurred in the Northeast United States and parts of Canada in August of 2003. This blackout affected an estimated 50 million people in Ohio, Michigan, Pennsylvania, New York, Vermont, Massachusetts, Connecticut, New Jersey, and Ontario, Canada, and power was not restored in some parts of the country for up to 4 days.[26] Con-

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[22] United States Department of Health and Human Services (July 11, 2013). States prepare for seamless exchange of health records after disasters. Retrieved from *http://www.hhs.gov/news/press/2013pres/07/20130711a.html*.

[23] National Research Council (2012). *Terrorism and the Electric Power Delivery System*. Washington, DC: The National Academies Press. Retrieved from *http://www.nap.edu/catalog.php?record_id=12050*.

[24] Engleman, Eric and Strohm, Chris (January 31, 2012). Cybersecurity Disaster Seen in U.S. Survey Citing Spending Gaps. *Bloomberg News*. Retrieved from *http://www.bloomberg.com/news/2012-01-31/cybersecurity-disaster-seen-in-u-s-survey-citing-spending-gaps.html*.

[25] Ponemon Institute (n.d.). Ponemon Institute—Why We Are Unique. Retrieved from *http://www.ponemon.org/about-ponemon*.

[26] U.S.-Canada Power System Outage Task Force (April 2004). Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations. Retrieved from *https://reports.energy.gov/BlackoutFinal-Web.pdf*.

sequently, this blackout was primarily initiated by a software failure in an alarm and logging system in the control room of the First Energy Corporation.[26]

In a piece documenting the impact of the blackout, CNN reported that "the outage stopped trains, elevators, and the normal flow of traffic and life."[27] In Michigan, the population's water supply was affected because of the system's dependence on electric pumps, and Amtrak stopped all trains leaving the New York City area as well as in Michigan between Detroit, Dearborn, and Pontiac.[27] The blackout also affected airports, communications networks, fuel pumps, and traffic signals.

The 2003 blackout shows us how dependent we are upon a readily available and reliable power supply to perform daily functions—and how quickly the failure of a computerized system can wreak havoc on a region's power availability. This incident's total cost was estimated at between $4 billion and $10 billion in the United States, and approximately $2.3 billion in Canada—where the Nation's gross domestic product was down 0.7% for the month of August.[26] This impact suggests that not only do our systems and much of the remainder of our infrastructure rely on power, but our entire economy also relies upon this resource as a critical component.

Power is the necessary backbone upon which virtually all information technology systems operate, and a reliable power supply is always a primary consideration in systems-level disaster planning. Perhaps most close to me is the great lengths to which we have gone at Clemson to ensure we adequately plan for any temporary power failures and keep our systems operational for our customers. We have developed a state-of-the-art data center and computing facility that houses our enterprise systems including our student information system, payroll and finance systems, and our learning management system for the campus. We also house the campus' high-performance computing system, and run the system responsible for the State of South Carolina's Medicaid eligibility and claims processing system. A temporary power failure, one lasting less than a full 24-hour day, has been modeled using our existing uninterruptible power supply (UPS) and generator capacity, and it is estimated that with our current load, Clemson could operate its systems for approximately 38 hours on both generators, and 46 hours on a single generator. This is critical for business continuity for Clemson's operations—and for the State's Medicaid system to operate without service interruption.

Coupled with the potential threat of a power loss, we need to increase the importance of robust disaster recovery and business continuity (DR/BC) planning for our State and Nation, especially for Government-operated systems. Clemson is currently relatively well-positioned in its environment, but our need for real-time, reliable disaster recovery and business continuity is ever-growing, and our reliance upon electronic messaging (e-mail), electronic payroll systems, and health care systems show no signs of decreasing. Aside from implications of a power loss, DR/BC plans are important for a wide variety of reasons—to include system hardware or software failures, data backups, or disaster events that affect other necessary functions of the primary site.

With the advent of cloud technologies and the potential cost savings associated with their adoption through leveraging shared investments, DR/BC planning in the cloud computing environment should be considered as a mechanism for ensuring minimum technology, system, and distance requirements are met while also maintaining a reasonable cost. With any provider of these services, however, there are considerations for the real-time nature of a system's ability to transfer locations with minimal service loss, and a remote site's ability to run the critical systems of the company, agency, or campus. As discovered with the Tulane University example during Hurricane Katrina, generally accepted notions of disaster recovery and business continuity plans can be challenged by the relative unknown any disaster brings, and it is important to continually test these plans in as-close-to-production environments as is feasible.

IMPLICATIONS FOR DATA SECURITY

Aside from risks associated with our basic infrastructure being compromised, perhaps another paramount risk is the loss or disclosure of critical data due to either inadequate security protocols or human error. In the era of "big data," it becomes increasingly important to protect our most valuable data from external threats. According to IBM, in 2012, nearly 2.5 exabytes of data were created on a daily basis and as storage density increases, coupled with declining storage costs, this is only

[27] CNN News (August 14, 2003). Major power outage hits New York, other large cities. Retrieved from *http://www.cnn.com/2003/US/08/14/power.outage/*

expected to grow.[28] Likewise, as computing devices such as phones and portable tablets continue their penetration into all aspects of society, it is increasingly likely that these devices will contribute to an exponential rise in data storage needs.

This presents a two-fold problem for ensuring the security of data and the underlying computing infrastructure on which it is stored. First, ensuring that proper security controls are applied to the data itself to prevent unauthorized access, use, or disclosure is of paramount importance, and second, to protect the infrastructure from growing ubiquity of these devices' need for access. Authorized users and consumers are not only demanding more connectivity to resources, but our economy has become increasingly dependent on the ability to communicate in real time or in near-real time. As our dependence on this real-time need for data escalates for personal devices as well as for economic and National security needs, so does the valuation and susceptibility of the data itself.

In a 2013 report published by PandaLabs, nearly 20% of all malicious code ever to be in circulation (known as malware) was created during the year 2013.[29] This means that nearly 82,000 pieces of new malware were created each day during 2013.[29] Many of these malicious codes are designed to compromise computing systems in order to release or provide access to sensitive data stores. While many cybersecurity-related events may be targeting the infrastructure for purposes of interruption of services, most cyber criminals will be attempting to acquire or compromise sensitive data for personal or nation-state advantages. It is becoming increasingly clear with each newly-published report in this space that several nations are engaging in cyber warfare. Some of these operations are covert for purposes of privileged data acquisition, and others for purposes of activities such as the accusations levied against Russia prior to the Georgian invasion in 2008.[30]

Clemson University takes the threat of a possible cyber attack as legitimate and real on a continual and daily basis. After joining Clemson University in 2006, one of the first actions I took was to create an Office of Information Security and Privacy to oversee the security and privacy activities of the university. From my experience in previous positions, I identified this is an immediate and critical need for the University. Securing computing systems and data in higher education has its own set of unique challenges commonly not found in other industries, but still faces similar threats. Universities, in general, are under attack daily due to the open nature of higher education, the vast amounts of computing infrastructure used by a wide variety of users, and the large volumes of intellectual property created by researchers. Also, taking into account all of the personally identifiable information, financial information, and health care data created and consumed by typical universities, it is clear why these institutions become very large targets for cyber criminals.

To protect all of this data and infrastructure, Clemson University employs many industry-accepted practices to prevent not only unauthorized intrusion into protected spaces, but to also avoid any interruption in services. Clemson's Computing and Information Technology organization also has a dedicated 24/7 Network Operations Center (NOC) for all network monitoring and operations. Mission-critical systems are consistently scrutinized for security-related concerns before, during, and after deployment and network activity is monitored for anomalies. We undergo numerous internal and external audits administered by both State and Federal agencies annually where processes, systems, and facilities are evaluated.

With this, it has become more important than ever for organizations to have a primary focus on protecting their information technology infrastructure and data from potential cyber criminals. In today's world, no enterprise, agency, or entity is exempt from attack; in fact, even individuals should employ appropriate practices to ensure their personal data is not compromised.

AN EYE TOWARD THE FUTURE

Given the multitude of potential threats, our Nation must be vigilant in our actions to prepare for the future. I would therefore submit, Mr. Chairman, that in order for our Nation to be prepared to defend against cyber disasters and other cyber threats, we must invest in the future of cybersecurity research, education, and training to prepare the next generation workforce. This is vital to ensuring that our Nation remains secure, competitive, and sustains our position as a world leader on

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[28] IBM Corporation (n.d.). Demystifying Big Data: Decoding The Big Data Commission Report. Retrieved from *https://www-304.ibm.com/events/wwe/grp/grp004.nsf/vLookupPDFs/Tim%20Paydos'%20Presentation/$file/Tim%20Paydos'%20Presentation.pdf*.

[29] Udemans, Chris (April 14, 2014). 20% of malware generated in 2013—PandaLabs. Retrieved from *http://www.humanipo.com/news/42720/20-of-malware-generated-in-2013-pandalabs/*.

[30] Markoff, John (August 12, 2008). Before the Gunfire, Cyberattacks. *The New York Times.* Retrieved from *http://www.nytimes.com/2008/08/13/technology/13cyber.html?__r=1&*.

the global stage. At Clemson, one industry partner has expressed to us that there are points in time where the company will have up to 300 open cybersecurity-related positions without enough qualified applicants to fill them. I fear our Nation faces an upcoming crisis in our cybersecurity workforce if investments are not made to encourage this career path and to ensure robust education and training programs at our Nation's universities.

Additionally, in order to protect the security of data in our age, more efforts are needed in the area of secure application development, as security must start within the application itself. In general, we are not adequately educating the next generation of programmers in the development of secure code or secure code development principles. We will likely continue to see common applications that we have become dependent upon for daily use becoming vulnerable over time as weaknesses are discovered.

Earlier this year, the commonly used OpenSSL cryptographic software library was discovered to have a critical vulnerability referred to as the Heartbleed bug.[31] OpenSSL was used to provide for the security of data and communications in many devices and systems. This discovered vulnerability would allow an attacker to have access to information that ordinarily would be protected by Secure Socket Layer/Transport Layer Security (SSL/TLS) encryption protocols. This oversight in programming required many in the computing industry to have to take production systems off-line, evaluate all of their systems for applicability, and then spend days to weeks of remediating the issues—including revoking and re-issuing all new certificates on their servers once all vulnerability patching was complete.

In 2008, the Comprehensive National Cyber-Security Initiative (CNCI) identified 12 initiatives to combat the threats that cybersecurity has to our economy and National security.[32] In response to Initiative 8 from the CNCI's charge—the need to expand cyber education—Clemson University and the information technology division have dedicated resources to help combat this shortage in cybersecurity practitioners.

One program at Clemson is the Cyber-infrastructure General Practitioner Program (NSF Award 1251544), where rather than becoming cyberinfrastructure (CI) users with limited skill sets, we intend to help students become innovative and productive CI "general practitioners" by providing participating undergraduate and graduate students with the critical broad perspective of CI needed to make the best decisions and make best use of available resources. These experiences primarily take the form of Creative Inquiry[33] courses that are added to (or substituted into) a student's regular course curriculum for his/her major. Once a student has demonstrated proficiency in a particular area, we work to find internship activities or projects sponsored by the IT organization or by one of our many commercial partners.

A second program at Clemson is designed to provide an immersive educational experience for those looking for a career in the information security field. Currently, there is an information security student organization at Clemson where students, advised by members of the Office of Information Security and Privacy, compete in both State and National competitions. Many of these students, and others from across the University, are currently taking security-related undergraduate courses offered by the University, but a gap exists in applications of operational security. Set to open in the spring of 2015, we will have a dedicated, student-centered Security Operations Center (SOC) on campus designed to employ students through official university internships and partner them with our Information Security and Privacy Office.

During the day, all operational security needs and incident responses will be maintained by the SOC and between operational needs, the students will be taught real-life skills in penetration testing, audits, compliance, and risk assessment. Industry-accepted practices and tools will be used to provide these students with demonstrable skills to make them competitive in the workforce. We have engaged public and private industry partners who will be participating in this program and they have identified this a great need for them to fulfill their future staffing needs in this space.

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[31] Kirk, Jeremy (April 8, 2014). Critical OpenSSL Heartbleed bug puts encrypted communications at risk. *PCWorld*. Retrieved from *http://www.pcworld.com/article/2140920/heartbleed-bug-in-openssl-puts-encrypted-communications-at-risk.html*.

[32] The White House (n.d.). The Comprehensive National Cybersecurity Initiative. Retrieved from *http://www.whitehouse.gov/issues/foreign-policy/cybersecurity/national-initiative*.

[33] Creative Inquiry (n.d.). Creative Inquiry and Undergraduate Research. Retrieved from *http://www.clemson.edu/academics/programs/creative-inquiry/*.

Even with these efforts, we as a Nation need to collectively make education and training in cybersecurity a priority to keep pace with the growing demand of professionals in this area. A workforce that is capable of preparing and protecting our infrastructure is paramount, and much like the probable future medical doctor shortage this Nation is facing, if we do not begin to provide the education and training to those who will be tasked with protecting our infrastructure, the vulnerabilities we face will continue to grow without the professionals educated to protect it.

CONCLUSION

In conclusion, it is evidenced that as our society has become more reliant upon information technology as a backbone for many of our most important functions as a Nation and as an economy, we also have a duty to prepare for a potential disaster that affects these systems. In 1989, information technology took a back-seat role in our society, and that no longer holds true in 2014. Therefore, any major disaster—natural or otherwise—is likely to have a significant impact on our cyberinfrastructure environment, and our emergency preparedness plans must account for this.

Furthermore, increased emphasis is needed on developing robust disaster recovery and business continuity plans for our Nation's most critical systems, and to build redundant capabilities that can serve us during these times of crisis. Additionally, I believe we as a Nation have progress to make if we are to be prepared in terms of emergency planning—especially for a cyber disaster—but also in terms of our long-range strategic efforts to ensure a robust and competitive cybersecurity workforce.

APPENDIX A

Year: 2005 Photo Credit: Luca Bruno, AP Retrieved from: http://photoblog.nbcnews.com/__news/2013/03/14/17312316-witnessing-papal-history-changes-with-digital-age.

Year: 2013 Photo Credit: Michael Sohn, AP Retrieved from: http://photoblog.nbcnews.com/__news/2013/03/14/17312316-witnessing-papal-history-changes-with-digital-age.

Mr. DUNCAN. Thanks so much.

Mr. Louden.

STATEMENT OF THOMAS LOUDEN, GENERAL SECRETARY, NORTH AND SOUTH CAROLINA DIVISION, THE SALVATION ARMY

Mr. LOUDEN. Good afternoon, Chairman Duncan, Congressman Meadows, and colleagues. I am Major Tom Louden, the general secretary for the Salvation Army's North and South Carolina Division. On behalf of our entire organization, thank you for this opportunity to share the story of the Salvation Army and our emergency disaster services program.

The Salvation Army is a religious and charitable nonprofit organization that provides assistance to needy families every day of the year in communities all across our country. The Salvation Army's mission is to preach the gospel of Jesus Christ and to meet human needs in his name without discrimination. Our disaster services program focuses on fulfilling that mission by helping any and all who need assistance during emergencies.

The Salvation Army's first disaster response in the United States occurred more than 100 years ago to the great Galveston hurricane of 1900. Since then, the Salvation Army has responded to just about every major disaster our Nation has faced.

I would like to share with you how the Salvation Army has been a vital part of our Nation's emergency disaster response system.

The geographical footprint of the Salvation Army reaches every ZIP Code in the country. Our front-line responders are the Salvation Army officers, staff, and volunteers who live in the impacted area. We support the development and training of community volunteers.

If an emergency overwhelms our local resources, our organizational structure allows us to augment as need demands. While our services may be adapted to the unique needs of natural disaster situations, we are also known for four core services.

Many of you are probably familiar with the Salvation Army canteen, our mobile kitchen on wheels that can provide food and hydration. Within our Southeast region, we have nearly 300 of these units, each capable of producing approximately 1,500 meals per day. Twenty of those feeding units are positioned in North Carolina and 10 in South Carolina.

In addition to food service, the Salvation Army offers practical aid to disaster victims, helping individuals and families meet emergency needs in the immediate aftermath of a disaster. We also collect and distribute donated goods, such as food boxes, cleaning supplies, and household items, by leveraging our network of facilities.

Perhaps most importantly, we minister to people affected by the disaster by offering emotional and spiritual care to rescue workers and survivors.

The Salvation Army is present in a community long before a disaster occurs, and we will continue to serve that community even after the disaster event is a distant memory. We participate in long-term disaster recovery operations, working closely with Government agencies and the Voluntary Organizations Active in Disasters, or VOAD, network.

For a catastrophic event like Hurricane Hugo, our disaster recovery efforts may continue for several years.

We rely on volunteers and the generosity of the public to support our service delivery. All Salvation Army disaster services are offered without charge and are supported entirely by donations and the generosity of others. This gives the Salvation Army a good deal of flexibility in how we are able to help. Because the public is tremendously supportive, it allows us to independently fund our operations.

Finally, and perhaps most importantly, we recognize that we are a very small part of a much larger emergency response network, and we are grateful for the support we receive from our local, State, and Federal partners.

Let me be clear here, without the strong support local, State, and Federal emergency management agencies provide, the Salvation Army would find it very difficult to offer all of our disaster relief services I have just described.

We are extremely grateful to the counties, States, and at the Federal level, FEMA, that consistently invite the Salvation Army to the table and to participate in interagency training and exercises to provide input in planning sessions and into emergency operations centers when a disaster occurs.

After Hurricane Hugo, the Salvation Army provided over 500,000 meals in partnership with local and National food vendors, 338,000 food boxes. Four thousand volunteers, employees, and officers provided almost 600,000 hours of service. Our mobile kitchens were serving for over 90 days.

As we ponder the question, "Are we ready for a 21st Century Hugo?" we must also consider that our next disaster of this magnitude might not be a hurricane, but some other natural or human-caused event.

We believe that effective disaster response is all-hazards and ready for whatever challenge the future places before us.

We also believe that the disaster response team extends across the whole community, including not just Government agencies and charitable organizations like the Salvation Army but also private industry, faith-based, and civic organizations, citizens.

The past 25 years have revealed that our Nation is vulnerable to a variety of hazards, and that it will take all of us working together to respond to these emergencies.

Thank you again for this opportunity. I will be happy to answer any questions that you may have. Thank you.

[The prepared statement of Mr. Louden follows:]

PREPARED STATEMENT OF THOMAS LOUDEN

NOVEMBER 21, 2014

Good afternoon Chairman Duncan, Members of the committee, and colleagues:

I am Major Tom Louden, the general secretary for The Salvation Army's North and South Carolina Division. On behalf of our entire organization, thank you for this opportunity to share the story of The Salvation Army and our Emergency Disaster Services program.

The Salvation Army is a religious and charitable nonprofit organization that provides assistance to needy families every day of the year in communities all across this country. The Salvation Army's mission is to "preach the gospel of Jesus Christ and meet human needs in His name without discrimination" and our disaster services program focuses on fulfilling that mission by helping any and all who need assistance during emergencies. The Salvation Army's first disaster response in the United States occurred more than 100 years ago—to the Great Galveston Hurricane of 1900—and since then, The Salvation Army has responded to just about every major disaster our Nation has faced.

I'd like to share with you how The Salvation Army has been a vital part of our Nation's emergency disaster response system.

The geographical footprint of The Salvation Army reaches every ZIP Code in the country. Our front-line responders are The Salvation Army officers, staff, and volunteers who live in the impacted area, and we support the development and training of community volunteers. If an emergency overwhelms our local resources, our organizational structure allows us to augment as need demands.

And, while our services may be adapted to the unique needs of a disaster situation, we are known for four core services. Many of you are probably familiar with The Salvation Army canteen—our mobile "kitchens on wheels"—that can provide food and hydration. Within our southeast region, we have nearly 300 of these units, each capable of producing approximately 1,500 meals per day. Twenty of these feeding units are positioned in North Carolina and ten in South Carolina.

In addition to food service, The Salvation Army offers practical aid to disaster survivors, helping individuals and families meet emergency needs in the immediate aftermath of a disaster. We also collect and distribute donated goods, such as food boxes, cleaning supplies, and household items, by leveraging our network of facilities. And perhaps, most importantly, we minister to people affected by the disaster by offering emotional and spiritual care to rescue workers and survivors.

The Salvation Army is present in a community long before a disaster occurs, and we will continue to serve that community even after the disaster event is a distant memory. We participate in long-term disaster recovery operations, working closely with Government agencies and the Voluntary Organizations Active in Disaster or VOAD network. For a catastrophic event, like Hurricane Hugo or Katrina, our disaster recovery efforts may continue for several years.

We rely on volunteers and the generosity of the public to support our service delivery. All Salvation Army disaster services are offered without charge and supported entirely by donations and the generosity of others. This gives The Salvation Army a good deal of flexibility in how we are able to help and, because the public is tremendously supportive, it allows us to independently fund our operations.

Finally, and perhaps most importantly, we recognize that we are a very small part of a much larger emergency response network, and we are grateful for the support we receive from our local, State, and Federal partners. Let me be clear here—without the strong support local, State, and Federal emergency management agencies provide, The Salvation Army would find it very difficult to offer all the disaster relief services I have just described. We are extremely grateful that the counties, States and, at the Federal level, FEMA, consistently invite The Salvation Army to

"the table"—to participate in interagency training and exercises, to provide input in planning sessions, and into their emergency operations centers when a disaster occurs.

After Hurricane Hugo, The Salvation Army provided over 500,000 meals, in partnership with local and National food vendors; 338,000 food boxes; 4,000 volunteers, employees, and officers provided almost 600,000 hours of service. Our mobile kitchens were serving for over 90 days. As we ponder the question, "Are we ready for a 21st Century Hugo?", we must also consider that our next disaster of this magnitude might not be a hurricane but some other natural or human-caused event. We believe that effective disaster response is all-hazards and ready for whatever challenge the future places before us. We also believe that the disaster response team extends across the whole community, including not just Government agencies and charitable organizations, like The Salvation Army, but also private industry, faith-based and civic organizations, and citizens. The past 25 years have revealed that our Nation is vulnerable to a variety of hazards and that it will take all of us—working together—to respond to these emergencies.

Thank you again for this opportunity. We are happy to answer any questions you may have and appreciate your continued support.

SUPPORTING DOCUMENTATION

The Salvation Army is a religious and charitable nonprofit organization, founded on the streets of East London, England, 150 years ago. We provide assistance to needy families every single day of the year in communities all across the United States and in 125 other countries around the world. The Salvation Army's mission is to "preach the gospel of Jesus Christ and meet human needs in His name without discrimination" and our disaster services program focuses on fulfilling that mission by helping any and all who need assistance during emergency events. The organization's first disaster response in the United States occurred more than 100 years ago—to the Great Galveston Hurricane of 1900—when our National Commander ordered Salvation Army officers to that stricken city to provide whatever practical aid and comfort they could. Since then, The Salvation Army has responded to just about every major disaster our Nation has faced.

Our National headquarters is in Alexandria, Virginia. We divide the United States into four administrative regions called "territories." The Salvation Army's Southern Territory, headquartered in Atlanta, GA, includes the States of North and South Carolina. The territories are further subdivided into 40 smaller entities called "divisions" that typically include from 1 to 3 States, with oversight provided by a divisional headquarters office. The divisional headquarters for the North and South Carolina Division is in Charlotte, NC. Additionally, we have smaller, more localized operations called "corps." These are The Salvation Army units you will find in many communities across this country. Smaller communities may have only a single corps or service unit; larger cities may include multiple service locations and facilities.

The Salvation Army has been active in North and South Carolina since 1887—opening units in Raleigh, Wilmington, and Spartanburg in that year. Today, The Salvation Army operates 64 commands in the two States, which serve all 100 counties and the Eastern Band of the Cherokee Nation in North Carolina as well as the 46 counties of South Carolina. These operations include providing youth programs, including Boys and Girls Clubs and summer camps; shelters for families in need of transitional housing; weekly worship services; drug and alcohol treatment programs; homeless shelters; affordable residential housing for seniors; and seasonal programs, such as our Christmas kettle program and toy drives. One of The Salvation Army's 25 Ray and Joan Kroc Community Centers opened in Greenville, SC in 2011.

Our local commands are typically directed by a Salvation Army officer—individuals or married couples who are ordained to full-time ministry within The Salvation Army. Officers wear navy blue uniforms with red epaulets and are responsible for leading a force of local volunteers, employees, and soldiers. Nationally, The Salvation Army in the United States now includes more than 5,300 officers, 63,900 staff, and tens of thousands of volunteers.

EMERGENCY DISASTER SERVICES

The Salvation Army has been a vital part of the Nation's emergency disaster response system.

First, because the presence of The Salvation Army reaches every ZIP Code in the country, we live and work in the communities where disasters strike. Our first responders are The Salvation Army officers, staff, and volunteers who live in the impacted area, and we support the development and training of community volunteers. If an emergency overwhelms our local resources, then we augment those resources

by deploying personnel and equipment from across our division and, if necessary, from across the country, to help where needed.

And, while our services may be adapted to the unique needs of a disaster situation, we are known for four (4) core services. Many of you are probably familiar with The Salvation Army canteen—our mobile kitchen on wheels—that can provide food and hydration. Within our southeast region, we have nearly 300 of these units, each able to produce approximately 1,500 meals per day. Twenty of these feeding units are positioned in North Carolina and 10 in South Carolina.

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The Salvation Army is present in a community long before a disaster occurs, and we will continue to serve that community even after the disaster event is a distant memory. We participate in long-term disaster recovery operations, working closely with Government agencies and the Voluntary Organizations Active in Disaster network. A VOAD is an association of voluntary organizations committed to cooperation, communication, coordination, and collaboration before, during, and after disasters. For a catastrophic event, like Hurricane Hugo or Katrina, our disaster recovery efforts may continue for several years.

We rely on volunteers and the generosity of the public to support our service delivery. All Salvation Army disaster services are offered without charge and supported entirely by donations. This gives The Salvation Army a good deal of flexibility in how we are able to help and, because the public is tremendously supportive, it allows us to independently fund our operations.

Finally, and perhaps most importantly, we recognize that we are a very small part of a much larger emergency response network, and we are grateful for the support we receive from our local, State, and Federal partners. Without the strong support local, State, and Federal emergency management agencies provide, The Salvation Army would find it very difficult to offer all the services I have just described on a disaster.

RELATIONSHIPS WITH THE STATES OF NORTH & SOUTH CAROLINA

The Salvation Army works together with the States of North Carolina and South Carolina and their respective emergency management agencies:

1. We maintain regular communications to ensure that The Salvation Army is appropriately involved in disaster planning, mitigation, preparedness, and response activities. The Salvation Army is invited to participate in interagency training and exercise programs and supports the States' disaster conferences, committees, task forces, and other emergency preparedness events.
2. We are included in the States' emergency operations plans as a provider of Mass Care—what some of you may know as the Emergency Support Function 6.
3. We are included in Federal, State, and regional emergency activation protocols and notified when a disaster or other emergency event has occurred.
4. The Salvation Army has designated liaison officers that reports to the State emergency operations center upon activation to help coordinate and exchange information among the organizations involved in the disaster response. Specifically, The Salvation Army keeps the two States' emergency management agencies informed of its disaster response activities, and its working relationships with local governments, other local voluntary agencies, and community-based organizations involved in the response. This includes engaging with Voluntary Organizations Active in Disaster (VOAD), which includes our colleague agencies, such as the American Red Cross, Southern Baptist Disaster Relief, and other charitable disaster responders.
5. The South Carolina Emergency Division, North Carolina Division of Emergency Management, and The Salvation Army work cooperatively in the dissemination of materials to educate the public on how to avoid, mitigate, prepare for, and cope with disasters. During disaster operations, the public information officers from State emergency management and The Salvation Army maintain close coordination to share disaster-related media releases produced by the two organizations.
6. The process and relationships described above are very similar to the relationships The Salvation Army has with other State emergency management agencies and with the Federal Emergency Management Agency (FEMA).

This level of collaboration is essential, and we believe that an effective disaster response team extends across the entire community spectrum—not just to agencies like FEMA and The Salvation Army, but also to private industry, local faith-based and civic groups, and citizens.

THE FEBRUARY 2014 ICE STORM

The February 2014 Winter Storm that hit the State of South Carolina illustrates The Salvation Army's structure and organized approach to disaster response.

On Monday, February 10, 2014 we alerted all Salvation Army locations in North and South Carolina about the impending storm. This communication activated our pre-established network of local Salvation Army commands to begin preparing for storm response and focused on three (3) key areas of concern:

1. Local Salvation Army units were to closely monitor the weather in their local area, especially in South Carolina since that was the area of concern for greatest impact.
2. Local Salvation Army units were to coordinate with their county emergency management officials regarding protective actions, including areas that could require assistance or where a shelter could be established.
3. Local Salvation Army units were to anticipate that winter storm conditions likely would inhibit travel so any service delivery should be localized initially and independent of additional support. Therefore, partnering with other local organizations and agencies to ensure meeting local needs was the initial priority.

Two days before the storm's anticipated arrival, Salvation Army senior leadership from divisional headquarters personally contacted every officer in these local commands across the Carolinas. This served three functions—establishing communication to reassure our local personnel, assess impacts or concerns regarding Salvation Army infrastructure, and report any service delivery taking place or anticipated.

A Salvation Army liaison established communication with the South Carolina Emergency Management Division and Emergency Support Function 6: Mass Care. This communication and coordination was maintained with the State Emergency Operations Center and the liaison deployed there on February 14. Salvation Army personnel participated in the coordination of mass care support to the impacted counties, communicating with the primary State agency for mass care, the South Carolina Department of Social Services, as well as other ESF 6 partner agencies and organizations, including the American Red Cross and South Carolina Baptist Disaster Relief.

The Salvation Army conducted and participated in conference calls with South Carolina Voluntary Organizations Active in Disaster (SCVOAD). These calls commenced the day after the storm and continued for 9 days—all of us focused on "the 4 Cs" of cooperation, communication, coordination, and collaboration. This focus helped organizations better anticipate local needs and assign resources as available.

Local responses took place in 19 communities—10 in North Carolina and 9 in South Carolina. The Salvation Army provided service and support from the Aiken, Anderson, Charleston, Florence, Georgetown, Greenville, Orangeburg, Rock Hill, and Sumter commands. Services included mass feeding, distribution of personal comfort kits, food boxes (in partnership with Harvest Hope Food Bank) as well as providing emotional and spiritual comfort.

Overall, in North Carolina, the Army provided 7,000 prepared meals, 18,000 drinks and snacks. In South Carolina, service delivery included 5,700 prepared meals, 8,500 drinks and 6,600 snacks. Our response involved 130 personnel, who provided 16,000 hours of service.

CONCLUSION

It is true that disaster relief is just one of the many services that The Salvation Army offers and that day-to-day, our other social services demand a tremendous amount of our time and resources. But when a major disaster strikes, The Salvation Army will be there and ready to offer fast, efficient, and practical aid to any and all that need assistance.

Mr. DUNCAN. Mr. Louden, thank you.

Let me just pause to say I hope everyone that heard the mission of the Salvation Army will think a little bit differently this Christmas when they hear the bells ringing.

Mr. LOUDEN. Thank you, Mr. Chairman.

Mr. DUNCAN. Thank you, sir.

Dr. Hallstrom.

STATEMENT OF JASON O. HALLSTROM, PH.D., DEPUTY DIRECTOR, INSTITUTE OF COMPUTATIONAL ECOLOGY, CLEMSON UNIVERSITY

Mr. HALLSTROM. Good afternoon, Chairman Duncan, Representative Meadows, colleagues. Thank you for the opportunity to provide testimony today.

As we witness apparent increases in the frequency and severity of Atlantic superstorms, emergency preparedness could not be more paramount.

My name is Jason Hallstrom, and I am a computer scientist in the School of Computing here at Clemson. I have the privilege of serving as deputy director and director of technology for the Institute of Computational Ecology—indeed, a mouthful, which I will try to talk to.

In assessing our preparedness for the next superstorm to make landfall on the coast, there are two important planning dimensions to consider.

The first is our capacity to plan proactively before the storm makes landfall on our coast. This involves our ability to predict, to track, and to gauge the severity of the storm in a timely fashion with high fidelity well in advance of its impact.

The second dimension to consider is our capacity to plan reactively after the storm makes landfall. This involves our ability to dynamically monitor infrastructure and natural resource impacts as they occur.

Both are critically important, and I am pleased to be able to offer an optimistic outlook on both of these fronts.

As we have heard a bit earlier today, since 1989, NOAA and the National Weather Service have made significant improvements to their data collection, modeling, and forecasting infrastructure. The Nation's radar network has been significantly enhanced to provide new measures that enable improved hurricane modeling, and the GOES satellite network has doubled in size with attendant improvements in resolution and accuracy.

Data enhancements and improved forecasting models have helped reduce the National Hurricane Center's 24-hour track error by approximately 40 percent, providing significant benefits to evacuation planning activities, which are estimated at approximately $1 million per mile of evacuated coastline.

While hurricane patterns are always going to be a stochastic phenomenon, the important take-away from this component of my testimony is that proactive monitoring capabilities were not a significant operational bottleneck in 1989, and they are unlikely to be operational bottlenecks in the future.

My optimism on the reactive front stems from the tremendous opportunities that I see for improving our capacity to dynamically adapt and respond to hurricanes and other emergency events as they occur. There has been a sea change in real-time in situ monitoring technologies. Ironically, the catalyst for this paradigm shift arrived in a tiny package, a computing device that we now refer to as a mote.

The unusual name reflects a tiny form factor that ranges in size from that of a Rubik's Cube to a matchbox to a quarter. Each device is capable of sensing, processing, and communicating information from its surrounding environment, enabling new applications in sniper-fire localization, wildfire monitoring, structural assessment of buildings and roadways, and classification of intruders near critical infrastructure.

Looking to the future, these devices will be even smaller and more robust, making it possible to seamlessly integrate in situ monitoring capabilities within our buildings, our roads, and our utility infrastructure.

In the event of a natural or man-made disaster, the resulting sensing fabric could be used to provide near-instantaneous feedback on the type, degree, and location of damage. Emergency management decisions would be optimized to rapidly commit personnel and resources to where they are needed most.

But this is still a vision. The hardware, software, and networking foundations that are necessary to deploy and manage a State-wide sensing infrastructure suitable for emergency response are still evolving. I believe that Clemson can play an important role in this evolution based on our work with the Intelligent River program.

The Intelligent River program brings together faculty and students across disciplines to develop the next generation of sensing infrastructure. The design represents a fully integrated sensing solution that enables end-users to collect, to share, and to utilize a broad spectrum of in situ data at dense temporal and spatial scales.

The result is a system that enables fine-grained, long-lived, low-cost in situ monitoring at local, regional, and landscape scales and supports meaningful analyses of the data that the system can collect.

Our team is actively managing Intelligent River deployment throughout the State, including an on-going deployment along the 312-mile reach of the Savannah River Basin, from the headwaters in North Carolina down to the estuary.

While our monitoring emphasis has been on water quality, the infrastructure design is sensor-neutral. So while the type of data being collected in the Savannah Basin could help to assess the type of drinking water impacts observed during Hurricane Irene and others, virtually any type of sensor can be deployed within this infrastructure across a wide range of challenging environments.

I believe that the Intelligent River represents an important foundation for growth as we consider how to improve our State's ability to efficiently respond to hurricane events and other natural and man-made emergencies.

I would like to thank the subcommittee once again for the opportunity to provide testimony on this important topic, and I am happy to answer any questions that you may have. Thanks very much.

[The prepared statement of Mr. Hallstrom follows:]

PREPARED STATEMENT OF JASON O. HALLSTROM

Chairman Duncan, Ranking Member Barber, and Members of the subcommittee, welcome to Clemson University. I know that for many of you, this is a welcome back. We're honored to have you on campus today.

My name is Jason Hallstrom and I am a computer scientist in the School of Computing here at Clemson, and I have the privilege of serving as the deputy director and director of technology for Clemson's Institute of Computational Ecology.

As the subcommittee is well aware, 2014 represents a bitter anniversary, marking 25 years since Hugo's landfall on the South Carolina coast. With wind speeds in excess of 130 mph, the storm resulted in 49 deaths and approximately $9 billion in damage. This wasn't the first Category 4 storm to hit our coast, but its ferocity fundamentally reshaped our perceptions of the tremendous impacts such storms can impose. In the quarter-century hence, South Carolina has been fortunate to avoid the brunt of subsequent superstorms—quite narrowly, it is worth noting, in the cases of Irene and Sandy, both of which dwarfed the aggregate economic impact of Hurricane Hugo. As we witness apparent increases in the frequency and severity of Atlantic storm systems, emergency preparedness could not be more paramount. Thank you for considering this important topic and for the opportunity to provide testimony to the subcommittee today.

While the timing is uncertain, the potential for another superstorm to make landfall on our coast is not. That is simply an unfortunate inevitability that we must face. In assessing our preparedness for such an event, there are two important planning dimensions to consider. The first is our capacity to plan proactively, before the storm makes landfall. This involves our ability to predict, to track, and to gauge the severity of the storm in a timely fashion, with high fidelity, well in advance of its impact. This capacity sets an upper bound on our ability to mobilize citizens out of harm's way, to establish appropriately-scaled response teams, and to establish infrastructure contingencies. The second dimension to consider is our capacity to plan reactively, after the storm makes landfall. This involves our ability to dynamically monitor infrastructure and natural resource impacts as they occur, setting an upper bound on our ability to direct response efforts to where they are needed most, and to reduce the duration and severity of infrastructure and resource disruptions. Today, I'm pleased to offer optimistic outlooks on both of these fronts.

Since 1989, NOAA and the National Weather Service have made significant improvements to their data collection, modeling, and forecasting infrastructure. The Nation's radar network has been enhanced to provide not only improved resolution and sensitivity, but also the ability to acquire wind speed and direction data, both of which are instrumental in hurricane modeling. The GOES satellite network has doubled in size, with attendant advancements in satellite stabilization, storm localization, detector optics, and available energy, enabling continuous high-resolution imaging. More frequent reconnaissance flights and higher-density in-flight data collection complement these continuous streams. Together, these datasets and improved forecasting models have helped to reduce the National Hurricane Center's 24-hour track error by approximately 40%, providing significant benefits to evacuation planning activities, estimated at $1 million per mile of evacuated coastline. While hurricane patterns will always be stochastic phenomenon, the important takeaway is that proactive monitoring capabilities were not a significant operational bottleneck in 1989, and they are unlikely to be operational bottlenecks in the future.

I promised an optimistic outlook on both planning fronts, and that remains true. But my optimism on the reactive front stems from the tremendous opportunities that I see for improving our State and Nation's capacity to dynamically adapt and respond to hurricanes and other emergency events as they occur. The improvements that we've witnessed in our portfolio of proactive monitoring technologies are unquestionably impressive, but reactive monitoring technologies have witnessed a seachange. Ironically, the catalyst for this paradigm shift arrived in a small package—a family of computing devices that we now refer to as motes.

This unusual name reflects a tiny form-factor, ranging from the size of a Rubik's Cube, to the size of a matchbox or a quarter. Each device is capable of sensing, processing, and communicating information from its hosting environment. Mote networks enable applications in locating sniper fire, monitoring wildfire conditions, assessing the structural integrity of buildings and roadways, and classifying intruders near critical infrastructure. Looking to the future, these devices are likely to be even smaller and more robust, making it possible to seamlessly integrate in situ monitoring capabilities within our buildings, our roads, and our utility infrastructure. In the event of a natural or man-made disaster, the resulting sensing fabric could be used to provide near-instantaneous feedback on the type, degree, and location of damage. Emergency management decisions would be optimized to rapidly commit resources and personnel to where they were needed most.

But this is still a vision. The hardware, software, and networking foundations necessary to deploy and manage State-wide sensing infrastructure suitable for emergency response are still evolving. I believe that Clemson can play an important role in this evolution based on our work with the Intelligent River® program.

The Intelligent River® brings together faculty and students from across campus to develop a new sensing infrastructure.[1] While the infrastructure design relies on mote networks, it is a fully-integrated solution that enables end-users to collect, share, and utilize a broad spectrum of in situ data at dense temporal and spatial scales. The result is a system that enables fine-grained, long-lived, low-cost in situ monitoring at local, regional, and landscape scales and supports meaningful analyses of the resulting data. Our team is managing Intelligent River® deployments throughout the State, including an on-going deployment along the 312-mile reach of the Savannah River, from the headwaters in North Carolina to the port in Savannah.

In these deployments, our monitoring emphasis is on water quality, but the design of our toolset is sensor-neutral. So while the type of data being collected in the Savannah Basin could help to assess the types of drinking water impacts observed during Hurricane Irene, virtually any type of sensor can be deployed within this infrastructure, across a wide range of challenging environments. I believe that the Intelligent River® represents an important foundation for growth as we consider how to improve our State's ability to efficiently respond to hurricane events and other natural and man-made emergencies.

I would like to thank the subcommittee once again for considering this important topic and for the opportunity to provide testimony today. I am happy to answer any questions you may have.

Mr. DUNCAN. Thank you. I will say, Dr. Hallstrom, the Intelligent River system has been instrumental in helping the Savannah River system with downstream flows, water quality, lake water retention, and all the things that the Corps is looking at in the environmental impact study. So thanks for your work on Intelligent Rivers.

Mr. HALLSTROM. Thank you, Mr. Chairman.

Mr. DUNCAN. Professor Bentley.

STATEMENT OF EMILY BENTLEY, J.D., ASSOCIATE PROFESSOR, HOMELAND SECURITY AND EMERGENCY MANAGEMENT PROGRAM, SAVANNAH STATE UNIVERSITY

Ms. BENTLEY. Thank you. Mr. Chairman, Congressman Meadows, esteemed panel members, and residents, my name is Emily Bentley. I am an associate professor of homeland security and emergency management at Savannah State University, so down the road from where we are today and our neighbor institution here.

I see my role in that academic program as preparing a new generation of leaders to deal with whatever the 21st Century will bring, whether it is human-caused disasters or natural disasters.

The topic of this hearing is the type of question that should be asked in communities across our Nation, not just in South Carolina or along the Atlantic coast, so I applaud the subcommittee's initiative and insight in convening this panel.

In determining and establishing preparedness, there is no one-size-fits-all answer. There is no silver bullet. Working toward disaster resilience involves policy and politics, science, and human behavior, with a focus on creating a culture of preparedness across communities, sectors, and levels of government.

The question posed by the subject of this hearing is a complex one: Are we more prepared than in 1989? In some ways, as other panelists have suggested, yes. But there is increased vulnerability to coastal hazards, like tropical cyclones, as well as other hazards.

[1] This work is supported through competitive awards from the National Science Foundation (CNS–1126344, CNS–0745846).

There have been improvements, as we have noted. Response in Hurricane Hugo exposed challenges in communication and coordination across agencies, which is not uncommon in significant emergencies and disasters. Since then, particularly in the first decade of the 21st Century, largely in reaction to the September 11, 2001, terror attacks, the United States has promoted a common incident command system and invested millions of dollars in interoperable communication systems.

We have seen States and localities throughout the Nation work toward and achieve compliance with an accreditation with National standards in emergency management. Several States in this region—South Carolina, North Carolina, Georgia, and Florida—are all Nationally accredited and have Nationally-accredited emergency management programs. We don't see many local jurisdictions in the Carolinas with any National accreditation. That may be something to note.

We have seen focus on and improvements in response and recovery planning throughout the Nation. In addition, as we have noted, we have at our disposal new and more immediate ways to communicate with the public and among responders. Many people have smartphones or at least cell phones and are connected to the internet 24/7. These technology developments can be valuable tools in notification and warning in a developing disaster.

These policy and investment activities can be expected to support improved coordination and communication in response to a major hurricane today. The extent of these benefits will depend to a large degree on how they are embraced and implemented at the local grass-roots level.

In emergency management and homeland security, we try to assess risk with some sort of methodology. We look at a combination of likelihood, vulnerability, and consequences. Several years ago, colleagues at Hazards and Vulnerability Research Institute at the University of South Carolina down the road used a loss estimation model called HAZUS–MH to estimate what a Hugo-type storm would do today in South Carolina.

Looking at Charleston County, for example, you would see an estimated more than 69 percent of county buildings with damage, more than a third of residential structures with more than 50 percent damage, and 0 percent of schools left functional, with a projected total of direct and indirect economic loss of $6.7 billion.

As has been noted, as we consider the status of preparedness compared to 1989, we have to consider the population growth in the southeastern United States in the intervening years. It has been a great time in the southeastern United States. It is a very attractive part of the country.

This plays a role in vulnerability as well as potential consequences. For example, South Carolina's population increased 38 percent from 1989 to 2013, from 3.46 million people in 1989 to almost 4.8 million in 2013, according to the U.S. Census. Other States in the Southeast have experienced comparable population growth.

In many ways, our society tends to increase our vulnerability rather than decrease it, from population growth, to our use of the internet, to some of our development tendencies. According to

NOAA and the U.S. Census, in 1990, the population in the coastal floodplain in South Carolina was about 275,000 people. In 2010, the population living in the coastal floodplain was more than 400,000, a 47 percent increase in population.

The percentage of this population younger than 5 or older than 65 increased from less than 19 percent in 1990 to 23.6 percent in 2010. This population growth impacts vulnerability in a number of ways, from increasing the number of people potentially in harm's way in a hurricane, to increasing the number of people who will need to be on the road or using some form of transportation, and who may need to stay in temporary shelters inland in an evacuation scenario.

The increase in the percentage of young and elderly may increase the numbers of people who need additional assistance or who are dependent on others in an evacuation or shelter.

So while there have been improvements, there are many preparedness and response issues that continue to present challenges: The diversity of hazards and gathering current and credible information to understand risk; reaching all segments of the population on an on-going basis with risk awareness and protective measure messaging; getting the public and decision-makers' attention when something is not going on, absent, of course, the attention of this committee; planning and implementing evacuation procedures, decision-making, and transportation modes and routes, traffic management and adequate shelter operations; and coordinating across agencies, sectors, and levels of government, particularly in a situation where normal operations are interrupted, so a continuity of operations-type scenario; and then, of course, resources for accomplishing all of these things.

On the subject of the population and their vulnerability, research at my institution, Savannah State University, and at others, including leading work by Susan Cutter at the University of South Carolina, has focused on social vulnerability in disasters. This research recognizes the fact that as important as what the hazard does, whether it be earthquake, hurricane, flood, or explosion, are the characteristics and the resilience of the population, the people where the hazard happens.

Social vulnerability factors include demographics like income, age, disability, educational level, literacy and language, race and ethnicity. These things can tend to make individuals, households, and communities more vulnerable to the impacts of disasters.

In Chatham County, Georgia, my university did some research that specifically focused on socially-vulnerable populations. We found that while 70 percent of the respondents thought it was important to evacuate when officials called for an evacuation, only 25 percent say they were very prepared or prepared to do so.

Of those who said they would not evacuate if asked, the biggest reason reported among survey respondents was lack of transportation to leave, 26.4 percent. But almost 18 percent of those who said they would not evacuate said the storm and aftermath probably would not be as bad as officials predict.

Mr. DUNCAN. If you can start getting to a wrap-up?

Ms. BENTLEY. Oh, I am sorry.

This research and research in other locations with similar findings illustrate the need to focus not only on the hazards but also the populations in the area with significant storm risk. This type of localized analysis of social vulnerability to disaster impacts is needed for all our communities, particularly those at risk from potentially catastrophic disasters.

Are we more prepared today than in 1989? Perhaps. Are we more vulnerable? Yes.

As this committee continues its work, I encourage you to take a leadership role in making sure that there are resources and support for local and State efforts to assess risk, engage the public in risk awareness and readiness to take protective action, and build capabilities across jurisdictions and agencies. These are key to improving the resilience and preparedness of communities for a 21st Century Hugo or whatever hazards our communities may face.

Thank you again for your time.

[The prepared statement of Ms. Bentley follows:]

PREPARED STATEMENT OF EMILY BENTLEY

NOVEMBER 21, 2014

Mr. Chairman, committee Members, panel members, and residents, the topic of this hearing is the type of question that should be asked in communities across our Nation—not just in South Carolina or along the Atlantic coast, so I applaud the subcommittee's initiative and insight in convening this panel.

In determining and establishing preparedness, there is no "silver bullet"—no one-size-fits-all answer. Working toward disaster resilience involves policy, politics, science, and human behavior, with a focus on creating a culture of preparedness across communities, sectors, and levels of Government. The question posed by the subject of this hearing is a complex one. Are we more prepared than in 1989? In some ways, yes. But is there increased vulnerability to coastal hazards like tropical cyclones (tropical storms and hurricanes) as well as other hazards? Yes. Hence the importance of this discussion . . .

In emergency management and homeland security, professionals assess risk as a combination of likelihood of occurrence or threat, vulnerability, and consequence. Vulnerability refers to the susceptibility to incur harm or loss, including humans' physical frailty or the exposure of property and infrastructure to damage. Proximity to the hazard is a key aspect of vulnerability, but there are other factors to consider. We often use computer models that help us quantify and visualize one or more of the three components of risk. Several years ago, colleagues at the Hazards and Vulnerability Research Institute at the University of South Carolina used a loss estimation model (HAZUS–MH, available from the Federal Emergency Management Agency (FEMA)) to estimate what a Hugo-type storm would do in South Carolina today. Selecting two counties as samples from those loss estimation results, Georgetown County could see 17 percent of county buildings damaged, 83 percent of schools unusable, and total economic impact (direct and indirect) of almost $85 billion. Charleston County would be estimated to see more than 69 percent of county buildings damaged, more than a third of residential structures with more than 50 percent damage, and zero percent of schools left functional, with a projected total (direct and indirect) economic loss of $6.7 billion. (Hazards and Vulnerability Research Institute 2014)

We seek to learn from each disaster. As college students at Savannah State University and other institutions study emergency management and homeland security, they identify lessons from past events like Hurricanes Andrew, Hugo, Floyd, Katrina, and Sandy. They examine earthquakes and tsunamis, hazmat releases, and the attacks at the Murrah Federal Building and on 9/11. Our governments as well as emergency management agencies make adjustments, sometimes with beneficial consequences as well as unintended consequences that may not be completely positive. Response in Hurricane Hugo exposed challenges in communication and coordination across agencies (not uncommon for significant emergencies and disasters). Since then, particularly in the first decade of the 21st Century, largely in reaction to the Sept. 11, 2001, terror attacks, the United States has developed a common Incident Command System (ICS) and invested millions of dollars in interoperable com-

munications systems. These policy and investment activities can be expected to support improved coordination and communication in response to a major hurricane today. The extent of the benefits of these improvements will depend to a large degree on how they are embraced and implemented at the local, grass-roots level.

After disasters, institutions and organizations try to identify and address weaknesses, or areas for improvement. But researchers also know that as time progresses from disaster events, the less we think about them and perhaps the less need we perceive to prepare for them or mitigate their effects. People tend to forget easily, and they often have the mindset that "it won't happen, and if it does, it won't happen to me." The challenge is that disasters do and will continue to occur. It is up to residents and their leadership and Government how prepared communities are to deal with them. Key to creating and maintaining a culture of preparedness is a realistic and current understanding of risk.

MORE AT RISK?

As we consider the status of preparedness compared to 1989, consider the population growth of the Southeastern United States in the intervening years. This plays a role in vulnerability as well as potential consequences. For example, South Carolina's population increased 38 percent from 1989 to 2013, from 3.46 million people in 1989 to almost 4.8 million in 2013, according to U.S. Census estimates. Other States in the Southeast experienced comparable and in several cases higher population growth.

In many ways, society moves to increase disaster vulnerability and consequences rather than decrease them. Consider the preference for living along the coast. In 1990, the population in the coastal floodplain in South Carolina, an area of about 2,900 miles, was about 275,000 people; in 2010, the population living in the coastal floodplain was more than 400,000, a 47 percent increase in population (NOAA 2011). The percentage of this population younger than 5 years of age or older than 65 increased from less than 19 percent in 1990 to 23.6 percent in 2010 (see discussion below of social vulnerability factors). This population growth impacts vulnerability in a number of ways, from increasing the number of people potential in harm's way in a hurricane to increasing the number of people who will need to be on the road, or using some form of transportation, and who may need to stay in temporary shelters inland in an evacuation scenario. The increase in the percentage of young and elderly may increase the numbers of people who need additional assistance or are dependent on others in evacuation and shelter operations.

The committee also should consider the potential increases in both likelihood and vulnerability of other hazards because of other developments in the region, such as expansion of nuclear plant operations in Georgia and South Carolina and projected sea-level rise associated with climate change. Sea-level rise is expected to cause negative impacts not only for human safety but also for property value and stability and the integrity of critical infrastructure like transportation (roads, bridges, mass transit systems), water and wastewater treatment facilities, and energy transmission and distribution. While not a significant issue for this immediate area, urbanization also adds to the need to focus on risk awareness, mitigation, and preparedness, with the concentration of people and infrastructure concentrating vulnerability to natural as well as human-caused hazards. Damage caused to the New York subway system as a result of 2012's Superstorm Sandy is an easy-to-visualize example. Vulnerability comes in varied forms. In his book, *The Next Catastrophe,* Charles Perrow laid out a concise explanation of the vulnerability of the U.S. electricity grid, damage to or disruption of which could have significant impacts on critical infrastructure, the economy, and social stability. (Perrow 2007) In addition to hurricanes and tropical storms, South Carolina and nearby States face a range of other hazards, from cyber attack to hazardous material or nuclear release, to earthquake, flooding, tornadoes, and infectious disease outbreaks.

These examples illustrate that we need to examine risk frankly and on an ongoing basis. While guidance on this front is helpful from the Federal level, risk assessment, mitigation, and disaster preparedness are fundamentally local, and to a degree regional and State activities. To improve disaster outcomes, the United States must build risk awareness, resilience, and preparedness capabilities at the local, regional, and State levels.

SOCIAL VULNERABILITY

Research at my institution as well as others, including leading work by Susan Cutter, Ph.D., at the University of South Carolina, has focused on social vulnerability factors in disasters. This research recognizes the fact that as important as what a hazard—hurricane, earthquake, flooding, or explosion—does are the charac-

teristics and resilience of the population, the people, where the hazard occurs. Social vulnerability factors include demographics like income; age; disability; educational level, literacy, and language; and race and ethnicity that can tend to make individuals, households, and communities more vulnerable to the impacts of disasters. (Cutter, Boruff, and Shirley 2003) In South Carolina's coastal floodplain, almost 13 percent of the population is below the poverty level based on 2010 U.S. Census figures. (NOAA 2011) Research by SSU,[1] in Chatham County, Georgia, that focused specifically on residents representing socially vulnerable populations (data was collected in areas with high percentages of low-income, minority, and elderly population), showed that while more than 70 percent of respondents thought it was important to evacuate when officials called for an evacuation, only 25 percent said they were very prepared or prepared to do so. (Rukmana, Bentley, and Clay 2011). Of those who said they would not evacuate if asked to, the biggest reason reported among survey respondents was lack of transportation to leave (26.4 percent). Almost 18 percent of those who said they would not evacuate said the storm and aftermath probably would not be as bad as officials predict. This research, and research in other locations with similar findings, illustrate the need to focus not only on the hazards but also the populations in areas with significant storm risk. For example, do local officials along the coast have a good understanding of the percentages and prime locations of residents without access to transportation?

PREPAREDNESS

Preparedness includes planning, training, and exercise all based on a comprehensive understanding of the risk associated with identified hazards in a particular location. Preparedness also includes communicating clearly with the public about potential hazards, including risk associated with each hazard and measures they can take to protect and prepare their family, households, businesses, and communities. Preparedness is not about fear but about empowerment. It can, however, be a challenge to get and hold residents' and decision makers' attention on a "blue sky" day. When an emergency or disaster occurs, people tend to pay more attention to warnings and advice about protective measures. However, Dennis Mileti's review of research shows that people respond much better to protective action messages if they are familiar with the decisions and actions they may have to take and have time to consider the information, process it with family and friends—"milling," and decide their course of action. Compliance with protective actions benefits from giving people clear, concise, actionable information on an on-going basis so they will know what to do when an emergency or disaster occurs. (Mileti 2012) I raise this issue because this disaster public education activities requires on-going work and focus by local and State government agencies charged with emergency management and homeland security with the assistance of private-sector and non-Governmental organization partners. It requires investment in local preparedness capabilities and activities that must be supported by every level of government. While some media may be free or low-cost, preparedness work with the public requires personnel time, a thoughtful approach, and communication through multiple, diverse means to reach all constituencies. The committee should evaluate whether enough emphasis is placed on empowering residents with information and resources so that the individual responsibility component of FEMA's "whole community" approach is a realistic goal.

Recent years have seen significant focus on emergency operations/response planning in many counties and cities in the United States, particularly in vulnerable areas along the Southeastern Coast. County governments where there is significant risk and/or significant population are expected to, and generally do, maintain an emergency operations plan (EOP) or comprehensive emergency management plan (CEMP) and local hazard mitigation plans as well as other plans and procedures. In most cases along the coast, response plans and procedures include an evacuation annex or appendix to guide decision making and conduct of an emergency evacuation of large segments of the population away from the coast. As was evident as Hurricane Katrina came ashore near New Orleans in 2005, it is vital that local governments have personnel and systems prepared to implement evacuation plans. In Louisiana, research supporting an exercise in the summer of 2004 estimated that approximately 100,000 residents of greater New Orleans would not be able to evacuate or would choose not to evacuate in the face of a hurricane. The State and city had not, however, by August 2005 implemented actions to reduce this number by engineering large-scale transportation options and public education/messaging to

[1] Supported by a grant from the U.S. Department of Homeland Security Science and Technology Directorate Minority Serving Institutions program, 2008–2010.

support it. The estimate proved tragically accurate and resulted in tens of thousands of people in desperate circumstances and in increased hazards to human health and safety. South Carolina and its neighboring States must learn from this, even though their elevation, risks, and populations are different. As the State and this committee consider preparedness, take into consideration whether government at each level has committed the resources needed to build capabilities to carry out plans and protective measures. This includes involving the community in the planning process so that plans, procedures, and capabilities fit the end-user. Engaging the community on an on-going basis is key to the "whole community" approach to preparedness and empowers residents and households with the information, understanding, and tools to take individual responsibility.

In the Southeast and Atlantic coast of the United States, several States, including Florida, District of Columbia, Georgia, Louisiana, Mississippi, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia have sought and achieved National accreditation through the Emergency Management Accreditation Program (EMAP). EMAP is designed to show that the jurisdiction has in place the elements of a viable emergency management program. (EMAP 2013) The development and application of voluntary National standards suggests an increased focus on building a consistent level of State and local capabilities for emergency management, including preparedness (sections of the standards address risk assessment, planning, training, exercise, and communication with the public, for example). This is a positive step. However, few local jurisdictions (city and county governments) have sought and attained EMAP accreditation. Most of the local governments that have achieved EMAP accreditation are in Florida (see *www.emaponline.org* for details; accessed November 16, 2014). This point as well as other indicators suggest the need for emphasis on local preparedness capabilities, both in South Carolina and in communities throughout the United States. I cannot address whether each coastal county in the Southeastern Atlantic has implemented mitigation measures to reduce damage or is prepared for a Category 4 hurricane or, in particular, whether their residents are ready and able to get out of harm's way. Other panelists may be able to address these questions for the jurisdictions within their responsibility. The point is that we need to make sure these questions are asked and addressed in each locale so that opportunities to improve preparedness can be addressed before the next storm—or whatever hazard—occurs.

In addition to the need for mitigation, response, and continuity plans and other preparedness activities, National standards as well as recent-vintage Federal guidance call for communities to create and maintain pre-disaster recovery plans to identify the structure, stakeholders, and key priorities it will use as it works to recover from a significant emergency or disaster. These plans should be in place before a disaster occurs. Beaufort County, South Carolina, has maintained such a plan for several years, for example, and Chatham County, Georgia, is currently updating its recovery plan to align with heightened expectations for recovery planning. States with hurricane risk should work with local governments to facilitate pre-disaster recovery planning that includes representatives of diverse community interests and stakeholder groups.

As emergency managers are fond of saying, like politics, all disasters are local. Local policies and people will deal with the emergency or disaster before and long after other levels of government and organizations. This concept should be central to development of policy and budgets that support preparedness for hurricanes and hazmat releases, mitigation measures like land use restrictions and building codes, and protection activities for critical infrastructure.

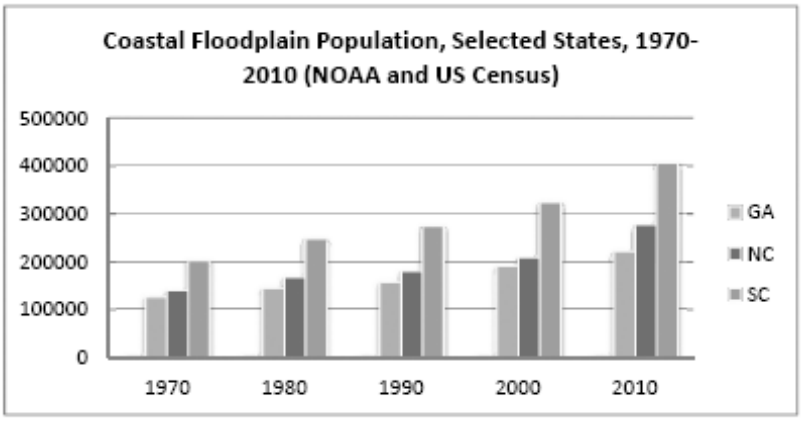
As this subcommittee and Congress continues its work, key measures to improve preparedness for large-scale and catastrophic disasters for your consideration include:

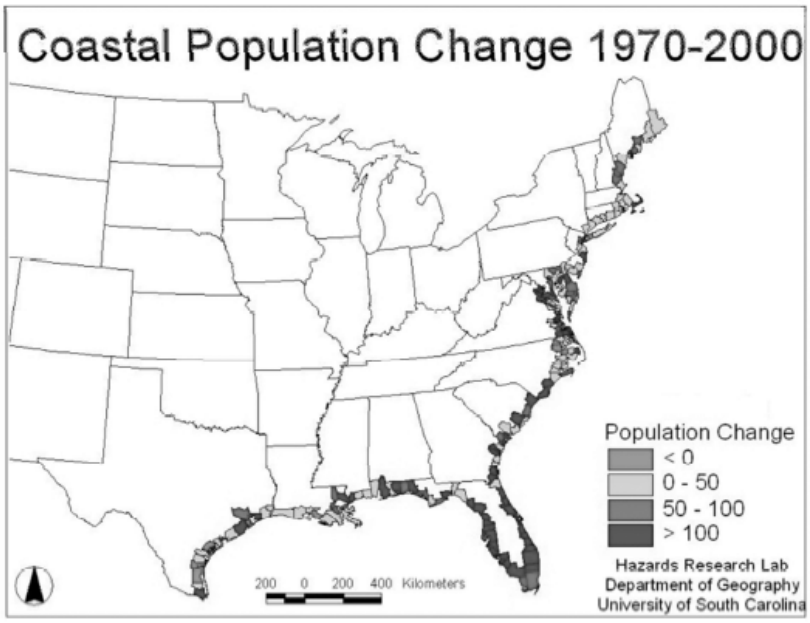
- Leadership and support, working with local and State emergency management and homeland security staff, in building a culture of preparedness among residents and business in your districts and within your areas of influence.
- Support for research to better understand and assess risk from all hazards and to integrate that research in local planning and policy development.
- Continued and increased support for Emergency Management Performance Grant (EMPG) funding, which provides a modest base of funding for local and State preparedness activities in South Carolina and throughout the Nation.
- Support of Federal, State, and local initiatives focused on engaging the diversity of our communities in risk awareness and disaster preparedness.

Are we more prepared today than in 1989? Perhaps. Are we more vulnerable? Yes. I encourage the committee to continue to evaluate whether the investment of time, attention, and resources at every level is adequate to protect your communities and constituents.

Thank you again for your time and attention to these important issues.

ATTACHMENT A.—COASTAL POPULATION CHANGE, 1970–2000





Mr. DUNCAN. Okay. Thank you.

Well, there are a lot of different topics here, and I am just going to dive right in. There are some things that are interesting me right off the bat.

Dr. Bottum, I talked earlier in my statement—Mr. Bottum. Doctor or mister? I think I introduced you as Dr. Bottum in Washington.

The CNN article about the threat to our grid system, if you take that in conjunction with the fact that we saw an explosive device and an incendiary device placed at a substation in the Southwest, I think that is a real threat. Now, can they take down a whole grid system or parts of it and what the effect would be?

Can you talk a little bit about the reality of that, of whether that is a real possibility, and how the Nation might react?

Can you pull one of those mikes a little closer? It doesn't matter which one.

Mr. BOTTUM. The threat is real. I think that report said at least one country. I think it said three countries could actually take down our power grid.

I think what we see going on in the world today are countries actually hiring people to do this, to mine intellectual property from companies in this country, and position threats. It is a different kind of warfare than we are used to in the past. I think it is real, but I don't know how to measure it. I honestly don't.

The thing that we do worry about is we hear company after company telling us they don't have trained people in this area. That is a real workforce issue. It would be interesting to look at intelligence reports on what other countries are investing in these cyber hacking experts.

Mr. DUNCAN. Right. One thing Clemson is doing that the gentleman from North Carolina might not be aware of is the drivetrain facility and the system they have there that actually impacts the grid system and creates the kind of breakers that might be necessary to stop something like that, if it is EMP, some kind of surge or something along those lines.

How is that being utilized? I know you are familiar with it.

Mr. BOTTUM. Yes, they are doing research projects on that. Companies are actually engaging the folks in Charleston at the drivetrain facility to do these kinds of things. I am not personally familiar with any of the projects that are going on there. But you can essentially simulate the power grid, so that would be a very wise area for investment by the government through places like the NSF and other agencies into research into these areas for simulating attacks, and then figuring out how to deal with that in advance.

Mr. DUNCAN. That is in Charleston, and a lot of power companies have invested in that.

Dr. Lacy, a threat of an electromagnetic pulse, whether it is man-made through a nuclear device exploded in the atmosphere, or whether it is a solar flare, we just had one go by the planet and the sun wasn't facing the right direction to affect us dramatically. But we have seen that happen in the Northeast.

So with the Iranian threat of them getting a nuclear weapon, and the real possibility—I will say that Congressman Meadows has as a constituent who wrote a fabulous book called "One Second After" that shows the impact of an EMP on a small community of 5,000 people.

I am part of the EMP caucus in Washington. I don't want to dwell on this issue, but an EMP, whether it is man-made or natural, can affect the grid system and our communication system,

and a lot of other things we talked about here today. So how do we combat that? What are we doing?

Dr. LACY. In my remarks, I intentionally omitted speaking about improvised nuclear devices and EMP attacks. They are horrific and large-scale events that are very hard to guard against. There are three points I think I want to make about them.

No. 1 is that although we tend to focus on the more frequent events—the active shooters, the explosive events, chemical events—there are many people in the country, the catastrophic preparedness working group, for example, is working on how to prepare for an improvised nuclear device or nuclear event in certain parts of this Nation.

I would say, No. 1, that the question should be—you are probably very familiar with this—but the question should be referred to the intelligence community, because those folks seem to think that that likelihood still exists.

In terms of EMP, it is very interesting. I was asked to give a talk at NORTHCOM, and the folks in DOD at NORTHCOM focused their remarks specifically on EMP and their concern for it. As a matter of fact, they took us to Cheyenne Mountain, which originally was developed there to withstand nuclear attack and EMP.

I think these are very daunting questions, the ability to intercede and stop a cascading effect of EMP needs to be focused on, but I think not to the extent that we ignore the more upfront and hazardous threats, active shooters, explosive threats, which are very easy to do, biological threats, chemical threats, radiological threats.

I will just mention the fact that every week, there are radiological sources, or every year numerous radiological sources in this country are either lost or stolen. Those radiological sources can be used to wrap around conventional explosives to cause radiological devices, RDDs, dirty bombs as they are called, which are weapons of mass disruption and fear, and cause other cascading effects of fear, cost, and disruption of society.

So I guess to answer your question, we need to focus on these low-frequency, very high-consequence events. But I don't want to think that those are more important than the high-frequency, lower-consequence events that can be done any day by anyone with an intent to do us harm.

Mr. DUNCAN. Thank you for that.

I am out of time. I am going to yield to the gentleman from North Carolina. I am going to recognize him for questions for 5 minutes or so, and then we may have another round.

Mr. MEADOWS. Well, I thank you each of you for your testimony. Let me go to really I guess the genesis of this, that we are here today to prepare.

But Professor Bentley was just talking about how a lot of times when they get a notice, they don't evacuate. Some of that is for logistical reasons, as you were pointing out. But most of the time, it is for reasons that they believe they can weather the event or that the event won't affect them.

I must confess, I am the same way. I will get an alert on my phone in Washington, DC, that says take cover, because there is a particular storm. Sometimes I think it has to say, "This means

you, stupid," because I will look at it, I will look outside, and say, it won't be so bad. I won't take cover.

How do we do a better job of pinpointing the urgency, so to speak, of needing to either be prepared, whether it is cyber attacks, natural events, without creating the fear factor and having everyone run and stay hunkered down in a shelter?

Dr. Lacy.

Dr. LACY. I think risk communication before, during, and after events is extremely important. It is important in a number of ways. One way is the more information you give, the more informed choices people can make. No. 2, it is a means of getting people to do the right thing.

For example, if there is an outbreak of disease, there is a tendency of people to try to run away from that area and you can have secondary and tertiary episodes and outbreaks of disease elsewhere. So by giving the appropriate message, you can keep people in the area. The message may be, "We have countermeasures for this, and the people in this area will be getting the countermeasures. Stay here."

So influencing behavior, allowing people to make rational and educated choices is extremely important.

One of the big conferences that we held in the last year had to do specifically with this, with risk and crisis communication and how conflicting messages can cause essentially minor to major chaos in communities, and how important it is to give crisp, understandable, and actionable messages so people know what to do.

If I may, for a moment, I can segue and explain how that conference came about, just for 1 minute, which is that we have the Rutgers Institute for Emergency Preparedness and Homeland Security. It is a multidisciplinary group of all the subject-matter experts across the entire State of New Jersey, from humanities to sciences, everybody doing homeland security, preparedness, disaster response.

These people are all under one big tent now, and they are able to look at issues all the way from risk communication to surge capacity to receptor biology. Everything is a one-stop resource for people who need this kind of consultation. We are happy to do it.

We have now joined over the past number of years with Robert Wood Johnson University Hospital. That is the premier academic medical center in the State—it is a Level I trauma center—to bring in the academic, medical, and health aspects of it, too.

I will give you one example. We did a mass casualty. We use RTLS, real-time locating system technology, to move mass casualties from a simulated multifocal explosive event at Rutgers Stadium through the hospital. When hundreds of casualties come through, we are able to effectively and efficiently bring them through using this technology.

We have enough subject-matter experts that we are able to make efficient and effective mass casualty management and surge management.

The only other point I want to make is that, because of the leadership of institutions, we are able to get buy-in from the highest levels. We had 2,000 volunteer victims and health care workers

participate in these exercises just in our academic medical center alone. So we are able to address these kinds of questions there.

Another one that we have addressed recently is the best practices for the management of blast injury. How do you do the medical management of blast at the same time you do the emergency management aspect at the same time do the law enforcement piece, because it is a criminal event? How do you not step on each other's turf?

By bringing all the subject-matter experts together from the University, from the medical school, and from Robert Wood Johnson University Hospital, we are able to do it in one stop.

Mr. MEADOWS. Okay.

Mr. Louden, obviously, those who serve with you to serve the public know that when they are part of the Salvation Army, they are there with one specific calling. As you mentioned, that calling is really a higher calling than just giving out food or providing for the physical needs. So how do you most effectively know who you can count on to help and who you can't count on to help?

Mr. LOUDEN. That is a great question, Congressman. Thank you very much.

The Salvation Army works year-round being prepared and exercising our teams, training, equipping. When the time comes for us to be called upon, we have established around the country response teams that are ready to move at a moment's notice, and, oftentimes, pre-stage for the event, if we know that the event is about to happen. So we have a pretty good idea of who we can call upon.

Mr. MEADOWS. In every ZIP Code, as you were saying?

Mr. LOUDEN. In every ZIP Code across the country.

Then, really, today for us represents a very helpful step forward in getting the message of the Salvation Army out, that we do partner and that many of our very effective partnerships are represented here today.

Those partnerships occur on a daily, weekly, monthly, regular basis where we can continually be prepared, equipped, and informed so that we can respond to whatever the need might be.

Mr. MEADOWS. I am out of time, so I would ask some of the others, if you would, if you could just respond in writing to us on the preparation and, obviously, Professor Bentley, on how we make them actionable when an alert comes in, if you could do that, respond to the committee, that would be very helpful.

I yield back.

Mr. DUNCAN. You can go ahead.

Mr. MEADOWS. Professor Bentley, let me come to you, because, obviously, we cannot provide vehicles for every person who needs transportation. You have your emergency hurricane preparedness vehicle sitting out there, so that just doesn't work. So how do we best communicate the threat level? I would ask you to keep it concise, if you can.

I also ask you to take off your lawyer hat who deals in facts and law, and put on your professor hat and give me maybe an opinion.

Ms. BENTLEY. Thank you, sir.

I think key for this, too, is the concept of engaging the public on a regular basis. As several other panelists have noted, people respond much better, and the research bears this out, they respond

much better when they have heard something before. The first time you ask somebody to get onto a bus and go somewhere and they don't know where they are going, in front of a hurricane, that may give them pause. So building that understanding of some decisions they may need to make, some actions they may need to take, while the sun is shining, that is critical.

Coca-Cola doesn't tell us one time to have a Coke, right? They tell us every day. We need to have that kind of approach. That is why it is labor-intensive. We have to engage the public on an on-going basis with clear, concise messages about things they may need to do and provide them the tools.

Mr. MEADOWS. So who is in the best position to do that? Obviously, the Salvation Army does that, and Chatham County, we are familiar with that. Maybe it is partly churches. But when we count on the Federal Government to do that—and so you are not suggesting the Federal Government communicate on a daily basis. Because normally what that does is it gets in one of these little leaflets that has publication No. 104–5, and it collects dust until the event happens and then we are scrambling around, saying, "Well, where is that?"

Ms. BENTLEY. You are absolutely correct. That is my point. Like politics, all disasters are local.

This is at the grass-roots level. This is local and State government, emergency management agencies, sheriffs' departments, Salvation Army chapters, with a coordinated message but an on-going effort. Let's go to the Rotary Club.

The best emergency managers I have known have been people who work in the community on a day-to-day basis, engaging the community so that the plans and procedures for evacuation, for example, fit the end-user, so that they know how to avail themselves of public transportation out of town if they don't have access to a vehicle.

We have several South Carolina counties that have about 4 percent of the population without transportation, access to vehicles.

Mr. MEADOWS. Thank you.

I will yield back.

Mr. DUNCAN. I will recognize myself for another round of questions.

Dr. Hallstrom, I like the Intelligent River concept and what you have been able to do with the Savannah River. The Rubik's Cube and it has gotten smaller, and the amount of data it collects is just phenomenal. Transmission of that data is still something I can't grasp and wrap my head around.

So take that concept, and you are talking about the Intelligent City project. In the post-Snowden days, where everybody is sensitive about personal information, what is being collected by the government, whether it is how you surf the internet, what you text, or conversations you may or may not have with loved ones, now we are going to have these components around the city monitoring God knows what.

I sincerely mean, how do you feel that the general public will accept the whole concept of Intelligent City and data collection?

Mr. HALLSTROM. So thank you for the question. I think that the response both to our deployments within the Savannah River Basin

for Intelligent River and also deployment within Aiken for Intelligent City and at the farm for Intelligent Farm, and other applications, the response has been tremendously positive. So we have worked very closely with the city, in the case of Aiken for Intelligent City, to make it clear what information we were collecting and what that information would be used for.

So in the case of Aiken, we have a very strong platform that is for the public good. In particular, we are collecting information on stormwater, and we are looking at the city's capability to process that stormwater and to look at best management practices for improving the treatment of that stormwater, so we have a lesser impact on Hitchcock Woods.

There are similar stories for the work that we are doing in the Savannah River. When you are collecting information on dissolved oxygen, collecting information on turbidity, there is a very strong explanation that resonates not just with agencies like the Army Corps and EPA, but resonates with the citizens who are very interested in water quality in that area.

So in terms of negative public reaction to the information we are collecting through Intelligent River, I would say we have seen none within the last 7 to 8 years. It has been extremely positive.

Now I would like to mention that for our buoy deployments in the Savannah, where you are putting in devices that look like large marker buoys, we have been careful to try to mark those devices with notes that indicate that this is for the public good, that this is a research program, and we are collecting general water quality and quantity data.

So I think there is a public outreach component that needs to continue, to ensure that the public understands that this is for the good of all.

But by and large, this has not been a problem for us.

Mr. DUNCAN. That is tough to do in these days, where the public doesn't trust the Government, getting their acceptance of a level of data collection, regardless. I mean, there is a negative connotation.

Look, I agree with General Alexander, that in order to find the needle in the haystack, you first have to have a haystack. But what the Government does, how long they hold that information—I see a connectivity here, a tie-in to this. I think this is absolutely the right thing to do to be able to pinpoint an activity and understand was that a car backfire or was that a gunshot? Was that a radiological device or something else?

So I get the need for that information. I am just kind of talking off the cuff here about what I hear when it gets down to privacy. So this really ties in, and I know Mark wants to say something, but I want to ask Mr. Bottum, after you chime in, about cybersecurity. It is so important. But it is taken in the context today of this arena of privacy and secure data.

So let me ask you to hold off, and I am going to let Mr. Meadows chime in here, and then I will come back to you.

Mr. MEADOWS. Well, I want to pick up on that, where you left off, Dr. Hallstrom, and I will just make a comment, and then let Mr. Bottum respond.

This whole privacy, when they see you out there collecting the data, they can say, well, OK, this is for clean water and we see that as great. You are the custodian of that data.

The real problem comes in with whom to trust as the custodian of that data that you have collected for one purpose that might potentially be used for another.

To give you an example, we talk about real and perceived threats. I can tell you that there are countries that have the ability right now to be listening to each one of you, listening to this over your iPhone that is probably turned off.

Now I take that threat as so real, because I have been in Classified settings, that I don't leave my telephone in my bedroom or anywhere close to me even when it is turned off.

Now I say that because all the people listening here say, oh, it can't be that bad, but it is like the person getting ready for the hurricane. If they believe that, it is not based in reality, I can tell you.

So the real question is, if you are collecting it, or if somebody else is collecting it, who do you trust to be the custodian if we allow that breach of what I call a Constitutional firewall to be overturned for National security or whatever the issue.

Sorry for the commentary.

Mr. DUNCAN. I really did not intend to go down that, but this subject cannot be broached without considering privacy.

So we are talking about cybersecurity. We are talking about how America can protect its infrastructure, and how private information is protected.

So in these post-Snowden days, Mr. Bottum, how do we reassure our constituents?

Mr. BOTTUM. I think what the Government can do is help the public understand the threats that we are under, and that is an education.

There is a trust issue. There is no question about that. But people every day give away their information to Google, to everybody else out there that they think—I heard Brad Wheeler from Indiana University say recently, if you are getting a free service on the internet, you are not the customer, you are the bait.

Basically, we are giving away our information every day. But I think, with respect, there is obviously a trust factor that the Government needs to work on. But the education of the public to know just how scary things are, when I get complacent, my chief information security officer is here, and I had a fellow named Gene Spafford back at Purdue. He had the first NSA Center of Excellence. When I feel myself getting too complacent, I go and talk to them for a while, just go in their office and listen to stories.

It is very, very scary what is out there. I think the public understands that, and there is going to be an appreciation for why things need to get done.

Mr. DUNCAN. We have broached a lot of questions that I wanted to ask as we have gone through this today.

I really don't have anything further, so I am going to yield to the gentleman from North Carolina.

Mr. MEADOWS. Let me ask just one, and I guess what I would like to do is, Dr. Lacy, very briefly, because we are running out of

time, Dr. Hallstrom, Professor Bentley, there is the training that happens in universities each and every day. You have students who you are working with that are just like sponges, taking in this information.

We send them out, having trained them, into the workforce, of which they go into an older system with this new knowledge that they may move the pendulum just a little bit, instead of actually being a vibrant part of the solution, where I see universities, land grant universities, wherever it may be, could truly—I visited N.C. State and saw unbelievable modeling that I said this needs to be, and I had just left the EMS Center in Raleigh, and I said the two of you need to be working together. Indeed, they are working together in a small way together, but really not a hand in glove.

So very quickly, how can we do that? I will let the three of you comment.

Dr. LACY. Well, that is one of the key purposes of our institute. We work very, very closely with the public and private sectors, with the county, the State, the Federal Government, National and international organizations. What we do is, in our work with our students, our graduate students, our postgraduate trainees, the idea is to have them become change agents and work very, very closely with the public and private sector to be the agent who makes the change.

There is a lot of inertia out there. But given a dynamic training program and dynamic individuals who join the workforce, there is an ability to do that. We see it happening.

Mr. MEADOWS. Dr. Hallstrom.

Mr. HALLSTROM. So I am in the business of training students to build embedded network systems, largely for doing large-scale sensing. One of the challenges that you face is ensuring that the students you produce and that you send out are able to work with agencies and work with folks across domain disciplines. That has been one of the major benefits of the Intelligent River program at Clemson, in terms of its training impact.

So we brought in faculty from all across campus, from river ecology and environmental toxicology, to computer engineering, computer science, applied statistics. You are really training students to work across those disciplines. When you send them out, they are much more effective, in terms of working across those barriers.

Mr. MEADOWS. So not just within their particular area of expertise, but across the dynamic.

Professor Bentley.

Ms. BENTLEY. I would agree that interdisciplinary approach is key to many of our degree programs. That is one of the reasons our program is homeland security and emergency management. At the bachelor's level, they get a comprehensive approach, and then they can specialize through electives and minor courses and other training.

The other component of that is that I think we could do more. In the technology fields, we tend to have technology transfer requirements in many of the grant programs for education and scientific research. I think we can do better in having knowledge transfer—in other words, outreach to local and State emergency management and other agencies—to move some of the research

that is in academia and some of our institutes in a more proactive way into the workforce and into the field.

Mr. MEADOWS. I thank the gentleman for your leadership. Thank you for allowing me to participate in this question-and-answer and committee hearing. Thank you.

Mr. DUNCAN. I thank the gentleman from North Carolina.

It is great to have Congress at Clemson. I want to encourage everyone to walk around this beautiful campus, walk around Bowman Field, look back up at Tillman Hall, and stay around until tomorrow and watch the Tigers beat Georgia State.

I want to thank Clemson University, my alma mater, for allowing us to conduct this field hearing here. It is great to bring Washington down to where the rubber meets the road, and that is in the States and localities.

I want to thank the witnesses for their testimony. I think both panels were fabulous.

Members of the committee may have some additional questions. We just ask you to submit answers in writing. We are going to leave the record open for a little while, in case there is some other information that comes to light.

With that, the subcommittee will stand adjourned.

[Whereupon, at 3:37 p.m., the subcommittee was adjourned.]

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