

# 2006 HURRICANE FORECAST AND AT-RISK CITIES

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## HEARING

BEFORE THE

SUBCOMMITTEE ON DISASTER PREVENTION AND  
PREDICTION

OF THE

COMMITTEE ON COMMERCE,  
SCIENCE, AND TRANSPORTATION  
UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

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ONE HUNDRED NINTH CONGRESS

SECOND SESSION

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## CONTENTS

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	Page
Hearing held on May 24, 2006 .....	1
Statement of Senator DeMint .....	1
Statement of Senator Bill Nelson .....	4
Statement of Senator E. Benjamin Nelson .....	3
Statement of Senator Lott .....	6
Statement of Senator Stevens .....	8
Prepared statement .....	8
Statement of Senator Vitter .....	5
WITNESSES	
Mayfield, Max, Director, Tropical Prediction Center/National Hurricane Center, National Weather Service, NOAA, Department of Commerce .....	9
Prepared statement .....	11
Spears, Major General Stanhope S., Adjutant General of South Carolina .....	20
Prepared statement .....	21
Spraggins, Brigadier General Benjamin J., Director, Harrison County Emergency Management Agency .....	14
Prepared statement .....	17
APPENDIX	
Response to written questions submitted by Hon. Daniel K. Inouye to Max Mayfield .....	31



## **2006 HURRICANE FORECAST AND AT-RISK CITIES**

**WEDNESDAY, MAY 24, 2006**

U.S. SENATE,  
SUBCOMMITTEE ON DISASTER PREVENTION AND PREDICTION,  
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,  
*Washington, DC.*

The Subcommittee met, pursuant to notice, at 2:32 p.m. in Room SD-562, Dirksen Senate Office Building, Hon. Jim DeMint, Chairman of the Subcommittee, presiding.

### **OPENING STATEMENT OF HON. JIM DEMINT, U.S. SENATOR FROM SOUTH CAROLINA**

Senator DEMINT. Good afternoon. I want to thank the witnesses and all my colleagues for being here today. And we still expect Chairman Stevens in a few minutes. But, in deference to your time, we need to move ahead.

About this time last year, we had one of the first hearings for this committee, and we talked about the possibility of hurricanes hitting different places in the United States. And I remember, Mr. Mayfield, and Senator Vitter, made a presentation on what would happen if a major storm hit New Orleans. Just a few months later, about 9 months ago, I was looking out the door of a Coast Guard Jayhawk helicopter, flying over the coast of Mississippi and Louisiana, reviewing the destruction that Hurricane Katrina had wrought upon the region. The devastation was as comprehensive as it was heart-wrenching, and it was almost exactly as had been predicted in this committee only a few months before.

All along the Mississippi coast you could see where the massive wall of water had flattened homes, leveled communities, and irreparably damaged the lives of so many Americans. When we flew over Louisiana, the water was still so high that, in many places, all we could see were the rooftops peaking out of the deluge. In the coming weeks and months, we learned that many American lives had been devastated, but also, again, recognize that, fundamentally, Americans are good and generous people who come to the support of their neighbors in their time of need.

Clearly, in the immediate aftermath of the storm, a number of things went wrong. Governments at all levels didn't perform as well as any of us would have liked. But some things did go right. And as we enter the 2006 hurricane season this week, it's worth learning from what has failed, as well as what succeeded.

As everyone saw, the Coast Guard performed splendidly. If it wasn't for the tireless and courageous work of the men and women

of the United States Coast Guard—many more lives would have been lost in the aftermath of the storm. And while the evacuation in the Gulf States—and New Orleans, in particular—was incomplete, it could have been much worse. A lot of people fled the region because they received advance notice from the National Weather Service of the coming storm. Estimates are that in excess of 80 percent of the population of the New Orleans area evacuated in advance of the storm. While we would have liked to have seen 100 percent evacuation, if it had not been for the accurate and timely predictions from one of our witnesses today, Max Mayfield, and his team at the Hurricane Center, the city and the states would not have been able to implement their evacuation plans and get as many of their citizens out of harm's way as they did.

This morning, the witnesses come before the Committee to discuss the 2006 season. NOAA put out its announcement on Monday, telling us that they are 80 percent confident that the Atlantic hurricane season is going to be an above-average season. While it might not be as bad as last year, they're estimating that we're going to see between four and six major hurricanes this year. And those are hurricanes between Category 3 and 5. If one of these makes landfall in the United States, it will have a devastating impact on the communities that it hits. And while NOAA generally did an excellent job last year, there are still some areas that give me concern.

Our emergency managers and first responders, represented by the two gentlemen sitting next to Mr. Mayfield, need to know not only where the storm is going to go, but how strong the storm is going to be. Without an accurate prediction of its intensity, emergency managers do not know what counties they need to evacuate, or what levels of resources they need to marshal, to be ready. If we overestimate the strength of a storm, too many people are evacuated, and the job of managing evacuations for the Coast Guard—or, for the National Guard—becomes much more difficult. If we under-estimate the storm, and people are stranded in their homes, and—local emergency managers end up having to rescue thousands, as we saw in Louisiana, who otherwise might have been evacuated.

I'm particularly concerned about this issue, because NOAA has shown little progress in improving the quality of its intensity forecasts. They stated earlier that they've shown about a 1 percent annual improvement in their hurricane intensity forecasts over the last decade. Now, this is nowhere near the dramatic improvement in hurricane tracking and nowhere near the level of accuracy our communities need to be safe.

My nightmare scenario, and one I think is shared by our witnesses, and probably my colleagues, is that citizens in a city like Charleston would go to sleep one night with a weak Category 1 storm off their shores, and wake up in the morning with a Category 3 storm bearing down on the city and few people having been evacuated. As you can imagine, the consequences would be devastating.

Again, I want to thank our witnesses for appearing this afternoon.

And I ask Senator Nelson if he would like to make an opening statement.

**STATEMENT OF HON. E. BENJAMIN NELSON,  
U.S. SENATOR FROM NEBRASKA**

Senator BEN NELSON. Thank you, Mr. Chairman. And, first of all, I thank you for bringing us together with this hearing today. And it's a pleasure to work with you.

And I'm not superstitious, but, last time, we talked all about it, and then things happened. I don't want to create a self-fulfilling prophecy. But the only way to avoid that, apparently, is through preparedness and response. So, I hope that's where we'll be heading up.

But, given the hurricane season that we endured last year, this hearing has to be of great interest to a number of people, so I look forward to hearing from Mr. Mayfield about what we can expect in the next few months, and from the other witnesses about how well, or how we, in Congress, can be helpful in preparing for this hurricane season.

In the hearings we held last year, in particular—on severe weathers, but particularly—weather conditions—but particularly hurricanes, much of the discussion did, in fact, focus on preparedness, and getting people to respond appropriately to the warnings. And so, I'm interested in hearing from Mr. Mayfield today about how he thinks we're doing on improving hurricane forecasts, because advance information, accurate information, is obviously extremely important to preparedness for the appropriate response, as well.

Are we getting more reliable, as far as predicting a track that you would decide that a hurricane's going to lead and take, as well as the intensity that it'll have when it makes landfall? Knowing the intensity and the location are critical points that must be improved.

I'm also interested to hear from the witnesses about any insight they have as to what impact they think last year's devastating hurricanes will have on how people in the hurricane-prone areas react to hurricane warnings, also whether the experience of last year has impacted how communities, and the governments of those communities, and the business and other leaders in that community, are preparing for this year's season.

So, we've got the upcoming hurricane season, something that concerns us all. I look forward to hearing the thoughts, and say, to General Spears, I suspect you know the Adjutant General from Nebraska, Roger Lempke, a personal friend of mine, and his predecessor, who was the Adjutant General during my 8 years as Governor, Stan Heng. And one of the first things I learned when I went to the new-Governor school, before I took office, was to meet with the emergency management people, Colonel Fran Layden, as well as General Heng, to be sure we had in place—we weren't worried about hurricanes, but, you know, there are other disasters that befall a State like Nebraska, land-locked, and we were prepared as best we could for it. We never got out-stripped of our resources, although at times we were stressed. So, I know, from your perspec-

tive, you're looking to be prepared for the worst, but also hope for the best.

So, thank you very much.

Thank you, Mr. Chairman.

Senator DEMINT. Senator Bill Nelson.

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

Senator BILL NELSON. Thank you, Mr. Chairman.

I'll just say to the—General Spears—as you know, the Florida Guard, under General Burnett—we are extremely experienced in hurricanes, and—we don't wish to be, but we are—and the good thing about the Florida Guard is that when another State needs our Guard, because we are so experienced, our Guard is very generous with their time, and their resources, to go out and help other states. And I hope your state doesn't need our assistance, but we're ready, in whatever state that does.

I just want to say, Mr. Chairman, that there are a few things, going into this hurricane season, that we have got to, in this Senator's opinion, focus on for NOAA, to help them out. Now, last year, Senator Stevens really helped us, in that we got the National Hurricane Center six additional positions, which Max Mayfield desperately needed so that he can train-up this crop of new specialists. And they are in place, and they're ready to go.

What they desperately need now is—in NASA terminology, we have a single-point failure about to happen, and that is, we've got one G4 that flies above the hurricanes at 40 to 47,000 feet, and the sonde packages with a drogue chute that goes all the way to the surface of the water. They get the measurements in the entire column of air, much of which, at that higher altitude, gives us an indication on the steering currents, which has increased their accuracy so much in the predictions. And I say "single-point failure," because if that G4 has an accident, or if it is down for maintenance, there's nothing up there flying. And Mr. Mayfield can tell you, with extraordinary charts, as well, just compare the accuracy, if the G4 is flying and when it's not, on the predictions of a hurricane.

The other thing that NOAA needs is that—the overall accuracy in the last two or three decades of predicting the path of a hurricane, and its intensity, has exponentially increased the accuracy by the computer modeling. The mortality due to hurricanes since the 1950s has been cut by 90 percent as a result of the increased accuracy of the predictions. And today's 5-day forecast on hurricanes is as accurate as the 3-day forecasts were 15 years ago.

And so, what we need to do is to help NOAA set up a computer modeling group, a group of about six people, that would be dedicated to computer modeling, the absolute state-of-the-art, that then could augment the National Hurricane Center.

And the final thing that I'll say is, on the other end of a hurricane is a consequence that is devastating, and that is in the insurance marketplace. And we are finding that out clearly along the Mississippi and Alabama coast right now as they are sorting through that question, was it wind or was it water that destroyed all of those structures?



I will be offering, by tomorrow, a package of bills drawing on my experience as the elected Insurance Commissioner of Florida during the 1990s, and the approach that we took when I was handed the aftermath of a paralyzed insurance marketplace in the entire State of Florida in the aftermath of Hurricane Andrew. And drawing on that experience, I'm going to make suggestions to the Senate, and will invite people to join as cosponsors as you see this package of bills that I'll be offering, as we come into this hurricane season. And that's on the question of, what is the role of the Federal Government to do as a backup to the State insurance systems in order to keep this system whole, and to keep it affordable for the average homeowner.

Thank you, Mr. Chairman.  
 Senator DEMINT. Thank you.  
 Senator Vitter.

**STATEMENT OF HON. DAVID VITTER,  
 U.S. SENATOR FROM LOUISIANA**

Senator VITTER. Thank you, Mr. Chairman. And thank you, again, for holding this hearing on this very important issue, coming into this hurricane season, hurricane prediction and preparedness.

As you said, about 11 months ago, you had a similar hearing, and we heard from Max Mayfield and others, and we discussed the concern that hurricane protection systems and infrastructure, particularly in south Louisiana, were inadequate. And we actually described what a scenario might look like if the big one hit. And there has never been a case where I've been sadder about being proved right, in terms of the discussion that was here in the Subcommittee.

Three months later, Katrina devastated the Gulf Coast. Less than a month after that, we got a second punch with Hurricane Rita in southwest Louisiana and east Texas.

Coming out of all that experience, I first want to say thank you to the American people for their generosity, in terms of an enormous and historic response. It really was overwhelming in so many ways, so I really want to thank everyone—the American people, a lot of private churches, foundations, other groups—for all of their work.

And, Mr. Chairman, you're exactly right, there were some good-news stories even including in the Federal Government. And, you're right, the Coast Guard was absolutely one. They did heroes' work from the beginning to the end, did their job magnificently.

And, happily, we have another such good-news story here today—namely, the National Hurricane Center. Max Mayfield and his center did great work. It literally saved thousands of lives. A lot of folks don't realize all that goes on behind the scenes on the prediction models that Max's team produces, but that model, that prediction, his personal calls to the Governor and the Mayor and others, absolutely saved thousands of lives. And their prediction of the track of Katrina was amazingly accurate 56 hours before the storm came ashore. So, we thank you for that great work.

Unfortunately, you know, there are some other examples of performance that are on the other end of the spectrum. Everybody knows about FEMA problems, but, also, I've been very frustrated,

quite frankly, with the response of the U.S. Army Corps of Engineers. Most recently, they have announced that their top, top priority work, which was supposed to be done by June 1 of this year for this hurricane season, is not going to be done by then, will only be done well into the hurricane season.

Mr. Chairman, I have to tell you, if this had happened in the private sector, with regard to what happened in the Corps, the managers would have been fired, and hundreds of billions of dollars in lawsuits would have been filed to recover losses. But, because it's the Federal Government, we basically rehire the same company. And, unfortunately, they're using some of the same processes that have let us down in the past. And so, the emergency supplemental, as well as a water bill, really have to be passed immediately. We need these statutory changes, and more institutional changes, to follow as soon as possible.

I look forward to this hearing, following up on last year's, and look forward to what more we can do to increase hurricane preparedness, as well as response issues.

Thanks to all the witnesses.

Senator DEMINT. Thank you, Senator Vitter.

And, Senator Lott, if you would give us your opening statement, and then introduce your witness, General Spraggins.

**STATEMENT OF HON. TRENT LOTT,  
U.S. SENATOR FROM MISSISSIPPI**

Senator LOTT. Well, thank you very much, Mr. Chairman.

And I won't be long, because I want to hear what this very important panel has to say.

I want to say, with regard to, Senator Nelson, I'll be interested in looking at your package of bills that you think maybe helpful, and will be very interested in your thoughts. You are from our neighboring state and have a little experience with hurricanes and disasters.

And I would say that there really is no debate about whether we got hit by wind or water. The answer is yes, both. The problem is, we're having trouble getting the insurance industry to acknowledge the wind side of it.

But sustained winds of 140, with gusts of 160 to 170, probably wouldn't do any damage to my house on the Gulf before the storm wave came. So, don't get me started on that.

Thank you, Mr. Chairman, for having this hearing. And I want to thank the panel. I'll be interested in hearing what they have to say.

Mr. Mayfield, we appreciate the work you do. You don't look as good in person as you do on TV—

[Laughter.]

Senator LOTT—no, seriously, we appreciate what you do. And, Senator Vitter is right. You warned us, and you saved millions of lives. And we had a tremendous evacuation, and still had tremendous devastation and 1,500 lives lost. Just think what it could have been if we had not known the seriousness of it.

I've been very proud, frankly, of my own state's local, county, and State officials. Our Governor of Mississippi called me on Saturday before the hurricane hit on Monday and said, "I'm having trouble

with a particular mayor putting out the emergency declaration urging people to leave.” He didn’t want to do it. He had just been on the job 5 months as mayor, and he was hesitant to say, “Evacuate.”

I’m sure the Governor was talking to the Hurricane Center and then called me, because he knew this guy is a friend of mine, and I called and said, “You’ve got to get people out of there.” General Spraggins knows exactly where I’m talking about.

I’m really honored to be able to introduce the first panelist here, Brigadier General Benjamin Spraggins. We’ve had a relationship for many years, and are good friends. I have a nickname for him, “Jesse James,” which I must say, General, I shouldn’t explain to this panel why I call you that. But he has been a real leader in our State. He’s commanded the Air National Guard unit on the Gulf Coast. He’s been in top leadership positions in our National Guard in Mississippi, statewide. He headed the unit temporarily at Meridian, Mississippi, I believe. And then, the day of the hurricane, was the first day on the job, his new job as the Harrison County, Mississippi, Director of Emergency Management and Homeland Security.

But he has done an outstanding job with our National Guard, and now in his new role there in Harrison County, which is where Biloxi and Gulfport are located. Probably several of you have been there to see the devastation. He and that county have done a wonderful job, and I’m very proud of them.

You mentioned what a great job, Senator Vitter, the Coast Guard did, but let me tell you what, our National Guard in Mississippi did a wonderful job, too. I mean, General Spraggins’ old airbase headquarters is where we all assembled in the immediate aftermath of the hurricane. Our Mississippi Army National Guard was pre-positioned about 70 miles north of the coast, at Camp Shelby. As soon as the winds died down, they started moving, I think, about 6:30 or 7:00, and I think they got there at 3:00 or 4:00 in the morning. They had to literally cut their way through, and it took them, I guess, 8—6 or 8 hours to get 70 miles, to show you how difficult it was. But they were on the spot the next morning.

So, General Spraggins, thank you for what you have done. Thank you to the National Guard. Our military served us well, Senator Vitter. The Coast Guard did a marvelous job. The National Guard did a great job. And it wasn’t just Mississippi. When I met with general Spraggins and others—and General Cross, our adjutant General in Mississippi—on Wednesday morning, in Gulf Port, Mississippi, the Guard units were already there from Alabama and, I believe, Tennessee and lots of others on the way. And it’s one of the success stories for which we haven’t given enough credit.

Having said that, Mr. Chairman, I know we’ve got a lot to learn from these people. We need to think, more than we have, and be prepared legislatively and administratively to do more to prevent disasters, predict disasters, and to deal with them after they occur.

So, thank you very much, Mr. Chairman.

Senator DEMINT. Thank you, Senator.

Before I introduce the last two witnesses, Chairman Stevens has joined us.

Mr. Chairman, would you like to make an opening statement?

**STATEMENT OF HON. TED STEVENS,  
U.S. SENATOR FROM ALASKA**

The CHAIRMAN. I'd be pleased if you'd put my statement in the record, Mr. Chairman. I'm sorry to be late, and I'm delighted to be here to hear these witnesses give us these predictions.

Thank you very much.

[The prepared statement of Senator Stevens follows:]

PREPARED STATEMENT OF HON. TED STEVENS, U.S. SENATOR FROM ALASKA

Thanks, Senator DeMint, for holding this hearing; I was one of 24 Senators to visit the Katrina-affected region of the Gulf, and I know full well the devastation a major hurricane can cause. That is why Senator Inouye and I created this subcommittee, so we can look at what we can do to better predict natural disasters, and understand how we can mitigate the damages of property and lives lost.

This is the Atlantic hurricane forecast that NOAA sent out on Monday to the American people. I have had my staff search for two days to find the Alaskan Storm forecast, but none exists. I hope it is that we don't have enough weather data or satellite coverage in Alaska to plug into computer models that predict these weather trends, and NOT that Alaskan storms are not a priority to NOAA. We get storms just as bad as the Atlantic does, you know.

Now, the Federal Government failed in its response to Katrina, but I think we can all agree that NOAA did a great job of predicting the path of the hurricane. Fifty-eight hours before landfall, Mr. Mayfield and the National Weather Service predicted the path of Katrina within 12 miles.

I thank you all for your testimony.

Senator DEMINT. Thank you, sir.

I'd like to introduce General Stan Spears, who leads our Guard in South Carolina. Stan, I'm not sure if it's true or not, but we say, in South Carolina, you are the highest ranking elected military officer in the country.

He is an elected general to head the National Guard there, and he's done a great job. He leads and directs the 10,500-member South Carolina Army and Air National Guard. Among his many decorations are the Distinguished Service Medal and the Order of the Palmetto, which is South Carolina's highest civilian non-military honor.

The National Guard plays a crucial role in the preparation for, and response after, a storm. And I know General Spears is going to have some useful, important insights this afternoon. And I look forward to his comments.

And I'd also like to introduce Mr. Max Mayfield, who needs no introduction on this committee. He's Director of NOAA's National Hurricane Center. Mr. Mayfield is the face of the Weather Service when a hurricane is threatening to make landfall in any neighborhood in this country. He's also the guy responsible for a lot of the lives being saved before Katrina last year.

While the work of his crew down in Miami may not be as flashy as plucking people off of rooftops in helicopters, the fact that they got the prediction right, and Mr. Mayfield personally picked up the phone and called two Governors, a mayor, and a State emergency manager, saved countless lives.

Mr. Mayfield, I'd like to start with you. You can talk about the season, what we expect, and I think you'll also talk about some potential serious-damage areas that could occur in some parts of the country we might not suspect. And then we'll talk to the folks who help us clean up after your storm.

**STATEMENT OF MAX MAYFIELD, DIRECTOR, TROPICAL PREDICTION CENTER/NATIONAL HURRICANE CENTER, NATIONAL WEATHER SERVICE, NOAA, DEPARTMENT OF COMMERCE**

Mr. MAYFIELD. Thank you, and good afternoon, Mr. Chairman and members of the Committee.

I am Max Mayfield, Director of the Tropical Prediction Center and National Hurricane Center. The National Hurricane Center is part of the National Weather Service of the National Oceanic and Atmospheric Administration in the Department of Commerce.

I thank you for inviting me here today, during Hurricane Preparedness Week to discuss the outlook for the 2006 hurricane season, and to talk about some of our Nation's cities and communities which are particularly vulnerable to the effects of a hurricane.

Last year's hurricane season set records for the numbers of hurricanes and tropical storms. However, whether we're predicting an above-average hurricane season, like we are this year, or a below-normal season, such as in 1992, the crucial message is the same: prepare, prepare, prepare. It only takes one powerful hurricane, like Andrew or Katrina, to expose our vulnerabilities.

First, let me express my sincere gratitude to the members of this committee. Your continued support of NOAA and our hurricane programs enables us to make the best forecast possible, and to help protect lives and livelihoods.

There is very high interest among the media, the public, and the research community in this upcoming hurricane season. People want to know how many hurricanes there will be and the chances of one hitting their area. This attention generates needed awareness about the potential effects of the hurricanes, and it helps ensure people take the right actions at the right time.

The official hurricane season begins June 1 and runs through November 30. The average peak of activity occurs with the warmest water temperatures, from the middle of August to near the end of October.

NOAA's official prediction for the 2006 hurricane season is for 13 to 16 tropical storms, with 8 to 10 of those storms becoming hurricanes. Of those, we predict 4 to 6 of them will be major hurricanes, what we call a Category 3 or higher, packing winds over 110 miles per hour. These Category 3 storms are the ones likely to cause the most extensive damage. In this hurricane season, we're predicting an 80 percent likelihood of an above-average number of storms in the Atlantic Basin, and that's the highest probability that we have ever predicted in our May outlook. This high degree of confidence comes from many favorable conditions, including the warmer sea surface temperatures in the Atlantic Basin, combined with low wind shear, lower surface pressures, and an African easterly jet stream. Many believe these favorable conditions, which came together around 1995, are part of a multi-decadal climate pattern, which last peaked in the 1950s and 1960s and could last for another 10 to 20 years.

While I acknowledge the ongoing scientific debate about the impacts of climate changes on hurricanes, I am focused on this upcoming hurricane season and the importance of being prepared.

While hurricanes can affect the entire coast from Texas to Maine, I want to highlight a few communities and coastal regions particularly vulnerable to a hurricane; because they have a large population, are difficult to evacuate, or a combination of both. These Areas include New York City, Long Island, Houston/Galveston, Tampa Bay, the Florida Keys, Miami, and, believe it not, New England. And, let's not forget, just because the Central Gulf Coast States were hit last year does not mean it will not happen again. New Orleans remains especially vulnerable to future hurricanes.

I want to call your attention to New York City. In the last 20 years, two hurricanes have passed east of the city—Gloria, in 1985, and Bob, in 1991. We need to ask, what if those storms were stronger, and hit the New Jersey coast? NOAA's Sea, Lake, Over Land Surge from Hurricanes, or a SLOSH, model shows a Category 3 hurricane producing a storm surge of over 25 feet in some sections of the New York City area. The black line that you see on the animation beside us here depicts the hypothetical track of that hurricane. And, like New Orleans, it is not a question of "if," but "when" this scenario will occur. I know that's up there for a very short period of time, but basically everything in green there represents storm surge of over 25—of over 20 feet, with maximums over 25 feet.

A large fast-moving Category 5 storm would inundate the Houston/Galveston area, with a storm surge of over 30 feet. And a large Category 5 storm, not unlike Katrina, will flood areas surrounding Tampa Bay with over 20 feet. Everything you see in green has over 20 feet of storm surge. Strong waves on top of the storm surge would cause catastrophic flooding in the areas shown here.

While these are just a few of the more vulnerable areas, I must emphasize that any city or community along the coast can be devastated by a hurricane. And a hurricane is not just a coastal event. The strong winds, heavy rains, flooding, and tornados from weakening tropical storms can spread well inland. The damage created can hinder preparation and evacuation efforts, and lead to increased loss of property and life.

Hurricane Hugo, that you're seeing up here now, which hit South Carolina in 1989, made landfill just north of Charleston. The storm surge was up to 20 feet just north of the city in that Cape Romain area, where not many people live. The effects of Hugo reached far inland, with flooding rains, and storm, and strong winds knocking down trees and disrupting power supplies for over a month in some areas.

While NOAA has made great strides in improving the accuracy of our hurricane track forecast, much more work needs to be done, especially on intensity forecasts. And we've been very honest about that. NOAA has asked outside experts to review our research and our programs to improve our ability to forecast intensity.

We also continue to test new products and models to improve our overall hurricane forecast. We intend to introduce a new hurricane modeling system, called the Hurricane Weather Research and Forecasting Model, being developed by the National Centers for Environmental Prediction. We appreciate Congress's support for this effort, and its overall support for the satellites, the aircraft, the buoys, and the people who make these crucial forecasts possible.

As you look at this last graphic, I think you'll understand our Nation's vulnerability to hurricanes. Those red lines show the tracks of all the tropical storms and hurricanes, going back to 1851. And we made the lines as thin as we could, and you still can't even see the coastline.

While NOAA will continue to do its best to provide as much possible warning, it is my hope that each family, each business, and each community on or near the coast will develop, and be able to execute, a hurricane preparedness plan. We must all be ready to protect our lives and property from the power of hurricanes.

Thank you for your time today.

[The prepared statement of Mr. Mayfield follows:]

PREPARED STATEMENT OF MAX MAYFIELD, DIRECTOR, TROPICAL PREDICTION CENTER/  
NATIONAL HURRICANE CENTER, NATIONAL WEATHER SERVICE, NOAA,  
DEPARTMENT OF COMMERCE

Mr. Chairman and Members of the Committee, I am Max Mayfield, Director of the Tropical Prediction Center/National Hurricane Center. The National Hurricane Center is a part of the National Weather Service (NWS), of the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce. Thank you for inviting me here today, during National Hurricane Preparedness Week, to discuss the outlook for the 2006 hurricane season, and to talk about our country's cities most vulnerable to hurricanes.

First, let me express my sincere gratitude to the members of this committee. Your continued support of NOAA and our hurricane program enables us to make the best forecasts possible, helping ensure the people of our Nation understand the potential impacts from hurricanes, and what they can do to protect their life and property. The FY 2006 Hurricane Supplemental Funding approved by Congress is being used as directed, including funding forecast model improvements, and storm surge and inland hurricane forecasting improvements. Thank you, again, for your support.

Everywhere I go, I am asked about the forecast for the upcoming hurricane season. People want to know how many hurricanes there will be and if one will hit their area. The media also gives these seasonal forecasts high visibility, and this can have a very positive effect, because it raises awareness about the threat from hurricanes, and encourages people to prepare for what might happen.

The official hurricane season is from June 1 through November 30, with the average peak of hurricane activity occurring with the warmest water temperatures, from mid-August to late October. NOAA's prediction for the 2006 Atlantic hurricane season is for 13-16 tropical storms, with 8-10 becoming hurricanes, of which 4-6 could become major hurricanes. A major hurricane is a storm Category 3 or higher on the Saffir-Simpson hurricane scale, with winds greater than 110 miles per hour. Major hurricanes cause about 80 percent of the damage sustained from tropical cyclones. We are predicting an 80 percent likelihood of an above average number of storms in the Atlantic Basin. Our forecast for this season is based primarily on the continuing multi-decadal signal in the global tropics. This year, the signal indicates favorable atmospheric (location and strength of upper and lower atmospheric wind and pressure patterns with their associated vertical and horizontal wind shears) an oceanic (warm sea surface temperatures) conditions for hurricane formation.

Last year was a record setting hurricane season with 28 storms and 15 hurricanes, of which 7 were major hurricanes. We know all too vividly the destruction and devastation hurricanes can cause. That is why it is important not to focus only on the total number of storms. It takes only one hurricane landfall to make for a bad year. A relatively quiet season does not mean there will be no problems. Let's recall 1992. That year was below average in the number of storms, but catastrophic for southern Florida because of Hurricane Andrew. No one can tell us reliably months in advance when or where the hurricanes are going to strike. The state of the science is simply not advanced enough at this time to do that. The bottom line is that all coastal states from Texas to Maine, Hawaii, and other U.S. interests in the Pacific and the Caribbean are vulnerable.

#### **Vulnerable Communities**

While all coastal communities can suffer the catastrophic impacts from hurricanes, there are a few areas particularly susceptible to the effects from a land-falling hurricane. These areas are uniquely vulnerable due to their large population,

and/or the length of time it would take to evacuate people out of harm's way. Houston/Galveston, Tampa Bay, southwest Florida, Florida Keys, southeast Florida, New York City/Long Island, and believe it or not, New England, are all especially vulnerable. And let's not forget, just because a hurricane struck the central Gulf Coast states last year, does not mean it will not happen again—New Orleans remains vulnerable to future hurricanes.

We work year-round with Federal, state, and local emergency managers; we educate them about weather impacts from hurricanes, and they educate us about response issues and their challenges. It is a constant learning process, and the key is working together to ensure the public takes appropriate action. Most preparedness activities and outreach takes place outside hurricane season. Just three weeks ago, I finished a Hurricane Awareness Tour along the Gulf Coast states to help raise awareness about the potential impact from hurricanes. The NWS forecast offices arrange the tour events with the Federal Emergency Management Agency, local governments, emergency managers, schools, the public, and the media in a team effort to increase hurricane awareness and encourage preparedness in this vulnerable area of the Nation. During land-falling storms, it is essential for the emergency management community and the weather community to have one message for the public, so people can take appropriate action. Nowhere is this more critical than in areas most vulnerable to the impact from hurricanes.

Let me elaborate further on vulnerabilities and first look at the New York City area. In the past two decades, two hurricanes passed near New York City—Hurricane Gloria on September 27, 1985, and Hurricane Bob on August 19, 1991. Each hurricane was moving north-northeastward. Gloria moved inland across Long Island and struck at low tide, so the storm tide (a combination of storm surge and astronomical tide) was not as high as it could have been. In contrast, Bob skirted Long Island and impacted Rhode Island and Massachusetts. Bob struck at high tide resulting in more damage. The New England Hurricane of 1938 also made landfall on Long Island on a northward track and was moving at about 60 miles per hour as it made landfall as a Category 3 storm. This speed caused an unusually rapid deterioration of conditions and allowed less time for preparation than normal. Storm surges of 10 to 12 feet inundated portions of the coast from Long Island and Connecticut eastward to southeastern Massachusetts, with the most notable surges in Narragansett Bay and Buzzards Bay.

What if those storms were stronger and headed northwest and hit the central New Jersey coast? NOAA's storm surge model, SLOSH (Sea, Lake, Overland Surge from Hurricanes), indicates a Category 3 hurricane could produce a storm surge raising water levels over 25 feet (slide 1) above mean sea level in some locations in the New York City area. The slide shows the surge from a hurricane moving along the black line making landfall in New Jersey. It is not a question of *if* a major hurricane will strike the New York area, but *when*. Fortunately, this is not news to New York emergency managers. They have been working with NOAA to plan for this type of disaster for two decades. They know it will happen, maybe this year, maybe next, maybe one hundred years from now—but it will happen and they are planning for it.

Let me talk briefly about a few other areas. A large, fast moving Category 5 storm can inundate the Houston/Galveston area with a storm surge over 30 feet (slide 2), while a large (size of Katrina) northeast moving Category 5 storm would flood some sections of the Tampa Bay area with over 20 feet of water (slide 3). Strong winds with the storm will produce large waves on top of the storm surge, and potentially catastrophic flooding in these areas. The Florida Keys is another area particularly vulnerable to hurricanes. The Keys sit only a few feet above sea level, and there is only one way in and out of the region. This escape route floods well before the hurricane strikes, and it takes about 48–72 hours to evacuate the region. Although emergency managers in the Keys recognize the potential impacts, it is still difficult to get people to take appropriate actions. Almost all of the Keys could be covered by water from an approximate 12 foot surge accompanying a Category 5 hurricane moving west to east across southern Florida (slide 4).

The next slide shows potential storm surges for other particularly vulnerable areas—southwest Florida near Fort Myers can have a surge over 20 feet (slide 5); a 15 foot surge could impact southeast Florida (slide 6); and New England could see about 20 feet of water along the coast (slide 7). And let's not forget what can happen in New Orleans with a Category 5 storm, flooding the city with a 20 foot surge (slide 8) meaning that some areas well below sea level could be under 30 feet of water.

While I specifically mentioned a few areas that are particularly vulnerable, let me emphasize that anywhere along the coast can be devastated by a hurricane. Just remember Hurricane Hugo, which hit South Carolina in 1989, making landfall just north of Charleston. The storm surge was large, up to 20 feet just north of Charles-



ton (slide 9). The impacts of Hurricane Hugo reached well inland, with many portions of South Carolina and North Carolina devastated by heavy rain and strong winds, knocking down trees and disrupting power supplies for over a month in some areas.

We have observed that steering patterns for major hurricane landfalls can *sometimes* persist over several years. For example, during the 1940s many major hurricanes hit Florida (slide 10). During the 1950s, many major hurricanes hit the U.S. East Coast (slide 11). During the 1960s, many storms hit the central and western Gulf Coast (slide 12). This pattern might lead one to assume that—given the recent major hurricanes like Charley, Ivan, Jeanne, Dennis, Katrina, Rita, and Wilma in 2004 and 2005 (slide 13)—Florida and the Gulf Coast are likely targets again this season. However, in each of these decades there were exceptions. For example, in the 1940s, while most storms hit Florida, two made landfall in the Gulf and one made landfall in New England. In addition, in the 1930s (slide 14) major land-falling hurricanes were relatively well distributed along the U.S. coastline—hitting the U.S. coast from Texas to New England. Consequently, while it is possible to observe these trends and make generalizations based upon these observations—it is important to understand that in any given year, a hurricane can impact any part of the U.S. coastline from Texas to Maine. The coastal communities along the Gulf and East Coasts (in addition to Hawaii and other interests in the Pacific and Caribbean) remain at risk for hurricanes, and the public must be prepared to respond if a situation arises.

It only takes one hurricane over a given community to make for a bad year. In 1983, there was only one land-falling hurricane in the United States, but it was Category 3 Hurricane Alicia that hit the Galveston/Houston area (slide 15). And in 1992, we only had one hurricane make landfall in the United States, but that was Category 5 Hurricane Andrew that hit southern Miami-Dade County, Florida (slide 16).

The message from NOAA is very consistent. We want every individual, every family, every business and every community on or near the coast to have a hurricane preparedness plan and have it in place before the hurricane season gets here. But I also want to go beyond the seasonal forecast for this coming year and focus on something I think is even more important. The research community is telling us we are in an active period for major hurricanes that could last another 10 to 20 years or more. Again, the message is clear. We all need to be prepared.

#### **NOAA Efforts to Improve Hurricane Predictions**

NOAA is focused on improving hurricane track, intensity, storm surge, and rainfall predictions. The accuracy of NOAA's hurricane forecasts is closely tied to improvements in computer-based numerical weather prediction models. This year NOAA implemented advances in its hurricane forecasting model that are expected to yield improved track and intensity guidance for our forecasters. This hurricane forecasting model was developed by the Geophysical Fluid Dynamics Laboratory in NOAA's Office of Oceanic and Atmospheric Research (OAR), and incorporated into operations at NWS's National Center for Environmental Prediction (NCEP). NOAA's central computer system will be upgraded in FY 2007 to increase computational speed, memory, and storage capabilities. This allows more sophisticated numerical models to run and make use of available data, including data from NOAA's polar orbiting and geostationary satellites. Significant improvements in intensity, precipitation, and wind distribution, forecasting are expected from the next-generation operational modeling system.

Predicting hurricane intensity remains one of our most difficult forecast challenges. We are all aware of the improvements made in predicting hurricane track forecasts and this has been where NOAA and the research community have, in the past, placed their emphasis. Within the past few years, the emphasis on improving intensity prediction has increased. Leading the way, in FY 2007 NOAA plans to introduce a new hurricane modeling system, called the Hurricane Weather Research and Forecasting model (HWRF), which is being developed by NCEP's Environmental Modeling Center. Congress supported this effort in the FY 2006 Hurricane Supplemental Funding, and HWRF implementation and development is included in the FY 2007 President's budget request. The HWRF will be a coupled atmosphere-ocean prediction system that will take advantage of the latest atmosphere and ocean observations, the most advanced methods to analyze those data and state-of-the-art physics to produce our Nation's next-generation hurricane forecast system. Once the HWRF becomes operational, our goal is to improve hurricane intensity predictions by about 30 percent by 2015.

NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) also conducts research to better understand internal storm dynamics, and interactions be-

tween a hurricane and the surrounding atmosphere and ocean. AOML's scientists provide data and information to operational NOAA forecasters and models. Through a greater understanding of physical processes and advanced hurricane modeling, NOAA continually improves models for predicting hurricane intensity and track, in collaboration with Federal partners, academic researchers, and commercial enterprises.

To help guide future research efforts, NOAA's Science Advisory Board commissioned a Hurricane Intensity Research Working Group to provide recommendations to the Agency on the direction of hurricane intensity research. The Working Group expects to transmit its final report to the Science Advisory Board in July 2006. The National Science Board of the National Science Foundation has also convened a working group of external advisors to review hurricane science and engineering. The final report from this group is scheduled to be submitted to the National Science Board in August 2006. Recommendations from these reports will be carefully considered by NOAA as we plan our efforts to improve our operations and predictions.

#### **Aircraft Reconnaissance Data**

NOAA aircraft, the W-P3 Orions and the Gulf Stream IV, provide essential observations critical to the National Hurricane Center forecasters, and supplement the U.S. Air Force Reserve Command's 53rd Weather Reconnaissance Squadron flights. A specialized instrument flown on both of the W-P3s, the Stepped Frequency Microwave Radiometer (SFMR), was developed by NOAA researchers at AOML; and provides essential data on hurricane structure, surface wind and rain rate to hurricane forecasters. The SFMR allows forecasters and researchers to see fluctuations in hurricane intensity not observed before. The Military Construction Appropriations and Emergency Hurricane Supplemental Appropriations Act, 2005 (P.L. 108-324) provided \$10.5M to the Air Force to outfit the complete fleet of Hurricane Hunters with this instrument. We hope the first of these additional units will be available toward the end of the 2006 hurricane season.

#### **Conclusion**

The truth is, right now no one knows exactly what areas of the coast, or which states or locations within those states, if any, will be impacted by hurricanes in 2006. Could it be Florida, again? Maybe. How about New England or New York City? That's possible. But right now we just don't know.

We also need to remember a hurricane is not just a coastal event. The strong winds, heavy rains, and tornados from weakening tropical systems can spread well inland and cause tremendous damage. Having said that, Katrina is a grim reminder that the greatest potential for large loss of life is from the storm surge near the coast.

Now, please look at the last graphic (slide 17), which shows the tracks of tropical storms and hurricanes since 1851. I think most people can look at this graphic and understand that the United States is vulnerable to hurricanes. The bottom line is that all coastal states from Texas to Maine, Hawaii, and other U.S. interests in the Pacific and the Caribbean are at risk. Everyone along the coast, including inland communities that can be impacted by heavy rain and tornados associated with hurricanes, must be prepared to protect their lives and property in the event of a hurricane.

Senator DEMINT. Thank you, Mr. Mayfield.  
General Spraggins.

#### **STATEMENT OF BRIGADIER GENERAL BENJAMIN J. SPRAGGINS, DIRECTOR, HARRISON COUNTY EMERGENCY MANAGEMENT AGENCY**

General SPRAGGINS. Thank you very much. It's an honor to be here today, Mr. Chairman.

No, it's not coming—there it goes. Okay. Sorry, sir.

Mr. Chairman, distinguished members of the panel, it's an honor to be here today. I'm Brigadier General Joe Spraggins, the Harrison County Emergency Management Director.

I think you know what happened in Harrison County on August 29, 2005, and we don't have to reiterate that. Obviously, it changed our lives and changed what we're going to do, and what we will do in the future.

We had a tremendous storm that hit us, but our recovery was because of a lot of great leadership. We had a great governor in Governor Haley Barbour, and Mr. Robert Latham, as the head of the Emergency Management, that stepped forward to help us do this, along with our National Guard that helped us in every way that we could—they ever thought of. They—we also had some strong leadership in the counties. We had five great supervisors in Harrison County, and then five great mayors that also stepped up to the plate; in being able to make the decisions to do what we needed to do.

One of the things that made our evacuation plan in Hurricane Katrina so successful was because we had a unified command. We had a unified command with the mayors, and the supervisors, saying what we would do and how we would do it, and we would do it in unison, together. That's the first time I think this has ever happened in the history of the Harrison County area, but it worked out perfectly. Each one of us sat there together, made the decision to do what we needed to, to make sure that we saved as many lives as possible.

Obviously, Mr. Max Mayfield and the Weather Service's advisories helped us make a lot of those decisions. We were on a regular conference call with them to try to get an update. Every time that they had anything possible to give to us, they gave it to us. We were able to use that, and use that for our evacuation.

However, as much as we planned, as much as we trained, we weren't prepared for what was going to happen. So, we had to make some adjustments at the last minute. One of the things that I've talked to Mr. Mayfield about before, and it's a big issue of what happened, is, once Hurricane Katrina went from a Category 5 to a Category 3, a lot of people thought that they were safe. They thought they were safe, because they lived through Hurricane Camille in 1969. Their homes had been there for over 100 years. They never dreamed of a 25- to 30-foot tidal surge. So, they basically—once it downgraded, and—which is nothing other than the wind velocity of what caused it to downgrade—the tidal surge didn't. So, some way, somehow, if there's any way—and I know Mr. Mayfield's been looking at this many ways, and Mr. Gray—Dr. Gray and them—of ways of being able to do something, a way to be able to implement the surge in with the wind to give a category of a storm, because it's—it has a—an effect on a lot of people.

Our evacuation—basically a timetable of what we did is, we started meeting on the 24th of August, once we found out that there was a big storm in the—out in the Caribbean area. We started looking. We said, "Hey, what are we going to do?" We started talking about how to make sure that we were going to have a plan, in case it did happen. We met with the executive committees we call our mayors, supervisors, our sheriffs and our elected officials. We started—then on the 26th of August, we decided—at that time, Max and I had talked, and I had some—and talked with the Slidell Weather Service, which is a great organization, to give us information, and we decided it was time, then, that we needed to start an evacuation. So, we did. We started to initiate an evacuation to initiate our—especially our assisted living, the ones who needed help there, and voluntarily.

On the 27th of August, we made a mandatory evacuation of zone A's and low-lying areas. As we were very confident that Hurricane Katrina was coming somewhere in the Mississippi coast area.

Senator LOTT. Now, was that Friday or Saturday?

General SPRAGGINS. Saturday, sir.

Senator LOTT. Saturday before the hurricane, on Monday.

General SPRAGGINS. Yes, sir. It made its turn on, like, Friday night, I think, is—that they—when we made the decision and when it was actually turning that-a-way, even though Mr. Mayfield and them had been projecting pretty much in the same area the whole time.

Then, on the 28th of August, we made a mandatory evacuation of zone A, B, and all low-lying areas, and strongly recommended the county, but, however, did not evacuate zone C and the county entirely. And the reason for that is, we would have put people in harm's way by taking people out of hospitals that were safe enough to be able to handle the storm and put them in harm's way by putting them in the ambulance to move them if they were in ICU conditions already. And I thank God we lost zero patients. Not one person died because of our maneuver there. And we will probably stick with that plan for the future.

We're working now to try to find a way to correct every problem we had. And if you want to know problems, we had plenty of them. We had things that stepped up to us—that stepped up and said, "Hey, what is going to happen next?"

And, first off, right off the bat, we had problems with communications. We didn't have a clue of what to do, because we went back to the 1930s in communication. We had only a few operational pieces of equipment that would work around the storm time and after the storm, shortly after that, and that was mainly radio systems, that was like our 9-1-1 system, that worked, and some of this other link that came up shortly after that. But most of your cellular systems were out, and most of all of your—basically the 228 area code was basically gone for south Mississippi. So, we had to correct that.

So, what we're doing is, we're correcting that, as far as the—as what we're going to do. We will correct it, and we have worked with cellular companies to be able to make sure that happens.

We're also working with our shelters. We had inadequate shelters, because we didn't have any way to put—to place people where we needed to with the proper stuff, and we will correct that. And we also had a couple of other things, transportation being a big issue. We didn't have transportation for a single soul to leave south Mississippi that didn't have transportation. That transportation is in effect at this point, so we will be able to do it.

I know that it was a big issue, and I know that there are a lot of things that went on, but I can tell you right now that south Mississippi is as prepared as it's ever been, and we will be a lot more prepared in the future, but we're ready for—if Mr. Mayfield's hurricane predictions come true, and they do have a storm in south Mississippi, we are prepared, and we will be ready for it.

Thank you very much for your time.

[The prepared statement of General Spraggins follows:]

PREPARED STATEMENT OF BRIGADIER GENERAL BENJAMIN J. SPRAGGINS, DIRECTOR,  
HARRISON COUNTY EMERGENCY MANAGEMENT AGENCY

Mr. Chairman and members of this distinguished committee:

I greatly appreciate the opportunity to accompany this distinguished panel here today to testify before you regarding Harrison County preparedness and response to Hurricane Katrina, and the readiness for hurricane season 2006. The north-eastern sector of the eye of Hurricane Katrina made landfall on the Mississippi Gulf Coast in Harrison County approximately 11:00 a.m. on the morning of August 29, 2005. Hurricane Katrina arrived in Harrison County at Category 3 strength, with maximum sustained winds over 130 mph. A storm surge estimated at 25 to 35 feet impacted most of the Mississippi Gulf Coast. Hurricane Katrina caused catastrophic damage throughout Harrison County, as well as surrounding counties and bordering states. Harrison County sustained significant damage to its infrastructure, critical facilities, residential, and business communities. County residents incurred a considerable loss of life and numerous injuries.

Our state and county efforts to prepare for Hurricane Katrina, and our tremendous successes to recover are a result of great leadership from Governor Barbour, Mr. Latham, Mississippi Emergency Management Agency (MEMA), and the Mississippi National Guard. Their efforts to be proactive, pre- and post-storm has been a major factor to our success in Mississippi. The professionalism, leadership, and teamwork of Supervisors: Bobby Eleuterius, Larry Benefield, Marlin Ladner, William Martin, Connie Rockco and Mayors: AJ Holloway, Brent Warr, Rusty Quave, Billie Skellie, Billy McDonald, along with Sheriff George Payne and the Harrison County Incident Management Team, were and continue to be instrumental to the extreme success Harrison County has accomplished before, during, and after Hurricane Katrina.

*Planning for Catastrophic Natural Events.* Being prepared for any natural disaster or catastrophic event includes extensive planning, training, and numerous exercises. Even though Harrison County had exceptionally trained and qualified personnel (except myself, as my first day on the job as Director of Emergency Management for Harrison County was August 29, 2005, a day I will always remember) and had participated in numerous exercises, we were not prepared for a catastrophic event of the magnitude of Hurricane Katrina. Even though we had experienced Hurricanes Camille, Frederick, Elena, and Georges over the past 36 years, the plans and shortfalls we had identified were not adequate to handle the massive destruction of this storm. Because of lessons learned from Hurricane Katrina I would like to expand on the following points:

*Evacuation.* The determination to evacuate a specific area or the entire county can greatly impact the time and safety of effected citizens. The most affected areas are the low lying areas and Evacuation Zone A. As a rule of thumb, this area is evacuated for any hurricane, tropical storm, and possibly heavy rains. Evacuation Zones B and C are evacuated when the storm is expected to reach flood levels equal to or above this zone. Because of two tropical storms and Hurricane Dennis, the Mississippi Coast had already issued recommendations or mandatory evacuations of these areas three times prior to Katrina. The evacuation of the coast is a great expense to most families, and the decision to evacuate could affect their quality of life due to expense. The average cost to evacuate a family of four for three days to include lodging, food, and transportation could easily exceed \$1000. Due to the damage of the East and West Bay bridges on Highway 90, the time to evacuate from Harrison County during the 2006 season will be greatly degraded, causing more time and expense.

The time table of events from 25 August, 2005 until Katrina landfall 29 August, 2005 were as follows:

**2005 Evacuation Plan for Harrison County Mississippi Timeline**

24 August 2005—Meet with the Emergency Operations Personnel from Gulfport, Long Beach, D'Iberville, Pass Christian, Biloxi, and Harrison County. Initiated plan to evacuate Special Needs, Assisted Living and Hospitals.

25 August 2005—Made the decision to start evacuation of these personnel by 26 August 2005 if the storm was still projected in the Gulf of Mexico with special interest if the storm moved further to the West.

26 August 2005—Initiated the evacuation for the special facilities and prepared for an Executive Meeting with the Mayors and County Supervisors. Used AMR to move Ambulatory Patients.

27 August 2005—Mandatory evacuation of Zone A and Low Lying Areas, issued warning to Hotels and Casinos to ensure their facilities were totally evacuated by 12:00 noon on 28 August 2005.

28 August 2005—Mandatory evacuation of Zone A and B and all Low-Lying Areas and strongly recommended the evacuation of the entire Harrison County. Did not order mandatory evacuation of Zone C and the entire county due to having to move ICU patients and putting them under extreme danger (no patient was lost due to this decision) and we feel strongly we would have lost patients from the ICU if we had transported them under a mandatory evacuation.

29 August 2005—Hurricane Katrina made landfall at 11:00 a.m. central standard time.

We are working with local, county and state emergency managers, law enforcement, and first responders, to ensure we give everyone in Harrison County, Mississippi, the education and opportunity to ensure the safety of their families. With the increased number of citizens living in temporary conditions, we must be proactive in education and plans for evacuation. Harrison County has approximately 13,000 FEMA trailers with around 32,000 people living in these facilities. This brings a new situation to the county as to when to start the evacuation of these facilities due to numbers and safety. Under normal conditions we would not have to evacuate 30,000 to 50,000 people from Harrison County in a tropical storm condition. However, with the extreme danger of winds in excess of 50 knots either destroying or severely damaging these temporary facilities we must encourage everyone to evacuate from the trailers from tropical storm to CAT 5 hurricanes. We also, have between 10,000 and 15,000 volunteer workers and approximately 20,000 other workers in the county each day, and most are living in tent cities or some form of temporary facility. We will need additional time to get these people to safety.

The ability to get the citizens, volunteer workers and other workers helping to rebuild South Mississippi to leave the area during a threat of a Tropical Storm/Hurricane will most likely be very easy. Most of the people in Harrison County are prepared to leave the area however; some may not have transportation or financial means.

Harrison County will evacuate as a county, including the cities of Biloxi, D'Iberville, Gulfport, Long Beach, and Pass Christian. The determination to evacuate will be made by the supervisors and mayors through the Emergency Management Director. This decision will come after extensive research of all available information. We will have briefings with Slidell Weather, National Weather Service, National Hurricane Center, State Emergency Management, and the Governor's Office, to ensure we have all available information. Slidell Weather will be our primary weather facility, and we will get a briefing after each national advisory update on the storm. The decision to evacuate an area will be determined by the wind force and tidal surge expected to hit Harrison County. As we have learned from Katrina we must evaluate storms by both wind velocity and tidal surge. Hurricane Katrina was only a CAT 3 Hurricane for wind; however; she was a CAT 5 for tidal surge. The diameter of the eye and total storm will determine the area and reasons for evacuating. The following is an example of when we would evacuate each area:

Tropical Storm to CAT 1 Hurricane—Evacuate Zone A and all low lying areas. Strongly encourage the evacuation of all FEMA trailers, tent cities, and anyone living in temporary housing. This would include homes that have not been completely rebuilt.

CAT 2 to CAT 4 Hurricane—Evacuate all volunteers and outside workers at 72 hours before landfall and mandatory evacuation of Zone A and Low-Lying Areas at 48 hours before landfall and Zone B and parts of Zone C at 36 hours before landfall. A complete evacuation of the county will not be ordered due to putting citizens in more danger by evacuating hospitals and assisted living homes. All hotels and casinos on the beach and Back Bay will be mandatory by 24 hours before landfall.

CAT 5 Hurricane—Mandatory evacuation of entire county.

We would also, work both the wind and tidal surge for CAT 2–4 to determine the areas to be evacuated.

Hurricane Katrina taught us many lessons, and we need to ensure we correct all of the faults we encountered before, during, and after Katrina. The following are areas we had problems and what we are planning to ensure correction:

1. *Evacuation:* The process of evacuation during Katrina was extremely good and we feel everyone that wanted to evacuate had the opportunity. However, some people would not evacuate due to health, pets, and believing they lived through Camille and nothing could be worse than Camille.

*Correction:* We are preparing a Special Needs Shelter for citizens with requirements for medical attention everyday. The area for Harrison County will be

Perkinston Community College and be funded and manned by the State Department of Public Health. We will also have a Special Needs Shelter in Harrison County at the Biloxi High School for people with special needs, but, no medical care required daily. We will also have transportation to take citizens to shelters out of harms way in north Mississippi. We have the first Pet Friendly Shelter in Harrison County, located at Harrison Central High School. This shelter will allow citizens to take their pets to a shelter and stay with the pets, we learned many citizens did not evacuate due to not willing to leave their pets behind. This caused several deaths of both citizens and pets. Pets sometime become more than just a pet; they become part of the family. We are giving our citizens, volunteers, and workers data and education on what could happen and the importance of evacuation.

*2. Shelters:* We did not have adequate facilities for our citizens in the shelters due to lack of backup power sources, sanitary facilities, communications, and food/water. No Special Needs Shelter with proper staffing and equipment—No Pet Friendly Shelters.

*Correction:* We have worked through the Red Cross to staff as many shelters as possible with trained personnel and proper food/water. We have requested the funds to buy backup generators for each facility used for shelters. Coca-Cola and Pepsi have committed to donate water for some of these facilities. MEMA will have food/water in warehouses to be brought to Harrison County within hours of landfall. As mentioned before we have a Special Needs Shelter and Pet Friendly Shelter.

*3. Transportation:* We did not have public transportation to take our citizens outside of Harrison County for evacuation. This caused numerous citizens to either try to ride the storm out at home or go to a shelter of last resort.

*Correction:* We have transportation for all citizens, volunteers, and other workers to take them to a safe shelter out of harms way, this is being provided by the State Department of Education. Also, Coast Transit Authority will bring anyone requiring transportation to an area to transport north or a shelter of last resort.

*4. Fuel:* Fuel was nonexistent after Hurricane Katrina. We did not have proper backup supplies, generators, and procedures to ensure we could get fuel to critical facilities and emergency equipment.

*Correction:* We have requested back-up generators for all of the county fuel pumping stations. If money is not available to purchase these we will rent them for this season. MEMA is working a contract with fuel companies to supply fuel to Harrison County within hours of storm landfall. The fuel will continue until we can get our own resources operational. Harrison County has a fuel distribution schedule for each critical facility and to ensure emergency equipment is refueled without a break in operations.

*5. Communication:* The loss of cellular power and cables being downed or severed during Hurricane Katrina, caused the Gulf Coast area extreme problems after the storm. Cellular towers were operational only a few hours after the storm. The loss of cellular service was excessive use and failure of emergency backup power (battery or generator). The cable connecting the Mississippi Gulf Coast to Mobile was severed by debris from the bridge and caused almost complete loss of the 228 area code. The 911 emergency radios were operational the entire time and Southern Link radio service was re-established within two days of the storm. However, the 911 radio system was not compatible for state and other agencies that responded to the disaster.

*Correction:* Bell South has repaired the cables and added measures to ensure this does not happen again. Cellular services in the area have installed generators to some towers, and have a scheduled method to refuel the backup systems. They have also, arranged for Cellular on Wheels (COW) to be in place within hours after landfall. The state has developed a Wireless Communication Commission, and is working on development of a statewide emergency system that is compatible to local system, ensuring all agencies can talk to each other during a disaster.

*6. Sanitary Facilities:* After Katrina the pumping stations for our sanitary systems were inoperable due to loss of power. We did not have sufficient backup generator systems to continue the operation. The county did not have a contract or any agreement to provide backup facilities or generators.

Because of this we had citizens in critical facilities and shelters without sanitary facilities for almost one week, causing severe health conditions.

*Correction:* We have back-up generators on most of our treatment plants and pumping stations. A contract is being established with MEMA to ensure we have back-up sanitary facilities brought into the county within hours of landfall.

As you can see we had numerous areas that needed improving before hurricane season 2006. Most of these areas have been addressed and corrected. Some of the areas still require resources to correct and funding requests have been filed with the County, State, and Federal authorities.

Major shortfalls are funding to purchase generators, equip shelters, re-inforce buildings to be used as shelters, communication equipment, and construction of new Emergency Operations Center. All of these items are currently being staffed as to how we acquire the funding. The cost of evacuation will become a factor in the future if the 2006 season is as active as predicted. With fuel and hotel pricing rising everyday the ability for a family to evacuate several times in a season will be a financial hardship.

Mr. Chairman and members of this distinguished committee; it has been an honor to address you today on the lessons learned from Hurricane Katrina and how we plan to correct the shortfalls in Harrison County. We are better prepared today than ever before however; we still have needs and will require assistance to complete our projects. Our motto in Harrison County is: "Hurricane Katrina Was a Force of Nature and What We Do After Is an Act Of God." Harrison County is in a state of disaster and will take years to rebuild. However, America should know our spirits are not broken and "We Will Rebuild Together and Be Better Than Ever."

Thank you for your time and consideration.

Senator DEMINT. That's good news, General, thank you.  
General Spears.

**STATEMENT OF MAJOR GENERAL STANHOPE S. SPEARS,  
ADJUTANT GENERAL OF SOUTH CAROLINA**

General SPEARS. Good afternoon. Mr. Chairman, distinguished members of this subcommittee, thank you for the opportunity to address you this afternoon on the matter—this matter of extreme importance.

Though my remarks will have a South Carolina slant to them, I think you will find they are relevant to all other States.

National Guard across the country has been busy—has been extremely busy preparing for this year's hurricane season. States directly impacted by hurricanes understand their responsibility to help their neighbors in need. Moreover, we all understand that the preparations we make for hurricanes also affects how we will deal with other emergency situations, whether man-made, natural, or the act of terrorism.

Although the National Guard in the States directly impacted by Katrina, with considerable support from other States, responded decisively and effectively, the scale of that disaster highlighted significant shortcomings in the Nation's emergency response, including the use of the National Guard and the active military.

One of the key lessons learned involves command-and-control issues. Military support to civil authorities is just that. States and local authorities are in charge. The military is there to support, and not to take charge. The challenge is to ensure unity of effort among Federal, State, and local agencies, along with non-governmental and private volunteer organizations, such as the Red Cross and the Salvation Army. Unity of effort requires the ability to communicate in a timely, effective manner, horizontally and vertically, and develop a common operating picture among all agencies.

In my opinion, the National Guard can be a key enabler to ensuring that unity of effort. We can bring communications equipment to multiple incident sites that enable first responders to com-



municate with each other and the military over disparate radio systems. For example, 800 megahertz UHF, VHF, HAM radios—this equipment allows all the systems to intercommunicate. The National Guard Bureau has purchased a limited number of systems that provide this unique capability. The latest version is called the Joint Incident Site Communications Capability, and was first fielded by the South Carolina National Guard in 2005. We will be demonstrating, in Charleston, South Carolina, next month, this system, and I hope that all of you can attend.

In addition to communications support, the Guard can bring very significant capabilities to support civil authorities. These include security forces, engineers, transportation, logistical support, rural search and rescue.

Is the National Guard ready? I can only speak for the South Carolina National Guard, and the answer to this question is yes. Certainly, overseas deployments have stressed our force, but even when we peaked, with over 4,000 South Carolina Army National Guard soldiers mobilized in 2004, we had sufficient strength and equipment available in South Carolina to meet all of our State's emergency contingency plans.

Are our soldiers and airmen ready? You bet. One of the major reasons young people join the National Guard is to be there in times of emergencies that affect their neighbors, friends, and families.

While we have not had any war-stoppers when it comes to equipment for natural disasters in South Carolina, the question that we can't answer is, how much is enough? How many electrical generators will we be asked to supply? How many helicopters will be needed for search and rescue? How many off-road trucks will be required to deliver potable water, food, clothing, medical supplies, and other commodities to hard-to-reach areas? Moreover, many other South Carolina—I'm sorry—many other National Guard States have critical shortages of authorized equipment.

Those questions, unfortunately, cannot be answered prior to the impact of the event. The bottom line is, the Guard is prepared.

I, again, thank you for this opportunity, and look forward to addressing your questions.

[The prepared statement of General Spears follows:]

PREPARED STATEMENT OF MAJOR GENERAL STANHOPE S. SPEARS,  
ADJUTANT GENERAL OF SOUTH CAROLINA

Good afternoon.

Mr. Chairman, distinguished members of this subcommittee, thank you for the opportunity to address you this afternoon on this matter of extreme importance.

Though my remarks will have a South Carolina slant to them, I think you'll find they are relevant to all of the states. The National Guard across the country has been extremely busy preparing for this year's hurricane season. States directly impacted by hurricanes understand their responsibility to help their neighbors in need. Moreover, we all understand that the preparations we make for hurricanes also affects how we would deal with other emergency situations—whether man-made, natural, or the act of terrorism.

Although the National Guard in the states directly impacted by Katrina, with considerable support from other states, responded decisively and effectively, the scale of that disaster highlighted significant shortcomings in the Nation's emergency response including the use of the National Guard and the active military.

One of the key lessons learned involves command-and-control issues. Military support to civil authorities is just that—state and local authorities are in charge. The

military is there to support, not take charge. The challenge is to ensure unity of effort among federal, state, and local agencies along with non-governmental and private voluntary organizations, such as the Red Cross and Salvation Army.

Unity of effort requires the ability to communicate in a timely, effective manner, horizontally and vertically, and develop a common operating picture among all agencies. In my opinion, the National Guard can be a key enabler to ensuring that unity of effort. We can bring communications equipment to multiple incident sites that enables first responders to communicate with each other and the military over disparate radio systems, for example, 800 megahertz, UHF, VHF, HAM radios. This equipment allows all systems to intercommunicate. National Guard Bureau has purchased a limited number of systems that provide this unique capability. The latest version is called the Joint Incident Site Communications Capability, and was first fielded by the South Carolina National Guard in 2005. We will be demonstrating this system in Charleston next month, and I invite you to attend.

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I, again, thank you for this opportunity, and look forward to addressing your questions.

Senator DEMINT. General Spears, we talked earlier. I had an initial concern that, with talk of moving National Guard troops from different States to the borders as part of securing our borders, that we might be undermanned in times of a hurricane. Is that a concern of yours?

General SPEARS. Yes, sir, it is. And if we will be left alone during the months of November—I'm sorry—during the months of April through November in order to protect our State in the event something happens, we can handle that. But if we have to provide troops to other parts of the country, it will hurt us. But, if they would just leave us alone during those times, it would be very helpful.

Senator DEMINT. Just another quick question, and I want to give my colleagues a chance to ask questions. What are the real keys to success? And, General Spraggins, you could answer here, too. I've heard some comments from guardsmen that governors are inconsistent when they order the Guard to be prepared or get involved with evacuations, and that we need to get geared up sooner. And that's—hasn't been just in the Katrina states, that has been in other places, too. I think it may be something, General Spears, you mentioned. And there's also the concern about cost of gearing-up for a possible storm. Does that create an obstacle to deploying guardsmen to be ready for a—potential hurricanes?

General Spears, I'll let you start.

General SPEARS. Sir, I think the more time we get notice that we are going to get hit with something is essential. And I would like to see that the governors be given the authority to give their National Guard—and to all the other people who are going to respond—at least 72 hours notice. I have heard, and I know in my own state, that our Governor is concerned about expense. And I just wish that the Federal Government could step forward and say, “governors, we’re going to give you enough money to take care of that 72-hour notice in order to properly—to protect our people in our State.”

Senator DEMINT. General Spraggins, is money a factor, as far as gearing up the Guard to get ready?

General SPRAGGINS. Yes, sir, it is. Matter of fact, I had the conversation, just a couple of days ago, with Major General Cross, the Adjutant General of Mississippi, and one of the things was, how quick can we mobilize? And—now, he feels very confident—General Cross feels very confident that he can get his people there within 24 hours prior to the storm, to have the people on ground to help us out to do what we need, and the people after that.

The question we were asking him was for some things to help us in advance. And he—and his idea is, “I can’t be there 72 hours prior to the storm,” or, “I can’t be there 48 hours, maybe, because of the fact of cost.” And that was an issue, because—so, I agree with General Spears, if there’s a way to give the governors authority to be able to help them with the backing of the Federal Government to give the funds, I think it is a big issue, sir.

Senator DEMINT. So, the way it stands now, if a governor orders National Guard into place 3 or 4 days before a potential storm, the State is stuck with the bill—

General SPRAGGINS. Right.

Senator DEMINT.—is that right?

General SPRAGGINS. Yes, sir.

General SPEARS. That’s correct.

Senator DEMINT. OK.

General SPRAGGINS. And then—sir, and then like to that, most of the time we don’t know, but maybe 3 days. That’s about the max that we have. But that’s—I think, is one of the major reasons.

Senator DEMINT. One thing I got out of this is, we need to make sure the Administration coordinates with the coastal states not to have the Guard serving in any other area during hurricane season.

Senator Nelson.

Senator BILL NELSON. Thank you, Mr. Chairman.

Senator Stevens.

The CHAIRMAN. Yes, sir?

Senator BILL NELSON. Before you got here, I wanted to thank you, and I complimented you, because you were instrumental at the end of the last hurricane season, of us getting six additional positions in the National Hurricane Center for Max Mayfield. And he can tell you, in his own words, what that has meant to him, as he’s getting prepared. And I want you to know, personally, how much I appreciate your direct intervention as we were trying to give him the stuff that he needed. And I want Mr.—

The CHAIRMAN. Would you yield just there?

Senator BILL NELSON. Certainly.

The CHAIRMAN. I'm pleased to hear that. I want to arrange for them to come up and fish in Alaska so they can see what happens up there, too. OK?

Senator BILL NELSON. You have——

The CHAIRMAN. We have typhoons up our way.

Thank you.

Senator BILL NELSON. You have typhoons?

The CHAIRMAN. He can tell you about them.

Mr. MAYFIELD. I would love to be the first one to volunteer to go fishing in Alaska, Senator.

[Laughter.]

Senator BILL NELSON. Well, Mr. Mayfield, if you'll just take the opportunity here to share with the Committee the potential single-point failure on a G-4 jet and what that means to you being able to track? And also, would you share with the Committee the need for a computer modeling group in NOAA to help you in the accuracy of your predictions?

Mr. MAYFIELD. I'll be glad to, Senator.

There are many parts of the puzzle here, and it's not just about the observations. The observations are important, and we can demonstrate—in fact, NOAA's Hurricane Research Division has made these impact studies with and without that jet data. And with the jet data, the one jet that we have, we have shown a 15- to 20-percent improvement, on average, in the watch/warning period. And, believe me, we have a couple of poster-children here in Katrina, in Rita, with and without that data. The forecasts without the data would not have been nearly as good as they were with that data.

So, that is one concern, as Senator Nelson said, but it's not all just about the observations. We have this new—as I mentioned in my testimony, a new hurricane model being developed that will become operational in 2007. And, in my opinion, we can move this along faster if NOAA had a dedicated hurricane modeling group. We have a modeling group called the Environmental Modeling Center right now. And they have really stepped-up to the plate and done some good things for us. But it would move along faster if we actually had a group dedicated to the hurricane modeling.

Senator BILL NELSON. And I would just add to that, what he does at the National Hurricane Center to get the ultimate track that they decide is, they take that series of models—it's six or seven models, isn't it?

Mr. MAYFIELD. Actually, about a dozen, total.

Senator BILL NELSON.—and they average it together, and then he puts his own Kentucky windage behind it as to what he sees in the data. What—Mr. Mayfield is suggesting that if they could go on and get this modeling group in NOAA set, it would be another place that they could coordinate all of that data with their own models and improve the accuracy of the predictions. And I think it speaks for itself. It's clearly in the interest of the country.

Thank you, Mr. Chairman.

Senator DEMINT. Thank you, Senator.

Chairman Stevens.

The CHAIRMAN. No questions.

Senator DEMINT. No questions?

Senator Vitter.

Senator VITTER. Thank you, Mr. Chairman.

Mr. Mayfield, as you know, when a hurricane's coming, everybody in a coastal area immediately focuses on, and talks about, Categories 1 through 5. And that's what every conversation is about, and how everybody tracks the development of a storm. And I'm concerned that that sometimes does us as much disservice as service, because it muddies up a lot of very important specifics that can vary within a category.

What are your thoughts on that? And if that shorthand does have real pitfalls, how do we fine-tune it?

Mr. MAYFIELD. This is a very legitimate issue. And, first of all, the Saffir-Simpson hurricane—the National Weather Service doesn't have ownership of that. It was developed originally by Herb Saffir, a consulting engineer in Coral Gables, Florida. It was also never meant to be a stand-alone, you know, index. You know, if you look back at our advisories, we really do—we talk about the size, and we try—every advisory there, you know, within the last 2 or 2-and-a-half days of landfall in Louisiana, we tried to emphasize the size of Katrina as well as the intensity. And I—Joe and I have talked about the storm surge, but if you actually look at our storm surge forecast in those advisories, they were excellent, the numbers that were in there.

But I think the point is, is there one index that will account for the rainfall and the storm surge, and the wind, and the tornados? And I'm certainly open to ideas on how to do that. A few people have proposed a few things that, quite frankly, don't do much for me right now, but I'm very willing to consider anything that the academic community or anybody else comes up with.

I've seen one that—it accounts for the size and the winds to some extent. But Hurricane Charlie didn't even make the scale. I mean, Charlie was a Category 4 hurricane, but it was so small that it didn't even register on this index.

So, we've got to be a little careful. And I am very hesitant to just go with another scale for, let's say, storm surge. If we have too many scales out there, it's going to be very confusing.

So, Saffir-Simpson has served us well, but it's not stand-alone, and I think that we do need to do a better job of emphasizing all the, you know, hazards associated with a hurricane. And we really do try to do this. I think the next step is really getting the media to help focus on things other than just the Saffir-Simpson scale.

Senator VITTER. Well, let me say that your advisories are great, because they go into that detail about different factors. The problem is, nobody, relatively speaking, reads the whole advisory, and it's not encapsulated in a very quick number. And maybe the solution isn't one scale, but a very limited number of scales focused on different factors. Wind speed, storm surge, size—might be three. But associate numbers with it, so that people can grasp it quickly. It's a storm surge X, it's a wind speed X, it's a size Y.

Mr. MAYFIELD. And I'm very willing to consider that. We'll—you know, before introducing anything like that, we would get some input from our customers. And I'm just a little hesitant about multiple scales causing some confusion, but I can assure you we'll do everything we possibly can to make sure that people understand it's not just about the maximum sustained wind, it's about the size,

the surge, the rainfall, the tornados, the whole nine yards. And we really do teach this—I can assure you that we teach this to the local and State emergency managers. When they come to one of the FEMA-sponsored workshops at the Hurricane Center, we go out of our way to emphasize that.

Senator VITTER. Well, I appreciate all that work. And I know it is in the advisories. But I'd encourage you to think more about how that can be very quickly communicated to the public. And specifically, of course, storm surge is a huge issue. Is it fair to say—I may be wrong, but is it fair to say that the surge you get is more associated with the hurricane, maybe a day out, than it is with the wind speed right at landfall?

Mr. MAYFIELD. Well, the surge—sorry—our surge simulations were actually very good. And I don't have that at my fingertips here. I'll be glad to provide that.

[Information.]

Mr. MAYFIELD. But the—our storm surge model actually did a very good job. A lot of the wave action that did a tremendous amount of the damage on the immediate coastline was, indeed, carried over from when it was a Category 5 hurricane just the afternoon before—

Senator VITTER. Right.

Mr. MAYFIELD.—And evening before landfall.

Senator VITTER. I guess what I'm suggesting as—is the following. Often hurricanes go down in wind speed near landfall. Often that makes people breathe a big sigh of relief, but, in fact, if you have, "Category 5-like storm surge" a day out, it's not necessarily going to go down—probably won't go down—by the time it hits.

Mr. MAYFIELD. That's especially true of the wave action that comes in along with the storm surge. We've—we know we need to do a better job on that. In the case of Katrina, you know, we were actually higher, operationally, with the wind speeds than we finally ended up with on post-analysis. We bumped it down a little bit, on post-analysis there. But I'd rather see that happen than the opposite, which Senator DeMint talked about—

Senator VITTER. Sure.

Mr. MAYFIELD [continuing]. Earlier.

Senator VITTER. Sure.

A final question. There has been some suggestion—and I don't know if it was out of your forecast or elsewhere—that the early part of this season for parts of the Gulf Coast might be particularly active, as opposed to the traditional season, where, as you say, activity would be expected to peak in the middle to later part of the season. Did I hear things right? Is there any validity to that?

Mr. MAYFIELD. Well, that didn't come from us, but the peak of the season is definitely in the middle of August to the middle or the end of October. And, typically, early- and late-season storms do form in the Gulf of Mexico or the western Caribbean, so that's not—that would not be unusual if we did have something in the Gulf or Caribbean early.

Senator VITTER. But there's nothing about this season, with regard to those factors, that's different, in your opinion, from a typical season, as it looks now.

Mr. MAYFIELD. No, sir, other than the fact that the Gulf of Mexico water temperatures are extremely warm, and that's like high-octane fuel for a hurricane, so we really have to watch that carefully. Rita—Hurricane Rita went from a tropical storm to a Category 5 hurricane in 36 hours. Wilma went from a category—from a tropical storm to a Category 5 in 24 hours. Luckily, both of those cases occurred over the open waters of either the—well, the Gulf or the Caribbean.

One of these days, that's going to happen right up at the time of landfall, and that's what's really going to get us. And we really have been—we've tried to be very honest with people in saying that we do—we know we help with intensity forecasting. NOAA has a plan. We're headed the right direction there. But it's a very, very difficult problem to solve, and it's going to take us some time.

Senator VITTER. Thank you.

Senator DEMINT. Senator Lott.

Senator LOTT. Thank you very much, again, Senator DeMint, for having this hearing.

Mr. Mayfield, thank you, again. I remember watching you. I mean, you warned us. You said, "This is going to be a very bad one." And you had me convinced, and most of us along the Gulf Coast.

Let me pick up just two or three things on the area you were just talking about, this storm surge issue. This was an abnormally high storm surge associated with Hurricane Katrina, wasn't it?

Mr. MAYFIELD. Absolutely.

Senator LOTT. In my hometown—I mean, at my house, as best we can determine by the mark on trees, the storm surge reached 21–22 feet. Over in Hancock County, I think it was 32 to 35 feet. And as—you know, you can't build a house, or a business, or anything high enough to withstand that kind of surge if you get a direct hit. Is that accurate?

Mr. MAYFIELD. Well—

Senator LOTT. I mean, I'm talking about the size of it, up to 35 feet.

Mr. MAYFIELD. That's higher than what I've seen measured. I've seen values up approaching 30 feet—

Senator LOTT. Thirty feet.

Mr. MAYFIELD.—but wave action on top of that.

Senator LOTT. Yes.

Mr. MAYFIELD. So, I—

Senator LOTT. Yes.

Mr. MAYFIELD.—It's—

Senator LOTT. If the big one didn't get you, the following wave action probably would, as it sucked back out in some areas.

You know, we have hurricane hunters that will go in there, and they take a look at these hurricanes, from Keesler Air Force Base, Biloxi, Mississippi, and they do a wonderful job flying into the center of these things, the eyes, and get us a lot of information. I guess it goes to you, and it's very helpful to you. Now, when are we going to figure out how to reduce a hurricane's strength—I mean, this hearing is disaster prevention and prediction. Can't we seed those things? Can we just bomb them, you know, blow them apart before they come ashore? How about that idea?

Mr. MAYFIELD. I get asked that question every now and then, Senator—

Senator LOTT. Well, I've been hearing about seeding hurricanes all my life.

Mr. MAYFIELD.—well—

Senator LOTT. Can we do that?

Mr. MAYFIELD.—NOAA used to have a program where we did go out, with the NOAA P-3s, and seed hurricanes. And the idea was to fly—you know, and seed the eyewall of the hurricane outside the eyewall to—you know, like the ice skater, if your arms are in tight, you spin fast; you extend your arms, you slow down—the idea was to expand that eyewall. But—

Senator LOTT. It didn't work?

Mr. MAYFIELD.—it did not work. And it—well, we've had examples. Hurricane Allen, 1980, is a good example. It went from a Category 5 to a Category 3, 5, 3, 5, 3, three different times without any seeding. And if nature can do that on its own, it's almost impossible to tell what puny man can do.

Senator LOTT. Well, we need you to give a little more thought to prevention. We've got to find a way to—

Mr. MAYFIELD. I have a stack of letters I'd be glad to—

Senator LOTT.—deter these things.

Mr. MAYFIELD.—share with you on that.

Senator LOTT. General Spraggins, again, thank you very much for being here. You talked about how our vehicles were destroyed, and communications were just extremely difficult. Unless you had a satellite phone, you basically couldn't communicate once you got on the coast. And you had a limited number of those. So, we know, from 9/11 and the Twin Towers, that we had problems with interoperability and didn't have modern communications. You said, "We are dealing with, decades-old equipment" in our National Guard and along the Gulf Coast, so we know this is a problem. And if we get hit again, and we can't communicate again, somebody's going to get hammered. I know that Senator Stevens has pushed for more funds for interoperability. What are we doing? How are we doing? Are you better prepared to communicate next time?

General SPRAGGINS. Yes, sir, we are better prepared. And one of the things that we—our E-911 system, which is like an 800-megahertz system, did stay up the whole time during the storm, but the problem with that was, if you came in with an 800 megahertz or a high-band or low-band, we could probably work you into that to be able to operate. The other thing we had was zero communication with the rest of the State, and that interoperability was not there, to be able to communicate with Jackson, Mississippi, to be able to communicate with anybody else and the first responders that we needed.

Senator LOTT. You didn't call me.

General SPRAGGINS. Sir? No—

Senator LOTT. You didn't call me.

General SPRAGGINS. We couldn't get to you. And—but we couldn't get through with any of those. But the thing that we have done—

Senator LOTT. Are we going to be able to—

General SPRAGGINS. Yes, sir—

Senator LOTT.—the next time?



General SPRAGGINS. Mr. George Phillips, a Public Safety Director for the State of Mississippi, has put together a wireless communications committee headed up by Mr. Bill Buffington, and they're working an issue, at this point, and they—to be able to handle that for the whole State, and they are working through our counties to make sure that we can go interoperable with them to be able to do that. And I know that's part of the bill that is up here at the Senate at this time, and—so, any help in that would be greatly appreciated.

Senator LOTT. General Spears, have you been addressing this potential problem in your State of South Carolina?

General SPEARS. Yes, sir, we have. And we are having an exercise, just next week, testing one of the new communications equipment that we have.

Senator LOTT. Right.

Thank you very much, Mr. Chairman.

Senator DEMINT. Thank you, Senator.

Just another quick question. General Spears, if a hurricane hits Mississippi, what kind of systems are set up for our Guard to provide reinforcements, or vice versa? How do the different Guards in the different states work together on backup and that kind of thing?

General SPEARS. Sir, we have agreements among the States to assist each one of us, and we have a—we have the 228 Signal Brigade headquarters located in South Carolina that is the premier signal brigade in the entire country, and we've already been talking to the—our other States—in the Southeast, in particular—and that unit is available to them in the event there is an emergency.

Senator DEMINT. Well, if you show up in Mississippi, are the—are you able to use the same communication systems that work with General Spraggins' people? Do we have interoperability of communication system when we bring Guards together from around the country?

General SPEARS. Yes, we do. And that's one reason we are testing that system.

Senator LOTT. To the credit of the National Guard—I don't know how they do it, but they have prearranged who will come in, and in what order, and who, I guess, would be the Commander. In fact, I think the Commander on the ground was an Alabamian there in Gulfport that day, wasn't he, General Spraggins? But, aside from that, whoever it was, they have a prearrangement with Guards all over the country. And I remember one day I came across some Black Hawk helicopters down there at Gulfport, and they were from New York National Guard. So, the National Guard was there, literally, from all over the country. And so, again, to their credit, they were ready.

General SPEARS. Yes, sir.

Senator DEMINT. One quick question, Mr. Mayfield. New York—the idea of Manhattan being under 20 or 30 feet of water is pretty disturbing, particularly when you consider all the underground facilities, from subways to floors on buildings. And I don't get the sense that the New Yorkers even think that's a possibility. So, I feel like, well, maybe that states like South Carolina and Mississippi are—feel a sense or urgency and are moving. I'm concerned

about a major market like New York. What do you—what's your sense of their preparation?

Mr. MAYFIELD. The entire Northeast is a big, big concern, and it's something that most people don't understand. One of the highest storm surges possible anywhere in our country is up there in New York, where Long Island juts out at nearly a right angle from the New Jersey coast. And if you had a hurricane up on the right track into New Jersey, you would have over 25 feet of storm surge, up to 30 feet in some areas, around New York City. The airports would be flooded, and the subways. Some people may think about taking shelter in the subway—they'll be flooded. This has the potential for tremendous—not just damages, but loss of life.

I was just at a luncheon meeting before we came over here, and there was an emergency manager from New York City assuring us that they've been talking to our local forecast office up there. In fact, I talked to the meteorologist in charge, Mike Wiley, up there, and they've been working hand-in-hand for a long time.

So, I know the decisionmakers understand this, but I'm not sure that this is on the top of everybody's list, in the public there, as something to worry about. Hurricanes are, you know, very rare events up in the Northeast, and that is, indeed, a big concern.

Senator DEMINT. Well, thank all three of you. It's been a great hearing, very helpful. I certainly want to look into the potential support from the Federal level of how we could encourage governors to get prepared and engage the Guard in a more advanced fashion.

And, Mr. Mayfield, thank you, again, for your work, and please give our thanks to your folks.

And let's get ready.

This meeting is adjourned.

[Whereupon, at 3:40 p.m., the hearing was adjourned.]

## A P P E N D I X

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO  
MAX MAYFIELD

### Background

In your written testimony, you commented that we appear to be entering into a period of heightened hurricane activity in the Atlantic. However, you did not indicate a similar trend for the Pacific, though last year's storm season in Hawaii was very violent. Recently, the National Oceanic and Atmospheric Administration (NOAA) documented warming of ocean waters in the tropics, where storms form. This leaves open the question of how certain the National Weather Service (NWS) is about what will happen this year, or this decade, in the Pacific.

*Question 1.* I understand the 2006 Central Pacific Basin forecast is for a less than average hurricane year, but how certain are you of this forecast?

Answer. NOAA has issued seasonal central Pacific hurricane outlooks since 2003. Given the short record of these outlooks and limited availability of long-term historical data, we do not yet include uncertainty levels (probabilities) in these outlooks.

Hurricane activity in the central Pacific is strongly affected by El Niño and La Niña. Activity is typically greater during an El Niño episode, and less during La Niña and neutral years. This year, tropical Pacific Ocean temperatures are expected to remain close to average, thus neither El Niño nor La Niña is expected to develop during the hurricane season. The forecast is for "less-than-average" hurricane activity in the central Pacific region this season. We have a 60–70 percent confidence level in this outlook.

Two important issues:

(1) The seasonal central Pacific hurricane outlooks are based on the best possible science available. However, any given year can deviate from the most likely probabilistic outlook due to some environmental forcing mechanism we do not yet fully understand.

(2) Even in a correctly predicted "less-than-average" year, a devastating hurricane could impact the Hawaiian Islands or elsewhere. The odds are simply a bit lower this year.

*Question 2.* We have had some very, unexpected severe weather in Hawaii this year, including torrential rains, floods, tornados, and cyclones. I do not recall the Congress or the public being apprised of this risk ahead of time. Why is that?

Answer. Though the first half of the 2005–2006 winter was dry in Hawaii, a change in the large scale weather patterns developed around the globe. For Hawaii, this pattern included an area of lower pressure just to the west of the Hawaiian Islands. This area of low pressure resulted in conditions favorable for heavy rain and severe weather to occur (but no tropical cyclones) across the islands from mid February to early April.

The Weather Forecast Office in Honolulu first discussed the possibility of this heavy rain period on February 14, 2006, in their Area Forecast Discussion. This was 5 days before the first event occurred. From February 19 through April 2, the National Weather Service Forecast Office in Honolulu issued over 500 advisories, watches, and warnings providing accurate and timely information to people in Hawaii about imminent or ongoing severe weather.

Despite the large amounts of rain, the Hawaiian wet season (November–April) of 2005–2006 was only the 11th wettest out of the 30 years, because November and December 2005, were drier than normal.

*Question 3.* I see you have identified the at-risk cities in the Atlantic and Gulf regions, but have you performed a similar analysis for the Pacific, particularly the low-lying islands, which are vulnerable to all kinds of severe storm activity?

Answer. A number of studies have been conducted or are underway on tropical cyclone risk analyses for Hawaii and other Pacific Islands. Some examples include:

- The Hurricane Relief Fund, which found all of the Hawaiian Islands are at equal risk of experiencing a hurricane, and provided an estimation of return periods for different wind speeds across Hawaii.
- The University of Hawaii, Manoa Campus, conducted a study funded by Hawaii State Civil Defense and NOAA's Coastal Zone Management program, which determined the frequency of hurricanes expected within 250 miles of Honolulu.
- The Pacific Islands Regional Integrated Science and Assessment program supports the emergence of an integrated risk management program for U.S.-affiliated countries and territories in the entire Pacific region. This program emphasizes reducing Pacific Island vulnerability to extreme events such as floods and tropical cyclones.
- The Pacific Risk Management 'Ohana is a family of risk management partners and stakeholders in the Pacific, and strives to improve the development and delivery of risk management-related information products and services in the Pacific.

*Question 4.* Where are the most vulnerable areas, and how are they kept prepared and informed?

Answer. All of the Pacific Islands are vulnerable to tropical cyclones. By looking at the historical record, the islands in the western Pacific experience more impacts than the Hawaiian Islands in the central Pacific. The hazards brought by Pacific hurricanes and typhoons are similar to what the Gulf and Atlantic coast experience; damaging winds and heavy rains carry a large threat. However, the islands experience a relatively small storm surge due to local bathymetry, but can experience massive waves. For example, in 2004, Cyclone Heta in the south Pacific produced waves of 80 to 100 feet.

There are many ways NOAA and our partners in State and local government, media, and other organizations prepare the public. The National Weather Service routinely provides training sessions and outreach material to all levels of government, schools, volunteer agencies, and the general public. Additionally, in May, the National Weather Service office in Honolulu, in conjunction with the State of Hawaii, conducts Hurricane Preparedness Week to increase awareness among the public.

With the National Weather Service's 5-day tropical cyclone forecasts, people are informed early of any potential hurricanes and are urged to closely monitor developing conditions. When a storm approaches, public, private, and government personnel are kept informed by a constant flow of information and warnings by the Central Pacific Hurricane Center (CPHC). State and County Civil Defense officials and media assist CPHC in getting the word out.

*Question 5.* I am concerned that your Pacific forecast will make people complacent about the risk of hurricanes and need for evacuation planning. What are you doing to get the word out in Hawaii and remote areas of the Pacific?

Answer. Representatives of the Central Pacific Hurricane Center (CPHC) have made preparedness presentations on Oahu and all of the neighboring islands, to a wide variety of people involved in many industries (marine, hotel security, shelters, civil defense, tourism, transportation, police, and fire). Additional presentations have been given at many State, local, public, and private events at various venues, including the Building Industry Association show. CPHC along with its partners, including the Federal Emergency Management Agency, the American Red Cross, and the State and County Civil Defense, use every opportunity to emphasize the need for preparedness regardless of the number of tropical cyclones. In the northwest Pacific, the Warning Coordination Meteorologist from the Weather Forecast Office in Guam visits each U.S. affiliated country/territory every year and gives typhoon preparedness presentations. In American Samoa, Weather Service Office Pago staff provide similar presentations.

*Question 6.* National Oceanic and Atmospheric Administration (NOAA) scientists recently reported a warming trend in tropical ocean waters, where tropical cyclones and hurricanes begin to take shape. Is it not possible that warming ocean waters in the Pacific, over the next ten years, will contribute to a heightened period of storm activity in the Pacific, more than you have initially forecast?

Answer. So far, the observed warming trend in ocean temperatures in the central Pacific is relatively small compared with the year-to-year variability in those temperatures related to El Niño and La Niña events. Scientists cannot say with certainty whether oceanic warming in the future will, or will not, lead to extended periods of enhanced hurricane activity for the central Pacific.

For the past two decades, scientists have observed that the same large scale atmospheric conditions enhancing Atlantic hurricane activity have also acted to suppress eastern and central Pacific hurricane activity. Because over 60 percent of hurricanes impacting the central Pacific area originate in the eastern Pacific region, we can say with reasonable certainty that as long as the Atlantic hurricane activity continues to be enhanced, we expect the eastern and central Pacific hurricane activity to be less active. However, there can be exceptions in any given year.

*Question 7.* How does coverage of the Pacific compare with the Atlantic in terms of NOAA resources?

Answer. NOAA provides the same level of hurricane forecasts and warnings for Pacific storms as for Atlantic storms. All the NOAA hurricane models used to forecast Atlantic basin storms are used to forecast Pacific storms. NOAA utilizes GOES-West and available Japan Meteorological Agency and Department of Defense (DOD) satellite imagery to support its Pacific basin forecasts and warnings. Operationally, the National Hurricane Center in Miami, Florida, is responsible for issuing all Pacific Storm advisories, forecasts, and warnings for all eastern Pacific storms (east of 140 degrees longitude). The NOAA/NWS central Pacific Hurricane Center, located with the Weather Forecast Office in Honolulu, Hawaii, is responsible for issuing all Pacific storm advisories, forecasts and warnings for all Central Pacific storms (west of 140 to the International Date Line (IDL)). The DOD-Joint Typhoon Warning Center, located in Honolulu, Hawaii, is responsible for all Pacific Storm advisories, forecasts and warnings for all (western Pacific) storms west of the IDL.

*Question 8.* How many Hurricane Hunters are based in the western Pacific?

Answer. There are no "Hurricane Hunters" based in the west Pacific. The U.S. Air Force has conducted a number of surveillance studies using small, unmanned aircraft to collect data around typhoons. The Department of Defense's Joint Typhoon Warning Center has the U.S. typhoon forecasting responsibility for the western Pacific. NOAA is examining use of Unmanned Aircraft Systems as a viable platform for observations in remote areas.

*Question 9.* Is the staff of the CPHC comparable to the staff of the National Hurricane Center?

Answer. The Central Pacific Hurricane Center in Honolulu and the National Hurricane Center, which is a part of the Tropical Prediction Center in Miami, have different missions, and, therefore, different staffing levels.

The Tropical Prediction Center specializes in tropical weather prediction, with a strong focus on hurricane forecasting and preparedness. The National Hurricane Center has a dedicated staff of hurricane specialists who prepare hurricane forecasts and advisories. In addition, the Tropical Prediction Center has other staff members who monitor tropical weather conditions throughout the year, and issue meteorological forecasts for international marine interests in the Atlantic and the eastern Pacific, and others who develop related products, software, and communications.

The Central Pacific Hurricane Center is collocated within the Weather Forecast Office (WFO) in Honolulu. The Central Pacific Hurricane Center's tropical cyclone responsibilities are integrated within the WFO's full range of duties for issuing local forecasts for Hawaii, along with regional responsibilities for domestic and international aviation, and marine interests for a large area of the central Pacific. The Central Pacific Hurricane Center issues hurricane forecasts and warnings for a large area of the north central Pacific. Due to the low average number of tropical cyclones in the central north Pacific (approximately 4.5 per season), the Central Pacific Hurricane Center has no dedicated staff assigned to it. When a tropical cyclone forms or moves into the central Pacific, specially trained staff are assigned hurricane specialist tasks.

*Question 10.* What kinds of resources are needed to better track cyclones in the Pacific?

Answer. The suite of observing systems available to hurricane forecasters in the Pacific is adequate to track cyclones in the Pacific and meet our mission, and our technology to communicate that information is also adequate. Given the lack of conventional observation data over the Pacific (i.e., few ships and buoys, minimal radar coverage except over Hawaii, and the lack of any land based systems) forecasters rely heavily on satellite data, both polar orbiting satellites and geostationary satellites. Data from these satellites populate NOAA's computer models, which provide storm track predictions used by our forecasters. Additional observation platforms including radars in the western Pacific Islands, critically placed buoys, use of unmanned aircraft systems, and improvements expected from the National Polar-orbiting Operational Environmental Satellite System (NPOESS), could provide additional information for forecasters to better track Pacific cyclones. These additional observations are addressed through the Global Earth Observation System of Systems, the

international program to help the international community produce and manage environmental information in a way that benefits the environment as well as humanity by taking a pulse of the planet.

