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STATEMENT OF
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RESOURCES, COMMUNITY, AND ECONOMIC DEVELOPMENT DIVISION
BEFORE THE
SUBCOMMITTEE ON LEGISLATION AND NATIONAL SECURITY
OF THE COMMITTEE ON GOVERNMENT OPERATIONS
HOUSE OF REPRESENTATIVES
ON
THE FEDERAL ROLE IN HURRICANE PREPAREDNESS PLANNING

Mr. Chairman and Members of the Subcommittee:

We welcome your invitation to discuss our review of the Federal role in hurricane preparedness planning. Hurricane preparedness planning--covering that time period from the hurricane advisory until the hurricane reaches land (landfall)--is a State and local responsibility. The Federal Government provides funds and technical assistance which, if properly used, can greatly facilitate and improve the planning process.

At the request of this subcommittee, we reviewed the principal Federal programs and activities relating to hurricane preparedness at the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Army Corps of Engineers. We also visited 6 States and 16 city, county, and regional planning jurisdictions within those States to determine how hurricane preparedness plans are developed. (Att. I lists State and local areas visited during our review.)

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The Federal Government provides three services having a direct impact on local preparedness levels:

--Forecasting. NOAA's National Weather Service (NWS) issues hurricane advisories to affected areas through the National Hurricane Center.

--Technical assistance. NWS has developed a computer simulation model that can be used by planners to predict flooding levels. Models are scheduled to be developed for 22 designated areas or basins.

--Financial assistance. FEMA is funding hurricane preparedness studies for 22 high-risk areas at a total cost of $6.7 million. The Corps and NOAA have also funded individual preparedness studies but have no current plans to fund additional studies.

Overall, the programs have helped improve preparedness levels in those communities that have received Federal assistance. However, problems in some areas have kept the programs from being as effective as possible. For example:

--FEMA provides little or no guidance to States on how to develop a preparedness plan;

--FEMA has no criteria by which to review planning proposals. FEMA has funded several studies with little assurance that the proposals would lead to a successful plan;

--NWS has provided computer model simulation runs for five basins but has insufficient funds to complete these runs for all areas; and

--Four of the 22 FEMA-designated, high-risk areas will not be able to take advantage of the NWS simulation models because of inadequate coordination between FEMA and NWS.

To better assure that available Federal assistance is effectively used in hurricane preparedness planning, FEMA must (1) coordinate and "package" available Federal technical and financial assistance and (2) assure that State-submitted proposals for technical studies and preparedness plans will adequately address stated needs. Additionally, FEMA, NOAA, other involved Federal agencies, and affected State and local areas should consider options and agree on a funding approach for the computer model simulations needed to assist in developing hurricane preparedness plans.

During the course of our review, FEMA initiated some steps to strengthen its coordination with other Federal agencies. FEMA is also developing a program paper which offers guidance to the FEMA regions on program goals and objectives. This paper--now in draft--should give the regions better guidance in reviewing State proposals.

BACKGROUND

Hurricanes are among the most destructive of all natural hazards. The risk of loss of life and property is enormous. Ninety percent of all hurricane-related deaths and most of the damage are caused by storm surge. As a hurricane approaches land, a dome of water some 40-50 miles across and as much as 25 feet or more above sea level--the storm surge--takes shape. The surge initially damages or destroys beach front property, but most of the damage and loss of life is caused by the resultant flooding. To minimize loss of life, all six of the States visited during our review required coastal areas to have in place emergency preparedness plans. These plans are designed to reduce loss of life or bodily harm by evacuating or sheltering at-risk individuals during a hurricane.

We found that responding to hurricane threats presents local and State officials with the need to make critical decisions, frequently without essential information. The local official must decide if evacuation is necessary, who should evacuate, where they should go, and by what route. If time were not a factor, these problems could be dealt with relatively simply. However, the lead warning time is typically 12-16 hours, and some communities require more than 30 hours for a full evacuation. Such lead times may require local officials to make evacuation decisions on uncertain information long before the official warning. A false warning may cost millions of dollars in unnecessary evacuation costs; conversely, a failure to order a needed evacuation could literally endanger thousands of lives.

Although we did not specifically evaluate individual hurricane preparedness plans, our review of local plans in Texas, Louisiana, Mississippi, Alabama, Florida, and Georgia led to the following observations:

--Local plans ranged from sophisticated efforts encompassing detailed technical information and covering a variety of storm conditions to informal plans that relied primarily on the residents' good sense to leave when a hurricane is expected.

--Local areas develop preparedness plans on one of three bases: (1) an informal, historical recollection relying largely on common sense, (2) a more formal vulnerability analysis based largely on historical data for storm information, and (3) a formal vulnerability analysis combining historical data with a technical data base developed from simulation models and containing information on probable surge height, evacuation zones, and appropriate evacuation routes for a variety of hypothetical storms.

--Those local or regional areas having a formal vulnerability analysis based on simulation models are in a better position to define actual problems to be faced during a hurricane emergency than those without such a base.

--Each location that has a formal vulnerability analysis based on simulation models was able to do so because of relatively large amounts of funding and technical assistance received from the Federal Government.

--Last, and most important, planning efforts are largely useless unless the plan results in operational guidelines that can be used by local jurisdictions before and during a hurricane emergency. Plans need to be developed by or in cooperation with those officials responsible for taking action. Local areas with strong local involvement in designing or conducting the vulnerability analysis seemed to be better equipped to translate the resultant data base into a plan of action.

Mr. Chairman, I will now briefly address the Federal Government's role in hurricane preparedness.

NATIONAL WEATHER SERVICE

NWS plays a key role in assisting State and local governments to develop and improve hurricane preparedness programs through its warning systems, storm surge models, and public awareness programs. We were impressed with NWS efforts in working with State and local governments to improve emergency response to a hurricane threat.

Hurricane advisories

NWS issues special storm advisories--hurricane warnings--for specific areas 24 hours or less before expected

landfall with most warnings coming 12-16 hours before expected landfall. NWS uses data from three observing systems: weather satellites, reconnaissance aircraft, and coastal radar to make its forecasts. Although the data received from the planes provides the most detailed information, state-of-the-art meteorological equipment is not being used for all weather reconnaissance activities. Reconnaissance missions are flown primarily by the U.S. Air Force using 18-22 year old planes (11 total) that are not well equipped and can transmit meteorological data by voice only. Additionally, these planes have maintenance problems that could affect reliability during a hurricane emergency. Two better-equipped NOAA research planes, having an on-board computer capability and automatic plane-to-ground communication links via satellite, are used only on a limited basis. The Air Force is considering updating its air fleet to include these capabilities, but any such update will be expensive and take considerable time.

Many local areas use the specific warning generated by NWS as a guide in ordering evacuation, but some communities have determined that evacuation times exceed this time period. For example, Harris County, Texas, could require up to 26 hours to evacuate for a major storm; the Florida Keys could take more than 30 hours; and the Tampa Bay, Florida, region could take up to 15 hours. Preevacuation mobilization can add another 3 hours to the required time. If a community had 40-50 hours of lead time, hurricane evacuation would not be a major problem. However, NWS does not anticipate any imminent advances in forecasting technology that would allow the warning time to be extended.

To increase the usefulness of information from available forecasts, NWS plans on releasing probability information to the public during the 1983 hurricane season. The probability of hurricane conditions will be released for specific locations up to 72 hours in advance of the predicted arrival time. The expected probabilities for any specific area will not exceed

12 percent for the 72 hour warning (before landfall) going up to a maximum of 50 percent for the 24 hour warning. These probabilities could be very useful to local officials in assessing the relative risks of hurricane conditions. (Att. II shows how this information might be presented.)

Some local areas have been requesting such information. However, release of this information is causing concern among some State officials. One State believes that the probability data will be confusing to the public, and it would prefer that NWS make the probability information available only to State officials.

Storm surge models

NWS has developed two models, SPLASH (Special Program to List the Amplitudes of Surges from Hurricanes) and SLOSH (Sea, Lake, and Overland Surges from Hurricanes), to determine storm surge effects. SPLASH is used to model surge effects along the coastline. SLOSH is a more sophisticated model that better accounts for more complex topographical features such as bays or estuaries and will also simulate or predict inland flooding.

These models have proved to be indispensable to local and regional areas wanting specific information on hurricane effects. Before the advent of computer simulation models, planners were forced to rely primarily on historical data for preparedness planning. They could review the flooding effects of past hurricanes and combine this with information from topographical maps to develop evacuation zones. With simulation models the planner can go well beyond this. These models give the planner a capability to review the probable flooding effects of dozens of hurricanes, each of a different intensity or direction. The planner can use this information to determine when and where particular locations will be flooded or

when evacuation routes will become impassable. When used in conjunction with population data and transportation studies, the planner can quantify evacuation times.

The SLOSH model is completed in two phases. First, the model is adapted or "fitted" to a specific coastal area or basin. At this point the model can be used for forecasting purposes. The second phase involves three steps: (1) running an average of 250 simulations for various hurricane scenarios, (2) consulting with local planners using these simulations to develop evacuation plans, and (3) summarizing all information and data in a storm surge data atlas that serves as a reference guide. At this point the SLOSH model results can be used for both forecasting and planning.

NWS has scheduled 22 basins for SLOSH development. The first model was operational (through phase one) in April 1979, and phase one work has since been completed on another 11 basins. The remaining basins will be completed by September 1985. (Att. III lists SLOSH basins.) Phase two computer simulation runs have been completed for only five basins. I should emphasize that, fortunately, no community has yet to test SLOSH results under actual hurricane conditions.

While NWS has obligated money to complete phase one development, no funding is currently available for phase two. Twelve other areas have either requested or are anticipated to request a SLOSH model. No funding is presently available or has been requested by NOAA for these 12 areas. (Att. IV lists these additional areas.) NWS estimates phase one development costs at about $131,000 per basin with phase two costing about $108,000 per basin. The computer simulations done within phase two cost approximately $87,000 per basin.

FEDERAL EMERGENCY MANAGEMENT AGENCY

Under its general responsibility to assist State and local governments in developing emergency preparedness plans, FEMA has become the primary Federal funding source for hurricane preparedness planning. By authority of the Disaster Relief Act of 1974, FEMA has established a Hurricane Preparedness Planning Program for assisting States and local governments in their planning efforts. FEMA has identified 22 high-risk locations and will fund preparedness studies through the States for each area. The program began in fiscal year 1981 and will be completed in fiscal year 1988 at a total cost of about $6.7 million. (Att. V lists each of the 22 areas.)

Each grant is funded over a 1- to 3-year period at a cost of $130,000 to $640,000. The grants are not intended to cover all costs. Four of the five grantees covered in our review have also received funding from State and other Federal sources. (A total of seven grants have been awarded; two of these were outside our review area.) In the case of Tampa Bay and Southeast Florida, the Corps of Engineers was the single major source of funds.

Each study is completed in two steps. First a vulnerability analysis is conducted to predict depth and extent of flooding from hurricane surge and resulting loss of property and human casualties. Secondly, plans are developed for evacuation, response, recovery, and mitigation based upon the vulnerability analysis. FEMA has strengthened its program by making the program's first objective that of saving lives and reducing casualties. This change will be reflected in guidelines going to the FEMA regional offices. FEMA has also decided to increase the funding amount for most of the individual studies.

FEMA review and guidance

FEMA has done little to assure that the hurricane preparedness studies will result in workable plans. Our review of FEMA regions IV and VI and FEMA headquarters revealed that the agency has no real criteria by which to evaluate proposals, and reviews have been cursory at best. Officials within each region have relatively little specific knowledge of the risks associated with hurricanes, the types of information needed to prepare for those risks, and the types of available technical support necessary to support planning efforts. In four of the five ongoing or completed studies covered by our review--Tampa Bay; coastal Georgia; Galveston, Texas; and Southeast Florida--this lack of FEMA guidance has had little negative effect because assistance and guidance were available elsewhere and those performing the studies were technically competent. For example, the Tampa Bay Regional Planning Council had already developed a definitive technical data base--largely paid for by the Corps of Engineers.

FEMA was not so fortunate, however, for the proposed New Orleans study. Before submitting the proposal, the Louisiana Office of Emergency Preparedness requested FEMA regional office guidance (specifically use of the Texas proposal) in developing their own study proposal. The regional office informed the State that they should develop their own methodology. The resultant study proposal had problems with funding and a major technical element; however, FEMA approved the proposal without being aware of those problems. FEMA is now aware of these problems and as a result has delayed additional funding by 1 year. With better review and coordination by FEMA, however, problems in the proposal could have been recognized early on.

The proposal included steps to update regional topographical data at an estimated cost of $400,000 because State officials believed that available topographical maps were outdated. NWS officials believe, however, that existing maps are adequate.

The State was later informed of this by NWS but still intends to perform the mapping. (Funds are not currently available for mapping.)

Additionally, the State assumed funding from largely unavailable sources. The State estimated that the vulnerability analysis would cost $1 million. Federal funding was to be secured with a $75,000 FEMA hurricane grant, $123,000 from other FEMA grant programs, $400,000 from NOAA's Office of Coastal Zone Management, and additional funds from the Corps of Engineers. The Office of Coastal Zone Management does not have available funds and Corps funding is questionable. To date, FEMA has awarded $75,000 to the State but, as noted above, is delaying additional funding by 1 year until the proposal is sorted out.

Finally, FEMA did not coordinate its review with appropriate Federal and local officials. For example, FEMA did not check with NWS to review the mapping proposal nor did it check with NOAA or the Corps to see if funding was available. FEMA was initially concerned that the State had not coordinated its proposal with appropriate local officials. The State did form a local government advisory committee, but one of the New Orleans' area parishes told us they intend to develop their own vulnerability analysis.

FEMA is now developing a paper outlining goals and objectives for the Hurricane Preparedness Program. This paper, now in draft, provides a good basis for FEMA regional office review of State proposals. It sets forth study elements which should be included in the State proposal, stresses the importance of the SLOSH model, and the need for stimulating local interest in the study.

SLOSH coordination

In selecting the 22 high-risk areas to receive funding assistance, FEMA did not take into consideration which areas had

previously been selected for SLOSH modeling. At that time FEMA did not consider SLOSH to be essential for developing a vulnerability analysis. Consequently, 4 of the 22 areas--coastal Georgia, Hawaii, Puerto Rico, and the Trust Territories--either were or will be unable to use SLOSH for preparedness planning. (NWS recently agreed to develop a SLOSH model for Georgia; however, the vulnerability analysis has already been completed.)

During our review, FEMA officials began to recognize the importance of using the SLOSH model to generate technical data needed for preparedness planning. FEMA is now coordinating more closely with NWS on SLOSH model development. FEMA also reordered its schedule of hurricane studies to coincide with the timing of future SLOSH models. However, FEMA does not intend to delay studies for areas not currently scheduled for SLOSH if the State or locality wishes to proceed with the study, especially if these are "open coast" areas (areas without major bays and estuaries) where FEMA believes SPLASH data can be used effectively.

OTHER FEDERAL INVOLVEMENT

Several other Federal agencies have been instrumental in initially assisting State and local areas to develop preparedness plans. For example, the Corps of Engineers' Jacksonville, Florida, district office has taken the lead in developing prototypical hurricane evacuation plans--first in Lee County, Florida; then in the Tampa Bay, Florida, region; and currently in Southeast Florida. These studies were among the first to develop a regional comprehensive preparedness plan. Tampa Bay was the first area to use SLOSH to develop an evacuation plan.

Although these studies are considered to be pioneering efforts, no documentation of procedures followed, methods used, or lessons learned has been developed. At this time the Corps has

no plans to provide such documentation. The Corps also has no immediate plans to fund additional hurricane preparedness studies.

NOAA's Office of Sea Grant and Office of Ocean and Coastal Resource Management (OCRM) have also played important roles in preparedness planning. The Office of Sea Grant has funded various individual studies such as the evacuation study done by Texas A&M University for the Galveston, Texas area. OCRM has provided funds for numerous hurricane preparedness studies in Florida under the Coastal Zone Management Act. NOAA is not seeking state assistance funds for either office for fiscal year 1984. OCRM will continue to coordinate coastal hazard programs within NOAA and could possibly help fund the SLOSH computer simulation runs out of its fiscal year 1983 continuing appropriation.

FEMA, the Corps, NOAA, and other interested parties such as the American Red Cross regularly meet to discuss hurricane preparedness planning. These meetings, originally intended to discuss vertical evacuation or refuge (moving residents up rather than out), have become an effective communications network for exchanging information among involved parties.

CONCLUSIONS

In conclusion, Mr. Chairman, I would like to emphasize that FEMA, NOAA, and other Federal agencies simply provide tools to assist in preparedness planning. The responsibility for that planning rests with State and local governments.

Federal assistance in hurricane preparedness planning is at a crossroads. The instructive, pioneering planning efforts largely supported by the Corps and NOAA's Office of Sea Grant, OCRM, and NWS are in place or nearing completion, and much of that Federal support--with the notable exception of NWS--is,

at least for the moment, largely unavailable for future preparedness studies. On the other hand, critical technical assistance is still available from NWS, and FEMA has in place a comprehensive funding program covering most of the high-risk coastal areas in the United States.

To better assure that these areas develop adequate preparedness plans, FEMA must shoulder more responsibility in coordinating remaining Federal hurricane preparedness programs and in providing necessary guidance to State and local areas developing such plans. Effective implementation will also likely require additional State expenditures.

For the program to succeed, we believe that FEMA must

--formally review current hurricane planning efforts to determine the criteria necessary for development and implementation of a workable preparedness plan;

--carefully review State proposals to see that (1) the proposals are technically feasible, (2) that the proposals will be developed by technically competent planners, (3) that funding is generally available to complete the proposals, and (4) that officials having ultimate responsibility for implementing emergency operating procedures during a hurricane are involved to some degree in the planning process; and

--have the proposals reviewed by the Corps of Engineers and relevant NOAA agencies. This is especially important since FEMA has limited inhouse expertise in engineering, modeling, and forecasting which might be required for a thorough review of the proposal.

Additionally, for most areas, availability of the SLOSH computer simulation runs provides substantially improved information necessary for a vulnerability analysis and

subsequent evacuation and preparedness plans. The ultimate utility of FEMA's hurricane preparedness program could be seriously weakened without the data provided by these runs. We feel that FEMA, NWS, other interested Federal agencies, and affected State and local governments should work closely together to determine funding options for completing this phase of SLOSH development. In its draft paper on hurricane planning, FEMA proposes to fund the SLOSH simulation runs. The study awards--for the FEMA high-risk areas--would then be reduced by a like amount. FEMA proposes this as an interim solution "until direct funding is provided by Congress."

That concludes my prepared statement, Mr. Chairman. I will be happy to respond to any questions you or other subcommittee members might have.

ATTACHMENT I

STATE AND LOCAL AREAS VISITED

Georgia

Coastal Area Planning and Development Council (covers the six coastal Georgia counties)

Florida

Tampa Bay region
Bay County
Dade County

Alabama

Mobile County

Mississippi

Harrison County
Jackson County
Hancock County

Louisiana

Orleans Parish
Jefferson Parish
St. Bernard Parish
St. Tammany Parish
Calcasieu Parish

Texas

Brownsville area
Galveston/Houston area
Beaumont/Port Arthur area

ATTACHMENT II

PROBABILITY OF HURRICANE CONDITIONS(a)

Coastal location	Less Than 24 hr	24-36 hr	36-48 hr	48-72 hr	Total for 72 hr period
Marco Island, Fla.	*	*	*	1	1
Fort Myers, Fla.	*	1	*	*	1
Venice, Fla.	1	*	1	*	2
Tampa, Fla.	1	1	1	1	4
Cedar Key, Fla.	2	3	1	1	7
St. Marks, Fla.	7	5	2	*	14
Apalachicola, Fla.	16	3	*	1	20
Panama City, Fla.	19	3	*	1	23
Pensacola, Fla.	21	3	1	*	25
Mobile, Ala.	16	6	1	*	23
Gulfport, Miss.	14	6	1	1	22
Buras, La.	16	4	1	*	21
New Orleans. La.	8	7	1	1	17
New Iberia, La.	1	6	3	2	12
Port Arthur, Tex.	*	1	3	3	7
Galveston, Tex.	*	1	2	2	5
Port O'Connor, Tex.	*	*	1	2	3
Corpus Christi, Tex.	*	*	1	1	2
Brownsville, Tex.	*	*	*	1	1

* Probability less than 1 percent.

(a) This table shows the probability of hurricane conditions for one hurricane threatening the Gulf coast.

The probability of hurricane conditions is defined as the probability that the storm center will pass within 75 miles to the left or 50 miles to the right of the coastal location within the forecast period.

There is an approximate maximum probability within each forecast period:

48-72 hours	12 percent
36-48 hours	20 percent
24-36 hours	30 percent
Less than 24 hours	50 percent

ATTACHMENT III

STATUS OF SLOSH DEVELOPMENT PROGRAM

	Basin	Phase I Operational Model	Phase II Simulations	Atlas
1.	Lake Okeechobee, Fla.	Completed		
2.	Lake Pontchartrain, La.	Completed		
3.	Tampa Bay, Fla.	Completed	Completed	
4.	Galveston Bay, Tex.	Completed	Completed	
5.	Charlotte Harbor, Fla.	Completed	Completed	Completed
6.	Florida Bay, Fla.	Completed		
7.	Biscayne Bay, Fla.	Completed		
8.	Corpus Christi, Tex.	Completed	Completed	Jan. 1984
9.	Mobile Bay, Ala.	Completed		
10.	Sabine Lake, Tex., La.	Completed	May 1983	
11.	Pensacola, Fla.	Completed		
12.	Charleston Harbor, S.C.	Completed	Completed	
13.	Pamlico Sound, N.C.	June 1983		
14.	Matagorda Bay, Tex.	Nov. 1983		
15.	Lower Laguna Madre, Tex.	Nov. 1983		
16.	Delaware Bay, Del.	Oct. 1983		
17.	Buzzards Bay, Mass.[1] Narragansett Bay, R.I.[1]	Dec. 1983		
18.	Chesapeake Bay, Md.	Sept. 1983		
19.	Long Island Sound, N.Y.	Sept. 1985		
20.	Boston Bay, Cape Cod, Mass.	Sept. 1985		
21.	Hilton Head, S.C.[2]	Sept. 1985		
22.	Brunswick, Ga.[2]	Sept. 1985		

[1]These basins were combined to reduce the number of original basins from 21 to 20.

[2]These two basins were added to the original list. NWS plans on completing these basins using currently obligated funding.

ATTACHMENT IV

ADDITIONAL AREAS FOR SLOSH DEVELOPMENT

Requests

1. Myrtle Beach, S.C.
2. Cape Canaveral, Fla.
3. Crystal River, Fla.
4. Apalachicola Bay, Fla.
5. Puerto Rico
6. Hawaii

Anticipated requests

7. Jacksonville, Fla.
8. Palm Beach, Fla.
9. Vermillion Bay, La.
10. New Jersey coast
11. Portland, Me.
12. Penobscot Bay, Me.

ATTACHMENT V

FEMA HURRICANE PROGRAM

Hurricane Risk areas	Total FEMA grant	Anticipated start date	Scheduled for SLOSH
Tampa Bay, Fla.	$ 175,000	FY 1981[1]	Yes
Georgia coast	133,000	FY 1981[2]	Yes[3]
Galveston/Houston, Tex.	200,000	FY 1982[1]	Yes
New Orleans, La.	325,000	FY 1982[1]	Yes
Southeast Florida	150,000	FY 1982[1]	Yes[4]
Tri-State: Fla., Miss., Ala.	640,000	FY 1983	Yes
Hawaii	350,000	FY 1983	No
New Jersey	195,000	FY 1983[1]	Yes
Long Island, N.Y.	130,000	FY 1983[1]	Yes
Puerto Rico/Virgin Is.	300,000	FY 1983	No
Beaumont/Port Arthur, Tex.	350,000	FY 1983	Yes
Charleston, S.C.	275,500	FY 1983	Yes
Corpus Christi, Tex.	350,000	FY 1984	Yes
Pamlico Sound, N.C.	350,000	FY 1985	Yes
Brownsville/ Rio Grande, Tex.	300,000	FY 1986	Yes
Norfolk/Virginia Beach/ Newport News, Va.	350,000	FY 1986	Yes
Boston Bay/Cape Cod, Mass.	400,000	FY 1986	Yes
Rehoboth/Delaware coast	300,000	FY 1986	Yes
Ocean City/Maryland coast	350,000	FY 1986	Yes
Connecticut coast	400,000	FY 1986	Yes
Narragansett Bay/ S. Rhode Island	400,000	FY 1987	Yes
Guam/Samoa/Trust Territories	350,000	FY 1987	No
	$6,773,500		

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[1]Study underway.

[2]Study complete.

[3]The National Weather Service plans to develop a SLOSH model for Brunswick, Georgia. However, preparedness planning efforts based on SPLASH were completed for that area by January 1983.

[4]The Corps of Engineers has already developed technical data for the South Florida area based on other models.

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