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on the Tsunami Preparedness Act of 2005

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The recent tragic earthquake and resulting tsunami in the Indian Ocean was a natural disaster of almost unimaginable proportion. The U.S. and the world have responded generously with aid to those who have been hurt and with resources to assist in assessing and responding to the damage. What made this event even more tragic is that many of the deaths were preventable—if only an effective warning system had been in place to alert the communities that were in harm's way. The Administration is committed to helping ensure that warning and response systems are put in place -- domestically and internationally -- that will substantially reduce loss of life and property in the future.

The Tsunami Threat

A tsunami is a series of very long, fast-moving waves that can travel long distances across the open ocean at speeds up to 500 mph. As the tsunami approaches shore, the successive waves may slow to speeds of 20-30 mph and grow substantially in height, with the first wave commonly not the largest or most destructive. Tsunamis are generated by any rapid, large scale sea disturbance. Approximately 90 percent are generated by undersea earthquakes, but not all undersea earthquakes generate tsunamis. They may also be caused by events such as volcanic eruptions or major landslides.

Approximately 85 percent of tsunamis occur in the Pacific Ocean because of this ocean's encircling major seismic zones that are associated with the volcanoes of the "Pacific Ring of Fire." Since 1946, five Pacific Ocean tsunamis have cost the U.S. more than 300 lives and hundreds of millions of dollars in property damage. Because of the much greater frequency of Pacific Ocean tsunamis, prior U.S. and global efforts to develop tsunami warning systems have focused on this region. Since 1968, the U.S. and other Pacific region nations have cooperated in the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU), which currently has 26 member states. This system operates under the auspices of UNESCO's Intergovernmental Oceanographic Commission (IOC). Currently, the world's most advanced tsunami detection systems, NOAA's Deep Ocean Assessment and Reporting of Tsunami (DART) systems, are deployed in the U.S. Pacific Tsunami Warning System.

Although less likely, tsunamis have some potential of occurring in the rest of the world's oceans, including the Indian Ocean, Caribbean, and Atlantic Ocean. Even though the probability is small, the potential for tsunami-related loss of life and property is increasing because of population migrations to coastal areas. The United Nations reports that already two-thirds of the world's population crowd near the coastline, and within three decades, if trends continue, 75 percent of humanity will reside in coastal areas. By 2025 nearly 75 percent of all Americans are

expected to live in coastal counties, many of whom will be in tsunami risk areas. Given a tsunami's great destructive power, expanding tsunami protection for U.S. coastal communities and developing global early detection and warning systems are justified.

While plans to expand the world's tsunami detection and warning capabilities for global coverage were already in development when the December 26 tsunami struck, this event has focused international attention on the need for tsunami detection and warning and has created opportunities for enhanced international cooperation in developing and deploying such systems.

Disaster Warning and Reduction Systems

Some of the components of a tsunami detection, warning and disaster reduction system are unique to the tsunami hazard, such as the sensors for deep ocean detection of tsunami waves. But, I would like to emphasize that a great deal of the investment is not confined to tsunamis alone. The communications infrastructure, emergency evacuation and response plans, damage assessment tools, public education programs, and other components are relevant to many types of disasters.

I would like to outline the generic components for a successful disaster detection, warning, and reduction system, including how these components relate specifically to the tsunami hazard. A complete system includes:

- Risk assessment, which is enabled by the detailed modeling of coastline communities and by increased scientific understanding of the formation and propagation of tsunamis;
- Detection, to reliably indicate whether a tsunami has occurred, avoiding costly false alarms and the associated erosion of public confidence;
- Warning, including the initial issuance; transmission to affected countries, regions, and communities; and communication to the affected population;
- Activation of a response plan, already in place in the local communities;
- A "ready public," able to respond in an efficient and timely manner through preparedness education;
- Situational awareness, with monitoring of the incident until an "all clear" has been sounded;
- Resilient infrastructure, protective shelters, reliable supply routes, food and water, medical supplies and medical evacuation procedures; and ultimately
- Lessons learned; a post-incident evaluation with feedback to enable future improvements.

Science and Technology for Tsunami Readiness

Mobilizing federal science and technology to support tsunami readiness requires the contributions from a number of federal agencies, and also requires a coordinated approach. The agencies represented here today, NOAA, USGS, and NSF, lead our tsunami readiness effort, but the contributions of other agencies, such as the Department of Homeland Security in disaster warning systems and NASA in satellite remote sensing, contribute in a variety of ways to tsunami detection and warning, as well as to post-incident damage assessment and response. Federal science and technology challenges that draw on the strengths of more than one agency are coordinated through the National Science and Technology Council (NSTC). In particular,

coordination through the Subcommittee on Disaster Reduction and the Interagency Working Group on Earth Observations has been critical in assuring the best use of our collective capabilities.

Although we are focused here today on what it will take to deploy a system that will allow faster and more accurate tsunami detection and warning, I would like to point out some of our other significant contributions to tsunami warning and disaster reduction:

- Our ability to do accurate risk assessment and prediction is supported by basic research on seismic and tsunami processes as well as by advances in numerical modeling and simulations of these processes and of their impact on coastal communities.
- Enhanced community warning systems and improved disaster response capabilities are being developed by FEMA and other agencies, capitalizing on an "all hazards" approach to disaster-resilience.
- Research findings from the social and behavioral sciences are being employed to improve emergency response planning.
- Advanced satellite communications technologies and data relay allow real-time monitoring of the situation, and satellite remote sensing images and products are being used by relief agencies to assess the extent of the damage and determine where relief efforts are most critical and how best to carry them out. Satellite images from the December 26 tsunami also provided the first large-scale, open ocean data of a major tsunami event.
- And, tsunami education programs are being developed and used with at-risk populations, such as NOAA's National Weather Service TsunamiReady Program that provides public education and preparedness measures for vulnerable U.S. coastal communities.

Tsunami detection begins with seismic monitoring. The Global Seismographic Network, which is managed jointly by the USGS and NSF with international partners, currently has a network of 137 seismic stations that have been installed around the world in a variety of configurations. The seismographs detect earthquakes and, judging from the location, type and magnitude of the earthquake, can indicate the possible generation of a tsunami. In many areas of the globe, the presence of a tsunami can only be confirmed as the tsunami nears shore and is detected by tidal gauges. However, in the Pacific Ocean NOAA has deployed six Deep Ocean Assessment and Reporting of Tsunami (DART) systems consisting of a seafloor pressure sensor that can detect a tsunami as it passes and relay the information to a moored surface buoy for communication via satellite to Tsunami Warning Centers. DART systems provide earlier and more accurate tsunami detection and significantly reduce costly false alarms.

U.S. plans for improved initial tsunami detection and warning hinge on deploying more DART systems to cover at-risk areas of the world's oceans, and on improving the Global Seismographic Network to provide enhanced coverage as well as improved analysis and communications of earthquake activity. Additional research into seismic and tsunami processes, and public education and preparedness programs, are also essential. The Administration has outlined detailed plans for an enhanced U.S. system that will provide nearly 100 percent detection capability for the U.S. coasts, and we have proposed to commit $37.5 million over the next two years to build and deploy this system. You will hear the details of this proposal from the other members of this panel.

International Coordination for Tsunami Readiness

Tsunamis and many other naturally occurring phenomena are global in scale and require international cooperation in response. The Administration is committed to working with our international partners on the process of developing a global tsunami detection, warning and response capability.

In the aftermath of December 26, a number of countries have called for expanded tsunami warning systems both in the Indian Ocean and globally. Australia, Germany, Japan, India, China and other countries quickly announced proposals for establishing early warning systems for tsunamis or, in the case of China, for all natural disasters. A number of countries and organizations have also proposed special international meetings on these topics. We are endorsing and promoting coordination of efforts among likely key contributors as well as incorporation of these efforts into existing mechanisms for global cooperation on disaster warning and reduction.

We propose that coordination be carried out through the Intergovernmental Group on Earth Observations (GEO). Enhanced Earth observation was a core element of the 2003 G-8 Evian Action Plan on Science and Technology for Sustainable Development. The World Summit on Sustainable Development in Johannesburg in 2002 also called for greater integration of Earth observation systems. Responding to this priority, the U.S. hosted the first Earth Observation Summit in Washington, D.C. in July 2003. As a result of this meeting, the GEO was established to organize the development of a comprehensive, coordinated, and sustained Global Earth Observation System of Systems (GEOSS). 56 countries are currently GEOSS partners, including India, Indonesia and Thailand. All nations are invited and encouraged to join. GEO has developed a ten-year plan that is focused on nine societal benefits, including "reduce loss of life and property from disasters" and "protect and monitor our ocean resources." Once implemented, this plan could not only revolutionize our understanding of the Earth and how it works, but how countries cooperate.

It is important to note that UNESCO's Intergovernmental Ocean Commission (IOC) is a GEO member and the coordinating body of the existing Tsunami Early Warning System in the Pacific. Efforts to establish a tsunami early warning system in the Indian Ocean can benefit from the experience and expertise of the IOC, not only in coordinating the Pacific Early Warning System, but also in addressing the full range of ocean and coastal problems through the sharing of knowledge, information and technology among countries.

At the World Conference on Disaster Reduction, January 18-22, in Kobe Japan, the U.S. delegation affirmed U.S. commitment to working with our international partners on a global tsunami warning system. I have just returned from the Ministerial Meeting on Regional Cooperation on Tsunami Early Warning Arrangements in Phuket, Thailand, at which we considered a Thai proposal for developing a regional tsunami early warning system for the Indian Ocean and Southeast Asia. The U.S. has proposed that the development of any regional or global tsunami warning system -- particularly in the Indian Ocean -- be coordinated through GEO and be a top, near-term priority for GEOSS. This discussion will continue when the Group

meets in Brussels, February 14-16 and formally adopts the GEOSS 10-year implementation plan. After the implementation plan is ratified by the GEOSS partners in February, specific country commitments and steps forward will be important topics for the G-8 summit in July 2005.

As part of the strategic planning for this international "system of systems," the U.S. has developed its own *Strategic Plan for the U.S. Integrated Earth Observation System* which, like the international plan, focuses on the nine societal benefit areas. This strategic plan was developed by the NSTC Interagency Working Group on Earth Observations, and provides the essential framework for the U.S. contribution to the GEOSS implementation plan. The expansion of the U.S. tsunami warning system will be implemented in the context of this U.S. Integrated Earth Observation System and as a U.S. contribution to GEOSS.

I should also mention that Admiral Lautenbacher is the U.S. Co-Chair of GEO, along with Japan, the European Commission, and South Africa, and that Dr. Groat is the U.S. representative to GEO. They will also speak in more detail about the development of GEOSS and the U.S. contributions to this important international project.

Conclusion

In closing, I would like to quote David Broder of the Washington Post on this topic: "Just as the world has managed to put aside political, religious, and ethnic rivalries to help the victims of this disaster, so the scientists and environmentalists meeting in Brussels will have an opportunity to show their foresight in making such calamities less likely. *The United States leadership in this international effort is a source of pride for the nation.*"