The *Grand Challenges for Disaster Reduction* outlines a ten-year strategy crafted by the National Science and Technology Council's Subcommittee on Disaster Reduction (SDR). It sets forth six Grand Challenges that, when addressed, will enhance community resilience to disasters and thus create a more disaster-resilient Nation. These Grand Challenges require sustained Federal investment as well as collaborations with state and local governments, professional societies and trade associations, the private sector, academia, and the international community to successfully transfer disaster reduction science and technology into common use.

To meet these Challenges, the SDR has identified priority science and technology interagency implementation actions by hazard that build upon ongoing efforts. Addressing these implementation actions will improve America's capacity to prevent and recover from disasters, thus fulfilling our Nation's commitment to reducing the impacts of all hazards and enhancing the safety and economic well-being of every individual and community. This is the tsunami-specific implementation plan. See also **sdr.gov** for other hazard-specific implementation plans.

What is at Stake?

DEFINITION AND BACKGROUND. Tsunamis—large, rapidly moving ocean waves resulting from disturbances on the ocean floor—are among the most devastating of all hazards. United States coastal communities are threatened by tsunamis generated by both local and distant sources.

IMPACTS. The Great Alaskan Earthquake and Tsunami was one of the most disastrous seismic events in United States history. The event began when the largest earthquake in North American history struck the Alaskan coast on March 28, 1964. The earthquake caused 115 deaths, 106 of which were the result of tsunamis generated by the quake. Five tsunami waves impacted the United States Pacific Coast from Alaska to California and Canada, resulting in $84 million in damages.[1]

Local tsunamis give residents only a few minutes to seek safety. Tsunamis of distant origin give residents more time to evacuate the threatened coastal areas, but require timely and accurate tsunami forecasts of the hazard to assure proper response and to avoid costly false alarms. For example, residents of Alaska can experience either a local earthquake and local tsunami or tsunamis of distant origin, while residents of Hawaii and the west coast generally experience hazards from distant tsunamis. The 1946 tsunami, which was the most devastating in Hawaiian history, originated in the Aleutian Islands, but resulted in waves of up to 17 meters (55 feet) in height striking Hawaii. This event ultimately resulted in 170 deaths and permanent damage to the city of Hilo.[2]

Similarly, Pacific Northwest residents can experience a local tsunami that also may have an impact on the distant states of Alaska and Hawaii. A tsunami in the Caribbean could result in a local tsunami for Puerto Rico that also impacts Atlantic coast communities in the Southeast as a distant tsunami. Of the two, local tsunamis can pose a greater threat to life because of the short time between generation and impact.

The Indian Ocean tsunami of December 26, 2004 gave rise to levels of loss and grief unprecedented in the history of natural hazards in the region. The massive impact was due to a lack of public awareness, effective warning systems, and implementation of mitigation measures. For example, rapid evacuation to inland areas would have saved many lives. Recognizing the complexity and scope of the sustained efforts needed to ensure tsunami risk reduction in the decades to come, hazard assessment, accurate warnings, response planning, and new or improved actions in public awareness, mitigation, and research are needed. All of these efforts require sustained coordination, attention, and support on the Federal, state, and local level. The National Science and Technology Council's 2005 report, *Tsunami Risk Reduction for the United States: A Framework for Action*, calls on the National Tsunami Hazard Mitigation Program, a Federal-state partnership led by NOAA, to "develop, coordinate and sustain an effective and efficient tsunami risk reduction effort in the United States over the long term."

TSUNAMI

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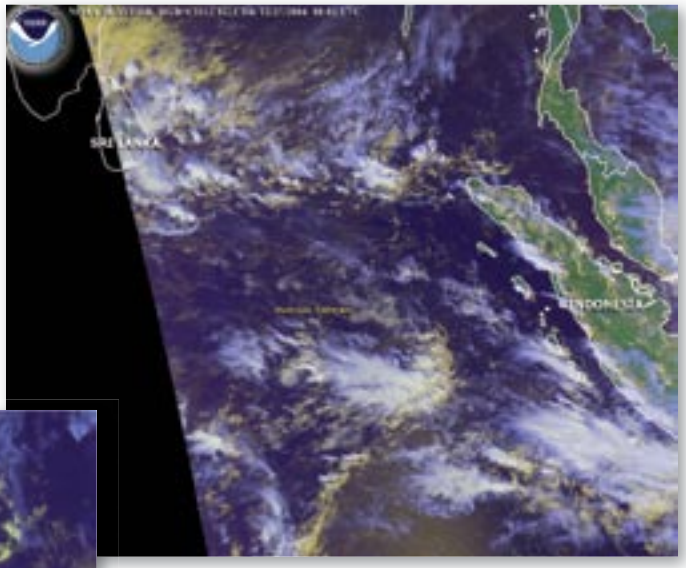
Grand Challenges for Disaster Reduction: Priority Interagency Tsunami Implementation Actions

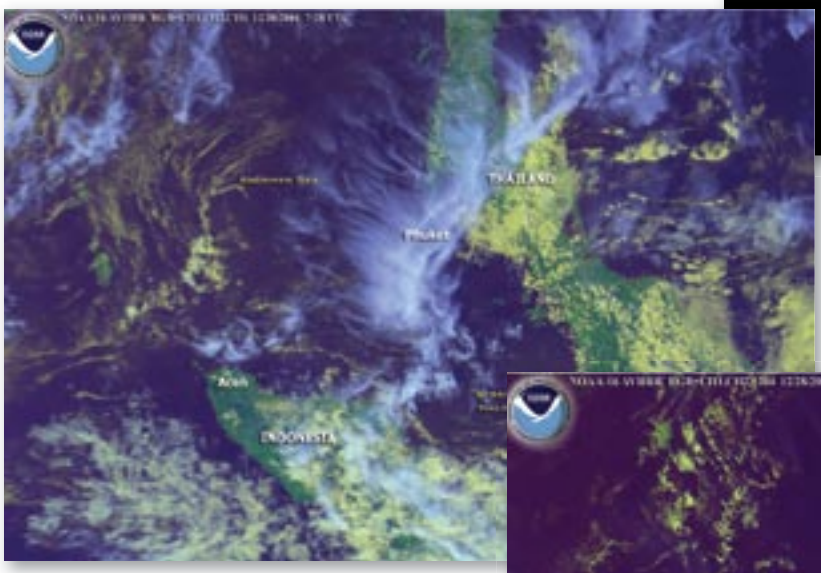
GRAND CHALLENGE #1: Provide hazard and disaster information where and when it is needed.

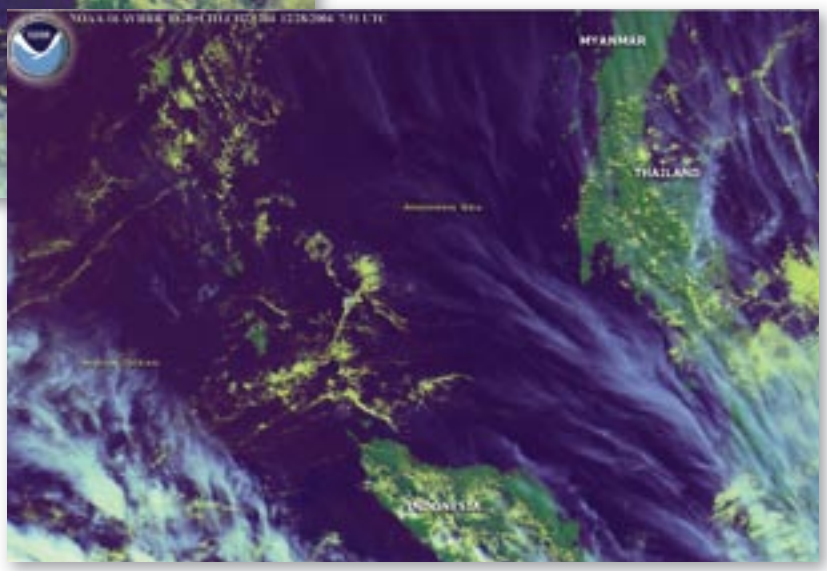
- ■ Improve tsunami and seismic sensor data and infrastructure for better tsunami detection;
- ■ Enhance tsunami forecast capability along our coastlines (Pacific, Atlantic, Caribbean, and Gulf of Mexico) by increasing the number of Deep-ocean Assessment and Report of Tsunamis (DART) buoys, tide gauges, and seismic sensors feeding real-time data into on-line forecast models;
- ➤ Develop standardized and coordinated tsunami hazard and risk assessments for all coastal regions of the United States and its territories;
- ➤ Encourage data exchange and interoperability among all regional tsunami and all-hazard warning systems, coordinated by the Intergovernmental Oceanographic Commission's sub-Commission for the Caribbean.

GRAND CHALLENGE #2: Understand the natural processes that produce hazards.

- ■ Develop improved and sustained monitoring and research of both the generating mechanisms and the physical characteristics of the tsunami and more accurate description of the sites at risk;
- ■ Research and better understand the protective role coastal marshes, coral reefs, barrier islands, and other coastal features play during a tsunami;
- ➤ Conduct an annual review of the status of tsunami research and develop a strategic plan for tsunami research in the United States.







Key: ■ Short Term Action (1-2 years) ➤ Medium Term Action (2-5 years) ◆ Long Term Effort (5+ years)

GRAND CHALLENGE #3: Develop hazard mitigation strategies and technologies.

- Develop engineering advancements for sea walls and energy dissipaters that will minimize impact;
- Develop coastal management plans that will protect coastal features that act as natural energy dissipaters to minimize the tsunami impact;
- Promote development of model mitigation measures and encourage communities to adopt construction, critical facilities protection, and land-use planning practices to reduce the impact of future tsunamis.

GRAND CHALLENGE #4: Reduce the vulnerability of infrastructure.

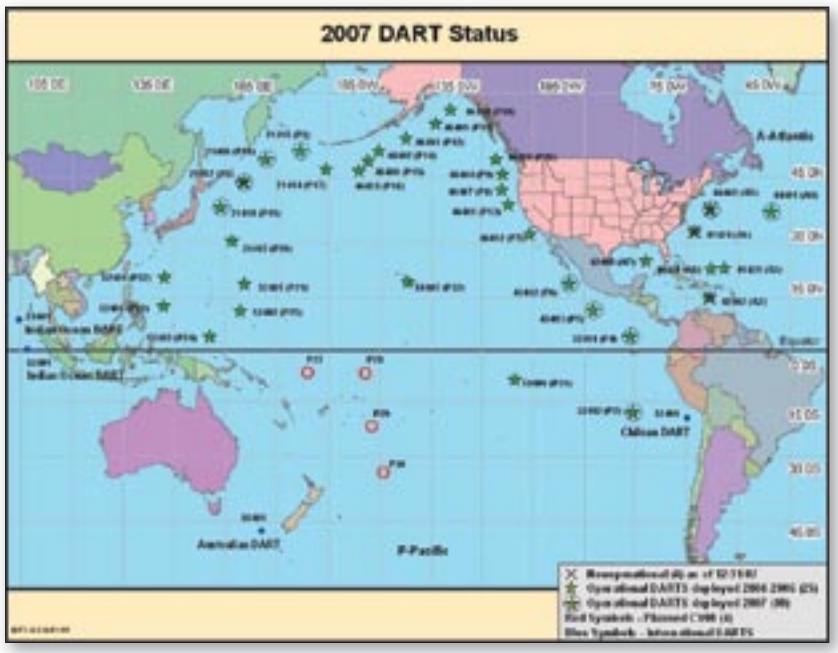
- Develop risk assessments and inundation models to inform the location of lifelines, hospitals, schools, power plants and utilities, fire and police stations, and equipment away from the risk area or harden those structures for adequate protection from the assessed tsunami risk.

GRAND CHALLENGE #5: Assess disaster resilience.

- Develop improved and standardized assessments of societal, economic, and environmental vulnerability to, impacts of, and a more robust response and recovery capacity related to tsunami;
- Develop effective land use plans based on risk assessments and better topographic and bathymetric maps to predict inundation levels and possible effects;
- Improve use of risk assessment tools, mitigation practices, evacuation plans, and timely and accurate warnings to promote risk-wise behavior by decision makers and individuals.

GRAND CHALLENGE #6: Promote risk-wise behavior.

- Increase outreach to all communities at risk to raise awareness, improve preparedness, and encourage the development of tsunami response plans;
- Ensure interoperability between the United States' national system and other regional tsunami warnings systems;
- Provide technical expertise and assistance, as appropriate, to facilitate the development and enhancement of the international tsunami and all-hazard warning systems, including for the Indian Ocean;
- Employ geographically specific communication and dissemination strategies for extended warnings and probabilistic forecasts based on improved social science research into individual response;
- Increase the effectiveness of warnings and evacuations through informed community planning and annual drills.



Key: ■ Short Term Action (1-2 years) ➤ Medium Term Action (2-5 years) ◆ Long Term Effort (5+ years)

Expected Benefits: Creating a More Disaster-Resilient America

Fulfilling this tsunami-specific implementation plan will create a more disaster-resilient America. Specifically:

Relevant hazards are recognized and understood. Coastal communities will be better able to prepare for the tsunami threat by understanding the characteristics of both distant and local tsunami sources and potential tsunami frequency. Continued broad scientific research will increase our understanding of tsunami processes and impacts, and will develop more efficient and effective risk assessment and risk communication prediction, preparedness, mitigation, and warning measures.

Communities at risk know when a hazard event is imminent. More accurate and timely warnings will be disseminated with greater timeliness. Outreach and education will focus on appropriate actions in response to local and distant tsunamis.

Individuals at risk are safe from hazards. Preparedness will be achieved through the increased TsunamiReady communities that have response plans, enhanced communications, and heightened awareness of their citizens. As a result, fewer lives will be lost, economic losses will be less, and recovery periods will be shortened. With a better understanding of the threat and impacts, better, sustained actions can be taken prior to the occurrences of the event.

Disaster-resilient communities experience minimum disruption to life and economy after a hazard event has passed. Due to effective land-use planning, preparedness, and warning, a tsunami could strike and not harm the built environment or cause loss of life.

Acronyms

DART	Deep-ocean Assessment and Report of Tsunamis
IOCARIBE	Intergovernmental Oceanographic sub-commission for the Caribbean

References

1. Sokolowski, Thomas J., "The Great Alaskan Earthquake & Tsunamis of 1964," The West Coast & Alaska Tsunami Warning Center, **http://wcatwc.arh.noaa.gov/64quake.htm**
2. Volcanic and Seismic Hazards on the Island of Hawaii, U.S. Department of the Interior and U.S. Geological Survey, **http://pubs.usgs.gov/gip/hazards/tsunamis.html**