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**2. Hazard Assessment- Inundation maps**

At the close of 1999, all five states are engaged in producing/upgrading tsunami inundation maps. Visit <http://newport.pmel.noaa.gov/time/reports/oct99stat.html> to see the current status of mapping activity. Here is a state by state summary of FY1999 inundation mapping activities.

**Oregon:** (Began in FY1997) The Gold Beach and Warrenton-Astoria inundation simulations were completed. Draft inundation maps are under review with local officials. This brings to five the number of completed Oregon inundation maps (other areas are Siletz Bay, Newport, and Seaside-Gearhardt). The Newport evacuation map was completed and published. In addition, George Priest's publication, "1995 Tsunami Hazard Maps" were used to develop pamphlet-size Tsunami Evacuation Maps for communities where detailed inundation mapping has not yet been completed. Eight such maps were completed for Bandon, Manzanita, Salmon Cove, Cannon Beach, Waldport, Yachats, Lincoln City, and Florence. Nine more of these maps are being developed for Seaside, Warrenton, Astoria, Gearhart, Newport, Reedsport, Gardiner, Winchester Bay and Cannon Beach.

**Washington:** (Began in FY1997) The Gray's Harbor/Willapa Bay/Long Beach inundation simulations were completed. These runs effectively covered the southern half of the Washington Pacific coast, from the community of Long Beach north to Moclips. Draft inundation maps were prepared and provided to Grays Harbor County and Pacific County officials. The draft inundation maps were also presented for discussion at four Southwest Washington Coast Tsunami Information Forums. Preliminary evacuation maps for Grays Harbor and Pacific counties were published by the respective counties.

*(continued, p. 3)*

**1999 Tsunami Program Summary**

by

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As 1999 draws to a close, it is a good time to reflect on our accomplishments for the year. Due to your continued involvement, we have secured funding for the fourth consecutive year. Completion of the original 5 year plan developed in 1996 appears to be within reach. FY2000 is a critical year in completing the intensive phase of the program.

Some highlights that may interest you.

**1. Overall Program**

Our April and October meetings in Eureka, California and Newport, Oregon gave us some feedback on the products of our program. These meetings also included field trips that showed the positive impact our mapping, signage, and educational activities are having on coastal communities. An excellent mitigation summary report was published by Chris Jonientz-Trisler of FEMA. Frank Gonzalez published a tsunami article as the cover story in the May issue of Scientific American that was translated into 7 foreign languages and read by an estimated 6 million people worldwide. His article included extensive information about our program.

The 1999 issues of *TsuInfo Alert* are now on the Internet, at <http://www.wa.gov/dnr/htdocs/ger/tsindex/html>

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WASHINGTON STATE DEPARTMENT OF  
**Natural Resources**  
Jennifer M. Belcher - Commissioner of Public Lands

**California:** (began in FY1998) A preliminary, course grid of the Los Angeles / Long Beach Area was completed and initial inundation model runs were performed. Three arc-second (~90m) computational grids were also constructed for the San Francisco, Santa Barbara, and San Diego areas. Inundation simulations are underway for these areas.

**Alaska:** (began in FY1998) The UAFGI implemented and tested the numerical simulation code. Propagation was tested for the 1964 source scenario. Inundation simulations are now underway for Kodiak, the U.S. Coast Guard Base Kodiak, and Women's Bay.

**Hawaii:** (began in FY1999) Two contracts were awarded for tsunami modeling of distant source scenarios (Kwok Fai Cheung, University of Hawaii) and local source scenarios (Gerard Fryer, University of Hawaii). A third contract will be awarded in the future for the purchase of tsunami coastal recorders.

### 3. Warning System Upgrade

A. Seismic Upgrades- The USGS completed installation of a communications interface (EARTHWORM) at the Pacific Tsunami Warning Center and the Hawaii Volcano Observatory. The interface installation is now complete at both warning centers. Ten new and/or upgraded real time seismic stations were installed in Alaska (4), California (1), Hawaii (3), and Oregon (2). Equipment is in hand to complete the installation of 22 more stations in FY2000 and, if funding continues in FY2001, to complete the installation of 58 new stations as called for in the original plan.

B. Tsunami Detection Buoys - Based on 1998 deployments, the systems were modified by adding a back-up GOES transmitter on each buoy and improving quality control on the welds for the buoy tower. The result of these modifications has yielded an increase in data return. Current return rates vary from from 96% to 99%. Four of these improved systems were deployed in May and October, 1999 off the coast of California and Alaska. All four systems are transmittinf hourly data ( visit <http://www.pmel.noaa.gov/tsunami-hazard/> and click on View Real Time Data). Earthquakes in California and Alaska in the fall of 1999 produced seismic surface waves that triggered two of the four systems into "event mode". The systems worked as designed in both the "tide" and "event" modes. Data are also being received by both warning centers through an independent communication system. These recent engineering improvements mark a major accomplishment in real time, deep ocean tsunami detection and move us one step closer to an operational system.

### 4. Mitigation

A. Mitigation Sub-Committee. Chris Jonientz-Trisler published and distributed an excellent summary of the first

two years mitigation activity in the five states, NOAA, FEMA, and USGS. Brian Atwater, United States Geological Survey (USGS), published and distributed copies of the tsunami educational booklet (USGS Circular 1187) supported by USGS in conjunction with The National Tsunami Hazard Mitigation Program. The booklet, "Surviving a Tsunami--Lessons from Chile, Hawaii, and Japan" contains true stories that illustrate how to survive a tsunami and how not to survive a tsunami. The booklet is an educational tool meant for those who live and work or who visit coastlines that tsunamis may strike. Connie Mason published 12 monthly issues of TsuInfo Alert newsletter that provides information on tsunami material suitable for mitigation. The draft of the Tsunami Warning Systems: Guidance for State and Local Officials was received from Robert Olson Associates, Inc. The Mitigation Guidance document contract has just been let by California and will be completed in FY2000.

All five states are engaged in tsunami mitigation activities

**Washington:** Washington continues work with sign installation and evacuation planning. Over 500 coastal residents attended four Tsunami Public Forums held on Nov 15 - 18, 1999 in Long Beach, Aberdeen, Ocean Shores, and Grays Harbor. The release of the tsunami inundation and evacuation maps was well received as tools for dealing with an actual tsunami event. Channel 7 ( CBS news affiliate) aired a sory about the maps on Nov 16th with no negative impact to the state or national program. We received excellent coverage from the local TV / radio stations, and newspapers. All coverage took a positive approach on personal preparedness and community involvement.

**Oregon:** Oregon continues work on tsunami signage, school evacuation planning, community evacuation brochures, assisting lodging facilities with education and evacuation, marketing of existing products and development of partnerships with ODOT and AAA to expose more people to safety information.

**Hawaii:** Hawaii is continuing work with various projects such as local tsunami modeling, purchase of coastal recorders, production of a state tsunami video, development of a safety brochure and purchase of needed equipment to improve warnings.

**California:** Workshops based on the mitigation guidance document are planned following agency review and approval of the document. The new USGS "Lessons Learned" booklet will be used at the workshops.

**Alaska:** Alaska is installing tsunami signs in their first community with interest from others. Brochures and other educational materials continue to be distributed. Public outreach consisting of presentations to a variety of groups continues. The community needs assessment database is in progress.

## B. Coordination -

A Meeting was held in mid-May in Seattle with the Emergency Managers (EMs) from Washington, Oregon, California, British Columbia, and Alaska as well as most of the Warning Coordination Meteorologists (WCMS) from the West Coast forecast Offices. In addition to briefings on the Warning System and developments at the two Centers an extensive discussion was held on the format of the Watch/Warning message. The input from the EMs and WCMS was very useful. The proposed changes to the format will be distributed for comment in the very near future.

Work continued on the Historical Tsunami Data Base for the U.S. with the "final" DOS version distributed to the

EMs and WCMS at the May meeting in Seattle. The complete set of files for the program are available for downloading at <ftp://ftp.www.nws.noaa.gov/htbd/>

Dissemination of tsunami warnings via NOAA weather radio and EMWIN continue to be emphasized. NOAA weather radio has increased its coverage for coastal communities in Alaska and an increased coverage is also planned in Washington for the very near future.

As you can read, FY1999 was a very productive year. Congratulations on your successes and thank you for your continued effort to minimize the effects of tsunamis along our coastlines. Our cause is worth the effort. I am proud to be a part of this successful partnership and I look forward to working with you in 2000.

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## Tsunami Mitigation Subcommittee Websites

### National

<http://www.pmel.noaa.gov/tsunami-hazard/links.html> (Links of Interest, including most of the Pacific states)  
<http://www.teleport.com/~alany/uscg/home.htm> (Tsunami Messages for Alaska and Hawaii)  
<http://www.pmel.noaa.gov/tsunami-hazard/TsunamiActivitiesBooklet.pdf>

### Alaska

<http://www.ak-prepared.com> (Alaska Division of Emergency Services)

### California

<http://glinda.cnrs.humboldt.edu/earthquakes/shaky2.html> (Living on Shaky Ground)  
<http://www.preparenow.org> (Community Preparedness Website Project)  
<http://www.wrth.noaa.gov/Eureka/eqr/eqr.html> (National Weather Service - Eureka Office)  
<http://glinda.cnrs.humboldt.edu/earthquakes/rctwg/toc> (Redwood Coast Tsunami Work Group)  
<http://www.nws.mbay.net/quake.html> (National Weather Service - San Francisco)  
<http://cowusa.com/crescentcity/tsunamis.htm> (Crescent City)  
[http://quake.crystal.ucsb.edu/ics/sb\\_eqs/1812/tsunami.html](http://quake.crystal.ucsb.edu/ics/sb_eqs/1812/tsunami.html) (1812 Santa Barbara tsunami)  
[http://vishnu.glg.nau.edu/wsspc/tsunami/CA/CA\\_survive.html](http://vishnu.glg.nau.edu/wsspc/tsunami/CA/CA_survive.html) (California State Tsunami Brochure)  
<http://www.usc.edu/dept/tsunamis/> (USC Tsunami Program - Shows an animation of tsunami inundation in southern CA - follow links -tsunami map - California)

### Hawaii

[http://www.pdc.org/pdc/WEB\\_PAGE/HawaiiEvacMaps.html](http://www.pdc.org/pdc/WEB_PAGE/HawaiiEvacMaps.html) (Hawaii County)  
[http://www.pdc.org/pdc/WEB\\_PAGE/OahuEvacMaps.html](http://www.pdc.org/pdc/WEB_PAGE/OahuEvacMaps.html) (Oahu County)  
[http://www.pdc.org/pdc/WEB\\_PAGE/KauaiEvacMaps.html](http://www.pdc.org/pdc/WEB_PAGE/KauaiEvacMaps.html) (Kauai County)  
[http://www.pdc.org/pdc/WEB\\_PAGE/MauiEvacMaps.html](http://www.pdc.org/pdc/WEB_PAGE/MauiEvacMaps.html) (Maui County)  
<http://www.pdc.org/> (Pacific Disaster Center)  
<http://www.tsunami.org/> (Pacific Tsunami Museum)

### Oregon

[http://www.osp.state.or.us/oem/oem\\_home.htm](http://www.osp.state.or.us/oem/oem_home.htm) (Oregon Emergency Management)  
<http://sarvis.dogami.state.or.us/store/press/96111-rel.htm> (Tsunami inundation maps info)

### Washington

<http://www.wa.gov/dnr/htdocs/ger/tsindex/html>  
<http://www.wa.gov/clallam/ccemd/tsunami/index.html> (Clallam County)  
<http://www.techline.com/~ghdem/> (Grays Harbor Dept. of Emergency Management)  
<http://www.willapabay.org/~pcema/> (Pacific County Emergency Management Agency)  
<http://www.willapabay.org/~pcema/tsunami/> (Pacific County E.M.A. tsunami page)  
<http://www.wa.gov/mil/wsem/> (Washington State Emergency Management Division, with a link to animated inundation maps)

## FY2000 Tsunami Program Activity Plan

by

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This FY2000 activity plan shows how funds are distributed in the program and what will be accomplished. NOAA will levy some taxes in addition to the 0.38% across the board reduction, so I am not exactly sure how much we will get at this time. The FY2000 program is funded at \$2,300,000 less taxes.

In FY2000 the Tsunami Hazard Mitigation Program will continue to complete hazard assessment, warning guidance, and mitigation activities identified in the 1996 Implementation Plan. Because of a reduced budget in year two (FY1998) of the program, FY2000 funding will be used to complete activities identified in year 3 of the original plan. The Plan can be found at <http://www.pmel.noaa.gov/~bernard/contents.html>. The following activities are organized into hazard assessment, warning guidance, and mitigation to track with the original implementation plan.

### **I. Tsunami Inundation Mapping-** (\$400,000 - taxes)

#### **A. TIME Center-** (\$200,000-taxes)

Dr. Vasily Titov has agreed to serve as Co-Director (with Frank Gonzalez) of the TIME Center, which will be relocated to Seattle on 7 January 2000. Dr. Titov is an internationally respected tsunami scientist, with extensive experience in numerical modeling. In addition to serving as Co-Director of the TIME Center, Dr. Titov will continue his closely related research into short-term tsunami inundation forecasting - i.e., the development of a methodology to provide site-specific forecasts of tsunami inundation in real-time during an actual event.

#### **B. Individual state activities-** (\$200,000- taxes) divided equally among 5 states

##### **Oregon** (started in FY1997)

###### 1. Complete Gold Beach work:

-- TIME is in the process of running models to resolve numerical problems in the Hunter Creek area.

-- Publish Inundation Map

###### 2. Continue work in Coos Bay

-- Gather data: TIME and OGI are checking on availability of bathymetry data in the area. DOGAMI has put out a request for bids for aerial photogrammetry and development of a digital elevation model (DEM) of the area.

-- Modeling: OGI has been awarded the modeling contract (5 May 99); contract duration is approximately one year.

3. Continue working with communities to produce evacuation maps

4. Begin inundation mapping in additional communities  
If funding and resources are available, Oregon has identified a list of priority communities (see Progress Report) for future work.

##### **Washington** (started in FY1997)

1. Complete small-scale (1:100,000) Inundation maps for Gray's Harbor County and Pacific County. Maps will be produced on an 'as needed' basis by WA DNR.

2. Hold a series of community workshops to explain the inundation products.

3. Work with communities to develop evacuation maps

4. Continue work in Port Angeles / Port Townsend

-- Gather data: TIME and OGI are checking on availability of bathymetry data in the area. It appears additional bathymetry data will be needed.

-- Modeling: OGI has been awarded the modeling contract (5 May 99); contract duration is approximately one year.

##### **California** (started in FY1998)

1. Complete work in progress San Francisco, Santa Barbara, Los Angeles / Long Beach, and San Diego areas. The following schedule is proposed:

-- USC provides OES beta version of Santa Barbara results by 30 October 99.

-- OES produces beta versions of Santa Barbara inundation maps by 30 November 99

-- NOAA, OES, USC (and others?) agree on worst case scenario event by 31 December 99.

-- TIME provides USC final bathymetry and topography grids by 28 February 2000

-- USC provides OES beta version of San Francisco, L.A., and San Diego results by 28 February 2000.

-- USC completes mapping effort by ground truth surveys by 31 May 2000.

-- USC provides OES final versions of all maps by 30 June 2000.

2. Time and resources permitting, begin follow-up study in Eureka and Crescent City.

## **Alaska**

1. Complete work in progress City of Kodiak , USCG Base, and Womens Bay. Further refine numerical grid for inundation. Transfer model result by 1 December 1999 to Alaska DNR, DGGS for map production

2. Produce inundation maps for additional communities. ADES will refine the 'short list' of communities for future work. Future work will be supported by the Alaska Science and Technology Foundation (ASTF). TIME will assess availability of bathymetry and topography data for future work.

## **Hawaii**

1. Continue work just beginning:

-- Distant Tsunami Modeling -- contract awarded to University of Hawaii (UH) team led by Dr. Kwok Fai Cheung  
-- Local Tsunami Modeling -- contract awarded to University of Hawaii and Applied Fluids Engineering. Principal Investigator is Dr. Gerard Fryer

2. Update evacuation routes as new modeling data becomes available.

## **II. Warning guidance upgrades (\$1,500,000 - taxes)**

### **A. Seismic- (\$800,000 - taxes)**

The USGS will ultimately install ~58 stations. Fourteen are currently installed. By end of FY2000 we should have more than 40 stations installed, and depending on the delivery of equipment, the remaining 18 or so instruments by end of 2001.

The distribution of instruments is roughly as follows:  
The final distribution may change slightly.

AK - 22 (3 at ATWC, 19 at UAF)

CA - 9 (NCSN)

OR - 12 (3 by NCSN, 8 by UW)

WA - 12 (UW)

HI - 3 (HVO)

### **B. Tsunami Detection Buoys - (\$700,000 - taxes)**

1. NOAA will build four moorings to be deployed in the following areas

a. Maintain the 2 existing AASZ stations at 165W and 157W

b. Add a third AASZ station at 175-180W

c. Add a CSZ station off the west coast

2. Data handling software for tide and event modes will be tested and debugged at ATWC, PTWC, and PMEL.

## **III. Mitigation (\$400,000 - taxes)**

### **A. Mitigation Sub-committee activities (\$400,000 - taxes)**

1. TsuInfo Newsletter \* will be distributed every two months beginning in January. Improvements include providing a PDF version and more State involvement by all to provide material on State activities and names of appropriate recipients including the Natural Hazards Center. This should serve as a good network tool for locals remembering that many locals will not have access to the internet version. PMEL web will point interested subscribers to subscription info. States should provide "breaking news/events" to Connie and encourage locals to submit material.

2. Multistate Warning Systems Workshop \* will be planned to Train the Trainers at the local level in each State by working with leaders among them to develop a document that will serve as NTHMP recommendations on successful and consistent local warning systems. The Olson document will serve as a beginning point for this activity. NOAA will receive Subcommittee funds to provide travel for local leaders chosen from each state who will serve as speakers and participants. This workshop and resultant NTHMP recommendation document is the next step in the Warning System Project and moves toward implementation of the material. The step after this workshop is a series of individual workshops in each state to promote implementation of the NTHMP recommendations.

3. Five State Mitigation Programs are equally funded at \$58,200 for total of \$291,000.

### **B. Coordination- (NOAA and States in kind contribution)**

The NWS facility modernization program will start on a new building at the same location for the WC/ATWC this year. NWS is in the final states of the installation of the NOAA Weather Radio at Dutch Harbor. Part of the FY 2000 Operations Plan for the State of Alaska is a proposal to establish a tsunami-wise community. This would be based on the existing storm-wise community model. Work will continue on the Historical Tsunami Data Base for the U.S.

## Tsunami Program News

### Appropriations Bills Passed and Signed

from: Disaster Research 309, December 16, 1999  
hazctr@spot.Colorado.EDU

Public Law 106-74, which appropriates funds for the operation of the Federal Emergency Management Agency (FEMA), has been signed. In this, FEMA received:

- \$300 million for emergency management planning and assistance under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, including:
- \$2.48 billion for disaster relief;
- \$1.3 million for the disaster assistance direct loan program
- \$267 million for the National Flood Insurance Act of 1968, the Flood Disaster Protection Act of 1973, the Stafford Act, the Earthquake Hazards Reduction Act, and other emergency planning and assistance programs, including the provision to states by the FEMA director of multihazard preparedness and mitigation grants;
- \$110 million for the emergency food and shelter program.

Public Law 106-79, the "Department of Defense Appropriations Act, 2000," provides:

- unspecified funds for the Pacific Disaster Center to carry out disaster information management and related support of a global disaster information network;
- \$5 million to the American Red Cross for Armed Forces Emergency Services; and
- unspecified funds for the Center of Excellence for Disaster Management and Humanitarian Assistance for education and training for appropriate military and civilian personnel of foreign countries.

For the complete text of these public laws, contact any federal repository library or access the Library of Congress via the World Wide Web: <http://thomas.loc.gov>.

### Tsunami Test Buoy Reacts to California Earthquake

A tsunami alert test buoy floating in the Pacific Ocean off of the coast of Monterey, Calif., reacted to an Oct. 16 Southern California earthquake. The buoy, deployed May 11, 1999, is one in a series deployed by the National Oceanic and Atmospheric Administration to provide early warning of tsunamis.

"Although there was no tsunami produced by the 7.0 earthquake, it did trigger the buoy and gave us an unexpected test of the system," said Eddie Bernard, director of NOAA's Pacific Marine Environmental Laboratory in Seattle, Wash. "The buoy system performed as designed."

The buoy's seafloor sensor was lifted by seismic waves from the earthquake, creating an amplified pressure change.

The buoys are part of the Deep Ocean Assessment and Reporting of Tsunamis program (DART), designed to provide as much warning as possible. The two warning centers, one each in Hawaii and Alaska, did not receive the data from the test buoy as they are in the process of

installing the necessary software, so no warning action was taken. The data are available on the PMEL Web site at <http://www.pmel.noaa.gov/tsunami-hazard/>

### The Tsunami Bulletin Board

from: Disaster Research 226, June 20, 1997;  
and personal communication from Mike Blackford, Director of ITIC

The Tsunami Bulletin Board (TBB) is an e-mail discussion list for tsunami researchers. It was created following the Nicaragua tsunami of 1992 by the Pacific Marine Environmental Laboratory (PMEL) to disseminate news and information on tsunami events, to serve as a forum for discussion and ideas on tsunami research, and to encourage and facilitate data sharing. After more than four years at PMEL, the TBB has been turned over to the International Tsunami Information Center (ITIC). To subscribe to the TBB, send an e-mail message to [listserv@itic.noaa.gov](mailto:listserv@itic.noaa.gov) with "Subscribe Tsunami" as the body of the message. Subsequently, the ITIC Director will contact you for additional information. Note that the TBB is primarily for persons or offices actively involved in tsunami research; however, ITIC will consider subscriptions for a broader group of interested individuals, especially emergency managers and others having a need for timely information on the status of potential or actual tsunamis, on a case by case basis. For more information, contact ITIC, 737 Bishop Street, Suite 2200, Honolulu, HI 96813-3213; (808) 532-6422; fax: (808) 532-5576; e-mail: [itic@itic.oaa.gov](mailto:itic@itic.oaa.gov)

Currently, this network is being used by some 150 tsunami researchers and practitioners in 15 countries to share the data and information of recent tsunamigenic events. (from: <http://omzg.sccc.ru/tsulab/IUGGTCrep99.html> (12-17-1999))

The Disaster Center Bulletin Board Directory (<http://www.disastercenter.com/bulletin.htm>) provides links to state disaster bulletin boards and bulletin boards for specific types of disasters. All five states have links; and there is a link to a Tsunami Bulletin Board, as well as several for earthquakes.

### Cascadia quakes--A tricentennial exposition:

#### The Burke Museum, Seattle, Washington, Jan. 26, 2000

By studying tsunami deposits and other coastal features, researchers knew that the most recent Great Earthquake on the Cascadia subduction zone had occurred between 320 and 280 years ago. A more precise date for that event had eluded them until an "orphan tsunami" on the east coast of Japan was identified by a Japanese historian, Dr. Kazue Ueda, and further clarified by Japanese seismologists. That tsunami struck in the morning hours of January 27, 1700. By calculating the tsunami's travel time across the Pacific, we can now confidently say that the most



recent Cascadia subduction zone earthquake occurred at about 9 pm, January 26, 1700.

To commemorate the 300-year anniversary of that event, a reception was held January 26, 2000 at the Burke Museum at the University of Washington in Seattle. Certificates of appreciation, signed by governor Gary Locke, were presented to the Japanese researchers for their significant contributions to understanding our geologic hazards. Scientists displayed dozens of posters about earthquakes and tsunamis in the Northwest, including many from participants in the National Tsunami Hazard Mitigation Program. The event had been announced in the Seattle Times and on various radio and television stations and was attended by about 300 people.

### Posters presented

- Bernard, E. N.; Gonzalez, F. I.; Milburn, H. B., National Tsunami Hazard Mitigation Program.
- Crawford, George, Washington State's strategy for tsunami mitigation and public awareness.
- Freitag, Bob; Westerlund, Frank; Willis, Robert, Institute for Hazard Mitigation Planning and Research.
- Gonzalez, F. I.; Bernard, E. N.; Milburn, H. B.; Stalin, S.; Titov, V. V.; Moffeld, H. O.; Eble, M. C.; Newman, J. C.; Kamphaus, R. A.; Harren, C. L., An integrated approach to improving tsunami warning and mitigation.
- Gonzalez, F. I.; Titov, V. V.; Kamphaus, R. A., Center for Tsunami Inundation Mapping Efforts.
- Kirby, S. H.; Creager, K. C.; Crosson, R. S.; Preston, Leigh, Large earthquakes under our feet and deep beneath the Puget Lowland and Georgia Strait--How often do they occur, how big can they get and what are their effects?
- Ludwin, R. S.; Barnett, Elizabeth, Evidence of Cascadia subduction zone quakes in archaeology and Indian lore.
- Malone, S. D., Early warning and rapid notification of the next great Cascadia earthquake.
- Manson, C. J., The TsuInfo system--The information delivery component of the National Tsunami Hazard Mitigation Program.
- Pearce, Ines, Seattle Project Impact--Three programs for a safer community.
- Perkins, W. J., Designing Safeco Field for earthquake-induced geologic hazards.
- Qamar, A.I., What can GPS satellite technology tell us about earthquake risk?
- Reinhart, M. A.; Bourgeois, Joanne, Pre-historic tsunami deposit? How can you tell?
- Steele, W. P.; Ludwin, R. S., The Pacific Northwest Seismograph Network. p. 10.
- Thomas, G. C., Strong motion in the Pacific Northwest.
- Ueda, Kazue; Musumi, Satoko, Cascadia detective story.
- Walsh, T. J., Some effects of intraslab earthquakes in western Washington.
- Walsh, T.J.; Caruthers, C. O.; Myers, E. P., III; Baptista, A.M.; Erdakos, Garnet; Kamphaus, R. A., Tsunami hazard map of the southern Washington coast--Modeled tsunami inundation from a Cascadia subduction zone earthquake.
- Wells, R. E.; Blakely, R. J.; Weaver, C. S., Tectonic plates, microplates, and earthquakes in Cascadia.
- Yamaguchi, D. K.; Atwater, B. F., Tsunami stones on Beacon Hill--How a rice-straw ruse saved a village in Japan and brought "tsunami" into the English language.
- Yamaguchi, D. K.; Benson, B. E.; Wegmann, K. W.; Shulene, J. A., Dating the quake.

## Other Tsunami News

### FEMA Disaster Mitigation Webcourse

FEMA is now offering an independent study course for home and small business owners on how to reduce losses from natural disasters. The course "Mitigation for Homeowners" (IS 394) is free and can be downloaded from the FEMA website at <http://www.fema.gov/home/EMI/ishome.htm> or <http://www.fema.gov/emi/is394.htm>. The course is intended to help residents:

- Identify the natural hazards affecting their community
- Determine which natural hazards are most likely to affect them personally
- Locate specific risks unique to their particular home or business
- Formulate a targeted plan of action to reduce risks to their property, family, and home.

The course provides nontechnical mitigation techniques for the home or small business - both pre-disaster (preventive) and post-disaster (corrective). In addition to signing up through the Web site, individuals and groups can also enroll by contacting the National Emergency Training Center, 16825 South Seton Avenue, Emmitsburg, MD 21727; (301) 447-1076. EMI's independent study Web page: <http://www.fema.gov/home/EMI/ishome.htm> offers numerous other independent study courses for emergency managers.

### Model Mitigation Plans from MCEER

The Multidisciplinary Center for Earthquake Engineering Research (MCEER) Information Service recently added model mitigation plans to their library at the State University of New York at Buffalo. These plans, from various states and communities across the nation, can serve as models to plan disaster resistant communities, to design postdisaster recovery and for reconstruction efforts. To borrow those or for additional information contact Laura Taddeo, (716) 645-3377; e-mail: [ltaddeo@acsu.buffalo.edu](mailto:ltaddeo@acsu.buffalo.edu).

### FEMA and the Joint Center for Sustainable Communities

On December 13, during the Second Annual Project Impact Summit in Washington, D.C., the Federal Emergency Management Agency's Project Impact and the Joint Center for Sustainable Communities (JCSC - an alliance between the National Association of Counties and the U.S. Conference of Mayors) signed a national partnership agreement. The partnership provides one more means for local governments to implement Project Impact in their communities. Project Impact: Building Disaster Resistant Communities is a nationwide initiative to promote local, sustainable mitigation as a key means for lessening the toll brought on by disaster.

Under the FEMA/JCSC partnership, the JCSC will create opportunities for Project Impact officials to



participate in national and regional events and interact with mayors and county officials. The agreement will allow the JCSC to use Project Impact tools and products and share them with local government officials nationwide. JCSC will encourage county officials and mayors to participate in Project Impact's training courses to learn the skills needed to prevent the devastation wrought by disasters.

The JCSC works to promote sustainable communities that incorporate economic development, environmental stewardship, and social well being through county/city collaborations and by helping counties find local solutions to local problems. In addition, JCSC also provides technical assistance, sponsors workshops at regional and national conferences, and maintains an information clearinghouse of state-of-the-practice information on strategies that promote sustainable communities.

### **"Project Impact Summit" Summary is on the Net**

Highlights from the recent "Project Impact Summit" held in Washington, D.C. are now available from the FEMA Web site <http://www.fema.gov/impact>. Included are numerous "lessons learned" recounted at that conference.

### **Natural Disaster Information Cards**

Of particular note is a recently released "Natural Disaster Information Cards (NDIC) System for 911 Dispatchers." The entire system is provided in downloadable PDF format. The cards are intended to be used for in-service training of 911 dispatchers, as refresher information on days when an event is anticipated, and as real-time guidance for use during an event. Those are available at [http://www.ci.fort-collins.co.us/c\\_safety/oem/ndic.htm](http://www.ci.fort-collins.co.us/c_safety/oem/ndic.htm)

These cards do not include tsunami information, but they do provide a template for creating cards to be used in any community for any type of disaster.

### **IUGG Tsunami Commission Activities Report**

The IUGG Tsunami Commission Activities Report 1995-1999 is available online at (<http://omzg.sssc.ru/tsulab/IUGGTCrep99.html>). It includes:

- upgrading the status of the Commission;
- sponsoring tsunami related meeting, conferences and workshops;
- published proceedings, reports and scientific articles;
- coordinating the tsunami related research projects;
- coordinating the Field Tsunami Surveys;
- supporting information exchange through electronic Tsunami Bulletin Board and dedicated Web sites.

### **Institute for Hazard Mitigation Planning and Research**

An Institute for Hazard Mitigation Planning and Research has been established in the College of Architecture and Urban Planning at the University of Washington. The institute is providing research, mitigation planning courses, and community outreach opportunities for graduate

and undergraduate students and faculty from a variety of disciplines. Through the Department of Urban Design and Planning's Masters in Urban Planning program the Institute currently offers an area of emphasis in mitigation planning and has plans to offer a certificate program during the coming year.

Institute research has already explored a wide variety of subjects, including geographic information systems, remote sensing, pre-event planning, and homeowners' attitudes toward structural retrofitting. Outreach opportunities will become available through intern positions in local government emergency management offices and through local disaster operations as they occur.

For further information about the University of Washington's new Institute for Hazard Mitigation Planning and Research contact Bob Freitag, e-mail: [bfreitag@u.washington.edu](mailto:bfreitag@u.washington.edu); or visit the institute's Web site: <http://depts.washington.edu/mitigate>.

### **Emergency Management Courses Available from FEMA/EMI**

The Federal Emergency Management Agency's Emergency Management Institute (FEMA/EMI) offers numerous courses that can be taken individually through its Independent Study Program. Interested persons can view course descriptions, download materials, and register via the EMI Independent Study Web page (<http://www.fema.gov/home/emi/ishome.htm>). Alternatively, one can contact FEMA, Emergency Management Institute, Independent Study Program, 16825 South Seton Avenue, Emmitsburg, MD 21727-8998; (301) 447-1000. A few of the courses currently offered include IS-393 Introduction to Mitigation; IS-1 Emergency Program Management - An Orientation to the Position; IS-120 An Orientation to Community Disaster Exercises; and IS-7 A Citizen's Guide to Disaster Assistance.

EMI also provides disaster management education on-site at the EMI campus in Emmitsburg, Maryland. EMI's schedule of resident courses through September 30, 2000, is available on-line from <http://www.fema.gov/EMI/rclist2000.htm>, or by writing the address above.

### **Red Rocks CC Offers Emergency Management Education On-Line**

As society's exposure to hazards increases and as emergency management career opportunities increase in parallel, the professional emergency manager must master new and increasingly complex disaster management functions. To do this, continuing education is essential. Recognizing this need, the faculty at Red Rocks Community College in Lakewood, Colorado, have developed a program to serve the many prospective students who, for a variety of reasons, are unable to attend traditional classes. They have developed an Internet program exclusively for emergency management personnel.

Students taking the Red Rocks' on-line courses can meet professional requirements or achieve an Associate of Applied Science Degree in Emergency Management and Planning or an Emergency Management Certificate. The program includes all seven courses required for the Federal Emergency Management Agency (FEMA) Professional Development Series Certificate.

The 60-credit-hour associate degree is geared toward new entrants into the emergency management field, while the certificate program, requiring 30 credit hours, is for current practitioners wanting to upgrade their skills. Being on the Internet, the courses are available to students anywhere.

Students interested in the Red Rocks Emergency Management distance learning courses can access a complete list of offerings and register for courses via the World Wide web at:

<http://www.cconline.org/catalog/index.cfm>.

Students can also register for courses by calling (303) 914-6360. The first session of the spring semester starts

### The EENET Schedule for January-April 2000

The Federal Emergency Management Agency's Emergency Education Network (EENET) broadcasts programs on various aspects of emergency management via satellite. Additional broadcasts will be added to the schedule. For the most current listing of programs and satellite information, check EENET's Web Page: <http://www.fema.gov/emi/eenet.htm>.

The upcoming programs include:

January 5	2:00-3:30 pm	Classroom Connection - "Community Emergency Response Team (C.E.R.T.) Training"
January 12	2:00-4:00 pm	Disaster Resistant Homes
January 19	2:00-3:30 pm	National Alert Broadcast (FEMA's monthly video magazine on emergency management activities and issues)
January 26	2:00-4:00 pm	Gems from EENET, "Recruiting and Retaining Volunteers: Preserving A National Resource"
February 2	2:00-3:00 pm	Special Y2K Wrap-up
February 9	2:00-4:00 pm	Exercising
February 16	2:00-3:00 pm	National Alert Broadcast
February 23	2:00-4:00 pm	Gems from EENET - "Even The Smallest Community Can Manage Fire Prevention"
March 1	2:00-3:00 pm	Learning Again - "Safe Room"
March 8	2:00-4:00 pm	A Case Study of Critical Incident Stress Management
March 15	2:00-3:00 pm	National Alert Broadcast
March 22	2:00-4:00 pm	National Fire Information Council - Part I
March 29	2:00-3:00 pm	"Around the Table" in Emmitsburg (A new series of programs that brings together the talents of the staff, faculty, and students at the National Emergency Training Center)
April 5	2:00-3:00 pm	Learning Again - program TBA
April 12	2:00-4:00 pm	National Fire Information Council - Part II
April 19	2:00-3:00 pm	National Alert Broadcast
April 26	1:30-4:00 pm	Living with Grief: Children, Adolescents, and Loss

The programs will be aired on these satellites:

C-Band	Ku-Band
Galaxy 6	SBS 6
Transponder 24	Transponder 4
Downlink Freq: 4180 MHz	Downlink Freq: 11798.5 MHz
Audio Freq: 6.2/6.8 MHz	Audio Freq: 6.2/6.8 MHz
Location: 99( West	Location: 74( West
Polarity: Vertical	Polarity: Vertical

January 25, 2000, and the second session begins on February 29, 2000. To receive more information, including a comprehensive brochure, call (303) 914-6462; e-mail: [EMP@rrcc.ccooes.edu](mailto:EMP@rrcc.ccooes.edu); or fax: (303) 914-6803.

*from:* Disaster Research 312, January 19, 2000

### Workshop Scheduled

A workshop, "Prediction of Underwater Landslide and Slump Occurrence and Tsunami Hazards off of Southern California", sponsored by the National Science Foundation, will be held in Los Angeles, March 10-11, 2000. Contact: Philip Watts, Applied Fluids Engineering, Private Mail Box #237, 5710 East 7th Street, Long Beach, CA 90803; tel/fax: (562) 498-9407; e-mail: [phil.watts@appliedfluids.com](mailto:phil.watts@appliedfluids.com); <http://rccg03.usc.edu/la2000/>.

### NOAA web posting

NOAA's tsunami emergency news and notes is available at (<http://www.disastercenter.com/tsunami.hts>)

# New Tsunami Mitigation Materials

## Added to the Division of Geology and Earth Resources Library

compiled by

Connie J. Manson

**Note: Free reprints of these materials are available. (See page 2 for ordering information)**

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### Oregon and Washington (the central Cascadia region)

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*Editor's note:* The National Tsunami Hazard Mitigation Program participants' directory is now available in print. Contact Connie Manson or Lee Walkling for copies (see page 2 for ordering information).

However, privacy is a concern. Now that the *TsuInfo Alert* issues are on the web, your local address and contact information are available to one and all. Please contact us if you'd prefer some of that information withheld from the online issues.

### **New Program Participants**

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## STATE EMERGENCY MANAGEMENT OFFICES

For general emergency management information, contact:

**Alaska** Division of Emergency Services  
Department of Military & Veterans Affairs  
P.O. Box 5750  
Fort Richardson, Alaska 99505-5750  
(907) 428-7039  
Fax (907) 428-7009  
<http://www.ak-prepared.com/>

**California** Office of Emergency Services  
2800 Meadowview Road  
Sacramento, California 95832  
(916) 262-1816  
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<http://www.oes.ca.gov/>

**Hawaii** State Civil Defense  
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**Washington** State Military Department  
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## Video reservations

Place a check mark ( ) beside the video(s) you want to reserve; write the date of the program behind the title.  
Mail to TsuInfo Alert Video Reservations, Lee Walkling, Division of Geology and Earth Resources Library, PO Box 47007, Olympia, WA 98504-7007; or email lee.walkling@wadnr.gov

\_\_\_ **Adventures of Disaster Dudes** (14 min.)  
Preparedness for pre-teens

\_\_\_ **The Alaska Earthquake, 1964** (20 min.)  
Includes data on the tsunamis generated by that event

\_\_\_ **Cannon Beach Fire District Community Warning System (COWS)** (21 min.)  
Explains why Cannon Beach chose their particular system

\_\_\_ **Disasters are Preventable** (22 min.)  
Ways to reduce losses from various kinds of disasters through preparedness and prevention.

\_\_\_ **Killer Wave: Power of the Tsunami** (60 min.)  
National Geographic video.

\_\_\_ **The Prediction Problem** (58 min.)  
Episode 3 of the PBS series "Fire on the Rim." Explores earthquakes and tsunamis around the Pacific Rim.

\_\_\_ **The Quake Hunters** (45 min.)  
A good mystery story, explaining how a 300-year old Cascadia earthquake was finally dated by finding records in Japan about a rogue tsunami in January 1700.

\_\_\_ **The Restless Planet** (60 min.)  
An episode of "Savage Earth" series. About earthquakes, with examples from Japan,

Mexico, and the 1989 Loma Prieta earthquake in California.

\_\_\_ **Tsunami and Earthquake Video** (60 min.)  
Includes "Tsunami: How Occur, How Protect," "Learning from Earthquakes," and "Computer modeling of alternative source scenarios."

\_\_\_ **Tsunami: Surviving the Killer Waves** (13 min.)  
Two version...one with breaks inserted for discussion time.

\_\_\_ **Understanding Volcanic Hazards** (25 min.)  
Includes information about volcano-induced tsunamis and landslides.

\_\_\_ **The Wave: a Japanese Folktale** (9 min.)  
Animated film to help start discussions of tsunami preparedness for children.

\_\_\_ **Waves of Destruction** (60 min.)  
An episode of the "Savage Earth" series. Tsunamis around the Pacific Rim.

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## **Infrequently Asked Questions**

compiled by  
Lee Walkling

### **Regarding tsunamis, what is a bore?**

"The popular image of a tsunami wave approaching shore is that of a nearly vertical wall of water, similar to the front of a wave breaking in the surf. In actuality, most tsunamis probably do not form such wave fronts; instead the water surface is very close to horizontal and it moves up and down. Under certain circumstances, however, an arriving tsunami wave can develop an abrupt, steep front, which will move inland at high speeds. This phenomenon, generally encountered under other circumstances only as a tidal phenomenon, it is known as a bore. ... The relationship of wave speed to water depth...can cause such a bore to be formed. "

*from: Tsunami!, by Walter C. Dudley and Min Lee, 1988, University of Hawaii Press, p. 38.*

"The most vulnerable coastlines for tsunami are along gulfs, bays, and estuaries. In these funnel-shaped inlets a tsunami can be amplified into a water bore---a vast wall of seawater weighing millions of tons that crashes inland with destructive power almost beyond belief."

*from: Earth's Fury, An Introduction to Natural Hazards and Disasters, by Robert L. Kovach, 1995, Prentice Hall, p. 123.*

### **What is a storm surge, as opposed to a tsunami?**

A storm surge is a rise of sea elevation caused by water piling up against a coast under the force of strong onshore winds such as those accompanying a hurricane or other intense storm; reduced atmospheric pressure may contribute to the rise.

*from: Coastal Zone Management Handbook, by John R. Clark, 1996; Lewis Publishers, p. 658.*

### **Is the shape of a coastline an important factor for assessing potential damage from waves?**

"A coastline's shape influences the 'angle of attack' of a water wave. Where there is a headland or promontory, wave refraction focuses on this land extension and away from the broader adjacent coastline, producing more forceful waves. Narrow channels also focus waves. In both cases, the angle of attack is greatly accentuated when there are storm waves, so damage is likely to be much higher than at coastlines whose contours are more even."

*from: Earth's Fury, An Introduction to Natural Hazards and Disasters, by Robert L. Kovach, 1995, Prentice Hall, p. 203.*





WASHINGTON STATE DEPARTMENT OF  
**Natural Resources**  
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