Communications Systems Used in the USA TARNS

Chris Hill, 
Meteorologist in Charge (ret) 
National Weather Service 
Seattle, Washington, USA
Washington Faces Many Non-Weather Hazards

- Earthquakes
- Tsunamis
- Terrorism
- Major Chemical Spills
Subduction Zone Comparison

The 2004 Indonesia Earthquake

Plate Tectonic Setting:
Subduction Zone: Indian plate subducting beneath the Burma plate
Rate: ~ 5 cm/year
Dip of interface: ~ 10°

December 26, 2004
Magnitude: 9.0
Rupture length: 1200 km
Rupture width: 100 km

Past earthquake history:
Most Recent Great Earthquake before present: 1833 Magnitude 8.8 – 9.2
Approximate recurrence: 225 years

Indian plate

Tsunami characteristics:
(extrapolated from media accounts)
Peak tsunami height at the near-source region ~30 feet in Indonesia
Peak tsunami height in Somalia (~8 hours travel time and 3300 miles away) ~10 feet
Affecting the entire Indian Ocean

Selected references:
Sach, K. and others, 2004 Fall AGU abstracts T12B-04, PA23A-1444
http://www.pmel.noaa.gov/tsunami/indo_1204.htm

The Cascadia Subduction Zone

Plate Tectonic Setting:
Subduction Zone: Juan de Fuca and Gorda plates subducting beneath the North American plate
Rate: ~ 3 cm/year
Dip of interface: ~ 12°

Past earthquake history:
Most Recent Great Earthquake 1700 Magnitude ~9.0
Approximate recurrence 500 years

North American plate

Juan de Fuca plate

Tsunami characteristics (approximate estimates from Native American oral history and written records in Japan)
Peak tsunami height in the near-source region ~60 feet at the mouth of Redwood Creek, northern California from Yurok stories
Peak tsunami height in Japan (9 hours travel time and 3900 miles away) ~15 feet

Selected references:
Armstrong, B. F. and others, 1995, Earthquake Spectra, v. 11, 1. p 1-10

Approximate rupture zone of the last great Cascadia earthquake in 1700 shown in red.

Information compiled by Lori Dengler, Humboldt State University 1/07/05. Base image from the Jules Verne Voyager project: http://jules.unavco.org/
National Weather Service Mission

Serving America Since 1870

Provide Weather, Hydrologic, and Climate Forecasts and Warnings for the United States, its Territories, Adjacent Waters and Ocean Areas, for the Protection of Life and Property and Enhancement of the National Economy.
To maximize the number of people who take appropriate and timely action to minimize injury, death, and property damage due to hazardous weather and flooding.
The Warning System

- Detection / Warning
- Dissemination
- Response
The Weather Warning Partnership:

- National Weather Service
- Public
- News Media & Private Sector Meteorologists
- Emergency Management

In Washington during the 1990s:
- Nearly 100 Fatalities,
- Hundreds Injured,
- Over $1 Billion in Property Damage
The Tsunami Warning System

Major Undersea Earthquake/Landslide (magnitude 7.0 or greater)

Seismic Measuring Equipment

Tide – Sea-Level Instruments

NOAA Tsunami Detection Buoys

Tsunami Warning Centers
  - West Coast/Alaska (Palmer, AK)
  - Pacific (Ewa Beach, HI)

Issue Tsunami Warning for Areas Close to Earthquake

(Only for Locations Close to Earthquake)

Tsunami Generated?

Yes

Continue/Expand Tsunami Information Bulletins, Tsunami Advisories, Watches and Warnings for Respective Areas

National Weather Service Coastal Offices activate EAS for Tsunami Watches and Warnings via NOAA Weather Radio

Those with NOAA Weather Radio Receivers (homes, businesses, schools, etc)

All-Hazard Alert Broadcast (AHABs)

General Public

No

Tsunami Information Bulletin – No Tsunami Generated, Cancel Tsunami Warning for Areas Close to Earthquake

State and Local Emergency Management Officials

Activate EAS for Evacuation of Low-Lying Coastal Areas

TV, Radio, Cable TV

Weather Radio Receiver
Dissemination Methods

- **NOAA Weather Radio** – radio broadcast
- **EMWIN** – satellite/radio
- **NOAA Weather Wire** – satellite/land lines
- **RANET** – radio internet
NOAA Weather Radio

A Life Saver for the Cost of a Pair of Shoes

Direct from the NWS 24 hours a day

Latest Area Forecasts and Conditions
NOAA Weather Radio
A Life Saver for the Cost of a Pair of Shoes

Over 900 Stations Across the U.S.

21 Stations Serve Washington
NOAA Weather Radio
A Life Saver for the Cost of a Pair of Shoes
Has a **Warning Alarm Feature**
NOAA Weather Radio
A Life Saver for the Cost of a Pair of Shoes

Key Element in Emergency Alert System (EAS)

“All-Hazards” Warning System
NOAA Weather Radio
A Life Saver for the Cost of a Pair of Shoes

 Receivers Available at Most Radio Electronic Retailers and via the Internet
Not All Weather Radios Receivers Are Alike

Key Features To Have
- Warning Alarm
- SAME (Specific Area Message Encoding)
- Event Selection
- External Antenna Jack
- Others

Best Reception
Programming Capabilities and Ease
Terrain Challenges
NWS Messages to EAS

* Tornado Watch or Warning

* Severe Thunderstorm Watch or Warning

* Flash Flood Watch or Warning

* Flood Warning

* High Wind Warning

* Winter Storm / Heavy Snow / Blizzard Warning

* Tsunami Watch or Warning

* Civil Emergency Message
Non-NWS Messages on NOAA Weather Radio

Examples include:

* Civil Emergency Warning
* Evacuation Immediate
* Shelter in Place Warning
* Volcano Warning
* Child Abduction Emergency (AMBER)
NOAA Weather Radio is Washington’s “All-Hazards” Warning System

Ocean Shores “AHAB”
Who Receives EAS Messages via NOAA Weather Radio

- **All Broadcasters**
  - TV
  - Radio
  - Cable TV

- **Weather Radio Receivers**
  - Homes
  - Businesses
  - Schools
  - Health Care Facilities
  - All-Hazards Alert Broadcast (AHAB) Units
  - Any With Receivers

Ocean Shores
“AHAB”
Communication Lines in Western Washington

[Map showing communication lines in Western Washington, with labels for NWS Seattle, USCG District 17, and Mount Olympus.]

B Dotson
Base map: Courtesy of UW Atmospheric Sciences K-12 Outreach Group (http://www-k12.atmos.washington.edu/)
Satellite Delivery - EMWIN

Emergency Manager’s Weather Information Network

- GOES East, at 75 degrees West
- GOES West, at 135 degrees West.
- Telstar 5 Satellite, at 97 degrees West.

- The GOES downlink frequency used for the 9600 baud EMWIN datastream is 1690.725 MHz
EMWIN is a nonproprietary operational dissemination system, primarily for the emergency management community. It provides a continuous, dedicated low speed data broadcast of up to 5,000 pages per day using an audio signal from the GOES satellite or terrestrial retransmitter.

The EMWIN datastream consists of:
- real-time weather warnings, watches, advisories, forecasts,
- a subset of alphanumeric products for each state,
- a limited suite of non-value added graphical products, and some satellite imagery.
Satellite Delivery - EMWIN

- The EMWIN datastream was designed to run at minimal cost to the NWS and at no recurring costs to users in range of the signal. Basic software developed, but unsupported, by the NWS to meet minimum needs of users is available for free, and can be downloaded from the Internet. Low cost, supported commercial software with more features is available.
To receive and make use of the EMWIN datastream, a user must be in acceptable signal range and have:

- at a minimum, a 80386 or 80486 personal computer with DOS 5.0 or greater and Windows 3.1 or greater;
- a relatively inexpensive portable receiver with antenna based on NOAA Weather Radio modified to receive the transmitted frequency; and
- a custom built, but inexpensive demodulator that receives the signal from the receiver and feeds it to the serial port of the user’s computer system.
U.S. National Weather Service
High Speed Users try out the new Animated IWIN

Active Warnings: Flash Flooc, Flood, Special Marine, Severe Thundersturm

This page will "REFRESH" itself every 5 minutes to keep you up to date
Click on the above map for current site specific weather observations.
You can now receive your weather forecast from the National Weather Service anywhere/anytime using your wireless device. All you need is a wireless device that can surf the Internet along with a wireless Internet service provider.
NOAA Weather Wire Service
RANET – RAdio and interNET

- RANET is an international collaboration to make weather, climate, and related information more accessible to remote and resource poor populations.

- RANET undertakes this mission in order to aid day-to-day resource decisions and prepare against natural hazards.

- The program combines innovative technologies with appropriate applications and partnerships at the community level in order to ensure that the networks it creates serve the entirety of community information needs.

- Community ownership and partnership is the core principle of RANET's sustainability strategy.
In co-operation with its partners, RANET is now able to make observations, forecasts, and bulletins more readily available to hydro-meteorological and extension services in Africa.

The satellite bandwidth is made available by the WorldSpace Foundation.

With an appropriate receiver and adapter, a digital radio, this information can be easily accessed:
RANET – RAdio and interNET

- The radio picks up information from the satellite using only a small antenna.

- From the radio, the signal passes through a modem to a computer on which the information can be seen as text, illustrations and pictures.

- In this way the limitations of internet connectivity or bandwidth and speed are no longer a barrier to critical information access.

- The information broadcast by RANET can also be seen via the Internet, on a NOAA mirror site.
The networks RANET develops, however, are not limited solely to satellite systems.

The program works with a variety of partners to standardize appropriate FM community radio station equipment, HF systems, and even energy solutions such as solar and wind.

By bringing together various appropriate and sustainable technologies, RANET supports ‘human networks' of dialogue and partnership that serve as the basis for sharing knowledge to improve the lives of communities in remote areas.
WorldSpace RANET Product Delivery

1) Global, regional, national and local information from various producers blended into single presentation, compatible with satellite broadcast.

2) Presentation sent via Internet to a satellite uplink station (Singapore or Melbourne). Some information.

3) At the top of nearly every hour the uplink station sends the uploaded information to the satellite for broadcast over all of Asia and parts of the Pacific.

4) The broadcast is then received by digital radios that are hooked into computers.

5) The broadcast can be used by meteorological services, extension agencies, or even local communities who might use the content to improve their own products or to translate information into the local language and according to local interest.

6) Technologies, such as HF and VHF radio, telephone and Internet, allow rural communities and extension agencies to send information requests, provide feedback.
StormReady / TsunamiReady

Working Together to Save Lives

Ocean Shores

Long Beach
What is Storm/TsunamiReady?

- A voluntary community preparedness program that promotes weather and tsunami hazard readiness.
- Primary goal to improve public safety during emergencies.
- A collaborative effort between federal, state, and local agencies, and the public.
Most important - REDUNDANCY

- REDUNDANCY

- REDUNDANCY!
TsunamiReady Community Components

**StormReady Elements**
- Emergency Operations Center
- Multiple Ways to Receive NWS Warnings
- Multiple Ways to Disseminate Warnings
- Multiple Ways to Monitor Conditions
- Hazardous Weather Plan
- Community Preparedness Education

**TsunamiReady Elements**
- Identify Hazard Zones
- Map Evacuation Routes and Assembly Areas
- Install Evacuation and Assembly Signage
- Educate Community on Tsunami Hazard and Safety Plans
StormReady / TsunamiReady

Who

- Counties
- Communities
- Cities
- Indian Nations
- Supporters
  - Businesses
  - Schools
Questions ??