

5 years after the Indian Ocean Tsunami: Where are we now?



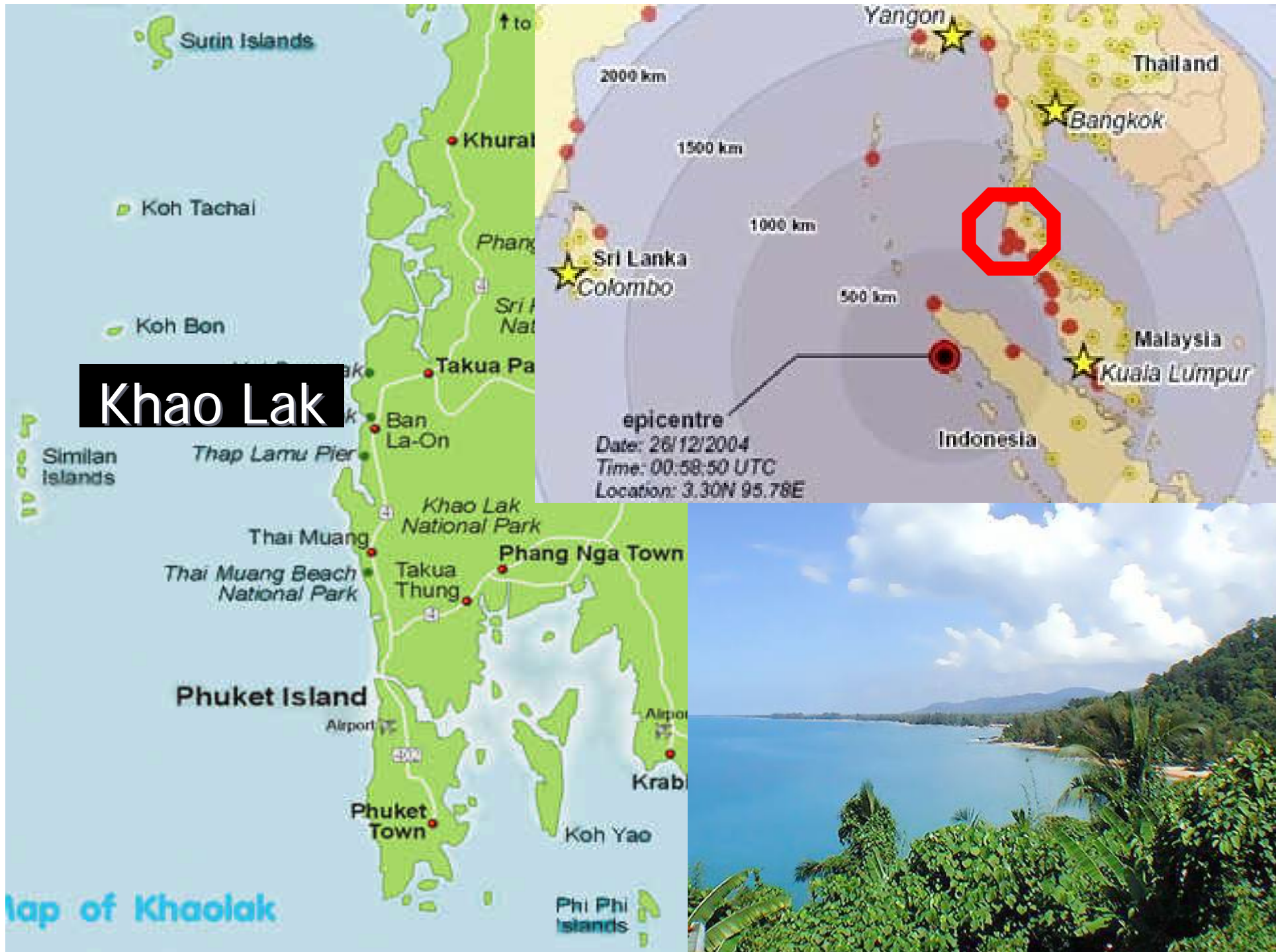
Dwayne Meadows, Ph.D.

DwayneMeadows@msn.com

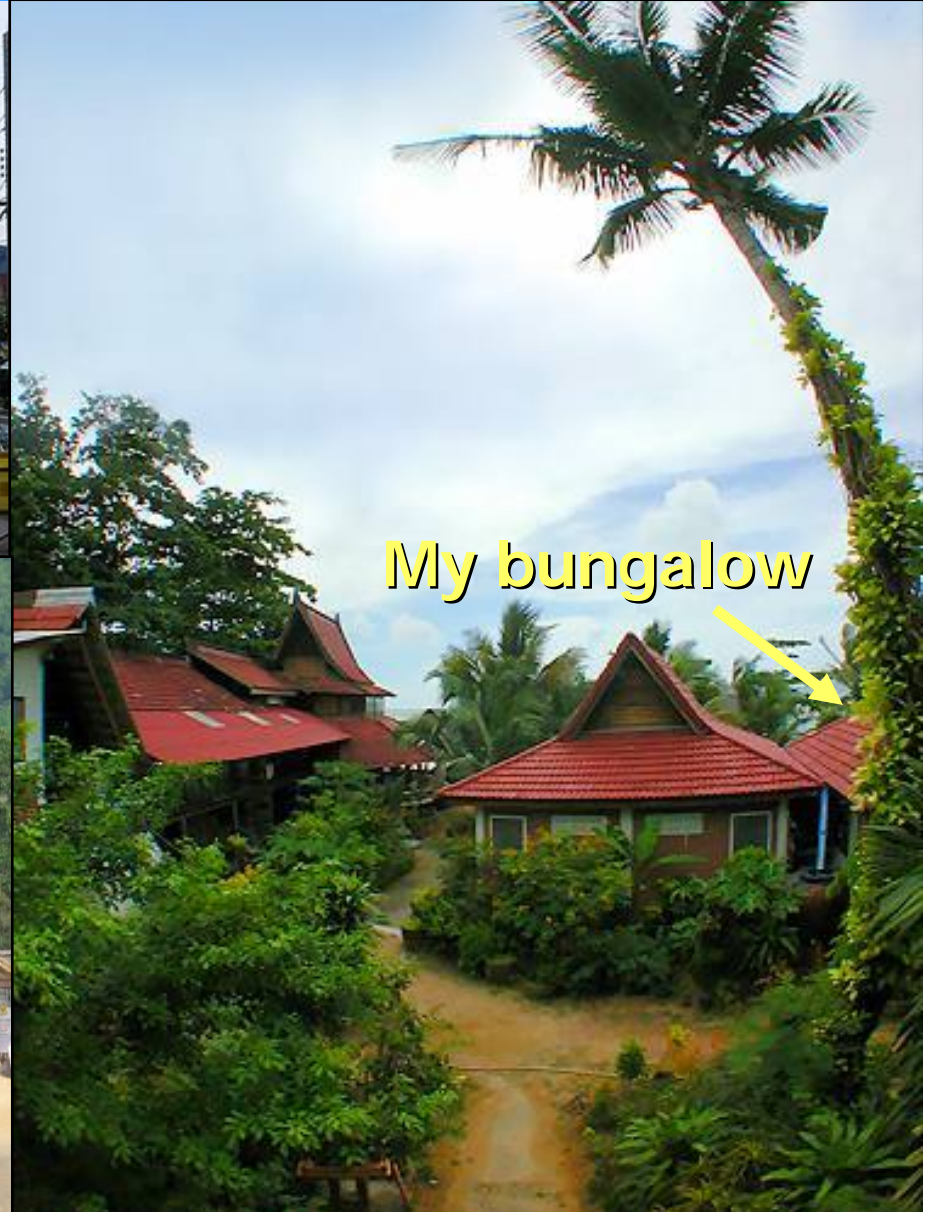


COUNTRY: USA
FULL NAME: DWAYNE MEADOWS

Dec 28, 2004

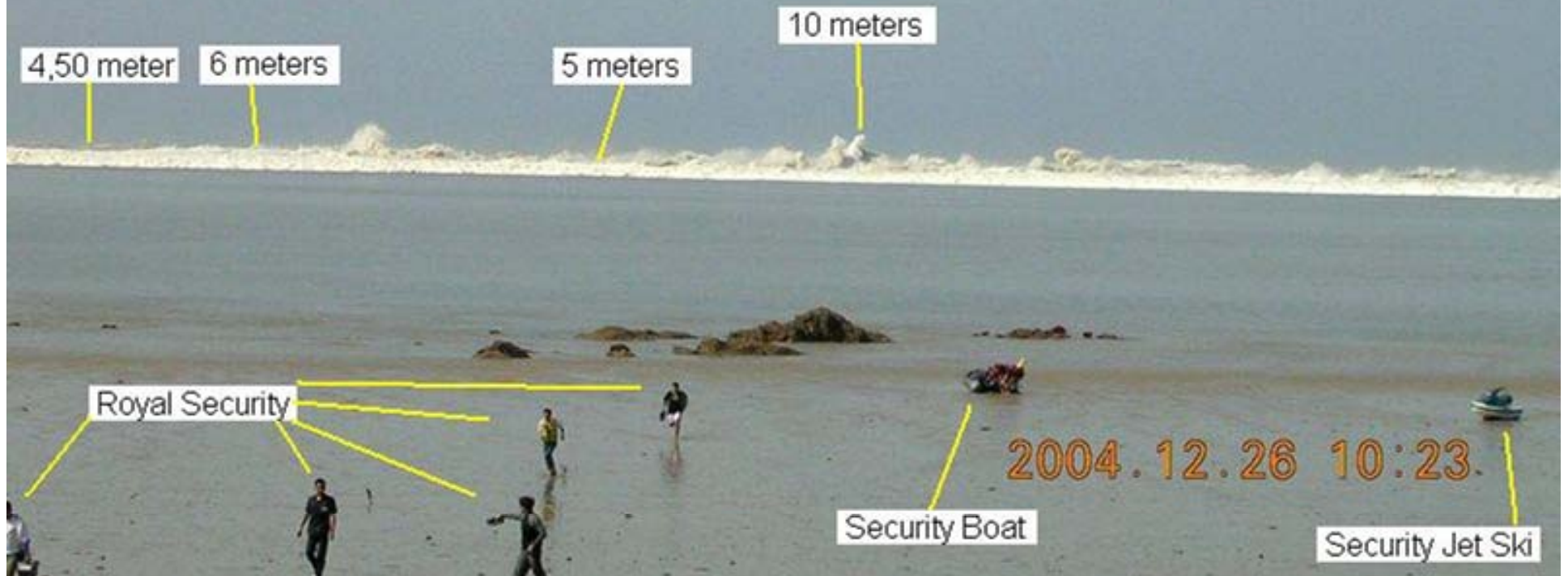


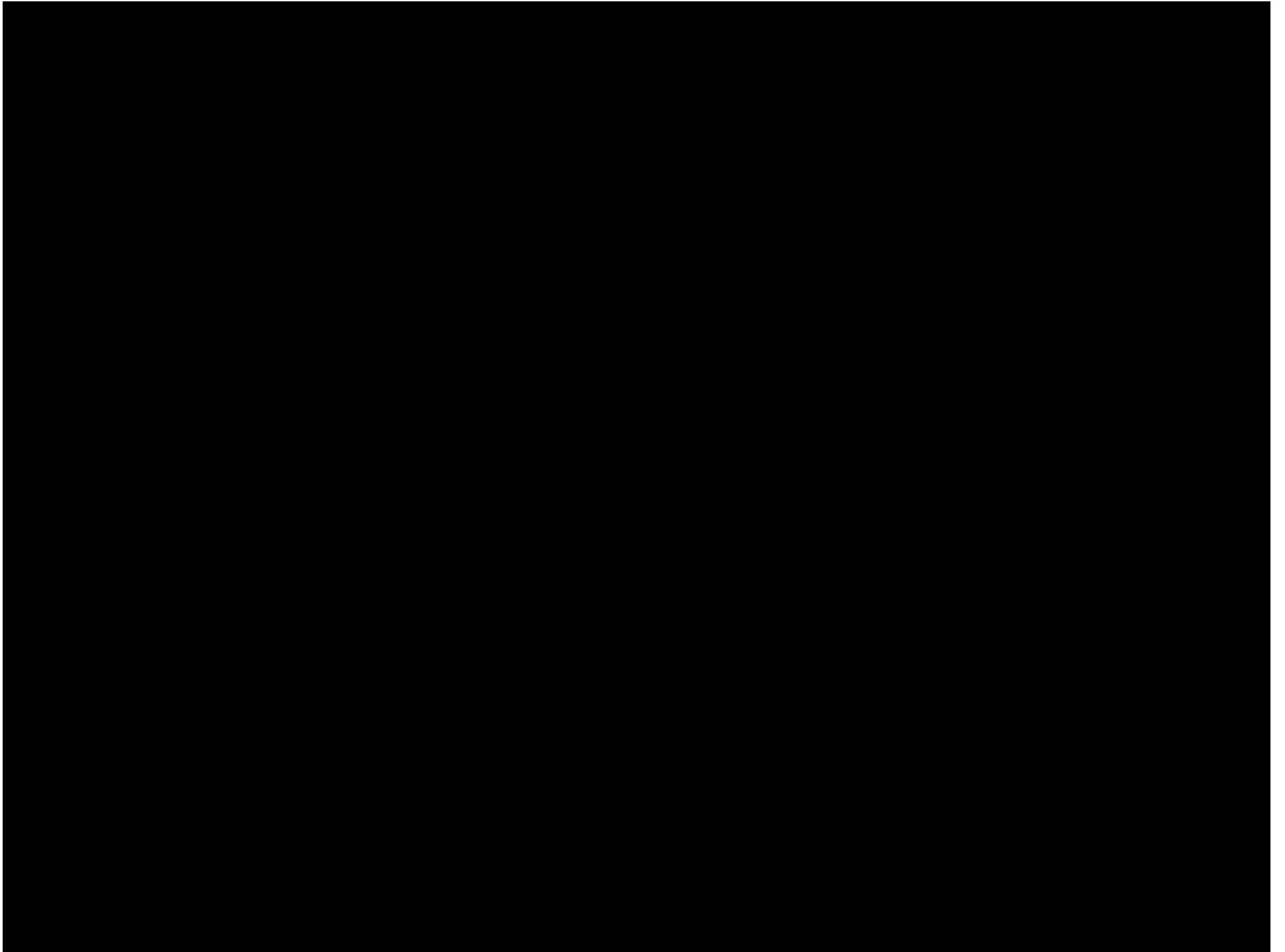
Khao Lak: A small resort area



December 26th, 2004 10:23am

In my bungalow getting supplies
...Not looking at the ocean





10:26 - ~10:40am

Riding a 40ft wave through the trees



~ 10:30am

Saved by a Female Mannequin



~ 10:40am
Calmer water, Debris fields

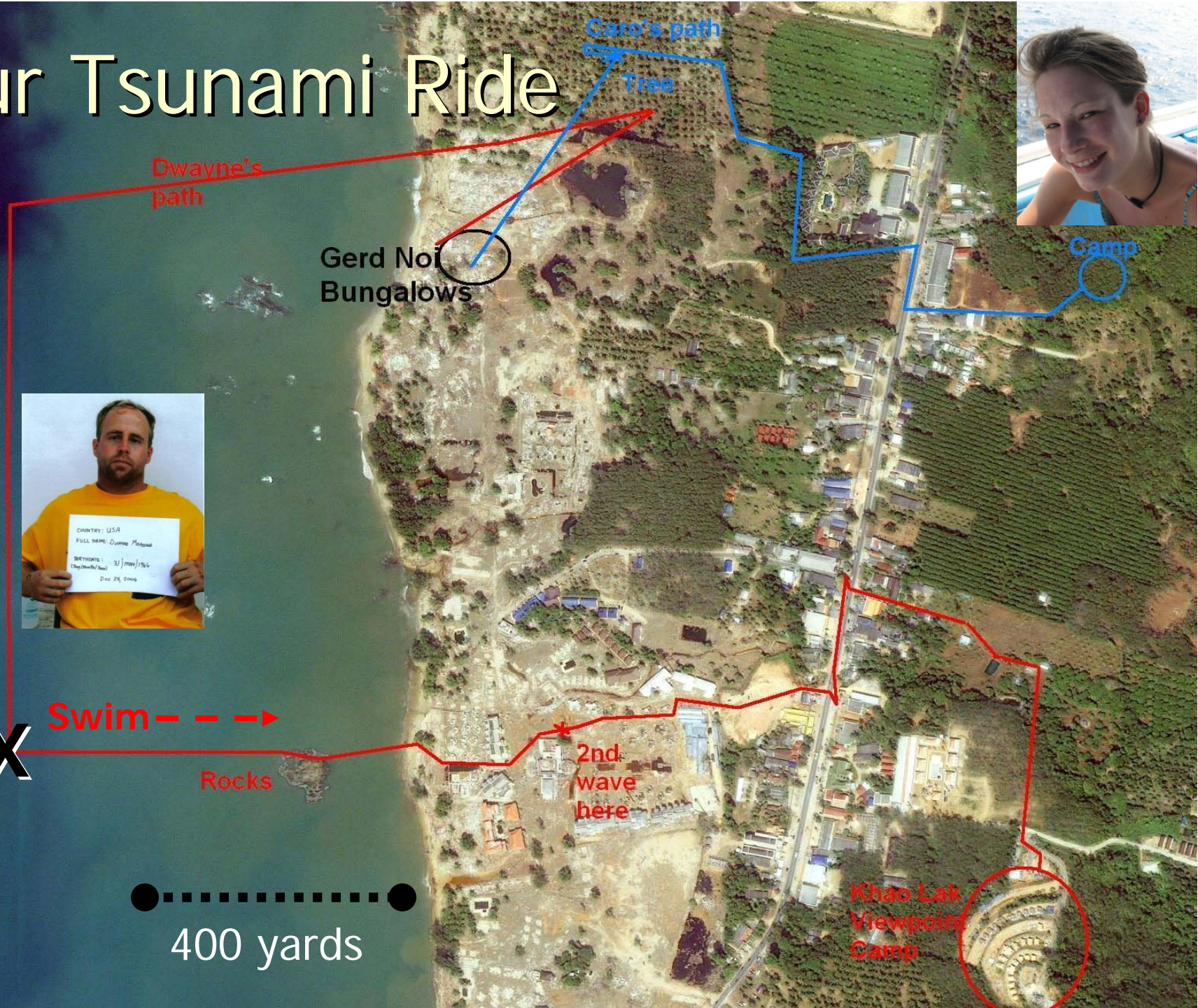




~ 11:00am
Swimming
to Shore



Our Tsunami Ride



It's All Gone

Gerd Noi Bungalows



Noon to next day
No outside help
We help ourselves



Jai
Breisch



- * 1st aid
- * water
- * shelter
- * lists



Day 3 9am – 9 pm: Evacuation to Bangkok



Stu and Sally
Breisch

The Search for Families & Friends



Kali Breisch (age 15)
Salt Lake City, Utah
Body discovered
17 January 2005

Worldwide Effects:

~ 300,000 dead

Millions homeless

Millions jobless

Aceh, Sri Lanka Wars



Orphans
Amputees
Mental traumas

2010: Where Are We Now??





Victims



► Identification

- Still 5% of victims unidentified in Thailand
- Some mis-identifications discovered after burial

► Lack of DNA or comparison tissue

► Burmese relatives not allowed to pick up bodies or provide tissues

► Process ended in 2009



Survivors

▶ Long mental health recovery

■ Caroline

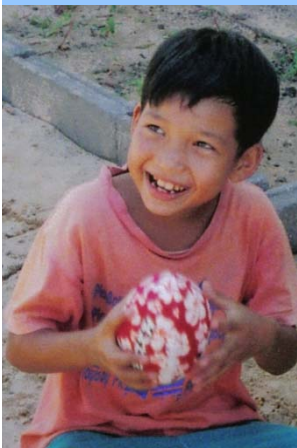
- ▶ Gave 1st public interview this year
- ▶ Married, 1st child in 2009

■ Jai Breisch

- ▶ 3.5 years of pain med addiction
- ▶ PTSD treatment
- ▶ Now: college freshman in music (age 22)
- ▶ Still won't speak publicly

Anon Saiyong

- ▶ Unable to be/sleep alone for 2-3 years
- ▶ Now: no nightmares, good grades



Reconstruction



My Resort



Then

Now



Economic Development





Land/Home Ownership Issues

Lost paperwork
Poor surveys
Squatter's rights issues
Bribery/ Fraud
Poor/wrong construction

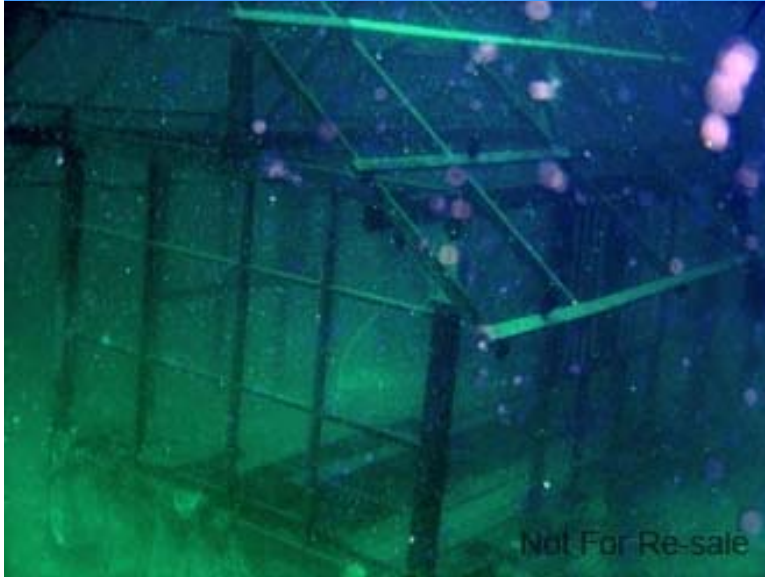


Environmental Issues

- ▶ Salinization of Land and Water wells
- ▶ Fishing (Over)Capacity and Technology
- ▶ Mangrove destruction
- ▶ Sea Walls
- ▶ Erosion



Over 400 tons of debris removed



Marine Environmental Damage

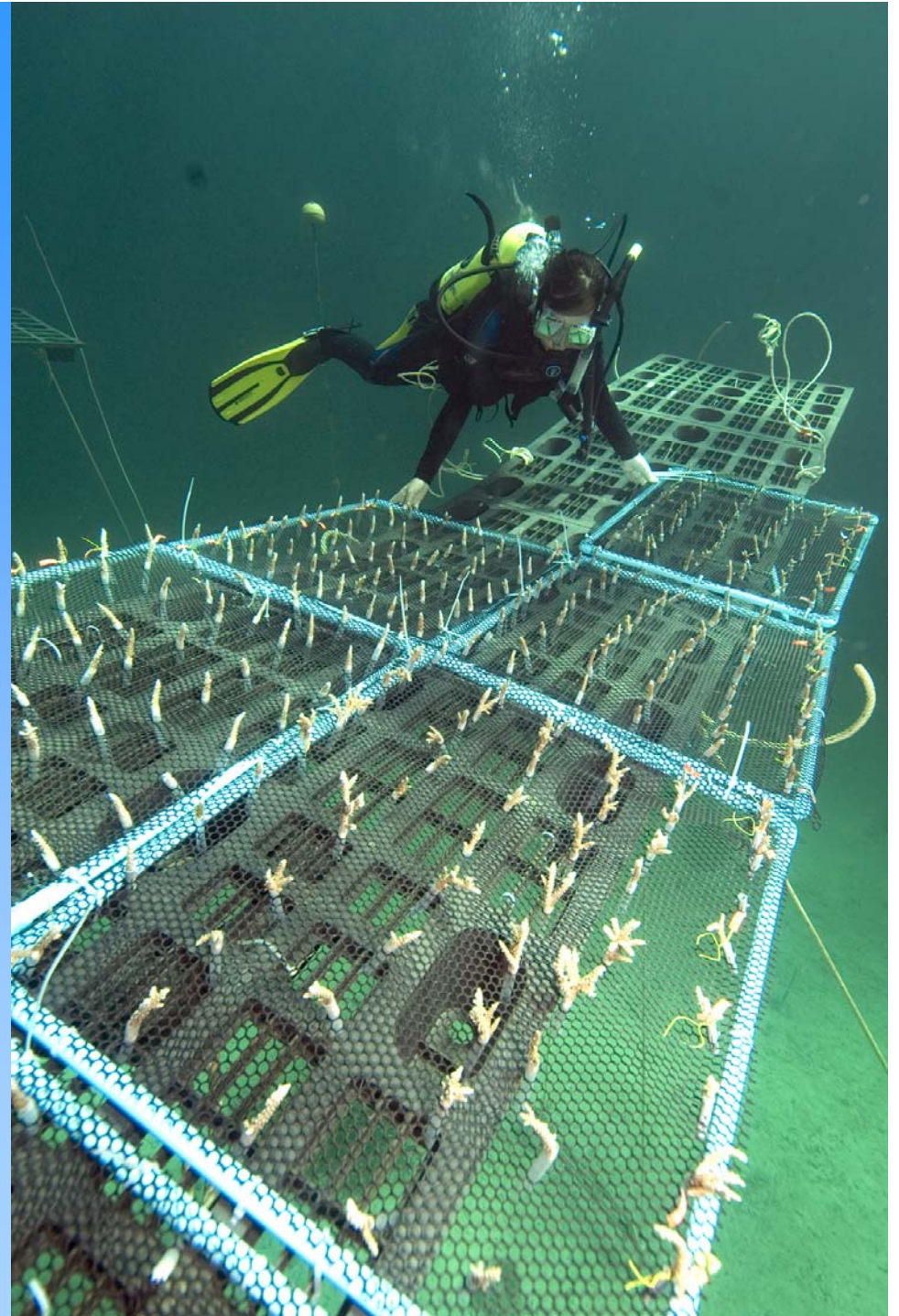


- ▶ 174 reefs surveyed
 - 13% destroyed, 47% low to medium impact
- ▶ Pollution
- ▶ Seagrasses, mangroves destroyed

Reef Restoration



Coral nurseries and Artificial reefs



Sea Fan Re-attachment



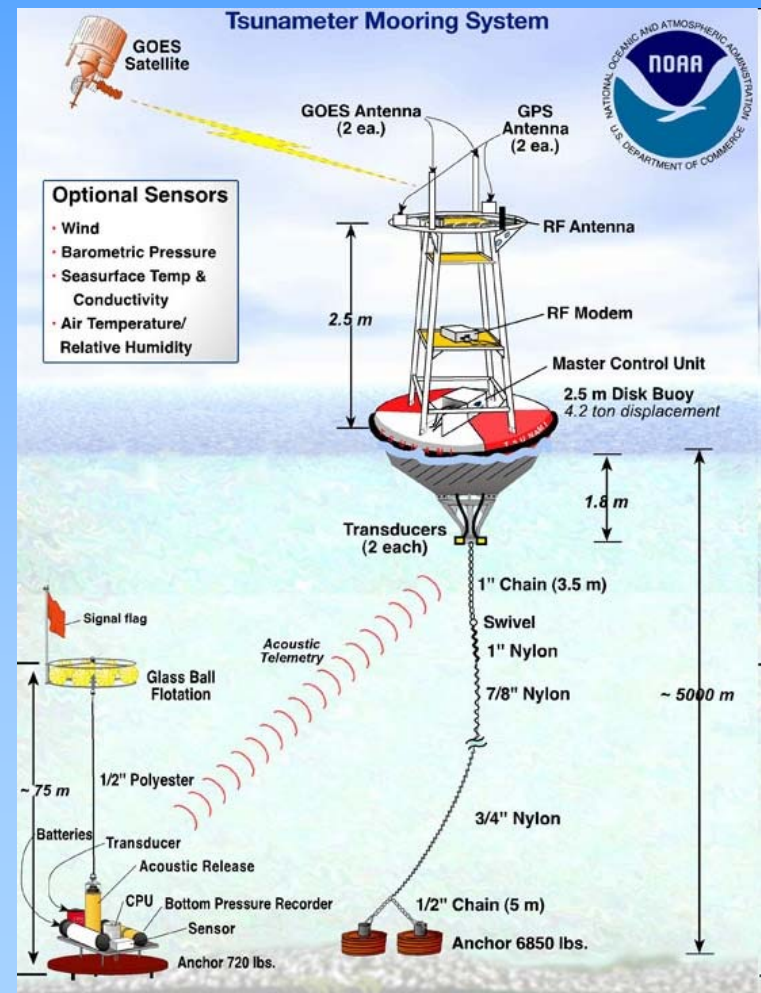






Thailand Improvements

- ▶ 60+ multilingual warning towers
- ▶ Disaster Response Center
- ▶ More sea level gauges
- ▶ 1 DART buoy



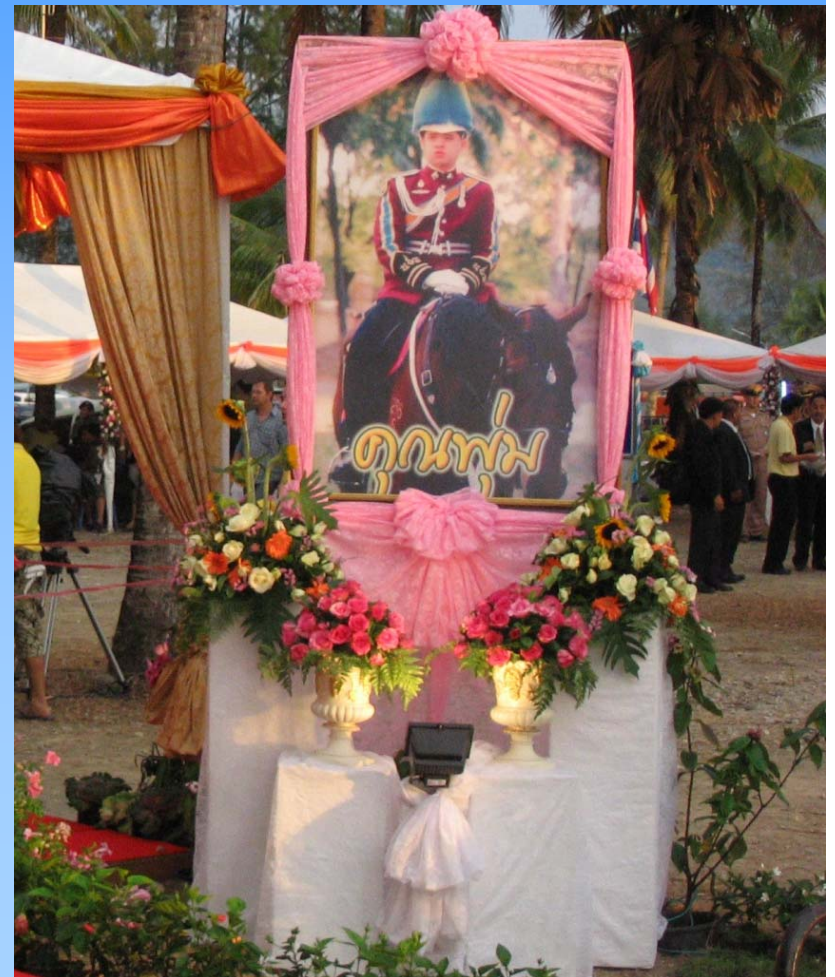
Thailand Preparedness

- ▶ Good evacuation signage
- ▶ Comprehensive evacuation drills
- ▶ Little tourist outreach



Thailand Outreach and Education

- ▶ 2 Museums
 - only 1 in world pre-2004 (Hawaii)
- ▶ Royal family involved
 - Death of King's grandson



International Improvements

- ▶ Better Regional Coordination
- ▶ Training/Capacity
- ▶ Some Outreach & Education
 - New (Multi-lingual) curricula
 - 1 --> 5 museums
- ▶ But More Needed



<http://www.whoi.edu/home/interactive/tsunami>



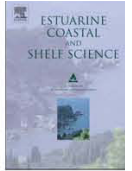
New science,
preparedness,
response and
donor
coordination
protocols



Contents lists available at ScienceDirect

Estuarine, Coastal and Shelf Science

journal homepage: www.elsevier.com/locate/ecss



The reduction effects of mangrove forest on a tsunami based on field surveys at Pakarang Cape, Thailand and numerical analysis

Hideaki Yanagisawa^{a,*}, Shunichi Koshimura^a, Kazuhisa Goto^a, Toyohiko Miyagi^b,



Natural Security

Protected areas and
hazard mitigation



A research report by WWF and Equilibrium

U.S. State Improvements

- ▶ Many New Risk Assessments
- ▶ More Preparedness & Planning
- ▶ Some Outreach & Education



In cooperation with the Civil Defense Division of the State of Hawai'i Department of Defense, the Office of Planning of the State of Hawai'i Department of Business, Economic Development, and Tourism, and the Pacific Disaster Center

Variations in Community Exposure and Sensitivity to Tsunami Hazards in the State of Hawai'i





US Needs

- ▶ Risk Reduction Framework (RRF - 12/05)
 - Improvements needed across all areas
 - "evacuation routes should be well known by residents and clearly marked for visitors in all coastal areas."
- ▶ GAO report (6/06): largely echoes RRF
 - NOAA needs risk-based strategic plan
 - Too much focus on east coast & distant tsunamis
 - Far Pacific largely ignored by report

US Improvements

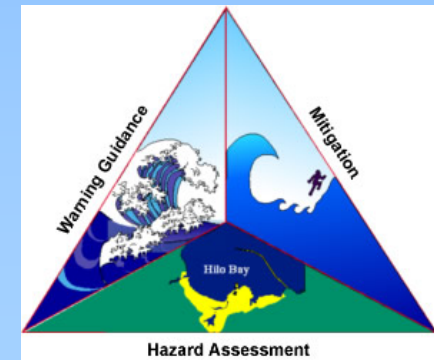
164 high-tech sea level gauges

80% -> 100% real time seismograph data

.... Faster warnings

Tsunami Warning and Education Act (12/06)

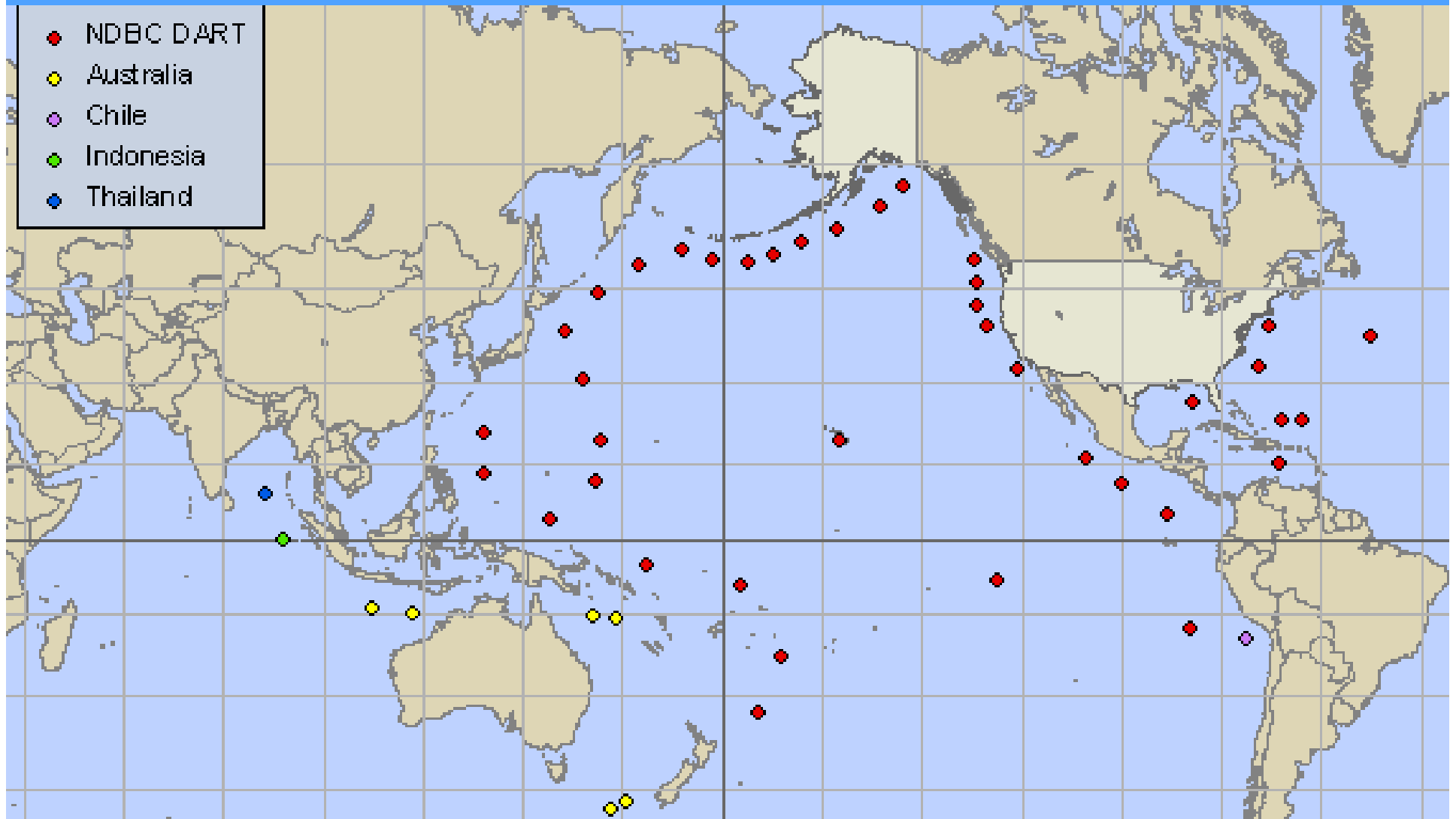
- Expands Nat'l Tsunami Mitigation Program from 5 Western States to all coastal states/territories
- Improve Tsunami Ready program
- NAS review in 2 years (late)



National Tsunami Hazard Mitigation Program

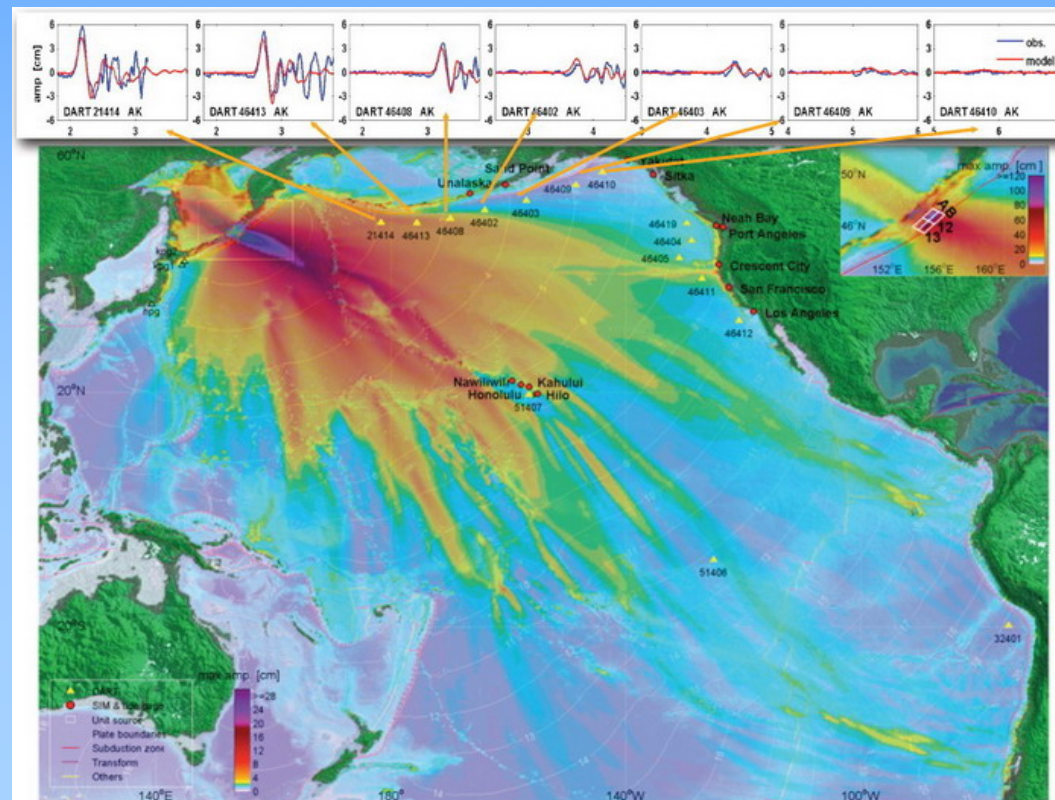
Improved warning buoy system

▶ 6→39 DART buoys



Improved warning system

- ▶ More coasts mapped
- ▶ 24/7 Warning Center Operations
- ▶ Real time forecast mapping





NOAA

- ▶ Framework suggestion: “implement and conduct routine end-to-end testing of warning dissemination and notification systems.”
 - Difficulties because of inter-jurisdictional issues
- ▶ Better coordination across all efforts
 - Strategic Plan
 - Research Plan
- ▶ New Education mandate



- ▶ More communities have qualified (11 to 72)
- ▶ But ...weak standards
 - Not require evacuation and mitigation plans
 - Honolulu (all of Oahu) has no evacuation signage (recall Framework)
 - Comprehensive community drills not required
 - No outreach to tourists

NOAA: \$42M FY 2009 (\$225M since 2004)

- ▶ \$4M – Legacy Program (pre 2005)
 - Tsunami Warning Centers (TWC)
 - PMEL Research
 - International Tsunami Information Center (ITIC)
- ▶ \$23.2 – U.S. Tsunami Warning System Strengthening Effort
 - 24/7 TWC Operations, Detection System Enhancement
 - National Tsunami Hazard Mitigation Program
 - ITIC Enhancement
 - Data Archive
 - TsunamiReady
- ▶ \$12.6M Spectrum (FY09-FY12)
 - Warning Center Operational Enhancements
 - Tsunami Research and Development
 - Modeling
 - Mitigation and Education

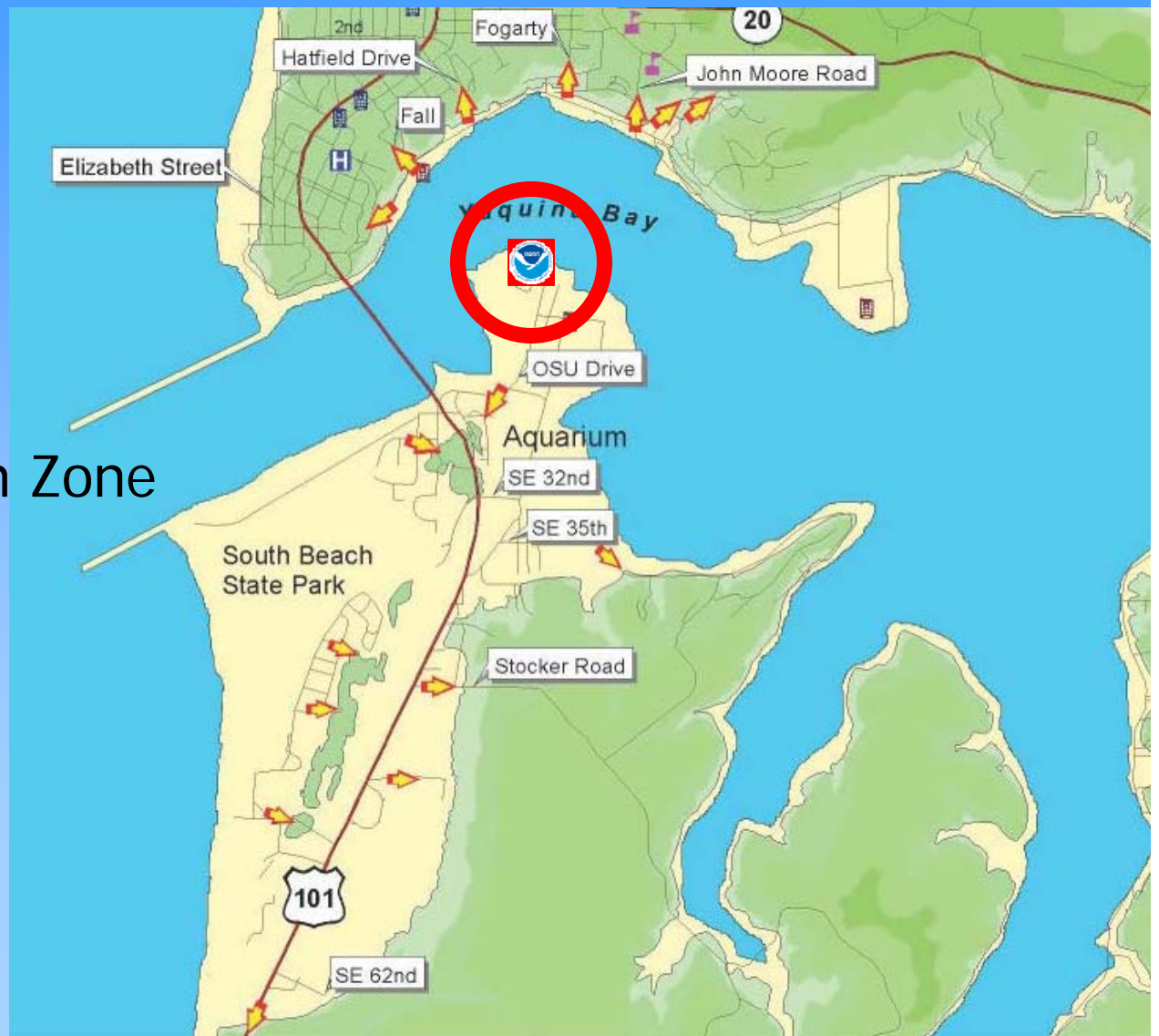
Why is NOAA moving more folks into or near tsunami zones?

2011
Pacific Marine Ops Ctr.
Newport, OR
(175 staff)

Tsunami Evacuation Zone

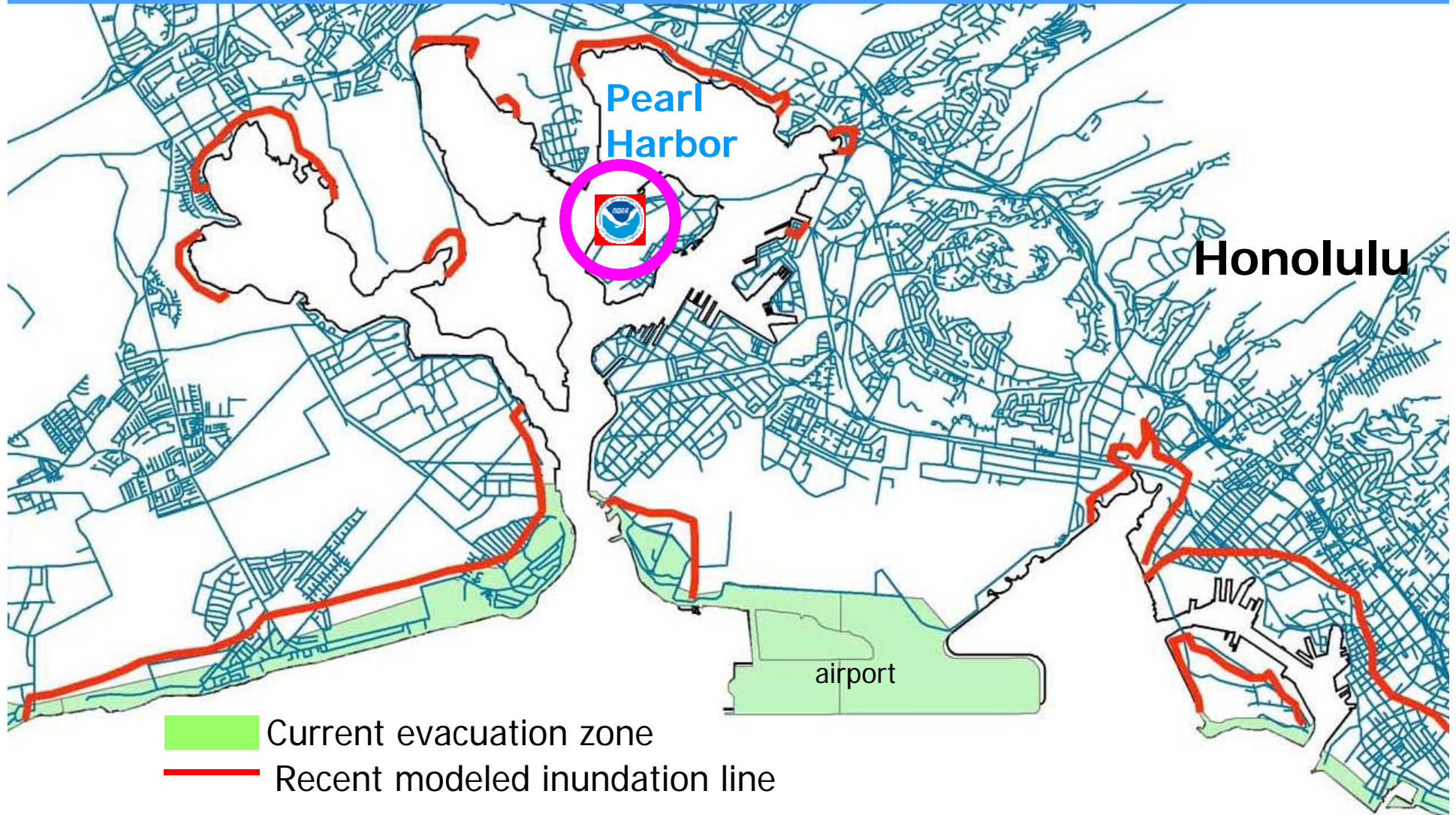
**Highest seismic, tsunami, visual, & species risks of all possible sites

Bellingham, WA challenged award as Newport bid includes building in 100 yr flood zone.
Sustained by GAO 12/09



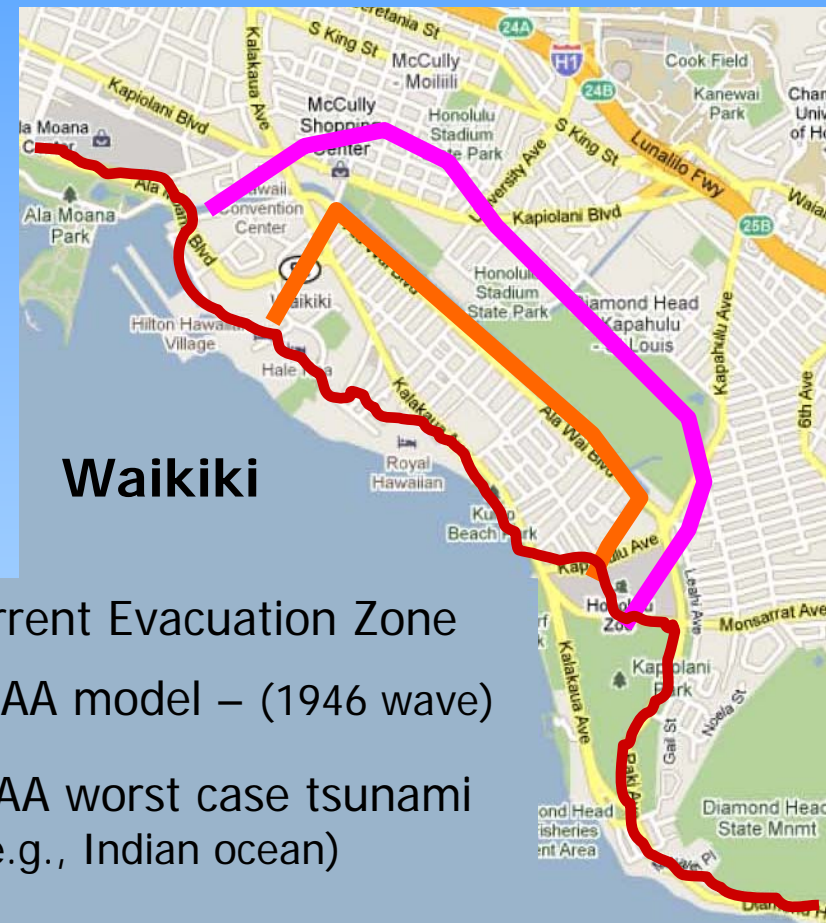
NOAA Pacific Regional Center, HI

- ▶ 500 staff (most now further from tsunami zone)



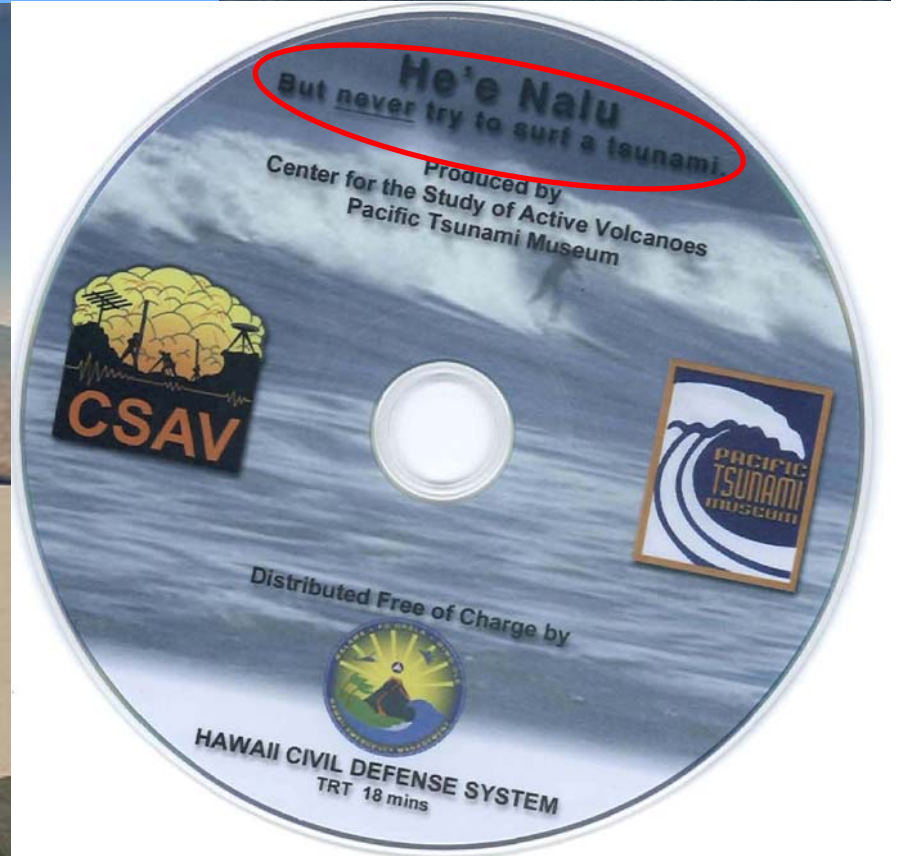
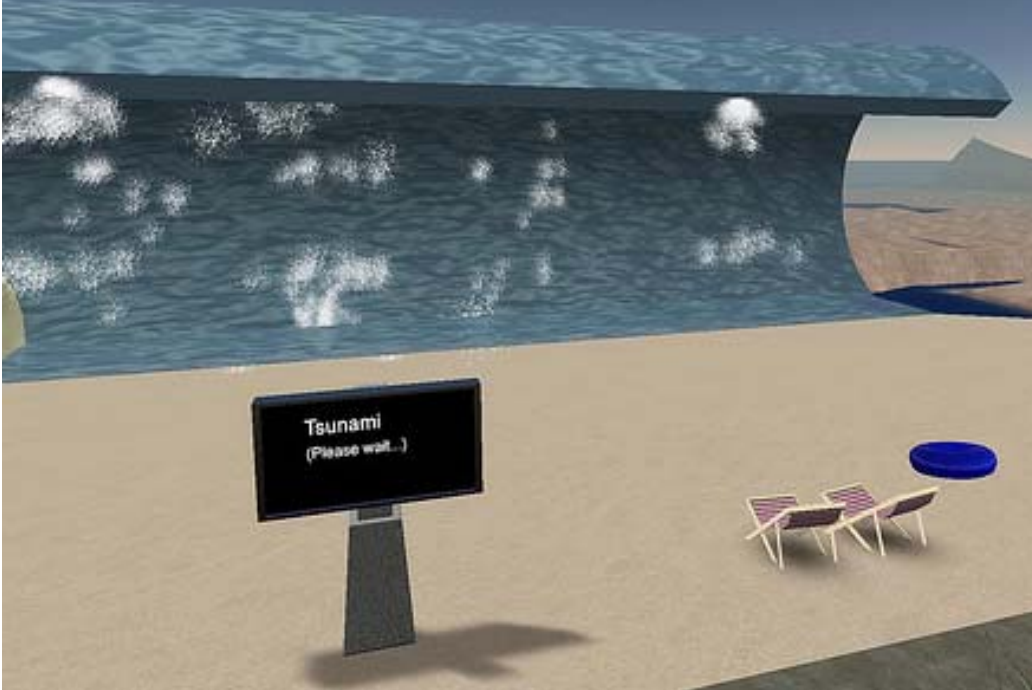
US/State Issues

- ▶ Adoption of updated evacuation, flood zones
- ▶ Inconsistent evac. zone, risk standards
- ▶ When involve media?
- ▶ Insufficient education and outreach



▶ Inconsistent messaging

- NOAA 2nd Life vs Hawaii Civil Defense



Samoa: 29 September 2009

190 deaths, 31 in U.S. (most since 1964)
(Including NOAA family)

PACIFIC ISLAND TSUNAMI RESILIENCE PLANNING GUIDE

Tsunami Hazard Mitigation and Disaster Management

Jeanne Branch Johnston
and
Dr. Walter C. Dudley

March 2009



- ▶ “We listened for a tsunami warning and there was no warning so we thought it was okay,” she said.
- ▶ “she saw some families stay behind in their homes, waiting for a warning or evacuation order that wouldn't come in time.”

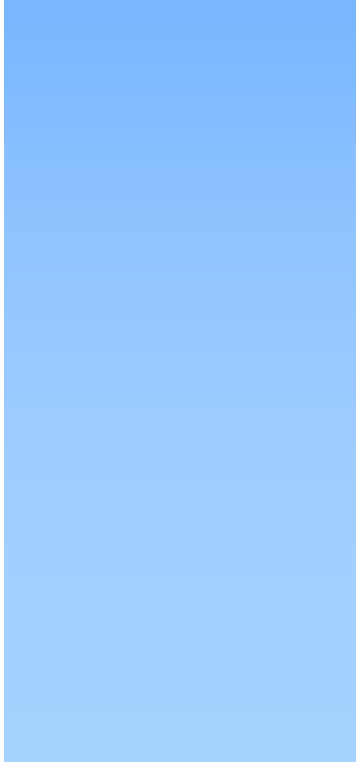
Source: *Samoa News* & other media reports

- ▶ “she sent her son in the car to fill up the gas tank.... The woman, her husband, 4 grandchildren & daughter-in-law **had planned to wait for the truck to return so they could flee.**”
- ▶ “Communication lines were jammed with families and friends trying to reach one another, tears and fear in their eyes.”



Time Lapse Photos





Oh Yeah..

Those last 2 slides

were Keahou Bay, Hawaii

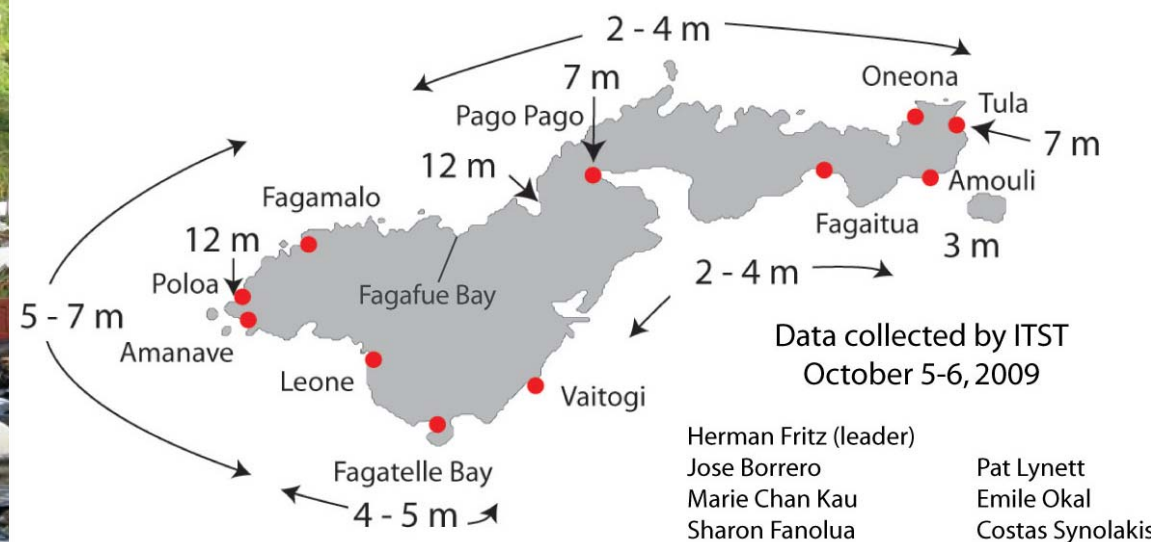
**Hawaii was under a
tsunami "advisory"
at the time after
watch was cancelled**

Samoa Lessons/Needs

- ▶ Disaster Education – still need more
- ▶ Need Faster Environmental Assessment
- ▶ Corruption Controls



American Samoa Run-up Heights (Tutuila)



U.S. NEEDS

- ▶ Strengthen Stafford Act
 - No \$\$ unless better plans, education, & frequent, comprehensive drills
- ▶ National Evacuation Zone standards
- ▶ Flood Insurance Program: require education
- ▶ Education Department: curricula, drill mandates
- ▶ Ecosystem Response Fund for disasters
- ▶ Coastal Zone Management Act: stronger stds
- ▶ Stronger local planning, zoning, building laws
- ▶ Executive Order on Federal construction

NOAA NEEDS

Focus More on:

- ▶ Education and Outreach
 - Warning systems, AND
 - Warning Signs
- ▶ Coastal Ecosystem Disaster Response



Tsunami Preparedness

- ▶ Know the danger signs
 - Water leaving the ocean unexpectedly
 - Can be **MANY** waves!
 - Big Earthquake = likely tsunami
- ▶ Get to 40 ft altitude
- ▶ Learn CPR,
LOTS of 1st AID
& SWIMMING
- ▶ **PLAN, PREP, BE CALM**



Every anniversary in Thailand:
1 lantern for every victim (5400)

