Maritime Mitigation and Recovery Planning

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And, members of the National Tsunami Hazard Mitigation Program

Partners =

[Logos of various organizations]
Historical tsunami impacts from notable distant-source events over the past 70 years. The USGS SAFRR and Cascadia scenario tsunamis are also summarized.

<table>
<thead>
<tr>
<th>Significant Historical Distant Source Tsunamis (year-magnitude-source location)</th>
<th>Tsunami Amplitudes for Historical Events, from NGDC Database (in meters above normal tide conditions; information in parentheses from Cascadia modeling by state; “-” no data)</th>
<th>Effects in California (damage value is presented in constant dollars, representing that year and not adjusted for inflation)</th>
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<tbody>
<tr>
<td></td>
<td>Crescent City</td>
<td>San Francisco</td>
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<tr>
<td>1946 M8.1 Eastern Aleutian Islands</td>
<td>0.9</td>
<td>0.3</td>
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<tr>
<td>1960 M9.5 Chile</td>
<td>2.0</td>
<td>0.5</td>
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<tr>
<td>1964 M9.2 Alaska</td>
<td>4.8</td>
<td>1.1</td>
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<tr>
<td>2006 M8.3 Kuril Islands</td>
<td>0.9</td>
<td>0.2</td>
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<td>2010 M8.8 Chile</td>
<td>0.6</td>
<td>0.3</td>
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<tr>
<td>2011 M9.0 Japan</td>
<td>2.5</td>
<td>0.6</td>
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<tr>
<td>Numerical Modeling of USGS SAFRR Western Alaska M9.1 Scenario</td>
<td>4.3</td>
<td>2.2</td>
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<tr>
<td>Catastrophic Cascadia M9 Scenario (FEMA and CalOES)</td>
<td>15+</td>
<td>(1.8)</td>
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One fatality; significant inundation in Half Moon Bay; damage approached several million dollars

Two fatalities; inundation in Crescent City; damage approached several million dollars

Thirteen fatalities; significant inundation in Crescent City; damage approached $20M

Damage to docks in Crescent City approached $20M

Damage to 12 harbors approached $3M

One fatality; damage to 27 harbors approached $100M

Projected: Inundation widespread; damage exceeds 10-Billion dollars

Projected: Flooding extensive in Crescent City, low-lying coastal areas in northern state
1. **Create in-harbor hazard maps** by modeling major harbors’ tsunami hazards [damaging currents]

2. **Create offshore safety zone maps** for use by harbors that recommend if, when, and where vessels can be repositioned or sent to sea

3. **Provide statewide guidance** for response planning, harbor protection, and recovery/business continuity [based on above results]
Mitigation Planning Guidance and Implementation
1. Review tsunami hazard maps

2. Review potential “real-time (soft)” and “permanent (hard)” mitigation measures

3. Identify where problem areas exist within the harbor and incorporate specific mitigation measures in Local Hazard Mitigation Plan, like:

   • Upgrade docks and floats
   • Strengthen piles and pile connectors
   • Strengthen cleats and mooring lines
   • Secure infrastructure, especially petroleum and sewage
Mitigation Planning Using Maritime Response Playbooks

• Identify areas prone to tsunami hazards using historical information, tsunami current maps, and other products

• Determine where planning for pre-tsunami vessel movement and infrastructure controls/shut-down can reduce damage

• Develop strategy for updating or hardening docks, piers, piles, etc.

• Incorporate reasonable and doable mitigation measures into Local Hazard Mitigation Plans
Mitigation Guidance: Future Work Plan

• FY14-15 Cooperative Technical Partnership with FEMA Region IX

• Continue work with Lynett (USC) and Eskijian (CA State Lands)

• Form Tsunami Mitigation Planning Work Group for guidance

• Develop “Tsunami Hazard Mitigation Plans” for each harbor
  • General engineering analysis using failure probability curves for various hazards
  • Use tsunami current results from both scenario-based modeling and PTHA-based modeling
  • Consider mitigation measures that address multi-hazard (EQ, storm, etc.) impacts
  • Develop harbor specific plans that can be easily integrated into Local Hazard Mitigation Plans, Local Coastal Plans, General Plans, etc.

• Assist harbors in obtaining funding for mitigation efforts from FEMA and CalOES

• Consult with NTHMP colleagues
Recovery Planning Guidance and Implementation
Direct Impacts (Damage):

- Vessels sunk or damaged
- Docks and infrastructure damage
- Permanent land change in large local source EQ
- Debris in water and on land
- Sedimentation and scour
- Contaminants in water and sediment
- Environmentally protected areas/species

Indirect Impacts (Time):

- Commercial fishing and shipping disruption
- Harbor business disruption
- Regulatory redundancy and delays
- Limited funding for recovery
- Limited resources for recovery
- Loss of business and workforce over time
Recovery Planning and Guidance: Future Work Plan

- FY14-15 Cooperative Technical Partnership with FEMA Region IX
- Continue work with Laurie Johnson, recovery/land-use planning specialist, and colleagues in Japan
- Develop “Guidance for Tsunami Recovery” for harbors/communities
  - Evaluate impacts on recovery from SAFRR scenario and Catastrophic Cascadia Plan scenario, as well as Japan and Chile
  - Test/Use/Integrate new HAZUS Tsunami Module
  - Align with Federal Disaster Recovery Framework
- Assist harbors in developing local recovery plans
- Develop state-level recovery plan
- Consult with NTHMP colleagues

Burning disposal of debris from 2011 Tohoku earthquake-generated tsunami, Japan. Bruce Jaffe photo

Port of Long Beach - large number of pier owners complicate planning.