

Not My Fault: Digging deeper into the last mile

Lori Dengler/For the Times-Standard
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March 11 is right around the corner and will mark the passing of a decade since the Great East Japan tsunami. Tsunamis are on my mind so I'd like to dig a little deeper into the last mile problem.

Why is it so difficult to get people out of harms' way? Two reasons: technology and human behavior. Turn the clock back to 1946 Hawaii. April 1 dawned sparkling clear like most Hawaiian mornings. At 6:30 AM, people were getting up, having breakfast, heading to school and work, and enjoying the lowered stress of the post-war era.

A colleague and friend, Jeanne Johnston, was six years old and in Hilo. She remembers awaking to car horns blaring and grabbing her four-year-old brother's hand to go outside and investigate. Ocean debris was scattered around the house. Fortunately, red ants began attacking her brother's bare feet, driving them back inside. From the second story of the house, Jeanne watched a surge of water pour in, reaching as high as the clothesline near where they had been standing. To this day, she thanks the ants for saving their lives.

In 1946, there was no tsunami warning system. In Hawaii, no one saw or felt anything that presaged the coming disaster. The tsunami was caused by a M8.6 earthquake centered in the Aleutian Islands more than 2300 miles from Hilo. Needless to say, no one in Hawaii felt the shaking.

There were seismographs in 1946. The University of California at Berkeley had a network in Northern and Central California, including a station in Ferndale. Caltech had stations that covered the southern part of the State. There were instruments elsewhere in the world including a pair in Hawaii, but earthquake investigations of that era relied on analyzing data after the event. It was often weeks until magnitude and location had been hammered down.

The 1946 tsunami killed 96 in Hilo, 158 throughout the Hawaiian Islands, five in Alaska, one in Santa Cruz and three elsewhere in the Pacific. The only people who received any warning were five Coast Guardsmen at the

Scotch Cap Lighthouse on Unimak Island. They felt a strong earthquake at 3:30 AM and forty minutes later the lighthouse was completely overtopped and destroyed by the tsunami. Their bodies were never found.

For the other 162 victims, there was nothing - just the water suddenly rising and overrunning everything in its path. Some people observed the water draw down, but most did not. There was nearly five hours between the earthquake and the arrival of the surges observed by Jeanne. Seismologists knew there had been a very large earthquake but had no way to rapidly determine where it was or its magnitude. To this day, April 1, 1946 remains the deadliest tsunami in US history.

Thus began an effort to develop a tsunami warning system. For more than two years, seismologists worked to create what is now the Pacific Tsunami Warning Center. This was the technological piece of the system - determining what seismic stations would be a part of the system and how long it would take a tsunami to reach Hawaii from different parts of the Pacific. There was no way to telemeter data into a central location at that time. The new system would rely on seismologists from as far away as the Philippines and Chile to watch their instruments, analyze the traces and telephone their observations to the new tsunami center in Hawaii. Alarms would trigger when the mechanical seismograph arm would swing larger than a preset amount. The alarm system was still in place when I was an undergrad in Berkeley in the 1960s. I can remember the excitement when it rang and everyone ran to look at the recordings.

The tsunami warning center officially opened in 1949, sharing a location with a geomagnetic laboratory on Oahu. It was by no means a fast system, usually taking more than an hour to assemble enough information to determine an accurate location and magnitude. Notifications were left to Hawaii Civil Defense. The focus was Hawaii and it didn't take long to be tested. A M9.0 in November 1952 and a M8.6 in March 1957 produced Pacific-wide tsunamis. On Hawaii, sirens sounded and people evacuated. Although there was considerable flooding and damage, there were no tsunami deaths.

By 1960, Hawaiians felt pretty good about how well the system was working. May 22, 1960 quickly dashed any feelings that the tsunami problem was solved. This time the earthquake was larger and there was far more time between quake and arrival in Hawaii. The M9.5 Valdivia Chile event was the largest earthquake ever recorded on seismographs. It took nearly 16 hours for the tsunami to

travel from the southern Chile coast to Hawaii. A warning was issued yet 61 people died in Hawaii.

What went wrong? Several things apparently. Water height estimates from Easter Island suggested the tsunami wasn't as large as the tsunamis from Alaska (we've now learned that "conical islands" don't amplify waves), and of more concern, Hawaii had changed their notification and response procedures. The last mile had failed.

The warning system worked for Hawaii in 1952, but there was no last mile in other parts of the Pacific. 1952 killed at least 4000 people in Russia's Kuril islands. The Kurils were not part of the system. In 1960 the greatest loss of life outside of Chile was Japan, again not part of the system. In 1964, the Hawaii-centric US system would be tested again and found wanting when the primary impacts were Alaska and the US West Coast. That should provide me plenty of fodder for next week.

Note: Read Jeanne Johnston's account of the 1946 tsunami at <https://www.gi.alaska.edu/alaska-science-forum/1946-tsunami-survivor-shares-her-story>. You can read other 1946 tsunami survivor stories and more about the founding of the tsunami warning system in the book *Tsunami!* by Dudley and Lee.

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