Coupled with the DART 4G buoy, PMEL is working on the next generation Tsunami Forecast System. New modeling capability will use NOAA supercomputers to quickly assimilate DART 4G data and provide high-resolution forecast of tsunami impacts for all U.S. coastlines minutes after the initial earthquake.

The 4G DART buoy consists of an anchored seafloor bottom pressure recorder (BPR) and a companion moored surface buoy for real-time communications. BPRs are capable of detecting and measuring tsunamis with amplitudes as small as 1 mm in 6,000 m of water.

An acoustic link transmits data from the BPR on the seafloor to the buoy at the surface, which then relays the information to a ground station via satellite telecommunications.

Two test DART 4G buoys are currently deployed off the Oregon coast. The technology is currently being transferred to commercial partner SAIC and evaluated by the National Weather Service National Data Buoy Center.

Before DART, tsunami source information was based only on the seismic information available for that event. Now, as a tsunami wave moves across the ocean and makes contact with a DART buoy, the buoys report sea level information to the Tsunami Warning Centers (TWCs). The information is then processed to produce a new and more refined estimate of the tsunami source, leading to more accurate forecasts that can be used to issue watches, warning or evacuations. More timely and precise warnings allow local emergency managers to take more effective actions to save lives and protect property.

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History of DART Technology

1st Generation: DART

First generation DART buoy prototype development began in 1995 and the first 4 DART stations were deployed by August 2000. The 1st system was comprised of two separate parts (the bottom pressure recorder and surface buoy). Capable of only one-way communications to NOAA Tsunami Warning Centers, they transmitted four sea-level height observations per hour.

2nd Generation: DART II

Second generation DART buoys, or DART II, were developed around 2004 offering two-way communications between the bottom pressure recorder and NOAA Tsunami Warning Centers allowing for real-time command and control and global deployment capability. The 2004 Indian Ocean tsunami fueled the development of the U.S. DART tsunami detection array and was completed in 2008 with 39 buoys, comprised largely of DART II systems, positioned around the Pacific basin, western Atlantic and Caribbean Sea. The array is now owned and maintained by the National Weather Service National Data Buoy Center. DART II buoy technology was also patented and transferred to an industry partner, SAIC, who now builds and sells DART buoys.

3rd Generation: DART - ETD

In 2007, PMEL developed the third generation DARTs, or Easy to Deploy (ETD) buoys that integrate the bottom pressure recorder and surface buoy into one easy to deploy system. DART ETD changed the way deep-water oceanographic moorings were deployed, utilizing small vessels, minimally trained staff and requiring less than 30 seconds to deploy. They offer the same two-way communications as the DART II and are also available from SAIC with the first commercial deployment in 2010.

4th Generation: DART 4G

4th Generation DART buoys, or 4G, began development in 2013 for the measurement of near-field tsunamis. The DART 4G is an enhanced version of the DART-ETD that incorporates advancement of sensors, software and power management to detect and measure near-field tsunami with unprecedented resolution. The improved pressure sensor is able to detect and measure a tsunami closer to the earthquake source providing valuable information to warning centers even faster and allowing the moorings to be placed closer to earthquake zones (and consequently the coastline).