

Scientists to create the most detailed map of California coastline ever assembled

Paul Rogers, Bay Area News Group, 7-18-10

Their tools are laser beams, airplanes and computer software — instead of compasses, wooden ships and parchment.

But more than 400 years after explorers like Sir Francis Drake and Sebastian Vizcaino made some of the first maps of California's spectacular coastline, state and federal scientists are embarking on a new project to construct the most detailed map of the California coast ever assembled.

The \$3.3 million effort will begin with researchers in an airplane flying back and forth along the coast shooting thousands of laser pulses per second at the rocks, beaches and cliffs along the 1,200-mile shoreline from Mexico to Oregon, generating ultra-detailed 3-D images of the contours of the land in huge computer files.

"We need a better sense of what's out there. We need a modern map. And with a modern map we'll have the knowledge to make better decisions," said Doug George, a project manager with the Ocean Protection Council, a state agency in Oakland that approved \$2.75 million toward the project last month.

The images will be so sharp the map should be able to discern individual boulders and telephone poles, George said. The data will provide a baseline to measure everything from the impact of rising oceans over the coming decades, to beach erosion, to flooding risks from large winter storms.

The mapping work, supervised by the National Oceanic and Atmospheric Administration, will start next month and is expected to conclude by December, with the images posted to the Internet by next summer.

Starting point needed

Over the decades, there have been many detailed photo sets and maps produced of sections of the coast. But there isn't a single, high-resolution topographical map of the complete California shoreline generated at the same time using uniform standards.

"The baseline is a critical piece. You can't monitor anything if you don't have a good starting point — and we don't have a good starting point," said Sam Johnson, a research geologist working on the project with the U.S. Geological Survey in Santa Cruz.

Apart from studying erosion and sea level rise, the images also will be used by agencies such as the California Coastal Commission, state parks, or cities to plan wetland restoration, floodplain management, storm water management, better public access to beaches and coastal development.

Every few years, heavy storms cause cliffs to erode in places like Pacifica, Capitola and Goleta. Beaches in San Diego and Orange County wash away. Better information could help prioritize projects in those places, supporters of the map effort say.

"California's coast has gone through some dramatic changes over the last 150 years. Beaches erode and grow, bluffs collapse," said Johnson. "Every place is different. You might lose 20 meters of beach over 50 years, or it might happen all at once."

The high-tech tools used in the mapping may have generated your last speeding ticket.

Known as Light Detecting and Ranging, or LiDAR, the technology is similar to what police use to nab speeders. Researchers shoot harmless pulses of light from the aircraft, and images are generated by computing the amount of time it takes a pulse to leave the plane, travel to the ground and return to sensors.

Each data point has a longitude, latitude and elevation. And where many satellite maps might have one data point every 100 feet, LiDAR images can provide one data point every 3 feet or less.

Ocean floor to land

In addition to the coast, the project will also take images of San Francisco Bay.

"This is absolutely cool. I have a picture on my wall of a 1770s map of San Francisco Bay. It looks like the results of a lower digestive tract x-ray," said Will Travis, executive director of the Bay Conservation and Development Commission, a state agency that regulates development around the bay.

"But from the perspective they had, without aerial photography, it was very reasonable. You look at that next to a USGS map, and you see how much more precise and realistic it is. This is taking it to the next generation."

The ocean already has risen 8 inches over the past 100 years, as measured by tidal gauges at Fort Point in San Francisco. Computer models run by the Scripps Institution of Oceanography, the U.S. Geological Survey and other research centers predict at the current rate of global warming, sea level could rise another 55 inches — or nearly five feet — by the end of this century as ice sheets continue to melt and the warmer ocean water expands.

The infrared laser beams don't penetrate water well. So researchers hope to combine all the images from land, which will extend inland from the water to about 30 feet in elevation, with other sets of sonar images of the ocean floor that USGS, NOAA and Cal State Monterey Bay have been collecting from boats since 2005.

"Our goal is to have a seamless map of the land and sea," said George. "That's the holy grail everyone is looking for to help with research on sea level rise, tsunamis, all kinds of work."

Findings could be used to figure out where to build sea walls, or expand wetlands to reduce flooding, or where to move existing development.

"The next step we want to do is an assessment of vulnerability of various resources to sea level rise — airport runways, Silicon Valley, the Embarcadero in San Francisco, Treasure Island," said Travis. "And you can't do that unless you know the exact height of everything."