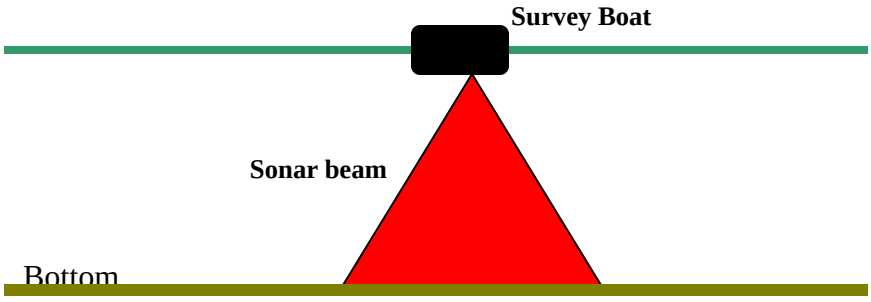
NOAA Teacher at Sea
Barney Peterson
Onboard NOAA Ship RAINIER
August 12 – September 1, 2006

NOAA Teacher At Sea: Barney Peterson
NOAA Ship RAINIER
Mission: Hydrographic Survey
Day 8: Monday, August 21, 2006

Weather Data from Bridge
Visibility: 10 n.m.
Wind direction: light airs*
Wind speed: light airs*
Seawater temperature: 11.1˚C
Sea level pressure: 1012.0
Cloud cover: cloudy
* "light airs" means there is little or no wind

Science and Technology Log
I have now been out on the survey boats twice and am scheduled to go out again this afternoon. Each survey boat is set up a little differently and some work better in shallower depths than others. They use the same basic systems to create profiles of the ocean bottom. The survey technicians and NOAA Corps officers have been great at explaining how their equipment works.

On the hull (bottom) of each survey boat is a transducer, a device that sends and receives pulses of sound waves. As the sound waves strike the seabed they bounce back to the receiver. Those that come back soonest are those that bounce off objects closest to the sonar device.



However, as the sound waves are transmitted straight down into the water, they spread out from the transducer in a cone shape. This means that waves on the outer edges of the cone normally travel farther before returning than do the ones that go straight down. The waves that come back to the receiver first show the tops of objects that are closer to the

boat. This works fine for objects straight down, but remember, the waves that are on the outside of the cone travel a little farther and take a little longer to reach things. That means that they may strike against the tops of higher objects, but they will still take a little longer to return than echoes from objects of the same height that are directly under the receiver.

This is where the sophisticated software comes into translating the echoes that the transducer receives. When the survey boats begin work, and every four to six hours after that, the crew uses a device called a CTD to read the temperature and conductivity of the water all the way to the seabed under the boat. Both temperature and chemical make-up of the water affect how fast sound waves can travel through it. Knowing how fast the sound waves can be expected to travel helps the receiver understand whether echoes are coming back from the tops of rocks (or fish, whales, shipwrecks, etc.), from straight down under the boat, or from the edges of the cone.

There are other considerations to analyzing the echoes too. It is important to have information on the height of the waves and the swell of the water at the time readings are being made. (Remember the sound waves are sent out from the bottom of the boat and the boat is floating on the top of the water.) This way the echo patterns analysis can take into account whether the boat is leaning a little to the right or left as it goes up or down with the swell of the water. That lean affects the angle at which the beam is aimed to the seabed from the bottom of the boat. The level of the sea surface changes with the tides, so the software also figures in the lowest level that probably will occur due to changes of tide. This is all linked to the time that surveys are made, (because tides change with the time of day, month, and year) the date and the exact geographical position for each bit of information is very important. This depends upon satellite and GPS technology.

The transducers send out pings faster or slower (pulse rate) and with a stronger or weaker signal, depending upon how deep the water is in the main area of the survey. The power is set higher for deeper water. The cone of the beam spreads out wider in deeper water so the resolution, or focus, is not as great. This is acceptable because objects that are hazards to navigation are generally sticking up from the bottom in shallower water. (Something sticking up 2 meters from the bottom in water 50 meters deep would still be 48 meters below the surface at its highest point. That same object in 10 meter water would only allow 8 meters of clearance for ships on the surface.)

There are many other considerations to using the sonar information for making good charts. Every day I have the opportunity to ask a few more questions and learn a little more about this technology.

Personal Log

This evening I got to go out in a kayak with the XO. We paddled away from the ship and followed the shoreline north around the island until we entered the next bay. The waves were small, but sometimes there was a pretty good gust of wind so I really had to pay attention as I was getting used to the feel of the little boat. About 100 yards from the ship a sudden gust caught my hat and took it off into the water. We were not able to recover it

because the waves and the current moved it away too fast and it sank before I could get to it.

NOAA Teacher at Sea, Barney Peterson, kayaking along the Alaskan coastline.

The view from the surface of the water is very different than from the ship. You can see quite a ways into the clear water. Near the shore I could see rocks with barnacles, jelly fish, and lots of sea birds. We were mainly sharing this area with Horned Puffins, Black Oystercatchers, Pigeon Guillemots, and gulls of several kinds. On the cliffs above the second bay we spotted Bald Eagles. One of the eagles was really concerned about what we were doing and either circled over us or sat on the high bluff and watched us the whole time we were in the area. Its mate flew back and forth through the area calling to it as it watched us.

We were hoping to see a waterfall that we had heard came down the side into this bay, but we never did sight it. The shoreline was beautiful with steep rock walls or narrow rocky beaches and mountains rising right up from the edge. The hillsides look like they would be smooth and easy to walk on, but the vegetation is actually thick, deep, brush and provides very uneven footing.

Our return to ship was much faster than the trip out because the wind was at our back and pushing us all the way.

Question of the Day
How were most of the islands in the Aleutian Chain formed?

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