NOAA Teacher at Sea
Gary Ledbetter
Onboard NOAA Ship RAINIER
July 7 – 25, 2008

NOAA Teacher at Sea: Gary Ledbetter, Peninsula College, Clallam Bay Correction Center, Clallam Bay, Washington
NOAA Ship RAINIER
Geographical Area: Pavlof Islands in the southeastern panhandle of Alaska
Mission: Hydrographic surveys of Pavlof Islands area
Date: Tuesday, July 15, 2008

Weather from Bridge
Winds SE/E @ 5 knots
Temperature: High 45 degree F
Seas 1-3 feet

Science and Technology Log

Sonar
Sonar, which is short for **sound navigation and ranging,** is a system that uses sound to communicate, navigate, detect other vessels, and determine the depth of the water. A hydrographic survey ship, such as the RAINIER, extensively uses sonar on their survey boats.

A Very Brief History
Using sound to detect objects is nothing new. In fact man has been using it for hundreds of years. Even before man was using sound, bats use their own form of sonar (more commonly referred to as radar) for navigation. As early as 1490 Leonardo Da Vinci inserted a tube in water, put his ear to the tube and reportedly was able to detect vessels. Not surprisingly, the use of the "echo locate" system was given a big boost following the Titanic disaster of 1912. The British Patent Office gave English meteorologist Lewis Richardson, the world's first patent for an underwater echo ranging devise within one month of the sinking of the famous ship.

Sonar usually plays an important part when we watch World War II war movies depicting the Navy hunting enemy submarines. These depictions were more than just Hollywood. In fact, the British were ahead of the U.S. in sonar technology even prior World War I. In 1916 Canadian physicist Robert Boyle took along with AB Wood, under the direction of the British Board of Invention and Research, produced a prototype for active sound detection in 1917. This was really secret stuff! In fact it was so secret that the word used to describe that early work, called "supersonics", was changed to ASD'ics. This term eventually morphed into ASDIC. It even gets more interesting. The Admiralty made up a story that ASDIC stood for "Allied Submarine Detection Investigation Committee. Many people today still think that's what ASDIC means even no committee with this name has even been found in the Admiralty archives.

It seems like we Americans always have to change the name of something, (you history buffs know that Britain had something called the wireless... but we changed it to radio) so we did the same thing with ASDIC. We changed it to SONAR, primarily because it was closely related to RADAR. The name change became official in 1948 with the formation of NATO's standardization of signals. Thereafter, ASDIC was changed to SONAR for all NATO countries.

So Just What Is This Sonar…?

There are two basic types of sonar: Active and Passive. We'll briefly discuss passive first. Passive listens without transmitting. It is used to determine the absence or the presence of something - primarily in the water. To come directly to the point it is detecting any sound that comes from a remote location. Listening to those sounds helps identify the sound. (Back to Hollywood: remember the scene in nearly any navy warfare movie when the sonar operator of the ship is talking with the captain: "it sounds like a X4IY9, Class H2 Russian sub, Captain). The sound of the sub was not being produced in any form from the ship, but from a remote location – the sub. Now you have an idea of passive sonar.

Active Sonar

Active Sonar creates a "ping". This ping travels through the water until it strikes something; it then bounces back. The bouncing is called reflection, or an echo. The ping is created, normally, electronically. When the ping is transmitted it travels through the water, strikes an object and bounces back (the echo). This time is measured and converted into range (distance) by knowing the speed of sound. Sounds pretty simple, right? Unfortunately numerous variables can affect the time it takes for the echo to return such as salt content (sounds travels faster through salt water than fresh water), the density of the water, and even the temperature of the water. Then there is the "noise", or other disturbances in the water: fish, seaweed, dirt, trash, etc., that effect an accurate measurement. All of these variables have to be taken into consideration by the survey technicians and scientists.

This is the Reson Sea Bat 7125, the type of sonar on the bottom of one of the RAINIER's launches.

The survey boats from the RAINIER use different types of sonar. The sonar on the boat I was recently on is called the Reson SeaBat. Instead of simply one "ping", it produced a swatch of 128 degrees consisting of 256 pings across the ocean floor. It then transmits these pings back to the boat.

Think in terms of a triangle, with the top of the triangle being the sonar unit on the boat. The sonar transmits the pings across the ocean floor and sends back numerous signals instead of just one.

Above: Matt from Earth Resources Technology working on one of the survey launches

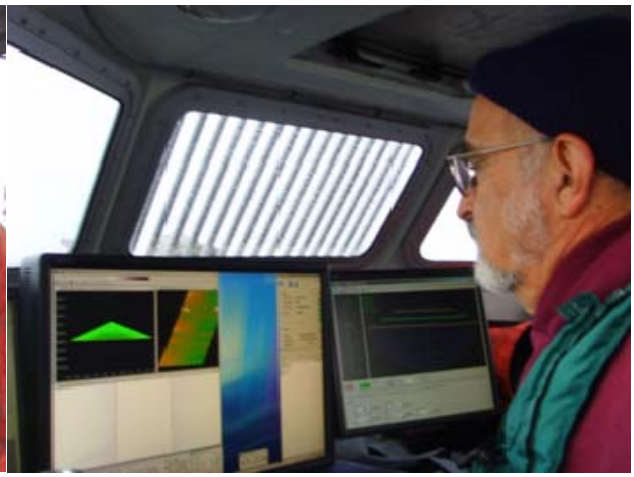
Personal Log

Yesterday I was aboard survey boat (called a launch) RA 4. These boats are deployed and retrieved each morning and night. On the ocean each boat follows a predetermined grid across the ocean much like mowing your lawn. Deploying the boats, retrieving the boats, and following the grid looks really simply until you do it yourself, and then you realize how difficult it really is. I guess when you watch experts do something; they always make the complex look simple.

Left: The lines you see make up the grid the survey boats follow. The ones scratched out are the ones we have completed.

The sea was nearly mirror smooth. Although it was cloudy and cool, there was little or no rain or wind. This makes the process much easier as well as more enjoyable. Tim, a NOAA Ensign

Yours truly trying his hand at driving the boat



Checking out the boat's computer

was operating the onboard computer system that kept track of the sonar readings. . I was able to try my hand at driving the boat and operating the computer. I'm not going to talk about how well I did, but as I said before, they make their job **look** so easy!