



**NOAA Teacher at Sea
Beth Carter
Onboard NOAA Ship RAINIER
June 25 – July 7, 2007**

NOAA Teacher at Sea: Beth Carter

NOAA Ship RAINIER

Mission: Hydrographic Mapping of Gulf of Esquibel, Launch Passage, Anguilla Bay,
Two Crack Island, Dome Islets

Day: 16, July 10, 2007

Weather Data from the Bridge:

Visibility: 2 nautical miles

Wind direction: 125 degrees

Wind speed: 11 knots

Sea wave height: 0-1 feet

Swell wave height: none

Seawater temperature: 11.7 degrees C

Dry bulb temp: 12.8 degrees C Wet bulb temp: 12.2 degrees C

Sea level pressure: 1021.0 mb

Cloud cover: 8/8, fog and drizzle

Science and Technology Log:

Yesterday, I went out on launch #6, which utilizes a sonar system called the "C3D," that produces interferometric sonar, which is a combination of side scan and multibeam sonar, to produce bathymetry. Interferometric sonar is the latest technological advance in hydrographic mapping.

This is the third technology I've been able to observe at work. The RAINIER has two launches that use single beam technology (June 29 log), three launches that use multibeam technology (June 28 log), and Launch 6 has the side scan sonar. There are advantages and disadvantages to each.



The NOAA ship RAINIER, also known as S221, at anchor in Alaska.

Erin Campbell, my Tarheel buddy who is a physical scientist from the Pacific



Erin Campbell, physical scientist, and Beth Carter, Teacher at Sea...two Tarheels at a rainy beach party near Bushtop Island, Alaska.

Hydrographic Branch of NOAA, took the time to explain some of the features and limitations of side scan sonar.

The greatest advantage to side scan is that it produces sound waves that can cover a much wider swath of ocean floor, with very good resolution. This means that NOAA can be more fuel-efficient with its launches and cover more floor in less time. Side scan can form accurate 3-D images of rocks, wrecks, and features of concern and interest on the ocean floor.

Hydrographers say that the side

beam enables them to “paint the ocean floor.”

The greatest disadvantage to side scan sonar is that it does not actually provide depths associated with those features. In other words, the hydrographers can look at the side scan images and locate a downed plane accurately on the ocean floor, but not know the exact depth of the plane.

Another disadvantage to use of side scan in Alaska is that the extreme angles of slope of the islands and landforms cause the sound waves to create shadows on the resulting data. This means that some features in the shadows are missed. Side beam sonar is used with great success on the eastern coast of the U.S., where the sea floor is sandy, is more uniform, and has less slope than in Alaska.



The C3D sonar transducer on the hull of the #6 Launch.

Therefore, NOAA uses side scan to cover wide areas of territory, and then examines the images collected. If the technicians see rocks or other potential hindrances to navigation, they send out the multibeam sonar launches to collect

more detailed information on the depths. If the concern is in a really shallow area, they might send out the single beam launches, which can get into shoal areas more easily with less threat of damage to the sonar equipment.

Side scan sonar is still evolving as a technology. NOAA provides valuable feedback and information to the makers of this technology, which enables the manufacturers to fine-tune and improve the technology.



Erin Campbell operating the C3D sonar aboard Launch 6.

As I prepare to leave the RAINIER, I am impressed with the depth of knowledge of the Commanding Officer, the survey crew, and officers on the ship. They take very seriously their work, which is to take information gathered utilizing sonar, and to produce the most accurate bathymetric products possible. The resulting charts and hydrographic maps are critical aids to shipping companies and fishermen, whose lives and safety and economic livelihood depend on the accuracy of the maps.

I've also learned that NOAA hydrographers are called in to assist after hurricanes. Erin, for example, was called upon to join a NRT (Navigational Response Team) after Hurricane Katrina. There were many container ships and other ships waiting in the Gulf of Mexico for the hydrographers to survey the waters in order to locate hazards (debris in the water, wrecks, storm damage) in the water that were blocking the port and docks. NOAA has six such teams that assist when there are oil spills, wrecks, storms, etc.

Terms Used:

Bathymetry: the science of measuring ocean depths. It is the underwater equivalent to altimetry, or measuring altitude of land forms. Bathymetry is utilized to create DTM's, or digital terrain models, or three-dimensional models of the ocean floor.

Hydrography: the study and science of ocean mapping.

Questions of the Day:

1. What kind of sonar would be best utilized in the search for a tugboat that sank unwitnessed, suspected to be in a deep harbor – vertical beam, multibeam, or sidescan sonar?

2. To see an example of a chart created with interferometric sonar, take a look at http://chartmaker.noaa.gov/hsd/TechPapers/Gostnell_PDDBS_CHC2006.pdf

and the more general site is:

<http://www.oceanservice.noaa.gov/topics/navops/hydrosurvey/welcome.html>

Personal Log: I want to close out my last log with a few pictures, which definitely communicate the Alaska experience better than my words. I also want to thank the entire crew of the RAINIER for its kind hospitality, for teaching me so much, and for reminding me what it feels like to not understand something. I can empathize with my students so much better, as I have been in their shoes now for almost 3 weeks...struggling to understand

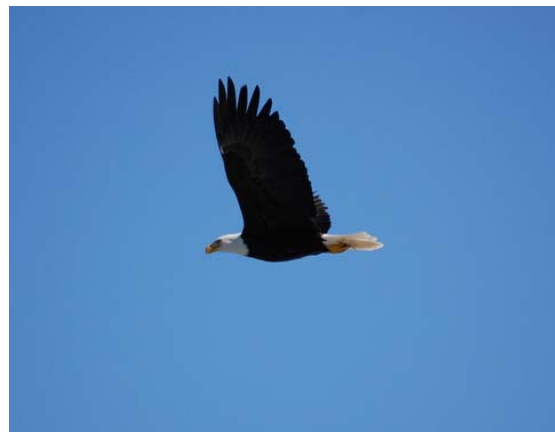


Alaska...known for its snow-topped majestic mountains. Photograph from the files of the RAINIER.



A humpback whale breaching... breathtaking sight! Photograph courtesy of Shawn Colvert.

technologies that were totally unfamiliar to me, feeling frustrated, feeling glimmers of hope when a few concepts dropped into place in my brain. Alaska is incredibly beautiful, incomprehensibly vast...I hope to return someday.



A bald eagle on the fly above Alaskan waters. Photograph from the files of the RAINIER.