NOAA Teacher at Sea
Christine Hedge
Onboard USCGC *Healy*
August 7 – September 16, 2009

NOAA Teacher at Sea: Christine Hedge
Ship: U.S. Coast Guard Cutter *Healy*
Mission: U.S.-Canada 2009 Arctic Seafloor Continental Shelf Survey
Geographical Location: Beaufort Sea, north of the Arctic Circle
Date: September 5, 2009

Weather Data from the Bridge
Latitude: 77^0 13'N
Longitude: 137^0 41'W
Temperature: 29^0F

Science and Technology Log

More Ways to Use Sound to See Beneath the Sea Floor
Today we "rafted" with the *Louis* (the ships tied together side by side). I have been eager to see the science instruments that the Canadian ship is carrying. Once the ships were securely tied together we could just walk back and forth between them and tour the Canadian vessel.

The two icebreakers are tying up side-by-side so that we can visit each other.

Seismic sled being hauled out of the water on the *Louis*. (Photo courtesy of Ethan Roth)

The *Healy* has been breaking ice so that the *Louis* can have an easier time collecting data using seismic reflection profiling. The goal is for the Canadian scientists to determine how deep the sediments are in this part of the Arctic Basin. The sound waves their instrument sends out can penetrate about 1500 meters below the seafloor. Using sound they can "see" inside the earth – amazing!

FOR MY STUDENTS: Remember your Latin/Greek

word parts? Look up "seism".

Here is how it works. The *Louis* steams forward at a low speed following in the path that the *Healy* has created through the ice. The *Louis* tows behind a weighted sled with 3 airguns suspended from the bottom. This sinks about 10 meters below the water.

Steamer on deck of *Louis*. The blue steamer is out of the water and lying on deck when we visit the *Louis*.

Attached to the sled is a long tube filled with hydrophones (underwater microphones) called a streamer. This streamer is about 400 meters long and stretches out behind the ship. It is best for the ship to move continuously so that the streamer will not sink or float to the surface.

FOR MY STUDENTS: Try to picture a 400-meter long "tail" on a ship. That is longer than 4 football fields.

The airguns create a huge air bubble in the water. When it collapses, it creates a sound pulse. Two of the guns use a low frequency, which will penetrate deep into the sea floor but will create a low-resolution image. The other gun uses a high frequency, which does not penetrate as deep but gives a high-resolution image. The 16 sound recorders in the streamer record the echo created by these sounds reflecting from the sediment layers below the sea floor.

The bubble created by the airguns on the *Louis.* (Photo Courtesy Pat Kelley USCG)

The final product this instrument creates is an image of a cross section through the Earth. Scientists can look at these images and "see" evidence of geologic forces that have disrupted the sediments in the past. In a

way, by observing this geologic history, the scientists are looking back in time.

You can imagine that ice can cause lots of problems when a ship is towing a 400-meter long streamer behind it. This is why we are working on collecting this data together. One ship breaks, the other collects the seismic reflection data.

Personal Log

The crew has been looking forward to the two ships tying up together for the entire cruise. Everyone is curious about the other ship. What are the staterooms like? What is the food like? How is their bridge different from our bridge? And of course there is shopping!! Both of the ship stores had their best *Louis* and *Healy* gear ready for the eager shoppers.

Behind the wheel on the bridge of the *Louis S. St. Laurent.*

After learning about the science instruments aboard the *Louis*, it was nice to finally see the seismic sled, streamers, and the computer nerve center where the seismic images are received. The ships are pretty different in their appearance. The *Louis* is an older vessel and has wooden handrails, panels cover the wires in the ceiling, and there are some larger windows with actual curtains. The *Healy* was built to be a science research icebreaker and so has many large spaces for science and looks generally more industrial. The *Louis* was an icebreaker first and some of their science spaces have been added later and are less spacious.

One of the lounge spaces on the *Louis*, we were impressed with their windows, ceilings, and Wii set up.

Shopping and tours were fun but the most anticipated events of the day were the evening meal, contests and games. The ship's officers exchanged gifts in a formal presentation and then we had an amazing buffet together. Personnel from both ships enjoyed scallops, halibut, salmon, shrimp, lobster, pork, beef, cheese, salads, and desserts. This was an exceptional meal and a great social event. The

idea of having Teachers at Sea (TAS) was a new one for most Canadians I spoke with and as we talked they seemed to think this TAS would be a great idea to stimulate interest in young Canadians about maritime careers. The evening concluded with some friendly competitions between the crews and the science parties. This entire event was a lot of work for the Coast Guard crews. The science party really appreciates all the hours they put into planning this event!