



**NOAA Teacher at Sea  
Brett Hoyt  
Onboard NOAA Ship RONALD H. BROWN  
October 8 – October 28, 2006**

**NOAA Teacher at Sea: Brett Hoyt**

NOAA Ship RONALD H. BROWN

Mission: Recovery of Stratus 6 mooring and deployment of Stratus 7 mooring  
Recovery of SHOA tsunami warning buoy and deploy a fresh replacement  
buoy

**Days: Saturday and Sunday, October 14 & 15, 2006**

**Weather Data from Bridge October 14**

Visibility: 12nm(nautical miles)

Wind direction: 110° True

Wind speed: 11 knots

Sea wave height: 2-3 ft

Swell wave height: 3-5 ft

Sea level pressure: 1016.8 millibars

Sea temperature: 18.6°C or 65 °F

Air temperature: 18.2°C or 64°F

Cloud type: cumulus, stratocumulus

**Weather Data from Bridge October 15**

Visibility: 12nm(nautical miles)

Wind direction: 140° True

Wind speed: 15 knots

Sea wave height: 5-7 ft

Swell wave height: 7-9 ft

Sea level pressure: 1019.5millibars

Sea temperature: 19.3°C or 66°F

Air temperature: 19.5°C or 67°F

Cloud type: cumulus, stratocumulus

**The Scientists**

Today we will visit with Dr. Robert (Bob) Weller. Dr. Weller is the lead scientist for this scientific cruise and upon whose shoulders the success or failure of this expedition rests. Dr. Weller is an easy going, soft-spoken, easy to approach, modest, and very intense man with a passion for understanding the climate of the earth and all the processes within it. Many times scientist possess a great mind for academic excellence yet they fail at relating to people. Dr. Weller is the exception, possessing a brilliant mind, keen insight and intuition, and superb people management skills. It is exactly these qualities that have enabled him to lead such important and ground breaking research on climate and climate studies. He understands that the success of a cruise depends on getting people

(sometimes of various nationalities, on our cruise five) to work together to accomplish great things.

Dr. Weller began at an early age to feel the pull of science. He entered college initially to be a biochemist but something happened. In the middle of college he accepted a job with an oceanographer and from that time on he knew that a new career was in order. He graduated in 1972 with a degree in engineering and applied physics. He continued on and five years later in 1978 earned his doctoral degree in oceanography.

Upon earning his doctoral degree he accepted a position working at the prestigious Woods Hole Oceanographic Institution. He has been there ever since. How many people do you know who have stayed at the same job for 28 years! Dr. Weller finds himself at sea 2-3 months out of the year. He is a self-described scientist who likes to do things “hand on”(he’s not afraid to get dirty please see the photo of him on deck and in his hard hat). When I asked him how long he has been a lead scientist he modestly replied” I don’t know if I’m there yet.” When I asked him what one message he would like to send to you future scientists he stated “ Kids and future scientists should be less concerned about outer space and more concerned about the planet we currently live on”. He wants kids to think about the things you can do about the temperature of the oceans and the role they play in the well-being of our planet we call home.



**Dr. Robert (Bob) Weller sitting on the aft (back) deck of the RONALD H. BROWN.**

### **The Machine**

Today we will examine the reason we all went to sea, the Stratus 7 Buoy. This buoy sends real time data from a fixed location off the coast of Chile. The buoy system maintained by the Woods Hole Oceanographic Institution (WHOI) out of Woods Hole Massachusetts plays an extremely critical role in understanding weather patterns that have worldwide implications. These buoys are highly sophisticated weather and climate data-gathering stations. The data collected from these stations is used to check the accuracy of powerful computer simulations that are used to predict climate change.

The Stratus 7 buoy replaces the aging Stratus 6 buoy that has been on station for over a year. There has been a Stratus buoy in this location since 2000. Dr. Weller stated that in years past buoys would not be on station for years at a time but rather for days at a time. Most did not exceed 40days. Through trial and error, research and innovation the life at

sea for a buoy has been extended into the years. Concerned about waste and pollution in the oceans, most buoys are serviced, refitted, and given a new life year after year. Some



**The Stratus 7 Buoy on station in the South Pacific Ocean just after being deployed from the ship**

might wonder about the cost, sometimes in excess of \$1million dollars, of the buoy programs. The economic payoff is immense. It is buoys like these and the data that they collect that help scientists predict the absence or presence of El Nino. This has a huge and direct agricultural impact upon coastal states and to a lesser degree states far removed from the oceans. Do you have droughts or floods out of

the norm in your area? The cause could be ocean related.

The Stratus Buoy can make the following measurements:

- precipitation
- wind speed and direction
- air temperature
- relative humidity
- barometric air pressure
- long wave radiation (radiation given off by a hot body)
- short wave radiation (incoming energy from the sun)
- sea surface temperature

The buoy not only transmits this data real time but also stores much more detailed information on flash cards. These cards are collected and taken back to the laboratory for further study. In addition to all the above surface instrumentation there is over 5,000 lbs of sub surface measuring instruments. These include current velocity, salinity, and temperature. These instruments are located at various depths down to 2,500ft. For example there will be 8 current velocity-measuring instruments at 8 different depths.



**The anchor for the buoy**

### Cool facts

-You probably wonder how this million-dollar instrument is powered. Wind, solar, high powered lithium batteries, nope none of the above. It is powered by 1,650 D cell alkaline batteries. Exactly the ones you would use in a flashlight in your house.



**Hundreds of pounds of chain!**

-The mooring line (the line connected to the anchor) will be over 12,000 feet long

-The anchor is a cast iron weight that weighs over 9,000 pounds.

-This anchor will take over 45 minutes to make it's journey to the bottom of the ocean

-The buoy will have over 5,000lbs

of instruments hanging from the bottom of it

### The Experiment

There is no direct experiment with the stratus buoy. The data collected by it is used by scientist world wide to generate new ideas, hypothesis, and conclusions. As stated earlier this data is used to help climatologists improve computer models and check them for accuracy.

### Classroom Activities

**ElementaryK-6:** Items needed- Styrofoam cup or similar floating device, small piece of string and a metal washer some rubber cement or other flexible glue, some round toothpicks and a large tub of water. Have the students decorate their cup using markers, plastic straws, aluminum foil, or anything else that the kids might think would make their buoy look scientific. Put the string through the bottom of the cup making as small a hole as possible (the point of a compass or the toothpicks work well) tie the string to a



**Dozens of instruments to be deployed directly beneath the buoy 800 meters worth that's over 2,400 feet of instruments!**

toothpick on the inside of the cup and let the toothpick rest on the bottom inside the cup. Place a small dab of glue on both the inside and outside of the string to keep the water from entering the cup. With the string dangling from the bottom outside of the cup tie on the washer or other object for weight. Ask the kids what scientific information their buoy collects.

**Middle school:**

Items needed- volt-ohm meter, glass beaker, two small copper wires, 500ml of distilled water, and some common table salt.

Salinity of the oceans seawater is of concern to scientists and is one of the tests conducted by the Stratus 7 Buoy. The way scientists test for salinity is called a conductivity test. That is they measure the conductivity of seawater. Have the student pour 250ml of distilled water into a glass beaker. Place two small copper wires on opposite sides of the beaker and submerged in the water. Be sure that at least 1cm of wire is exposed copper and in the water. Set the voltmeter to ohms and get a reading and record it. Add .5 grams of salt and mix well. Test the conductivity again. Keep adding salt in .5-gram increments. Does the readings change? If so how? Are the numbers getting larger or smaller? If so why?

**High School:**

Items needed- volt-ohm meter, glass beaker, two small copper wires, 250ml of distilled water, and some common table salt, and sugar.

Salinity of the oceans seawater is of concern to scientists and is one of the testes conducted by the Stratus 7 Buoy. The way scientist test for salinity is called a conductivity test. That is they measure the conductivity of seawater. Have the student pour 250ml of distilled water into a glass beaker. Place two small copper wires on opposite sides of the beaker and submerged in the water. Set the voltmeter to ohms and get a reading and record it. Add .5 grams of salt and mix well. Test the conductivity again. Keep adding salt in .5-gram increments. Does the readings change? If so how? Are the numbers getting larger or smaller? If so why?

Now run the test with sugar. What are your results? Was there a change?  
Now change the temperature of the solution by heating or chilling with ice. Does this make a difference in your readings?

Lead a class discussion on what each instrument of the stratus buoy does and why it is important to scientists.