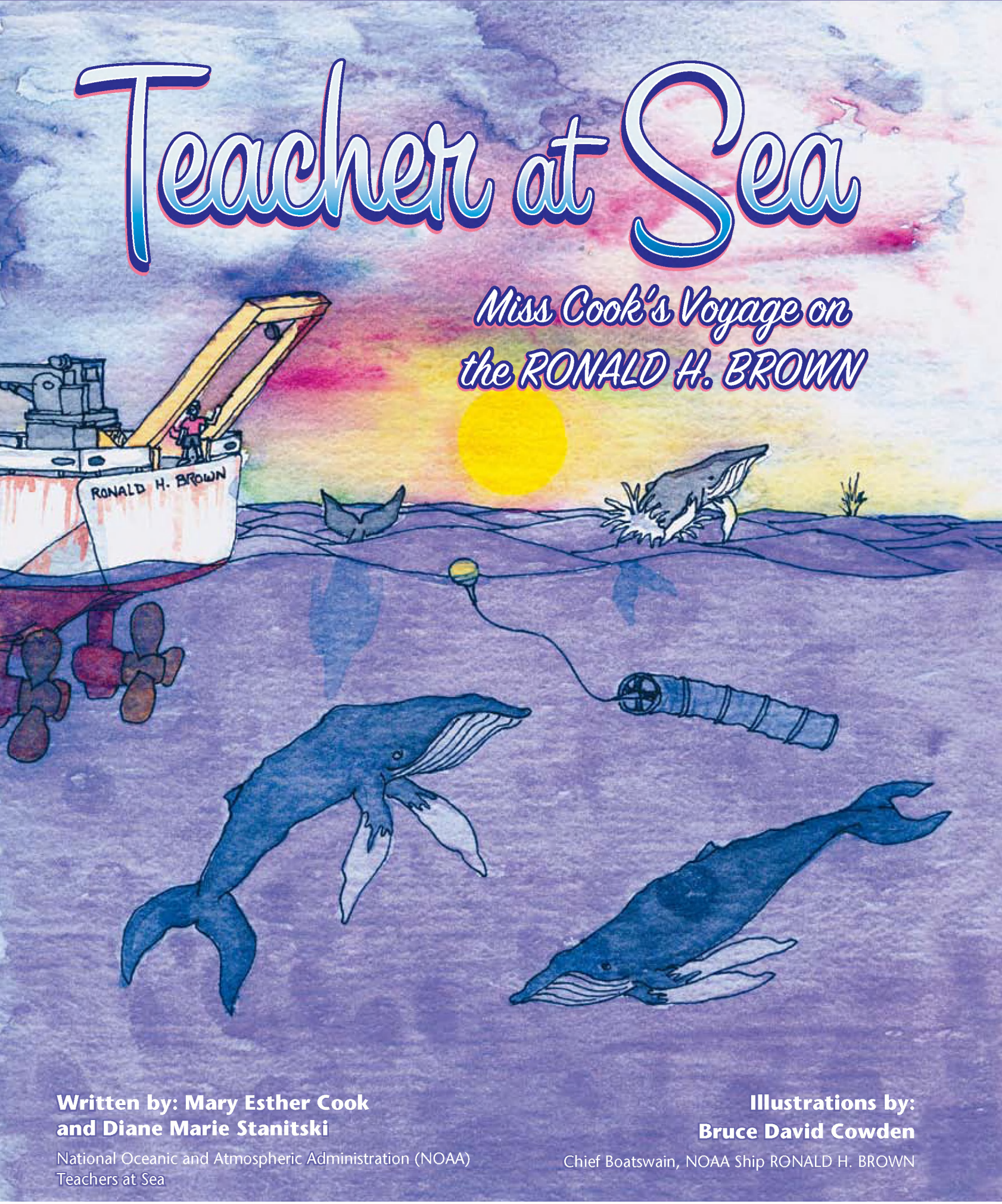
Teacher at Sea

Miss Cook's Voyage on the RONALD H. BROWN



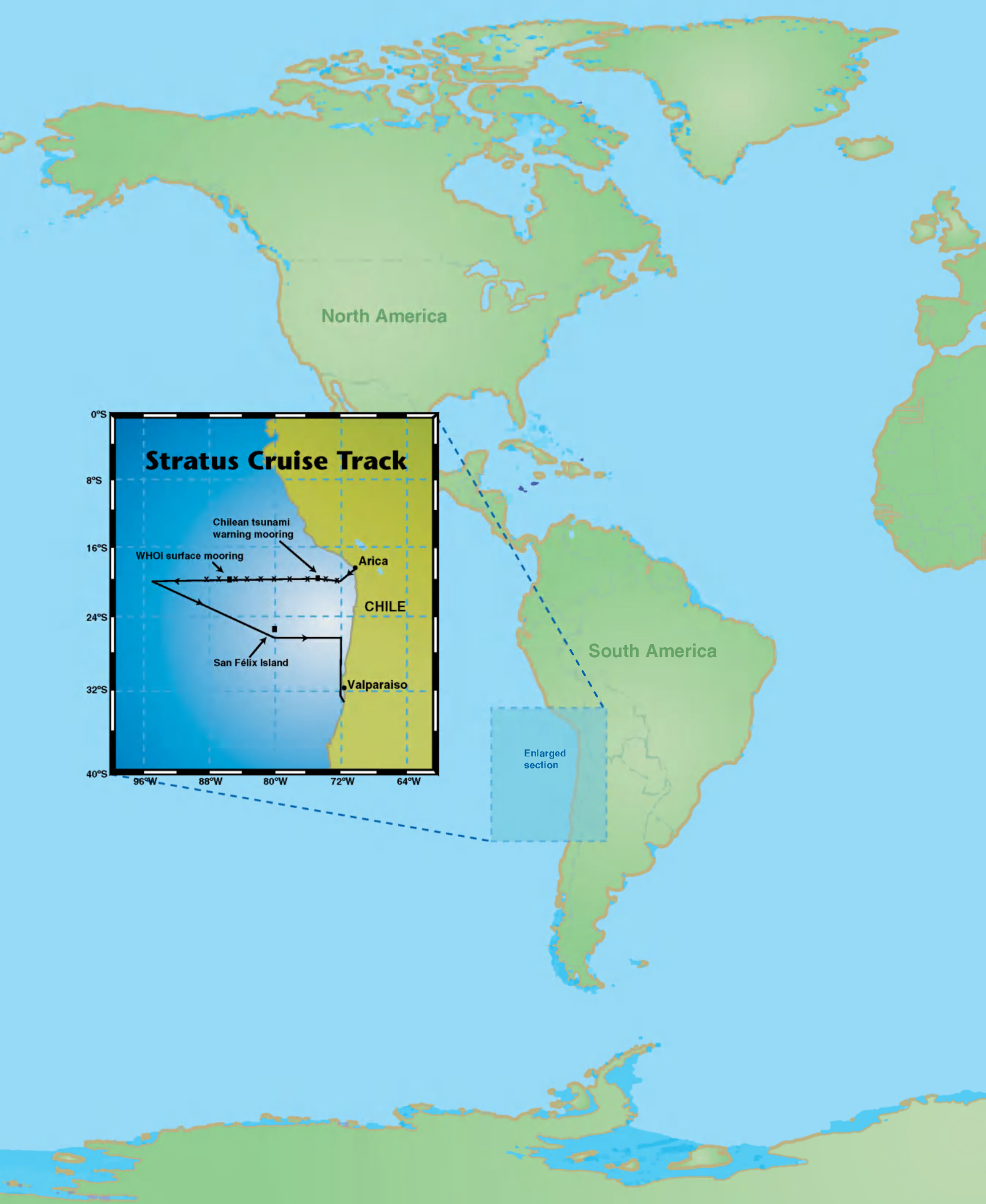
Written by: Mary Esther Cook and Diane Marie Stanitski

National Oceanic and Atmospheric Administration (NOAA) Teachers at Sea

Illustrations by: Bruce David Cowden

Chief Boatswain, NOAA Ship RONALD H. BROWN

A National Oceanic and Atmospheric Administration (NOAA) Publication


North America
South America
Stratus Cruise Track
Chilean tsunami warning mooring
WHOI surface mooring
Arica
CHILE
San Félix Island
Valparaiso
Enlarged section
0°S
8°S
16°S
24°S
32°S
40°S
96°W
88°W
80°W
72°W
64°W

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A National Oceanic and Atmospheric Administration (NOAA)
Publication
2005

Acknowledgements

The authors would like to thank the many individuals who provided guidance, support, and feedback during the writing of this children's book. Their editorial remarks and suggestions were priceless. We extend our appreciation to LeeAnn Conyers, Rear Admiral Samuel P. De Bow, Jr., Melanie Ellsworth, Jennifer Hammond, Mike Johnson, John Kermond, Jeanne Kouhestani, Michael Patterson, Tim Sisk, Jason Smith, Patricia Stanitski, Raymond Stanitski, Lisa Thomas, Dana Tomlinson, and Robert Weller. We also appreciate the cooperation of the officers, crew, and scientists on board the NOAA ship RONALD H. BROWN. Printing of this book was made possible by the Cooperative Institute for Climate and Ocean Research (http://www.whoi.edu/science/cicor), NOAA Marine and Aviation Operations (http://www.nmao.noaa.gov), NOAA National Sea Grant (http:// www.seagrant.noaa.gov), the NOAA Office of Education and Sustainable Development (http://www.oesd.noaa.gov), the NOAA Office of Global Programs (http://www.ogp.noaa.gov), and NOAA Satellite and Information Service (http://www.nesdis.noaa.gov).

Joint Office for Science Support
University Corporation for Atmospheric Research
PO Box 3000
Boulder CO 80307

This report was prepared by the University Corporation for Atmospheric Research under award NA17GP1376 from the National Oceanic and Atmospheric Administration U.S. Department of Commerce. The statements, findings, conclusion, and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration or the Department of Commerce.

This book is dedicated to Dr. Robert Weller, Senior Scientist, Woods Hole Oceanographic Institution, for his guidance and contributions to the global ocean observing system.

Teacher At Sea

Miss Cook's Voyage on the RONALD H. BROWN

It was a beautiful day and clouds were building above the hill slopes. In their outdoor classroom, Miss Cook and her 8th grade students were discussing the wonders of **weather**. The students had built their own weather station and were excited to make their very first weather observations. Suddenly, the school's principal, Mr. Franks, came running out the door waving a faxed announcement stating that Miss Cook had been selected as NOAA's next Teacher at Sea!

The students gasped and then cheered because they knew that Miss Cook was waiting to hear if she had been chosen to be the Teacher at Sea. Most of her students had never even seen the ocean. This would prove to be their first encounter with ocean exploration…and hopefully, not their last.

As the NOAA Teacher at Sea, Miss Cook would soon embark on a three-week journey on board NOAA's research ship, the RONALD H. BROWN. While at sea participating in exciting experiments and research, she would email her students daily, send them photographs, and describe the cutting-edge science.

The most exciting news of all was that their school, Southside Middle School, would be the first school in the world to adopt a **drifting buoy**. What is a drifting buoy, you might ask? Read on, and you will discover the answer.

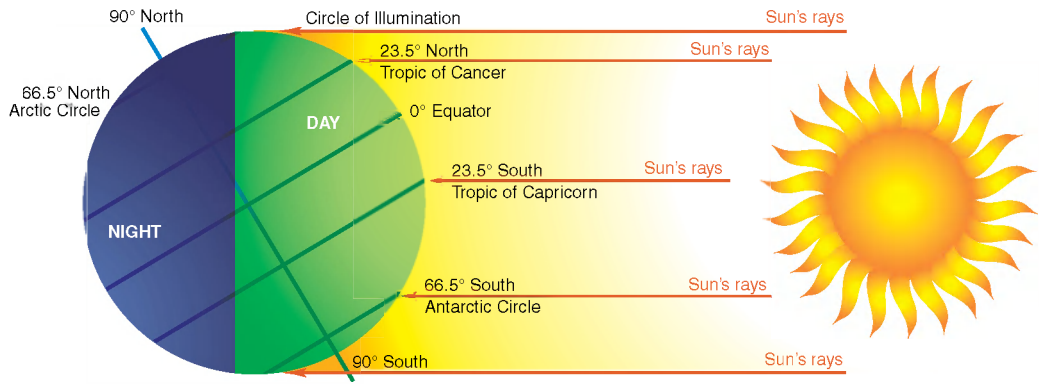
NOAA is the National Oceanic and Atmospheric Administration.

Four weeks later, Miss Cook flew to Chile to begin her great adventure at sea. This was exciting for many reasons, including the fact that this was her first visit to South America and she left her students during **winter** to fly into **summer**.

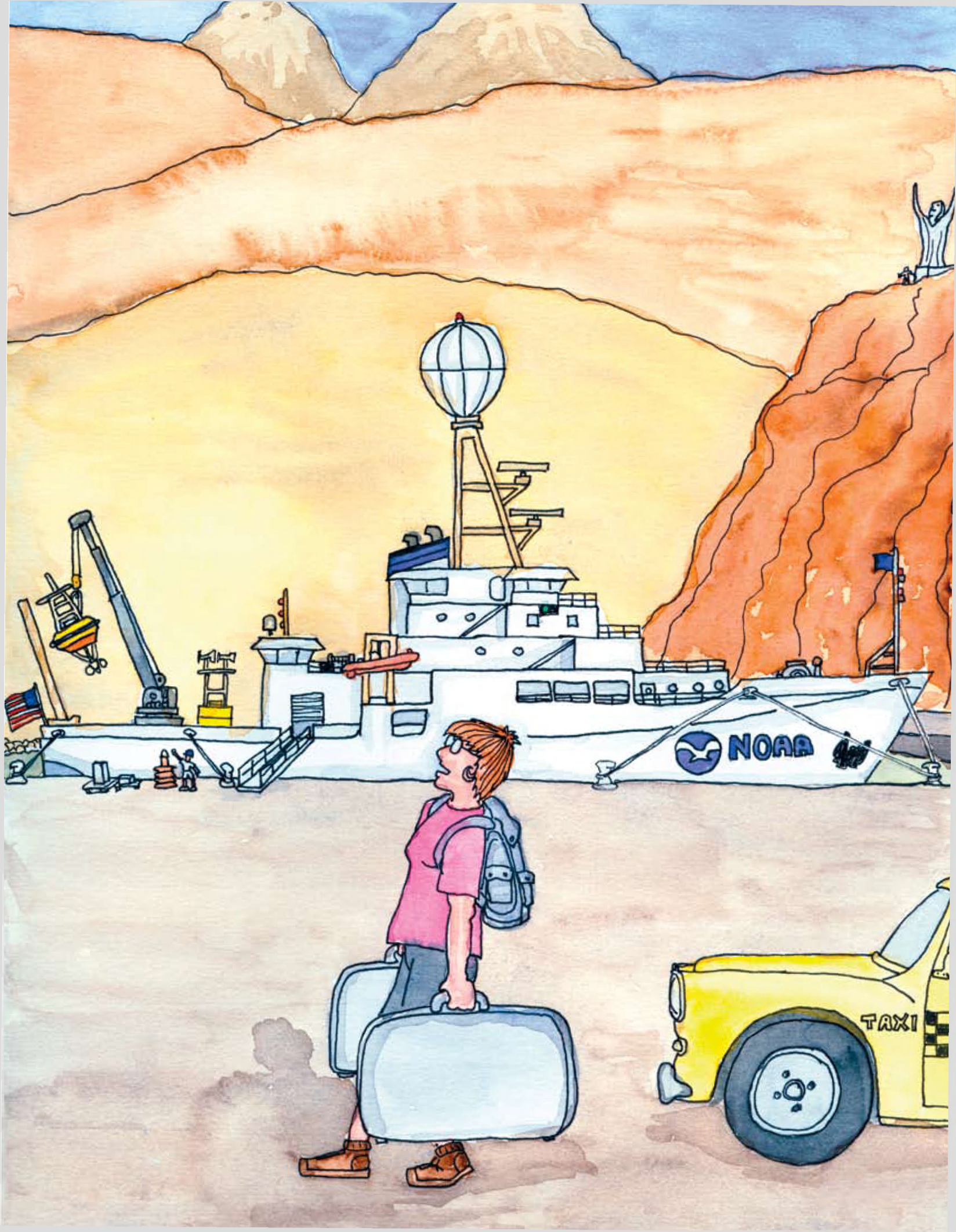
The sun was high in the sky when she arrived and tiptoed up the gangway onto the NOAA ship RONALD H. BROWN, her home for the next three weeks. Miss Cook wondered what the voyage would be like. Would she get seasick or homesick? Would she be able to understand the science? Would she encounter sharks or giant squid? Would she make friends easily on the ship? Would she be able to communicate with the Chileans on board? She knew her high school Spanish classes would make a difference, but she still had so many questions. The next three weeks would tell the story.

December Solstice

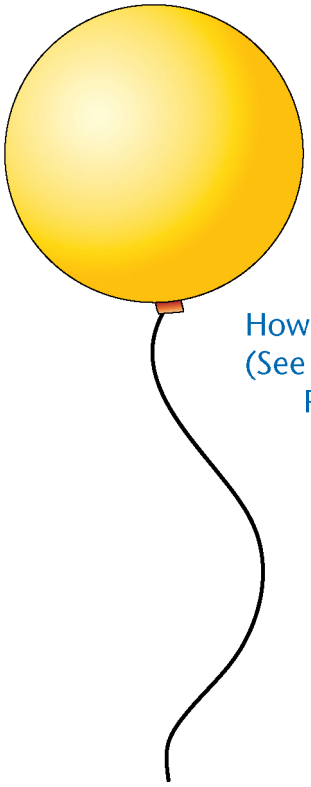
(First day of summer in the Southern Hemisphere...their longest day)



Chile is in the Southern Hemisphere (SH) and, for people who live there, the sun is highest in the sky during December due to the tilt of the Earth on its axis at an angle of 23.5° as the Earth revolves around the sun. During December, the sun's rays strike the SH more directly than the Northern Hemisphere (NH), providing the SH with more energy. Therefore, summer in Chile begins during the month of December and seasons in the SH are opposite those in the NH.


NOAA
TAXI

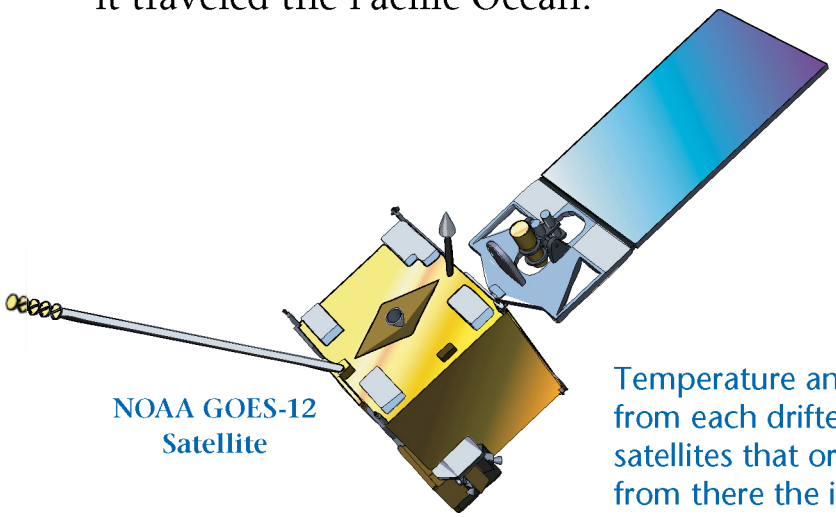
During her first day at sea, Miss Cook learned how to launch **weather balloons** that help us understand the atmosphere and the air we breathe. First she started the computer to activate the **radiosonde**, a small instrument attached to the bottom of the balloon that measures air temperature, pressure, and relative humidity. Then she filled the balloon with helium. Miss Cook wondered if the balloon could lift her from the ship, it was so large and **buoyant**. It was quickly whipped into the air by the strong breeze as Miss Cook released it. Swoosh! Her spirits soared with the balloon as it went higher and higher. Where was it going? Was it following the **trade winds**? Would it go on forever? Nobody knew the precise height to which it would ascend, but when Miss Cook went inside to peer at the computer, she could tell that the balloon burst when it reached high in the sky, nearly **25 kilometers**! Wouldn't you love to release a weather balloon?



How high is 25 kilometers in miles?
(See conversion table on page 31.)

For comparison, the cruising altitude of a commercial jet airplane is around 12,000 meters (35,000 ft). Which goes higher, a weather balloon or a commercial jet airplane?

The day that Miss Cook and her students had been waiting for finally arrived! Miss Cook would soon toss her school's adopted drifting buoy into the vast Pacific. The little drifter sat on the stern of the ship dreaming of its new life in the ocean. Miss Cook threw the **drifter** into the sea and bid it farewell. The **drogue** below the buoy spread apart like an accordion as it began to move with the ocean current. Miss Cook wondered as she stood on the **fantail**, what was the fate of this little drifting buoy? Will the drifter encounter whales and sharks as it monitors the cold and warm ocean currents? Miss Cook waved goodbye and watched the buoy until it was a speck on the horizon. Even though she could no longer see the drifter, she and her students would continue to follow its location on the computer. How long would it be on its journey? Would it bump into an island? What a story it would be able to tell. Miss Cook quickly emailed her students telling them that they could start following their drifting buoy's progress and graphing its temperature and pressure data as it traveled the Pacific Ocean.

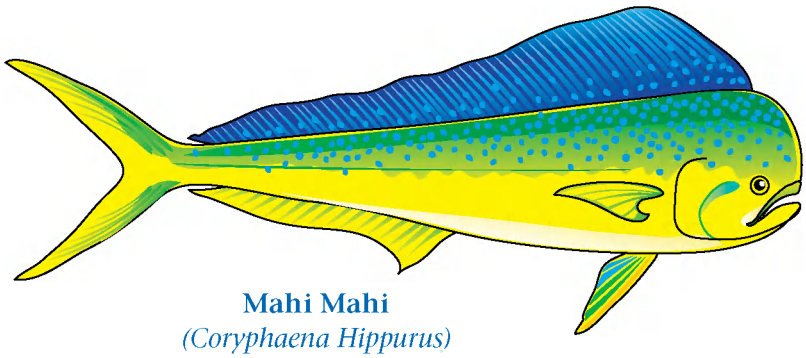


NOAA GOES-12 Satellite

Temperature and pressure data from each drifter are relayed to satellites that orbit Earth and from there the information is sent to data centers around the world. This makes it possible to share the buoy's information with all people.

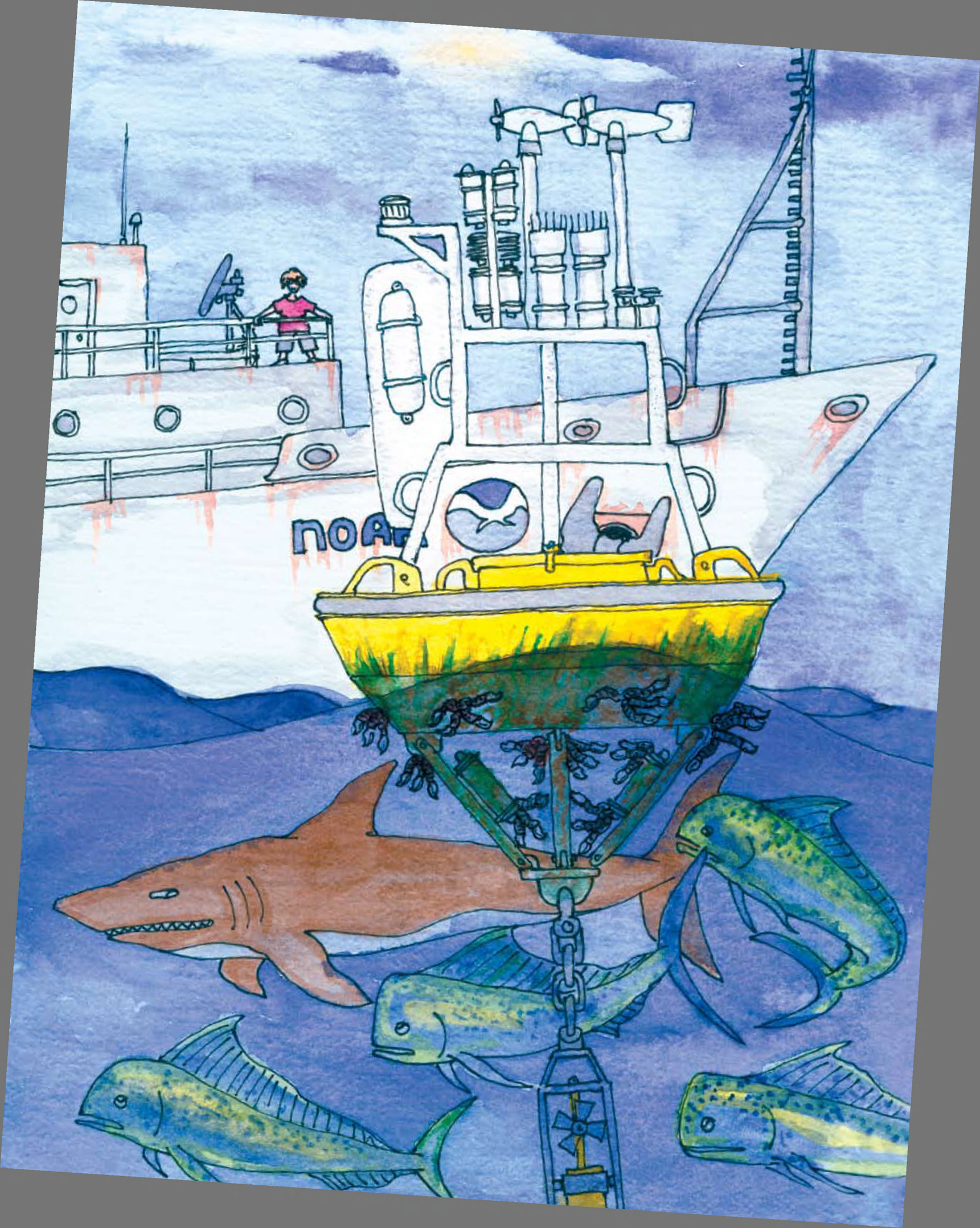

RONALD H. BROWN

The **RONALD H. BROWN continued west for 6 days**. It was headed for a buoy (known as Stratus 4) that had been positioned at **20°S, 85°W** beneath the **stratus** clouds the year before. The scientists had anchored the buoy to the bottom of the ocean and now searched for it on the horizon. Suddenly, Miss Cook exclaimed, "There it is!!!" as she pointed toward the buoy. The scientists on board were eager to learn about the story of the changing weather and ocean patterns over the past 365-1/4 days. What had this buoy witnessed? Had it been in a **hurricane** or had a **waterspout** caused it to teeter? Only by carefully looking at the thousands of measurements recorded by the buoy would the scientists be able to tell. Had the now familiar **albatross** that soar in this area used this buoy as a resting place? And, had fishermen noticed the buoy way out in the open ocean? One would never know, but one thing was obvious...green, slimy algae and **barnacles** galore had attached to the buoy and made it their home. A new **ecosystem** had formed beneath the buoy, attracting a multitude of beautiful fish.



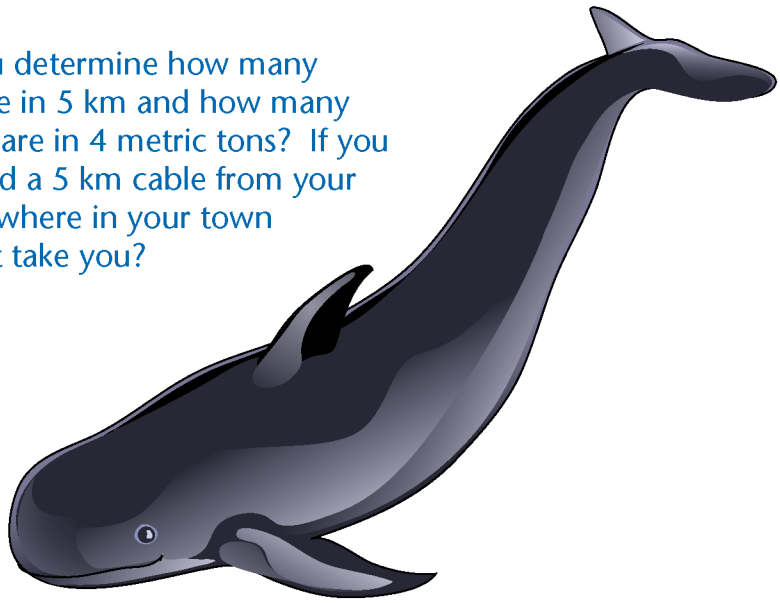
Mahi Mahi
(Coryphaena Hippurus)

See the inside of the front cover for a **chart** showing Miss Cook's journey on the RONALD H. BROWN.



The scientists were curious to discover the **trends in climate** in this area of the Pacific and how the temperature of the ocean changed weather and climate on land, even far across the globe. They could hardly wait to retrieve the Stratus 4 buoy to collect its stored data. They had to use machinery to hoist the buoy on board. Whew! What a job! Miss Cook helped stabilize the buoy as it was lifted onto the deck. Retrieving the buoy was dangerous and challenging work because of the motion of the ship. It took all day because the scientists, officers, and crew of the RONALD H. BROWN had to reel in nearly **5 kilometers** of heavy-duty nylon rope and steel cable that had secured the buoy to the anchor, a 4 metric ton weight, at the bottom of the ocean. The anchor is slightly heavier than the weight of a **pilot whale**!

Can you determine how many miles are in 5 km and how many pounds are in 4 metric tons? If you stretched a 5 km cable from your school, where in your town would it take you?

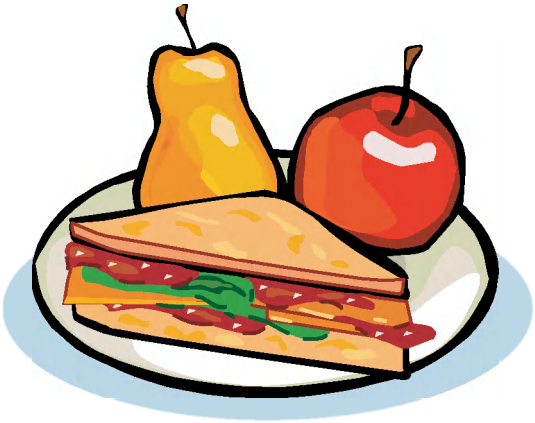


Pilot Whale
(Globiecephala malaena)


FOO

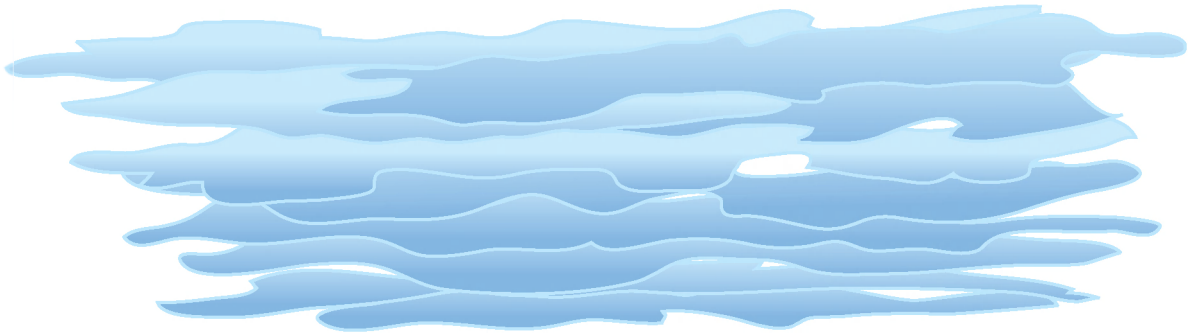
Everyone grew tired and hungry from all their hard work on the fantail. It was already time to eat lunch! In the **mess hall**, the **Captain** of the ship sat with the **Boatswain**, the **Chief Scientist**, a **Climatologist**, and Miss Cook. Miss Cook enjoyed the Captain's tales of adventures on the high sea.

Toward the end of the meal, the wind outside picked up and the ship began to **pitch**. Suddenly, Miss Cook began to feel a bit queasy. This must be the **seasickness** everyone had warned her about. Her stomach began to churn and the Chief Scientist said that she looked a bit green. Despite walking outside and staring at the horizon, something everyone recommends to cure seasickness, she still felt uncomfortable. So, she decided to rest for an hour in her **stateroom** before returning to the fantail to take pictures of the afternoon preparations on board. After lunch and her nap, she felt much better and got excited about the next day's deployment of a brand new buoy.

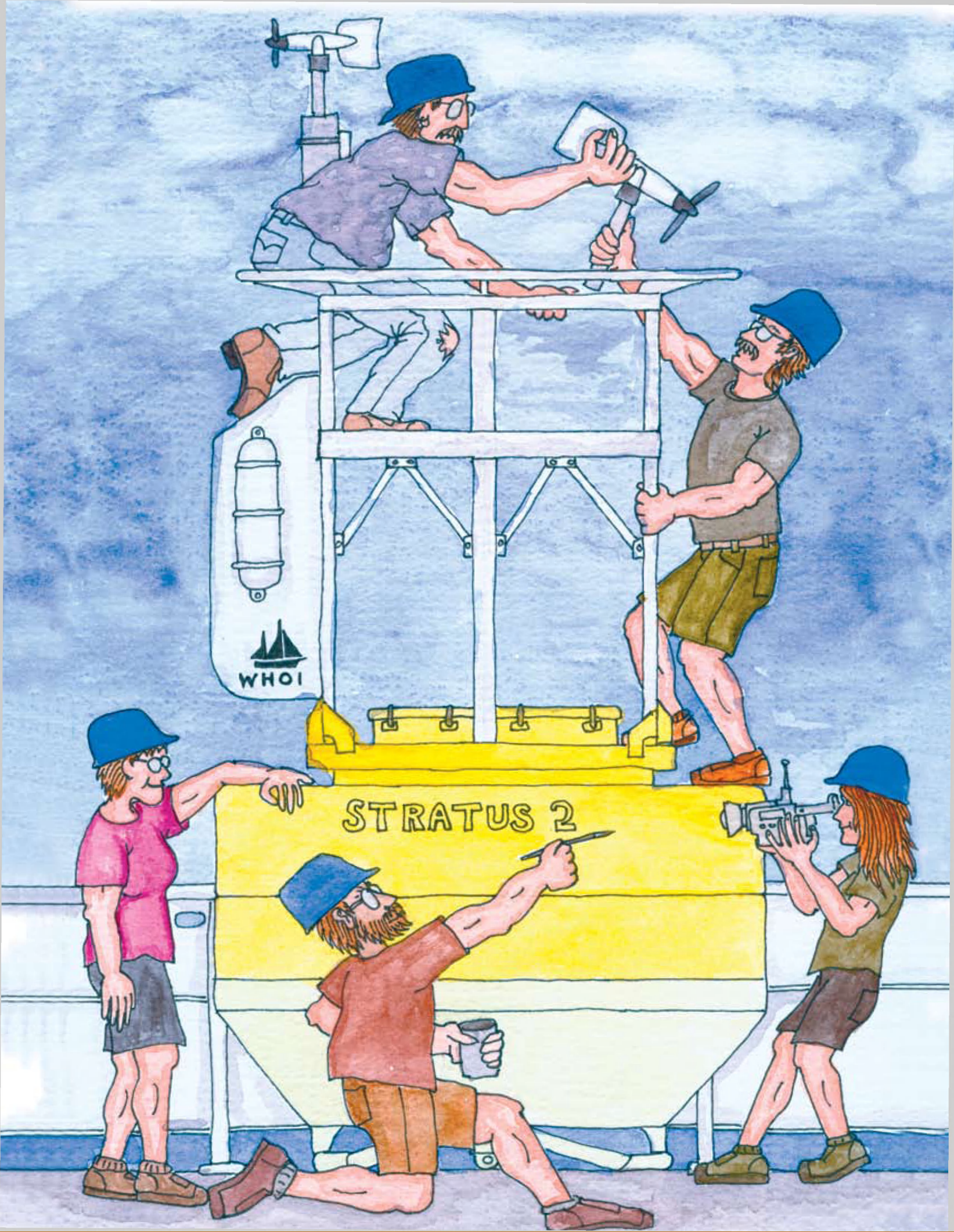



NOAA
MESS DECK
ICE CREAM LOCKER
CHOCOLATE
VANILLA
CEREZA

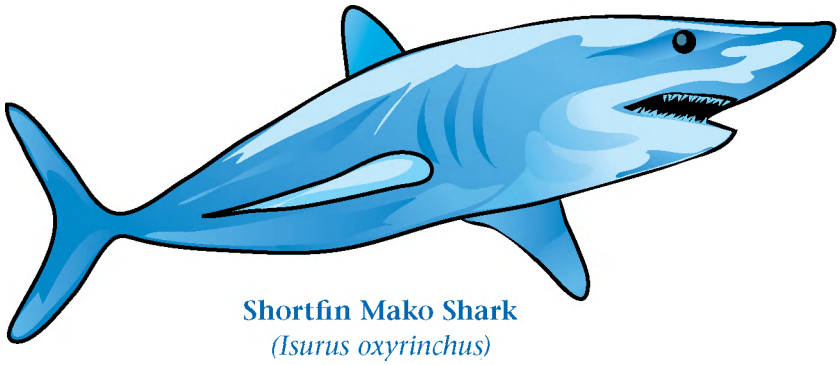
The following day, Miss Cook watched as the scientists busily prepared the new and improved Stratus 5 buoy. They attached and tested weather instruments and made sure the 3,000 D-cell batteries in the **hull** worked. The entire operation was videotaped for a television **documentary**. They wanted the new Stratus 5 buoy to record the most accurate data beneath the **stratus clouds**, clouds often seen along the west coast of South America. Scientists are curious as to how the stratus clouds affect climate; this new buoy would help unfold the mystery. Have *you* ever seen stratus clouds?



Stratus clouds are flat and can be layered or thin and wispy. They typically appear as uniform gray clouds covering the entire sky. They also resemble fog that is not at ground level. Little to no precipitation, but sometimes light drizzle or mist, may fall from stratus clouds.


WHOI
STRATUS 2

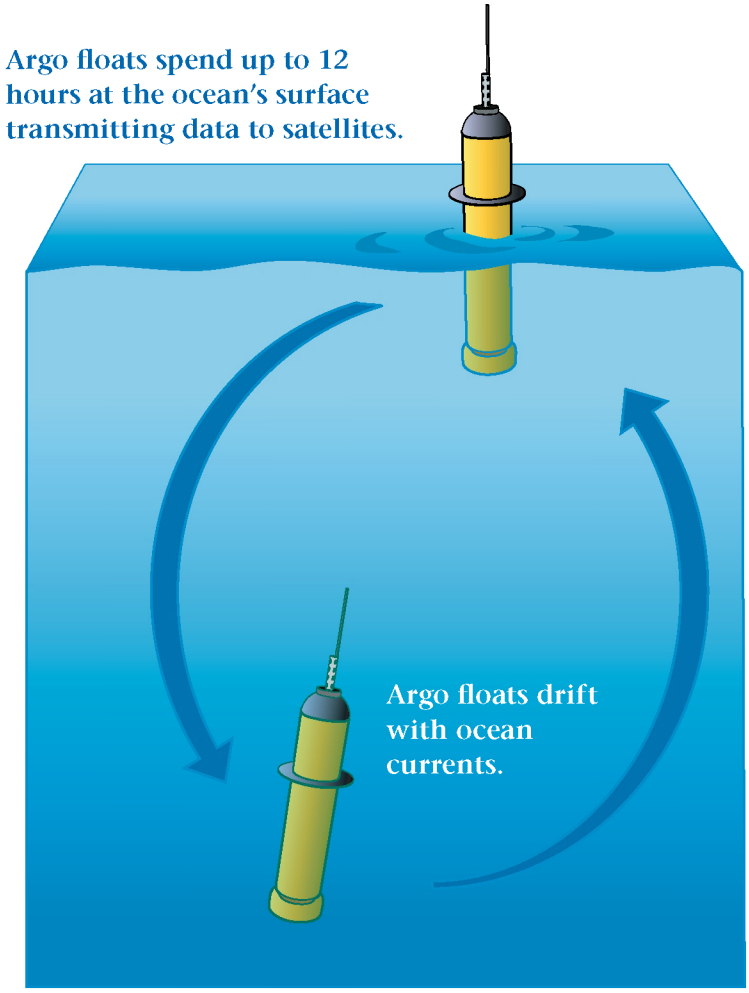
After the new yellow buoy was anchored to the ocean floor, Miss Cook excitedly hopped into the little orange **RHIB**, the inflatable boat used to transport people to and from the ship. The ride to the buoy was wild!! The waves looked huge when riding in the small, rocking boat. Salty water sprayed Miss Cook in the face as the RHIB crashed through the waves. She wondered if there might be sharks lurking below. Arriving at the new buoy, one of the scientists hopped onto the bobbing buoy to check that all the instruments on the top were working. Everything was in good shape. They returned to the ship and then waved goodbye to the buoy. "We'll see you next year!" As the large ship departed, all aboard knew that it had many miles to go and there was more research to complete.



Shortfin Mako Shark
(Isurus oxyrinchus)


NOAA

It was time to deploy another instrument. The **Ensign** on board and the **Chief Survey Technician** taught Miss Cook about the remarkable **Argo profiling float**. This torpedo-like instrument is lowered from the side of the ship and programmed to sink 2000 meters. That's over a mile below the surface of the water! While there, it drifts with the current until 10 days later when it surfaces slowly while measuring water temperature and **salinity**, the saltiness of the ocean. Each Argo float has a **global positioning system (GPS)** unit inside that communicates with satellites orbiting the Earth. So, we always know where these floats are located. The Argo floats gather important information to help us make better forecasts of our climate. Would you believe that there will soon be 3,000 of these clever floats monitoring our oceans?



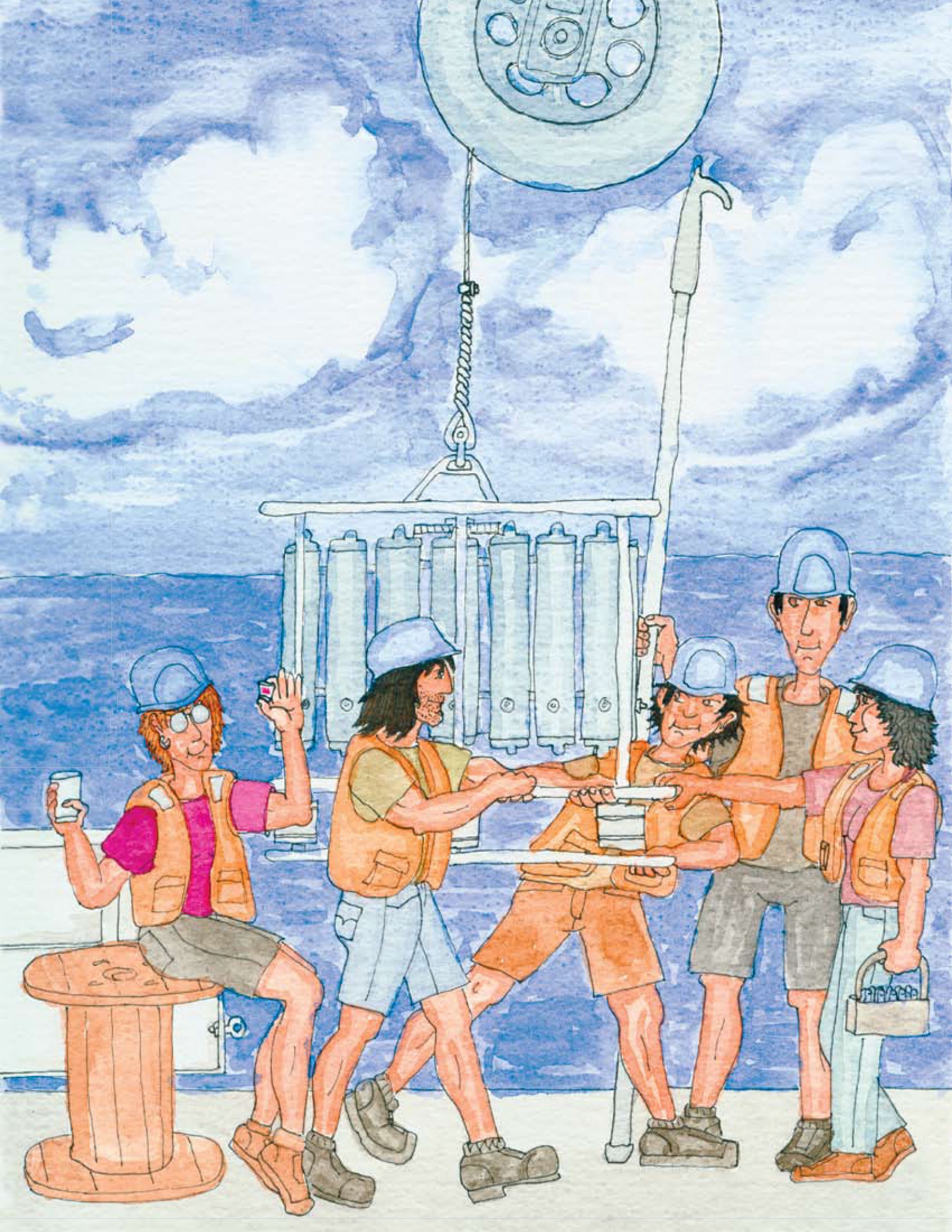

CST
USMC

Later that night, while Miss Cook was rocked into a peaceful sleep by the motion of the ocean, the Chilean scientists on board were busy preparing a scientific experiment. They were emptying and cleaning the **conductivity**, temperature, and depth package, otherwise known as the CTD, which is mounted on a frame called a **rosette**. The frame carries many gray canisters resembling giant rolling pins. With a **winch**, the scientists lowered the instruments to a depth of **3,000 meters** and then slowly pulled them up to the surface, stopping occasionally to allow water to fill each of the gray tubes one at a time at various depths. The Chilean researchers used the water samples from the bottles to measure the presence of **bacteria** in the water, a sign of the ocean's **productivity**.

As soon as Miss Cook awoke, she hurriedly dressed, threw on her **life vest**, and hopped, skipped, and jumped to the **starboard** side of the ship. She greeted the Chilean scientists, "Hola!" The night before, Miss Cook had attached a mesh bag containing styrofoam cups to the rosette and she was anxious to inspect them. The cups were now miniature replicas because of the intense **pressure** they had experienced at great depths below. The picture that Miss Cook had drawn on the cup the day before was now extremely small. She knew her students would be excited to hold these amazing little styrofoam cups and compare them to their original size!

3,000 meters is nearly 10,000 feet! How many football fields (100 yards long) would extend from the ocean's surface down to the depth of the CTD rosette at 3,000 meters? Remember that 1 yard is not exactly equal to 1 meter.

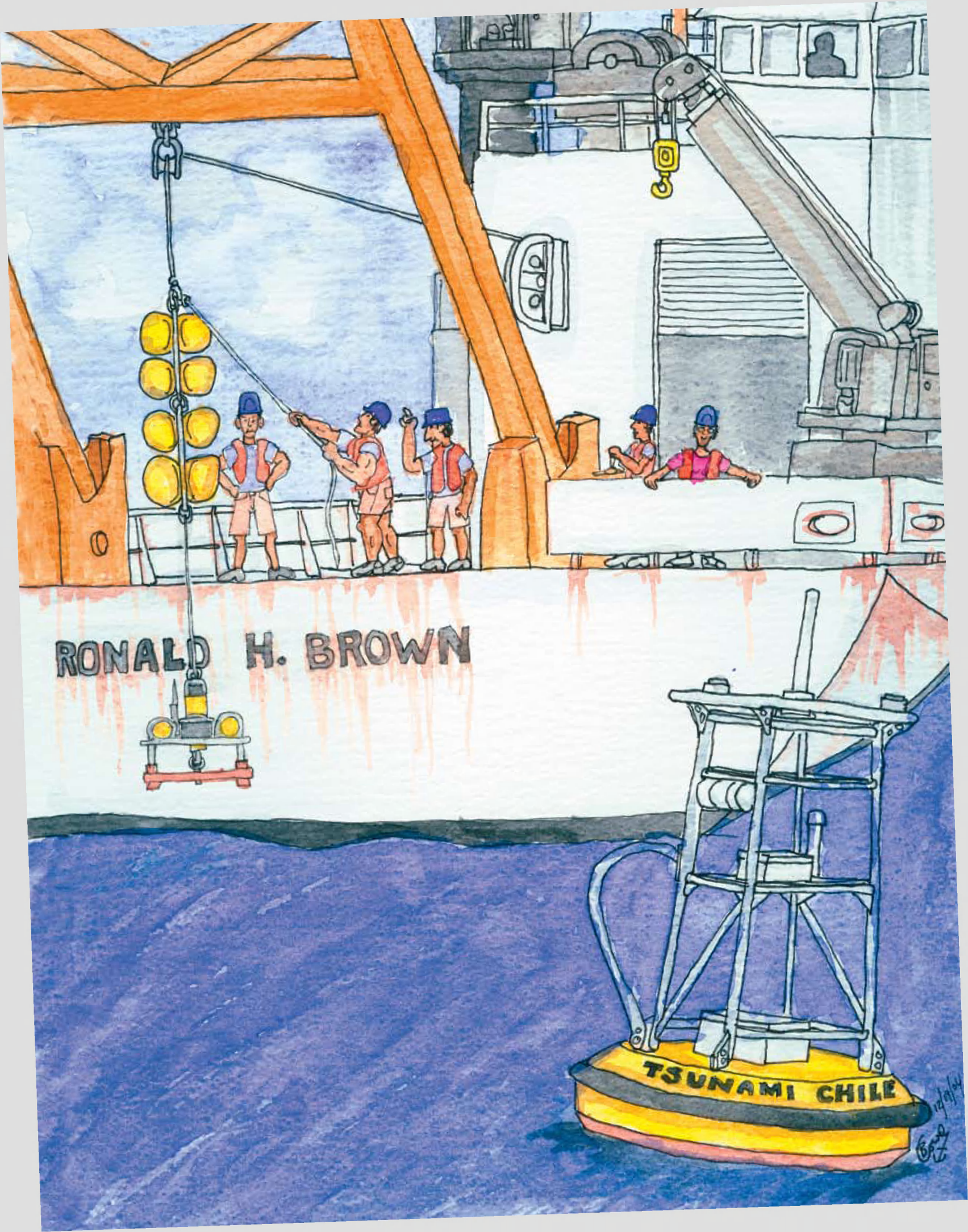
Pressure/depth exercise: Water pressure, like air pressure, is a function of weight; the deeper you go, the greater the surrounding water pressure. The pressure due to the overlying water increases by 1 **atmosphere** (atm) for every additional 10 meters (m) depth. So, the pressure at 10 meters below the ocean's surface is 2 atm. This is calculated by adding 1 atm due to the weight of the atmosphere at the Earth's surface to 1 atm due to the weight of 10 m of water. What is the water pressure (in atmospheres) at a depth of 3,000 meters?



Miss Cook's students had been emailing her about the **tsunami** buoy on board. After conducting their own Internet research, they discovered that the word tsunami means "harbor wave" in Japanese. They also saw pictures of the destruction that these waves could cause after being triggered by a **submarine earthquake** or volcanic eruption. Wow! This was truly an important buoy, a critical part of the **ocean monitoring system**.

Miss Cook was surprised when she discovered that the buoy was actually made up of two parts. One floats on the ocean's surface while a **bottom pressure recorder** sits on the ocean floor. When a tsunami's long waves pass through the ocean, these two parts work together to produce a signal that is sent to a satellite hovering in space far overhead. Then that signal is relayed to a station on Earth to warn people in coastal areas of an approaching tsunami. Miss Cook and her students were pleased that the instrument could save thousands of lives and that she played a part in the buoy's deployment.

One of the most interesting things associated with the bottom pressure recorder is the set of plastic-covered glass balls **tether**ed above it. These glass balls are filled with air and are buoyant enough to bring the instrument back to the surface the following year after being triggered by an **acoustic release**.


RONALD H. BROWN
TSUNAMI CHILE

After three weeks learning about the atmosphere and oceans, Miss Cook was excited to return home to share her experiences with her 8th grade students. She knew that they would be eager to hear her stories and to ask questions about the tales she had shared in her daily logs.

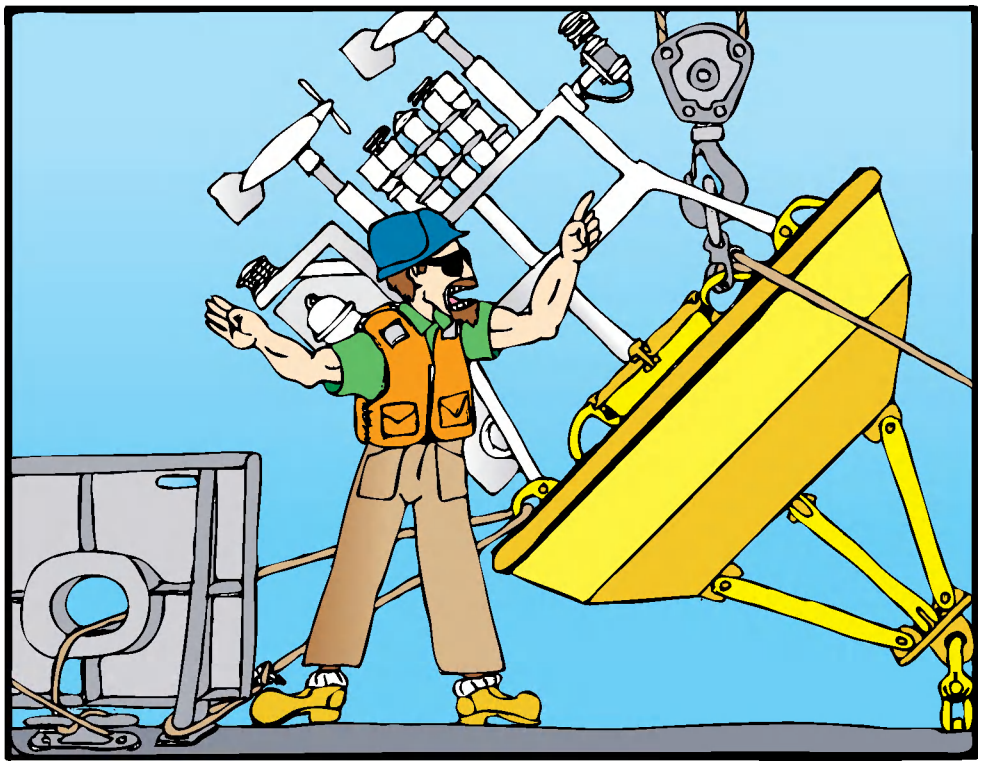
After checking her bags at the airport and carefully stowing the miniature styrofoam cups for her class, Miss Cook found her seat on the plane and sat down with a real sense of contentment and personal satisfaction. Aaaahhhhh! She couldn't believe that she had been a significant part of a team effort to learn more about our mysterious and dynamic oceans. How much she had learned! As she relaxed and drifted off to sleep, her mind was a whirl with dreams of her students and the amazing things they were going to study about oceanic and atmospheric research. She hoped to inspire them to get more involved in experiments in class, and even to consider science as a career. Wouldn't it be exciting to explore our world in order to make it a better place?

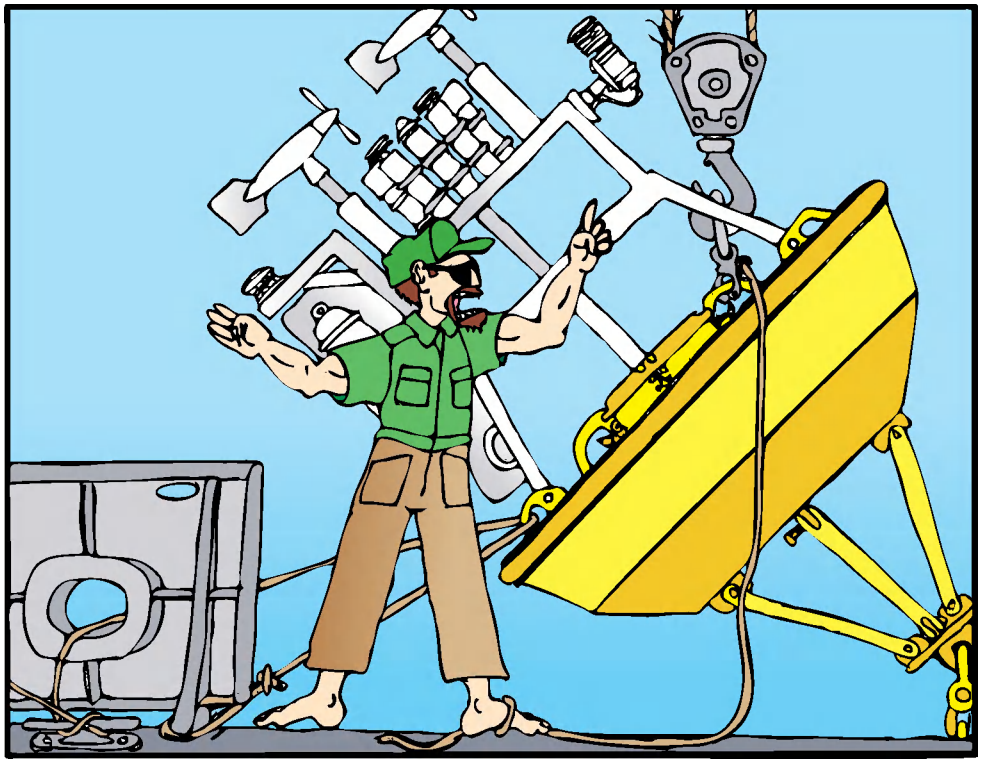
Miss Cook and her students would continue to follow their adopted drifter and the research conducted on board the RONALD H. BROWN to remain involved and excited about ocean exploration. What a wonderful adventure it had been as **NOAA's Teacher at Sea!**


EMERGENCY EXIT
SALIDA DE EMERGENCIA
EXIT
SALIDA

Safety Observation Quiz

Compare the bottom picture with the top picture. You should be able to find at least six safety violations in the bottom picture that are not present in the top picture. Note: there are a few differences between the pictures that are not considered to be safety hazards. Hint: there are actually 10 safety violations in the bottom picture. Answers can be found on page 33.





GLOSSARY

Scientific words in bold print in the text are defined below.

20° S, 85° W – the coordinates (latitude 20° S and longitude 85° W) of the Stratus 4 buoy in the Pacific Ocean

Acoustic release – an electronically activated release allowing instruments to be recovered from the bottom of the ocean

Aft – at, near, or toward the stern of a ship

Albatross – a web-footed bird that is the largest of sea birds, capable of long periods of flight, and often seen at great distances from land. They are found chiefly in the southern hemisphere.

Argo profiling float – an ocean instrument that drifts at a depth of 2,000 m and rises to the surface every 10 to 14 days to relay the temperature and salinity data that it records as it rises. Satellites then relay the data to land-based receiving stations.

Atmosphere – a unit of measure for pressure (which is a function of the mass of fluid above a given surface) equivalent to 14.7 pounds per square inch

Bacteria – single-celled or noncellular organisms lacking chlorophyll that are important as pathogens and for biochemical properties

Barnacle – a marine crustacean with a shell consisting of several plates, which cements itself firmly by means of its head to rocks, hulls of boats, and other underwater objects

Boatswain – a lead crew member of a ship who controls the work of other crew members

Bottom pressure recorder – an instrument placed on the ocean floor used to detect tsunamis as small as 1 cm, which would not be noticed by a human observer in deep water

Buoyant – tending to float on a liquid or rise in air or gas

Captain – an officer in command of a ship

Chart – a map designed to assist navigation by air or sea

Chief Survey Technician (CST) – person in charge of the **hydrographic** work on board a ship

Chief Scientist – main scientist in charge of all of the science and other scientists on board

Cleat – a fastener (usually with two projecting horns) around which a rope can be secured on a ship

Cleat hitch – a knot used to secure a boat to a dock or secure a line to a boat

Climate – the average and extreme long-term conditions of temperature, precipitation, winds, clouds, and other variables in an area

Climatologist – a scientist who studies Earth's climate

Conductivity – the ability of a material to allow the flow of electrical current; the salinity of the ocean is derived from the conductivity

Documentary – a film or TV program presenting facts about a person or event

Drifter (or Drifting buoy) – floating ocean buoy equipped with meteorological and/or oceanographic sensing instruments with transmitting equipment to send the observations to land-based data centers

Drifting buoy (see Drifter)

Drogue – restraint consisting of a canvas-covered frame that floats beneath a drifting buoy ensuring the buoy drifts with the prevailing current

Earthquake – a shaking of the earth due to underground movement along a fault plane or from volcanic activity

Ecosystem – an ecological community, including the biological inhabitants and the environment in which they live, and encompassing the interactions among them, which permit the system to function and to sustain life

Ensign – a person who holds a commissioned rank in the United States Navy, Coast Guard, or NOAA Corps; below lieutenant junior grade

Fantail – an overhang consisting of the fan-shaped part of the deck extending **aft** of the **sternpost** of a ship

FOO (Field Operations Officer) – an officer responsible for all field operations on board; the interface between the ship's officers and the scientific party

Global Positioning System (GPS) – a satellite-based navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time in all weather conditions, anywhere in the world

Hull – the frame or body of a ship or buoy

Hurricane – a tropical storm that has winds of 119 kilometers per hour or higher; typically about 600 kilometers across

Hydrographic – of or relating to the science of hydrography, the study and survey of rivers, streams, creeks, springs, wells, ponds, lakes, reservoirs, oceans, seas, bays and estuaries with respect to their tides, flow characteristics, and navigability

Life vest – life preserver consisting of a sleeveless jacket of buoyant or inflatable design

Mess hall – a (large) military dining room where people eat or relax

National Oceanic and Atmospheric Administration (NOAA) – a federal agency with a mission to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs.

Ocean monitoring system – an array of various instruments to get a snapshot of prevailing and changing ocean conditions (e.g., CTDs, Argo floats, drifters)

Pilot whale – large whale with a large head cavity

Pitch – abrupt up-and-down motion (as caused by a ship or other conveyance)

Productivity – the amount of organic material produced by organisms from inorganic material within an ecosystem

Radiosonde – an instrument intended to be carried by a balloon up through the atmosphere, equipped with sensors to measure one or several meteorological variables (pressure, temperature, humidity, etc.), and provided with a radio transmitter for sending this information to an observing station

RHIB – rigid hull inflatable boat, the small boat that is available to take short trips to and from the ship

Rosette – a frame upon which are mounted water sampling bottles and a conductivity, temperature, and depth instrument

ROV – remotely operated vehicle

Salinity – the total amount of dissolved salts in a water sample

Seasickness – motion sickness experienced while traveling on the ocean

Starboard – on the right-hand side of a vessel or aircraft when facing forward; "the starboard side"; the left side is the port side

Stateroom – cabin accommodation on board a ship

Sternpost – last above deck structure of rear of ship

Stratus – clouds that form in flat layers

Submarine earthquake – shift in Earth's crust below the surface of the ocean

Tether – a rope (or light chain) used to restrain an instrument

Trade Winds – the trade winds, or tropical easterlies, are the winds that diverge from the subtropical high-pressure belts (centered at 30-40°N and S latitude) towards the equator, from northeast in the northern hemisphere and southeast in the southern hemisphere

Trends in climate – a change in climate through time; the patterns of climate

Tsunami – a giant wave caused by an earthquake, landslide, or volcanic eruption on the ocean floor

Waterspout – violently spinning column of air saturated with water that forms over the sea

Weather – the condition of the Earth's atmosphere at a particular time and place

Weather balloon – a helium-filled balloon that has an instrument package attached to measure atmospheric conditions as it rises

Winch – lifting device consisting of a cylinder on which a cable or rope winds

Woods Hole Oceanographic Institution (WHOI) – a private, non-profit research facility dedicated to the study of marine science and to the education of marine scientists. It is the largest independent oceanographic institution in the world.

Conversions

1 kilometer (km) = .6214 miles (mi)

1 foot (ft) = .3048 meters (m)

1 mile (mi) = 5,280 feet (ft)

1 meter (m) = 39.37 inches (in)

1 centimeter (cm) = .3937 inches (in)

1 fathom (fath) = 6 feet (ft) = 1.8288 meters (m)

1 gallon (US) = 3.785 liters (l)

1 kilogram (kg) = 2.205 pounds (lb)

1 metric ton = 2,204.6 pounds (lb) = 1,000 kilograms (kg)

1 atmosphere (atm) = 14.7 pounds per square inch (psi)

1 yard (yd) = .9144 meters (m)

Internet Resources for Teachers, Parents, and Students

Additional information on the science behind research cruises like those on the NOAA Ship RONALD H. BROWN can be found by accessing:

- Adopt a Drifter Program: http://osmc.noaa.gov/OSMC/adopt_a_drifter.html
- Climate Prediction Program for the Americas: http://www.ogp.noaa.gov/mpe/cppa/index.htm
- Environmental Technology Laboratory: http://www.etl.noaa.gov
- National Oceanic and Atmospheric Administration: http://www.noaa.gov
- Office of Global Programs: http://www.ogp.noaa.gov
- Office of Climate Observation: http://www.oco.noaa.gov
- Pacific Marine Environmental Laboratory: http://www.pmel.noaa.gov
- Teacher at Sea Program: http://www.tas.noaa.gov
- Woods Hole Oceanographic Institution, Upper Ocean Processes Group: http://uop.whoi.edu
- Chilean Navy Hydrographic and Oceanographic Office: http://www.shoa.cl

Mary Cook's voyage on board the RONALD H. BROWN was funded by NOAA's Teacher at Sea program, the Office of Climate Observation, and the Climate Prediction Program for the Americas.

The enthusiasm for learning generated between teachers and students is the biggest payoff of **NOAA's Teacher at Sea (TAS)** program, where teachers from elementary school through college go to sea aboard one of 18 NOAA research and survey ships to work under the tutelage of scientists and crew. The program has enabled more than 400 teachers to gain first-hand experience of science at sea. Teachers can enrich their classroom curricula with a depth of understanding made possible by living and working side-by-side, day and night, with those who contribute to the world's body of scientific knowledge.

NOAA's Office of Climate Observation (OCO) has as its mission to build and sustain the ocean component of a global climate observing system to provide information 1) to forecast centers where climate models are created and future climate change predictions are made, 2) to international research programs that conduct climate research, and 3) to respond to needs expressed in major science reports to gain a more complete understanding of climate. The program objectives are to document long-term trends in 1) sea level change, 2) ocean carbon, 3) the ocean's storage and global transport of heat and fresh water, and 4) the ocean-atmosphere exchange of heat and fresh water. NOAA's Office of Climate Observation endorses climate education initiatives by supporting NOAA Teachers at Sea and sponsoring NOAA's Adopt a Drifter Program (ADP) for K-16 teachers.

NOAA's Climate Prediction Program for the Americas (CPPA) sponsors research projects designed to improve forecasts of climate variations expected in the next season to year. The scientific basis for CPPA is the notion that the predictability of climate from season to season and year to year is largely determined by slow variations of the ocean and land surface conditions. The program therefore undertakes research to improve the understanding and modeling of ocean, atmosphere and land-surface processes that give rise to climate phenomena such as El Nino and the monsoons which drive regional-scale droughts and floods across the Americas.

You are invited to participate in the Adopt a Drifter Program!

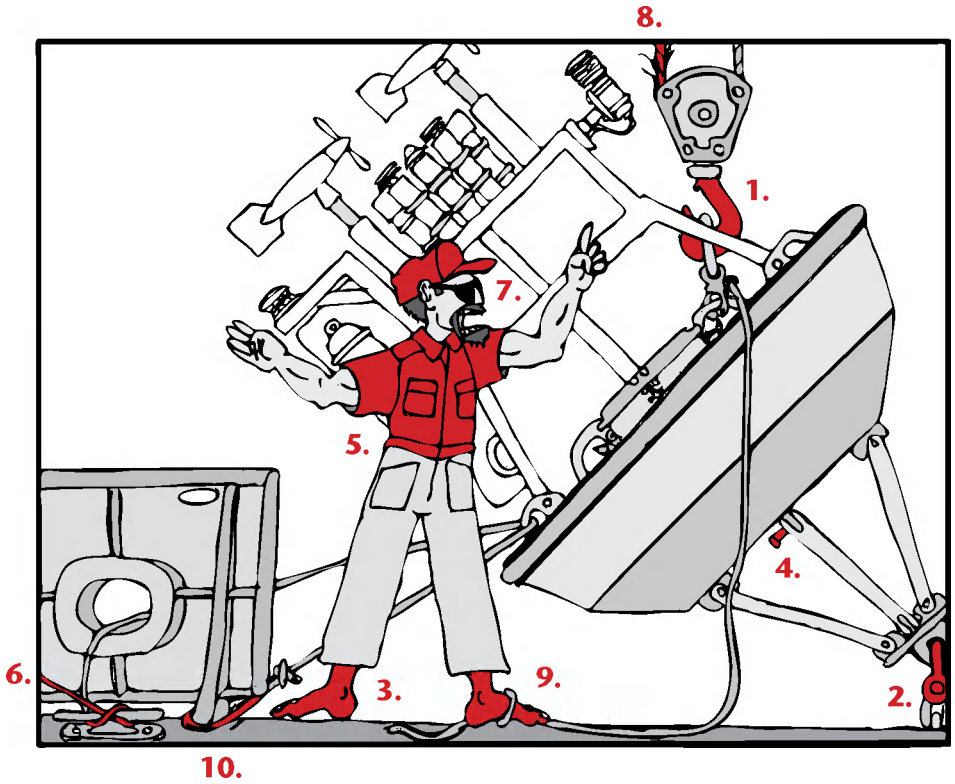
NOAA's Office of Climate Observation (OCO) sponsors the Adopt a Drifter Program (ADP), an opportunity for K-16 teachers to infuse observing system data into their curriculum. The ADP allows one school from the United States to partner with one international school to mutually adopt a drifting buoy deployed from a ship at sea. A teacher from each school may be on board the ship during deployment, although this is not a prerequisite for participation in the Program. The teachers access data from the drifter online. Participating teachers develop lesson plans to encourage their students to use the drifter data. Students in the teachers' classes receive a drifter-tracking chart to plot the coordinates of the drifter as it moves freely in the currents. Teachers and students can make connections between the data accessed on line and other maps showing currents, winds, and sea surface temperatures.

RONALD H. BROWN

NOAA Ship RONALD H. BROWN, a state-of-the-art oceanographic and atmospheric research platform, is the largest vessel in the NOAA fleet. With its highly advanced instruments and sensors, RONALD H. BROWN travels worldwide supporting scientific studies to increase our understanding of the world's oceans and climate.

Commissioned on July 19, 1997, in its home port of Charleston, South Carolina, RONALD H. BROWN has sailed in the Pacific, Atlantic, and Indian Oceans. The ship was named to honor the late Secretary of Commerce, Ronald H. Brown, who was killed in a plane crash on April 3, 1996, while on a trade mission to Bosnia.

RONALD H. BROWN is owned by the United States of America, Department of Commerce's National Oceanic and Atmospheric Administration. The ship is operated by NOAA Marine and Aviation Operations and carries a complement of six NOAA Corps officers, 20 crew members, and maximum of 33 scientists.



Answers to Safety Observation Quiz:

1. No safety gate on the hook holding the buoy
2. No cotter pin in bolt
3. No shoes worn by the crew member
4. Loose screw at the top of the bridle under the flotation device
5. Crew member is not wearing a life vest
6. The cleat hitch is improperly tied on the cleat
7. Crew member is not wearing a safety hat
8. Rope is frayed
9. Guide wire is wrapped around crew member's foot
10. Frayed rope is caught under base of wall

Answers to science questions in sidebar:

Page 3: 15.535 mi; weather balloon

Page 6: 3.107 mi; 8818.4 lb; answers will vary

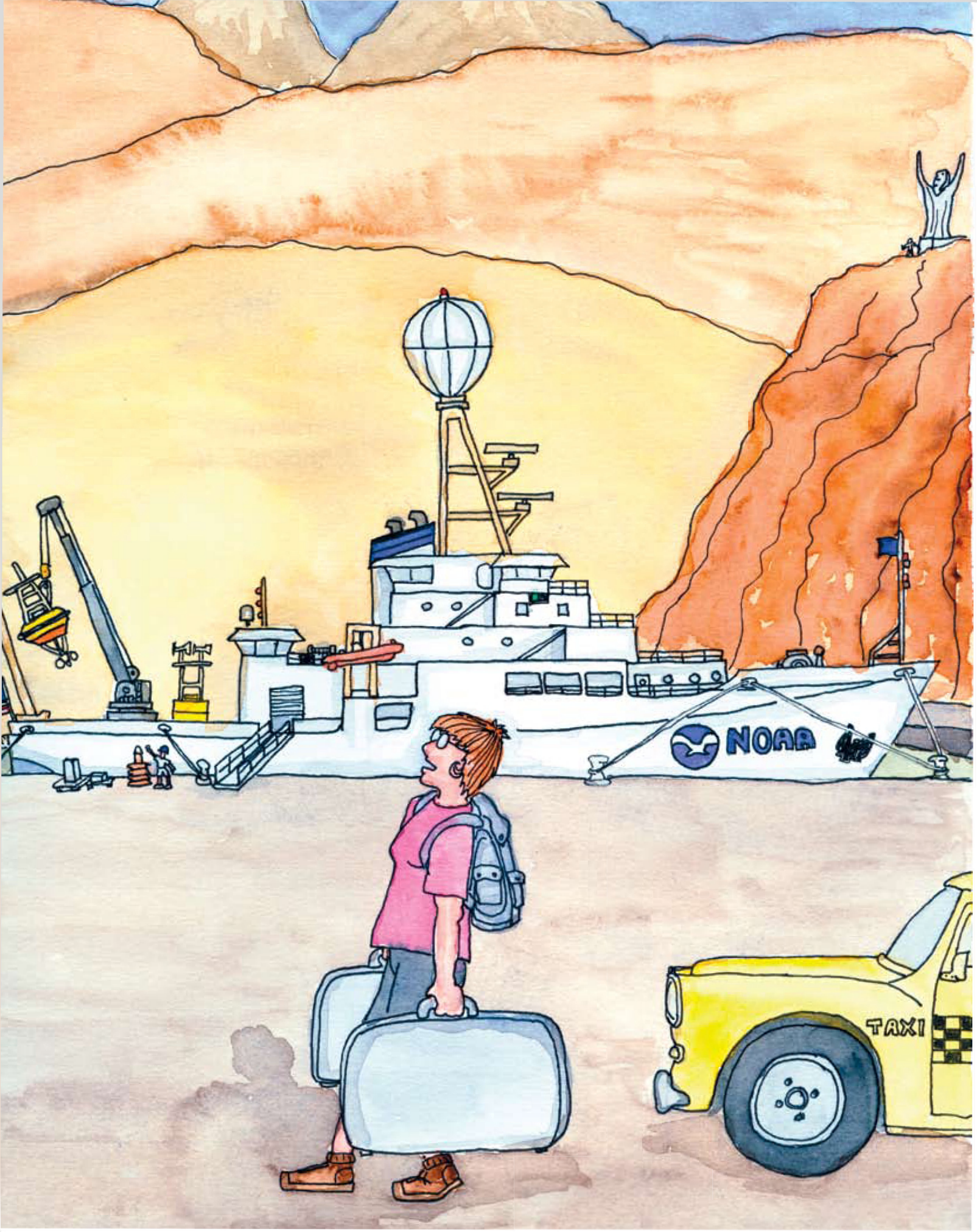
Page 11: 32.8 football fields; 301 atm

Notes:

Mary Cook lives in Oil Trough, Arkansas and teaches 8th grade earth science at Southside Middle School in Batesville, Arkansas. She loves to travel and hopes to see the entire world. She served as NOAA's Teacher at Sea on board the NOAA ship RONALD H. BROWN during December 2004.

Diane Stanitski serves as a Program Manager in NOAA's Office of Climate Observation in Silver Spring, Maryland. She is on a leave of absence from Shippensburg University in Pennsylvania where she is an Associate Professor in the Geography-Earth Science Department. Diane is a previous NOAA Teacher at Sea and has a passion for science and travel.

Bruce Cowden lives in Charleston, South Carolina, the homeport of the RONALD H. BROWN (RHB). He started going to sea at the age of 18 where he cruised around the Caribbean on sailing vessels. He then joined the US Navy and sailed with them for six years. In 1988, he began his career with NOAA on the research vessel MALCOLM BALDRIGE. He worked his way up to Boatswain group leader and then took the Chief Boatswain position on the NOAA Ship FERREL. After a few years on the FERREL, he started working in Gray's Reef National Marine Sanctuary in Savannah, Georgia, where he served as captain of the Sanctuary's support vessel and was a diver, **ROV** operator, and submersible pilot for sustainable seas operations. He then started working on the RHB where he currently serves as Chief Boatswain and Dive Master. His hobbies include cartooning and watercolor painting, and carving jewelry and figurines.



A National Oceanic and Atmospheric Administration (NOAA) Publication