

AUGUST 2026

SIGNAL Kids

AFCEA's STEM PUBLICATION



STEM AT SEA

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THE OCEAN

You may have heard this fact before. The Earth's surface is about 70% covered by water. Water is an essential source of life. All living things need water to survive. Even 60% of the human body is made up of water!

You may know that trees produce oxygen that's necessary for us to breathe. But did you know that more than 50% of Earth's oxygen comes from the ocean? Oceanic plankton are plant algae and bacteria in the ocean that can make oxygen. A marine cyanobacteria species called Prochlorococcus is the smallest organism on Earth that creates oxygen, and it produces almost 20% of Earth's oxygen all on its own!

It's important to take care of our oceans because they support our lives in so many ways. It might surprise you how the sea plays a role in the U.S. military and international communication!

DID YOU KNOW?

About 80% of the ocean hasn't been explored! There is more life in the ocean than anywhere else on Earth, but the waters are so deep that humans can't explore all of it. While submarines, underwater vehicles, satellites and modern sonar technologies help us see some of the seafloor, there are still parts that are too deep to see. The water pressure, freezing temperatures and total darkness prevent humans and underwater vehicles from traveling that far down.

Scientists estimate that there may be 700,000 to 1 million species in the ocean that we haven't discovered. Some deep-sea vehicles have captured images of unknown animals. Researchers also sample water to detect DNA particles, allowing them to identify species without even seeing them.

Around 2,000 new species are discovered every year. Who knows what scientists will find in the next few years!

Q&A WITH A MARINE BIOLOGIST

NAME: MACKENZIE GRIFFIN

JOB: Biologist for the Marine Mammal Health and Stranding Response Program, National Oceanic and Atmospheric Administration (NOAA) Fisheries

WHAT IS A MARINE BIOLOGIST?

A marine biologist is someone who is curious and cares about the ocean. Marine biologists study the environment and work to protect it. A marine biologist can study a variety of species from small plankton to large whales.

WHAT DO YOU DO EACH DAY AT YOUR JOB?

I lead a program that supports “stranding biologists.” A stranding biologist is similar to a first responder. They come to help stranded animals. If the animal is alive, they might try to take it to a rehabilitation center so it can get better and be released back into the wild. If the animal is dead, they might take it back to their lab to perform a necropsy, which is an animal autopsy. Most of my work is online and talking with biologists in the field. I also help create informative content for the public that highlights the hard work of biologists and why conservation matters.

WHAT MADE YOU WANT TO BECOME A MARINE BIOLOGIST?

I wanted to become a marine biologist because I have always loved all animals, and marine animals fascinate me. I took a marine biology class in high school and found myself looking forward to going to class because I enjoyed learning about the ocean. There are so many species living in the ocean, and I wanted to learn how to help support and protect them.

WHAT'S THE COOLEST MARINE ANIMAL YOU'VE EVER SEEN UP CLOSE?

The coolest marine animal I've seen up close is a green sea turtle. I was an intern on turtle patrol, and we walked up and down the beach at night to see if any female sea turtles were laying eggs. After they laid their eggs, we measured their body length and tagged them before they went back into the water. These adult turtles can be up to 350 lbs, and it was such a cool experience to watch her lay her eggs and help hold her during tagging. Tagging them helps us keep track of them later on and can tell us if they've laid eggs before and where.

WHAT IS THE BIGGEST PROBLEM FACING OUR OCEANS TODAY?

I believe one of the biggest problems facing our oceans today is pollution. Animals in the ocean aren't able to adapt, and shouldn't have to, to the



A blue whale skull collected in 1903 from New Finland. Currently housed at the Smithsonian Institute Marine Mammal Collection.

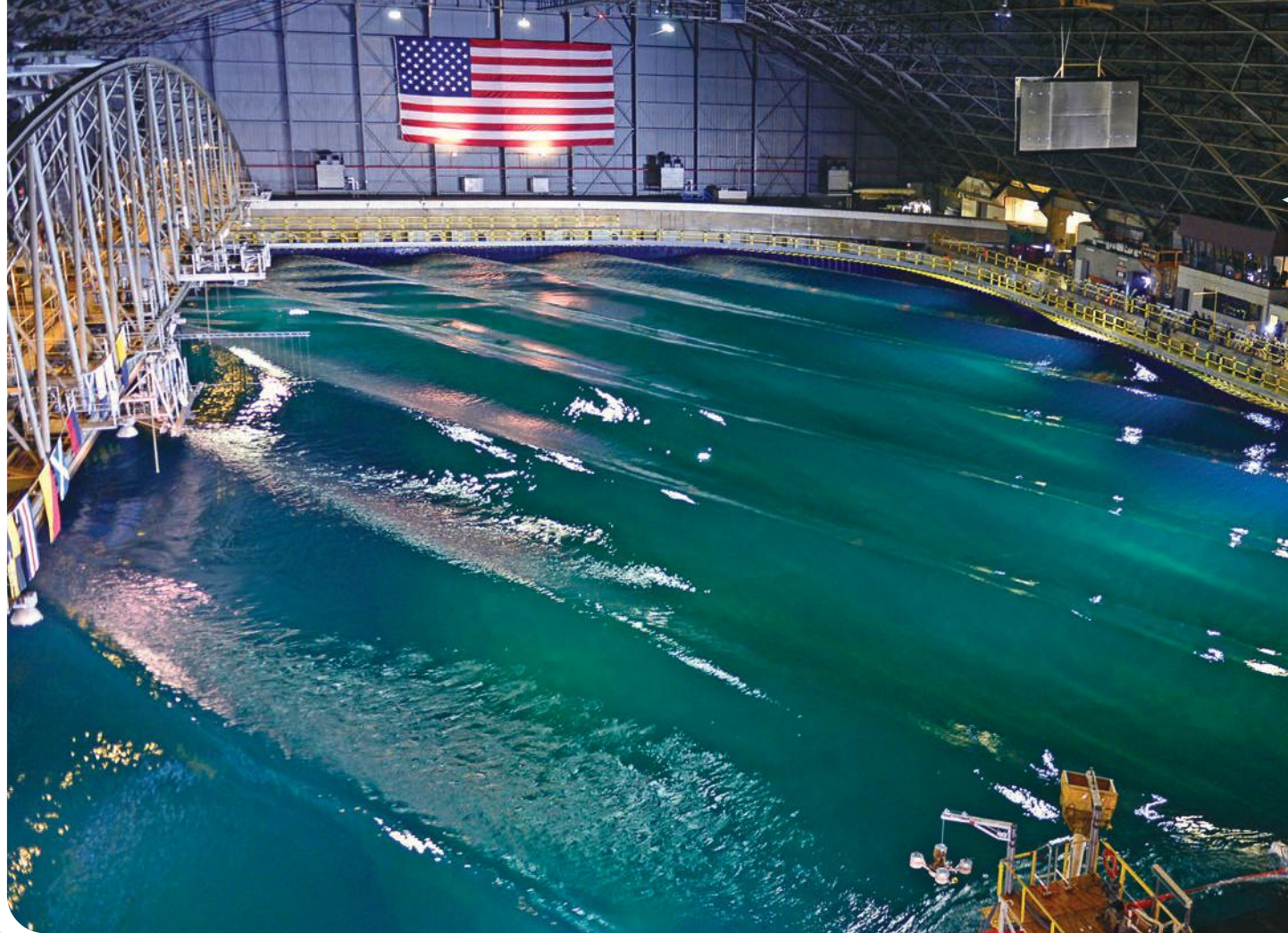
large amounts of trash that are coming into their environment. Pollution can cause things like a sea turtle accidentally eating a plastic bag because it looks like a jellyfish, or a dolphin swimming into fishing line because it isn't easily visible in the water.

WHAT ARE THREE SIMPLE THINGS KIDS CAN DO TO HELP THE OCEAN?

1. **Reduce** trash by opting out of single-use plastics and goods. Use a refillable water bottle, reusable straws, totes and cloth napkins.
2. **Reuse** by opting to thrift or rent something before buying new. See if your friends want to do a clothing swap, or visit the library for books rather than buying new.
3. When you **recycle**, make sure to do so responsibly by only putting in materials that can be recycled.

WHAT'S ONE OCEAN FACT THAT SURPRISES MOST PEOPLE?

Animals have unique patterns and markings, similar to humans and their fingerprints. Dolphins can be identified by the nicks and notches in their dorsal fin; large whales can be identified by their fluke tails; and manatees can be identified by their scars on their back.



MAKING WAVES

THE LIFE OF AN OCEAN ENGINEER

BY CASSIUS RAINEY, AGE 9

Miguel Quintero is an ocean engineer at the Naval Surface Warfare Center in Carderock, Maryland. That means he gets to work with ships in the ocean. He takes small models of big ships, and he puts them in wave pools to try to help improve designs for ships in the future. In an interview with *SIGNAL Kids*, Miguel talked about his job and how his team works together.

Miguel works at a facility called the Maneuvering and Seakeeping (MASK) Basin. It is a big basin that makes waves so that engineers like Miguel can put models of ships into it to see how they would perform in the actual ocean. That's

what seakeeping is. It's how waves interact with stuff in the ocean. Miguel's team tests criteria like if models are rolling a lot or if they have a lot of drag.

Miguel said that the first design of a ship comes from computer-aided designs and numerical simulations. And then from there they make a model of the first design. The models used to be made out of wood, but now they use a material called fiberglass, and in the future, they might switch to using 3D printers.

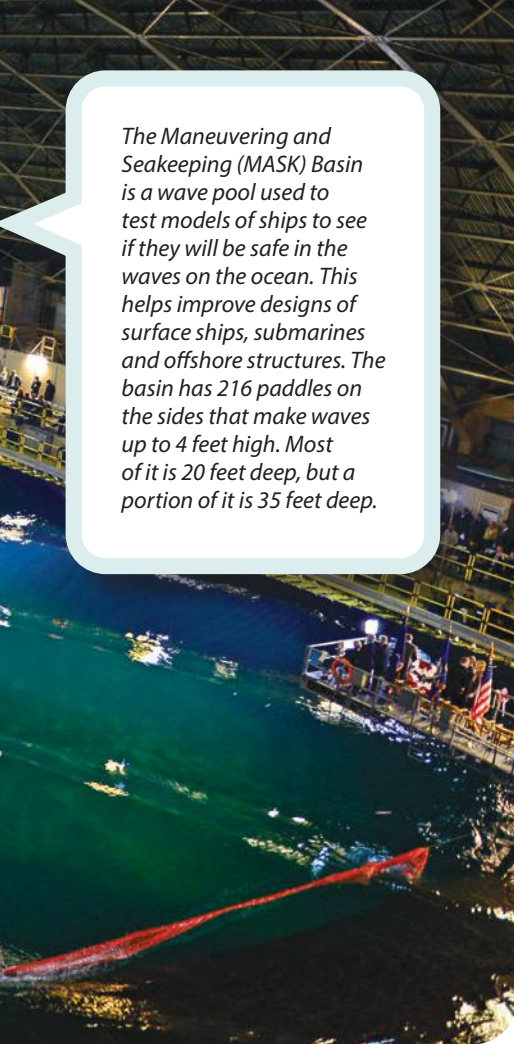
From the first design, Miguel's team tests the models in the basin. They take the results from the tests in the basin, and they use that data to improve the design. Testing can show that the design wasn't as safe or good as they thought it would

be. Then they make a new model and test that and continue taking the results from the testing and improving until the results say that it's a good enough design. Then they make the big version of the ship. They go on the actual ships and take measurements to compare the data to the testing from the basin.

A good ship design depends on what the ship is being used for. If you want a fast ship, you want it so that it has low resistance and drag and uses the least amount of energy. Miguel says, "Our main mission is to make sure that the sailors on the boats are safe," and you have to meet certain safety criteria because you don't want people rolling out of bed. He recently worked on a project about studying the motions of the ships to see if helicopters landing on them would be safe.

Miguel is an ocean engineer because he really liked to surf when he was in high school. Someone asked him, "Do you know what an

The Maneuvering and Seakeeping (MASK) Basin is a wave pool used to test models of ships to see if they will be safe in the waves on the ocean. This helps improve designs of surface ships, submarines and offshore structures. The basin has 216 paddles on the sides that make waves up to 4 feet high. Most of it is 20 feet deep, but a portion of it is 35 feet deep.



ocean engineer is?" And he didn't know, so they told him an ocean engineer works with waves. And he went to a college with an ocean engineering program.

In conclusion, Miguel gave some great advice for YOU! Here it is: "I think you've got to find a topic you like because when you study hard, if it's something you don't like, you won't be successful." Miguel is a very successful person, and hopefully you can be like Miguel too.

ABOUT THE KID REPORTER:



Cassius is a 9-year-old going into fourth grade. He lives in San Diego and loves to do math, write code and listen to ABBA. When he grows up, he wants to be a mathematician or a computer scientist.

SAVING OUR OCEANS

More than 8 to 11 million tons of plastic enter the ocean each year, according to the Ocean Blue Project. That's about the same weight as 1 million school buses combined! By 2050, there could be more plastic than fish (by weight) in the ocean if this keeps going.

Plastic in the oceans affects more than 700 marine species. The good news is that inventors have come up with many different technologies to help keep the ocean clean.

Here are some cool technologies saving our oceans and other bodies of water.

Searial Cleaners



The BeBot sifts through sand to find litter.

BeBot

The BeBot is a small robot on wheels that cleans beaches. Created by Searial Cleaners, the BeBot can detect plastic, cardboard and other trash under the sand.

Using a remote control, you can make the BeBot rake through sand to find the things that don't belong so they can't float into the ocean where animals may accidentally eat or get caught in the plastic.



Mr. Trash Wheel on the Patapsco River in Baltimore.

Mr. Trash Wheel

Mr. Trash Wheel is a trash collector that lives in Baltimore. He sits at the end of a stream or river and waits for trash to float into his mouth. Then, he uses solar power and his giant 14-foot water wheel to lift the trash with a rake and send the trash to his belly on a strong conveyor belt. The litter goes from his belly to a dumpster to keep the water clean!

When it rains, litter—like plastic bags, bottles and foam containers—falls into the storm drains and is carried into the harbor. According to the Waterfront Partnership of Baltimore, if you lined up all the cigarette butts collected by Mr. Trash Wheel, they would stretch more than 150 miles!

The trash wheel family, with Mr. Trash Wheel, Professor Trash Wheel, Captain Trash Wheel and Gwynnda the Good Wheel of the West, collects about 500 tons of trash from the Baltimore Harbor every year.

Marcus Jones-stock.adobe.com

NAVY TECHNOLOGY

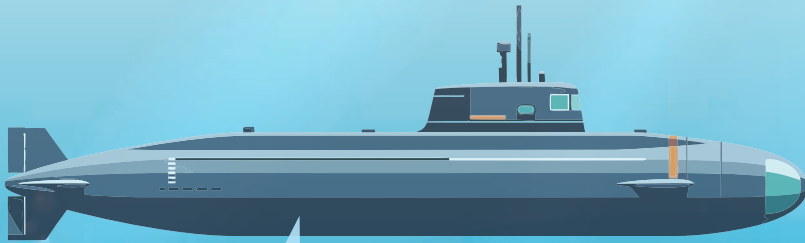
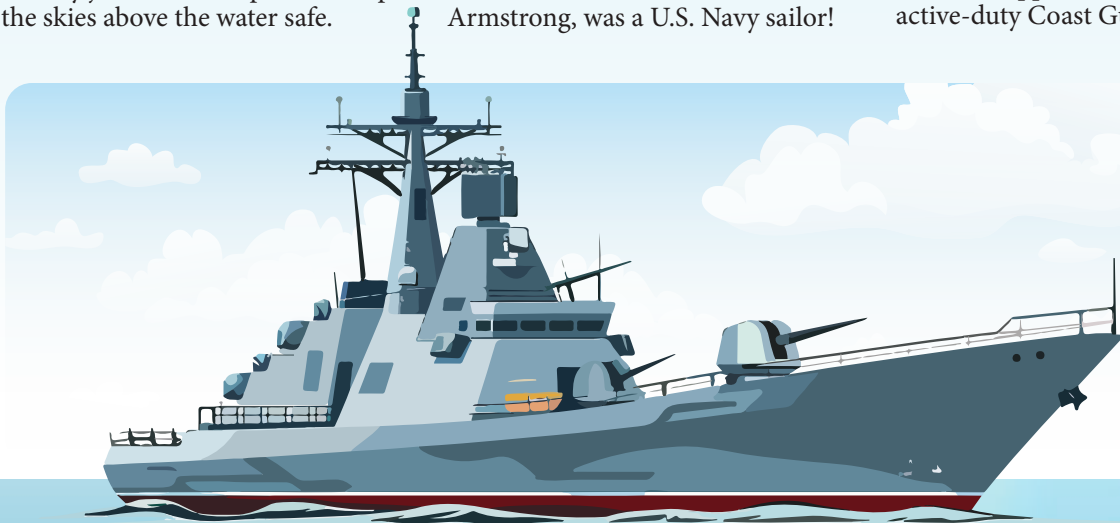
LEARN MORE ABOUT THE U.S. MILITARY AT SEA

The Navy is the third largest branch of the U.S. military, and it keeps an eye on the oceans—everything above, below and on the water! It defends the United States by sending ships to monitor the oceans and submarines to protect the cables along the sea floor. There are even naval aviators who fly jets and helicopters to keep the skies above the water safe.

Currently, there are more than 340,000 Navy sailors and about 290 combat vessels, including aircraft carriers, cruisers, destroyers and submarines. Within the Navy, there are more than 150 types of jobs, ranging from pilots and engineers to cyber and medical professionals. The first man to walk on the moon, Neil Armstrong, was a U.S. Navy sailor!

The U.S. Marine Corps is another military branch that is a part of the Department of the Navy. There are about 170,000 active Marines. They are trained to operate on land and sea, often acting as the fighting force aboard Navy ships and on shore.

The U.S. Coast Guard also protects the United States' shores, but it specializes in search and rescue and law enforcement. After natural disasters that cause floods and other damage, the Coast Guard acts as a first responder, sending troops to save civilians. There are approximately 39,000 active-duty Coast Guard members.



SUBMARINE: Victor Vescovo holds the record for going the deepest a human has ever traveled in a submarine. The DSV Limiting Factor submarine made it almost seven miles into the Pacific Ocean's Mariana Trench in 2019.

UNDERSEA CABLES lie across seabeds to make the internet and communications work across the world! There are more than 600 cables in the ocean, which equals 900,000 miles of cables total.



AUTONOMOUS UNDERWATER VEHICLES

are robots that operate on their own and can map the seafloor and collect data. ROVs, remotely operated underwater vehicles, are controlled by humans and are attached to a boat. They are used to explore shipwrecks like the Titanic!

SINK OR FLOAT?

THE SCIENCE BEHIND WATER VEHICLES

The largest aircraft carrier and warship in the world is the USS *Gerald R. Ford*, and it weighs more than 220 million pounds. You may be wondering how something so heavy can float!

The answer is simple: buoyancy.

Buoyancy is the force that pushes upward against gravity, which makes items float. For an object to float, the amount of water it pushes out of the way must be equal to its weight. The strength of an object's buoyancy depends on its density, which measures how tightly particles are packed (mass) in a space (volume). For example, rocks are dense because their mass is greater than their volume. They are small and heavy. Navy ships are large and heavy; however, naval engineers make the ships float by making them less dense than water.

WHAT'S LESS DENSE THAN WATER? AIR!

Ginormous ships carry a lot of supplies, but they have to make room for large areas of empty space inside the hull (the body of the ship) so that air can fill the space and make the ship more buoyant.

BUILD YOUR OWN BOAT

Become a naval engineer yourself! Try building your own boat out of household items.

- MATERIALS:**
- PIPE CLEANERS
 - TIN FOIL
 - SPONGES
 - POPSICLE STICKS
 - GLUE

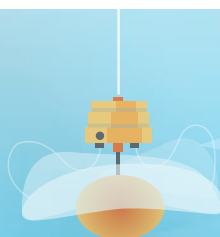
There isn't just one way to make a boat out of tin foil. The possibilities are endless! The most important thing is to make sure there are no holes and that the structure isn't too dense. It might take a few tests to find the perfect design.

Maybe you make a small canoe with popsicle sticks covered in foil. Or maybe you craft a big pirate ship using all the materials! Just make sure to leave enough room for air in the hull of your ship to keep it afloat.

The sky's the limit ...
or should we say, the sea's the limit!

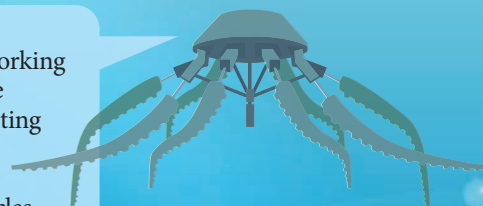


Water absorbs light with the longest wavelengths. Red has the longest wavelength, so at about 15-20 feet deep, the water completely absorbs red light. Once all the red light is absorbed, a red object looks gray or black to the human eye. Blue and purple have the shortest wavelengths, so they stay visible the deeper you get in the ocean.



JELLYFISH: Since humans can't explore every part of the ocean, researchers are creating robot jellyfish to help collect water samples.

OCTOPUS: Scientists are working on soft robots inspired by the octopus. They are experimenting with technologies that can fit into small spaces and carefully wrap items in tentacles.



DOLPHINS use echolocation to map out their surroundings. They make high-frequency clicks and wait for the echo, allowing them to measure the distance of objects. Modern sonars map the seafloor using this same method.



OCEAN WORD SEARCH

Learning new things about our waterways and how to protect them is so important! The Patapsco River and Patuxent River both run through central Maryland and connect to the Chesapeake Bay. They provide fresh drinking water and connect to ports where ships dock. To keep the rivers and streams clean, remember to throw away your trash and pick up litter when you can.

Search for the words you learned after reading *SIGNAL Kids* in the box to the left!

I O P I W V P Y C J C F X T Z
I W F U E J Q K L S K U E Q T
C W V M Y A I P Y M O J K Z N
Q A Y W S J J K H M A R I N E
V T N E O C T O P U S T L Q G
P E L S U B M A R I N E O X A
F R D O L P H I N A A D W T J
Y Z I C Y Y I D N Q T I W C E
R F D R I J K W A V E S K Q L
O D A F H T B K V C U O B G L
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A O F A H S H I P P W K G Z I
N A R T B U O Y A N C Y E U S
K T X K L N M Q K A O E U Z H

SUBMARINE
MARINE
WAVES

NAVY
BUOYANCY
OCTOPUS

FLOAT
SHIP
BOAT

JELLYFISH
DOLPHIN
WATER
OCEAN

The AFCEA Central Maryland Chapter supports STEM education through its grant and scholarship programs.

Learn more at centralmd.afceachapters.org

DOLPHINS ON DUTY

Meet the U.S. Navy's amazing animal teammates.

Imagine having a bottlenose dolphin as your work partner. For some U.S. Navy sailors and marine scientists, that's not imagination. It's reality! Based in San Diego through the Naval Information Warfare Center Pacific, the Navy Marine Mammal Program trains bottlenose dolphins and California sea lions to detect, locate, mark and recover objects in harbors, along coastlines and deep in the open sea.

Dolphins have an incredible superpower called echolocation. They send out clicking sounds that bounce off objects underwater, kind of like a living sonar system. The Navy uses this skill to find dangerous underwater mines before anyone gets hurt. Sea lions join the team too, using their sharp eyesight to track down lost equipment on the ocean floor and even help catch underwater intruders.

The best part? These animals are never in danger. They're treated like the VIPs they are—great food, excellent veterinary care and plenty of playtime. They even work voluntarily. If a dolphin doesn't feel like working, it can simply swim away.



A mammal trainer with the Navy Marine Mammal Program demonstrates techniques with a bottlenose dolphin to local students during Fleet Week San Diego Student STEM Days.

The program has been running since the 1960s, and scientists say no technology we've built can match what these incredible creatures do naturally. Pretty cool teammates, right?

AFCEA San Diego supports STEM education and connects students with the people and technologies shaping our future.

Visit sandiego.afceachapters.org to learn more.

U.S. Marine Corps photo by Lance Cpl. Hannah Hollerud