Traversing Technology 9-12

Program Description:

How has technology developed to help humans understand marine environments? Our planet is mostly made of water and yet, humans know less about our own oceans than we do about our solar system. Humans are a curious species and have developed different tools over time to help them explore the oceans past the limitations of our bodies. In this program, students will observe some of these tools and analyze their purpose for ocean exploration.

At the end of program, students can…

- Analyze the functions of ROVs and how they can explore beyond human limitation.
- Conceptualize the importance of diving for oceanic discovery.
- Identify the importance of laser photogrammetry and satellite tagging for scientific discovery.

Background:

Studying the ocean requires biologists, chemists, oceanographers, geologists, archaeologists, engineers and so many more. All these different fields must work together to gather data on the ocean. Baseline information can be established through ocean exploration. This is necessary to better understand environmental changes and provides foresight about future conditions. Humans have developed different kinds of technology to perform these studies. One reason for technology's necessity is that humans can't go very deep underwater without equipment. The current world record holder made it about 400 feet. However, the deepest point of the ocean, the Marianna trench, is about 124 miles.

What to Know Before

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There are three classes of satellites: High orbit, medium orbit and low orbit.

High Orbit Systems

High orbit systems are located at around 35,786 Km or 22,236 miles from the surface. Satellites at high orbit travel at the same speed as the Earth's rotation, this is called geosynchronous. When directly over the equator it is geostationary, meaning it does not move at all relative to the ground. A geostationary is vital to weather monitoring, because satellites in this orbital provide a constant view of the same surface area.

Medium Orbit Systems

Medium orbit systems are anywhere between low and high orbit. There are two notable orbits: semi-synchronous and Molniya. Semi-synchronous take 12 hours to complete an orbit and crosses the same two spots on the equator every day, GPS satellites utilize this orbit. The Molniya is highly eccentric, meaning it moves elliptically with the Earth at one edge. Communication satellites use this for far north and south regions.

Low Orbit Systems

Low orbit satellites are 2,000 km or less. They are most often circulate the Earth twice in a twenty four hour period. Most scientific and many weather satellites are in low orbit.

Scientist utilize satellites to track animals. NOAA tracks animals through the Argos System, a low orbit system. Thousand upon thousands of animals are tracked through these systems, over a variety of species.

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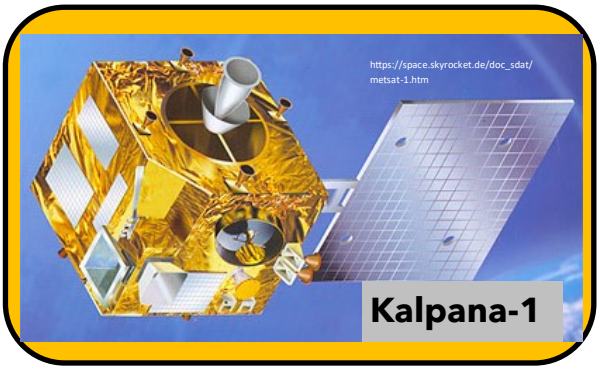
After reading the previous page for general information on satellites, select a satellite from the list below, research the satellite and answer the following questions on a separate sheet of paper.

What class of satellite is it? What country did it launch from? What is one use for this satellite (GPS, oceanic measurements, etc)? Is it still active?



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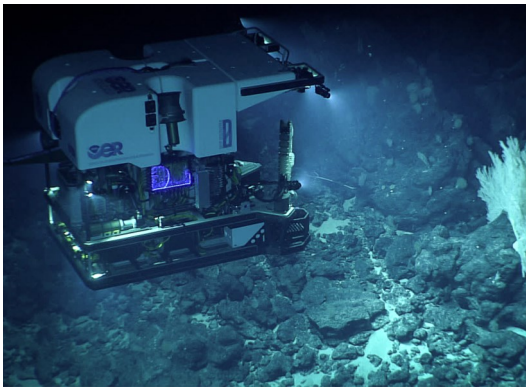

List out the basic components required for a ROV (Hint: there are seven).

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What is an ROV and how is it different from an AUV?

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What is technical diving? _____

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What are the two different kinds of satellite tags discussed by Dr. Dove?

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What is the purpose of laser photogrammetry?

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What can scientists learn from coral cores?_____

What is the difference between micro-fragmentation and standard fragmentation? Which one is more beneficial and why?_____

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What to Know Before KEY

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After reading the previous page for general information on satellites, select a satellite from the list below, research the satellite and answer the following questions. An excellent resource is ESA International.

What class of satellite is it? What country did it launch from? What is one use for this satellite (GPS, oceanic measurements, etc)? Is it still active?

GLONASS

GLONASS is in medium orbit. The satellite was launched from Russia. It's primary purpose is GPS and is still active.

AAUSAT-2

AAUSAT-2 was in low orbit. The satellite was launched from India, but made by Denmark students. It's primary purpose was gamma ray detection and is no longer active.

ADEOS

ADEOS was in low orbit. The satellite was launched from Japan. It's primary purpose was environmental research and is no longer active.

GOES

GOES series is in high orbit. The satellite was launched from America. It's primary purpose is meteorological studies and is still active.

Kalpana-1

Kalpana-1 is in high orbit. The satellite was launched from India. It's primary purpose is meteorological studies and is still active.

Galileo

Galileo is in medium orbit. The satellite was launched from French Guyana. It's primary purpose is GPS and is still active.

What I Learned KEY

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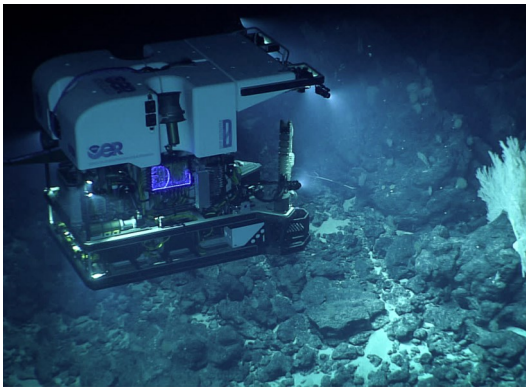

List out the basic components required for a ROV (Hint: there are seven).

Frame, power, control, tether, propulsion, buoyancy and tools.

What is an ROV and how is it different from an AUV?

An ROV is a remotely operated vehicle that is connected to the surface with a tether and can do exploration underwater. An AUV is very similar but is controlled via radio waves instead of a tether.

What is technical diving? Going beyond the limitations of basic and/or recreational SCUBA diving by bringing more specialized equipment.

What are the two different kinds of satellite tags discussed by Dr. Dove?

SPOT (Smart Position and Temperature)- Transmits real-time movement data of species that break the surface of the water.

PAT (Pop-up Archival Tag)- Stores information and then transmits data once it has detached.

What is the purpose of laser photogrammetry?

To measure the length/size of an organism or space with the use of two laser points a certain distance away. It helps understand scale of a space or organism and to track its growth.

What can scientists learn from coral cores? The climate of a specific month in the past and the health of the coral itself.

What is the difference between micro-fragmentation and standard fragmentation? Which one is more beneficial and why? Standard fragmentation breaks off a piece ranging 16–64cm², while micro is a piece about 1cm². Micro-fragmentation is more beneficial, coral can grow up to 25 times faster than the standard method.