Flying High, Swimming Low

Be a Power Reader

Read and Summarize After reading each section, stop for a minute before continuing. Use your own words (say them aloud if you are alone or silently to yourself in class) to describe to yourself what you've just read. This process helps your brain remember what you've learned.

Introduction

Computers work hard in many areas of transportation. They schedule when we arrive and depart, they operate the vehicles we use, and they help planes and trains arrive safely and on time.

What do you think of when you hear the word *transportation*? Most of us think first of land-based vehicles, such as cars, buses, trucks, and trains. From there we consider air and over-the-water travel. Today, computers are used in virtually all aspects of transportation and travel.

Computers in Space

Computers play essential roles in space travel. In fact, it is fair to say that without computers, there would be no space program.

Let's take a look at an imaginary astronaut named Mariko. She spends years preparing and training for her work in space. She learns how to pilot her spacecraft using the navigation computers. She understands how to troubleshoot problems with its engines by using special testing software. And she studies how to take off and land safely with the flight control computers.

During one flight, Mariko's job is to deploy a satellite. The satellite consists almost entirely of computers and software. The satellite's job is to orbit Earth, receive radio signals, and rebroadcast those signals in a different direction.

On a long flight, Mariko docks with a space station to refuel. A space station could be described as a combination home and office building in space. It provides a habitat for humans to live, eat, sleep, and work. Computers control all life-support systems such as air and water recycling, and they maintain the station's orbit around Earth.

Computers in Airplanes

Computers are used extensively in today's airline business. They begin working for us while we're still on the ground. The moment we book tickets for travel, computers get busy: They schedule arrival and departure times, log our presence on flights, and even record our preferences for in-flight meals. At airport check-in, they route our luggage so hopefully it will end up at the same airport we do.

Aboard today's jet aircraft, computers obey **pilot** and **navigator** commands during all phases of a flight. They assist in takeoff to change the wing configuration to provide lift. Once the plane reaches cruising level, the pilot can turn on the

autopilot. It uses extremely sophisticated software to fly the plane without human help. And the computers assist during descent and landing to make sure the plane arrives safely.

Like space travel, air travel has some distinct characteristics. Air gets thinner the higher the plane gets from the ground, so it would be very difficult to breathe in an open cockpit. Do you know how airplanes are designed to solve this problem?

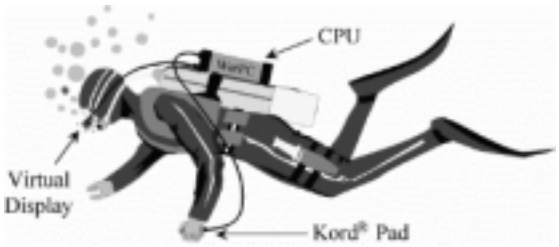
Computers Underwater

Computers in the water? How can that be? Yet specially constructed computers perform their functions very well deep in the cold, dark home of squids and whales.

Let's visit a professional diver named Eric. He lives in Key West, Florida, and he is a diving tour guide for sunken vessels. He uses a number of miniature computers, because they quickly give him vital information.

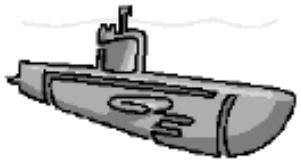
The ProSub Classic Computer, for example, is a power-packed miniature computer that provides Eric with facts such as his current depth and water temperature. He wears this computer on his wrist, like a watch. Like all divers, Eric knows the dangers of ascending (going up) too quickly and developing the "bends." The bends occurs when nitrogen bubbles form in the bloodstream. It can be fatal. The wrist-computer provides automatic warnings to help Eric monitor how fast his students are ascending. This helps keep everyone safe. The computer also records information for up to ten dives. When Eric gets back to his office, he can automatically transfer the information to his desktop computer.

Occasionally when Eric dives, he needs to record specific information while he's underwater. To do this, he uses the WetPC underwater computer. The virtual display mounts on Eric's mask, so that the computer image appears on top of what Eric would normally see through his mask. His input device is called a "Kord Pad." The Kord Pad contains only five keys. Eric presses these keys in various combinations to enter data. The computer itself resides in his waterproof backpack. Eric can now easily enter data into his computer even while he is diving.



Special computer equipment can be used underwater.

Underwater Vehicles



What about underwater vessels? An average submarine depends on its computers to perform many of the same duties they do on an airplane or spacecraft. Computers help calculate speed, direction, and depth, and assist with communication. They also control propulsion—or making the craft "go."

Computers play an especially important part in underwater navigation. A submarine is entirely surrounded by water. As the vessel sinks deeper, several things happen:

- The weight of the water above the submarine gets heavier on its hull.
- The water gets darker.
- The water gets colder.

A submarine is blind. It does not have portholes, but even if you could look out one, you would see only blackness. Instead, the sub navigator learns a very useful technique from porpoises and bats: he uses **sonar**, or sound waves, to find underwater landmarks and obstacles. The idea is to send a sound signal (or **ping**) through the water and measure how long it takes an

echo to return. The more quickly the echo returns, the closer an object is to the sub.

But just knowing how to avoid underwater obstacles is not enough. A sub navigator must know where he is on Earth. When necessary, he can send a buoy to the surface of the water to gather signals from **Global Positioning System** (**GPS**) satellites. His navigation computer uses the GPS information to determine the sub's exact location. The navigator must also know the sub's depth. His computers determine this by measuring the current **pressure**, or weight of water on the hull. All this information is necessary to keep the sub, and everyone on it, safe.

Review Questions

1. Compare space travel with underwater travel. What do they have in common? How do they differ?
2. What animals mentioned in this article use sonar to navigate? Can you name any others?
3. True or false: We could have a perfectly safe airline industry without computers. Why or why not?

What Do You Think?

1. What ways other than the ones mentioned here might computers be helpful in transportation?
2. Sonar is a controversial method to navigate underwater. Some evidence indicates that the sound pings used by submarines and buoys can hurt or even kill sea creatures such as whales. Yet submarines must be able to navigate. Do you have any ideas how we could meet the needs of both naval fleets and underwater animals?

Glossary

Global Positioning System (GPS) A system of 24 satellites that are used to determine the location of objects on Earth.

navigator A person who directs the course of an aircraft or ship.

pilot A person who operates an aircraft, ship, or boat.

ping A sound signal used with a sonar system to determine the current position of objects.

pressure Force that is applied uniformly over a surface.

sonar A system that uses underwater sound waves to detect and locate submerged objects or measure the distance to the floor of a body of water.