Facilitator Information

(All you need to know about Robotics to survive the day)

Robots are used for several different tasks. They help us achieve complicated tasks. They provide the first information about places of which we know little. They explore remote places that are too far for people to go at this time. They explore places that may be dangerous for humans. Robotic missions are exploring all over our solar system right now! Satellites are orbiting the Moon, Mars, Saturn, and Mercury. Spacecraft are on their way to Pluto and beyond into the Kuiper Belt, and are exploring the very edge of our solar system.

Mars Rovers – Robots Help Scientists Explore Mars!

NASA's twin robot geologists, the Mars Exploration Rovers, landed on Mars in January 2004 to begin their search for answers about the history of water on Mars. Other robots have visited Mars, including Viking 1 and 2 in the 1970's and Pathfinder (and little Sojourner) in the 1990's. New robots bring different capabilities and new engineering and technology to address the evolving questions of science.

The Mars Exploration Rover mission is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the red planet. Robots include orbiting space craft, landers, and rovers. The main goal of the Mars Exploration Rover mission is to search for and characterize a wide range of rocks and soils that hold clues to past water activity on Mars. The rovers went to sites on opposite sides of Mars that appear to have been affected by liquid water in the past.

The landings were spectacular! After the airbag-protected landing, the craft settled onto the surface and opened, and the little robots rolled out to take panoramic images. These real-time images give scientists information they need to select promising geological targets that tell part of the story of water in Mars' past. Then, the rovers – instructed by the scientists on Earth - drive to those locations to perform on-site scientific investigations. The original goal for each rover was to drive up to 40 meters (about 44 yards) in a single day, for a total of up to one 1 kilometer (about three-quarters of a mile). Both goals have been far exceeded!

Moving from place to place, the rovers perform on-site geological investigations. Each rover is sort of the mechanical equivalent of a geologist walking the surface of Mars. The mast-mounted cameras are 1.5 meters(5 feet) high and provide 360-degree, stereoscopic, humanlike views of the terrain. The robotic arm is capable of movement in much the same way as a human arm with an elbow and wrist, and can place instruments directly up against rock and soil targets of interest. In the mechanical "fist" of the arm is a microscopic camera that serves the same purpose

as a geologist's handheld magnifying lens. The Rock Abrasion Tool – the RAT! - serves the purpose of a geologist's rock hammer to expose the insides of rocks.

The International Space Station – Robots and Humans Working Together

To build and maintain the International Space Station, astronauts work in partnership with a new generation of space robotics. The space shuttle's mechanical arm and a new space station arm operate both as "space cranes" to precisely maneuver large modules and components and also as space "cherry pickers" to maneuver astronauts to work areas.

The shuttle's Canadian-built mechanical arm has been enhanced with a new "Space Vision System" (SVS) that helps the operator literally see around corners. The SVS allows the shuttle arm to be operated with great precision even when visibility is obstructed. Astronaut Nancy Currie, with her view partially obstructed, used the mechanical arm to attach the first station component, the Zarya Control Module, to the second component, the Unity Connecting Module.

Canada also has provided the new station mechanical arm. Called the Space Station Remote Manipulator System (SSRMS), or Canadarm2, the 55-foot-long arm has the capability to move around the station's exterior like an inchworm.

Two other robotic arms will be on the International Space Station. A European Robotic Arm (ERA) built by the European Space Agency will be used for maintenance on the Russian segment of the station and the Japanese laboratory module will include a Japanese robotic arm that will tend exterior experiments mounted on a "back porch" of the lab. In addition to mechanical arms, other robotics that may be used aboard the station include a free-flying robotic camera that will be used to inspect the exterior of the station, including the solar panels.

Robonaut

NASA is also working on the development of a robot astronaut called Robonaut, a humanoid robot. The Robonaut may eventually function just like an EVA astronaut. While Robonaut jumps generations ahead, it still keeps a human operator in the loop. The challenge engineers face is to build machines that can help humans work and explore in space. Working side by side with humans, or going where the risks are too great for people, machines like Robonaut expand our ability for construction and discovery.