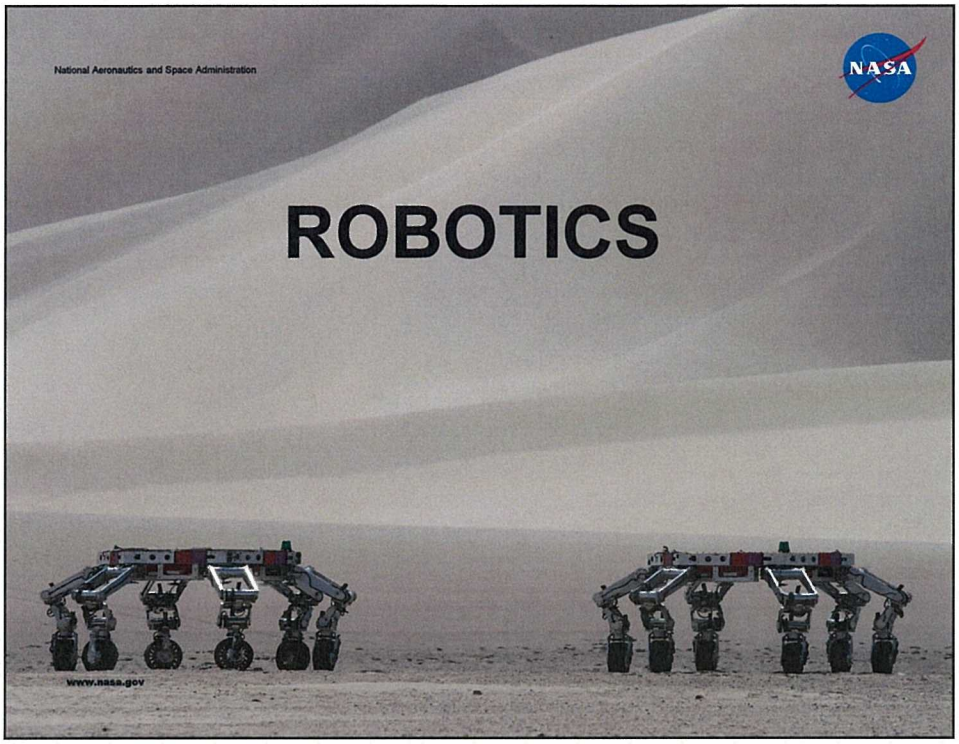


The most important thing is to familiarize yourself with what you're working with. Don't stress about knowing all the details but know what to expect when you talk about the slides and the activity. Time management is probably the most important thing. Don't rush through the presentation but make sure you leave enough time for students to really have fun with the activity. You should expect high school students to be more engaging and ask more questions. It's far more important to engage those students and their questions than push through the presentation.

It's important to be able to communicate what you do for NASA. You need to either go ahead and address your profession or just be prepared because someone will ask.

Breathe.

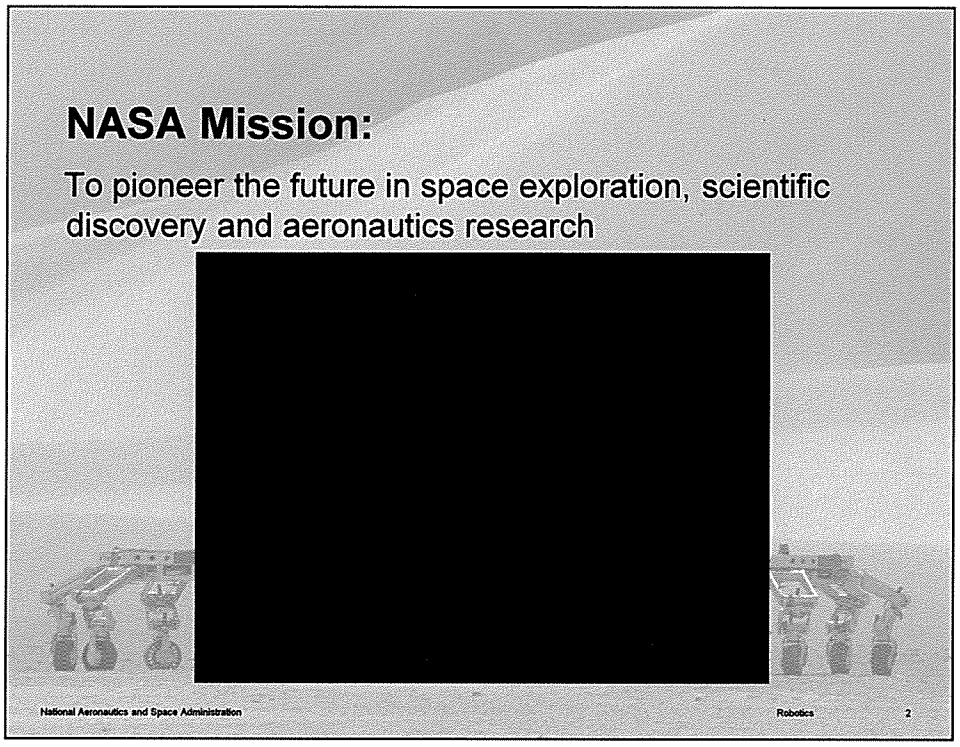
Be yourself.

Have fun.

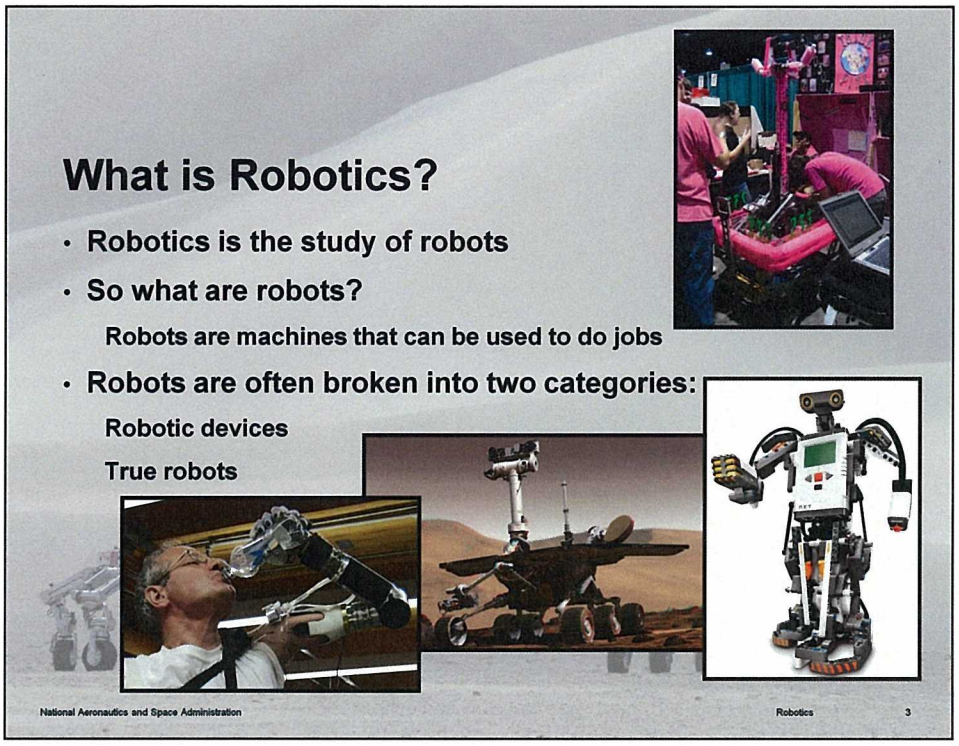
Good luck!

Pictured is a pair of NASA's "A.T.H.L.E.T.E." (All Terrain Hex-Legged Extra-Terrestrial Explorer) robots.

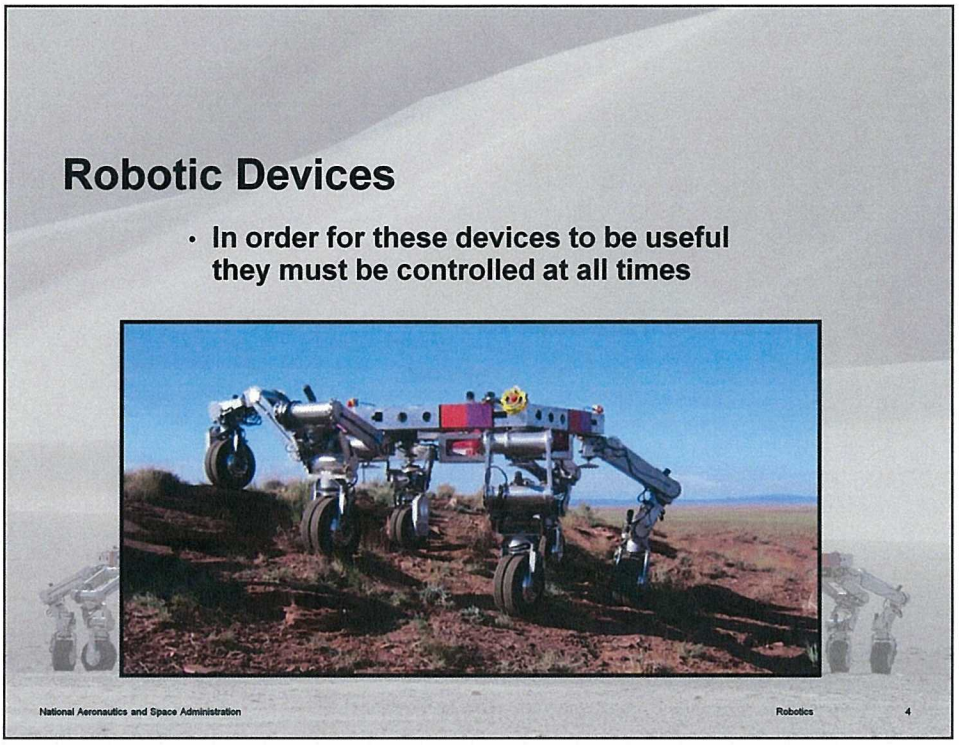
The All-Terrain Hex-Limbed Extra-Terrestrial Explorer (ATHLETE) vehicle concept is based on six 6 DoF (Degrees-of-Freedom) limbs, each with a 1 DoF



NASA's mission and focus. Feel free to discuss your job at NASA and how this mission statement relates to what you do.



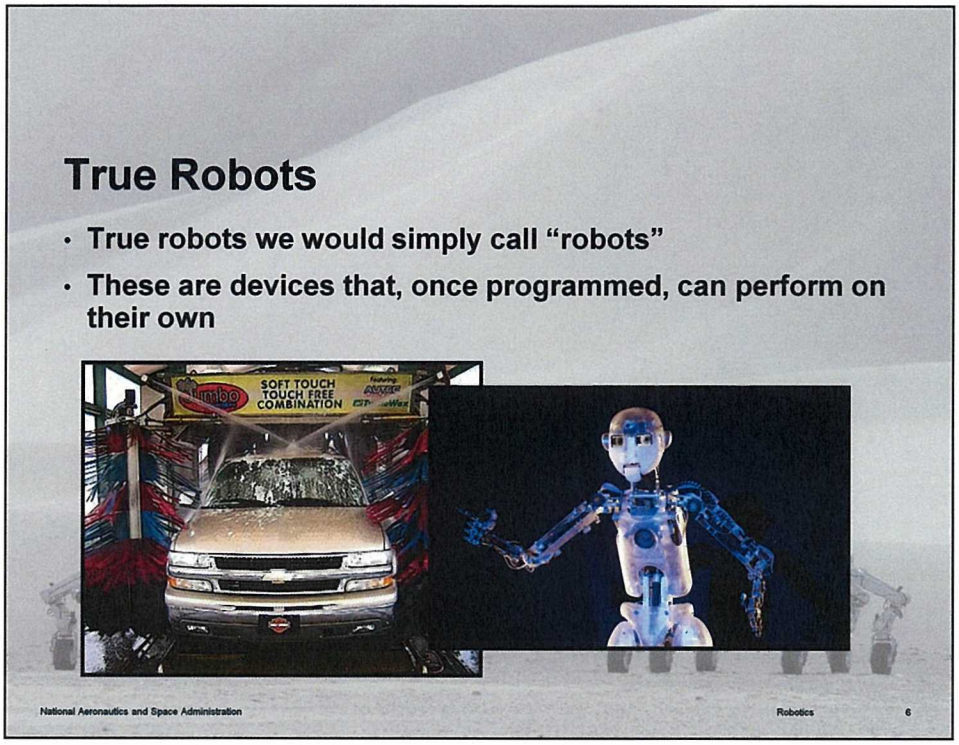
Pictured is a man with robotic arm, one of the teams sponsored by NASA in the FIRST Robotics competition, a concept of a Mars Rover and a LEGO Mindstorm robot kit.



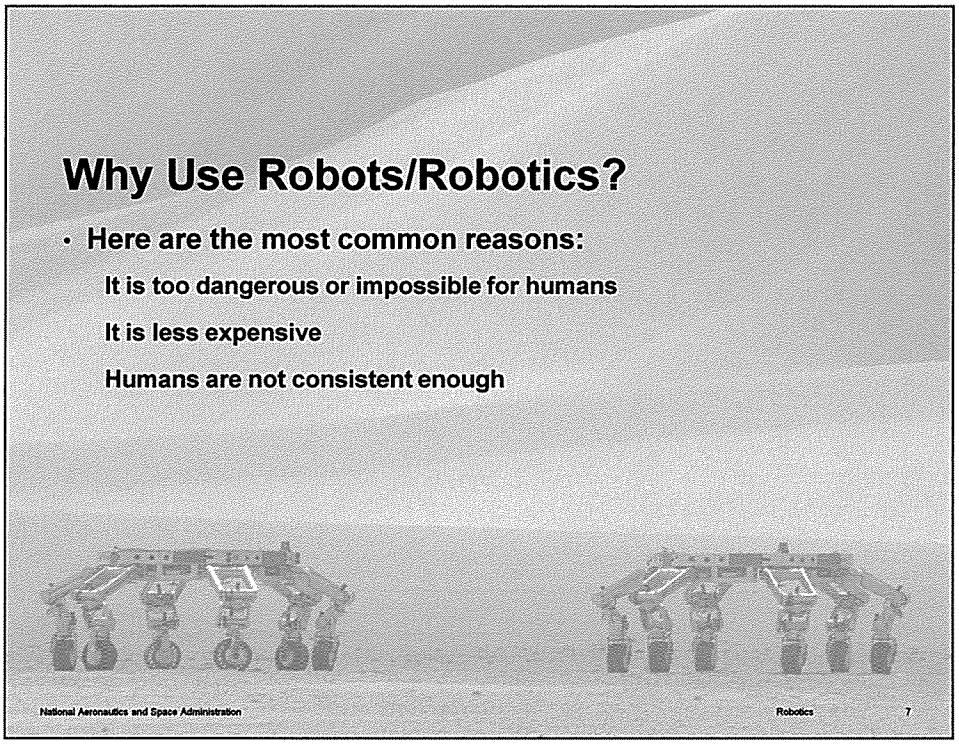
Pictured is the A.T.H.L.E.T.E.

The All-Terrain Hex-Limbed Extra-Terrestrial Explorer (ATHLETE) vehicle concept is based on six 6 DoF (Degrees-of-Freedom) limbs, each with a 1 DoF wheel attached. ATHLETE uses its wheels for efficient driving over stable, gently rolling terrain, but each limb can also be used as a general purpose leg. In the latter case, wheels can be locked and used as feet to walk out of excessively soft, obstacle laden, steep, or otherwise extreme terrain. ATHLETE is envisioned as a heavy-lift utility vehicle to support human exploration of the lunar surface, useful for unloading bulky cargo from stationary landers and transporting it long distances.

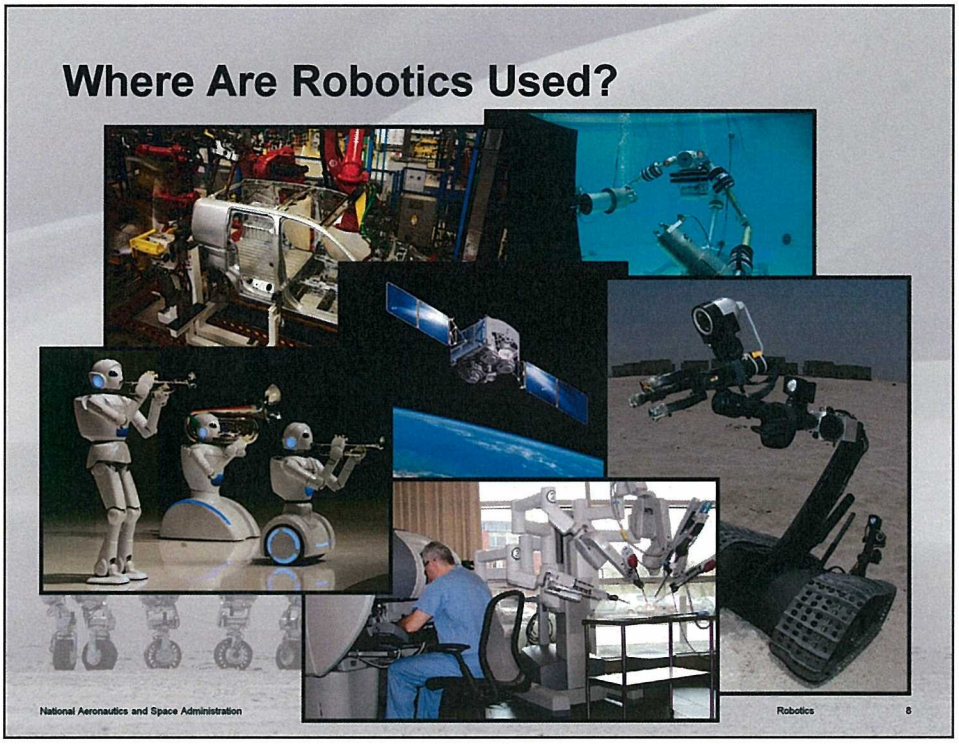
This is a comprehensive video explaining and demonstrating the A.T.H.L.E.T.E.



Talk a little bit about the differences in robots, how some can act on their own and others need constant control. Pictured are two good examples of robots that can work on their own. The car wash is completely automated. On the right is the Robothespian that, once programmed, can carry out all of its functions by itself.



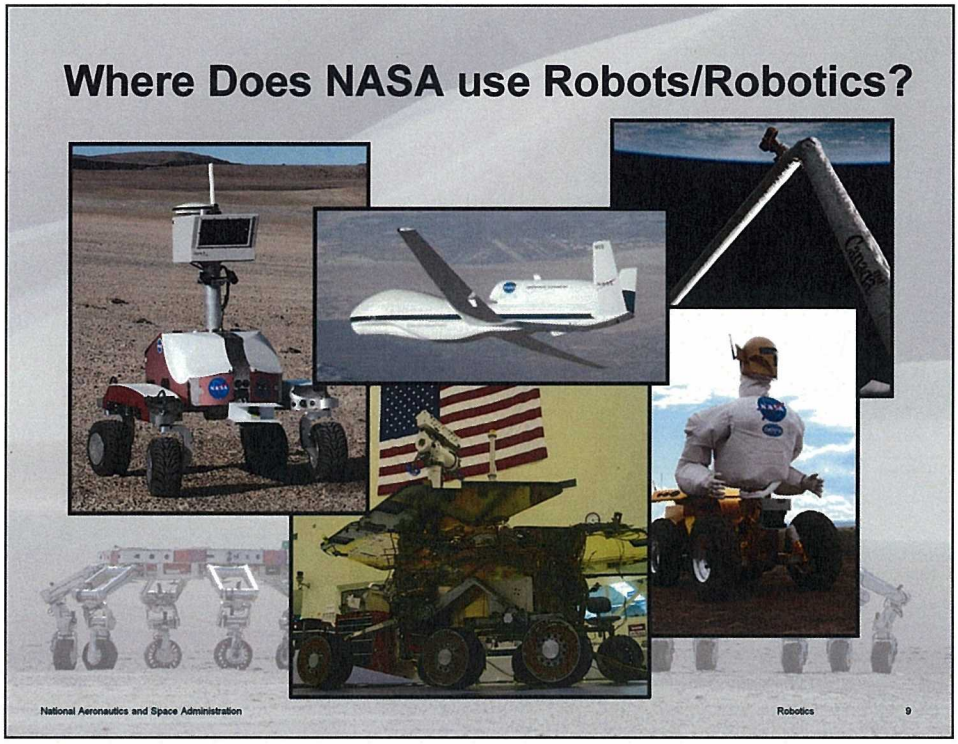
Here is a list of some of the common reasons why robots are used. Before displaying this list on screen ask students what they think reasons are to use robots. Encourage them to think about what robots/robotic devices they use in their daily life. (ex: electric tooth brush, car, etc)



Try asking what other kind of robots the students can think of. After they've done some guessing display the images on this slide. Be sure the students understand what each of these does.

Pictured (left to right, top to bottom) is a automated automobile assembly line, an underwater discovery robot, robots playing music, a satellite, a military mine hunting/reconnaissance robot, robotic surgical equipment.

Feel free to mention other kinds you can think of (ex: LEGOs, prosthetics, FIRST Robotics, etc)



Now you can talk about how NASA is using robots specifically. Be sure to mention if you work with robots in your line of work.

Can the students identify any of the robots on this slide?

Pictured (clockwise):

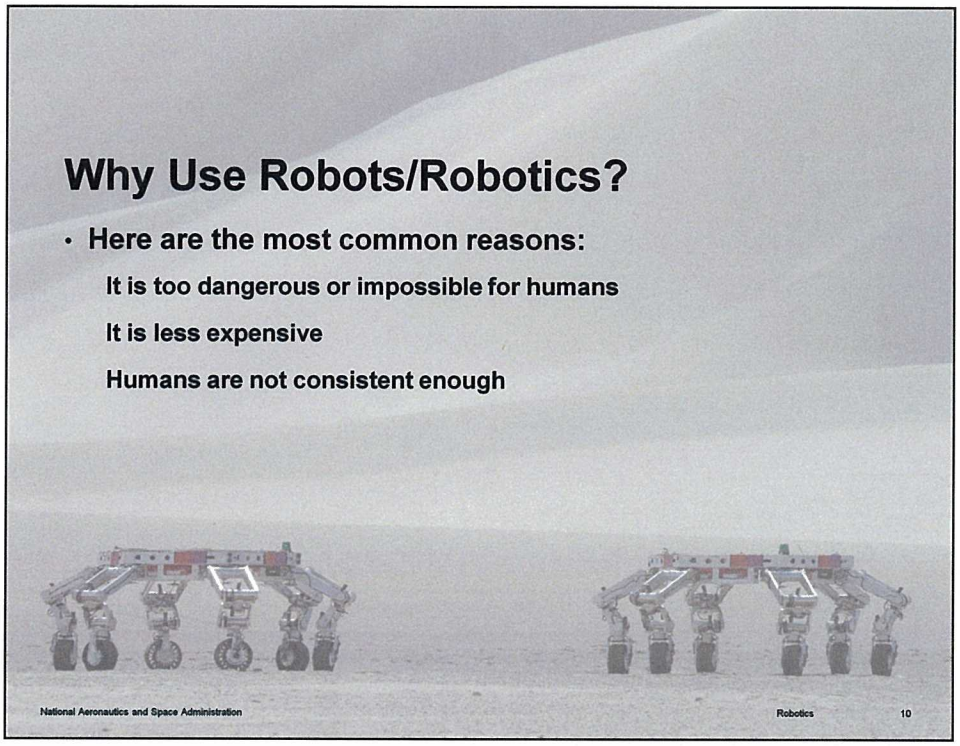
NASA K10 Red planetary rover - For the Robotic Recon experiment, NASA is using a robot to scout portions of the Black Point Lava Flow in northern Arizona. The robot, called "K10", will be remotely operated from the NASA Lunar Science Institute located at the NASA Ames Research Center (Moffett Field, California). The data from "robotic recon" will be used to plan geology field work, which will be subsequently carried out by astronauts driving in the NASA "Lunar Electric Rover".

Unmanned aerial vehicle (UAV) Global Hawk - studies atmospheric science over the Pacific and Arctic oceans. The Global Hawk is a robotic plane that can fly autonomously to altitudes above 60,000 feet (18.3 kilometers) -- roughly twice as high as a commercial airliner -- and as far as 11,000 nautical miles (20,000 kilometers) -- half the circumference of Earth. Operators pre-program a flight path, and then the plane flies itself for as long as 30 hours, staying in contact through satellite and line-of-site communications to the ground control station at NASA's Dryden Flight Research Center in California's Mojave Desert.

Canadarm – discussed in slide 12

Mars Exploration Rover – The Mars Exploration Rover mission is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the red planet. Moving from place to place, the rovers perform on-site geological investigations.

Robonaut - A Robonaut is a dexterous humanoid robot built and designed at NASA Johnson Space Center in Houston, Texas. Our challenge 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, Robonauts will expand our ability for construction and discovery. Central to that effort is a capability we call dexterous manipulation, embodied by an ability to use one's hand to do work, and our challenge has been to build machines with dexterity that exceeds that of a suited astronaut.



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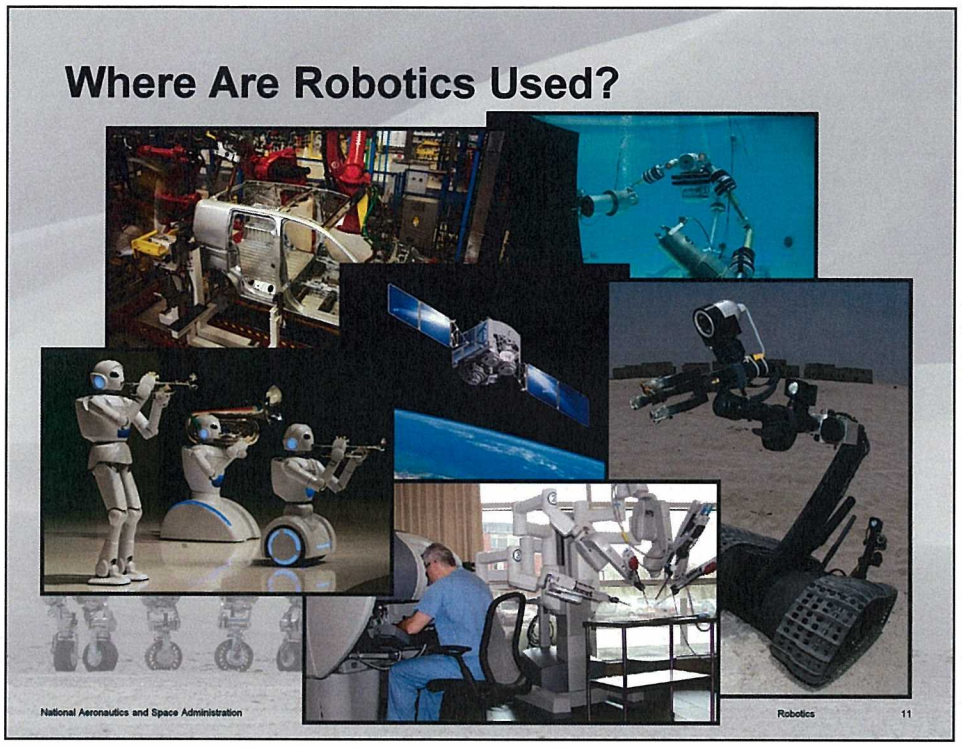

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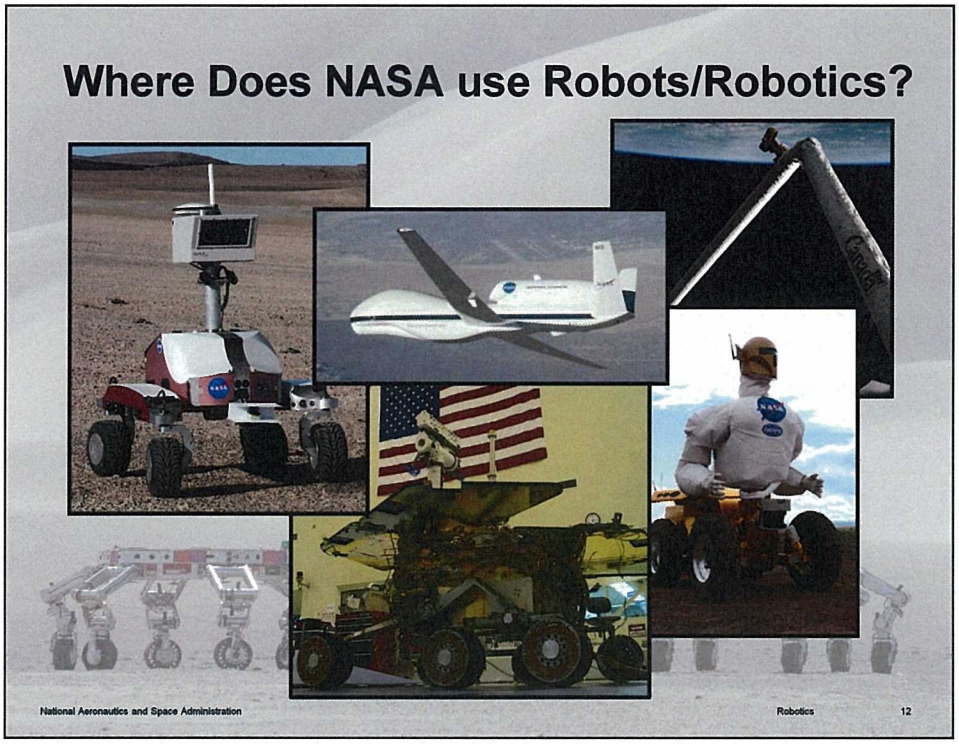
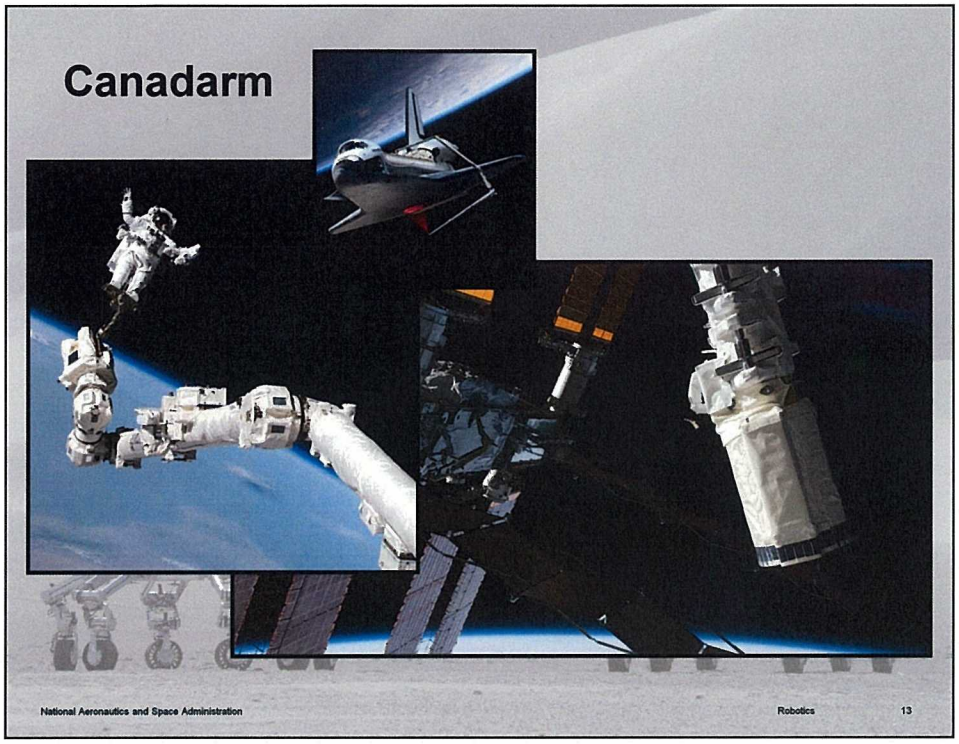


Now you can talk about how NASA is using robots specifically. Be sure to mention if you work with robots in your line of work.

Pictured is a reconnaissance robot, the unmanned Global Hawk, the Canadarm, a Mars Rover, and the Robonaut. Which ones are robotic and which are robots?

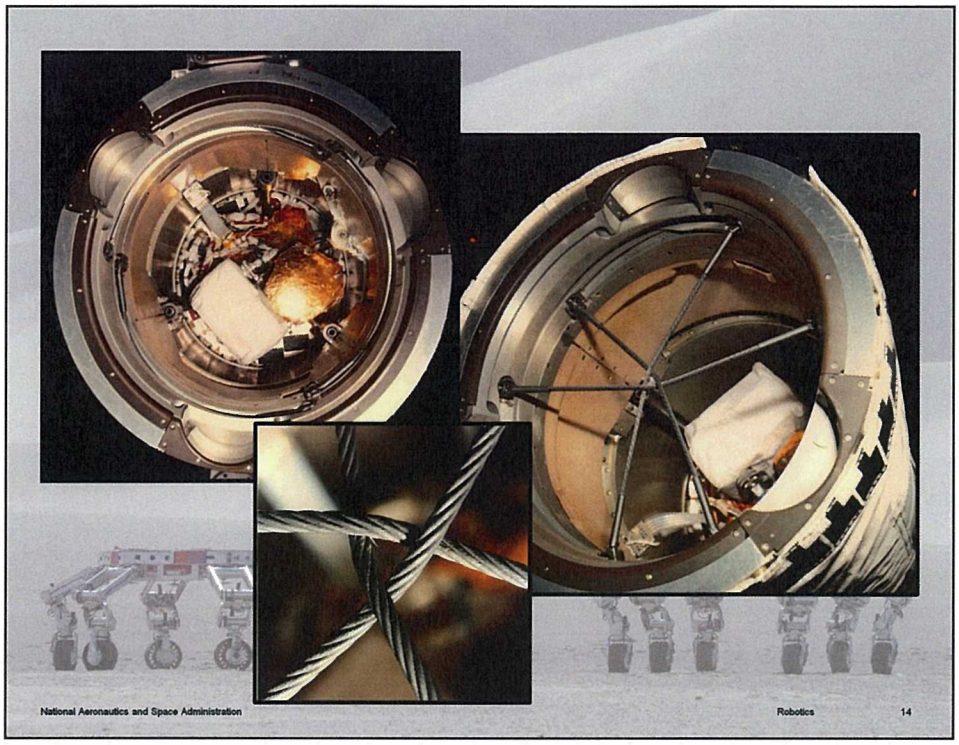


Today, new exploration strategies are at work. The goal is no longer humans or robots. It is humans and robots working together. Each bring important complimentary capabilities to the exploration of space. This has been demonstrated time and again with the Space Shuttle Remote Manipulator System (RMS) robot arm, also known as the Canadarm. The arm, also called Canadarm because it was designed and constructed by Canada, has been instrumental to the success of numerous space missions.

Explain how the Canadarm is a vital part of the Space Station construction, repair and deployment of Hubble, and, more recently, the safety of the Space Shuttle and its crew.

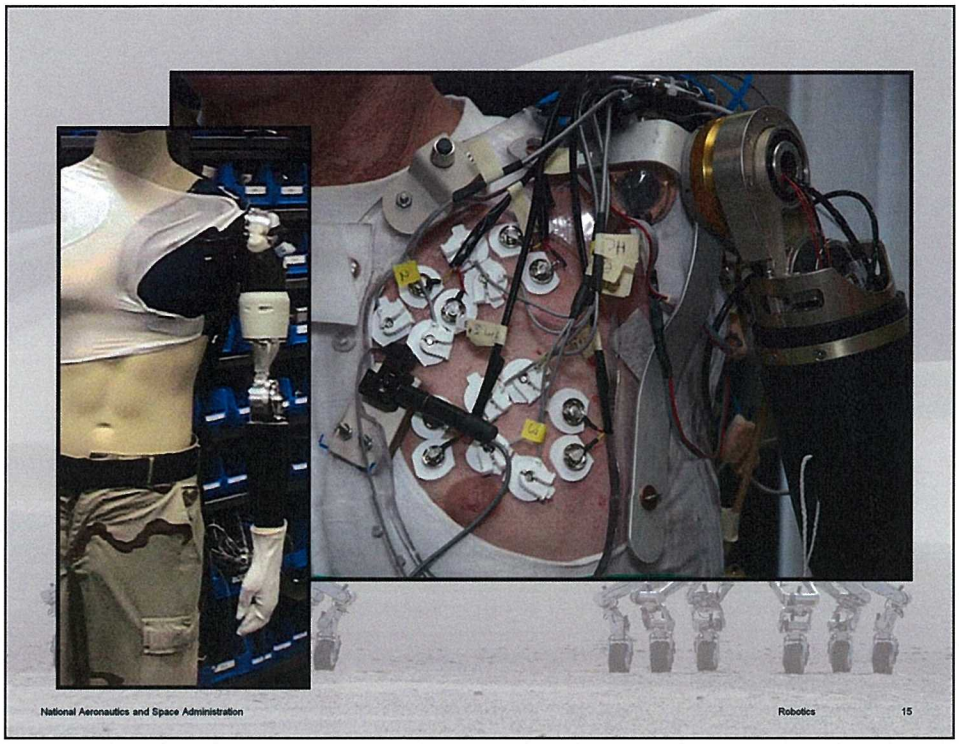
On several occasions, the RMS was used to grasp the *Hubble Space Telescope and bring the spacecraft into* the orbiter's payload bay. After the spacecraft was locked into position, the RMS helped spacewalking astronauts repair the telescope and replace some of its instruments. During operations, the RMS is controlled by an astronaut inside the orbiter. The RMS actually becomes an extension of the operator's own arm. Television cameras spaced along the RMS permit the operator to see what the arm is doing and precisely target its **end effector**. At times, during the *Hubble servicing,* one of the spacewalkers hitched a ride on the end effector to gain access to parts of the telescope that were difficult to reach. The arm became a space version of the terrestrial cherry picker.

The 15-meter-long arm is mounted near the forward end of the port side of the orbiter's payload bay. It has seven *degrees of freedom (DOF). In robot terms, this means* that the arm can bend and rotate in seven different directions to accomplish its tasks. Like a human arm, it has a shoulder joint that can move in two directions (2 DOF); an elbow joint (1 DOF); a wrist joint that can roll, pitch, and yaw (3 DOF); and a gripping device (1 DOF).



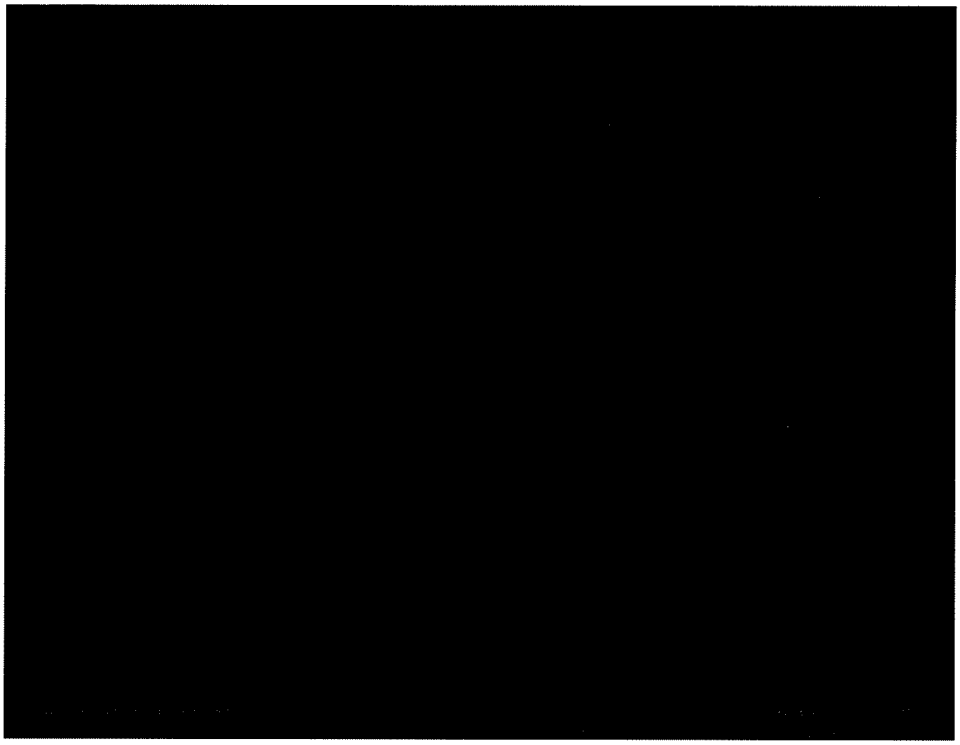
Pictured is the mechanism, called an End Effector, used on the Canadarm to grab objects in order to manipulate them.

The gripping device is called an *end effector. That* means it is located at the end of the arm and it has an effect (such as grasping) on objects within its reach.

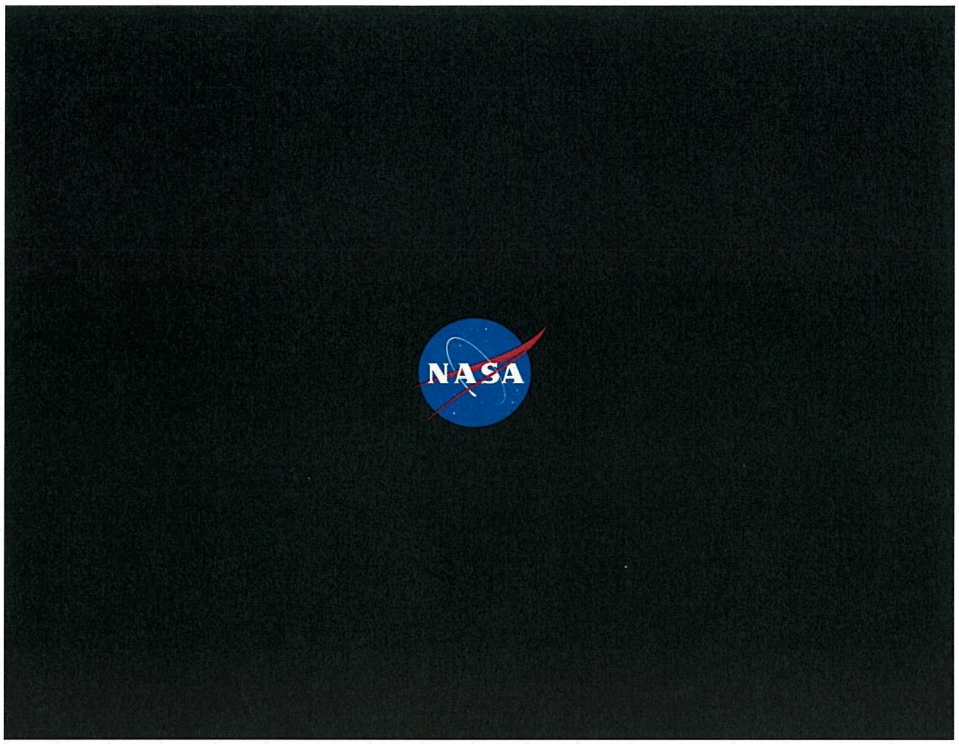


It would be good to talk about the benefits of the robotics pictured here. Explain how robot appendages are able to actually read what we're thinking to perform the desired tasks.

Here is a list of exciting careers that students can pursue relating to STEM (science, engineering, technology, mathematics) in the field of robotics.



This video is of NASAs Project M. The claim is that, given the permission, what's seen in the video can be a reality inside of 1000 days.



NASA Presentation Sign-Off Page