SUGGESTED REFERENCES

- *NASA – Mars Exploration Rover Mission*
  http://marsrovers.jpl.nasa.gov/home/index.html
- *The Honda Humanoid Robot Asimo*
  http://world.honda.com/ASIMO/
  and http://asimo.honda.com/EducationMaterials.aspx
- *Robotics Online*
  http://www.robotics.org/
- *DaVinci Surgery®*
  http://www.davincisurgery.com/surgery/system/features.aspx
- *Kids OLR – Kids Online Resources*
  (kindergarten to college)
  Science: Robots and Robotics
  http://www.kidsolr.com/science/page1c.html

NATIONAL SCIENCE EDUCATION STANDARDS

Grades K - 4
Science & Technology
Abilities of technological design
Understandings about science & technology

Grades 5 - 8
Science in Personal & Social Perspectives
Science & technology in society

Grades K – 4
History and Nature of Science
Science as a human endeavor

**Source: National Science Education Standards, 1996, National Academy Press*

CREDITS

Some video footage courtesy of Intuitive Surgical, Inc. 2008.

EDUCATOR ADVISORY PANEL

Patricia Heydet-Kirsch, Ed.D.

PRODUCTION CREDITS

WRITER/PRODUCER:	Jon Glassman
ASSOCIATE PRODUCER:	Judi Sitkin
EDITOR:	Stuart Scoon
NARRATORS:	Cyrilla Baer Pond & Andrew Forman

Science Screen Report FOR KIDS

Science Brought To Life In The Classroom

SCIENCE SCREEN REPORT FOR KIDS is a proud participant in the Presidential Awards for Excellence in Mathematics and Science Teaching Since 1984.
For information visit:
www.nsf.gov/pa

1000 Clint Moore Road, Suite 108, Boca Raton, FL 33487
tel: 1.800.232.2133 email: info@ssrvideo.com
www.ssrvideo.com

COPYRIGHT © 2009 Allegro Productions, Inc. All rights reserved.

Science Screen Report FOR KIDS

VOLUME 19 ISSUE 1

ROBOTICS - ENGINEERING MARVELS

SYNOPSIS

Over forty years ago the first industrial robot was “employed” in an automobile assembly plant. Robots have since made their way into hazardous and difficult tasks, agriculture, entertainment, the medical field, and even space exploration. Welding robots have increased assembly plant efficiency with robot technologies such as touch sensing and seam tracking. In medicine, surgeons have pioneered robotic surgery to give patients less pain, quicker recovery and shorter hospital stays. NASA brought us one step closer to understanding our solar system when they sent the robotic rovers Spirt and Opportunity to explore and research the possibility of water on Mars. Other scientists are creating more humanoid robots for human assistance. Some robots can walk and run, recognize people, and identify sounds and voices.

ABET
Accreditation Board for Engineering and Technology
www.abet.org

National Science Foundation
Presidential Awards for Excellence in Mathematics and Science Teaching

JETS
Junior Engineering Technical Society
www.jets.org

CURRICULUM UNITS	RUNNING TIME
■ COMPUTER ENGINEERING	17 minutes
■ ENGINEERING	
■ MECHANICAL ENGINEERING	
■ ROBOTICS	

BACKGROUND

Scientists and engineers from every aspect of research find homes for their inventions in manufacturing, underwater and space exploration, medicine, and more. Robots assist by doing tasks that are primarily detail-driven, repetitive and often hazardous.

In 1961, General Motors "employed" Unimate, the first industrial robot in history. Unimate stacked hot sections of die-cast metal and later performed spot welds on automobiles using step-by-step instructions stored on a magnetic drum.

Today, General Motors uses over 20,000 welder-robots throughout its many plants. More than 1,200 are in the Ohio assembly plant where more than 16,000 vehicles are produced per month. The GM Pontiac G6, for example, has nearly 5,000 robotically applied welds, each executed with astounding speed and precision.

Consistency is what makes these robots so efficient. A robot can make a series of spot welds in a short period of time with a gun that might weigh from 45 to 90 kilograms. Impervious to the heat, gases, fumes and sparks, robot arc-welders display an impressive 85% arc-time spent actually welding. But no matter how sophisticated the robots become, they will still need H.M.I., or human machine interface. They need to be programmed and maintained by knowledgeable engineers.

In medicine, robots function as support staff, nurses and even surgeons. Some are programmed to dispense medication, make deliveries to patients and accomplish simple administrative tasks. Through tele-operation, an operation being performed at a distance from the actual site, robots have assisted surgeons in a variety of different operations including mitral valve, prostate, hysterectomy, and coronary artery bypass.

The DaVinci Robotic Surgical System is an advanced platform for minimally invasive surgery. Utilizing high resolution 3D visuals, miniaturized wristed instruments, and intuitive motion control, a surgeon can perform complex and delicate procedures, with the assistance of robotic arms, through 1 to 2 centimeter incisions with outstanding precision. To reduce trauma and for improved cosmesis, the robotic arms move around fixed pivot points.

Ultimately, this robotic system benefits patients. There is reduced risk of infection, less blood loss, pain and scarring. The hospital stay is shorter, recovery time faster and the patient returns to normal activities sooner.

Robots are not limited to the confines of Earth. NASA has developed and sent several robotic rovers to research and explore the distant surface of Mars. Twin robot geologists, Spirit and Opportunity, were separately sent to Mars in the summer of 2003. Their purpose included the search for and characterization of a variety of rocks and soils that hold clues to past water activity.

Spirit and Opportunity are equipped with several robotic devices to help in their quest. The rover arm, also called the IDD or instrument deployment device, holds and maneuvers several instruments. At the end of the arm is a turret with four tools: the microscope imager, the Mossbauer spectrometer, the alpha particle x-ray spectrometer, and the rock abrasion tool.

Using these tools, astonishing discoveries are transmitted to Earth. Spirit found the composition of rock outcrops altered by water, and Opportunity discovered evidence that water once flowed on Mars.

CRITICAL THINKING EXERCISES

1. Identify a definition of a robot. Defend your definition with examples from the video and from real world experiences.

2. How are robots used in hazardous situations? How are they used in situations where precision is the goal?

3. Discuss with students the possibilities nanorobotics may offer. How do you think these robots may help in the future?

4. Ask students to design their own robot. What would it do? What purpose would it serve?

ADVANCED ORGANIZERS

Prior to viewing this program, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 3. The Nature of Technology
Section A: Technology and Science, Grades 3-5

- Technology extends the ability of people to change the world: to cut, shape, or put together materials; to move things from one place to another; and to reach farther with their hands, voices, senses, and minds. The changes may be for survival needs such as food, shelter, and defense; for communication and transportation; or to gain knowledge and express ideas.

Grades 6-8
- Technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

Section C: Issues in Technology, Grades 6-8

- Technology is largely responsible for the great revolutions in agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications that have radically changed how people live and work.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

VOCABULARY

Aerogel . . . . . A highly porous solid formed from a gel, such as silica gel, in which the liquid is replaced with a gas.

Anthropomorphic . . . . . Ascribing human form or attributes to a being or thing not human.

Cosmesis . . . . . A concern in therapeutics, especially in surgical operations, for the appearance of the patient; A resort to an operation which will improve the appearance.

Human Machine Interface. . . In the case of some robotic devices, the need for it to be programmed by a human.

Seam Tracking . . . . . A process that helps a robot stay within a seam as it is welding.

Teleoperation . . . . . Operations from a robotic device operated by a person from a distance.

Touch Sensing. . . . . Using sensors, a robot can record positional data and perform tasks using trigonometric calculations.

Welder-robots . . . . . Robots designed to join metals by applying heat, sometimes with pressure and sometimes with an intermediate or filler metal having a high melting point.

CAREER POSSIBILITIES

- MECHANICAL ENGINEER
- SOFTWARE ENGINEER
- ROBOT TECHNICIAN
- INDUSTRIAL ENGINEER