

# Robotics Web Hunt: The Answers

## 1. Into which volcano did Dante descend, and where is it located?

- Mt. Erebus, in Antarctica

## 2. What is the name of the first robot landed on Mars, and what year was it launched?

- Viking 1, launched in 1976

## 3. Who is known as “The Father of Robotics?”

- Joseph Engleberger. Engleberger was the co-developer of the Unimate manipulator, which was the first robot gain significant commercial acceptance and be incorporated into automated manufacturing processes. The Unimate formed the basis for the later Puma (Programmable Universal Machine for Assembly) manipulator, which gained broad acceptance in research laboratories and assembly lines, and is still one of the most popular research manipulators.

## 4. Where did the term “robot” originate?

- The term was credited to Czech playwright Karel Capek (alternate spellings acceptable) in 1921 in his play “R.U.R” (“Rossums Universal Robots”). The term was used to refer to working serfs with no autonomy.

## 5. Identify five universities which feature robotics research programs (bonus points: identify the only university in the United States with a PhD program in robotics).

- any of these (or any of the university programs listed in indexes such as [http://ranier.hq.nasa.gov/telerobotics\\_page/internetrobots.html](http://ranier.hq.nasa.gov/telerobotics_page/internetrobots.html)): CMU, Stanford, MIT, USC, U. Maryland, Cal Tech, Cornell, Ga. Tech, UCLA, U. Michigan, U. Texas, UVa, Va. Tech, U. Wisconsin.
- CMU currently has the only robotics PhD program in the country.

## 6. Identify four national or international robotics competitions held each year.

Any of these (or others appropriately documented):

- FIRST
- RoboCup robotic soccer
- RoboSumo
- IEEE robotics contest
- AAI robotics contest
- KIPR Bot-ball
- BEAM robotics

## 7. List the five major elements or subsystems of any robotic system.

- sensing & perception
- planning & reasoning
- system integration
- mechanisms & actuators
- cognition & control execution

## 8. Define the following terms “Robot,” “Teleoperator,” “Telerobot,” “Android.”

- “robot” : a device which precisely executes commands which have pre-programmed into the device by a human operator; all cognitive capabilities must be preprogrammed as there is little or no interaction with the human operator at the time of operation
- “teleoperator” : a device which precisely executes motion commands supplied by a physically distant human operator who provides most or all of the cognition for the system
- “telerobot” : a device which can combine the characteristics of both a robot and a teleoperator, depending upon the task currently being performed
- “android” : an intelligent robot constructed to physically resemble human form

**9. Where are robots typically used?**

- In environments where it is typically too dangerous or expensive for humans to work, or in areas where the work is extremely boring, repetitive, or requiring a level of precision or control not normally obtained from human operations.

**10. When was the AERcam robot flown on board the Space Shuttle (bonus points: identify the Space Shuttle flight and the AERcam “pilot”)?**

- November 1997, on STS-87; the AERcam pilot was astronaut Greg Lindsay

**11. Describe the differences between open loop and closed loop control**

- In an open loop control system, the control computer signals the actuators or motors to implement a motion, but never verify that the motion is actually completed (ie. the control system may send a voltage to a motor for a few seconds and assume that that is sufficient for the motor to drive the required distance - but the control system has no ability to verify that the motor actually received the supply voltage or turned the required number of turns); in a closed loop system, the control system uses additional sensors to determine that the commanded motions are actually completed, and will issue additional or alternate commands to the motors if the requested movement is not completed.

**12. What was the first movie to feature a robot?**

- *Metropolis*, made in 1926 by Fritz Lang.

**13. Name the robot in “The Day The Earth Stood Still” (bonus points: what phrase was used to prevent the robot from destroying Earth?).**

- Gort was prevented from destroying Earth with the phrase “Gort - Klaatu Birrada Nicto!”

**14. What are Asimov’s “Three Laws Of Robotics?”**

- 1. A robot must do nothing to harm a human, through action or inaction, 2. A robot must obey all commands from a human, except those that would cause a violation of rule #1, 3. A robot must protect itself, except in those instances where doing so would cause a violation of rule #1 or rule #2.

**15. What does the “HAL” in “HAL 9000” stand for?**

- Heuristic Algorithm

**16. What was “Shakey” and why was it significant?**

- Shakey was a robot invented in the late 1960's by Nils Nilsson and his colleagues at Stanford Research Institute. Shakey was a box with motorized wheels and a television camera for eyes. Conceived in the dark ages of electronic miniaturization, Shakey had a brain that was too big to keep on board, so the robot used a radio transmitter to communicate with a central computer. Human operators would type commands on a keyboard, like "Push the box off the platform." Shakey would dutifully explore the room until it found the box. Then it would push a ramp up to the platform, roll up on top and shove the box onto the floor. The robot was able to navigate because its software was designed to recognize the signature that boxes, pyramids and other objects left on the electronic retina of its video eye. As an object came into sight, the computer would measure differences in illumination, detecting an edge here, a corner there. Referring to rules about how different objects look from different vantage points, it might decide whether it was seeing the slope of a pyramid or the incline of a ramp.

**17. Name any three robots developed by William “Red” Whittaker.**

- Ambler, Dante I, Dante II, Terragator, Work Horse, Navlab 1-4, Nomad, Pioneer, Rosie, TUGV, FastNav, Remote Reconnaissance Vehicle, Remote Core Sampler, Remote Work Vehicle (used to clean up Three Mile Island nuclear accident site), REX, Portable Pipe Mapper, RoboHost, Demeter, AutoLoad, etc.

**18. What is “COG” and who developed it?**

- Rod Brooks developed COG, which is a research robot that is being used to investigate simulated human

behaviors and cognition

**19. What is the current “Cool Robot Of The Week?”**

- Check the web site [http://ranier.hq.nasa.gov/telerobotics\\_page/coolrobots.html](http://ranier.hq.nasa.gov/telerobotics_page/coolrobots.html)

**20. What is the name of the robot that first explored the interior of the RMS Titanic?**

- Jason

**21. Intelligent robots rely heavily on the use of computers to provide the brains for the robot. Who is credited with developing the first meaningful computing machine?**

- Charles Babbage

**22. Name the three robots in the film “Silent Running”**

- Huey, Dewie and Louie

**23. Who built the “Handyman,” and why was it important?**

- The Handyman was the first successful implementation of a human-based exoskeleton to mimic the movements of the human operator. Developed under a joint U.S. Air Force/AEC project that started in 1958, the Handyman was built by General Electric Corporation. The device included a two-armed master-slave manipulator arrangement which was intended for handling nuclear materials, and featured force feedback/reflection to the operator, articulated exoskeletal master arms that conformed to the operator’s body, and dexterous hands. An offshoot of Handyman was the 1965 “Hardyman” project, which was the first attempt to develop a full-body exoskeleton system to amplify human movements and forces.

**24. What are the three classes of actuators?**

- “linear, rotary and reciprocating” (full credit) or “electric, pneumatic and hydraulic” (1/2 credit)

**25. Who is this?**

- Robby the Robot from “Forbidden Planet,” filmed in 1956 (1/2 credit if you ignored the robot and instead correctly identified the actress as Anne Francis).