UNIVERSITY OF
SOUTH CAROLINA

CSCE 774 ROBOTICS SYSTEMS

Robotics and Ethics

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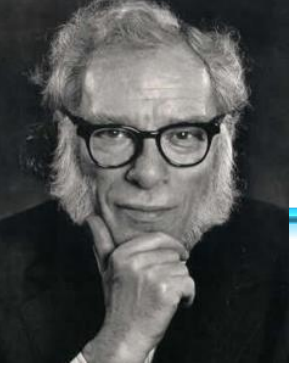
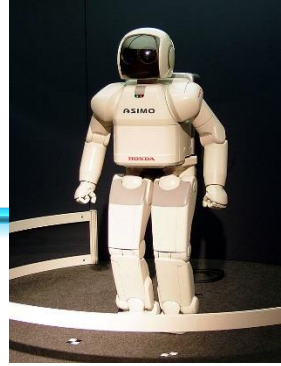


Three Laws of Robotics



Short story "Runaround" (1942) by I. Asimov

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

0. A robot may not harm humanity, or, by inaction, allow humanity to come to harm.

Present Everywhere

- At home
- On the road
- In the sky (drones)
- In the fields (agricultural robotics)
- In resource utilization (ROV in the oil industry)
- Along power lines
- Education
- In Factories
- In Warehouses
- In Space

At Home

- Helping at home
- Eliminating many tedious tasks
- Improving life for elderly and disabled people

- Privacy concerns:
  - Do you want to share what is, and what you do, in your house with Company X and Agency Y?

On the Road

- Safer
- More efficient
- Enable people

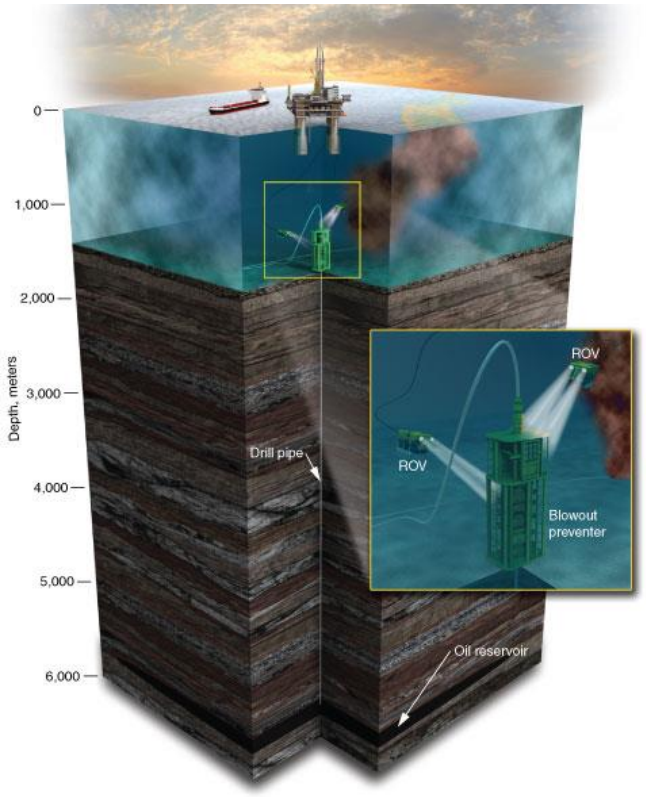
The Nevada law went into effect on **March 1, 2012**, and the Nevada Department of Motor Vehicles issued the first license for a self-driven car in **May 2012**. The license was issued to a Toyota Prius modified with Google's experimental driverless technology.

Power-lines

- Robots can crawl along power-lines, inspecting for damages.
- Faster coverage
- Avoid forest fires
- Avoid black-outs

Resource Utilization

- Good News:
  - Plug the hole at the Deepwater Horizon oil spill of 2010
  - Enable us to reach depths forbidding to humans
- ??? News
  - Enabling disasters in hard to reach places



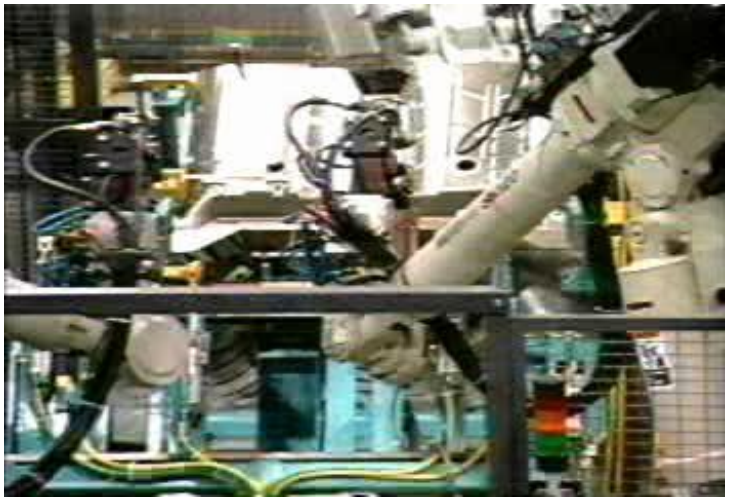
Warehouse Automation

- Amazon bought Kiva for $775M

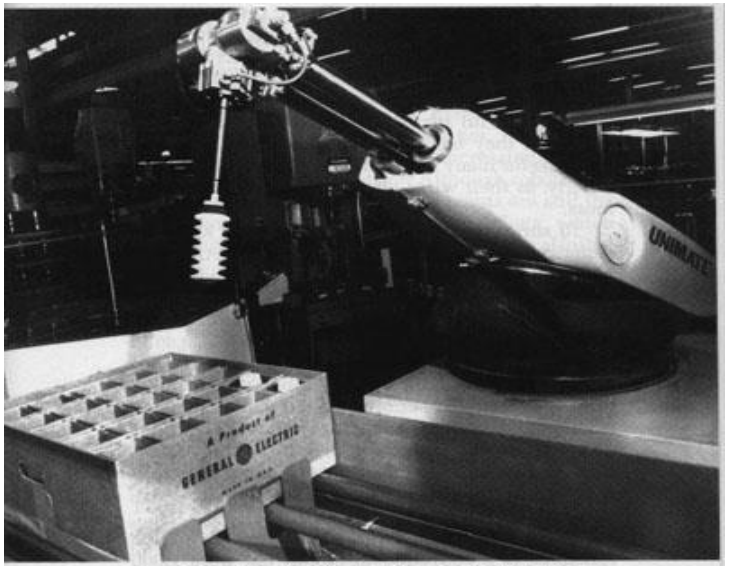
Factory Automation

Factory Automation

- 1950-Now
- Taking over many tasks; especially boring, repetitive, dangerous.



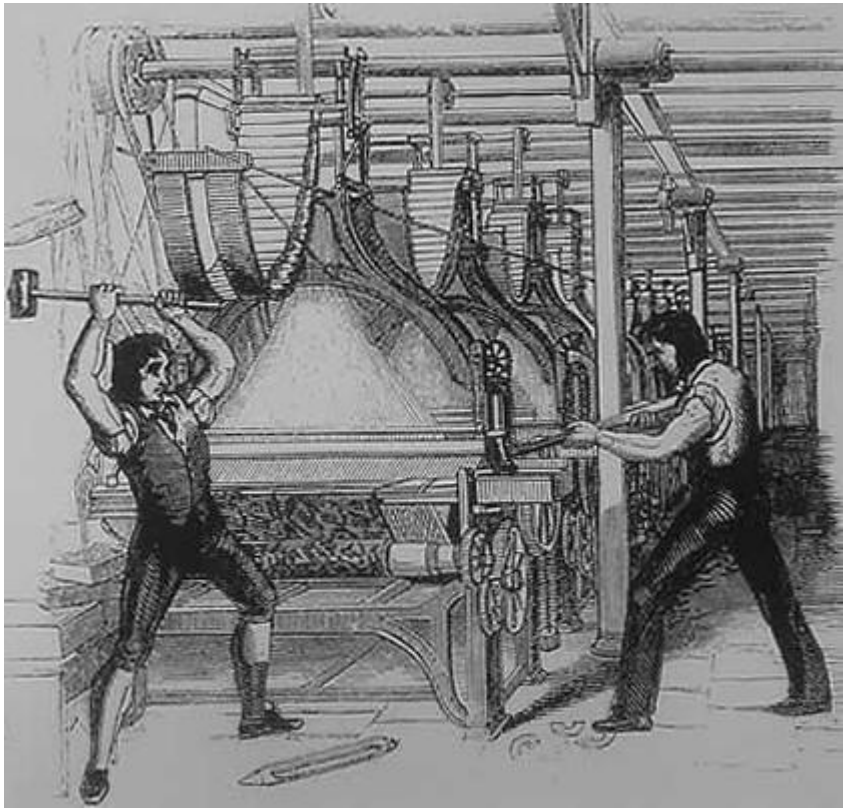
- Take over all tasks!
- No need for a workforce
- Who is going to buy the products?



Armed for duty. A Unimate robot—really, just an arm—picks up and puts down parts in a General Electric factory.

Factory Automation

- What happens when a machine replaces a human?
- Luddites?
- What happens to the unemployed?



In the Sky

- **Hobbyists**
- Commercial
- Military

Privacy

In the Sky

- **Hobbyists**
- **Commercial**
- Military

Privacy

In the Sky

- Hobbyists
- **Commercial**
- Military

Privacy

In the Sky

- Hobbyists
- Commercial
- **Military**

The Bureau of Investigative Journalism estimates the following cumulative statistics about US drone strikes:
(As of January 2014)
•Total strikes: 381
•Total reported killed: 2,537 - 3,646
•Civilians reported killed: 416 - 951
•**Children reported killed**: 168 - 200
•Total reported injured: 1,128 - 1,557

From CNN: According to the senior U.S. official, an estimated 2,000 militants and **50 civilians** have been killed in strikes since 2001. Since May 2010, the strikes have killed 600 militants, the official said.

Battlefield Robots

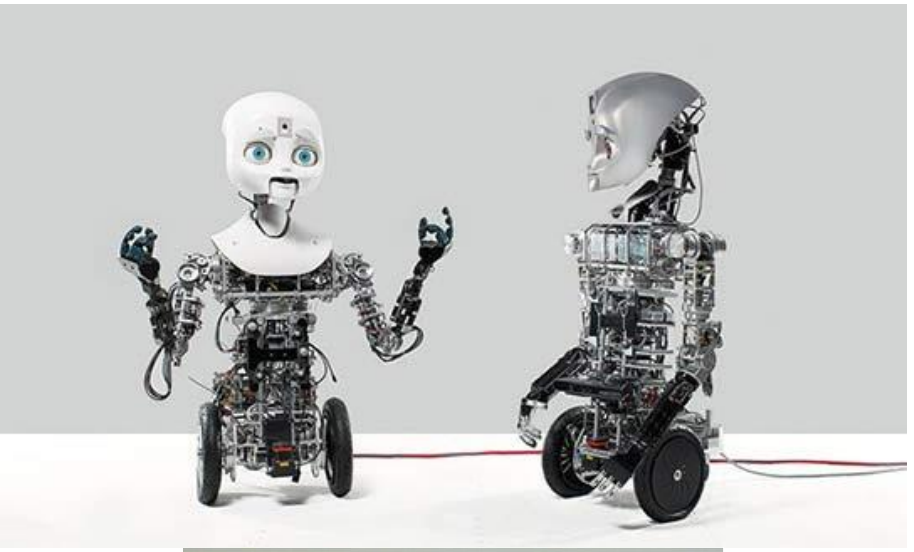
- More efficient
- Saving soldier lives
- Rational thinkers

- Responsibility
  - Buggy s/w?
- War with no cost
- **I was just obeying orders!**

Concentration camp guards, following orders, hanged after WWII

Social Robots

- Fuzzy, furry and cute
- Help people in rehabilitation
- Provide companionship
- Here in CSCE, Charlie was used in autism therapy



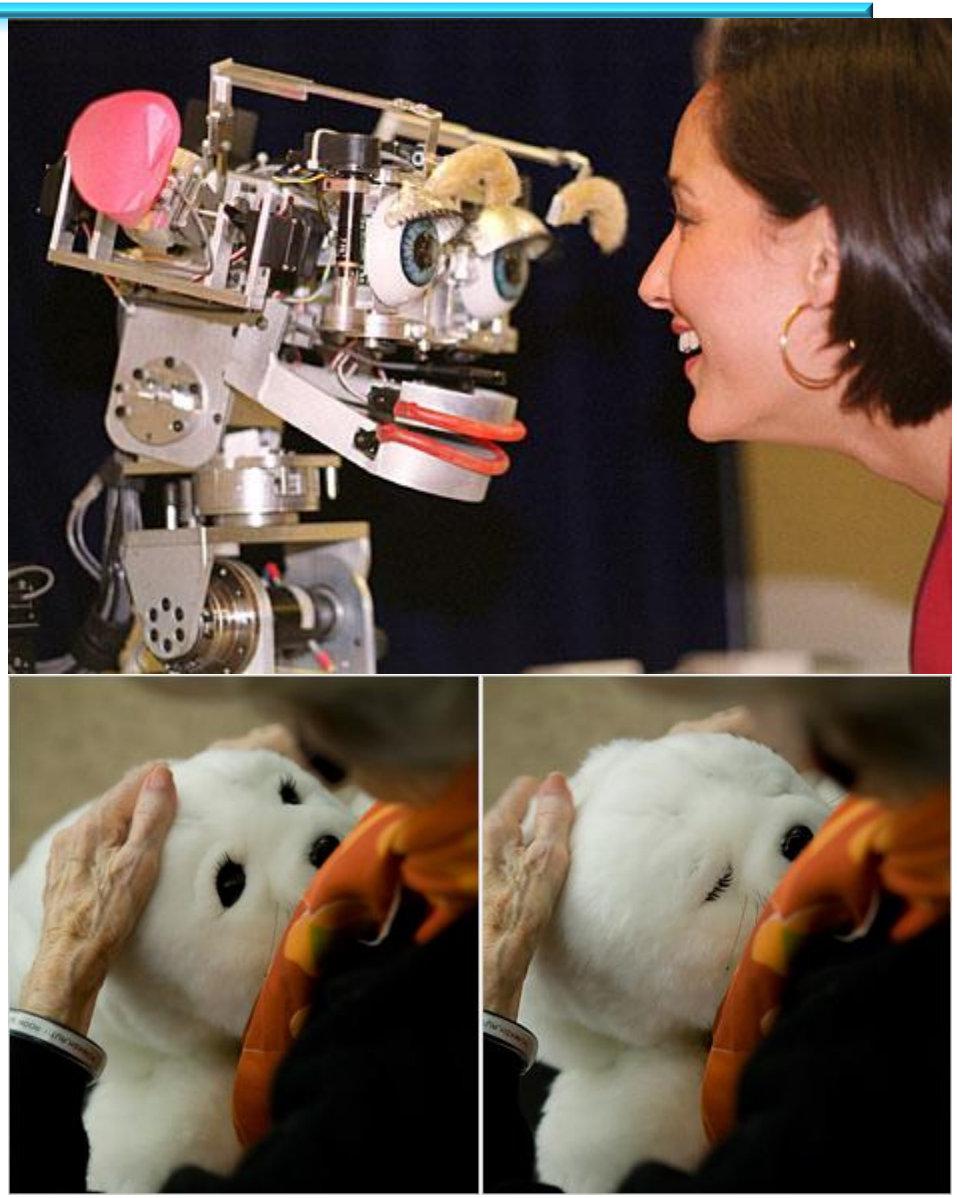
- See: L. Boccanfuso, J. M. O'Kane. CHARLIE: An Adaptive Robot Design with Hand and Face Tracking for Use in Autism Therapy. International Journal of Social Robotics, 2011.

Social Robots – Care for the Elderly

Concerns:

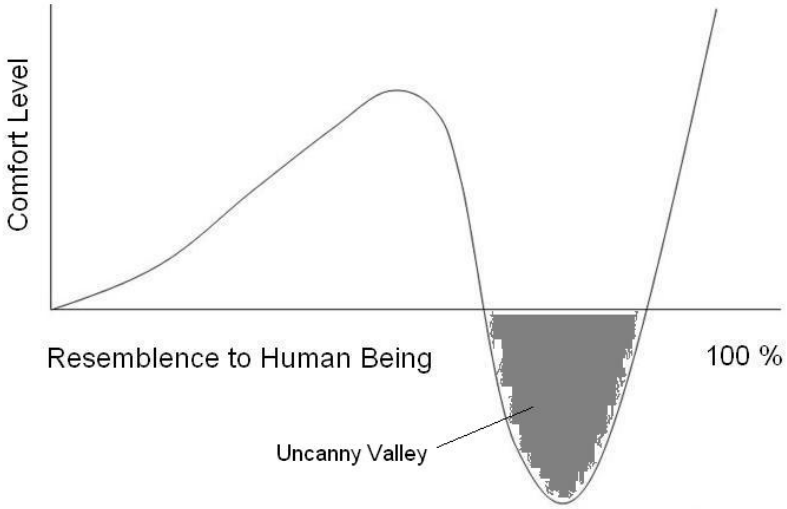
- Reduced human contact
- Loss of privacy
- Deception and infantilisation
- Loss of control
- Loss of personal liberty
- Questions about responsibility
  - if something goes wrong when older people are in control of the robot, who is to blame?

From: Sharkey A, Sharkey N (2012) "Granny and the robots: ethical issues in robot care for the elderly". Ethics Inf Technol 14(1):27–40



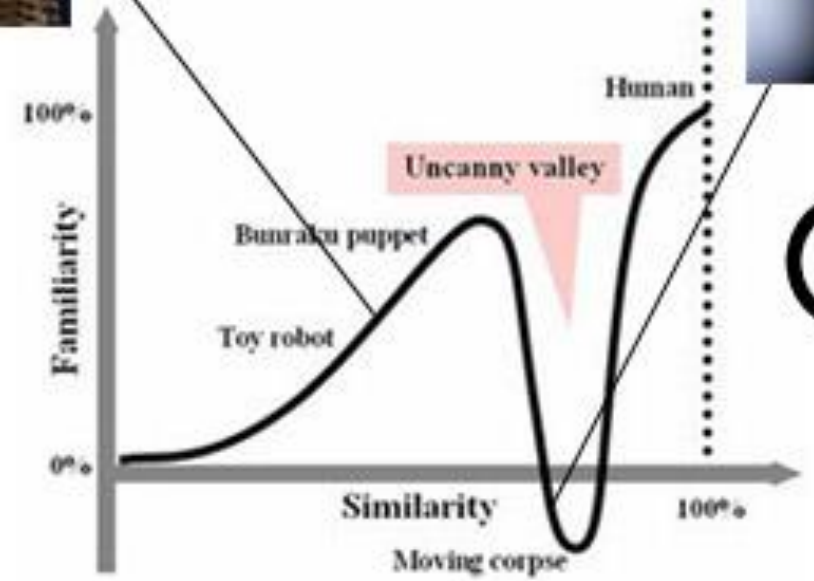
Human-like Robots

The Uncanny Valley Effect



The Uncanny valley

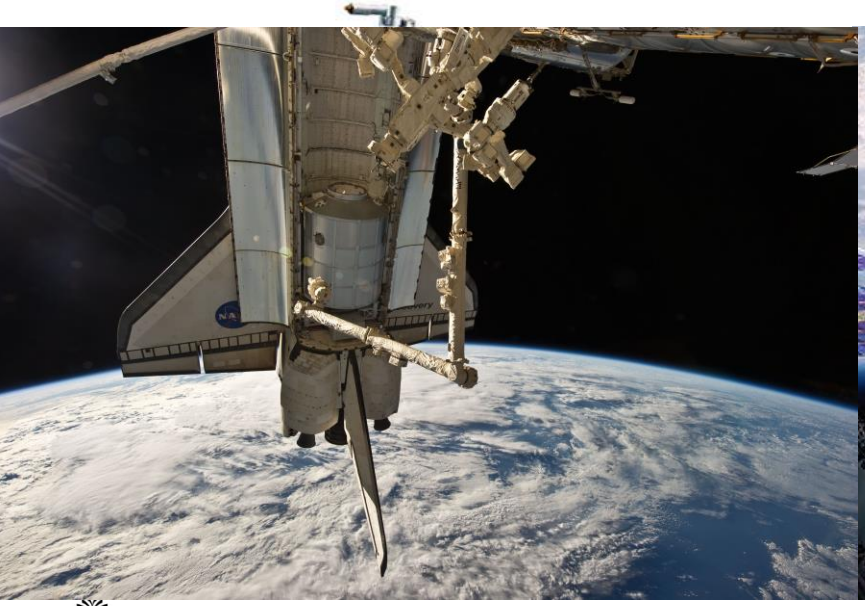
CUTE

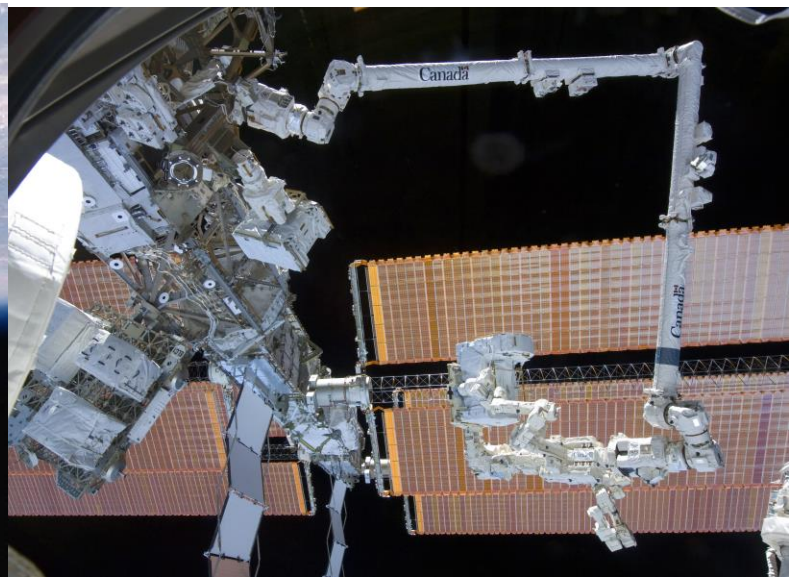


CREEPY

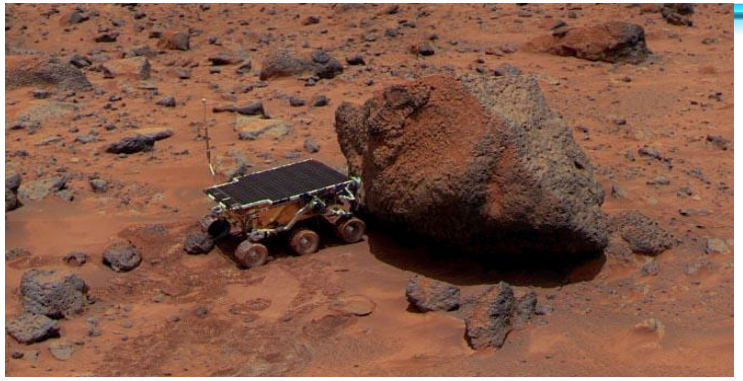
Space – On-Orbit

- International Space Station
- Robonaut
- Canadarm
- Canadarm2



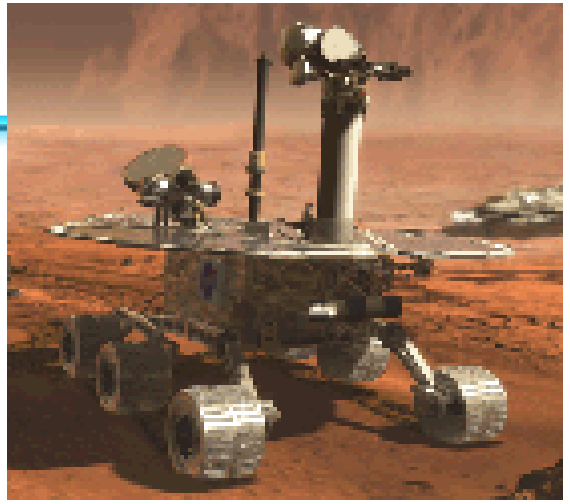


Space - Exploring Mars

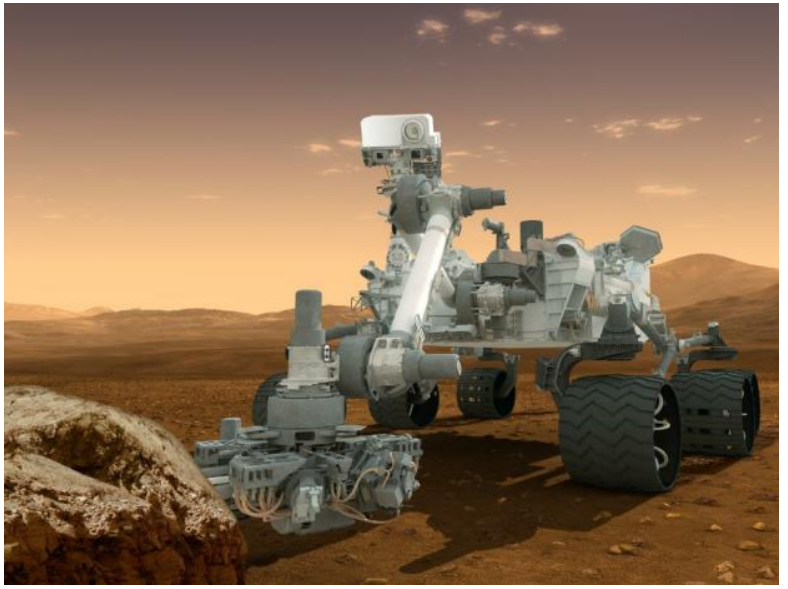


Sojourner
1997

Spirit and
Opportunity
2003



Phoenix-2008



Mars Science Laboratory
Curiosity (2012)

Space Expenditures

Technology developed for space:

- Invisible Braces
- Scratch-resistant Lenses
- Memory Foam
- Ear Thermometer
- Shoe Insoles
- Long-distance Telecommunications
- Adjustable Smoke Detector
- Safety Grooving
- Cordless Tools
- Water Filters
- Artificial Limbs
- Ventricular Assist Device
- Anti-Icing Systems
- Improved Radial Tires
- Fire-Resistant Reinforcement
- Firefighter Gear
- Freeze Drying Technology
- Harnessing Solar Energy
- Pollution Remediation
- Refrigerated Internet-Connected Wall Ovens
- Improved Mine Safety
- Light-Emitting Diodes (LEDs)

See http://www.discovery.com/tv-shows/curiosity/topics/ten-nasa-inventions.htm
http://spinoff.nasa.gov/Spinoff2008/tech_benefits.html

CSCE Courses in Robotics

- CSCE 274
- CSCE 574
- CSCE 774

Questions?

Halifax, Nova Scotia, Canada

Issues

- Privacy
- Responsibility
- Asimov's Law #1
- Asimov's Law #0
- Job loss