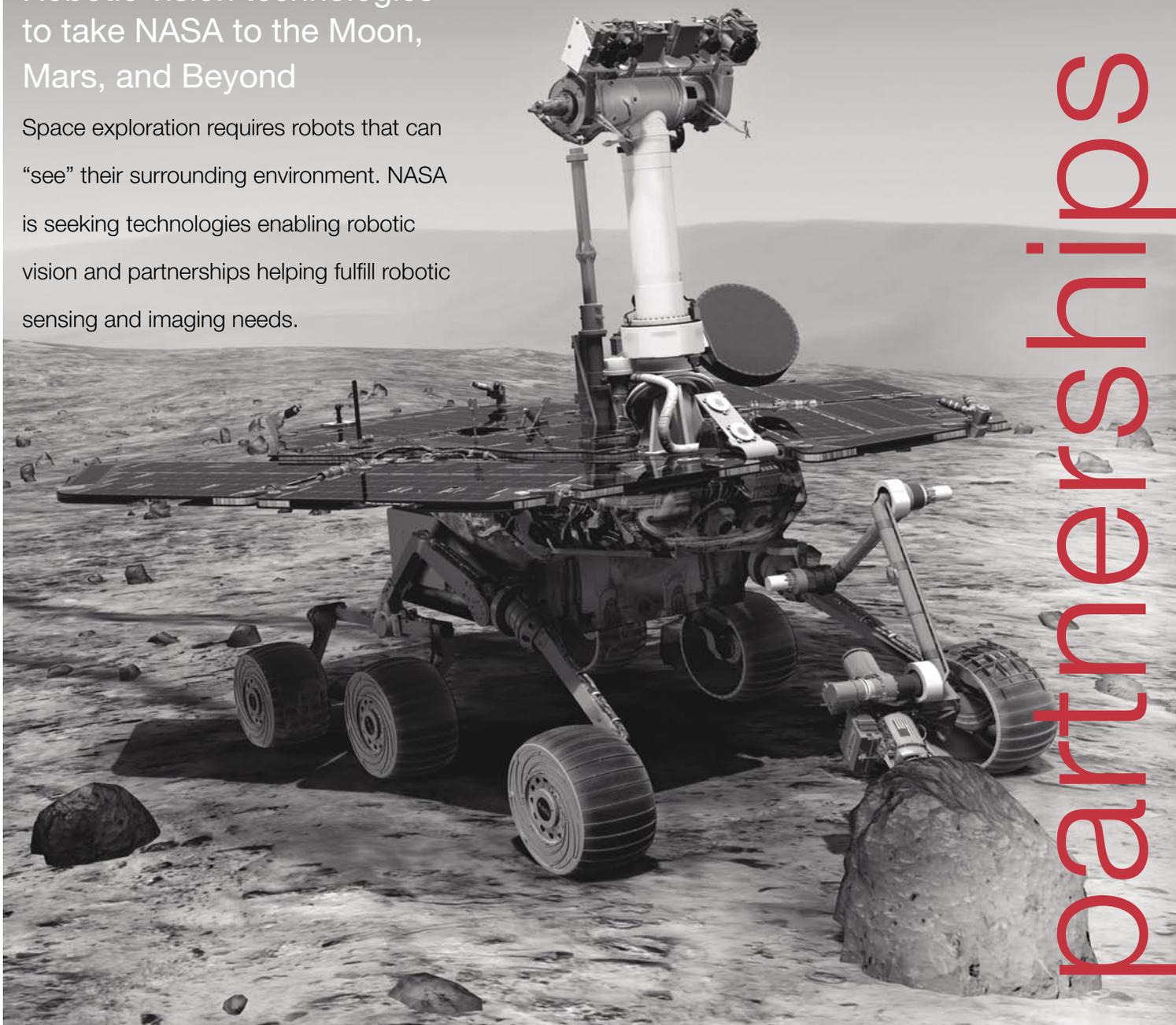




Wanted:

Robotic vision technologies
to take NASA to the Moon,
Mars, and Beyond

Space exploration requires robots that can
“see” their surrounding environment. NASA
is seeking technologies enabling robotic
vision and partnerships helping fulfill robotic
sensing and imaging needs.



partnerships



Robotics and space exploration

Robots are an essential part of achieving the new *Vision for Space Exploration*. In order to function, respond, and adapt to changes in the environments on the Moon, Mars, and Beyond, robots will use a combination of optical and non-optical vision as well as decision-making capabilities. Intricate, integrated sensing and imaging technologies will enable rudimentary responses, such as movement and manipulation of robotic arms, as well as complex, multiple-step actions.

examples

Robotics will be used to prepare for and implement **assembly and deployment** tasks:

- **Staging:** Capturing, docking, berthing
- **Storing:** Environmental protection, just-in-time component availability
- **Preparing:** Unpack, inventory, prepare worksite and worksystem
- **Constructing:** Erect, inflate, fabricate
- **Transporting:** Local delivery
- **Positioning/Aligning:** Prepare for joining
- **Joining:** Connections, welding, bonding
- **Verifying:** Inspect, test, as-built documentation
- **Planning, logistics, training:** Time estimating, resource management, decision criteria

Robotics will be used to perform **servicing and maintenance** tasks:

- **Inspection:** Passive, active
- **Diagnostics:** Characterize and project system performance
- **Planned maintenance:** Modular, human-robotic
- **Unplanned maintenance:** Diagnosis and planning, improvisation skills
- **Install upgrade:** Modularity
- **Planning, logistics, training:** Time estimating, resource management, decision criteria

how robotics will be used

assembling
characterizing
constructing
exploring
inspecting
observing
preserving safety
sampling
servicing
verifying

robotic capabilities

adaptation
automation
interaction (with each other and humans)
locomotion
manipulation
navigation
positioning
reconfiguration

electronic component needs

radiation hard
tolerant of extreme temperatures
flexible (for robotic "skin")

IT needs

algorithms for path planning
multi-sensor data fusion
planning
scheduling

industry sources for technologies and partners

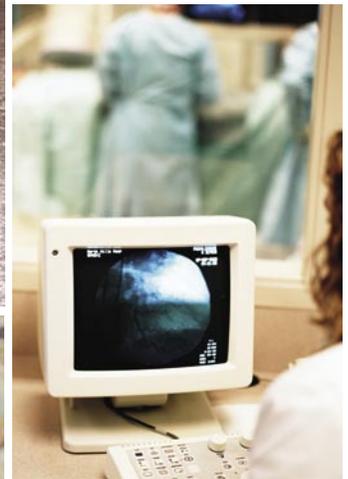
automotive
biomedical
consumer goods
electronics
health care
homeland security/defense
military
nuclear power
oil and gas industry

satellite communications
smart fabric, interactive textiles

underwater discovery/exploration

sensing needs for robotics

acoustic conduction
chemical
elemental
field
haptic
orientation
particles
pressure
proximity
sniffers
tactile
visual



Innovative partnerships

NASA's *Vision for Space Exploration* encompasses a broad range of human and robotic missions to the Moon, Mars, and Beyond. In fulfilling this vision, NASA intends to partner with outside organizations to address the many technical challenges.

Innovation challenges

- Advanced materials and structures
- Energy conversion, storage and management
- Autonomy and robotics
- Systems health management

Leveraging other developments

NASA is interested in advancements in industry, universities, and other government agencies. Their significant investment of resources can be leveraged by NASA to advance space exploration.

NASA has innovative technologies, state-of-the-art facilities, and cutting-edge experts. In partnering with NASA, you will have access to these inventions and capabilities to advance your own research and development.



New to NASA?

NASA is looking for partners in a wide range of industries, including medicine, advanced materials, transportation, telecommunications, manufacturing, consumer products, and other industry sectors. Whether you have partnered with NASA in the past or you're new to working with NASA, contact us to find out how you can contribute to NASA's robotic vision needs.

contact us today:

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www.nasa.gov