Mars Robotic Outpost Papers

"We can all go to Mars- the Mars Outpost Proposal" Louis Friedman and Bruce Murray, the Planetary Society, 2001
http://www.planetary.org/html/news/articlearchive/headlines/2001/marsoutposts.html

"Robotic Outposts as Precursors to a Manned Mars Habitat" Huntsberger, Pirjanian, Schenker, JPL
http://robotics.jpl.nasa.gov/people/terry/papers/STAIF2001.pdf

"Relative Roles of Robots and Humans in the Exploration of Mars" M. Golombek, JPL, 2001
http://www.lpi.usra.edu/publications/reports/CB-1089/golombek.pdf
** science tasks for humans
- -Explore
- -Emplace infrastructure
- -Demonstrate and develop ISRU
- -Locate resources
- -Develop materials for habitat locally

"Astrobiology and Human Exploration of Mars" Chris McKay, Ames,
http://www.lpi.usra.edu/publications/reports/CB-1089/mckay.pdf

Robotic outposts to:
- -establish and demonstrate agricultural systems
- -experiment with natural ecosystems

"Robotics Challenges for Robotic and Human Mars Exploration" Huntsberger, Rodriguez, and Schenker, JPL, CalTech
http://robotics.jpl.nasa.gov/people/terry/papers/space2000.pdf
- -deployment and servicing of power systems and ISRU generators
- -establishing long-life robotic science stations for measurement and communications
- -construction of beaconed roadways
- -site preparation and deployment of human habitation modules
- -multiple cooperating robots
  - currently addressed at JPL:
  - -behavior based control systems for cooperating robots
  - -autonomous systems for repair of robots
  - -robotic platforms for construction (material transport and site clearing)

robotic requirements:
- -load transportation and handling
- -terrain conditioning and site preparation
- -Infrastructure servicing and repair
- -object manipulation and handling
- -ISRU plant deployment
- -internal habitat servicing

"Automation and Robotics for Human Mars Exploration" Keyser-Threde, SA, Exec Summary
http://www.esa.int/gsp/completed/ExecSum00_S56.pdf

"Advanced Communication and Networking Technologies for Mars Exploration" Bhasin, Hayden, Agre, Clare, Yan, JPL and Glenn
http://scp.grc.nasa.gov/resources/Pdfs/MarsExploration.pdf

-assumptions for communication and networking infrastructure
-microsatellite constellation
-Mars comm sat in aerosynchronous orbit

NASA Cross Enterprise Technology Development
http://sbir.nasa.gov/SBIR/sbir2000/phase1/solicitation/topic27.html

**funding for Surface Systems
-Intelligent system software for site selection, preparation, habitat-deployment
-robotic excavation and tunneling systems
-systems that can repair/replace/reconfigure themselves
-surface sampling from aerial vehicles
-in situ propellants and vehicles that use them
-subsurface and submersible vehicle concepts
-high speed, rough terrain, sensing and processing for autonomous navigation and data acquisition
-high accuracy GPS
-dexterous pointing, placement, manipulation, and excavation devices and processes
-inflatable rover technology
-dynamic simulation of multiple interacting autonomous robotic systems
-technologies for deep drilling and analysis

"Carl Sagan Memorial Lecture: The Role of Robotic Outposts in Establishing a Permanent Presence in Space" Edward Stone, JPL, 2000
http://www.astronautical.org/pubs/vol39no3CSML.html

-miniature surface laboratories
-systematic analysis of elemental abundances using laser drill
-Raman spectroscopy to detect organic material
-evaluate H_2O, CO_2, and C and O isotopes in pole layers
-solar power for material processing, fuel generation, and drilling
-expanding communication nodes
-6 microsats -> 10 gigabits/day, GPS
-Aero-stationary sate over robotic outpost -> 100 gigabits/day
-precision landing (1 km of target)
-miniature biochemistry laboratories
-mobility systems
-ISRU, power
-sample acquisition rovers
-subsurface sampling

"Human/Robotic Exploration of the Solar System" Chun, LM Space Systems, 2000
http://centauri.larc.nasa.gov/robot/hress01/RFI_responses/chun.pdf

-robot team: 3-4 bots, each search, dig, push, carry, lift, etc
-each bot has primary function, projected life 100 years
-spare bot on each team
-robot shelter
-survey, map
-excavate and transport regolith