

Robots on the Moon, and their Role in a Future Lunar Economy

Adrian Stoica, Ph.D.
Senior Research Scientist
Manager, Robotic Systems Estimation, Decision and Control NASA Jet Propulsion
Laboratory
MS 198-219, 4800 Oak Grove Drive, Pasadena, CA 91109
adrian.stoica@jpl.nasa.gov
http://www-robotics.jpl.nasa.gov/people/Adrian_Stoica/

Abstract: With the notable exception of NASA, which has already left a significant footprint - and recently has been driven by going to Mars and beyond - all prominent space agencies are focusing their near term efforts on the Moon. The Moon is more affordable, a lunar base provides a stepping stone from which to move to farther destinations, and it allows for validation of technologies and mechanisms of international collaboration. Furthermore, advances in robotics would permit teams of robots to collaborate on the lunar surface. Concepts such as that of the *Moon Village*, promoted by the European Space Agency (ESA), offer a vision of collaboration via assets owned (and operated) independently, by different nations, yet engaged in mutual support and assistance, in a robotic ecosystem. Yet, perhaps the most profound factor affecting the future exploration and use of the Moon comes from the imminent involvement of private companies. The Moon is gradually becoming interesting from a commercial point of view; and this is indeed a logical next phase of an emerging space economy, which, with Earth-orbiting satellites, has already proven that it can bring profits to investors. The talk will review current and planned lunar missions, illustrating the state-of the art in technologies and operations; then, it will take a leap into the future, presenting a vision of lunar robotic villages, robotic mining operations, and human presence, permanent colonies, and tourism and entertainment zones. It will point out what technologies need maturation, in order to make this future possible. Among those, perhaps within the next decade, and, if not, almost certainly before the end of the following one, exploration by robotic intelligence will exceed the capabilities of current human-driven exploration, and become the determining factor in conquering space. I discuss the consequences of such a disruptive technology.

Bio Note: Dr. Adrian Stoica has over 22 years of work at the NASA Jet Propulsion Laboratory (JPL), California Institute of Technology. Known primarily for building the first US Satellite, Explorer 1, for building and operating the Voyager spacecraft that has now travel beyond the boundaries of our solar system, and for building and operating the Mars rovers, JPL is the leading NASA Center for robotic space exploration. JPL has over 6000 researchers involved in imagining, planning and execution of space missions. Adrian is currently Manager of the Robotic Systems Estimation and Controls Group, acts as Program Executive for Blue Sky Studies Program, and Coordinator of the Innovation to Flight Program at JPL. He is a NIAC Fellow (NASA Innovative Advanced Concepts) having lead a study on a solar power infrastructure at the lunar south pole. His research interests include robotic intelligence and learning, collaboration between humans and teams of robots, non-conventional computing, and technologies for enhanced quality of life. He has started three conferences, the oldest, NASA/ESA Conference on Adaptive Hardware and Systems, running yearly since 1999.