

# **Human and Robot Teamwork on Mars or Moon**

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With the recent exciting events of NASA's Mars Exploration Rovers and President Bush's announcement for NASA to return to the Moon as a stepping stone for going to Mars with humans and robots, the debate about why we should send humans to do the scientific exploration on extra-terrestrial planetary surfaces is again upfront and central. Can robots explore? Are the MER rovers really geologists on Mars, or is geology still performed by the scientists on Earth? What would it mean for humans to explore Mars? How would robots and humans work together? How will the astronaut geologist collaborate with his or her colleagues on Earth? These are but some of the questions that are now going to be seriously considered at NASA.

At NASA Ames, in particular in the Work Systems Design & Evaluation group, we have been asking these questions for more than five years. We have studied today's geology scientists in the field in order to understand what they do and why they do things the way they do. We have studied them on Devon Island in the High Arctic, and in the desert in Utah. We have also done detailed studies of the work processes for the Apollo missions, the only time humans were actually on an extra-terrestrial surface. Based on these ethnographic field studies, we are developing human-centered software systems that support the astronaut geologist in living and working on Mars, collaborating with remote scientists back on Earth and working together with robots in the field.

In this talk I will give an overview of some of the issues concerning human and robot exploration and will present our work on the Mobile Agents Project during the last three year's two-week field tests in the Mars Dessert Research Station, located in the Utah desert near Hanksville, Utah.

## **Bio:**

### **Maarten Sierhuis, Ph.D.**

Maarten Sierhuis is a Senior Research Scientist at RIACS/USRA, located at NASA Ames Research Center. He is Principal Investigator for the NASA Exploration Systems Mission Directorate funded project End-to-end Mission Modeling and Simulation Environment. He is also a Co-Principal Investigator for the Brahms project, working in the Work Systems Design & Evaluation group in the Collaborative and Assistant Systems (CAS) area within the Computational Sciences Division at NASA Ames Research Center. Previously, he worked at NYNEX Science & Technology, the former R&D organization for the NYNEX Corporation (now Verizon) in White Plains, NY. He received a Ph.D. in Social Science Informatics from the University of Amsterdam, The Netherlands and holds an engineering degree in Informatics, from the Polytechnic University in The Hague, The Netherlands.

Involved with expert systems and knowledge engineering since 1985, Maarten's research involves multi-agent systems and modeling and simulation of human organizations and social technical system. Maarten was co-inventor of the Brahms multi-agent modeling and simulation environment, as well as the Compendium methodology for informal modeling of wicked-problems and conversations in facilitated meetings.

He is a Co-Investigator and project manager for the Mobile Agents project, leading six independent research teams with a total of 49 people in a yearly two-week field test of human-robot teams at the Mars Desert Research Station in the Utah desert.

He has presented invited lectures on both Brahms and Compendium, has published widely in these areas, and holds patents for both Brahms and Compendium.

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