

Agents for Distributed Team Operations

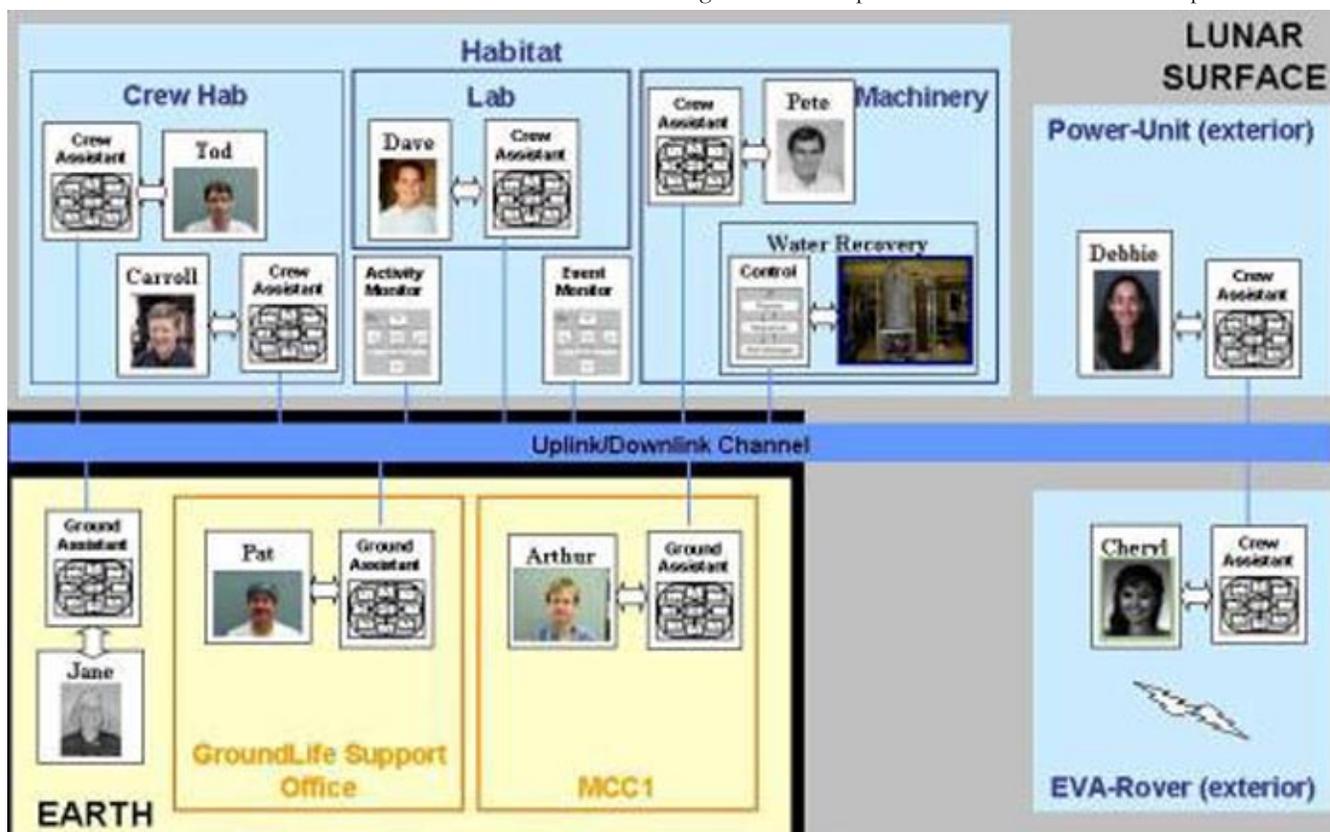
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The ADTO project is a three-year effort begun in 2003 to research autonomous distributed operations for advanced human space missions and to develop a concept of operations for such advanced missions. The specific goal is a mature intelligent software agent and distributed team technology designed for: (1) more effective information management to decrease distraction, interruptions, and workload (2) effective

use, supervision, and direction of autonomous control agents and (3) the reduction of mission impact of off-nominal situations by better coordination, better situational awareness, and prompt and appropriate information dissemination.

The purpose of this research is to develop requirements for the support of future space mission operations, both on the ground and in space. Since astronaut crews will operate for



extended periods of time at great distances from Earth, they must be provided with the means of accomplishing operations and maintenance tasks autonomously with minimal intervention from ground personnel. This project intends to demonstrate an innovative system of understandable and responsive intelligent software agents in a mission information management framework for distributed team operations. This technology is reconfigurable and evolvable, and provides the types of information that are needed for supportability in future space exploration missions. This technology enables greater crew autonomy and more effective use of ground personnel.

The technical approach chosen for this project is to develop three increasingly sophisticated prototypes of a research platform that will permit study, development, and robust demonstration of an operations concept and architecture to support cooperating teams of human and software agents. Three different types of software agents will be demonstrated working together as a team: automated environmental control agents, automated systems monitoring agents, and crew operations assistants. Knowledge, plans and actions of these agents will be used with information about system performance and events to make the agents more understandable, predictable and responsive to human team members.

In 2003, an integrated demonstration of such a research platform was developed and presented to the mission operations community at JSC. In 2004, new technologies from Ames Research Center were evaluated for possible inclusion in the mission operations concept demonstrations. A new operations possibility that is appropriate for long-duration exploration missions was developed to replace the 2003 International Space Station scenario. The new operations scenario is one in which the crew resides at a lunar base for weeks or months and could operate for a few days without ground support. In 2005, the results of the new technology evaluations and development will be integrated into the new operations scenario, creating intelligent software agents that work with humans instead of for humans. This distinction implies that agents are more effective at operating autonomously (and are more reliable in accomplishing assigned work) in environments where other agents and humans are assumed to perform duties as well. Also, in 2004/2005, spin-offs of prototypes into Station mission operations and NASA Extreme Environment Mission Operations (NEEMO) missions were made for evaluation, adoption, and maturation.