Field Robotics at NASA Ames

The Computational Sciences Division at NASA Ames Research Center has a long history and extensive experience in field robotics and human/robot field testing. Ames has been running robotic field experiments in planetary analogue sites since 1993, and has the staff and expertise to design and build robotic test platforms and embedded control systems.

Background

NASA Ames Research Center has long been a pioneer in robotic and human/robot field testing. Starting in 1993 with the deployment of TROV, a teleoperated underwater vehicle, into McMurdo Sound in Antarctica, through numerous remote science operations using the Russian-built Marsokhod rover, to current tests using the Mars exploration rover prototype K9, Ames has tested human interface and autonomy technologies in many challenging environments.

In 1999, in collaboration with Johnson Space Center, Ames ran ASRO, the first astronaut/rover field experiment, in which the Marsokhod rover acted as a scout, photographer, and field assistant to a suited astronaut. Field tests in 2003 and 2004 tested the Mobile Agents Architecture (MAA) for human-machine work systems.

Tom Trower, NASA Ames Research Center

Capabilities Overview

In support of field testing of autonomy and human/robot interaction technologies, NASA Ames has built and is continuing to build a highly capable staff, a fleet of robotic testbeds appropriate for robotic autonomy and human-robot interaction validation, and a field deployment infrastructure.

The Intelligent Robotics Group (IRG) robotics staff is experienced in mechanical design and fabrication, electronics, instrumentation, embedded control, computer vision, robotic navigation, state estimation, diagnosis, networking, educational robotics outreach and user interface design.

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Test platforms include the K9 rover, built upon a FIDO-style JPL base, a legged Scorpion walking and climbing robot for extreme terrain and fifteen Personal Exploration Rover programmable robots. Ames is currently developing two new high-speed human-robot interaction rovers, designed to serve as platforms for field trialing of human-robot team interaction systems, that will be ready in January 2005.

IRG maintains 3/4 acre outdoor rover yard and is completing construction of a year-round indoor rover yard suitable for developing and demonstrating robot-human joint missions such as assembly, inspection and maintenance.

Visualization tools suitable for field trialing includes the Viz software system, a 3D virtual reality tool that enables the user to virtually explore a photorealistic terrain and develop command sequences to control a robot. Viz and its associated software have been used at Mars Ops in JPL for the MER mission.

TAZ is a 2.4 Meter fully deployable satellite dish that is currently capable of 1.5 Mbps downlink and 364 Kbps uplink. An upgrade currently underway will give the capability of 10 Mbps downlink and 5 Mbps uplink. TAZ provides data transfer, access to e-mail and the web, Voice Over IP, video transfer, video teleconferencing, and with future capabilities, HDTV. An Ames ground station provides a seamless and fully secured link from the field-deployed TAZ to any network at Ames.

Relevance to Exploration Systems

The field deployment capabilities at NASA Ames provide testing and validation of Exploration System technologies.

H&RT Program Elements:

This research capability supports the following H&RT program /elements:

ASTP/Software, Intelligent Systems & Modeling

TMP/Lunar and Planetary Surface Operations

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