Smarter machines for space missions

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NASA has tapped Penn State's Applied Research Laboratory (ARL) to lead a $9.6 million effort to give machines enough computer-based "intelligence" to deal safely with component failure or malfunction, with minimal human help, during unmanned deep space exploration missions.

The co-principal investigators are Dr. Karl Reichard, ARL research associate and head of ARL's Complex Systems Monitoring and Automation Department, and Dr. Lora Weiss, ARL senior research associate and head of ARL's Autonomous Control and Intelligent Systems Division. They lead a team that includes NASA's Stennis Space Center and Ames Research Center as well as three industry partners, Vector Technologies, Burke, Va., Gormley & Associates, Irvine, Calif., and Applied Perception Inc., Pittsburgh, Pa.

The partners will operate under a recently-awarded, four-year contract from NASA's Exploration Mission Systems Directorate that calls for $6.1 million of the $9.6 million to flow directly to Penn State to support efforts by University researchers and their industry partners. The remaining funding will support the NASA centers' participation.

"On long, unmanned, deep space missions, there is a need for equipment to continue operating when something breaks or is about to fail," Reichard says.

"There is a need for both human-in-the-loop systems, in which the machine waits for instructions from humans, and autonomous systems, in which the machine assesses its own condition and collaborates with

humans or other machines in making decisions about what to do," he adds.

For example, Reichard points out that during the current Mars Exploration Rover mission, one of the rovers has developed a fault on one of its wheels. However, the mission is continued because human operators commanded the rover to change the way the wheel was driven by the motors and avoid additional damage -- a human-in the-loop system.

In the future, using techniques developed through the new ARL-led effort, system designers may be able to anticipate this situation and provide the vehicle with the "intelligence" to solve the problem itself.

Reichard says, "Our goal is to develop new approaches to integrating control and condition monitoring systems for Intelligent Vehicle Health Management that will be useful in a wide range of situations and will be transferable to the commercial sector, defense applications and robotics in addition to their application in deep space."

Penn State's Center for Space Research Programs (CSRP) was actively involved in identifying the NASA opportunity for researchers at Penn State and sending information to potential Penn State principal investigators, preparing proposals and identifying teaming opportunities.

Source: Penn State