National Aeronautics and Space Administration

NASA and Sensics, Inc. See Clearly with New Technology Developed for Future Space Missions

Robots have long been a part of America's space exploration program – from robots digging on the Red Planet and soaring in the atmosphere of Jupiter to a quick stint on an asteroid. For the last few years, scientists and engineers at Johnson Space Center have been taking several giant leaps in robotic development in order to meet the dexterous manipulation needs foreseen in future exploration missions.

It is known as "Robonaut," and it is the ultimate union of man and metal.

This state-of-the-art robotic system is the size of an astronaut in a space suit and configured with two arms, two five-fingered hands, a head and a torso. Its dexterous pair of arms enables dual-arm operations, and its hands can interface directly with a wide range of interfaces without special tooling. Robonaut is controlled by a human operator either on earth or on orbit.

Basically its role is to help humans work and explore in space – especially in tight places and in high-risk situations. Future human exploration and development of space will require intense extravehicular activity (EVA, or space walks) workload from a small number of crew members, which can be alleviated by use of robotics.

Early in the development stages, however, engineers discovered challenges within the visual interface of Robonaut and its limited field of view with traditional head-mounted displays. NASA called on private industry for a solution, and Baltimore-based Sensics, Inc. developed a technology – a high resolution, ultra wide field-of-view telepresence display, called piSight – through the agency's Small Business Innovation Research (SBIR) Program. PiSight uses a patented optical design to seamlessly combine images from several microdisplays into a stunning, panoramic three-dimensional visual experience.

"For so long, we've only been able to work with a 40 degree field-of-view on this project," said Dr. Darby Magruder, a robotics engineer with the Johnson Space Center's Robotic Systems Technology Branch. "That's basically tunnel vision and is very inhibiting to the operator."

Larry Brown, president of Sensics, noted Sensics' technology and its advantage over other head-mounted displays. "The piSight offers a field-of-view of 150 degrees. The operator basically sees a field-of-view that has virtually no limitations."

Protective gear worn by astronauts also causes limited movement. "With piSight, the robot can do tasks precisely controlled by the interface, which results in a dramatic increase in the level of situational awareness," Brown said.

The exciting result for NASA is that this enhanced visual interface now matches the superior technology of the Robonaut and may be able to support human astronauts with various tasks like repairs and maintenance to the Space Station or the Crew Exploration Vehicle, and especially with activities posing increased risk.

NASA's sophisticated Robonaut (left photo) met its match with piSight, a head-mounted display that drastically enhances the field-of-view for the operator.

After four years in development and testing, Sensics delivered the piSight prototype to NASA in early 2007 and continues to refine the product, which includes improving the ease of use with the product, reducing cost and enhancing electronic components of the technology. Sensics also has developed a camera as a companion component for piSight that captures panoramic, high-resolution live video which can be viewed in 3D while wearing the piSight head-mounted display.

In addition to working with NASA, Sensics is finding success in the commercial sector as well, with sales of its products topping $1 million in 2007.

tech transfer

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