

onto either connector assembly. Sets of circles or equivalent reference markings are affixed to the face of the tool, located at the desired positions of the mating contact pairs. An inspector would simply fit the tool onto a connector assembly, engaging the clocking tabs until the tool fits tightly. The inspector would then align one set of cir-

cles positioning a line of sight perpendicular to one contact within the connector assembly. Misalignments would be evidenced by the tip of a pin contact straying past the inner edge of the circle. Socket contact misalignments would be evidenced by a crescent-shaped portion of the white dielectric appearing within the circle. The tool

could include a variable magnifier plus an illuminator that could be configured so as not to cast shadows.

*This work was done by Christopher R. Smith of United Space Alliance for Johnson Space Center. For further information, contact the Johnson Commercial Technology Office at (281) 483-3809. MSC-23757*

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## ⚙️ An ATP System for Deep-Space Optical Communication

*NASA's Jet Propulsion Laboratory, Pasadena, California*

An acquisition, tracking, and pointing (ATP) system is proposed for aiming an optical-communications downlink laser beam from deep space. In providing for a direction reference, the concept exploits the mature technology of star trackers to eliminate the need for a costly and potentially hazardous laser beacon. The system would include one optical and two inertial sensors, each contributing primarily to a different portion of the frequency spectrum of the pointing signal: a star

tracker (<10 Hz), a gyroscope (<50 Hz), and a precise fluid-rotor inertial angular-displacement sensor (sometimes called, simply, "angle sensor") for the frequency range >50 Hz. The outputs of these sensors would be combined in an iterative averaging process to obtain high-bandwidth, high-accuracy pointing knowledge. The accuracy of pointing knowledge obtainable by use of the system was estimated on the basis of an 8-cm-diameter telescope and known parameters of com-

mercially available star trackers and inertial sensors: The single-axis pointing-knowledge error was found to be characterized by a standard deviation of 150 nanoradians — below the maximum value (between 200 and 300 nanoradians) likely to be tolerable in deep-space optical communications.

*This work was done by Shinhak Lee, Gerardo Ortiz, and James Alexander of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact [iaoffice@jpl.nasa.gov](mailto:iaoffice@jpl.nasa.gov). NPO-41736*

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## ⚙️ Polar Traverse Rover Instrument

*NASA's Jet Propulsion Laboratory, Pasadena, California*

A Polar Traverse Rover (PTR) is a device designed to determine the role of Antarctica in the global climate system by determining typical paths of continental air that passes the South Pole, and by obtaining insight into the relationship between events at the Antarctic and the meteorology of sub-polar altitudes. The PTR is a 2-m-diameter ball in which an Iridium modem, with an integrated global positioning system (GPS) receiver and a commercial lithium battery pack, is suspended. The modem is

attached to an aluminum plate and is surrounded by shock-absorbing plastic for protection. This core is attached to the interior walls of the shell by strings on three axis points. The unit's total weight is 10 kg, and it returns data regarding location, altitude, ground velocity, and vertical velocity.

The PTR traverses the terrain solely through being blown around by the wind. The unit is much lighter than its predecessor, the Tumbleweed, and requires less wind to put it in motion and to sustain mo-

tion. The system is autonomous, requiring minimal monitoring, and enables long-range, unmanned scientific surface surveys in harsh environments.

*This work was done by Alberto Behar of Caltech; Henrik Karlsson and Andreea Radulescu of International Space University; Jonas Jonsson of Angstrom Space Laboratory; and Mika Pegors, Spacegrant Student for NASA's Jet Propulsion Laboratory. For more information, contact [iaoffice@jpl.nasa.gov](mailto:iaoffice@jpl.nasa.gov). NPO-45463*