

Such a tiny penetrator can be integrated with instruments for life and water detection as well as materials characterization for planetary applications. It is also a useful tool for gaining subsurface access, an exploration goal that is an essential element of future missions. Terrestrially speaking, this tool has applications with regard to testing soil for toxic chemicals, the presence of mois-

ture, and various other analytical tests.

This work was done by Stewart Sherrit, Mircea Badescu, and Yoseph Bar-Cohen of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Inline Electrical Connector Mate/Demate Pliers

These pliers are designed for use in tight spaces and recessed electrical panels.

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Military and aerospace industries use Mil-Spec type electrical connections on bulkhead panels that require inline access for mate and demate operations. These connectors are usually in tight proximity to other connectors, or recessed within panels. The pliers described here have been designed to work in such tight spaces, and consist of a mirrored set of parallel handles, two cross links, two return springs, and replaceable polyurethane-coated end effectors. The polyurethane eliminates metal-to-metal contact and provides a high-friction surface between the jaw and the connector.

Operationally, the user would slide the pliers over the connector shell until the molded polyurethane lip makes contact with the connector shell edge. Then, by squeezing the handles, the end effector jaws grip the connector shell, allowing the connector to be easily disconnected by rotating the pliers. Mating the connector occurs by reversing the prescribed procedure, except the connector shell is placed into the jaws by hand. The molded lip within the jaw allows the user to apply additional force for difficult-to-mate connectors.

Handle design has been carefully examined to maximize comfort, limit weight, incorporate tether locations, and improve ergonomics. They have been designed with an off-axis offset for wiring harness clearance, while placing the connector axis of rotation close to the user's axis of wrist rotation. This was done to eliminate fatigue during multiple connector panel servicing. To limit handle opening width, with user ergonomics in mind, the pliers were designed using a parallel jaw mechanism. A cross-link mechanism was used to com-



The Mate/Demate Pliers, shown in their open and closed configurations, feature cross-link springs to ensure they remain in the open position until adequate force is applied to close them.

plete this task, while ensuring smooth operation.

Forward slides allow the links to change position during opening and closing. Springs were added to the cross links to ensure that the pliers remain in the open position until adequate force is applied to close them. The jaw end effectors can be easily removed and replaced to accommodate a range of connector sizes. Because the pliers were designed with the intent of reducing the

risk of foreign object debris (FOD), the end effectors contain two capturing features. They are held in place by means of two captive screw retainers while a secondary detent feature holds the jaws in case the screw retainers fail or become loose.

This work was done by Brian Yutko, Michael Dininny, Gerard Moscoso, and Adam Dokos of Kennedy Space Center. Further information is contained in a TSP (see page 1). KSC-13322