

mally, helium is vented once the lander is on the surface, but it can be utilized for powering pneumatic systems. Should sufficient helium not be available, a simple gas delivery system may be taken specifically for the heat flow probe. Either way,

the pneumatic heat flow probe system would be much lighter than other systems that entirely rely on the electrical power of the lander.

This work was done by Kris Zacny, Magnus Hedlund, Eric Mumm, Jeffrey Shasho, Philip

Chu, and Nishant Kumar of Honeybee Robotics Ltd. for Marshall Space Flight Center. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-32935-1.

Method to Measure Total Noise Temperature of a Wireless Receiver During Operation

NASA's Jet Propulsion Laboratory, Pasadena, California

A method has been developed to measure the total effective noise power in a GPS receiver, including contributions from the system temperature, the antenna temperature, interference, lossy components, etc. A known level of noise is periodically injected before the preamplifier during normal tracking, with a switch set to a very low duty cycle, so that there is insignificant signal loss for the GPS signals being tracked. Alternately, a signal of known power may be injected.

The coupling port is fed with a switch that can be controlled from the receiver's digital processing section. The switch can connect the coupling port to

a noise or signal source at a known power level. The combined system noise is measured, and nearly continuous noise calibrations are made. The effect from injected noise/signals on the performance of the GPS receiver can be less than 0.01 dB of SNR loss. Minimal additional components are required. The GPS receiver is used to measure the SNRs required to solve for the noise level. Because this measurement is referenced to the preamplifier input, it is insensitive to variations in the receiver gain.

This work was done by Lawrence E. Young, Stephan Esterhuizen, and Dmitry Turbiner 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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Refer to NPO-47818, volume and number of this NASA Tech Briefs issue, and the page number.

Cursor Control Device Test Battery

A suite of software-based tasks can be used for the study of cursor control devices, gloved operations, and fine motor control.

Lyndon B. Johnson Space Center, Houston, Texas

The test battery was developed to provide a standard procedure for cursor control device evaluation. The software was built in Visual Basic and consists of nine tasks and a main menu that integrates the set-up of the tasks. The tasks can be used individually, or in a series defined in the main menu.

Task 1, the Unidirectional Pointing Task, tests the speed and accuracy of clicking on targets. Two rectangles with an adjustable width and adjustable center-to-center distance are presented. The task is to click back and forth between the two rectangles. Clicks outside of the rectangles are recorded as errors.

Task 2, Multidirectional Pointing Task, measures speed and accuracy of clicking on targets approached from different angles. Twenty-five numbered squares of adjustable width are arranged around an adjustable diameter circle. The task is to point and click on the

numbered squares (placed on opposite sides of the circle) in consecutive order. Clicks outside of the squares are recorded as errors.

Task 3, Unidirectional (horizontal) Dragging Task, is similar to dragging a file into a folder on a computer desktop. Task 3 requires dragging a square of adjustable width from one rectangle and dropping it into another. The width of each rectangle is adjustable, as well as the distance between the two rectangles. Dropping the square outside of the rectangles is recorded as an error.

Task 4, Unidirectional Path Following, is similar to Task 3. The task is to drag a square through a tunnel consisting of two lines. The size of the square and the width of the tunnel are adjustable. If the square touches any of the lines, it is counted as an error and the task is restarted.

Task 5, Text Selection, involves clicking on a Start button, and then moving

directly to the underlined portion of the displayed text and highlighting it. The pointing distance to the text is adjustable, as well as the to-be-selected font size and the underlined character length. If the selection does not include all of the underlined characters, or includes non-underlined characters, it is recorded as an error.

Task 6, Multi-size and Multi-distance Pointing, presents the participant with 24 consecutively numbered buttons of different sizes (63 to 163 pixels), and at different distances (60 to 80 pixels) from the Start button. The task is to click on the Start button, and then move directly to, and click on, each numbered target button in consecutive order. Clicks outside of the target area are errors.

Task 7, Standard Interface Elements Task, involves interacting with standard interface elements as instructed in written procedures, including: drop-down

menus, sliders, text boxes, radio buttons, and check boxes. Task completion time is recorded.

In Task 8, a circular track is presented with a disc in it at the top. Track width and disc size are adjustable. The task is to move the disc with circular motion

within the path without touching the boundaries of the track. Time and errors are recorded.

Task 9 is a discrete task that allows evaluation of discrete cursor control devices that tab from target to target, such as a castle switch. The task is to follow a

predefined path and to click on the yellow targets along the path.

This work was done by Kritina Holden, Aniko Sandor, John Pace, and Shelby Thompson of Lockheed Martin for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-25214-1

Functional Near-Infrared Spectroscopy Signals Measure Neuronal Activity in the Cortex

This non-invasive monitoring method can be used to evaluate the mental state of people performing critical tasks.

John H. Glenn Research Center, Cleveland, Ohio

Functional near infrared spectroscopy (fNIRS) is an emerging optical neuroimaging technology that indirectly measures neuronal activity in the cortex via neurovascular coupling. It quantifies hemoglobin concentration ([Hb]) and thus measures the same hemodynamic response as functional magnetic resonance imaging (fMRI), but is portable, non-confining, relatively inexpensive, and is appropriate for long-duration monitoring and use at the bedside. Like fMRI, it is noninvasive and safe for repeated measurements. Patterns of [Hb] changes are used to classify cognitive state. Thus, fNIRS technology offers much potential for application in operational contexts. For instance, the use of fNIRS to detect the mental state of commercial aircraft operators in near real time could allow intelligent flight decks of the future to optimally support human performance in the interest of safety by responding to hazardous mental states of the operator. However, many

opportunities remain for improving robustness and reliability. It is desirable to reduce the impact of motion and poor optical coupling of probes to the skin. Such artifacts degrade signal quality and thus cognitive state classification accuracy. Field application calls for further development of algorithms and filters for the automation of bad channel detection and dynamic artifact removal.

This work introduces a novel adaptive filter method for automated real-time fNIRS signal quality detection and improvement. The output signal (after filtering) will have had contributions from motion and poor coupling reduced or removed, thus leaving a signal more indicative of changes due to hemodynamic brain activations of interest. Cognitive state classifications based on these signals reflect brain activity more reliably. The filter has been tested successfully with both synthetic and real human subject data, and requires no auxiliary measurement.

This method could be implemented as a real-time filtering option or bad channel rejection feature of software used with frequency domain fNIRS instruments for signal acquisition and processing. Use of this method could improve the reliability of any operational or real-world application of fNIRS in which motion is an inherent part of the functional task of interest. Other optical diagnostic techniques (e.g., for NIR medical diagnosis) also may benefit from the reduction of probe motion artifact during any use in which motion avoidance would be impractical or limit usability.

This work was done by Angela Harnivel and Tristan Hearn of Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steven Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18952-1.

ESD Test Apparatus for Soldering Irons

Prior lengthy testing now takes less than a minute.

Goddard Space Flight Center, Greenbelt, Maryland

ESDA (Electrostatic Discharge Association) ESD STM 13.1-2000 requires frequent testing of the voltage leakage from the tip of a soldering iron and the resistance from the tip of the soldering iron to the common point ground. Without this test apparatus, the process is time-consuming and requires several wires, alligator clips, or test probes, as well as additional equipment. Soldering iron tips must be tested for electrostatic

discharge risks frequently, and this typically takes a lot of time in setup and testing. This device enables the operator to execute the full test in one minute or less.

This innovation is a simple apparatus that plugs into a digital multimeter (DMM) and the Common Point Ground (CPG) reference. It enables the user to perform two of the electrostatic discharge tests required in ESD STM 13.1-2000.

The device consists of a small black box with two prongs sticking out of one end, two inputs on the opposite end (one of the inputs is used to connect the reference CPG to the DMM), and a metal tab on one side. Inside the box are wires, several washers of various materials, and assembly hardware (nuts and screws/bolts). The device is a passive electronic component that is plugged into a DMM. The operator sets