



FUEL CELL TODAY

Opening doors to fuel cell commercialisation

Fuel cells for extra-terrestrial exploration

Bill Walker, Analytic Systems – 28 January 2004

The Science, Crew, Operations, & Utility Testbed or SCOUT program is building technology and power-rich crewed utility vehicle testbeds that allow NASA engineers to gain hands-on experience in systems and operations while developing and demonstrating missions concepts.

Jason Dugas, the project engineer, says “the program allows NASA to test integrated cutting-edge technology without the high risk and cost of space operations, while developing operational concepts applicable to lunar and Mars exploration”. A series of rovers were developed that give NASA the capability to assess and compare technology by swapping in and out various modular boxes containing the technology. The technology includes both mission hardware such as motors, a fuel-cell/battery power plant, and wide-band communications capabilities as well as science operations hardware including payloads like drills that might be used to take core samples from the Martian or lunar terrain.

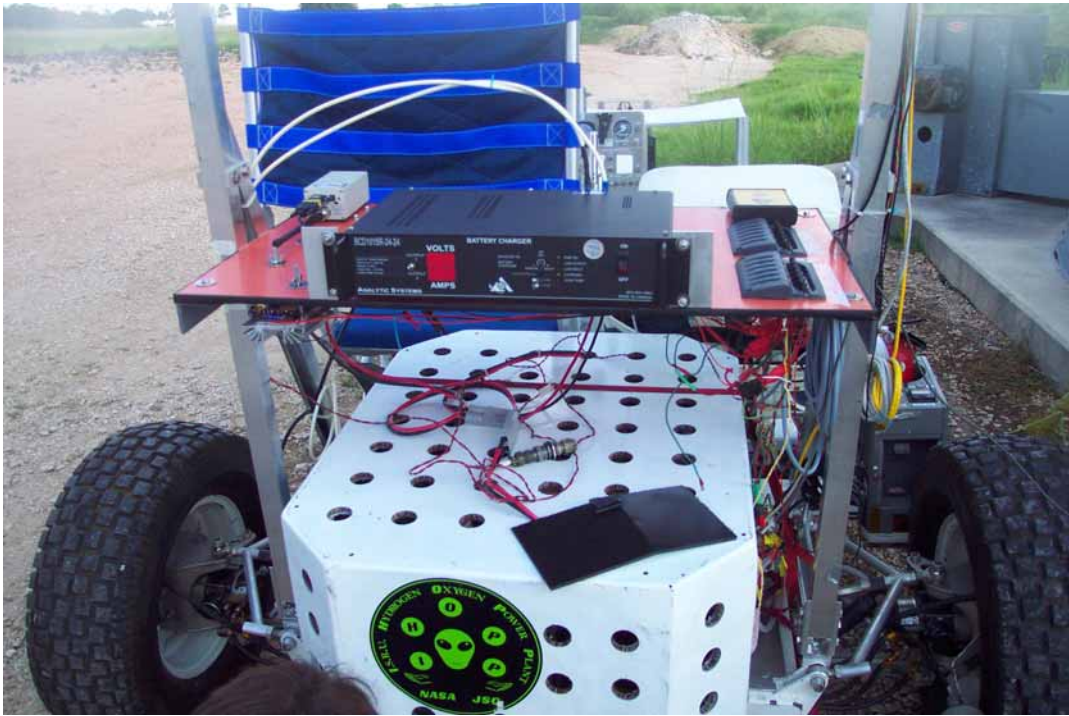


The rovers can accommodate two suited or shirt-sleeved crew members. The precursor test vehicle was a revamp of an old Apollo program lunar-rover trainer (LRT) on-loan from the U.S. Geological survey in Flagstaff, Arizona. That trainer completed successful field testing at Meteor Crater, Arizona in September of 2003, which was the first field test of a manned rover since the Apollo program. Two more vehicles, SCOUT I and SCOUT II are to be built, each with increased capability. SCOUT I will be an engineering unit that will demonstrate the first iteration of motion systems and crew/payload operations with a round trip capability of 6 miles. SCOUT II will raise the bar to 60 miles at 6 miles per hour.

The lunar trainer, which was originally powered by four 6V batteries, had its power system overhauled to two series-12V batteries along with a fuel-cell power plant and *Analytic Systems* (www.analyticsystems.com) battery charger which provided for extended missions operations. During those times where the 'astronauts' were conducting science away from the vehicle, the battery charger was used to take voltages between 18 – 36V from the fuel cell and regulate power to a constant-current charge rate for the 24V battery system.

The product that Jim Hargrove, President of Analytic Systems, supplied for this program is a BCD1015-24-24 fully isolated 1000 watt DC source battery charger (shown below). The full isolation feature allows the input voltage to bracket the desired output voltage. A number of modifications were made to the charger to tailor its operation with a fuel cell. A 'discontinuous operating mode' feature was added to prevent the charger from pulling the output voltage of the fuel cell below its optimum power point. Normally a low-input voltage condition will cause the charger to sound an audible alarm, however as this is a common condition when powered by a fuel cell, the audible alarm was disabled (for this condition only). The alarms for charger over temperature, battery over temperature, and low output voltage were retained, as was the temperature compensated charging voltage, user selectable 2 or 3 stage charging algorithm as well as semi-automatic equalization (user initiated).

The fuel cells were Proton Exchange Membrane (PEM) type manufactured by BCS Fuel Cells of Bryan, Texas (www.bcsfuelcells.com/). The two stacks (each 800W) were OR'd through Schottky diodes (i.e. linked through OR gates, allowing either to supply power individually or both together) to allow for combined power output.



The next vehicle under design within the SCOUT program plans to shrink vehicle mass, while maintaining the power-rich characteristics of the last vehicle. This time batteries will be used only in a 'boot-strap capacity' and will only be needed during peak motor loading such as going over rocks. Nominal power will be supplied by the fuel cell power plant alone.

For more information please contact:

Bill Walker

Business Development Manager

Analytic Systems

billw@analyticsystems.com