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Electrochemical Power Systems Laboratory

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Focused Areas [1] - **Projects & Partners** [2]**Published Articles** [3]

Battery and Electric Hybrid Vehicle Research Program in HNEI:

The Hawaii Natural Energy; Institute (HNEI) has been a partner with, and under the support of, the Hawaii Center for Advanced Transportation Technologies (HCATT) and the Air Force Advanced Power Technology Office (APTO) at Robins Air Force Base in Georgia to evaluate electric and hybrid vehicles (EHV) and advanced battery systems to promote and evaluate advanced power source systems for various ground vehicle applications.

Currently, within the HCATT and APTO program, we are involved in two major areas: (A) rechargeable lithium battery (RLB) testing and evaluation, and (B) data collection and analysis for various ground vehicle demonstrations, including PEM fuel cell hybrid vehicles, at Hickam Air Force Base in Honolulu. One of the

major objectives in this effort is to develop tools, protocols, and approaches to benchmark various power source and powertrain technologies for vehicle applications. The following efforts exemplify what on-going endeavors are being undertaken in HNEI:

- Continue to expand a commercial RLB Database for EHV applications through laboratory bench top and vehicle on-board evaluations.
- Improve existing battery performance prediction model and simulation capability for both cells and packs to accommodate new test and analysis data, including RLB degradation mechanisms for service life prediction.
- Develop a Battery Pack Design graphical user interface to enable the database for future power source design and integration.
- Develop a common platform for power source design and development to include diagnostics and prognostic capabilities.
- Expand the knowledge of laboratory benchmark to allow real-life prediction and simulation for making better cost estimates, control strategies and other business decisions.

Advanced vehicle driving cycle and battery duty cycle analyses and graphical user interface for data display we are also working with Expert Microsystems (EM), Orangevale, CA, to develop battery analytic, diagnostic models for prognostic applications. We have completed a Navy STTR Phase I study to integrate the battery models to EM?s prognostic toolbox. In this project, we developed techniques focused on how to utilize diagnostic tools such as incremental capacity analysis and state-of-charge (SOC) estimate to identify capacity loss attributes and failure modes to enable an accurate estimate of battery performance and remaining life prediction. This project is jointly supported by Saft America, GE/Smith Aviation, and Lockheed-Martin with funding from NAVAIR for the Joint Strike Fighter (JSF) program.

Separately, we are working with Southwest Research Institute (San Antonio, TX) to develop power source models (lead acid, Ni-MH, Li-ion and ultracapacitor) for its hybrid vehicle simulation platform for DOD. This package is similar to the one for the Argonne National Laboratory, known as PSAT. We have developed several power source models that are written in MATLAB and SIMULINK, which can be easily integrated with other modules for very versatile simulation work. Our models are versatile and adaptive to any chemistries or configurations as long as the test data are available.

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