

Prismatic Format Nickel Metal Hydride Batteries for the Transportation and Stationary Markets

*The 24th International Battery Seminar & Exhibit
Ft. Lauderdale, FL
March 22, 2007*



Who is Cobasys?



Formed in July, 2001 as Texaco Ovonic Battery Systems (TOBS)

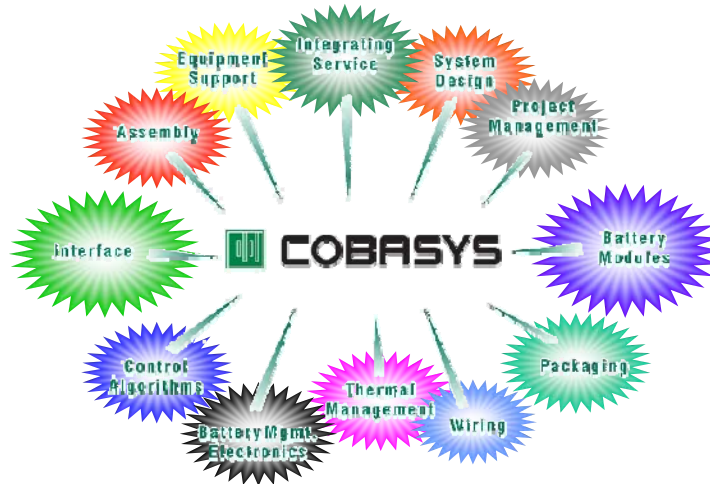
A joint venture to further develop and advance the commercialization of Nickel Metal Hydride (NiMH) energy storage systems

Chevron has provided financial backing for commercialization and manufacturing capital

ECD has contributed its rights to all patents and technology for prismatic NiMH technology



Fully Integrated Energy Storage Solutions



 **COBASYS**

Cobasys Market Segments

- **Transportation – HEV**
 - Automotive (Full Hybrid and Mild Hybrid)
 - Medium and Heavy Duty

- **Stationary**
 - Uninterruptible Power Supplies (UPS)
 - Telecom
 - Distributed Generation



 **COBASYS**

Cobasys Facilities



Orion, Michigan USA

Over 240 Employees

- 97,000 Sq. Ft.
- Product Development
- Product Engineering
- Prototype Development
- Process Development
- Systems Design & Engineering
- Systems Testing & Development
- Applications
- Administrative
- Marketing
- Sales
- Quality
- Health & Safety
- Research

Springboro, Ohio USA

Over 140 Employees

- 170,000 sq. ft.
- Complete System Assembly
- Automated Production of:
 - Battery modules
 - Transportation Systems
 - Stationary Systems



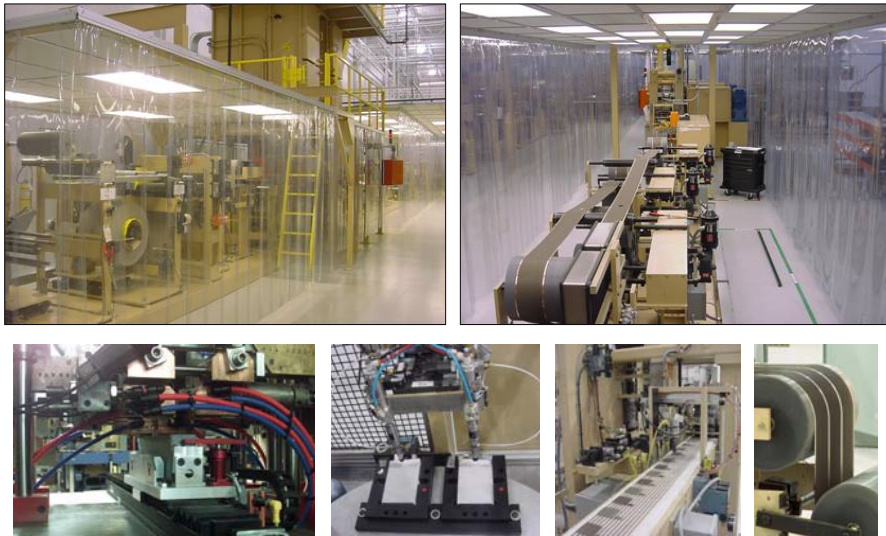
Springboro - 2003



Springboro 2006



Springboro Capabilities - 2006



Springboro –Battery Pack EOL Testing



 **COBASYS**

Manufacturing

- **Battery Manufacturing Facility in Springboro, Ohio.**
 - 170,000 sq. ft. – expandable by 50,000 sq. ft.
 - State-of-the art manufacturing systems.
 - Fully automated from plate production through formation.
 - TS16949 certified, ISO4001 certified, TL9000 certified.
- **Production Plans**
 - EV, HEV and 42 volt system solutions.
 - Stationary power system solutions.
- **Capability to Produce 3.0 Million + Battery Modules Annually when fully capacitized.**

 **COBASYS**

UPS & Telecom System Power Solutions



NiGUARD

- Applications for Mission Critical Central Offices & Outside Plants
- Lead Acid Replacement
- Premium Energy Alternative



NiCOM

 **COBASYS**

Series 9500 for Stationary



- 12 volt construction – can be configured in alternate voltages.
- 85 amp hour rated capacity.
- Long life under deep discharge cycling (> 1000 80% DOD).
- Greater than ten year calendar life.
- Cobasys NiGUARD system allows float usage under wide operating range.

 **COBASYS**

Example of UPS installation – Chevron Bellaire Data Center

- Provided more than three times the power and energy of lead-acid batteries
- Reduced 65% of the floor space and 70% of the weight
- Eliminated hazardous materials
- Provided higher reliability

NiGUARD



Before: Lead Acid (Flooded)



After: NiGUARD

COBASYS

Announced Transportation Applications



COBASYS

Announced Transportation Programs



Saturn VUE Green Line



Saturn Aura
Green Line



NiMHax Standard Products - Transportation



GM BAS Pack



“Plug and play” 42 volt air cooled battery pack for mild hybrid application.

 **COBASYS**

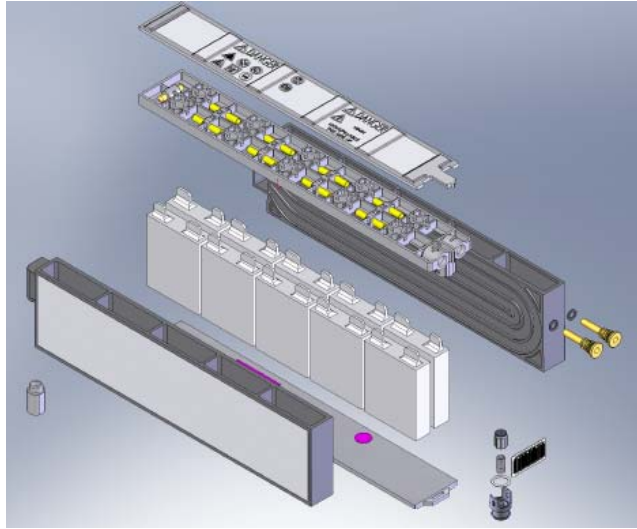
Series 880 Module for HEV



- 8.5 Ah nominal capacity.
- 12 volt monoblock construction.
- 2400 watt peak power.
- Liquid or air cooled operation.
- Designed for long cycle life under shallow DOD cycling.
- Incorporates design features for ease of integration into high voltage packs.

 **COBASYS**

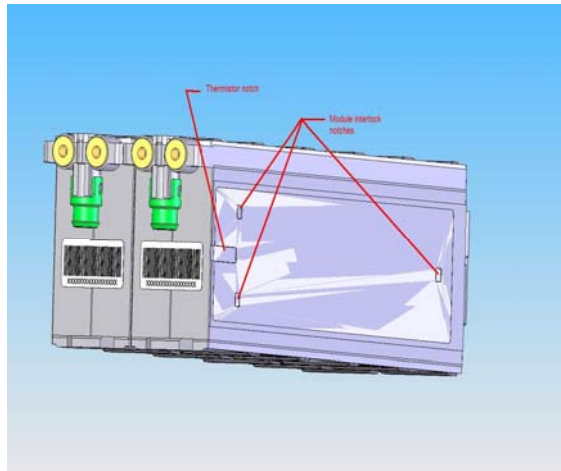
Series 880 Module Exploded View



 **COBASYS**

S880 Case Design

- Interlocking Features
- Improve Assembly of pack
- Recess for Thermistor
- Preferred Position for Best Temperature Sensing



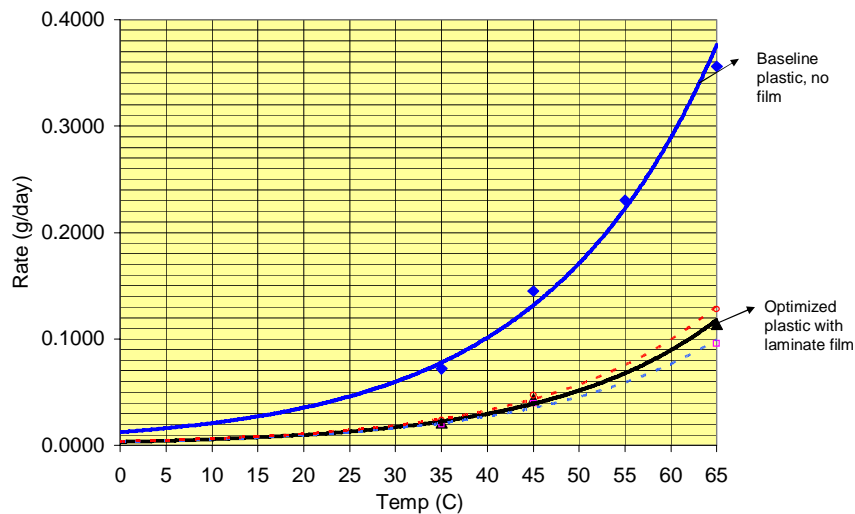
 **COBASYS**

Series 880 Battery Design

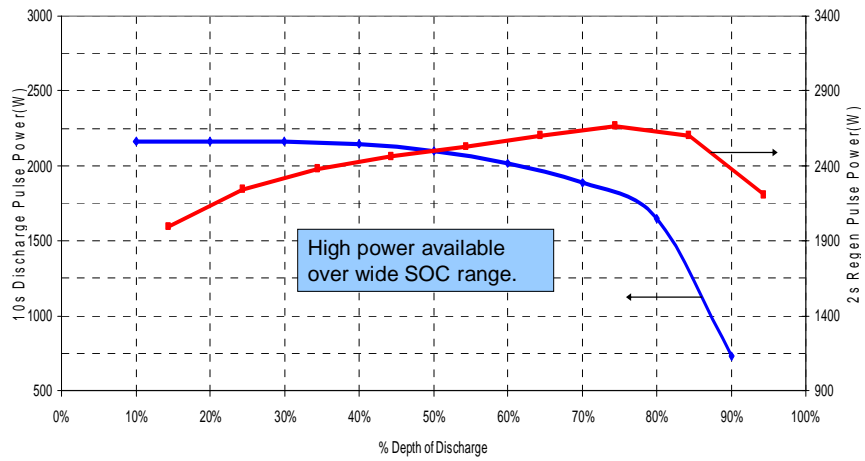
- Negative electrode incorporates improved AB₅ hydride alloy pasted on NPS perforated metal substrate.
 - Alloy provides improved cold temperature power.
 - Optimized formulation for long cycle life under HEV shallow cycling.
- Pasted positive electrode optimized for high power and long life over wide operating temperature range.
- Grafted PP separator provides excellent electrolyte retention and low self-discharge due to ammonia trapping.
- Advanced plastic prevents hydrogen and water vapor permeation for long calendar life.



Optimized Plastic with Laminate Film for Low Water Permeation

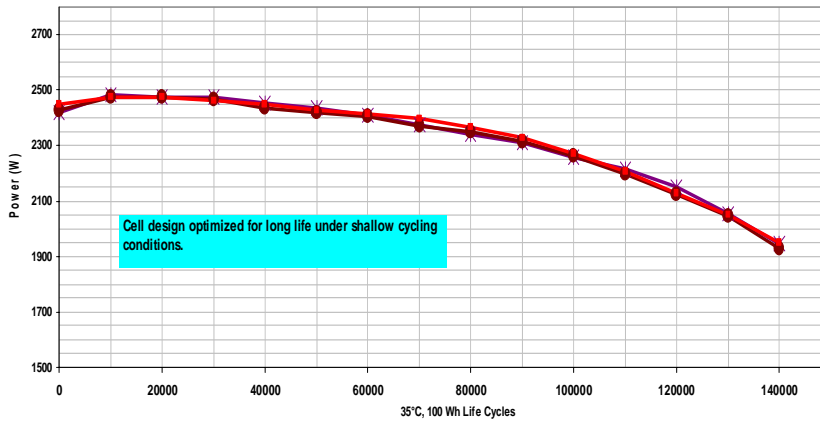


HPPC Characterization of Series 880 Module



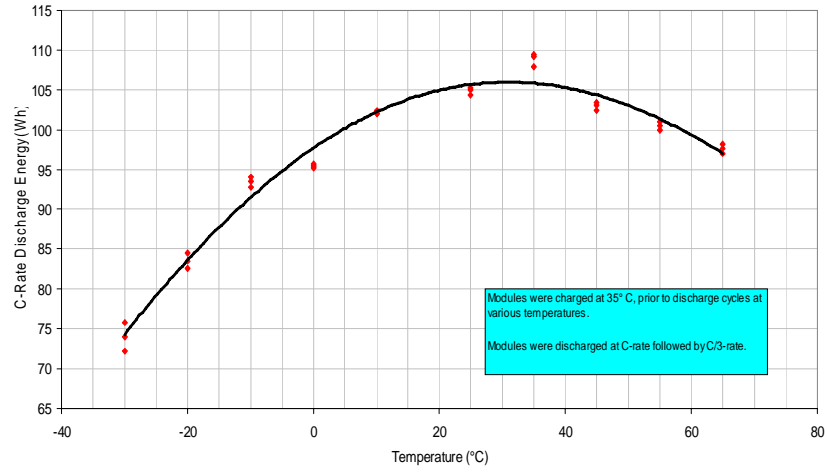
COBASYS

Series 880 Cycle Life

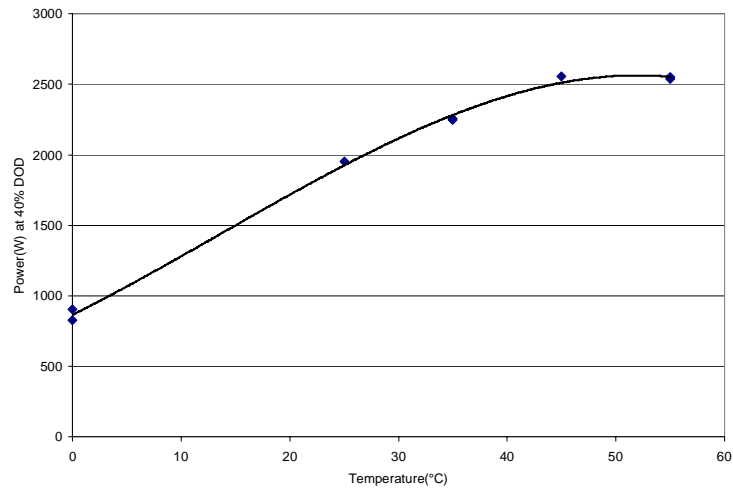


COBASYS

Series 880 Thermal Performance - Energy

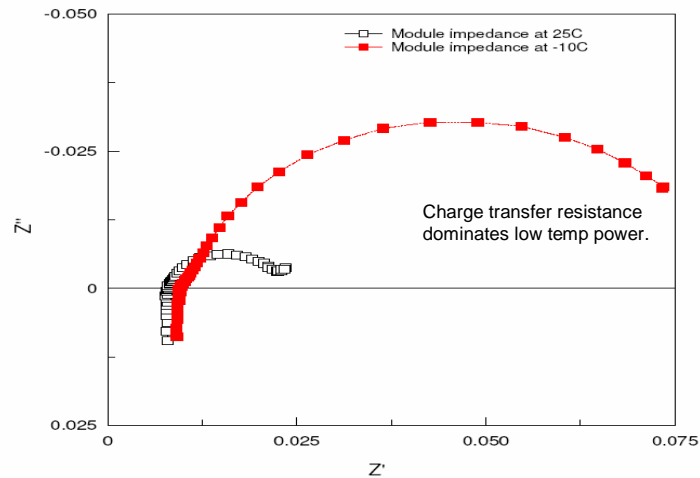


Series 880 Thermal Performance - Power



Cold Temperature Performance

Impedance spectra for Series 880 Module



Future Developments

- Nickel Metal Hydride technology continues to be the chemistry of choice for hybrid electric vehicles.
 - Proven durability, reliability and safety.
 - Focus on continuous improvement.
 - Cost reduction!
- No single chemistry is a perfect fit for every application.
- Lithium Ion – no longer a question of “if” but a question of “when”.
 - Higher voltage allows reduced number of cells.
 - Higher specific energy.
 - Seen as a potential alternative for plug-in hybrids.
 - Still work to be done!



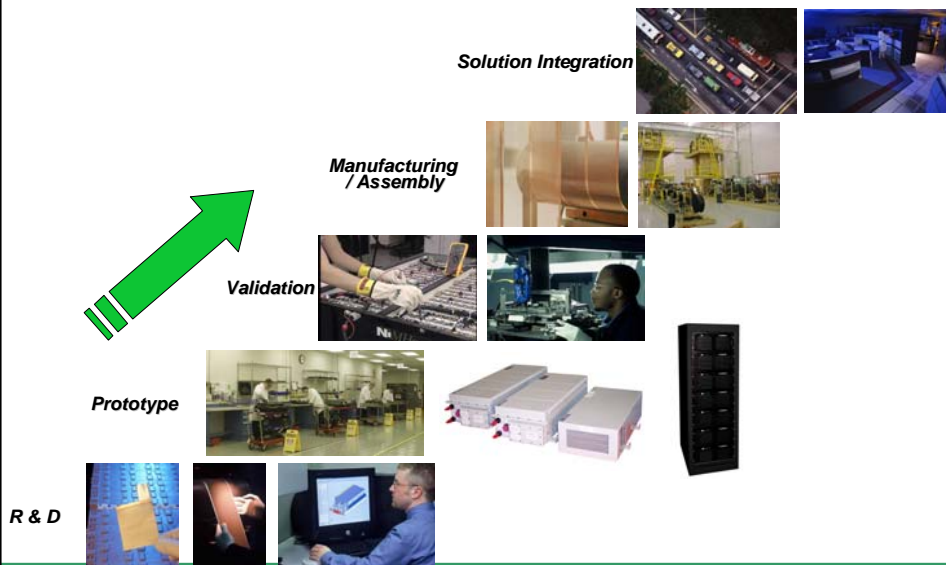
Cobasys Li Ion Development

“Cobasys and A123Systems Announce Partnership to Develop Lithium Ion Hybrid Electric Vehicle Battery Systems”

“Cobasys Awarded General Motors Contract to Develop Lithium-Ion Battery System for Plug-In Hybrid”



Cobasys – A Fully Integrated Organization



Summary

- ✓ Recognized as an Advanced Energy Storage Systems Provider
- ✓ Strong Market Position With Contracts in Hand
- ✓ Strong Intellectual Property Position
- ✓ Solid Plan for Sustained Growth
- ✓ Systems Integration Expertise
- ✓ Right Place, Right Time, Right Products, Right People

