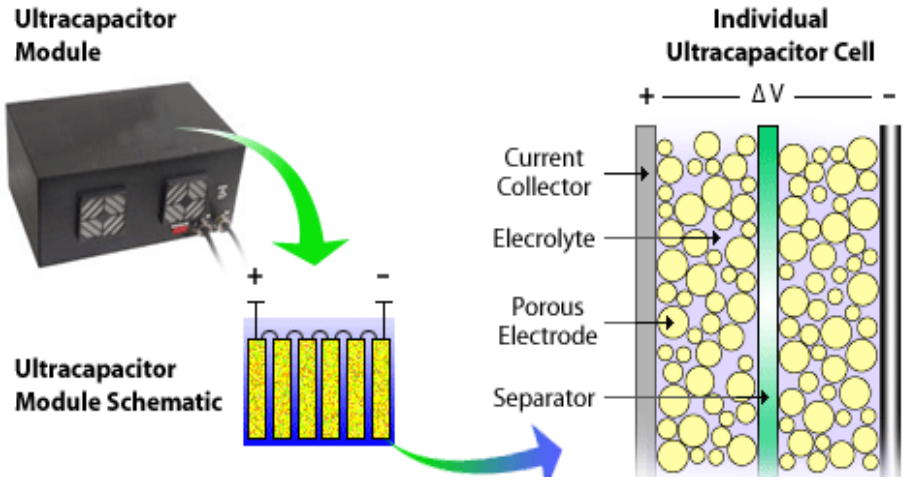
Superior, More Affordable Ultracapacitors

Maxwell Advances America's Power Capabilities



The inner workings of an ultracapacitor.

The Challenge—In the late 1990s, the power demands of such commercial systems and products as personal communication devices, electronic games, hybrid vehicles, and industry production lines were approaching or exceeding battery power capabilities. Many of these products and processes use ultracapacitors to assist batteries with power demands and to reduce power disruptions. However, existing ultracapacitors were expensive and increasingly unable to satisfy requirements of the next generation of products and manufacturing systems.

In 1998, Maxwell Energy Products applied for ATP funding under the 1998 "Premium Power" focused program to develop superior, less expensive ultracapacitors. Maxwell turned to ATP because the project's high technical risk discouraged private sector funding.

The Outcome—As a result of the ATP award, Maxwell achieved many of its technical and development objectives. Among these highlights:

- Researchers successfully combined a graphite lithium negative electrode with a thinner, double-layer, carbon cloth product as a positive electrode. This new high-power positive electrode, made with less expensive materials, allowed more electrically charged ions to form on the current collectors, which increased power performance by a factor of 2 to the 2.7–2.8-volt range.
- The company implemented a demand-based flow manufacturing plan that reduced product voltage leakage by 50 percent and increased ultracapacitor yields from 11 percent to 65 percent.

By the end of the project, Maxwell discovered that implementing demand-based flow manufacturing and using less expensive but highly effective materials allowed the company to achieve a $50/cell production and material cost for its large-cell ultracapacitors. This level represented a 75 percent reduction in cost over the baseline cell, and helped the company launch new lines of highly effective ultracapacitors. The success of this project resulted in seven patents and the publication of several articles.

As of 2006, Maxwell Technologies (which changed its name in 2004) was making small, large, and modular ultracapacitor systems. Maxwell ultracapacitors are used in hybrid buses, automatic meter-reading systems, industry production lines, and a military application. Looking forward, the developing U.S. hybrid and electric car and truck market may use Maxwell ultracapacitors.

Partnering Organization:	Maxwell Technologies, San Diego, CA
Project Duration:	11/1/1998 – 5/31/2001
Project Cost:	$2.0M ATP cost-share; $2.2M industry cost-share
Project Brief:	http://jazz.nist.gov/atpcf/prjbriefs/prjbrief.cfm?ProjectNumber=98-03-0050
Project Status Report:	http://statusreports.atp.nist.gov/reports/98-03-0050.htm Research conducted April 2006