

## Hydrogen Storage Challenges for Mobility Symposium

December 6 - 7, 2006

Center for Hydrogen Research  
Aiken, South Carolina, USA  
I.D. #2006S05

### Overcoming the Barriers

#### Topics of Discussion:

- Reversible metal and complex hydrides
- H<sub>2</sub>-reversible liquid carriers
- Carbon nanotube, liquid hydrogen, and high pressure storage
- Recent progress and future plans

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# Hydrogen Storage Challenges for Mobility Symposium

## Overcoming the Barriers

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**Storage. Safety. Efficiency.**

## Overview

The internal combustion engine has served the transportation industry admirably since its introduction by Henry Ford. Steady progress has been made over the last century in improving the engine itself and the liquid gasoline fuel. Recently however, rising costs of petroleum, global warming fears, and concerns that nations are exhausting their reserves of petroleum have fueled a global interest in the hydrogen economy.

As the first symposium to explore this topic specifically, it will concentrate on answering questions such as: What are these challenges and can they be overcome? Is the hydrogen economy just hype or is it feasible to consider that future cars and trucks will be powered by hydrogen? This symposium will address the issue of safe and efficient hydrogen storage, which has been identified as a key requirement for a future hydrogen economy. In addition, experts working on the hydrogen storage challenge will describe their latest achievements and put into perspective how these novel hydrogen storage methods may achieve current and future Department of Energy and vehicle company goals.

## Organizers

### Jack Simon

Senior Advisory Consultant  
Savannah River National Laboratory

### Robert F. Bennett

Research Manager, Global Business Development  
South Carolina Department of Commerce

### Peter F. Finamore

Manager, Research and Development  
John Deere Advanced Energy Systems

### Fred E. Humes

Director  
Economic Development Partnership

### Wen Li

Sr. Principle Scientist  
Toyota Motor Engineering & Manufacturing  
North America

### Theodore Motyka

Manager, Hydrogen Technology Laboratory  
Savannah River National Laboratory

### Harold F. Sturm, Jr.

Sr. Management Consultant  
Savannah River National Laboratory

# Agenda

## DAY 1

**Wednesday, December 6, 2006**

- 3:00 p.m. .... Registration with tabletops in lobby  
 4:00 p.m. .... Tour at the Center for Hydrogen Research  
 5:00-6:30 p.m. .... Reception—sponsored by the **Center for Hydrogen Research**

## DAY 2

**Thursday, December 7, 2006**

- 7:00 a.m. .... Registration  
 7:30 a.m. .... Continental Breakfast  
 8:00 a.m. .... Welcome/Introductions

Symposium Presentations	Speakers
<b>8:15 a.m.</b> The Department of Energy's National Hydrogen Storage Project: Recent Progress and Future Plans	<b>Sunita Satyapal</b> , Team Leader, Hydrogen Storage Team U.S. Department of Energy
<b>8:45 a.m.</b> Hydrogen Storage: The Challenge with Science and Engineering	<b>Kazuo Kawahara</b> , Sr. Executive Engineer Toyota Motor Engineering & Manufacturing North America Inc. <b>Katsuhiko Hirose</b> , Project General Manager Fuel Cell System Development Toyota Motor Corporation
<b>9:15 a.m.</b> The Challenge of Hydrogen Storage for FC Vehicles	<b>Udo Winter</b> , Director FCA Mainz-Kastel Adam Opel GmbH
<b>9:45 a.m.</b> Practical Approaches to On-Board Hydrogen Storage	<b>Tarek Abdel-Baset</b> -Project Engineer Fuel Cell Systems—Hydrogen Storage DaimlerChrysler
<b>10:15 a.m.</b>	Break
<b>10:45 a.m.</b> Performance and User Analysis of Off-Road Hydrogen Fuel Cell Powered Utility Vehicles	<b>Peter Finamore</b> , Manager, Research & Development John Deere Advanced Energy Systems
<b>11:15 a.m.</b> The Challenge of Hydrogen Storage: An Energy Company Perspective	<b>David M. Austgen Jr.</b> , General Manager Technology, Operations, HSE Shell Hydrogen LLC
<b>11:45 a.m.</b> Luncheon	<b>U.S. Rep. Bob Inglis</b> (invited), Keynote Speaker
<b>1:15 p.m.</b> Hydrogen Effects on Materials: Impact of Materials Systems Integrity, Codes and Standards Development, and Hydrogen Distribution Technologies	<b>Thad Adams</b> , Fellow Engineer Materials Science and Technology Savannah River National Laboratory
<b>1:45 p.m.</b> Liquid Hydrogen Storage—Roadmap to Mass Market	<b>Tobias A. Brunner</b> Concept Development Hydrogen Storage BMW Group
<b>2:15 p.m.</b> High Pressure Storage Applications	<b>Neel Sirosh</b> , Director Advanced Fuel Storage Quantum Technologies Inc.
<b>2:45 p.m.</b>	Break
<b>3:15 p.m.</b> Hydrogen Storage: From Carbon Nanotubes to H <sub>2</sub> -Reversible Liquid Carriers	<b>Guido P. Pez</b> , Chief Scientist Air Products
<b>3:45 p.m.</b> Reversible Metal & Complex Hydrides	<b>Ted Motyka</b> , Manager, Hydrogen Technology Laboratory Savannah River National Laboratory
<b>4:15 p.m.</b>	Symposium adjourns

# Special Events

## Tour! The Center for Hydrogen Research



4:00 p.m.  
Wednesday, December 6, 2006

A chance to tour the only facility of its kind in the world! Having opened in February 2006, this Aiken-County owned building occupies more than 60,000 square feet at the Savannah River Research Campus in South Carolina. Facilitating cooperative research among the Savannah River National Laboratory, universities, and industry, the CHR's purpose is to develop new products and services necessary for the emerging hydrogen economy. An innovative opportunity you won't want to miss!

- Tours will last approximately 30 minutes.
- Attendee Limit: 90
- To participate in the tour of the Center for Hydrogen Research, U.S. citizens will be required to present two forms of identification, at least one of which includes a photo. Non-U.S. citizens must show their passports and visas, if applicable.

## Networking Opportunities

Discuss the changes that will come from using hydrogen as a future energy provider. Meet and socialize with colleagues, competitors, customers and suppliers involved in the hydrogen economy during these occasions:

**Evening Reception**—sponsored by the Center for Hydrogen Research....5:00-6:30 p.m.—Wednesday, December 6

**Continental Breakfast**.....7:30 a.m.—Thursday, December 7

**Luncheon**—Keynote Speaker U.S. Rep. Bob Inglis (invited)..... 11:45 a.m.—Thursday, December 7

# Registration and Fees

Join SAE  
and save \$200

Category	On/Before November 17	After November 17
SAE Member	\$395	\$495
Non-Member	\$595	\$695
Participant (organizer, presenter, moderator, speaker)	FREE	FREE

Symposium fee includes the program, continental breakfast, breaks, luncheon, Networking/Welcoming Reception, tour of the Center for Hydrogen Research (for eligible attendees—see tour information), and attendee binder with presentations.

*Conditions of Sale - All cancellations must be in writing and received by SAE prior to November 17, 2006. A \$50 processing fee will be assessed for each cancelled registration that results in a refund. Refunds will not be issued if cancellation occurs on or after November 17. This policy includes special event and meal fees. For the SAE membership registration rates, member dues must be current at the start of the event. Children under 16 years of age are not permitted.*



SAE will do what is feasible to make its events reasonably accessible to attendees. If you have special accommodation needs, please let us know in advance by calling 1-877-606-7323 (1-724-776-4970 outside U.S. and Canada). Accommodations requested on site will be provided only if possible for us to do so on short notice.

## To Register

Web: [www.sae.org/hydrostorage](http://www.sae.org/hydrostorage)

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1-724-776-4970 (Outside the U.S. & Canada)

Email: [CustomerService@sae.org](mailto:CustomerService@sae.org)

I.D.# 2006S05

# Hotel and Travel Information

SAE has not contracted for a block of hotel rooms for this event. The following list of local lodging is provided for your convenience. All attendees are responsible for making their own travel arrangements. Please refer to the event page, [www.sae.org/hydrostorage](http://www.sae.org/hydrostorage), for additional information regarding hotels in the area.

## Country Inn & Suites

3270 Whiskey Rd.  
Aiken, SC 29803  
1-803-649-4024

## The Willcox

100 Colleton Avenue  
Aiken, SC 29801  
1-803-648-1898

## Hampton Inn

100 Tamil Dr. at Whiskey Rd. South  
Aiken, SC 29803  
1-803-648-2525

## Holiday Inn Express

155 Colony Parkway-Whiskey Rd.  
Aiken, SC 29803  
1-803-648-0999

## Marketing Solutions

### Tabletop Displays-only \$750!

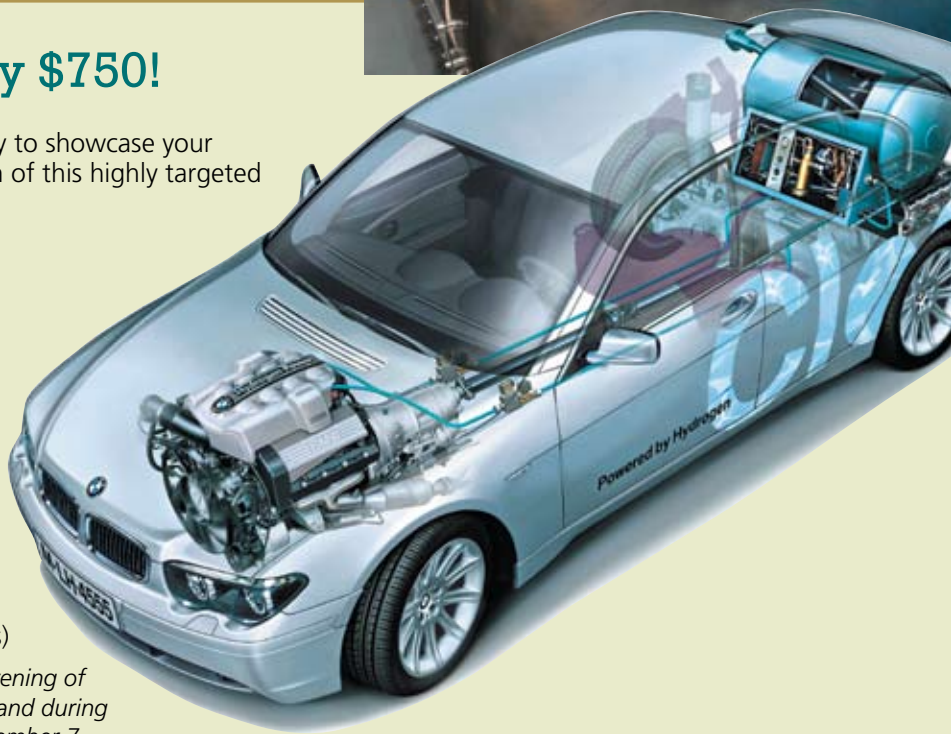
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#### Fee includes:

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*Displays will be available to attendees on the evening of Wednesday, December 6, during the reception and during Symposium breaks and lunch on Thursday, December 7.*

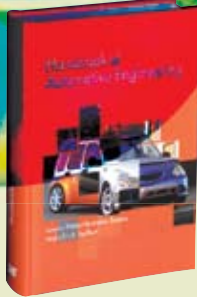


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# Related Resources from SAE International



## Fuel Cell Systems Explained

### Second Edition

By James Larminie and Andrew Dicks

Fuel cell technology is developing at a rapid pace, thanks to the increasing awareness of the need for pollution-free power sources. Moreover, new developments in catalysts and improved reliability have made fuel cells viable candidates

in a road range of applications, from small power stations, to cars, to laptop computers and mobile phones. Building on the success of the first edition, Fuel Cell Systems Explained presents a balanced introduction to this growing area. Fully revised and updated, this second edition:

- Provides an essential guide to the principles, design and application of fuel cell systems
- Includes full and updated coverage of fuel processing and hydrogen generation and storage systems
- Presents a full and clear explanation of the operation of all the major fuel cell types, and an introduction to possible future technology, such as biological fuel cells
- Features a new chapter on the direct methanol fuel cell
- Now includes examples of the modeling, design and engineering of real fuel cell systems
- Offers a clear overview of fuel cell operation and thermodynamics
- Provides coverage of the complete fuel cell system, including compressors, turbines, and the electrical and electronic sub-systems such as regulators, inverters, grid inter-ties, electric motors, and hybrid fuel cell/battery systems

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## Hydrogen IC Engines

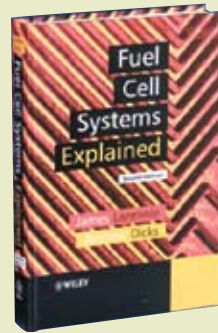
This Special Publication is a collection of 8 related SAE technical papers from one or more technical sessions at a particular SAE event. SPs can save you 60% or more when compared to the collective purchase price of all the individual papers included in the collection.

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## Applications of Fuel Cells in Vehicles 2006

This Special Publication is a collection of 11 related SAE technical papers from one or more technical sessions at a particular SAE event. SPs can save you 60% or more when compared to the collective purchase price of all the individual papers included in the collection.

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## Handbook of Automotive Engineering

By Ulrich W. Seiffert and Hans Hermann Braess

This latest edition and successor to the well-known German-language handbook last published by Professors Heinrich Buschmann and Paul Koessler comprehensively describes the fascinating world of the automobile and its development. Serving concurrently as a

“time capsule” and a timely resource, this technical reference book covers all areas of automotive research and thoroughly examines the recent state-of-the-art and rapidly changing developments of the automobile. From powertrains and electronics to vehicle safety and future materials, this handbook provides the reader with wide-ranging insight into all assemblies, components, and systems of modern motor vehicles and the complete life cycle of the automobile.

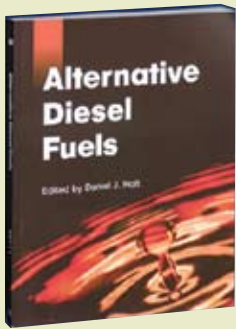
In addition to gathering the most comprehensive information on automotive engineering technology, editors Hans-Hermann Braess and Ulrich Seiffert focus on balancing theory and practice and ensure they are communicated in a synergistic manner. Because of this desirable balance, more than 40 well-known authorities from the automotive and supplier industries engaged as contributors, and—although this text is based primarily on the writings of German authors—the global nature of the automobile industry ensures that its contents have worldwide applicability.

If you are an engineer or automotive specialist who seeks to expand his or her knowledge, or a technically interested person, student, and non-technical layman who wishes to learn more about the modern automobile and its systems, this handbook is the reliable source for day-to-day advice and information.

Contents cover:

- Mobility
- Requirements and Conflicting Goals
- Vehicle Physics
- Shapes and New Concepts
- Powerplants
- Body
- Suspension
- Electrical and Electronic Components and Systems
- Materials and Manufacturing Methods
- The Product Creation Process
- Traffic and the Automobile - How Can This Go On?
- Outlook - Where Do We Go From Here?

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## Alternative Diesel Fuels

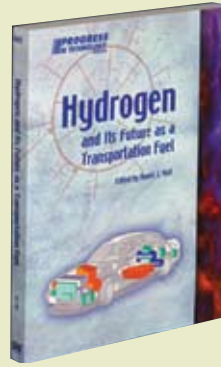
By Daniel J. Holt

A key topic of many technical discussions has been the development of alternative fuels to power the compression ignition engine. Reasons for this include the desire to reduce the dependency on petroleum-based fuel and, at the same time, to reduce the particulate matter (PM) and NOx emissions.

The 25 technical papers in this SAE Progress in Technology Series book discuss the findings and testing procedures used to evaluate the alternative fuels and blends such as:

- Sunflower and safflower oils
- Methanol
- BioDiesel
- Soybean oil
- Diethyl ether
- Esterfied vegetable oil
- Low sulfur diesel fuel blend
- Oxygenated fuels
- Alcohol
- LPG
- Water blend emulsions
- Hydrogen
- Natural gas

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## Hydrogen and Its Future as a Transportation Fuel

By Daniel J. Holt

With today's emphasis on emissions and the search for an alternative fuel, hydrogen is being touted by many as the fuel of the future. This book collects 43 SAE technical papers covering the last five years (1998-2002) of research on the uses of hydrogen as a transportation fuel.

Contents:

- Hydrogen Issues
- Internal Combustion Engines
- Diesel Engines
- Hybrid Vehicles
- Fuel Cells
- Hydrogen Storage and Generation

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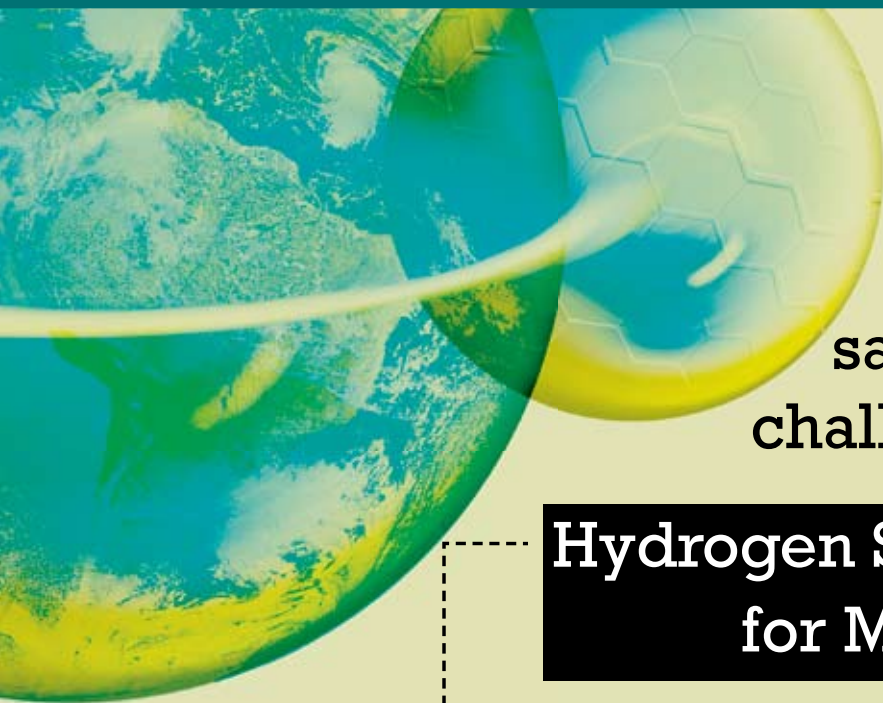
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