

# STAPP CAR CRASH CONFERENCE

Hyatt Regency  
in Fairlane Town Center  
Dearborn, Michigan

November 6-8, 2006

50<sup>TH</sup>  
ANNIVERSARY



# The John Paul Stapp Conferences

Naming a series of conferences after an individual is a unique manner of expressing love and appreciation for one whose untiring efforts in the use of an overwhelming knowledge has gently perfused his dedication into the works of others. As a Doctor of Medicine, he has laid aside the treatment of the ill, and rather, as a Doctor of Philosophy, he has attacked the structural elements of transportation, which, when they go awry, devastate the human bodies within them.

He believes that more can be done to reduce the misery of man in this field than in any other. He has felt that, by joining all who would participate with him in these Conferences, the frontiers of ignorance would be pushed back in the sharing of experimental information. Certainly, he has known the loneliness of advanced thought; and the rejuvenation on contact with these dedicated souls.

The keynote of the Conferences is Fellowship. Although the faculty and participants come from many disciplines and in many cases have diametrically opposite viewpoints, the integrity of the individual is completely respected, and friendship itself lends a helping hand in the understanding of the problems. These are truly John Paul Stapp Conferences!

Professor James J. Ryan  
Mechanical Engineering Department of the Institute of Technology  
University of Minnesota

(Acknowledgment is made for the above Preface contained in the Fifth Stapp Conference Proceedings, edited by M.K. Cragun. Minneapolis, MN: University of Minnesota, Center for Continuation Study of the General Extension Division, 1962.)



# STAPP



## Dr. John Paul Stapp, In Memoriam, 1910-1999

A bronze bust of Dr. John Paul Stapp Col USAF MC is displayed each year at the Stapp Car Crash Conference. It was created by artist Walter Rawley of Ruidoso, New Mexico, and donated by Dr. Stapp. The bust depicts Colonel Stapp when he rode the rocket sled at Holloman Air Force Base, subjecting himself to injury-producing accelerations in order to study human tolerance to high-*g* environments. In his final sled ride in 1954, Dr. Stapp was accelerated to 632 miles per hour in five seconds, and was then decelerated to a stop in 1.4 seconds, experiencing a peak sled deceleration in excess of 40 *gs*.

Visit our website at <http://www.stapp.org/>

# Welcome

The Stapp Car Crash Conference is the premier forum for the presentation of research in impact biomechanics, human injury tolerance, and related fields that advance the knowledge of land-vehicle crash injury protection. The conference provides an opportunity to participate in open discussion regarding the causes and mechanisms of injury, experimental methods and tools for use in impact biomechanics research, and the development of new concepts for reducing injuries and fatalities in automobile crashes.

The papers that will be presented at this year's Stapp Conference cover a range of timely and important topics in impact biomechanics and occupant protection. These topics include biomechanics of the abdomen, biomechanics of the pelvis and lower extremities, biomechanics of the thorax, restraint system performance, biomechanical analysis using computational models, and biomechanics of the head and brain.

We would like to thank all of the authors as well as members of the Stapp Advisory Committee for the significant efforts that have been put forth in preparing and reviewing these papers. We encourage all attendees to use the time provided following each paper presentation to offer comments and questions to the presenters. This is a valuable opportunity for further clarification of the research from which all in attendance will benefit. It is

hoped that the material presented at this year's conference will provide ideas and motivation for further research that will lead to improvements in occupant protection systems. We also encourage those who are active in impact biomechanics research to submit abstracts for papers to be included in next year's Stapp Conference, which will be held at the Catamaran Resort Hotel in San Diego, California.

The 50<sup>th</sup> Stapp Car Crash Conference is being held in the Detroit area to recognize the support and contributions made by the auto industry since the inception of the Stapp Conference and also to recognize the industry's efforts in implementing research discussed at past conferences. We hope you join us on this special occasion.

On behalf of the Stapp Car Crash Conference Advisory Committee, we invite you to participate in what promises to be a stimulating and exciting 50<sup>th</sup> anniversary celebration of the Stapp Conference at the Hyatt Regency in Fairlane Town Center in Dearborn, Michigan.

**Harold J. Mertz and Priya Prasad**  
**General Co-Chairs**  
**Leda L. Ricci, Executive Director**  
**50<sup>th</sup> Stapp Car Crash Conference**

STAPP

## Stapp Advisory Committee

**John P. Stapp**, 1955-1999 Permanent Chairman  
Colonel USAF MC

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**Priya Prasad**, Ford Motor Company  
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**John W. Melvin**  
**Barry S. Myers**  
**Alan M. Nahum**  
**Guy S. Nusholtz**  
**Frank A. Pintar**  
**Stephen W. Rouhana**  
**Lawrence W. Schneider**  
**Richard L. Stalnaker**  
**Xavier Trosseille**  
**Jac S.H.M. Wismans**

Britax Childcare Limited  
Wayne State University  
PMG Technologies  
National Highway Traffic Safety Administration, ret.  
The University of Michigan  
Wayne State University  
Wayne State University  
University of Pennsylvania  
Tandelta, Inc.  
Duke University  
University of California, San Diego  
DaimlerChrysler Corporation  
Medical College of Wisconsin  
Ford Motor Company  
The University of Michigan  
Ristal Engineering  
LAB PSA Peugeot-Citroën Renault  
TNO Science & Industry/Eindhoven University of Technology

**2006 Conference Hosts** • General Motors Corporation and Ford Motor Company

**Co-Sponsors** • University of Michigan Transportation Research Institute • University of California, San Diego • Wayne State University

# Conference Registration

## Conference Registration Information

**Registrations may be faxed to the Stapp registration office until November 3, 2006.**

- Complete and return the registration form provided in this program with payment to the address or fax number listed at the top of the form.
- Payments may be made by major credit card or check.
- Conference badges will be available at the registration desk.
- Registration for the conference includes one copy of the *Stapp Journal*, technical session attendance, continental breakfasts, refreshment breaks, Tuesday lunch, and evening receptions. Student registrations do not include the *Stapp Journal*.

### ON-SITE REGISTRATION — Hubbard Foyer

Sunday, November 5	3:30 PM – 6:00 PM
Monday, November 6	7:30 AM – 4:00 PM
Tuesday, November 7	8:00 AM – 4:00 PM
Wednesday, November 8	8:00 AM – 10:00 AM

### Stapp Car Crash Journal Pickup

Pre-registered attendees, as well as those registering on-site, may pick up their copy of the *Stapp Car Crash Journal* along with a conference badge in the Hubbard Foyer.

Additional copies of the *Stapp Journal* may be purchased for \$119.95 list/\$95.96 for SAE members. Also available this year is the updated CD collection of Stapp technical papers at a prepublication price (through November 30, 2006) of \$360/\$288 for SAE members. The Stapp CD is updated this year to include papers published in the 2005 and 2006 issues of the *Stapp Journal* and the 1993 and 1997 Proceedings of the Child Occupant Protection Symposiums. The collection is fully searchable and includes 1,310 technical papers in PDF format that can be viewed and printed. Individual documents can be searched for key words and phrases using Adobe Acrobat Reader, which is included with each CD-ROM. The *Stapp Journal* and/or historical collection of Stapp papers on CD may be ordered following the conference, by calling (724) 776-4970 [toll free U.S. and Canada (877) 606-7323], or by faxing (724) 776-0790. E-mail: [publications@sae.org](mailto:publications@sae.org); Internet: <http://store.sae.org/>

### SAE Publications

SAE publications will not be available for purchase during the conference. However, there will be a display of catalogs and promotional material in the conference registration area and SAE publications can be ordered on site. Publications are also available on the SAE web site at [www.store.sae.org/](http://www.store.sae.org/)

**For Stapp Conference information,  
call Rachael Ross (734) 763-3582 or  
E-mail: [rachaelr@umich.edu](mailto:rachaelr@umich.edu)**

# Hotel Information

## Hotel Information

### Location — Fairlane Town Center, 600 Town Center Drive

The **Hyatt Regency Dearborn**, the host hotel for the Stapp Conference, is located near historic Greenfield Village, Automotive Hall of Fame, Henry Ford Museum, Detroit Institute of Art, and stadiums. It is adjacent to Fairlane Town Center shopping mall and Ford Motor Company headquarters, and is just nine miles from downtown Detroit. It is 15 minutes from Detroit Metropolitan Airport and 10 minutes from the Amtrak Railroad Station.

### Accommodations/Reservations

Reservations at the **Hyatt Regency Dearborn** may be made by calling the hotel directly at (313) 593-1234 or register on-line from the Stapp website—<http://www.stapp.org>. The room rate for the Stapp Conference is \$127 single/double if you register by October 13<sup>th</sup>. A limited number of rooms are available at a government rate. Be sure to identify yourself as attending the Stapp Car Crash Conference.

Please make your reservations as soon as possible to be assured of a room at the Stapp Conference hotel. Reservations must be guaranteed by credit card or one-night's deposit. Reservations must be cancelled one day prior to date of arrival before 3:00 p.m. EST to have your deposit refunded.

**Reservations requested after October 13<sup>th</sup> will be confirmed at the Stapp room rate on a space-available basis.**

### Hotel Parking

Outdoor self parking is complimentary. Valet parking is available at \$15 per day with in and out privileges.

### Hotel Amenities

The **Hyatt Regency Dearborn** offers many guest facilities, including a complimentary fitness center, a heated indoor free-form pool, whirlpool, and sauna, business service center, and gift shop. Each room is equipped

# Travel Information

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## Transportation from Detroit Metropolitan Airport

### Car Rental

Alamo, Avis, Budget, Dollar, Enterprise, Hertz and National car rentals are located on site at Detroit Metropolitan airport, while Thrifty is located just outside the airport.

### Taxis

Cab fare from the airport to the hotel is about \$30.



## Directions to the Hyatt Regency Dearborn

### From West

I-94 East to Southfield Fwy (M39). Proceed north to Michigan Ave West. Michigan Ave westbound, turn right at Evergreen Road, right into Fairlane Town Center and again at the stop sign. The **Hyatt Regency** is across from Sears on the right.

### From South

I-75 North to exit #41, Southfield Road exit. Turn left at the light, follow Southfield Freeway North to Michigan Ave West. Take Michigan Ave West to the first street, Evergreen, and turn right. Turn right into the Fairlane Town Center, the **Hyatt Regency** is located across from Sears, in the southeast corner of the mall.

### From North

I-75 South to I-696 West to Southfield Road/Freeway South (M39). Exit Michigan Ave West. Turn right at Evergreen Road, right into Fairlane Town Center and again at the stop sign. The **Hyatt Regency** is across from Sears on the right.

### From Northwest

I-96 East to Southfield Fwy (M39) South to Michigan Avenue West. Turn right at Evergreen Rd, right into Fairlane Town Center and again at stop sign. The **Hyatt Regency** is across from Sears on right.

### From the East

I-94 west to exit 210-A, Michigan Ave west. Proceed approximately 5 miles to Evergreen and turn right. Stay to the right, turn right into the Fairlane Town Center. The **Hyatt Regency** is located across from Sears, in the southeast corner of the mall.

with high-speed wireless internet access, computer modem hookups, private voice mail, cable TV with HBI/CNN/ESPN, coffee maker, hair dryer, iron and ironing board. High-speed internet is also available in all meeting rooms and lobby areas.

## Hotel Dining

**Perks** coffee bar offers take-out coffee and donuts in the morning and sandwiches at noon. It features Starbucks coffee, breakfast bakeries, juices, sandwiches, snacks, etc. **Giulio & Sons** is a popular chophouse and features Italian specialties, fresh seafood, and steaks. **Archimedes Lounge** is located in the hotel lobby and is a convenient place to have a drink or to meet friends and colleagues for a quick snack. Food is served until 11:45 p.m. There are several restaurants in the adjacent Fairlane Town Center.

## Detroit Weather

The Southeast Lower region of Michigan has four seasons and due to its location near Lake Huron and Lake Ontario, it does experience lake effect, such as increased cloudiness during late fall and early winter. During November, the average high temperature is 49-degrees Fahrenheit (9-degrees Celsius) and the average low temperature is 35-degrees Fahrenheit (2-degrees Celsius). For an up-to-date 10-day weather forecast for the Detroit area, for the meeting week, visit the following Web site before your departure: <http://www.weather.com/weather/print/48201>



# Conference Information

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## Speaker Lounge — Model T Room

The speaker lounge is available to all authors and co-authors of conference papers.

## Stapp Conference Technical Sessions — Hubbard Ballroom

- Please check the session schedule in this program for starting times.
- Audio or video recording of presentations or discussions, and taking of photographs during the technical sessions, is not permitted.
- In consideration of the speakers and conference attendees, please turn off all cell phones when entering the meeting room.

## Message Center

For information on conference-related activities or to leave a message for someone attending the conference, please call the hotel at (313) 593-1234

and ask for the Stapp Conference Registration Desk. All messages will be posted in the Stapp Conference registration area. Fax messages may be sent to (313) 593-3366.

## Business Center

The Business Services Center is located on the Lobby Level close to the Registration Desk. It is open from 7:00 a.m. to 7:00 p.m. Monday through Friday. The following services are available in the business center: conference room rental, photocopies/transparencies, in/out facsimile service, internet access, computer usage, laptop hookup and laser printing, CD duplication, file downloading, equipment rental, posters, notary public, technology accessories, and office supplies. Additional services are also available.

## *Hosted Receptions & Refreshments*

Sunday evening, **Denton ATD** will host a reception to welcome Stapp Conference attendees from 5:00 to 7:00 PM.

Monday, a continental breakfast and refreshment breaks will be provided by **Nissan**.

Monday evening, reception to be determined.

Tuesday, **Toyota** will host a luncheon from 12:00 to 1:30 PM.

Tuesday evening, **First Technology Safety Systems** will host a reception from 5:00 to 7:00 PM.

## *Preceding the Stapp Conference*

**Sunday, November 5 — 9:00 AM–5:00 PM — Dearborn Ballroom**

**34<sup>th</sup> Annual International Workshop on Human Subjects for Biomechanical Research**

**Sponsored by the National Transportation Biomechanics Research Center, National Highway Traffic Safety Administration**

Erik G. Takhoumts, Chair

National Highway Traffic Safety Administration

The purpose of the workshop is to provide a forum for the exchange of ideas and the presentation of current research methods using human volunteers or surrogates. No registration fee is required. For additional information, contact:

Erik G. Takhoumts, Ph.D.

NHTSA/Human Injury Research Division, NVS-323

400 Seventh Street, S.W.

Washington, D.C. 20590

Phone: (202) 366-4737

Fax: (202) 366-5670

E-mail: Erik.Takhoumts@dot.gov

Monday, November 6

# Technical Program

In the Hubbard Ballroom

**Audio and videotaping are not permitted. Please turn off cell phones in the meeting room.**  
**Smoking is not permitted in the sessions.**

- 8:20 **WELCOME AND OPENING REMARKS**  
Harold J. Mertz, General Motors Corporation  
Priya Prasad, Ford Motor Company  
General Co-Chairs
- 8:30 **JOHN PAUL STAPP MEMORIAL LECTURE**  
**The Birth of European Biomechanics Fed by the Atlantic Umbilical Cord**  
Claude Tarriere, M.D., Accident and Biomechanical Researcher

## BIOMECHANICS OF THE ABDOMEN

- Co-Chairs: Xavier Trosseille, LAB PSA Peugeot-Citroën Renault  
Stephen W. Rouhana, Ford Motor Company
- 9:00 **Biomechanical Response of the Pediatric Abdomen, Part 1: Development of an Experimental Model and Quantification of Structural Response to Dynamic Belt Loading**  
Richard Kent, Stephen Stacey, Matthew Kindig, Jason Forman, and William Woods, Center for Applied Biomechanics, University of Virginia; Stephen W. Rouhana, Ford Motor Company; Kazuo Higuchi, Hiromasa Tanji, and Schuyler St. Lawrence, Takata Corporation; Kristy B. Arbogast, Children's Hospital of Philadelphia
- 9:30 **High-Speed Seatbelt Pretensioner Loading of the Abdomen**  
Craig D. Foster, Warren N. Hardy, King H. Yang, and Albert I. King, Wayne State University; Syuzo Hashimoto, Toyota Motor Corporation
- 10:00-10:30 REFRESHMENT BREAK

## BIOMECHANICS OF THE PELVIS AND LOWER EXTREMITIES

- 10:30 **Investigations on the Belt-to-Pelvis Interaction in Case of Submarining**  
Jérôme Uriot, Pascal Baudrit, and Pascal Potier, CEESAR; Xavier Trosseille, Philippe Petit, and Hervé Guillemot, LAB PSA Peugeot-Citroën Renault; Laurent Guérin, FAURECIA; Guy Vallancien, Université Paris Descartes
- 11:00 **Side Impact: Influence of Impact Conditions and Bone Mechanical Properties on Pelvic Response Using a Fracturable Pelvis Model**  
Eric Song, Xavier Trosseille, and Hervé Guillemot, LAB PSA Peugeot-Citroën Renault, France
- 11:30 **Derivation and Theoretical Assessment of a Set of Biomechanics-based, AIS2+ Risk Equations for the Knee-Thigh-Hip Complex**  
Tony R. Laituri, Scott Henry, Kaye Sullivan, and Priya Prasad, Ford Motor Company
- 12:00-1:30 LUNCH
- 1:30-1:45 **TRIBUTE TO PROFESSOR LARRY M. PATRICK** – Harold J. Mertz, General Motors Corporation

## BIOMECHANICS OF THE THORAX

- Co-Chairs: John M. Cavanaugh, Wayne State University  
Frank A. Pintar, Medical College of Wisconsin
- 1:45 **Anterior-Posterior Thoracic Force-Deflection Characteristics Measured During Cardiopulmonary Resuscitation: Comparison to Post-Mortem Human Subject Data**  
Kristy B. Arbogast, Matthew R. Maltese, and Vinay M. Nadkarni, The Children's Hospital of Philadelphia;  
Petter Andreas Steen, University of Oslo and Ulleval University Hospital; Jon B. Nysaether, Laerdal Medical Corporation
- 2:15 **Oblique and Lateral Impact Response of the PMHS Thorax**  
Joshua M. Shaw, Transportation Research Center Inc./The Ohio State University; Rodney G. Herriott, Transportation Research Center Inc.; Joseph D. McFadden and Bruce R. Donnelly, NHTSA – VRTC; John H. Bolte, IV, The Ohio State University
- 2:45 **Finite Element Analysis of Hard and Soft Tissue Contributions to Thoracic Response: Sensitivity Analysis of Fluctuations in Boundary Conditions**  
Daisuke Murakami, Seiichi Kobayashi, and Toshikazu Torigaki, Nissan Motor Co., Ltd.; Richard Kent, Center for Applied Biomechanics, University of Virginia
- 3:15-3:45 REFRESHMENT BREAK
- 3:45 **Thoracic Response of Belted PMHS, the Hybrid III, and the THOR-NT Mid-Sized Male Surrogates in Low Speed, Frontal Crashes**  
Jason Forman, David Lessley, C. Greg Shaw, Jay Evans, and Richard Kent, University of Virginia, Center for Applied Biomechanics;  
Stephen W. Rouhana and Priya Prasad, Ford Motor Company
- 4:15 **Dynamic Biaxial Tissue Properties of the Human Cadaver Aorta**  
Chirag S. Shah, Warren N. Hardy, Matthew J. Mason, and King H. Yang, Wayne State University; Chris A. Van Ee, Design Research Engineering;  
Richard Morgan and Kennerly Digges, The George Washington University
- 4:45 **Study of Potential Mechanisms of Traumatic Rupture of the Aorta Using In Situ Experiments**  
Warren N. Hardy, Chirag S. Shah, James M. Kopacz, and King H. Yang, Wayne State University; Chris A. Van Ee, Design Research Engineering;  
Richard Morgan and Kennerly Digges, The George Washington University
- 5:15 ANNOUNCEMENTS

Tuesday, November 7

**Technical Program**

In the Hubbard Ballroom

**Audio and videotaping are not permitted. Please turn off cell phones in the meeting room.**  
**Smoking is not permitted in the sessions.**

8:30 **Vehicle Safety—A 34-Year Perspective**  
 Brian O'Neill, Insurance Institute for Highway Safety, ret.

**RESTRAINT SYSTEM PERFORMANCE: TESTING, METHODS, AND ANALYSIS**

Co-Chairs: Farid Bendjellal, Britax Childcare Limited  
 Dainius Dalmotas, PMG Technologies

9:00 **Biomechanics of 4-Point Seat Belt Systems in Farside Impacts**  
 Stephen W. Rouhana, Sundeep V. Kankanala, and Priya Prasad, Ford Motor Company; Jonathan D. Rupp and Thomas A. Jeffreys, University of Michigan Transportation Research Institute; Lawrence W. Schneider, The University of Michigan

9:30 **Whole-Body Kinematic and Dynamic Response of Restrained PMHS in Frontal Sled Tests**  
 Jason Forman, David Lessley, and Richard Kent, University of Virginia, Center for Applied Biomechanics;  
 Ola Boström and Bengt Pipkorn, Autoliv Research

10:00-10:30 REFRESHMENT BREAK

10:30 **Improved Positioning Procedures for 6YO and 10YO ATDs Based on Child Occupant Postures**  
 Matthew P. Reed, Sheila M. Ebert-Hamilton, Miriam A. Manary, and Kathleen D. Klinich, University of Michigan Transportation Research Institute;  
 Lawrence W. Schneider, The University of Michigan

11:00 **The Effect of Breast Anthropometry on the Hybrid III 5<sup>th</sup> Female Chest Response**  
 Suzanne Tylko and Dominique Charlebois, Transport Canada; Alain Bussi eres and Dainius Dalmotas, PMG Technologies

11:30 **Crash Protection of Stock Car Racing Drivers—Application of Biomechanical Analysis of Indy Car Crash Research**  
 John W. Melvin and Paul C. Begeman, Wayne State University; Ronald K. Faller and Dean L. Sicking, University of Nebraska-Lincoln;  
 Scott B. McClellan and Edwin Maynard, Independent Witness Inc.; Michael W. Donegan and Annette M. Mallott, Delphi Electronics and Safety;  
 Thomas W. Gideon, General Motors Racing

12:00-1:30 LUNCH

1:30 **BEST PAPER AWARD** – Presentation by Rolf H. Eppinger, 2005 General Chair  
 Remarks by Wilford Lee Stapp  
 The John Paul Stapp Award for the best paper of the 2005 Conference and Journal will be presented to  
 Ying Lu, Chaoyang Chen, Srinivasu Kallakuri, Ajit Patwardhan, and John M. Cavanaugh, Bioengineering Center, Wayne State University,  
 for *Neural Response of Cervical Facet Joint Capsule to Stretch: A Study of Whiplash Pain Mechanism*

**INVITATION AND CALL FOR PAPERS**

John W. Melvin and Alan M. Nahum, General Co-Chairs, 51<sup>st</sup> Stapp Conference, San Diego, CA

**BIOMECHANICAL ANALYSIS USING COMPUTATIONAL MODELS**

Co-Chairs: Barry S. Myers, Duke University  
 Jac S.H.M. Wismans, TNO Science and Industry/Eindhoven University of Technology

1:45 **Development of Numerical Models for Injury Biomechanics Research: A Review of 50 Years of Publications in the Stapp Car Crash Conference**  
 King H. Yang, Jingwen Hu, Nicholas A. White, and Albert I. King, Wayne State University; Clifford C. Chou and Priya Prasad, Ford Motor Company

2:15 **Analysis and Evaluation of the Biofidelity of the Human Body Finite Element Model in Lateral Impact Simulations According to ISO-TR9790 Procedures**  
 Jesse S. Ruan, Raed El-Jawahri, Stephen W. Rouhana, Saeed Barbat, and Priya Prasad, Ford Motor Company

2:45 **Investigation of Anteroposterior Head-Neck Responses During Severe Frontal Impacts Using a Brain-Spinal Cord Complex FE Model**  
 Hideyuki Kimpara, Yuko Nakahira, Masami Iwamoto, and Kazuo Miki, Toyota Central R&D Labs., Inc.;  
 Kazuhiko Ichihara, Shun-ichi Kawano, and Toshihiko Taguchi, Yamaguchi University School of Medicine

3:15-3:45 REFRESHMENT BREAK

3:45 **A Study of Cervical Spine Kinematics and Joint Capsule Strain in Rear Impacts Using a Human FE Model**  
 Yuichi Kitagawa, Tsuyoshi Yasuki, and Junji Hasegawa, Toyota Motor Corporation

4:15 **Comparative Structural Neck Responses of the THOR-NT, Hybrid III, and Human in Combined Tension-Bending and Pure Bending**  
 Alan T. Dibb, Roger W. Nightingale, V. Carol Chancey, Lucy E. Fronheiser, Laura Tran, Danielle Ottaviano, and Barry S. Myers, Injury and Orthopaedic Biomechanics Laboratory, Duke University

4:45 ANNOUNCEMENTS



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Smoking is not permitted in the sessions.**

**BIOMECHANICS OF HEAD/BRAIN INJURY**

- Co-Chairs: Rolf H. Eppinger, National Highway Traffic Safety Administration, ret.  
John W. Melvin, Tandelta, Inc.
- 9:00 **Application of a Finite Element Model of the Brain to Study Traumatic Brain Injury Mechanisms in the Rat**  
Hajie Mao, Liying Zhang, King H. Yang, and Albert I. King, Bioengineering Center, Wayne State University
- 9:30 **A New Model of Traumatic Axonal Injury to Determine the Effects of Strain and Displacement Rates**  
Anita Singh, Ying Lu, Chaoyang Chen, Srinivasu Kallakuri, and John M. Cavanaugh, Bioengineering Center, Wayne State University
- 10:00 **Biomechanical Properties of the Superior Sagittal Sinus-Bridging Vein Complex**  
Hans Delye, Jan Goffin, Peter Verschueren, Jos Vander Sloten, Georges Van der Perre, Herwig Alaerts, Ignaas Verpoest, and Daniel Berckmans, Katholieke Universiteit Leuven, Belgium
- 10:30-11:00 REFRESHMENT BREAK
- 11:00 **Biomechanical Response of the Bovine Pia-Arachnoid Complex to Tensile Loading at Varying Strain-Rates**  
Xin Jin, Jong B. Lee, Lai Yee Leung, Liying Zhang, King H. Yang, and Albert I. King, Bioengineering Center, Wayne State University
- 11:30 **Risk Functions for Human and Porcine Eye Rupture Based on Projectile Characteristics of Blunt Objects**  
Eric A. Kennedy, Tracy P. Ng, Craig McNally, Joel D. Stitzel, and Stefan M. Duma, Virginia Tech – Wake Forest, Center for Injury Biomechanics
- 12:00 **STAPP STUDENT AWARDS**  
Presentation by Albert I. King
- 12:15 **ADJOURNMENT**  
Harold J. Mertz and Priya Prasad, 2006 General Co-Chairs

## CALL FOR PAPERS

51<sup>st</sup> STAPP CAR CRASH CONFERENCE®  
Catamaran Resort Hotel  
San Diego, California  
October 29-31, 2007

John W. Melvin and Alan M. Nahum  
General Co-Chairs

### The Stapp Conference Advisory Committee

invites abstracts of prospective papers for consideration in planning the 51<sup>st</sup> Stapp Car Crash Conference. Papers are desired on research in impact biomechanics, human injury tolerance, and related fields that advance the knowledge of land-vehicle crash injury and occupant protection.

### Paper offers should include the following information:

1. a tentative title for the paper
2. author information (name, affiliation, address, phone, fax, and e-mail)
3. an abstract of 200 to 300 words that
  - states the objective of the study
  - outlines the problem the study attempts to solve and the methodology
  - states explicitly the data to be included
  - summarizes the results and conclusions of the study

Since paper invitations are based solely on the abstract, it is important that authors provide clear, descriptive, and specific information by which the paper offer can be evaluated. Abstracts will not be reconsidered.

### Abstracts should be submitted by

**March 9, 2007** to: Leda L. Ricci, Executive Director, Stapp Conference Advisory Committee, University of Michigan Transportation Research Institute, 2901 Baxter Road, Ann Arbor, MI 48109-2150. Authors may also submit abstracts by fax to (734) 647-3330 or by e-mail to leda@umich.edu. If you have questions regarding abstract or paper submission, please call (734) 936-1114.

Authors whose abstracts are accepted will be invited to submit a manuscript in final form by **May 18, 2007** for extensive peer review by members of the Stapp Advisory Committee. **Acceptance of an abstract does not guarantee acceptance of a paper.** Papers that are judged to meet the standards and requirements of the *Stapp Journal* will be accepted for publication and presentation.

Papers offered for consideration at the Stapp Conference must be written in an objective,

scholarly, and scientific manner, and must be free of commercialism, advertisement, and product identification. Papers must be prepared in clear English, and all data must be presented using SI units. Papers accepted for the conference must be presented at the conference.

All papers accepted for publication must be based on new data and results that will not have been published elsewhere prior to the conference, or submitted for publication elsewhere.

Authors reporting on research directly involving human or animal subjects are required to provide appropriate acknowledgment in the abstract submission and paper offer that the research was approved by a properly constituted institutional review board or ethics committee. Abstract submissions and paper offers that cannot provide this information will not be accepted for consideration by the Advisory Committee.

### Technical Paper Awards

The **John Paul Stapp Award** is offered annually for the Stapp paper presented at the previous conference that best meets the goals of the Stapp Car Crash Conference as judged by the Stapp Advisory Committee.

**Stapp Student Awards** of \$1,500, \$1,000, and \$500 are presented annually to the three students who are judged by the Stapp Student Award Committee to have made the most significant contributions to the research presented in a Stapp paper. Authors of accepted papers that include significant contributions by a student are invited to describe those contributions in a letter in order for that student to be considered. The three awards are made at the end of the conference in which the papers were presented.

# STAPP REGISTRATION

## 50<sup>TH</sup> STAPP CAR CRASH CONFERENCE® November 6-8, 2006

### EARLY REGISTRATION DEADLINE: October 27, 2006

#### Mail to:

Stapp Car Crash Conference  
UMTRI, 2901 Baxter Road, Room 422, Ann Arbor, MI 48109-2150  
Fax: (734) 647-3330 (Credit card registrations only)

#### For registration information:

Phone: (734) 961-9866; E-mail: bfolks@umich.edu or  
Phone: (734) 763-3582; E-mail: rachaelr@umich.edu

### Please attach a business card or complete the following:

Dr./Mr./Ms. \_\_\_\_\_

Name (for Meeting Badge) \_\_\_\_\_

Job Title \_\_\_\_\_

Division \_\_\_\_\_

Company \_\_\_\_\_

Department \_\_\_\_\_

Road/P.O. Box \_\_\_\_\_


City \_\_\_\_\_ State (Province) \_\_\_\_\_

Zip+4/Postal Code \_\_\_\_\_ Country (if not USA) \_\_\_\_\_

Work Phone \_\_\_\_\_

Fax \_\_\_\_\_

E-mail Address \_\_\_\_\_

 ☐ Please check here if you require special accommodations and attach a written description of your needs.

Hotel reservations and conference registration are also available on the Stapp website: <http://www.stapp.org/>



CID	CLB	CL#	OB	O#
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**NOTE: You must register by October 27, 2006 to be eligible for the reduced registration rate.**

### 50<sup>th</sup> Stapp Car Crash Conference® November 6-8, 2006

- ☐ Attendee\*
- ☐ Presenter\* (NHTSA Workshop presenters are not eligible.)
- ☐ Student\*\* (Registration must be accompanied by a letter from student's advisor.)
- ☐ Advisory Committee Member

Children under 18 are not permitted at conference functions.

\*Registration includes admission to all technical sessions, continental breakfasts, refreshment breaks, evening receptions, and a copy of the Stapp Journal.

\*\*Student registration does not include the Stapp Journal.

#### CONFERENCE FEE

	Prior to 10/27/06	AFTER 10/27/06
<input type="checkbox"/> Attendee*	\$ 600	\$ 650
<input type="checkbox"/> Presenter* (NHTSA Workshop presenters are not eligible.)	\$ 500	\$ 550
<input type="checkbox"/> Student** (Registration must be accompanied by a letter from student's advisor.)	\$ 100	\$ 100
<input type="checkbox"/> Advisory Committee Member	\$ 350	\$ 400
<b>Total</b>	<b>\$</b>	<b>\$</b>

#### Payment Method\*

☐ Check enclosed. Make payable to "Stapp Association."

☐ Charge my: ☐ MasterCard ☐ Visa ☐ American Express

Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

Visa and MasterCard 3-Digit Security No. (on back of card) \_\_\_\_\_

American Express 4-digit Security No. (on front of card) \_\_\_\_\_

Name on credit card \_\_\_\_\_

Billing Address \_\_\_\_\_

Signature \_\_\_\_\_

\*Payment must accompany registration. All cancellations must be submitted in writing. There is a \$50.00 handling charge for cancellations received before October 27, 2006. We regret we cannot process any refunds for cancellations following that date. Refunds are processed six to eight weeks after the conference. **If you have any questions, please call (734) 961-9866.**

**34<sup>th</sup> NHTSA-sponsored International Workshop  
on Human Subjects for Biomechanical Research  
November 5, 2006**

☐ Check here to register. No registration fee is required.