Automotive Research and Education at Stanford
“Automotive with a Flavor of Silicon Valley”

Energy @ Stanford & SLAC Conference
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Dr. Sven A. Beiker
Executive Director, Center for Automotive Research at Stanford - CARS
416 Escondido Mall, Bldg 550/Room 131, Stanford, CA 94305-4021, USA
(+1)650 736-1504, beiker@stanford.edu, http://automotive.stanford.edu
Dynamic Design Laboratory - Prof. Chris Gerdes
School of Engineering, Mechanical Engineering Dept
- Handling Customization, Control at Handling Limits
- Lanekeeping Assist, Envelope Control, Friction Estimation
- Control of HCCI with VVA, Multi-Combustion-Mode Engines

Artificial Intelligence Lab – Autonomous Driving Group
School of Engineering, Computer Science Dept
- Autonomous Vehicles, Driver Assistance, Assistive Technology
- Robotics Perception and Control, Machine Learning
- Statistic Methodology and Decision Theory in Robotics

CHIMe Laboratory - Prof. Clifford Nass
School of Humanities & Science, Communication Dept
- Research in Relationships btw. Humans & Interactive Media
- Quantification / Assessment of Multitasking, Driver Distraction
- Interfaces for Automobiles, Mobile Systems, Robotics
The Center for Automotive Research at Stanford is a partnership of academia and industry with the goal of advancing research and education in the automotive realm and addressing the needs of personal mobility in the 21st century.

CARS – connect > advance > reach out > support

The Revs Program at Stanford was founded to inspire a new trans-disciplinary field connecting the past, present and future of the automobile.

The Revs Program fosters an intellectual community bridging the humanities and fine arts, social sciences, design, science and engineering, and the professions.

The Revs Program is focusing on the human experiences of designing, making, restoring, driving, being driven by, living with, admiring, and dreaming of the automobile, as well as the automobile itself as machine, work of art, and cultural symbol.
Automotive Innovation Fields & Research Disciplines

If you want to create the future of the automobile, you should consider...

...because the connections and interdependencies are the challenge!
Technology, Consumers, Impact Aspects of Electric Mobility
Group of 3-5 Students
2-3 units, final paper results 12/2011

Safety Requirements and Risk Assessment of Autonomous Vehicles
Group or Individual
2-3 units, final paper results 12/2011

Peer-to-Peer Carsharing – Overview and Outlook for a New Mobility Option
Individual Student
2-3 units, final paper results 12/2011

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**Automotive Research & Education – Project Proposal**

**Topic**: Technology, Consumers, Impact Aspects of Electric Mobility

**Level**: Class Project X

**MA Thesis**: Post Doc

**Contact**: Sven Beiker, beiker@stanford.edu

**Sep, 2011**

**Summary**

As the personal mobility sector (to a large extent this means "automoblies") seems to be transitioning toward electric vehicles (EV), specific aspects regarding environmental impact, consumer preferences, or technology concepts still remain unclear. Especially the connections between those aspects are important to understand in order to determine how much electrification of the mobility sector is adequate to address the challenges of climate change, resource depletion, and air quality.

Because it is not clear whether highly-efficient conventional, hybrid-electric, plug-in hybrid-electric, battery-electric, or fuel-cell vehicles present the "best solution", the following questions should be addressed for further clarification:

- Which vehicle is the "best solution" for whom? Do respective groups know that?
- How do consumers overcome "range anxiety" and instead cherish "hypermiling"?
- How does the evolution of battery technology match with consumer expectations?
- How do public / residential utility infrastructures match with charging needs?
- Which are key regions and key players to drive an e-mobility movement?

For an independent study a team of 3-5 students is supposed to investigate the respective fields "Consumers", "Technology", and "Impact" of Electric Mobility pursuing the following steps:

- Research facts and publications in the respective fields.
- Summarize trends and needs in the respective fields.
- Generate a comprehensive scenario for electric mobility that shows benefits, challenges, and necessary decisions for the personal mobility sector.
- Discuss the findings with experts from academia and industry and propose directions for further research.

**Automotive Research & Education – Project Proposal**

**Topic**: Safety Requirements and Risk Assessment of Autonomous Vehicles

**Level**: Class Project X

**MA Thesis**: Post Doc

**Contact**: Sven Beiker, beiker@stanford.edu

**Sep, 2011**

**Summary**

From vehicles that automatically avoid obstacles to cars that are entirely capable of navigating urban terrain without any human intervention, autonomous driving is currently one of the most intensively pursued developments in automotive research. Once available to consumers, this technology could dramatically improve safety, efficiency, and mobility by taking the driver out of the loop wherever computer control is more reliable or convenient. However, this scenario also raises important questions regarding the procedures of risk assessment and certification for public use.

Because failure needs to be considered for any kind of technology, remedial actions need to be defined to minimize the implications of such failure. The process of doing this includes the risk assessment of a certain technology. For autonomous vehicles it includes considerations how the companionship between vehicle and driver needs to be designed so that the driver can take over in case of a system failure, but also which actions need to be taken if the driver cannot cope with a respective situation.

In this context, functional safety requirements for autonomous vehicles need to be established that will eventually permit the market deployment of such technology. While the process of defining those requirements is expected to be very complex and lengthy, an initial study should be conducted to frame the topic and investigate basic considerations. Therefore the following steps should be taken:

- Define typical operating situations relevant for the safety of autonomous vehicles
- Classify these situations regarding likelihood, severity, controllability
- Propose general rationale for remedial actions in case of system failure

This topic is supposed to be worked on as an independent study and the findings will be discussed with experts from academia and industry and propose directions for further research.

**Automotive Research & Education – Project Proposal**

**Topic**: Peer-to-Peer Carsharing – Overview and Outlook for a New Mobility Option

**Level**: Class Project X

**MA Thesis**: Post Doc

**Contact**: Sven Beiker, beiker@stanford.edu

**Sep, 2011**

**Summary**

Peer-to-peer carsharing recently received increased news coverage. Members of this service sign up to put their personal vehicles on a sharing program where other people who need cars can sign up to rent time slots as needed. Besides other aspects, this seems to indicate that more and more people identify differently with their vehicles. In fact, California law was changed in 2010 that removes the liability from the owner, which paved the way for the creation of peer-to-peer car sharing as the coordinating companies handle the insurance.

While several companies have begun to offer a platform for peer-to-peer carsharing, the question arises if that service should be seen as a "short-term hype" or rather as a "long-term trend". In order to find out about this, as study is proposed to tackle the following questions:

- Which are the target groups for p2p carsharing (age, gender, education, profession, location...) and why?
- Which are preferred cars for sharing (EVs, low consumption, large range, large space, small space, sporty, versatile...)?
- Which technology would help to make the sharing experience even more convenient (for the borrower, for the lender)?
- What are the specific risks of p2p carsharing compared to "normal" carsharing, renting? And what are solutions?
- Which new business models might evolve?

This topic is supposed to be worked on as an independent study pursuing the following steps:

- Summarize the evolving market of peer-to-peer carsharing solutions.
- Conduct interviews with respective service providers (and if possible with users).
- Generate an outlook how the field of peer-to-peer carsharing might evolve over the next 5 years and what the implications could be for consumers, industry, and public sector.
- Discuss the findings with experts from academia and industry and propose directions for further research.
Automotive / Mobility Related Courses 2011 / 2012

- COMM 168: Experimental Research in Advanced User Interfaces
- EE 25Q: Electric Automobiles and Aircraft
- ME 250: Internal Combustion Engines
- ME 185: Electric Vehicle Design
- ME 227: Vehicle Dynamics and Control
- ME 302: The Future of the Automobile
- MS&E 296: Sustainable Mobility
- STRAMGT 574: Strategic Thinking in Action (Automotive Industry in 2020)
- URBANST 165: Sustainable Urban and Regional Transportation Planning

Further Information: www.automotive.stanford.edu >> Classes/Jobs