Introductions

• Dan McGehee, Director
• Omar Ahmad, Deputy Director
• Tim Brown, Director – Cognitive Modeling
• Cher Carney, Sr. Research Associate
• John Gaspar, Assistant Research Scientist
• Dawn Marshall, Director, SAFER-SIM UTC
• Michelle Reyes, Research Associate
• Chris Schwarz, Director, Engineering & Modeling Research
• Andy Veit, Program Manager MINISIM™
We Have a New Director!

Daniel V. McGehee:
• Associate Professor, Mechanical and Industrial Engineering
• Associate Professor, Occupational and Environmental Health
• Associate Professor, Emergency Medicine
• Director, National Advanced Driving Simulator

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Iowa Has Interdisciplinary Approach to Vehicle Safety and Transportation
National Advanced Driving Simulator (NADS) at the University of Iowa
NADS Areas of Organization

- Human Factors & Behavioral Sciences
- Research Logistics
- Cognitive Driver Modelling
- Engineering & Modeling Research
- Instrumentation & Operations
- miniSim™
- University Transportation Center
- Automotive Medicine
- MyCarDoesWhat.org
- Information Technology
- Administrative Support
- Proposal Development, Editing, Media Support
Comprehensive Suite of Simulators and On-road Vehicles

NADS-1 Dome in Bay

NADS-2 with Heavy Truck Cab

‘12 Camry, Instrumented Vehicle

‘16 Volvo XC90, Instrumented Vehicle

Springfield: Large-Scale Virtual Proving Ground for Automated and Connected Vehicle Research

NADS miniSim™
NADS-1

• Largest motion envelope
• Sustained motion cues
• Vibration actuators provide road feel: smooth roads, rough roads, gravel
• 360 degrees of visuals
• Transforms between car, SUV, heavy truck
• Large library of driving scenarios
Recent Upgrades to NADS-1

- 16 HD projectors
- 2015 model year cab
- Rich, saturated colors; nighttime scenes
Interior representative of modern vehicles

Fully programmable infotainment system

CAN bus integration
Infotainment system integrated with simulation software
Life-like 3D pedestrians display realistic movement and behaviors.
Springfield: A Virtual Proving Ground for Connected and Automated Vehicles

- 285 square miles
- 230 miles of roadway
- 178 intersections
- 143 traffic signals
- 1362 signs
A short drive through Springfield
<table>
<thead>
<tr>
<th>Sim Comparison</th>
<th>Field of View (degrees)</th>
<th>Visual Acuity (arcmin/pixel) (Lower is better)</th>
<th>Motion Envelope Track Size (X by Y)</th>
<th>Motion DOF</th>
<th>Publicly Available</th>
<th>Number of Full Size Vehicle Cabs</th>
<th>Automated Vehicle Proving Ground</th>
<th>Full-time Technologists</th>
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</thead>
<tbody>
<tr>
<td>NADS/UIowa</td>
<td>360x40</td>
<td>H: 1.3 V: 1.7</td>
<td>64’x64’</td>
<td>13</td>
<td>Yes</td>
<td>5 (2 Cars, SUV, Heavy Truck, Tractor)</td>
<td>Yes, 285 square miles</td>
<td>8</td>
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<td>FORD Virttex</td>
<td>F: 180x40 R: 120x25</td>
<td>H: 2.3 V: 2.0</td>
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<td>6</td>
<td>Yes</td>
<td>1 Car</td>
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<td>5</td>
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<tr>
<td>Toyota/Lexus</td>
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<td>H: 2.3 V: 2.0</td>
<td>100’x64’</td>
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<td>No</td>
<td>1 Car</td>
<td></td>
<td>?</td>
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<td>George Mason</td>
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<td>FHWA HDS</td>
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<tr>
<td>Ohio State</td>
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<td>Yes</td>
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<td>?</td>
</tr>
</tbody>
</table>
NADS miniSim™

- Portable, small footprint
- Off-the shelf parts. Single PC.
- Cost Effective, Reliable
- Multiple configurations
  - Quarter Cab
  - Simplified Cab
  - Desktop
- Tool for collaboration across institutions/industry/agencies
- Scenarios/software compatible with NADS-1, NADS-2 simulators
- Growing network of users
- Software actively being improved
  - Distributed simulation
  - Automated vehicle models
  - Multi-site studies
Dual-Purpose Instrumented Vehicle

• Modern 2012 Toyota Camry with navigation
• Instrumented sensors and CAN bus integration
• Repositionable video cameras for cab and roadway views
• Can link to part-task simulator
Level 2 Vehicle
Our Capabilities

Development

• Hardware Engineering / Instrumentation
• Software Engineering
• Integration with 3rd Party Devices / Software
• Vehicle Dynamics
• Automated Vehicle Models
• Driver Behavior Models

Human Subject Studies

• Experimental Design / Test Plan
• IRB / Subject Recruitment / Handling
• Data Collection using Simulators, Instrumented Vehicles, Naturalistic Data Recorders
• Dosing/Drug Protocols
• Data Reduction / Analysis
• Report Writing
Task/System Evaluation for Automakers

• Evaluate driver interfaces for media system functions
  • Radio
  • Navigation
  • Phone
  • Setup
• NHTSA Visual Manual Distraction Guidelines
• Utilized occlusion and simulation methods
• Measures for each task:
  • Total glance time/shutter open time
  • Mean glance time
  • Percent glances longer than 2 seconds
• Produced pass/fail report for each task
National leader in consumer education of advanced driver assistance systems

It’s all about reducing driver error and making our roads safer

Campaign has achieved over 5.8 billion media impressions in one year
Driver State Detection

• Algorithms for detecting driving impairment from alcohol, distraction, and drowsiness
• Off-line vs. real-time
• Real-time drowsiness algorithm uses steering, throttle, brake
• Tested mitigation systems for drowsiness
• Distraction currently under development
• Hierarchical model includes both
• Research idea for applying driver state detection for automated driving
Automated Vehicle Models

• Self driving mode
• Transfer of control between automated and manual
• Usable for all levels of automation
• Automated vehicle can turn, change speed, change lanes, pull over, merge/exit highways
• Currently software model only
• HMI needs work
• Does not model specific vehicles yet; want to develop