

Overview & Capabilities



Driving Simulators

Technology

Software

Vehicle Technology

Acceleration

Driving Safety

Research

Discovery

Dedicated Team of Experts



THE
NATIONAL ADVANCED
DRIVING SIMULATOR



The nation's premier driving simulation facility.

Our mission is to improve driving safety for everyone by researching the connection between humans and motor vehicles.



Inside the NADS-1 today.

What is NADS?



NADS is the nation's premier driving simulation research and development facility. In 2001, the NADS-1 became operational and was the largest and first simulator of its kind anywhere in the world.

The Beginning

In 1992, the National Science Foundation held a competition to find the host site for a driving research center. The University of Iowa won and with investments of \$80 million from the US DOT, a consortium of companies, University of Iowa, and the State of Iowa NADS was created.

What We Do

Since our inception we have accrued over \$55 million in funding through contract-based research for government agencies and industry organizations. We have conducted over 50 research studies with more than 3,900 volunteers.

NADS Research

Keeping up with the pace of technology we are always expanding our areas of research expertise. Our range of current projects includes:

Paving the Way for Driverless & Connected Vehicles



- Vehicle-to-Vehicle (V2V) Crash Warnings
- Vehicle-to-Infrastructure (V2I) Applications for Heavy Trucks

- Distraction Unique to Connected Vehicle Technology (CV)

Expanding Areas of Research Expertise

- Integrating Geospatial Information into Simulation
- Using Simulation in Roadway Design
- Distraction Guideline Conformance Testing
- Creating Simulator Protocols for Crash Test Warnings

Impacting the Future of Safety

- Assessing Legal & Illegal Drug Impairments on Driving
- Driver State Detection from Vehicle Control Data
- Assessment of Agricultural Tractor Drivers

Developing New Simulations & Test Methods

- Instrumented On-Road Vehicle
- New Scenarios for Driver Training
- How Glare Affects Vision After Eye Surgery
- Duplicating European Roads & Racetracks



NADS Control Room



Live Stream from NADS-1 Drive

NADS Facility & Operations Today

Today, we operate a suite of compatible driving simulators the

NADS-1



NADS-2



miniSim



and a dual-purpose instrumented vehicle to conduct studies to help accelerate the adoption of new vehicle technologies for safety advancements and the next generation driving.

Capabilities & Research Expertise

- Scenario & Virtual Environment Development
- Simulator Design & Software Development
- (OEM) Hardware & Software Integration
- Cab Instrumentation
- Vehicle Dynamics
- Motion System Design & Maintenance
- Consulting Services

We have a staff of experts in the areas of human factors, psychology, and pharmaceuticals.

- Experimental Design
- Subject Recruitment
- Dosing & Treatments
- IRB/Regulatory
- Data Collection
- Data Reduction, Analysis & Interpretation
- Report Writing

NADS Partnerships

Our research capabilities and range of simulation technology have provided the opportunity to form partnerships worldwide and across multiple industries.

Department of Transportation

Automotive Industry



Pharmaceutical Industry



NADS Staff 2014



Iowa Senator Tom Harkin
Visits NADS 2014

Range of Simulation Applications

- Vehicle Safety & New Technologies
- Highway Design
- Driver's Education
- Safety/Remedial Training
- Clinical Trials
- Clinical Assessment
- Military Training & Simulation



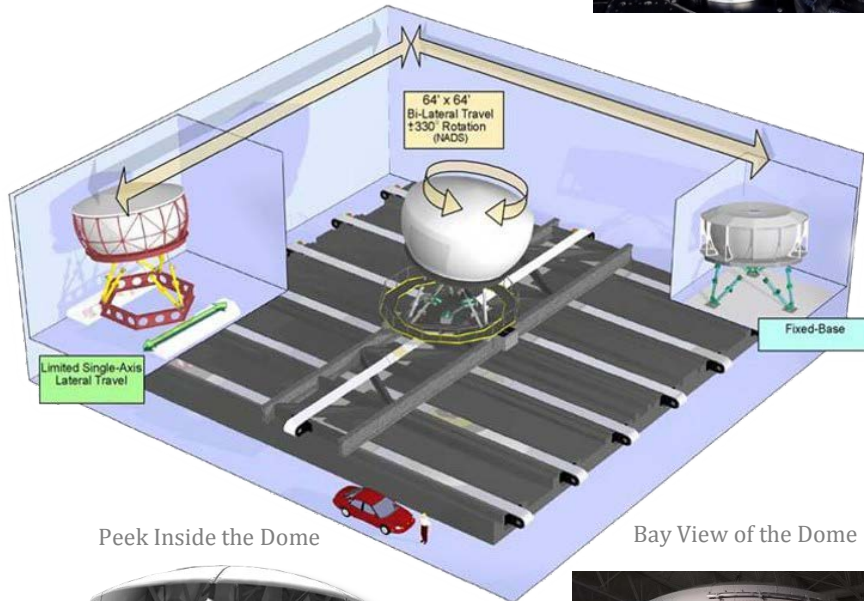
Day & Night Scenarios
Developed at NADS

NADS-1 – Technical Specifications

The combination of its large motion envelope, HD graphics from 16 projectors, custom software, vehicle cab flexibility, and measurement capabilities continues to make it one of the most advanced driving simulators in the world.

Producing Motion & Road Sensation

- 13 degree of freedom motion base
- 6 DOF hexapod
- X-Y rail system (64 ft. x 64 ft.)
- Turntable (+/- 330 degrees)
- 4 independent vibration actuators



Peek Inside the Dome

Bay View of the Dome



NADS-1 – High Fidelity

Produces the most realistic driving experience to date in a controlled, repeatable environment.



Interior with Malibu Cab

Driving Realism

- 4 independent vibration actuators at each wheel allows the driver to feel different types of roads (smooth, rough, gravel).
- The 13-degree motion base provides unparalleled sensation of braking, sliding, and turning.
- 360° of driving scenery that include varying visibility conditions and realistic human pedestrians.
- Audio sounds include engine, road, wind, traffic, navigation, alerts, and other special features.

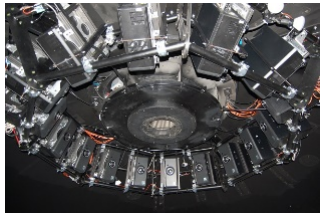
Vehicle Flexibility



- Multiple cab options are available including: Chevy Malibu, Jeep Cherokee, and Freightliner heavy truck.
- Validated vehicle dynamics simulate cars, SUVs, heavy trucks, farm tractors, and wheel loaders for better measurement of handling comparisons.

NADS-1 – Inside the Dome

Producing Simulation Scenery



- 16 Digital WUXGA: 1920x1200 LED Projectors display 360° of rich, saturated colors for realistic night scenes.

- LED lighting improves fidelity

in day scenes, and better dimming for night imagery.

Data Collection Features of NADS-1 & NADS-2

- Using Facelab 5.0 both simulators measure eye-tracking.
- Glare device in NADS-2 mimics oncoming traffic's headlight glare.
- Posture data from seat sensors.
- Video data from multiple cameras.
- Secondary mirrors, displays, and response buttons for distraction tasks.



Visuals During Actual Drive



Taurus Cab Interior

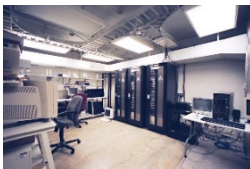


Image Generatoor

Our internally developed PC based Image Generator controls warping, blending, and viewpoint controls for 360 degrees of clear visuals.

NADS-2 – Medium Fidelity

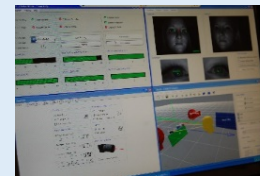
The same advanced simulation and measurement technologies of the NADS-1, but without the motion. It supports the same cab options, realistic driving scenarios, and has the same high resolution visuals. This makes it a great compliment or option for any driving simulation needs.



NADS-2



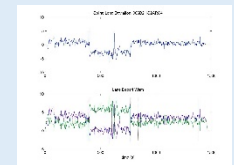
NADS-2 with Heavy Truck Cab



Eye-tracking Interface



Glare Device



Sample of Data Collected

Dual Purpose Instrumented Vehicle

The NADS facility recently added a dual purpose instrumented vehicle to our resources. Our 2012 Toyota Camry doubles as a fixed base simulator in our NADS-2.

It has navigation, instrumented sensors, CAN bus integration, and repositionable video cameras for cab and roadway views expanding the types of research and data we can collect at NADS.



NADS miniSim Global Network

The miniSim has facilitated collaboration with researchers and practitioners around the globe, which has enabled multi-site studies and built a network of simulation professionals. There are nearly 50 minSims located at university, industry, and government labs in 4 countries.



NADS miniSim

The miniSim™ driving simulator is PC-based, with powerful scenario editing, data acquisition and analysis capabilities that are based on nearly 15 years of research and driving simulation experience at the NADS facility.

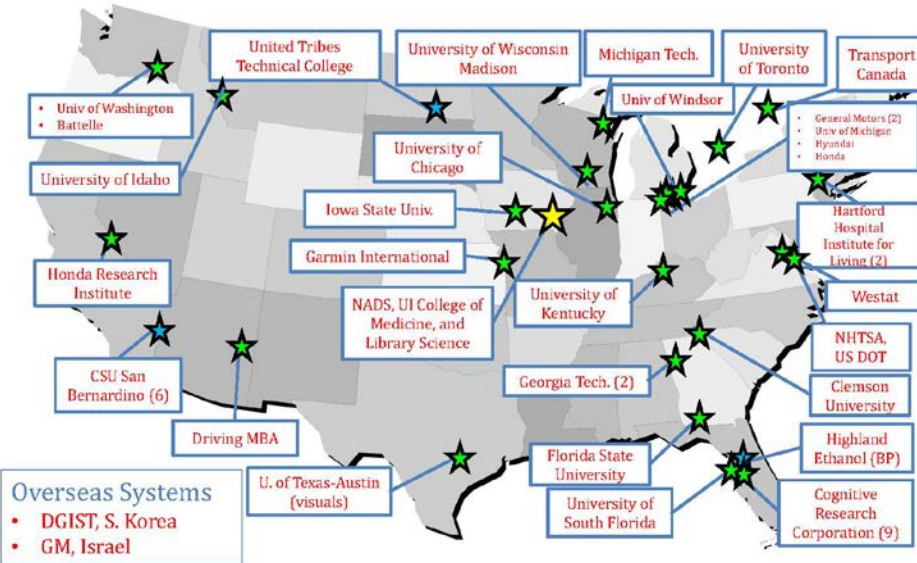
The miniSim is based on software developed for the NADS-1, and it is now available for research and commercial applications through the miniSim program.

Scenarios and visual environments are fully compatible between the miniSim, NADS-1 and NADS-2. NADS staff utilize the same tools that are included with the miniSim to execute research on the NADS simulators.

Multiple Configurations

While all miniSims use the same software, the hardware is available in three standard hardware configurations: Quarter Cab, Simplified Cab, and Desktop.

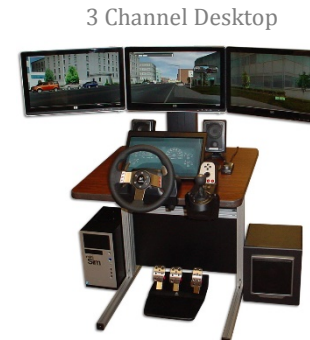
In addition, NADS engineers can deliver a custom hardware and software solution to meet your needs, including cab and display systems, visual environments, control algorithms, APIs, and integration with auxiliary devices.



The **Power** of the World's Most Advanced Driving Simulator.

The **Flexibility** of a Desktop Computer.

The **Support** of a World of Professionals.



NADS Simulation

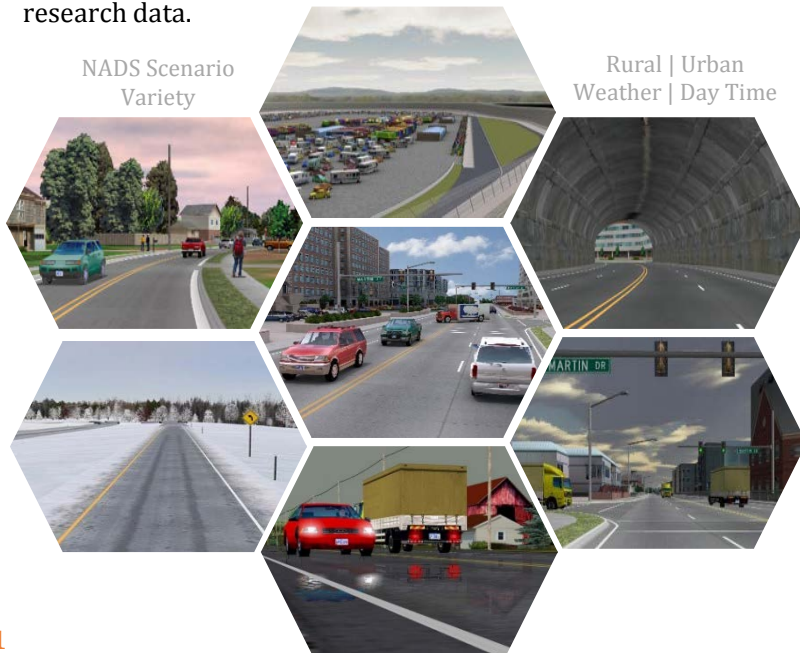
We have created a safe and accurate environment to test and measure the effectiveness of vehicle technologies and human factors that are evolving our transportation systems today.

Simulation Software

Our simulation software is developed in-house, which makes it compatible with each of our simulators. This provides the opportunity for a single study to collect data using a range of fidelity.

Virtual Driving Reality – Our simulation scenarios have advanced vehicle dynamics, realistic humans, particulate weather effects, and variable friction roadways to add to the realism of the experience.

Data Collection & Analysis – During drives the software collects over 100 variables to monitor behavior and performance. The data is compatible with tools like Matlab, SASS, SPSS & R to provide a detailed statistical analysis to make the most of your research data.



Research Discoveries

The Impact of Simulation

Results from some recently completed research studies with our long-term partner, NHTSA.

Fact: 22-24% of crashes per year are caused by drowsy drivers (averaging 850 deaths in one year).

Multi-Year Vehicle Based Sensors of Driver Impairment – Drowsiness Study

Results: Our researchers developed a machine learning algorithm that detects drowsiness in real-time. Through the use of inexpensive, vehicle-based **sensors drowsiness can be successfully detected 6 seconds before lane departure.**

Similar algorithms can be used to detect alcohol impairment and distinguish between the two situations.

Fact: People over age 65 are the fastest growing segment of the U.S. population and are over represented in intersection crashes and account for nearly 50% of fatal intersection crashes.

Enhancing the Effectiveness of Safety Warning System for Older Drivers Study

Results: **Drivers were 3 times less likely to violate a red light or stop sign** when they had a warning system in their vehicles.

It also showed the most at-risk population of older drivers stopped before the collision zone 2.6 times more.

Connected Vehicles



We are currently working with the USDOT and state government to help make a connected transportation system a reality.

The Connected Vehicle (CV) technology is being designed by the USDOT and major automakers to increase drivers' situational awareness and could affect up to 82% of crashes, preventing tens of thousands of them each year.

We have created simulation scenarios and begun conducting research on the driver-vehicle interface, studying the interactions people have with the technology's alert system.

Future Research

- Humans & Automation
- Safety Benefits of New Vehicle Technologies
- Effects of Different Combinations of Drugs, and Distraction on Driving
- Driver Response to Pedestrians & Bicycles
- Sleep Disorders
- Neurological Conditions
- Veteran Crash Rates (Particularly Motorcycle)
- Simulator Role in Rehab & Medical Settings
- Human-Vehicle Interface
- Driver Monitoring Systems
- Vehicle Lighting



University of Iowa Partners

Our facility is part of the College of Engineering at the University of Iowa. This has provided us the opportunity to establish partnerships with a number of invaluable resources in our backyard.

Public Policy Center
Human Factors & Vehicle Safety

College of Engineering
Industrial, Civil

College of Liberal Arts & Sciences
Computer Science, Psychology, Geography

College of Medicine
Psychiatry, Neurology, Vision Rehab

College of Pharmacy

**College of Public Health Occupational
& Environmental Health**



Virtual Iowa City developed by NADS.

University Transportation Center (UTC) Program



The NADS facility was appointed the lead institution by the UTC for the Safer-Sim Program for Safety Research Using Simulation.

Mission: To advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research and technology transfer at university-based centers of excellence.

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