



**PROGRAM PROGRESS PERFORMANCE REPORT FOR
UNIVERSITY TRANSPORTATION CENTERS**

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Research and Innovative Technology Administration

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Project Title: Safety Research Using Simulation (SAFER-SIM)

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Overview

The SAFER-SIM center was established in October 2013. Since that time we have begun the research projects included in the initial grant proposal. The first round of competitive research grants was completed and 11 new projects have begun. The second round of competitive grants is mid-process with 30 new proposals received Oct.1 2014 which are now under review. We also participated in several outreach events including summer transportation camps, K-12 teacher training, and freshman engineering course curriculum development related to safety and simulation. We held our first Safer-Symposium which brought together faculty and students from all the consortium schools for a research and technology exchange at the University of Massachusetts-Amherst.

1. Accomplishments

a. Goals and objectives of the program

The goal of the SAFER-SIM UTC is to use simulation techniques to address the safety issues prioritized by the US DOT. Specifically, our center has identified seven areas of activity:

- 1. Conduct safety research using simulation techniques.** Researchers at all of the consortium institutions began work on the initial collaborative projects and individual institution research programs that were proposed in the 2013 Center proposal. The Consortium held a competition for additional research projects with FY13 funding in February. Proposers submitted a two-page project description. All of the SAFER-SIM Associate Directors reviewed these and provided comments and rankings. Eleven proposals were received. Each school selected one project to begin in June or September 2014. These project have all now begun and are supporting approximately 14 graduate and 8 undergraduate students, as shown in Table 1. Faculty and students from Engineering, Public Health, Psychology, and Computer Science are participating in these projects.

The RFP for projects funded with FY2014 money was issued in August. This competition invited proposals for large collaborative multi-institution projects as well as individual institution projects. The larger projects will be reviewed by Advisory Board Members. Proposals were due Oct. 1 and funded projects will be announced Dec. 1 following review and ranking by the consortium associate directors. We saw a strong increase in the number and variety of proposals submitted compared to the first round. This is an indication of growing visibility of our center on campus and the success of our marketing efforts. Table 2 lists the proposal titles, PI Departments, and project type.

To summarize the proposals received in October 2014, we received:

- 24 Individual research projects;
- three collaborative research projects; and
- three proposals for course development and STEM curriculum development

Table 1. Research projects selected for funding with FY13 money.

Project Title	Project Type	Institution (s)	PI Co-PI	PI Departments	# of Grad Students	# of Undergrad Students
Examination of Driver Behavior in Response to Pedestrian and Bicyclist Behaviors						
	Individual	Iowa	Cara Hamman Susan Chrysler	Public Health NADS	1	1
Using Connected Vehicle Technology to Deliver Timely Warnings to Pedestrians						
	Individual Completed	Iowa	Joe Kearney Jodie Plumert	Computer Sci Psychology	1	2
Cross-Platform Driving Simulator Scenarios to Use in the Roadway Design and Planning Process						
	Collaborative	Iowa Wisconsin	Shawn Allen David Noyce	NADS Civil Eng	2	1
Effectiveness of In-Vehicle Virtual Traffic Control Devices						
	Individual Completed	Wisconsin	David Noyce	Civil Eng	2	1
Driving Simulators for Virtual Road Safety Audits						
	Individual	Wisconsin	David Noyce	Civil Eng	2	1
The Effect of Roadside Vegetation and Clear Zone Design on Driver Behavior						
	Individual	UMass	Mike Knodler	Civil Eng	1	1
Development and Evaluation of Infrastructure Strategies for Safer Cycling						
	Individual Completed	UMass	Mike Knodler Kathryn Slater	Civil Eng	1	20+ (class project)
Impact of Deflection Angle on Roundabout Driver Behavior						
	Individual Completed	UMass	Eleni Christofa Mike Knodler	Civil Eng	1	1
Operational and Safety-Based Analyses of Varied Toll Lane Configurations						
	Collaborative	UMass UCF UPRM	Mike Knodler M. Abdel-Aty Didier Valdes	Civil Eng	3	0
Integration of Microscopic Big Traffic Data in Driving-Simulation-Based Safety Analysis						
	Individual	UCF	M. Abdel-Aty	Civil Eng	2	1
Dynamic Simulation Models for Road Safety and its Sustainability Implications						
	Individual Completed	UCF	M. Tatari	Civil Eng	1	0

Table 2. Proposals received in Oct 2014 for FY14 funding.

Project Title	Project Type	Institution (s)
Utilizing Micro Simulation to Evaluate the Safety and Efficiency of the Expressway System	Individual	UCF
Determining the Optimal Locations of Wrong-Way Driving Countermeasures on the Central Florida Expressway Authority's (CFX) Toll Road System	Individual	UCF
A Low-Cost Mobile Sensor-Augmented Blind Spot Monitoring Add-On System	Individual	UCF
Exploratory Simulation Models for the Road Safety-Climate Nexus	Individual	UCF
Evaluation of the Distraction Potential of Novel Messaging Systems	Individual	UCF
Psychological Efficacy of Work Zone Barriers	Individual	UCF
Lane Keeping during Distracted Driving and Simulator Fidelity	Individual	UI
Speed Control during Distracted Driving and Simulator Fidelity	Individual	UI
Identifying Postural Control and Thresholds of Instability Utilizing a Motion-Based ATV Simulator	Individual	UI
Using a driving simulator to determine safety of driving in patients with a peripheral neuropathy	Individual	UI
Anthropometric Fit of Children to Youth-Size All-Terrain Vehicles	Individual	UI
An Investigation of Peer Influences on Risky Child and Adolescent Pedestrian Road Crossing	Individual	UI
Effectiveness of user-adaptive Forward Collision Warning for older drivers	Individual	UI
Automation at the Boundaries: Will Drivers Trust Automation if It Does Things They Would Not	Individual	UI
Transfer of Control from Automated to Manual Driving: Immediate and Prolonged Effects on Driving Performance	Individual	UI
The Relationship between Nurses' Fatigue and Driving Performance	Individual	UI
Models of Driving: Simulator assessment of Adaptive Cruise Control conceptual understanding	Individual	UI
Proposal for Simulation and Predictive Modeling in Support Predictive Maintenance for Category 7 and 8 Vehicles	Individual	UI
Visually Impaired Pedestrian Safety at Roundabout and Midblock Crossings	Individual	UMass
The Impact of Vehicle Automation on the Safety of Vulnerable Road Users	Individual	UMass
Analysis of Driver Behavior and Operations Intersection Short Lanes	Individual	UMass
A Driving Simulator Evaluation of Cross-Sectional Design Elements and the Resulting Driver Behaviors	Individual	UMass
Neural Correlates of Older Driver Performance	Individual	UW-M

Driving Simulator Evaluation of Countermeasures to Improve Pedestrian and Bicycle Safety	Individual	UW-M
Phase II: Operational and Safety-Based Analyses of Varied Toll Lane Configurations	Collaborative	UCF, UMass, UPR-M
Assessing cognitive distraction from heads-up displays during driving	Collaborative	UI, UCF
Using naturalistic driving data to develop simulator scenarios	Collaborative	UI, UW-M
Exploring the Science of Driving	Education /STEM	UI
Train the teacher: transportation topics in K-12 math and physics curriculum	Education /STEM	UI
Global Road Safety	Education /STEM	UI

2. Leadership Development. As described in the grant proposal, we are planning on a series of research symposia where students supported by our center will be able to present and participate in leadership development activities. The first of these “Safer Symposium” events was held in late September at the University of Massachusetts-Amherst. This three day event brought all of the associate directors and their students together for technical exchanges, role-playing professional development exercises, and research presentations. Thirty eight people attended from the five schools plus two researchers from the driving simulation laboratory at the Liberty Mutual Insurance Research Institute for Safety. In total, 29 students participated in the events of the Safer Symposium.

The first evening dinner activities revolved around an activity we called “The Situation Room.” Students were broken into four groups with 4-6 students at a table. Each associate director spent fifteen minutes at each table leading the students through an exercise on professional networking skills. The topics covered were:

- How to introduce yourself to a conference speaker after a presentation
- How to introduce yourself to a peer or professional at a social function
- What to say when you are presenting a poster
- What to say when you are visiting a poster

This activity was well-received by the students and they had a chance to put their new skills into action at the social events during the following days.

The collaborative research project teams had time in the agenda to meet to discuss technical issues surrounding simulator scenario and visual environment development as well as performance measures and analysis techniques. Students directly funded by SaferSim projects as well as other students active in the participating labs each presented short overviews of their projects.



Figure 1. Students discuss technical issues in the UMass Human Performance Lab



Figure 2. Twenty-nine students attended the lectures, tours, and networking events at the Safer Symposium



Figure 3. A group of participants at the Safer Symposium at the University of Massachusetts-Amherst

3. **Education and Workforce Development.** The SAFER-SIM consortium members organized several education events and made plans for future collaborative efforts in education and workforce development.

Dr. Mike Knodler at **UMass-Amherst** has developed curriculum units about traffic safety and simulation to incorporate into the freshman general engineering course. The activity based video includes a mix of both driving simulator scenarios and active micro simulation models that encourage active audience participation. The developed scenarios are appropriate for a range of ages and tend to couple nicely with a live demonstration of a driving simulator. These activities are being used Fall 2014 semester at UMass-Amherst.

The **University of Central Florida SaferSim** team participated in Camp Connect engineering exploration program on Tuesday, July 15. The students were welcomed by Dr. Mohamed Abdel-Aty, who shared an overview of the diversity of disciplines within the Department of Civil, Environmental and Construction Engineering (CECE). Each type of engineering was explained using real-world examples of where its role fits in the industry. The students then embarked on an experience where the students participated in multiple activities revolving around the selected CECE disciplines.



Camp Connect has evolved into a multi-year experience that is a summer engineering exploration program with three differing programs for students to return to and experience. Targeted for students from underrepresented communities, the program is facilitated each summer by the College of Engineering and Computer Science (CECS) Office of Diversity. Each program is a week-long experience takes 8th through 10th graders into the realm of the engineer by exposing them to the many different disciplines found within CECS.

The goal of the camp is to fuel kids to become more interested and realize their desire to become involved in the engineering field. Students participated in presentations, activities, lab tours and were given insight into what the life of a college student and an engineering professional is like, beyond the classroom. The program provided a method of exploration and preparation advice for the start of their college career by networking with students and faculty at UCF in addition to presenting their experiences to their peers.

Camp Connect students were able to partake in a tour of the driver simulator that was hosted by the Center for Advanced Transportation Systems Simulation (CATSS), which included a brief presentation about the transportation industry. At the same time, the students also explored the facilities of our Transportation Lab and were given an overview of the types of work that goes on in both facilities and how they are applied to the real-world. The culmination of the experience was a visit to the CATSS driver simulator. CATSS was able to show the students the driver seat module of a track-trailer cab providing them with a tour and synopsis of the types of

projects that may warrant the need for a simulator. Although to many of the students, the simulator may have looked like a video game, it was stressed that this is a vital tool in many research projects that happen at the university.

Hosted by Alex Navarro, the tour began with a visit to the control booth where the systems that run the simulator were explained. Students were asked questions about the scenarios that should be considered for simulation and some of the applications to current topics in research in this field. In addition to providing an overview of the application of the simulator's use they were also informed of the logistics of the simulator along with the human interactions that may be encountered while the device is in operation. With a variety of configurations, the simulator showcases the diversity of research initiatives that have been undertaken at UCF. Some of the current research projects were explained to the students as a part of this experience. The team was ecstatic to participate in a program that gives an insight into the fundamentals of what we accomplish.



The Traffic Operations and Safety Lab (TOPS Lab) at the **University of Wisconsin-Madison** conducted several outreach activities related to driving simulators and traffic safety.



Congressman Mark Pocan, the U.S. Representative for Wisconsin's 2nd district, visited the Wisconsin driving simulator laboratory as part of his campus visit September 30, 2014. David Noyce, Associate Director of SaferSim and a UW-Madison Civil Engineering Professor, discussed the benefits of using full scale driving simulator to proactively evaluate safety of proposed highway projects. The congressman expressed interest in the process and inquired about how federal funding helps support the efforts of the research team.

The TOPS lab also hosted the Transportation Engineering and Road Research Alliance (TERRA) which is a dynamic partnership of government, industry, and academia that continuously advances innovations in road engineering and construction. SaferSim Associate Director and Civil Engineering Professor, David Noyce made an elaborate presentation to the visiting TERRA group on the invaluable role driving simulators can play in improving safety, mobility and economic effectiveness of the transportation system.

On September 25, 2014 a group of engineers from the Wisconsin Department of Transportation's Bureau of Project Development visited the UW driving simulator to understand the benefits of the incorporating driving simulators into project planning, design, and

evaluation. The team from the Wisconsin DOT had an opportunity to discuss how the simulator has been previously used to visualize proposed designs. Furthermore, strategies for integrating full scale driving simulation into the project design workflow were discussed. The Wisconsin DOT was particularly interested in how proposed projects design documents can be used to create driving simulator scenarios and the resultant benefits for designers and the general public.

TOPS Lab researchers Dr. Madhav Chitturi, Kelvin Santiago and David Noyce presented “Neural Correlates of Older Driver Performance” at the Alzheimer Research Day Poster session on May 15th, 2014, held at the Wisconsin Institute for Discovery on the University of Wisconsin-Madison campus. The event included presentations from all disciplines that address normal aging, Alzheimer’s disease and other dementing illnesses and opportunities to foster collaboration across disciplines.

The objectives of the research presented were to investigate age-related differences in the brain networks engaged in simulated driving tasks and investigate if fMRI (functional Magnetic Resonance Imaging) measures can predict unsafe driving behavior. The adjacent picture shows the incorporation



of a driving simulator into a MRI scanner environment. The presentation was very well received and multiple researchers from the University of Wisconsin School of Medicine expressed interest in incorporating driving simulators into their research.

The University of Wisconsin – Madison SaferSim team also participated in these outreach events:

- Outreach to consultants about using the simulator for examining driver behavior for innovative interchange designs
- Outreach about simulator at DataPalooza in Washington, DC (June 2-4)
- Project training Civil 3D-Blender-Simulator with UMass on June 13th. A video was created and has been used by others in the UTC.
- Outreach to Bob Aresenau, City of Madison, to discuss roundabouts.
- Outreach to Wisconsin Division of Health Services (July 8th)

The **University of Iowa** staff at the National Advanced Driving Simulator participated in an NSF funded summer program for K-12 teachers focusing on incorporating science across the curriculum. Science Education faculty member Dr. Leslie Flynn along with a high school physics teacher from the Iowa City School district organized a variety of hands-on science learning

activities for a group of elementary school teachers to the simulator.



Figure 4. Dr. Chris Schwarz points out the new projectors for a group of elementary school science teachers participating in a summer institute on teaching science across the curriculum.

The activity developed by Dr. Chris Schwarz of NADS led teachers through interpreting graphs of driving performance measures by pairing them with video clips of Dr. Flynn driving in the simulator.

In September, the National Advanced Driving Simulator provided simulators and staff support for the U.S. DOT exhibit booth at the Intelligent Transportation Society World Congress in Detroit. SaferSim participated by providing a touchscreen kiosk for visitors to use to view video clips about Connected Vehicles and driving simulator safety studies. The World Congress held daily Youth Showcase activities involving STEM students from nearby middle and high schools. While these groups were touring the exhibit floor, Dr. Chrysler invited them to visit the U.S. DOT booth to get an opportunity to drive the simulators and learn about future Connected Vehicle applications. Over 150 students visited the booth over the course of several days and enjoyed driving the simulator and learning about future transportation concepts. Even Assistant Secretary Winfree got an opportunity to drive the simulator and visit with the students.



Figure 5. Dr. Chrysler shows a group of students video recordings of vehicle safety research drives at the SaferSim kiosk in the U.S. DOT Booth at the ITS World Congress meeting.



Figure 6. STEM high school students from the Detroit area drive a simulator in the U.S. DOT booth at the ITS World Congress meeting.



Figure 7. Assistant Secretary Greg Winfree drives the Connected Vehicle demonstration simulator in the U.S. DOT booth at the ITS World Congress.

The University of Iowa SaferSim team also hosted several simulator tours during this reporting period. These included Paul Trombino, the Executive Director of the Iowa Department of Transportation. U.S. Senator Tom Harkin visited NADS in August and met several University of Iowa students working on SaferSim projects during his visit. Senator Harkin had been instrumental in securing funding for the creation of the National Advanced Driving Simulator and has been a strong supporter of simulation and education throughout his career.



Figure 8. U.S. Senator Tom Harkin (D-IA) visits the National Advanced Driving Simulator.

4. **Technology Transfer.** The SaferSim lecture series was launched in September with a presentation by Dr. John Gaspar of the University of Iowa on recent driving distraction work. A video of the lecture is available on our website.

The 14th COTA (Chinese Overseas Transportation Association) International Conference of Transportation Professionals (CICTP 2014) was held in Changsha, China, July 4-7 2014.



SaferSim Associate Director David A. Noyce made a presentation on “Development of New Technologies for Safer and Smarter Intersections” at the conference. Dr. Noyce also interacted and discussed with Chinese students about ongoing traffic safety and driving simulation research at SaferSim and UW-Madison.

5. **Collaboration.** The collaborative research projects are utilizing web conferencing, site visits, and regular teleconferences to work together to solve the technical issues associated with the work. University of Puerto Rico-Mayaguez student Juan Rivera spent the summer at UMass-Amherst learning to create simulator objects for their collaborative project on toll plaza operations. University of Iowa staff member Shawn Allen visited the University of Wisconsin-Madison to demonstrate software used to create simulator visual environments with the team for the collaborative project on simulator tools for roadway design.



Lecture Series
Wednesday September 24
3:00-4:00 PM
3220 Seamans Center

Investigating the effects of videophone conversations on younger and older driver performance

Dr. John Gaspar
National Advanced Driving Simulator
University of Iowa

Cell phone use can impair driver performance and safety, and such impairment is theorized to stem, in part, from the remote conversation partner's lack of awareness about the driving situation. The goal of the present experiments was to investigate a novel strategy for mitigating driver distraction by providing remote partners views of the driver and driving scene via a novel videophone interface. The efficacy of the videophone in reducing distraction for different driver groups (younger, older) and in different driving environments (highway, intersections) will be discussed.

Questions? Contact SaferSim@uiowa.edu

Sponsored by the Chinese Overseas Transportation Association (COTA), the Central South University, the Transportation Research Board, the Institute of Transportation Engineers (ITE), and the Transportation and Development Institute (T & DI) of the American Society of Civil Engineers.



Figure 9. University of Puerto Rico-Mayaguez student Juan Rivera and the virtual toll plaza he created while working at UMass-Amherst for the summer.

6. **Program Efficacy.** The center continues to hold bi-weekly teleconferences among the consortium members to share information, track progress on collaborative research projects, share outreach ideas, and plan future activities. These regular phone calls have proven to help preserve the collaborative nature of our center. A student marketing assistant was hired at the University of Iowa to maintain the website and promote Center activities. This person, Adrienne McKee, has a journalism background and is currently pursuing a second degree in computer science. We have initiated a bi-weekly digest of news items related to safety and simulation that is being distributed via email to over 150 people. Archives of the news digest are also posted on our website.

UTC program staff from OST-R conducted their site visit at the University of Iowa in June. While in Iowa they toured several simulation facilities and discussed Center deliverables and programs.



Figure 10. OST-R staff visit the simulation facilities at the University of Iowa during their June 2014 site visit.

In June, SaferSim director Sue Chrysler and administrative assistant, Kathy Holton, attended the Council of University Transportation Center meeting in Lincoln, Nebraska.

- 7. Diversity.** SaferSim Research projects are providing funding for several students from minority groups. The UCF summer camp program was specifically targeted toward underrepresented student groups to encourage careers in engineering.

Plan for Next Reporting Period

Now that the Center has been established administratively, the next reporting period will bring more activity in research, education, and outreach. Planned activities are:

- Second Safer Symposium to be held at the University of Puerto Rico-Mayaguez.
- UI will attend high school STEM events organized by the state STEM office as well as by invitation. Many of these visits will include the mobile simulator developed in partnership with Iowa State University.
- The SaferSim lecture series will continue with videos available on our website.
- All FY14 funded research projects will be underway.
- First Advisory Board meeting will be held in November.
- Student of the Year will be selected.
- SaferSim student social meeting will be organized during TRB.

b. Products

The SaferSim News Digest is available by subscription at our website. This email digest gathers news stories, program announcements, and conference information from around the world in the areas of safety and simulation. (<http://safersim.nads-sc.uiowa.edu/>) The website also hosts videos from the SaferSim lecture series.

c. Participants & collaborating organizations

The University of Iowa (UI) is collaborating with the Midwest Transportation Center regional UTC at Iowa State University (ISU) in developing a mobile driving simulator demonstration for teenagers. The initial phase of the demonstration includes a short drive where students will be asked to read a text message during the drive. The simulator will then display driving performance measures while distracted compared to baseline. This scenario was created by an undergraduate Computer Science major at UI and a Civil Engineering graduate student at ISU.

MetroPlan Orlando (area MPO) hosted a UCF student as a summer intern, partially supported by SaferSim.

d. Impact

Because our center is so new, it is hard to assess the impact to date beyond attendance at events. Clearly, within each institution, the establishment of SAFER-SIM has had an impact on students and researchers through new projects. Through the outreach events, we believe we have had an impact on the students and community members who attended.

The re-establishment of the DrivingWiki site will enable shared access to technical simulation information worldwide.

Additional information regarding Products and Impacts

Several of the SaferSim consortium member faculty has had the opportunity for international travel over the past six months. While these trips were not directly funded by the UTC, the trips served to promote awareness of SaferSim's products, news digest, and website offerings.

Dr. Abdel-Aty visited Beijing Jiao Tong (BJTU) and Tsinghua Universities in China in the period September 8-12, 2014. UCF's Department of Civil, Environmental and Construction Engineering is cooperating with BJTU's School of Transportation Engineering on multiple research and educational fronts. UCF and BJTU have an active MOU and other agreements. During his visit to BJTU, Dr. Abdel-Aty was able to visit several simulator facilities including a passenger car, light rail, and high speed rail.



While at Tsinghua University, Dr. Aty made an invited presentation entitled “*Overview of the Current Practice and the Future of Traffic Safety Research*” and had an opportunity to visit their driving simulator laboratory.



The 14th COTA (Chinese Overseas Transportation Association) International Conference of Transportation Professionals (CICTP 2014) was held in Changsha, China, July 4-7 2014. Sponsored by the Chinese Overseas Transportation Association (COTA), the Central South University, the Transportation Research Board, the Institute of Transportation Engineers (ITE), and the Transportation and



Development Institute (T & DI) of the American Society of Civil Engineers. SaferSim Associate Director David A. Noyce made a presentation on “Development of New Technologies for Safer and Smarter Intersections” at the conference. Dr. Noyce also interacted and discussed with Chinese students about ongoing traffic safety and driving simulation research at SaferSim and UW-Madison.

In June, while visiting South Korea, Dr. Abdel-Aty delivered a presentation at the International Conference on Sustainable Urban Transportation Research and Innovation entitled “Applications of Big Data in Traffic Safety and Operation.”

While in Korea, he also went to the Seoul Transport Operation & Information Service. He presented a seminar at the Korea Research Institute for Human Settlement entitled, “Geographical Unit Based

Analysis in the Context of Transportation Safety Planning” He also gave a presentation at the International Seminar on Traffic Safety and Simulation at Hanyang University entitled “The Potential of Simulation Techniques to Evaluate Traffic Safety Improvements.”



Dr. Abdel-Aty with seminar attendees at the American University of Dubai, October 2013.

e. Changes/Problems

None to report