Summer graduate student exchange program
For the first time, The Ohio State University Crash Imminent Safety Transportation University Center, along with collaborating universities, held a graduate student exchange program on driving simulator training from June 20 to 27. Allan Anzagira and Saina Ramyar from North Carolina A&T State University and Peng Liu from Ohio State attended the program, which this year was hosted by Professor Don Fisher’s group at the Arbella Insurance Human Performance Lab (HPL) at the University of Massachusetts Amherst. Throughout the week, students learned about constructing scenes and scenarios on the Real-Time Technologies driving simulator, using eye tracker to gather information critical to safety, and designing experiments on the simulator which can answer particular questions that researchers develop. The students also had individual practice sessions with the technologies followed by meetings with Professor Fisher and the UMASH HPL faculty. At the meetings, students discussed how to apply what was learned to their research on modeling human drivers and reaching driving safety. The students found these individual sessions to be very useful to compile the complicated topics, and obtain useful advice about experiment design and scientific methods.

CrIS UTC hires new program manager
Theresa Gordon joined the CrIS UTC in late May as the new program manager. Theresa is a long-time Ohio State employee and was the former program manager for the university’s Aerospace Research Center and Nanoscale Science and Engineering Center. She holds a master’s degree in zoology from Ohio State. Theresa will serve as the point of contact for the center and will facilitate center operations. Welcome, Theresa!

Recent publications and presentations
An invited presentation, (2015) Use PreScan to Simulate the Integration of V2V and PCS. Will be given to the PreScan Users Group Meeting on April 20, 2015.

SMOOTH: Smart Mobile Operation: Ohio State Transportation Hub
Researchers at the Center for Automotive Research are looking to develop a solution to a common mobility issue for many Americans: a lack of access to public transportation, and a lack of mobility from that mode of transport to the individual’s final destination. Many people in the U.S. do not live or work close to a public transportation access point, and these points are not always close to where they are looking to ultimately arrive. The proposed solution to this issue is a network of on-demand automated vehicles, which will be installed as part of the Smart Mobile Operation: Ohio State Transportation Hub (SMOOTH) pilot project proposed to take place on The Ohio State University’s Columbus campus. These shuttles will be equipped with GPS technology, a map database to help in routing and vehicle to vehicle (v2v) communication modes, along with vulnerable road user detection technology, which will be useful in areas congested with pedestrians. With Ohio State’s extensive bus routes, lines, and pedestrian crossings, the campus will make an ideal location for this smart city pilot study. Program organizers hope the SMOOTH endeavor will ultimately benefit Columbus in later phases of its operation. While operating in these areas, the automated shuttles will also implement accident avoidance maneuvers in a way that respects the personal space of nearby pedestrians, while actively maneuvering out of accident situations with manual drivers. Alongside the Center for Automotive Research, participating entities in the SMOOTH endeavor include Battelle, City of Columbus and Mid-Ohio Regional Planning Commission (MORPC).

Inside This Issue:
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• Summer graduate student exchange program
• Analyzing CIREN scenarios to determine patterns of injury mechanism
• CrIS presents at T-SET Safety Summit
• Robots and Ohio State students add a spark to the WIE RISE summer camp
Robots and Ohio State graduate students add a spark to the WiE RISE summer camp

Ohio State graduate students Danielle Fredette, Michael Vemier, Monna El-Shaer and Sarah Yasseen Al-Shareeda spent this summer doing more than just research. These students volunteered their time to share their enthusiasm for engineering with 36 female high school students through Ohio State’s Women in Engineering’s WiE RISE summer camp. Sponsored by the GM Foundation and Shell, WiE RISE is a six-day, residential summer camp designed to introduce female high school juniors and seniors to Ohio State’s undergraduate engineering majors and related career fields.

This year’s camp took place from July 12-17 and participants came from 32 different high schools from Ohio and beyond. Throughout the week, the students participated in fun and educational activities that included department demos, hands-on engineering and team building projects, movie nights, flying airplanes and playing real-life battleship. The bulk of their hands-on learning took the form of a week-long programming project, which culminated in a robot competition at the end of the week.

The very popular robotics project was developed and taught by students associated with the Center for Automotive Research and the University Transportation Center. It consisted of two to five laboratory hours per day of the camp, where the students learned basic programming concepts and completed detailed challenges for points.

The projects for each day were all based on autonomous vehicle concepts, such as navigation, obstacle avoidance, lane change, line following, convoying and intersection handling. The final challenge was a competition, where all students had to program their robot to complete a convoying section, obstacle avoidance and decision making using ultrasonic sensors and black-and-white line following, which had to be completed with complete robot autonomy. The students quickly learned many sophisticated control concepts and were very competitive. Danielle Fredette commented that working with this group “was a fun and rewarding experience.” It is hoped that we see some of these aspiring students in Ohio State’s College of Engineering in the coming years.

This Women in Engineering summer program will begin accepting applications in January. Currently, admission is limited to 36 participants that meet the required academic criteria and are rising juniors and seniors. The program is exploring accepting rising sophomores in future years, while still offering some type of experience for 12th graders.

Analyzing CIREN scenarios to determine patterns of injury mechanism

The Injury Biomechanics Research Center at The Ohio State University is using Crash Injury Research and Engineering Network (CIREN) data to investigate trends of injury mechanisms for defined crash scenarios using medical and engineering evidence [1]. These trends are often compared using two key variables: abbreviated injury scale (AIS) severity and vehicle component contact. Two crash scenarios were preliminarily investigated for patterns of injury mechanisms: lead vehicle stopped (LVS) and near-side impact (NSI) (Table 1).
**Analizing CIREN scenarios to determine patterns of injury mechanism**

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**Table 1: Criteria for Crashy Cases within the CIREN Database**

<table>
<thead>
<tr>
<th>Principal degree of force ranges (degrees)</th>
<th>Lead Vehicle Stopped (LVS)</th>
<th>Near Side Impact (NSI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td></td>
<td>10-30</td>
</tr>
<tr>
<td>30-90</td>
<td></td>
<td>30-90</td>
</tr>
</tbody>
</table>

The two case scenarios were analyzed separately for unique injury mechanisms. Each case contained a description of one occupant, one crash scenario, and a group of injuries and their associated point of contact in the vehicle. Multiple injuries can occur per occupant; no injuries were counted twice. The analysis included cases with an AIS severity score of three to six, which correspond to injuries ranging from serious to maximum when considering threat to life of the occupant.

Occupant body regions with the highest prevalence and highest AIS injury severity were chosen for our injury mechanism analyses. For example, out of eight possible body regions, thorax injuries accounted for over 25% of the injury outcomes in the LVS scenario group. Approximately a quarter of these injuries were AIS four or five. AIS three injuries were found to be caused predominantly by energy absorbing structures and restraints (e.g. seat belt restraint and webbing). Injuries with severities above three, however, were due to primary or secondary impacts of the occupant with the interior of the motor vehicle. Injury outcomes within this variety of crash vary with the type of vehicle struck (V2). For example, truck under-riding the case vehicle (V1) caused more serious to critical injuries compared to case vehicles (V1) collisions with stopped cars.

In the NSI scenario group, thorax injuries were found to account for over 16% of the injury outcomes. Over a quarter of these injuries were AIS four, five, or six severity. Over 50% of the total thorax injuries were rib injuries (with or without hemo- or pneumothorax). These injuries were predominantly caused by door or striking vehicle (V2) intrusion into the near-side of the case vehicle (V1).

Research is ongoing to determine more in-depth injury mechanisms for other regions of interest. Once injury mechanisms are elucidated, the data will be analyzed to find ways to mitigate these injury mechanisms.


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**CrIS UTC Seminar Series 2015**

**CrIS UTC successfully launched its seminar series in April with guest speaker and Ohio State alumna Lina Fu, whose work is now based at the Xerox Research Center in Rochester, New York. The CrIS UTC seminar series addresses a broad set of scientific and technical themes in automated and connected vehicle research. Tuula Kaitio, an assistant research scientist at the University of Michigan in Ann Arbor, was the second guest speaker for the autonomous vehicles discussion. Professor Hilary Ozbay, a former faculty member of Ohio State, concluded the series in June.**

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**CrIS UTC News, Volume 1 Issue 3**

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SUMMER GRADUATE STUDENT EXCHANGE PROGRAM

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