UTC Project Information	
Project Title	Bioinjury Implications of Pre-crash Safety Modeling and Intervention
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Brief Description of Research Project	Project 4 will directly address the UTC's human physiology strategy. The goal will be to include bioinjury expertise in scenario generation, data collection, and human behavioral models so that research outcome metrics are closely aligned with the goal of improving safety. In particular, we will investigate whether bioinjury data from a particular crash scenario can suggest particular evasive actions by the driver or the autonomous vehicle to minimize injury. We hypothesize that bioinjury data from a particular crash scenario can suggest situations in which the driver should not re-engage and assume control of the vehicle but rather leave the autonomous system in control, because human motor skill or reaction time would be insufficient to mitigate injury. Coupled with human behavioral models developed in Projects 2 and 3, we will be able to extrapolate situations beyond those for which data currently exist, and to test these extrapolated situations under Project 1. We will also investigate how bioinjury data can inform the user community—both vehicle designers and vehicle safety policy makers—about the optimum position of the driver and the timing of passive restraints for given crash scenarios. As an example, recent data from airbag injury studies have suggested that the position of the driver's hands on the wheel should be modified to avert arm and wrist fractures when airbags are deployed. This information is expected to inform policy and safety procedures as well. As a second example, increasing vehicle autonomy for crash prevention increases the likelihood that the vehicle is braking hard at the time of impact, placing the driver and passengers in very different positions than those currently being employed in crash testing. The research on both driver behavior and autonomous vehicle behavior is expected to suggest alternative—and more relevant—safety testing procedures. A primary resource for this research will be the crash data available from two

national sources. The National Automotive Sampling System (NASS) Crashworthiness Data System (CDS) provides a broad range of data from crashes that occur in the United States. These data, largely based on police reports, focus on passenger vehicle crashes and are used to investigate injury mechanisms. The database may be queried across several relevant variables, including primary direction of impact, object impacted, age and sex of occupants, safety restraints, and resulting injuries. The Crash Injury Research Engineering Network (CIREN) consists of detailed analyses of motor vehicle crashes, including both accident reconstruction and medical injury profiles. CIREN is University Transportation Centers Program more focused on specific crashes in which the occupant received a serious injury. The CIREN network brings together the first responders to the crash, the treating physicians, and a panel of bioinjury experts to examine each injury in detail and to document corresponding injury mechanisms. Similar to NASS CDS, CIREN cases may be searched across several relevant variables. The CIREN database is ideal for comparing bioinjury data across variations in a given crash scenario, such as different passive restraints or different occupant positions.

We will use the NASS CDS to define the most critical injury mechanisms related to each scenario to be considered in the UTC. We will also examine CIREN to document specific injury outcomes based on variations related to the automobile safety systems and to the driver's position and reaction. These analyses will be used to understand which variations lead to fewer or less severe injuries, providing valuable input to both human behavior influencing strategies and autonomous vehicle control strategies considered in other projects, with the goal of improving pre-crash safety. Information leading to improvements in passive restraint systems and more effective crash test protocols are also expected.

Research Objectives

- Year 1: Analyze NASS CDS and CIREN data for proposed pre-crash scenarios and quantify bioinjury outcomes for these scenarios.
- Year 2: Generate and test scenario changes or autonomous vehicle behavior changes that are likely to lead to improved safety.

Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	Pending project completion.
Impacts/Benefits of Implementation (actual, not anticipated)	Pending project completion

Web Links
    • Reports
 	
    • Project website
	http://citr.osu.edu/CrIS/wp-content/uploads/CrIS_UTC_PPPR_Final_Draft_043014.pdf
	
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