Development & Demonstration of New Technologies & Software Tools

Examples of new technologies and software tools developed and/or evaluated by the CenTIR are described below.

- *Virtual Human Abdomen Model*

The CenTIR sponsored a program to develop a Virtual Human Abdomen Model using a haptic interface (a sensitive instrumented glove) that measures pressure forces and position. This invention has great and wide application potential in biomechanics and medicine for detecting and understanding organ and other soft tissue injuries and abnormalities. A CenTIR supported engineer working on this project was one of the recipients of the "WNY Inventor of the Year Award" in 2005 for this effort. (See "Research goes Beyond Doctor's Touch" news article in Appendix A, Exhibit 1.)

- *Tools for Crash Visualization*

The CenTIR has supported the development of computer models that employ crash-related information to create a 3-D time history of the vehicle occupant motion during the crash. The resulting 'motion picture' provides clinicians with information on potential injuries that may have been produced during the crash. (See Figure 1.) Dr. Kenneth L. Mattox, renowned trauma surgeon, characterized the June 1, 2000 demonstration of the CenTIR's ACN and crash visualization projects by saying, "This technology...is very exciting...and will be useful for the betterment of the patient."

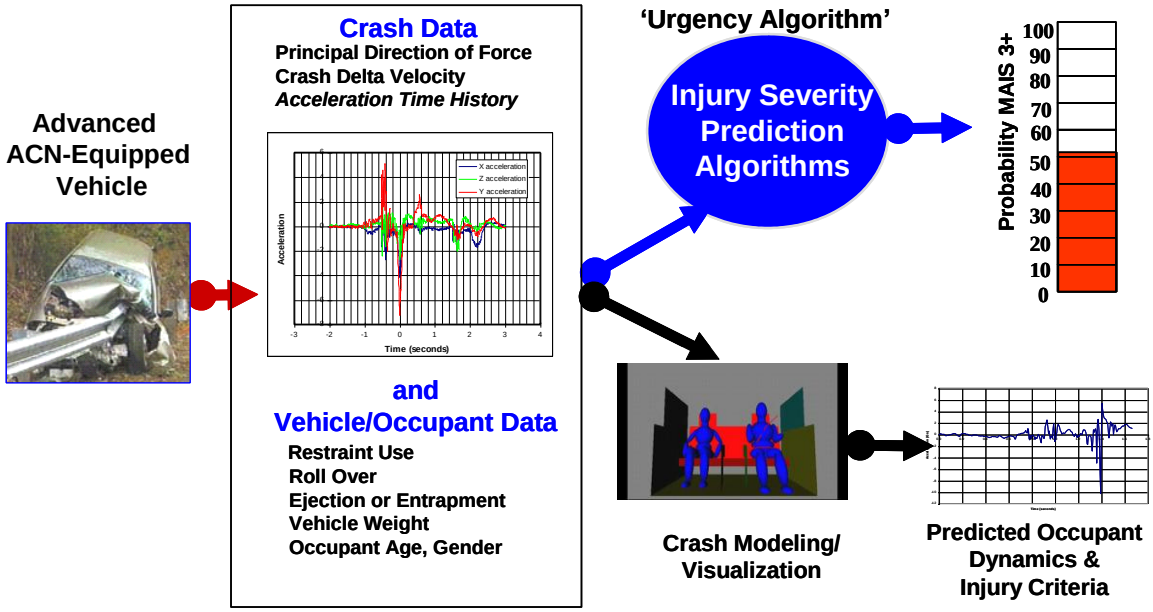

Figure 1. Crash Visualization & Injury Prediction using 3D Time History of Vehicle Occupant Motion During Crash

- *Exploitation of ACN Field Operational Test Data*

The CenTIR supported analysis of crash data from the NHTSA sponsored Automatic Crash Notification (ACN) Field Operational Test which was conducted in WNY from 1995-2000. Approximately 800 vehicles were instrumented with ACN technology which consisted of a crash detection module with 3-axis accelerometers, GPS receiver & hands-free cell phone / telematics platform. Vehicles equipped with ACN systems were involved in 70 crashes (22 above threshold). Fifteen of these crashes were investigated fully by the CenTIR to evaluate ACN performance. This research was instrumental in developing the technology and supporting infrastructure that has made commercial introduction of advanced ACN systems feasible.[1,2]

- *Advanced In-Vehicle Crash Sensors*

Several CenTIR programs have supported the development and integration of advanced in-vehicle sensor suites for crash detection and characterization. The data from these sensors can improve triage, transport & treatment decision-making. A CenTIR sponsored project for Ford Motor Company demonstrated the use of a small digital camera in conjunction with a 3-axis crash sensor. The camera was controlled by the crash sensor and provided pre- and post-crash images of the vehicle interior. During the technology demonstration tests conducted at the Ford Motor Company, these images were compressed and transmitted with the automated crash message. It is expected that these images could be used to identify the number of injured occupants, whether an occupant has been ejected and whether extrication will be required. This system was tested & showcased by Ford in its "RescueCar." (See "RescueCar" article in Appendix A, Exhibit 2).

- *Electronic Data Gathering for EMS (EDGE)*

Under the sponsorship of the CenTIR, a team of emergency physicians, paramedics and software engineers designed and developed the EDGE system. The CenTIR's EDGE (Figure 2) is a hand held computer platform with customized menu-driven software developed for use in a pre-hospital "field" setting. It was designed to operate on an inexpensive Windows CE pen-computer. Over the last few years, the EDGE was beta tested in Western New York. Once collected, electronic data was transferred to a master database via dial-up, cellular (CDPD), or TCP/IP connections. Electronic data was then be utilized for quality improvement/quality assurance, research and billing purposes. The ***CenTIR's EDGE*** supports report printing to a variety of HP printers via wireless infrared transmission or standard serial cable hookup. The EDGE has been used for several years in Erie County by Rural Metro.

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[1] "GM Will Offer Advanced Automatic Crash Notification In 2003", GM Press Release, July 31, 2002.

[2] "Ford Pilots Automatic Crash Notification Technology Designed to Save Lives", Aug 2, 2002.

Figure 2. EDGE Tablet Computer for EMS Data Collection in the Field (Developed by CenTIR)

- *Mapping Tool to Determine Means of Trauma Patient Transport.*

This CenTIR sponsored project produced a model/mapping tool that can be used to minimize the out-of-hospital time for trauma patients. The model used historical transport data in the local Erie County area to create a map (using a geographic information system) that identifies zones from which ambulance or helicopter transport will result in shorter out-of-hospital times. These maps can be used as a tool by emergency dispatchers and service providers to decide on the appropriate transport modality. (See technical paper in Appendix B, "Use of Geographic Information System to Determine Means of Trauma Patient Transport".)

- *DUI/DWI In-Vehicle Detection; ID & Evaluate Promising Technology*

The DUI/DWI project began with a review of the historical and current literature on direct and indirect methods for detecting and quantifying alcohol levels in the body. Sensor technologies for measuring alcohol in blood, breath, saliva and sweat were examined. Both traditional and non-traditional approaches were reviewed and legal and social issues were considered. Technical requirements and operational issues related to successful automatic, in-vehicle, driver-specific detection of alcohol-impaired drivers were identified. Laboratory testing of one candidate sensor technology was performed. However, the sensor had operational shortcomings which precluded its successful implementation in a motor vehicle. Advanced chemical sensor technologies under development (for other applications) were investigated to determine if they could be adapted for in-vehicle use in real time. Initial discussions with several technology developers suggested that the technology (in particular, near-infrared) was still cost-prohibitive and not yet small enough for incorporation into a vehicle. It is expected that this will change in the future however. Options for combining chemical sensing of alcohol with real time driving performance data from the 3-axis accelerometers (resident in the ACN Crash Detection Module) were also considered.

- *Airway DVD for Distance Learning*

The NHTSA EMS Agenda for the Future states that EMS education providers and academic institutions should collaborate to develop innovative solutions, such as distance learning and advancing technology that address cultural variation, rural circumstances, and travel and time constraints. These institutions are encouraged to develop their own EMS education programs that offer academic credit. The State University of New York at Buffalo, School of

Medicine, Department of Emergency Medicine (UEMS), and its Telemedicine Program, Medical Residency Program, EMS Fellow, and Office of PreHospital Care had the research infrastructure and video production expertise to collaborate with the Center for Transportation Injury Research to advance research in this area. With the support of 2 local private foundations in the Buffalo area, in collaboration with Full Circle Studios, the Department of Emergency Medicine created a pilot DVD video educational project for airway management training for pre-hospital personnel (Figure 3). This pilot project consists of multiple DVD learning modules and served to illustrate the potential of DVD and internet connected DVD as a powerful teaching tool for public health and safety personnel in the future.

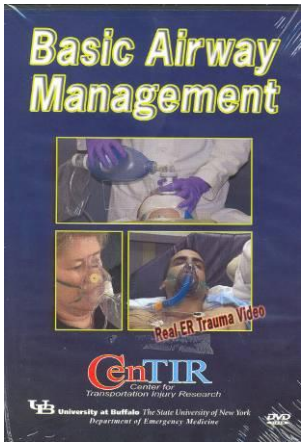

Figure 3. Airway DVD on Basic Airway Management Developed by CenTIR Collaborators at ECMC.

- *Implementation of Urgency on a PDA*

The Scene URGENCY algorithm seeks to predict the likelihood of serious injury from a motor vehicle crash using crash data and patient observables acquired by the EMS provider at the crash scene. The objectives of this project were to 1) implement the URGENCY Algorithm on a PDA platform, 2) support NHTSA's evaluation of the ability of on-scene EMS responders to collect patient and crash information using this tool, and 3) support the comparison of the resulting predictions of the URGENCY Algorithm with patient outcomes. This 'Scene URGENCY' algorithm was installed on ten PDAs and shipped to the Mecklenburg EMS Agency in Charlotte, NC in late June 2005. A training session for the participants in the project was held in Charlotte. We received word that the EMS user was pleased with both the PDA platform selected for this project and the URGENCY algorithm software as implemented on the PDA. During the project, the CenTIR staff responded a number questions which arose during NHTSA's ongoing evaluation of this tool.