



Protecting the Agricultural Safety and Health of Farm Families

GLC Newsletter August 2005

**GLC PROJECT UPDATE
FEASIBILITY STUDY:
A Camera-Based Predictive
Safety Device for Tractor
Rollover Prevention**

Today's agricultural production employs mobile machinery to perform various farming operations in the field. While greatly helping farmers achieve abundant and efficient production, such moving machinery also creates a hazardous work environment. Even with enormous efforts to improve tractor design for safety, the rate of tractor-related fatalities has shown a slight increase due to lack of awareness of unsafe operating conditions and inadequate maneuvering of the machinery under such conditions. To equip agricultural producers with safer machinery, researchers have made great achievements by adding rollover protective structures (ROPS) to protect the driver in machinery overturn accidents; however, ROPS provides only a passive protection to reduce rollover-caused fatalities.

The most effective way of eliminating rollover-caused fatalities is to prevent rollover from occurring. A research group at the University of Illinois at Urbana-Champaign, led by Dr. Qin Zhang, has verified that it is feasible to use a stereovision camera to assess the rollover possibility of a moving tractor in terms of both the tractor motion status and the pathway terrain in front of the tractor. Such information can be used to design an intelligent tractor rollover prevention device. The most significant impact of this sensor-based predictive tractor rollover prevention technology is its practical means to eliminate tractor rollover-caused fatalities by either preventing the tractor

from entering high-risk terrains or imposing appropriate motion restrictions to a tractor operating in risky terrains.

The pilot research sponsored by GLCASH is focused on investigating the use of a stereovision camera to create a 3D virtual terrain map on which the tractor will travel. Tractor motion parameters such as the yaw, roll, and pitch can also be estimated progressively. A series of field tests have been conducted to evaluate the dynamic performance of the conceptual predictive rollover prevention system in an actual field environment. Field test results proved that the system could predict the pose and motion status of the vehicle approximately 8.0 meters ahead of its actual position with favorable and consistent accuracy. Such information can be used as a precautionary warning signal to prevent rollover from occurring. Based on this method, a 3D virtual terrain map can be created based on two images of the same scenery from two "eyes" of a stereo camera. The vehicle motion parameters, including roll/pitch angles and their changing rates, can be used to estimate the stability of a hypothetical vehicle traveling on the virtual 3D terrain.

This pilot study has reasonably proved it is feasible to create a sensor-based predictive tractor virtual ROPS that prevents tractor rollovers. This technology can have three potential applications to designing automated active rollover protection devices, designing predictive rollover indicators, and creating interactive rollover virtual simulators. The automated active rollover protection device can be installed on tractors equipped with electronic control units to activate automated safety protection. The predictive rollover indicator uses the same sensor and signal processing units to generate a warning signal to tractor drivers whenever

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September 2005

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**COLLEGE OF
FOOD, AGRICULTURAL,
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an unsafe circumstance occurs. This option will make the developed fundamental technology usable to many existing tractors. The interactive tractor rollover virtual simulator can be used as a training tool for farmers, particularly young farmers, in learning the causes of tractor rollover and appropriate tractor maneuvering techniques to avoid tractor rollover. This virtual simulator can also be used by experts to study the mechanics of tractor rollover under various operating conditions, allowing them to determine effective ways to prevent such accidents.

For more information, contact Dr. Qin Zhang, Associate Professor, Department of Agricultural and Biological Engineering, University of Illinois at Urbana-Champaign, Urbana, IL 61801. Phone: 217-333-9419; e-mail: qinzhang@uiuc.edu

REGIONAL AGRICULTURAL SAFETY SPOTLIGHT

Pennsylvania State University Agricultural Safety and Health

Penn State Agricultural Safety and Health (PSASH) has been quite busy the past few years completing goals for the National Safe Tractor and Machinery Operation Program (NSTMOP); researching and developing an Agricultural Safety and Health Best Management Practices (ASHBMP) program; expanding our line of demonstrations, models, and simulators to provide hands-on training and realistic educational experiences; and extending resources through the Web.

Eight regional focus groups, including the full range of stakeholders, kicked off the effort to revitalize the National Safe Tractor and Machinery Program. Key feedback from the stakeholders includes a desire for new and flexible curriculum materials, a need for national program standards, and the importance of credentialing instructors.

A new and flexible curriculum was addressed by developing and testing 77 task sheets, including 44 that make up a core curriculum. These are now available either on the Web, on an NSTMOP instructional CD, or as a print copy. New operational procedures for conducting NSTMOP programs were devised and piloted. A total of 58 State Master Trainers from 38 states were certified after successfully completing one of two Master Trainer Workshops in 2004. Additionally, a national certification tracking system that allows for the efficient entry of data has been designed utilizing the expertise of the National Safety Council. The system has been piloted and the database is currently operational. Partners in these efforts include USDA, The Ohio State University, the National Safety Council, and the National Education Center for Agricultural Safety.

ASHBMP is a PSASH-developed hazard audit tool. Using gradation scales, photos, and other useful features, the tool objectively describes the condition of a particular hazard or exposure. Through its use by a producer or agricultural service provider, the ASHBMP audit tool conveys important intervention information to the user. This tool has been experimentally evaluated with agricultural producers and is currently being evaluated with an agricultural insurance company. Current plans are for the tool to be used with specific agricultural commodity groups such as farm bed and breakfasts, vegetable growers, Christmas tree growers, etc. Approximately 120 agricultural-based topics including tractors, agricultural machinery, structures, residences, and liability exposures encountered on agricultural sites are now covered by the tool.

PSASH utilizes a variety of demonstrations, models, and simulators to provide engaging educational experiences. The Hazards of Flowing Grain, which includes cut-away models of a grain bin and gravity wagon, is now available to travel throughout



GLC STAFF SPOTLIGHT

Outreach Director

In the fall of 2004, GLCASH brought a new director on board to head the outreach activities of the Center.

Dee Jepsen has been with OSU Extension for 13 years. During this time period she has worked extensively with agricultural safety outreach programs.

She sees her role as a liaison between the academic and research community, various service providers, and the agricultural workers, including their families.

Jepsen's experience in outreach education, as well as her strong agricultural knowledge, strengthen the Center's ability to serve the needs of clients both on the farm and in rural areas.

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Pennsylvania. A remote-controlled ATV will be unveiled at Penn State's Ag Progress Days in August. These two demonstrations expand the amount of resources available for farm safety presentations across the state. Two simulators challenge participants' notions that they can "beat the machine" by safely replicating PTO and corn picker entanglements with participant reaction times displayed in thousandths



of seconds. Two models—Tractor Overtake Hazards and Mr. Egg—address the dynamic factors involved in overturns and the need for ROPS. Personal protection is illustrated with the Head, Eye, and Foot demonstration. "Little Mac" is an engaging robot that can hold safety conversations with farmers of any age.

Work to overhaul the PSASH web site began in the summer of 2004. In addition to creating a web site that is easy to navigate, a fundamental goal was to extend access to PSASH resources. A visitor to the web site can now review the available demonstrations, models, and simulators; track agriculturally-related injury and fatality data; learn what safety programs are available to the public; investigate current and recent research projects; and find agricultural safety and health videos and publications.

For more information, contact Dennis J. Murphy. Phone: 814-865-7157; e-mail: djm13@psu.edu, Web: <http://www.age.psu.edu/ASH>

SAFETY STATISTICS

Overview of the Bureau of Labor Statistics Chartbook on Fatal Occupational Injuries in the U.S., 1995-1999. Where do the Great Lakes states stand in regards to agricultural fatalities?

The Bureau of Labor Statistics' Census of Fatal Occupational Injuries program has published a chartbook, in partnership with state agencies, entitled *Fatal Occupational Injuries in the United States, 1995-1999* (Report 965). This chartbook presents an overview of fatal work injury data for the five-year period.

The chartbook contains national, state, and industry profiles regarding Fatal Occupational Injuries in the United States. Below is a synthesis of state profiles in regards to the Agriculture, Forestry, and Fishing Industry fatalities in the GLCASH region. Additional information on agricultural fatality statistics in the GLCASH region can be found at the GLCASH web site http://www.ag.ohio-state.edu/~agsafety/glc/safety_stats/index.html.

Illinois

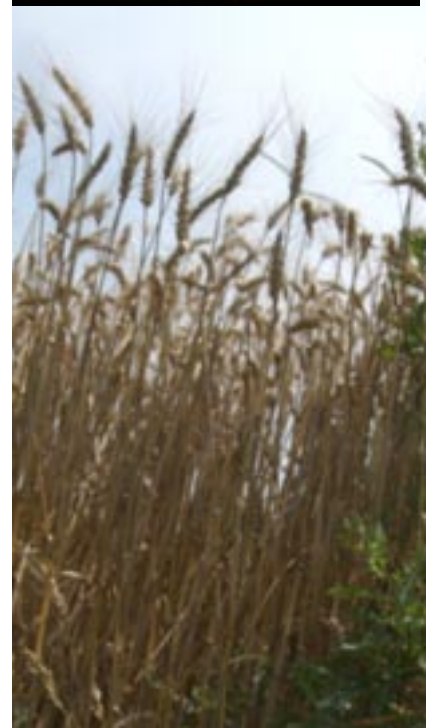
Illinois experienced 153 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 13% of the total fatalities for the five-year time period. As an industry, it ranks third largest for fatalities in Illinois. The classification, *Farming Operators and Managers* experienced 117 fatalities, making it the occupation with the fourth largest number of fatalities in Illinois.

Indiana

Indiana experienced 119 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 15% of the total fatalities for the five-year time period. As an industry, it ranks fourth largest for fatalities in Indiana. The classification, *Farming Operators and Managers* experienced 90 fatalities, making it the occupation with the second largest number of fatalities in Indiana.

Kentucky

Kentucky experienced 174 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 26% of the total fatalities for the five-year time period. As an industry, it ranks first for fatalities in Kentucky. The classification, *Farming Operators and Managers* experienced 82 fatalities, making it the occupation with the third largest number of fatalities in Kentucky. The occupation classification *Other Agricultural and Related Occupations* experienced 90 fatalities, making it the occupation with the largest number of fatalities in Kentucky.



Michigan

Michigan experienced 73 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 9% of the total fatalities for the five-year time period. As an industry, it ranks sixth largest for fatalities in Michigan.

Ohio

Ohio experienced 152 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 15% of the total fatalities for the five-year time period. As an industry, it ranks third largest for fatalities in Ohio. The classification, *Farming Operators and Managers* experienced 108 fatalities, making it the occupation with the third largest number of fatalities in Ohio.

Pennsylvania

Pennsylvania experienced 171 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 14% of the total fatalities for the five-year time period. As an industry, it ranks third largest for fatalities in Pennsylvania. The classification, *Farming Operators and Managers* experienced 117 fatalities, making it the occupation with the third largest number of fatalities in Pennsylvania.

West Virginia

West Virginia experienced 8 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 3% of the total fatalities for the five-year time period. As an industry, it ranks eighth largest for fatalities in West Virginia. Although not falling exclusively under the Agriculture, Forestry, and Fishing Industry, the occupation classification *Forestry and Logging* experienced 34 fatalities, making it the occupation with the second largest number of fatalities in West Virginia.

Wisconsin

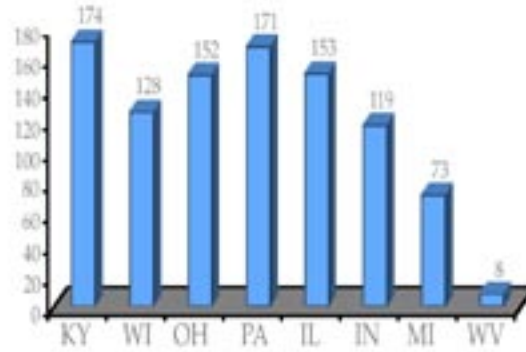
Wisconsin experienced 128 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 24% of the total fatalities for the five-year time period. As an industry, it ranks first for fatalities in Wisconsin. The occupation classified as *Farming Operators and Managers* experienced 79 fatalities, making it the occupation with the largest number of fatalities in Wisconsin. The occupation classified as *Other Agricultural and Related Occupations* experienced 55 fatalities, making it the occupation with the third largest number of fatalities in Wisconsin.

The Great Lakes Region

The Great Lakes states experienced 978 fatalities in the Agriculture, Forestry, and Fishing Industry, accounting for 24% of the 4,093 total fatalities that occurred in this industry during the five-year time period. Six of the eight states report agriculture as one of the top five deadliest industries, with the other two states ranking sixth and eighth.

To obtain a copy of the chartbook, send an e-mail to blsdata_staff@bls.gov with your mailing address included in your request; or mail a request to the Office of Publications and Special Studies, U.S. Department of Labor, Bureau of Labor Statistics, Washington, DC, 20212; or call 202-691-5200.

Number of Agriculture, Forestry, and Fishing Fatalities in the GLCASH Region, 1995-1999



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This newsletter is a publication of the Great Lakes Center for Agricultural Safety and Health based at The Ohio State University. The goal of the Center is to promote agricultural safety and health for farm, forestry and fishery employers, workers, families and their communities in the Great Lakes region (Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, Wisconsin and West Virginia).

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Great Lakes Center for Agricultural Safety and Health website: <http://www.ag.ohio-state.edu/~agsafety/glc>



SAFETY & HEALTH CALENDAR September 2005

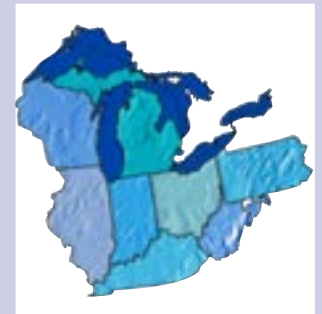
September 18-22, 2005

XVIIth World Congress on Safety and Health at Work

Orlando, Florida

September 18-24, 2005

National Farm Safety & Health Week



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THE OHIO STATE UNIVERSITY

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