

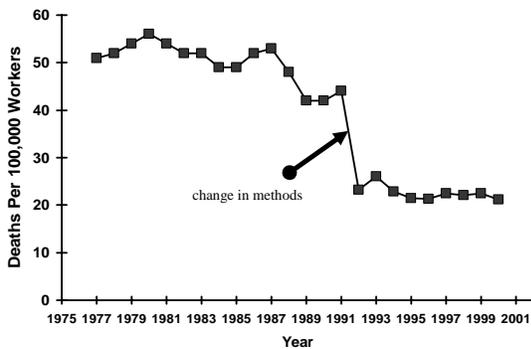
New Tractor Technologies -- Opportunities for Progress

John M. Shutske, PhD
 Department of Biosystems Engineering
 Associate Professor and Agricultural Safety &
 Health Specialist
 University of Minnesota

Overview

- We've Made Progress
- Future Technologies
- Remember Multiple Strategies
- Questions, Comments

National Death Rate in Agriculture

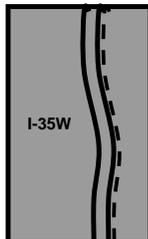


Building on What We've Learned

- Animal power to mechanical power.
- Narrow machines, high CG to wider, squattier machines.
- Engineering standards (ASAE, SAE, ANSI, etc.)
- ROPS
- Ergonomic considerations in design
- Capturing and using INFORMATION

Right Now, With Tractors and Other Types of Machines, We Can Readily Determine:

- Where is the machine? (with respect to any "dimension" - global, local, within a given property)
- Is the machine moving?
- Are parts of the machine moving?
- Are key components of the machine operating within designed limits? (temperature, position, forward velocity, RPM's, etc.)
- Is a person sitting in the seat?



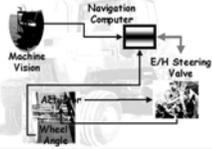
Newer Wireless Technologies Add a New Level of Intrigue and Possibility



Certainly there must be ag-related applications to positively use these new technologies to improve safety.

Associated Press
 Connie Adams testifies during a preliminary hearing in Kenosha, Wis., last month in the case of a man charged with stalking her with help from a satellite tracking device placed under the hood of her car.

Driverless Tractors and Machines



From the University of Illinois - Agricultural Engineering

Need to Apply Systems Safety Concepts - Risk Assessment of Old vs. New Technologies

(driverless tractors, robotic milkers, etc.)

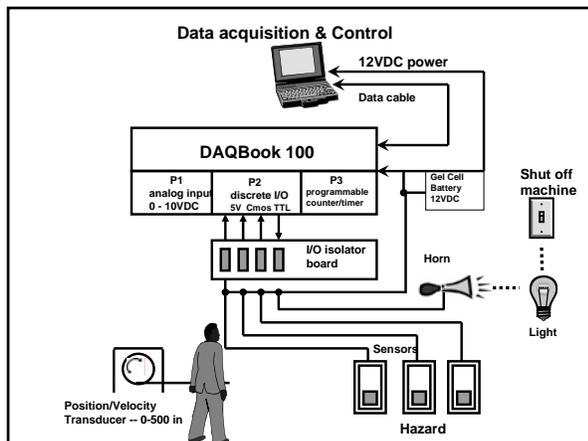
- Basic Hazard Analysis (probability of occurrence and severity of outcomes)
- Failure Modes and Effects Analysis
- Fault Tree Analysis

Human Presence Sensors - For Prevention of Machine Entanglements

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1. Shutske, J.M., W. Gilbert and J. Chaplin. 2001. Evaluation of a Microwave/Infrared Human Presence System for Agricultural Equipment. *Journal of Agricultural Safety and Health* 7(4): 253-264.



What We've Learned

- Multiple sensor technologies needed (performance overlap).
- Application in stationary applications is not terribly difficult.
- Tying sensor condition (on/off) to shut-off devices on new tractors is not difficult.
- Sensor system developed and tested gives about 0.5 to 1.0 second to take action (shut off machine, warn, etc.)
- You can buy more time by designing the sensor to "look" out a further distance from the hazard, but you dramatically increase false alarms.

All This Applies to Future Machines

- **Professor Cole's paper "Cognitive-Behavioral Approaches to Farm Community Safety Education: A Conceptual Analysis," JASH8(2):145-159. (particularly page 155)**

Socioculturalist Interpretation

Mr. Simms..and neighboring farmers had great respect for the tractors they used...they knew that their tractors were durable, reliable, easy to maintain, and safe machines...Mr. Simms... and his friends expressed strong loyalty and appreciation for the various brands... Mr. Simms and his peers thought that these older tractors were not originally equipped with ROPS because it was unnecessary and costly...

Furthermore, they believed it remained unnecessary and costly to retrofit ...with ROPS. He and his fellow farmers talked and told stories about government regulations that threatened their independent way of life.

They viewed tractor manufacturers equipping newer tractors with ROPS and seat belts as an expensive and unnecessary concession to meddlesome regulations.

What should our balance of efforts be on old vs. new machines and technologies?

Another Guidance Document Due Out Shortly

- **NCR-197 -- Committee on Agricultural Safety and Health Research and Extension**
- **Some key areas related to tractors:**
 - stability indicators
 - high speed ag vehicles (marking, braking, controls, suspension systems)
 - enhanced ROPS

Questions/Comments??