

2<sup>nd</sup> MMTS Summit  
May 10<sup>th</sup>, 2006

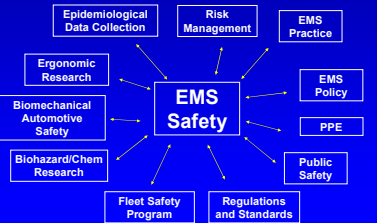
## Research, Technology and Reality -

*Everything You Always Wanted to Know About Ambulance Safety Science but Were Afraid to Ask*



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## EMS Safety IS Complex AND Multidisciplinary



## What's new

- ▶ New automotive safety technologies
  - EVS
  - ITS
  - Monitoring and feedback enhancements
- ▶ New expertise
  - ASSE
  - SAE
  - UTRC
  - Ergonomics
  - Industrial Design

## Regional University Transportation Research Centers



## Essentials

- ▶ Automotive Safety is a Science that has clear and well founded principles and concepts.
- ▶ Fleet: 50,000 vehicles, Type I, II, III, freightliner, motorcycles
- ▶ 16 million trips to the Emergency Department annually

## What a novel idea...



## Technical Research

- ▶ Based on reliable and real world field data
- ▶ Cost effective and practical
- ▶ Involve low cost development – University engineering and transportation research centers

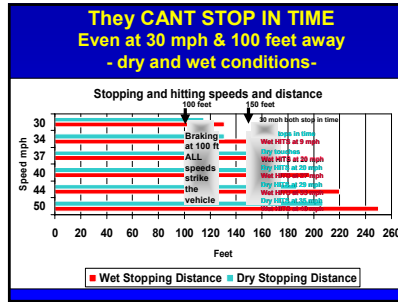
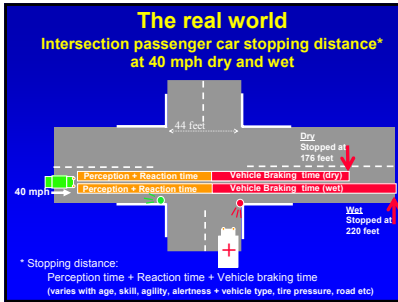
## “Are our policies killing people?”

- ▶ 1991-2000, 302,969 Emergency vehicles were involved in MVCs - 1,565 involving fatalities\*
- ▶ In PA 1997-2001, ambulances were more likely than similar sized vehicles to be involved in\*:
  - 4 way intersection crashes (43% vs 23%, p=0.001)
  - Collisions at traffic signals (37% vs 18%, p=0.001)
  - MVCs with more people injured (76% vs 61%, p=0.001)

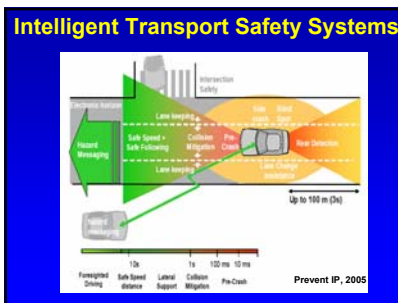
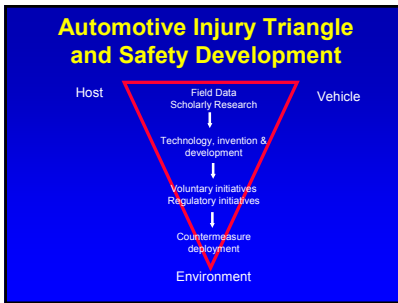
\*Comparison of Crashes Involving Ambulances with those of similar sized vehicles – Adam Ray, Douglas Kupas, PEC Dec 2005;9:412-415

## So.. The real world for an EMS vehicle approaching a red light

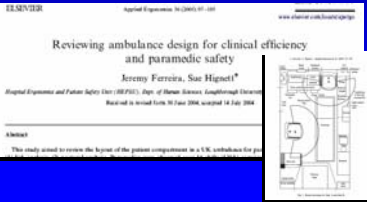
- ▶ You think they heard you...
- ▶ You know they must have seen you..
- ▶ And maybe they did
- ▶ ..... But..
- ▶ There is NO way humanly possible that they could stop.....



- ### A peer reviewed tragedy
- Persistent disconnect between automotive safety science and EMS transport safety approach
  - Pre-hospital and Emergency Care 2004
    - "EMS vehicle drivers are advised to approach the intersection, slowing to ensure that traffic has stopped and making eye contact with other drivers before entering the intersection."
  - In the modern era of road safety to suggest that a strategy of "eye contact" to be made at an intersection with a driver traveling at ~40mph in the hope that this would result in a safety intervention, is at best frightening



## We should use the best safety practices demonstrated



and... now for my most scary slide



## The difference having data makes?



## TRB Active Projects

(all due late 2006)

- ▶ Commercial Motor Vehicle Driver Training Curricula and Delivery Methods and Their Effectiveness
- ▶ Commercial Motor Vehicle Carrier Safety Management Certification
- ▶ The Role of Safety Culture in Preventing Commercial Vehicle Crashes
- ▶ The Impact of Behavior-Based Safety Techniques on Commercial Motor Vehicle Drivers
- ▶ Health and Wellness Programs for Commercial Motor Vehicle Drivers

## Published TRB Projects

(available at [www.trb.org](http://www.trb.org))

- ▶ Effective Commercial Truck and Bus Safety Management Techniques (2003)
- ▶ Security Measures in the Commercial Trucking and Bus Industries (2003)
- ▶ Highway/Heavy Vehicle Interaction (2003)
- ▶ Individual Differences and the "High Risk" Commercial Driver (2004)
- ▶ Training of Commercial Motor Vehicle Drivers (2004)
- ▶ Operational Differences and Similarities Among the Motorcoach, School Bus, and Trucking Industries (2005)
- ▶ Effective Motorcoach Industry Hours of Service and Fatigue Management Techniques (2005)
- ▶ Commercial Motor Vehicle Driver Safety Belt Usage (2005)
- ▶ Literature Review on Health and Fatigue Issues Associated with Commercial Motor Vehicle Driver Hours of Work (2005)
- ▶ Alternative Truck and Bus Inspection Strategies (2006)

## Concern

- ▶ What is currently occurring as routine practice in EMS is in many ways ignoring that science, and worse there are initiatives that are automotive safety in their entirety that are occurring outside of the automotive safety industry and those principles.

## Low Hanging Fruit

- ▶ There is NO JUSTIFICATION for NOT using over the shoulder harnesses on EVERY patient
- ▶ There is NO JUSTIFICATION for NOT firmly securing each and every piece of equipment during transport
- ▶ Seat belts should be used routinely, and in the RARE circumstance that use of the seat belt is not possible due to patient care needs – the driver of the vehicle should be notified that there are vulnerable occupants and extra driving caution applied
- ▶ There is NO JUSTIFICATION for not having crash and event data for EACH service by 100,000 miles traveled and per trip for each year of operation

## What is known in automotive safety:

- ▶ The seat is a key safety device for passengers in a vehicle
- ▶ Any device that allows or encourages an occupant to be out of the seat puts them at risk
- ▶ Crash dummies are designed to be seated in a seat – testing of devices that allow an occupant to be out of a seat using a crash dummy are unreliable and may well give false results

▶ What we need to consider, where is the 'bang for buck' in ambulance transport safety:

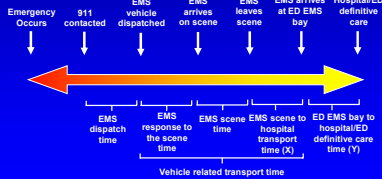
### Current fleet

- ▶ Secure all equipment
- ▶ Secure occupants
- ▶ Don't drive through red lights
- ▶ Use properly implemented "Black Boxes"
- ▶ Monitor crash events with common denominators (ie. per 100,000 miles and per trip)
- ▶ Have a written and implemented 'safety program'

### Future

- ▶ Vehicle design enhancements
- ▶ PPE
- ▶ Practice policy
- ▶ Data/Monitoring/Oversight

### 911 Call to Hospital/ED Definitive Care Time Intervals\*



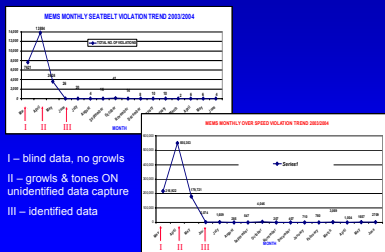
### Purpose of a 'Black box' Program

- ▶ Enhance Safety
- ▶ Improve Driver Performance
- ▶ Save Maintenance Dollars
- ▶ Aid Accident / Incident Investigation

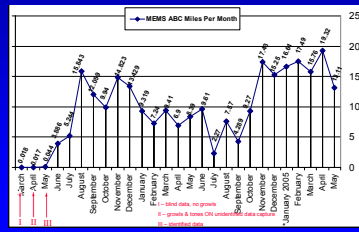
### The "Black Box"

Driver behavior monitoring and feedback device

### Demonstrated Effectiveness



### MEMS Road Safety Average Between Count Miles 2003/2005



### Improved safety, performance and decreased costs

- ▶ No increase in response times
- ▶ Pays for itself in 6 months in reduced maintenance costs alone
- ▶ Improved safety proxies by orders of magnitude and sustained with no in-service
- ▶ Reduced crash rate by up to 90%
- ▶ Well accepted
- ▶ Is it ethical NOT to have these devices in all vehicles now?

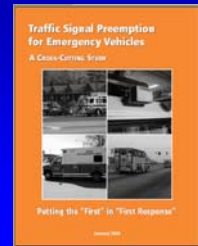
## Other monitoring devices

- ▶ Primarily to record events during and immediately preceding a crash
- ▶ Give no driver crash prevention feedback
- ▶ Administratively burdensome
- ▶ Intrusive
- ▶ Not demonstrated to be as effective in improving vehicle maintenance costs or as effective in modifying driver behavior long term

## The jury is out on

- ▶ Opticon
- ▶ Simulators

## Data, but is it generalizable



## The 'workplace' IS a vehicle

- ▶ Providers often in vulnerable positions during transport.
  - Bench seat
  - Captains chair
  - Standing or kneeling



View of Ambulance interior from Rear

## But what about head protection?



## Role of a head protective device

- ▶ A simple, immediate and inexpensive adjunct – a protective device -
  - To protect occupants from hazardous interiors
  - As vehicle crashworthiness design advances
  - As driver training advances
  - For when equipment becomes unsecured
  - As EMS Safety Standards are developed, for both EMS vehicles and EMS occupational safety

## New EMS Helmets for 2006



## Real world

- ▶ We do know from large samples that the most common reason for medics to get up is to get to the radio
- ▶ We do know that CPR enroute to the hospital is a very rare event – too small in frequency to even evaluate using national data bases, and often with non survival out come when it does occur

## Project SUPPORT, Johns Hopkins Engineering/Public Health Collaboration

Levick NR, Lincoln A, Gupta P et al

- Passive and active protection of EMT
- Minimize injury severity to the EMT
- Simple retro-fit to existing ambulances
- not interfere with treatment activities or EMT access to the patient
- be relatively inexpensive
- ? Equipment restraint

## Netting and Harness System

1. Netting system
2. Limited motion harness, with characteristics of safety, strength and ease of use

## What we know:

- ▶ Secure providers and other seated occupants with existing restraints
- ▶ Secure patient with over the shoulder harness
- ▶ Secure Equipment
- ▶ Use driver and vehicle monitoring and feedback technology
- ▶ Use tiered dispatch as in John Russell's impressive data!

## What we don't know

- ▶ We have NO POPULATION based data on vehicle crash injury rates
- ▶ We have NO POPULATION based data on mechanisms of vehicle crash injury
- ▶ We have NO WAY of evaluating that any safety interventions impact injury rates or injury mechanisms
- ▶ We have NO ERGONOMIC data

## High speed crash, rolled and the occupants (patient and medics) had only minor scratches

John Flynn, NSW Ambulance Sydney Australia



## A glimpse of the future



## What's missing

1. What EMS safety data is collected nationally?
    - We have no complete denominator data
    - We even have incomplete numerator data
  2. Absent population based national injury data or injury mechanics data for EMS
  3. Absent structured automotive safety engineering input
- 1+ 2 +3 = resultant inability to design and evaluate efficacy of injury interventions
4. What oversight is there?
  5. Which organizations would determine policy?

## Current and Future Research

- ▶ Epidemiology
- ▶ Ergonomic hazards
- ▶ PPE & Head protection (coexistent with Bio/Chem/Radiation hazard initiatives)
- ▶ Transport
  - Vehicle/Occupant automotive testing
  - Vehicle design innovation
  - Driver behavior (Real time and Simulated)
  - Intelligent Transportation Systems
- ▶ Operations tracking
- ▶ Data systems/reporting systems
- ▶ Enhanced Practice Policies evaluation

## What needs to happen NOW

- ▶ Data
  - Epidemiology
  - Ergonomic
- ▶ Safety research priorities
- ▶ Safety oversight

## Key Points

**Vehicle Operation**  
Safe driving practice  
Stop at red lights, stop signs  
EVOC

**Vehicle Design**  
Non-hostile interiors  
Attention to ergonomics  
Compact vehicles i.e. vans  
Lock down positions for routine equipment  
ITS – driver/vehicle feedback devices

**Safety Practices**  
Secure all equipment  
Use portable communications  
Notify driver if rear occupants are in vulnerable positions

**PPE**  
Use of seat belts  
Biohazard protection  
Head protection

**Safety Management**  
Safety program  
Safe driving policy  
Safety monitoring and feedback  
ANSI/ASSE Z.15

## Future

- ▶ Meaningful Goals
- ▶ New policies
- ▶ New practices
- ▶ New standards
- ▶ New vehicles
- ▶ New technologies



<http://www.objectivesafety.net>