

2007 NWRETC Leadership Conference
Glenwood Springs, Colorado
April 27, 2007

EMS – Is it Safe?



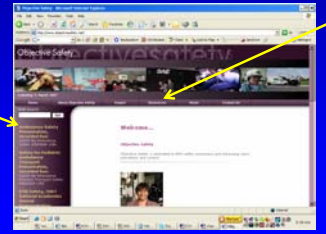
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Objective Safety LLC

A tragic emergency health care intervention outcome



It does happen....

<http://www.objectivesafety.net>



A few weeks ago in New York



Major deal...



A devastating tragedy...

- ▶ An ETT down the wrong hole may kill your patient and be a terrible burden for the pts family and for the medic involved
- ▶ BUT an EMS crash can kill all involved AND wipe out an EMS systems response capacity.....

Objectives

1. Educate on the risks to patients, transport and emergency medical service providers and the public from ambulance crashes.
2. Explore factors related to ambulance crashes and identify potential mechanisms of injury to patients and transport providers
3. Explain new transport safety technologies and innovations, and describe the new concepts that are underdevelopment.
4. Instruct providers on strategies for enhancing transport safety and reducing risk of injury to patients and providers during transport

This week.....



Last month....



Some questions for you all:

- ▶ Have you ever been in a EMS crash?
- ▶ How many times?
 - 1?
 - 2?
 - More?
- ▶ Have you ever been hurt in an EMS crash?
- ▶ Do you know any one who has ever been hurt in an EMS crash?
- ▶ Do you know of anyone who has been killed in an EMS crash?

Transport related aspects of EMS

- ▶ dispatch of EMS vehicles
- ▶ transport policies and protocols
- ▶ vehicle fleets and vehicle design
- ▶ vehicle purchase standards
- ▶ Intelligent Transportation Systems technology
- ▶ driver training
- ▶ training simulation
- ▶ driver performance monitoring
- ▶ roadside and road design
- ▶ integrated traffic safety technologies
- ▶ scene safety and visibility
- ▶ safety data capture
- ▶ safety oversight

Some odd facts

- ▶ Ambulances are generally not built by the automotive industry
- ▶ Intelligent Transportation Systems (ITS), transportation safety engineering and transport systems engineering are not generally integrated into EMS systems
- ▶ Although all EMS systems have medical direction and oversight, it is rare for there to be transportation expertise oversight

What happened??

- ▶ Why is it that Emergency Medical Services have developed outside the umbrella of transportation safety infrastructure??

Some recent adverse outcomes



UPS and Laundry trucks have very similar design and even more stringent safety requirements to EMS vehicles BUT very different cargo.....

People are passengers and NOT packages or parcels

JEMS.com Member News November 21, 2006 Volume 207

To view this newsletter online, go to <http://www.jems.com>

Vigilance and training, not sirens, protect ambulance crews

As an ambulance gets halfway through an intersection, a red sport utility vehicle slams into the side of it, injuring one of the medics inside and seriously injuring the SUV's driver.

This event, captured by the video camera of a Little Rock, Ark., police car, illustrates what authorities say is a growing problem: drivers who don't yield to emergency — [Full Story](#)

Related News Reports:
— [Colorado ambulance safety threat in roadblock](#)

What a novel idea...

Tuesday, 14 March 2006

National Patient Safety Agency

Designing future ambulance transport for patient safety

Background

In June 2005 the Department of Health (DH) set out a vision of how ambulance services can be transformed from a service focusing primarily on transportation, towards one towards becoming the mobile health resource for the whole NHS, taking healthcare to the patient in the community. The benefits include:

- patients will receive improved care by consistently receiving the right response first time, in time,
- more patients treated in the community
- greater job satisfaction for staff
- more effective and efficient use of NHS resources
- improvements in staff care and health promotion

Patient safety and ambulatory

EMS Transport Safety

- ▶ 'patient safety'
- AND also
- ▶ 'provider' and 'public safety'

What are the solutions?

- ▶ Training?
- ▶ Practice Policy?
- ▶ Transportation Systems Engineering?
- ▶ Automotive Engineering?
- ▶ Education of other road users???

What's missing

1. What data is collected nationally?
 - We have no denominator data
 - We have incomplete numerator data
2. Absent population based national injury data or injury mechanics data
3. Absent structured transportation 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?

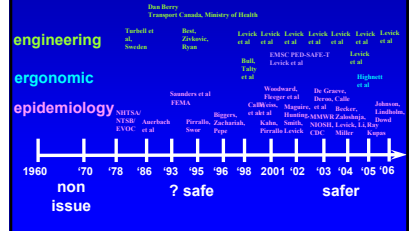
This IS a transportation safety issue

- ▶ Systems engineering
 - Where do ambulance crashes occur?
 - What transportation safety engineering interventions
 - ITS –
 - Does opticom work effectively in this environment given the traffic density and emergency vehicle density?
 - Merit of emergency vehicles being fitted with early warning technologies
 - Proper design of emergency vehicle traffic flow
 - Fleet mix to match anticipated transport environmental challenges (ie police model – bicycle, motorcycle, horse, three wheeled, cruiser, van, truck)?

EMS Best Practice, Sept 2006

A Simple Question....

Ambulance Safety Research: A New Field



So for EMS personnel...

- ▶ What's going to kill you?
- ▶ What's going to injure you?

Predictable risks

- ▶ More often at intersections, & with another vehicle ($p < 0.001$)*
- ▶ Most serious & fatal injuries occurred in rear (OR 2.7 vs front) & to improperly restrained occupants (OR 2.5 vs restrained)*
- ▶ 82% of fatally injured EMS rear occupants unrestrained**
- ▶ > 74% of EMT occupational fatalities are MVC related***
- ▶ Serious head injury in >65% of fatal occupant injuries#
- ▶ 70% of fatal crashes EMS crashes during Emergency Use#
- ▶ More likely to crash at an intersection with traffic lights (37% vs 18% $p=0.001$) & more people & injuries/crash than similar sized vehicles##

*Klein CA, Pivato RG, Kuhn EM. *Prehospital Emergency Care* 2001; 11:563-5/3:261-9
 **Rosen Z, Zarogian L, Levin L. *Acc Anal Prev* 2003
 ***Maguire, Hastings, Smith, Linnick. *Am J Emerg Med* 2002
 ##WSDH, 2003
 ###WJTA, 49 CFR Parts 571, 572 & 589 Document No. 50-26, notice 7

Fatalities and funerals

and what is killing EMS ?

EMS personnel fatalities*

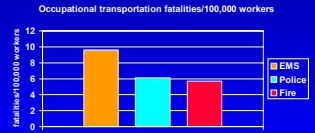
- ▶ 74% transportation related
 - 1/5 of ground transport fatalities were struck by moving vehicles
- ▶ 11% were cardiovascular
- ▶ 9% were homicide
- ▶ 4% needle sticks, electrocution, drowning and other

* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

So does it make sense ?

- ▶ Gloves and universal precautions?...
... good biohazard protection BUT aren't going to give much protection in a ambulance crash

A word about occupational transportation fatalities..



▶ WE HAVE A BIG PROBLEM HERE

* Maguire, Hunting, Smith & Levick, Occupational Fatalities in Emergency Medical Services: A Hidden Crisis, Annals of Emergency Medicine, Dec 2002

USA EMS

- ▶ EMS Systems - >15,000
- ▶ Personnel - ~1 million
(~30% F/T professional & 70% volunteer)
- ▶ Vehicles - ~50,000
(Type I, Type II, Type III, Freightliners, ?motorcycles)
- ▶ Transports - ~50 million
(to Emergency Depts ~ 50%, < 1/3 emergent)
- ▶ Cost - ~\$8 Billion annually
- ▶ Safety Oversight - ? Disparate

Safety oversight of what and by whom

- ▶ Vehicle Safety
- ▶ Vehicle Design
- ▶ Safety Equipment Design
- ▶ Vehicle and Safety Equipment Testing and Standard development
- ▶ Safety policies

Unique workplace

- ▶ In vehicles
- ▶ At roadside and other emergency scenes

the EMS transport process

- ▶ communications/dispatch
- ▶ the patient
- ▶ restraining device/seat
- ▶ transporting device/gurney
- ▶ paramedics/transport nurses, doctors & family
- ▶ patient monitoring equipment
- ▶ clinical care & interventions
- ▶ protective equipment
- ▶ the vehicle
- ▶ the driver/driving skill
- ▶ other road users
- ▶ the road



The Emergency Department (ED)



An ambulance is not an ED /ICU on wheels





This is not acceptable

In the USA*

- ▶ ~ 5,000 crashes a year
- ▶ ~ One fatality each week
 - ~ 2/3 pedestrians or occupants of other car
 - Approximately 4 child fatalities per year
- ▶ ~10 serious injuries each day
- ▶ Cost estimates > \$500 million annually
- ▶ USA crash fatality rate/capita 35x higher than in Australia

*FARS/HTS 2004-6

Occupational Health and Safety.....?

▶ **This IS an Automotive Safety issue**

Paramedic charged in crash that killed 2

By Tyler Fong, Rocky Mountain News
May 24, 2006

STERLING—A paramedic with Metropolitan Ambulance has been charged with careless driving in connection with an accident in May that killed two people and injured two others.

Chris Larusso, 22, of Westborough, was issued a summons for two counts of careless driving resulting in death and two counts of careless driving resulting in serious bodily injury.

All are misdemeanor charges and carry possible sentences of 10 days to a year in jail and fines of \$100 to \$1,000.

Larusso was driving an ambulance May 9 on Interstate 76, about 15 miles west of Sterling, when he apparently rear-ended a semi-tractor truck.

Two passengers in the ambulance - nurse Karen Woods, 41, of Elizabeth, and ultrasound technician Vicki Thomas, 36, of Goodland, Kan. - were killed.

A patient, Valney Gillichemeyer, 43, of Burlington, was seriously injured, but hours after the accident, gave birth to a boy at Sterling Regional Medical Center.

Larusso and paramedic Dan Beza, 31, of Centennial, were treated for their injuries and released.

Balance of concerns and risk during transport

- ▶ Response and transport time
- ▶ Clinical care provision
- ▶ Occupant safety/protection
- ▶ Public Safety

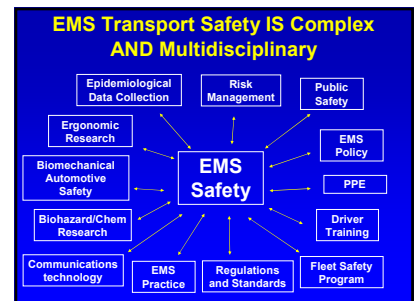
Benefit of Safety

▶ Any cost of addressing these issues is dwarfed in contrast to the huge burden of not doing so - in financial costs let alone the personal, societal, ethical and litigation costs

This is about you and your safety

▶ **What safety practices do you use??**

- Seat belts ?
- EVOC training ?
- Equipment lock down ?
- Helmets ?
- "Black Box" technology ?
- Tiered dispatch ?





Background: USA Problems

- ▶ No reporting system or database specifically for identifying ambulance crash related injury
- ▶ No occupational and health safety standards to protect providers from injury
- ▶ Rear passenger compartment, > 60cm behind driver - exempt from Federal Motor Vehicle Safety Standards (FMVSS)

USA Ambulances: FMVSS Exempt

DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
49 CFR Parts 571, 572, and 589
(Docket No. 92-28; Notice 7)
(DOT No. 2127-6849)
Federal Motor Vehicle Safety Standards
Rear Passenger Protection

1. This notice is issued pursuant to the Department's authority under 49 U.S.C. 30101-30105, 30117, 30119, 30121, 30123, 30125, 30133, 30135, 30141, 30143, 30145, 30147, 30149, 30151, 30153, 30155, 30157, 30159, 30161, 30163, 30165, 30167, 30169, 30171, 30173, 30175, 30177, 30179, 30181, 30183, 30185, 30187, 30189, 30191, 30193, 30195, 30197, 30199, 30201, 30203, 30205, 30207, 30209, 30211, 30213, 30215, 30217, 30219, 30221, 30223, 30225, 30227, 30229, 30231, 30233, 30235, 30237, 30239, 30241, 30243, 30245, 30247, 30249, 30251, 30253, 30255, 30257, 30259, 30261, 30263, 30265, 30267, 30269, 30271, 30273, 30275, 30277, 30279, 30281, 30283, 30285, 30287, 30289, 30291, 30293, 30295, 30297, 30299, 30301, 30303, 30305, 30307, 30309, 30311, 30313, 30315, 30317, 30319, 30321, 30323, 30325, 30327, 30329, 30331, 30333, 30335, 30337, 30339, 30341, 30343, 30345, 30347, 30349, 30351, 30353, 30355, 30357, 30359, 30361, 30363, 30365, 30367, 30369, 30371, 30373, 30375, 30377, 30379, 30381, 30383, 30385, 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NAEMT July 2006 Position statement

**National Association of Emergency Medical Technicians
Statement on Safety Restraint Use in Emergency Medical Services**

Statement

The National Association of Emergency Medical Technicians (NAEMT) strongly advocates the use of available safety restraint systems to prevent injury to EMTs, Paramedics, patients, and all occupants of any emergency response vehicle.

Background

Emergency Medical Services (EMS) brought forth by federal law has been shown to be a lifesaving profession, although there is a need to study the impact of the increased use of personnel by all agencies with EMS. It is generally accepted that the most likely cause of death or a major cause of the EMS personnel is the excessive vehicle operator behavior. It is also well known that a majority of EMS fatalities occur because of excessive driving in an average of one hour per month.

Tips for Emergency Vehicle Operations

Alive on Arrival
Tips for Safe Emergency Vehicle Operations

EDMA

The truck and bus industry is on the right track.... Where is EMS??

Commercial Truck and Bus Safety

Systemic 1

Effective Commercial Truck and Bus Safety Management Techniques

Published by the National Highway Traffic Safety Administration

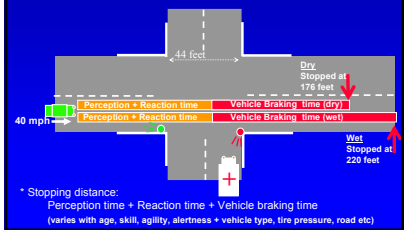
And very Predictable...

- ▶ Intersections are lethal environments

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.....

The real world Intersection passenger car stopping distance* at 40 mph dry and wet



Increasing awareness ...

EMS CLOSE CALLS

Firefighter's Close Calls.Com

THINK ZONE

EMS Close Calls.com

EMS Transport Safety Strategies - 2006-2007 New York State Strategic Highway Safety Plan

- ▶ EMERGENCY MEDICAL SERVICES DISPATCH SERVICES
- ▶ EMERGENCY MEDICAL SERVICES PARTNERSHIPS
 - * Increase the participation and role of Regional EMS Councils in local and regional highway traffic safety boards and/or organizations
- ▶ PRE-HOSPITAL TRAINING PROGRAMS
 - * Train EMS providers in the use of the new medical protocols; provide funds and/or other support to certified EMS Course Sponsors to train EMS providers in the use of these protocols; and collaborate with Regional EMS Councils and/or Regional Emergency Medical Advisory Committees (REMCA) on the development and implementation of training programs
- ▶ ROAD CONDITION AND INCIDENT RESPONSE
 - * Provide a placeholder for regional and/or county EMS representatives in municipal DOT emergency management plan development and implementation

EMS Transport Safety Strategies - 2006-2007 New York State Strategic Highway Safety Plan

▶ EMS RESPONDER CRASH PREVENTION

- Undertake a systematic review of other state actions and protocols on ambulance traffic safety measures to identify and prioritize those appropriate for the New York State pre-hospital system
- Increase education and involvement of EMS providers in principles of appropriate traffic safety techniques
- Develop and implement ambulance traffic safety protocols at state, regional and service level
- Review treatment modalities and protocols to identify those that may contribute to injuries resulting from the impact of ambulance crashes
- Identify methods to provide incentives for adoption by EMS services of protocols that enhance traffic safety
- Partner with organizations that provide public driver awareness and education campaigns to improve driver awareness of driver responsibility and appropriate response to approaching emergency vehicles

'Workplace' Hazards



Rollover Crash Kills Medical Technician

Ambulance Flips Off I-60 and Rolls Over, Injuring Two Employees and a Patient

It does happen....

But what about head protection?



New EMS helmet prototypes for 2006-2007



Hmm...



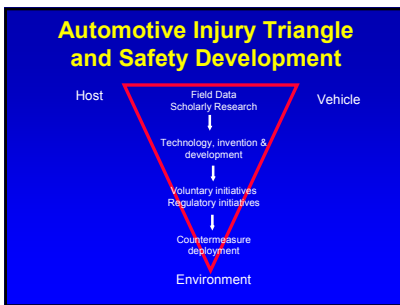
So why is it...

- ▶ That the EMS providers -
 - Were wearing navy blue – one of the most difficult colors to see at night
 - Had no head protection, when all other emergency personnel at the scene did
 - Had no protective clothing, when other emergency personnel at the scene did???

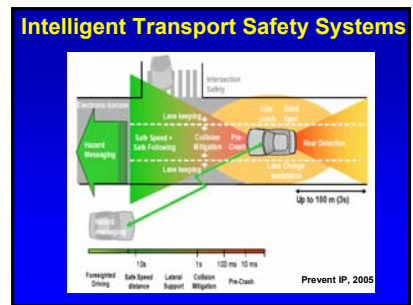




- ### What Z15 encompasses
- ▶ Safety Program
 - ▶ Safety Policy
 - ▶ Responsibilities and Accountabilities
 - ▶ Driver Recruitment, Selection and Assessment
 - ▶ Organizational Safety Rules
 - ▶ Orientation and Training
 - ▶ Reporting Rates and Major Incidents to Executives
 - ▶ Oversight



- ### Protective devices/concepts
- To prevent a crash
- ▶ Driver feedback
 - ▶ Driver monitoring
 - ▶ Driver training
 - ▶ Vehicle Intelligent Transportation System (ITS) technologies
 - ▶ Tiered dispatch
 - ▶ Appropriate policies
- In the event of a crash
- ▶ Vehicle crashworthiness
 - ▶ Seat/seat belt systems
 - ▶ Equipment lock downs
 - ▶ Padding
 - ▶ Head protection



Back up Camera..... Shouldn't all vehicles have one of these?

VRBC9300 - Backup Camera



Backup Camera

- Complete with all accessories. Nothing else to buy
- 150° Horizontal Camera Viewing Angle
- 80° Vertical Camera Viewing Angle
- Monitor Mounts on Dash or Visor
- For Use With 12 Volt DC Electrical Systems
- Great for Cars, SUVs, RVs and Delivery Vehicles!
- Help Avoid Accidents & Injuries!

English product manual

FAQs - English

The "Black Box"

Driver behavior monitoring and feedback device

EVG Education - Activities

How to modify the risk-taking behaviour of emergency medical services drivers?




How to modify the risk-taking behaviour of emergency medical services drivers?

Dr. Graeme H. Davis PhD, Falls Rd, Northside UK, Bristol UK.

Conclusion - implementation of emergency monitoring by the driver can reduce the risk of an aggressive state of driving. Furthermore, we are convinced that a 'black box' is a good way to modify the risk-taking behaviour of emergency medical services drivers.

High impact - implementation of emergency monitoring by the driver can reduce the risk of an aggressive state of driving. Furthermore, we are convinced that a 'black box' is a good way to modify the risk-taking behaviour of emergency medical services drivers.

Consequently, hospital emergency medical services vehicles have an increased collision risk. We report on the studies designed to modify the risk-taking behaviour of emergency medical services drivers.

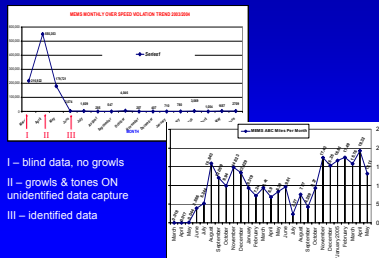
Purpose of 'Black box' Program

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

Monitoring and feedback devices

- ▶ Implementation well received by the providers.
- ▶ 20% cost saving in vehicle maintenance within 6 months.
- ▶ No increase in response times
- ▶ Fewer crashes and less severe crashes
- ▶ Sustained improvement in safety proxies, with no inservice or retraining after the initial introduction period.

Demonstrated Effectiveness



A key to safe ambulance transport



What do we know now??

- ▶ Intersection crashes are the most lethal
- ▶ There are documented hazards, some which can be avoided
- ▶ Occupant and equipment restraint with standard belts is effective. (Over the shoulder harnesses for patients should be used, with the gurney in the upright position where medically feasible)
- ▶ Some vehicle design features are beneficial - automotive grade padding in head strike areas, seats that can slide toward the patient
- ▶ Electronic Driver monitoring/feedback systems appear to be highly effective
- ▶ Head protection??

Dynamic Safety Testing

- ▶ requires sophisticated, expensive equipment
- ▶ measurably demonstrates forces generated during collision
- ▶ accepted international standard for vehicle restraint systems

If we know this – and its published....



Why do we do this?



Patients must be in the over the shoulder harness, medics restrained in seat belts, equipment secured

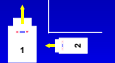


Foldable



Full Vehicle Crash Tests

Test 1 - Right side impact



- 1 - Target vehicle, Type I ambulance
- 2 - Strike vehicle, Type II ambulance

Closing speed 34 mph

Test 2- Frontal



- 1 - Strike vehicle, Type II ambulance
- 2 - Target vehicle, Type I ambulance

Closing speed 34 mph



PPE from the stationary environment can be highly hazardous in the automotive setting



Being seated IN an automotive seat is what will protect you

- ▶ Anything that allows or encourages you to get up out of your seat will also encourage you to be injured or killed – it is potentially lethal to be out of your seat in any fashion
- ▶ 4 or 5 point harnesses for sidefacing occupants are potentially lethal – and is in **NO WAY** SUPPORTED BY ANY DATA OR AUTOMOTIVE SAFETY EXPERTISE

Were we safer in the Cadillac???



Safety Management

- ▶ A Safety Culture
- ▶ Protective Policies
- ▶ Protective Devices
 - ♦ In the event of a crash
 - ♦ To prevent a crash
- ▶ Continuous Education and Evaluation

Creating a Safety Culture

within a company must start with upper management's commitment to safety

- ▶ Awareness
- ▶ Training
- ▶ Incentive

An excellent model

www.EveryoneGoesHome.com

16 Firefighter Life Safety Initiatives

1. Define and address the need for a culture change within the service leading to safety, accountability, excellence, management cooperation, the avoidance of personal responsibility, and the removal of personal and organizational accountability for health and safety throughout the service.
2. Ensure the personal and organizational accountability for health and safety throughout the service.
3. Force greater attention on the integration of risk management with incident management at all levels, including change, tactics, and strategy responsibilities.
4. All initiatives must be implemented by the service's own people.
5. Develop and implement national standards for training, qualifications, and certification including all those who are involved in the service's operations that are directly related to the safety of the service's personnel.
6. Develop and implement national standards and procedures for those elements that are directly related to the service's operations that are directly related to the safety of the service's personnel.

<http://www.EveryoneGoesHome.com>

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

Active Projects

(all due early 2007)

- ▶ 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

USA design initiatives



New Australian vehicles



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



UK Ambulance vehicles



Clear safety message



Sweden initiatives



Norway initiatives



Other successful models



So....

- ▶ Which vehicle do you want to be in ?
- ▶ Which vehicle is the best for efficient, and effective patient care?
- ▶ Which vehicle provides optimal risk management ?
- ▶ What is the optimal fleet mix?

Safety Enhancements Being Implemented

- ▶ EVOC
- ▶ Tiered dispatch
- ▶ Monitoring & Feedback devices
- ▶ Helmets
- ▶ Optimized ambulance vehicle design
- ▶ New Policies and Standards

Important Principles !

1. A culture of safety
 2. Drive cautiously
 3. Wear your belts & restrain all occupants
 4. Secure all equipment
 5. Integrate scientific data into your policies and procedures
- Unrestrained occupants and equipment are a potential injury risk to all occupants

Very Important Principle

Ambulance transport safety is part of a **SYSTEM**, the overall balance of risk involves the safety of all occupants and the public

small changes can make a BIG DIFFERENCE

- ▶ **PREPARE – TEACH – REACH – RESPOND**
 - Look at your own safety record
 - Teach safety and hazard awareness
 - Reach out with safety information to all your EMS providers
 - Respond with the best safety practices

**PREDICTABLE
PREVENTABLE
and
NO ACCIDENT**

Conclusion

- ▶ EMS transport has serious hazards and safety issues
- ▶ Major advances in EMS safety research, infrastructure and practice over the past 5 years
- ▶ New technologies for vehicle design, occupant PPE and equipment restraint and driver performance are now available
- ▶ Development of substantive EMS safety standards is a necessity and a reality
- ▶ Enhanced cross disciplinary collaboration in development of safety initiatives now exist
- ▶ EMS is still way behind the state of the art in vehicle safety and occupant protection

And....

- ▶ It is no longer acceptable for EMS to be functioning outside of automotive safety and PPE safety standards for prevention of and protection of EMS providers and the public from injury and death

Thank you!

Any Questions??

Electronic handout available online
<http://www.objectivesafety.net>

