



Winthrop Ambulance Service
March 26th, 2016, Winthrop, Maine

EMS Safety Seminar: The Cutting Edge and You!

Module 1 – Ambulance safety background & principles
Module 2 – Ambulance safety applied solutions & innovation

Nadine Levick, MD MPH
Research Director, EMS Safety Foundation
CEO, Objective Safety, New York, USA
Chair, TRB, EMS Subcommittee, National Academies

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Who am I?

- ▶ Nadine Levick MD, MPH
- ▶ Emergency Medicine Physician and Public Health Academic, (USA-Hopkins, Columbia SUNY, Montefiore & Australia – Royal Melbourne, Royal Childrens Hospitals, Royal Australian Flying Doctor Service)
- ▶ Chair, National Academies Subcommittee TRB EMS Transport Safety, USA
- ▶ Founder of EMS Safety Foundation
- ▶ Recipient, International Society of Automotive Engineers, Women's Leadership Award for EMS Safety




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What are we going to cover today?


- Key principles of ambulance transport safety
- Ambulance safety research and data
- National and Regional Standards and Guidelines
- How to make your ambulance transport environment safer right now
- Future goals for Ambulance transport safety



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Goals and Learning Objectives

- Educate on the risks to patients, transport and emergency medical service providers and the public from ambulance transport adverse events
- Identify and explore factors related to ambulance crashes and identify potential mechanisms of injury to EMS transport providers, patients and the public and expose safety myths
- Instruct providers on strategies for enhancing transport safety and reducing risk of injury to patients and providers and the public during transport



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EMS Safety Crisis

"The **Chinese** word for **'crisis'** (危機) is made up of the words **'danger'** (危) and **'opportunity'** (機)"



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In a nutshell...


- Understanding of the dangers in Ambulance Transport
- Overview of the opportunities to enhance safety



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Outline

- I. Review of data on ambulance crashes and safety standards and guidelines that exist for the ground EMS
- II. Identification of ground EMS transport safety issues, hazards and areas of risk to patients, providers and public
- III. Highlight unacceptable mythology and challenges to advancing EMS transport safety
- IV. Profile innovation, new safety technologies and strategies and knowledge transfer to enhance safety and reduce risks of ground EMS and patient



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Things can go wrong – but when there are sound safety policies and technologies in place, and the system is well prepared, you can minimize harm

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Safety Dimensions

- Safe systems – CRM / transport system safety
- Risk perception
- Fleet and operations management
- Vehicle design safety
- Scene safety
- Patient Handling
- Health and wellness



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- EMS operations are identified to be high risk. This presentation outlines the concept of a systems engineering safety approach and innovations developed and developing to address the key determinants of the safe design of EMS vehicles.



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Much of what you shall hear today is thanks to the work of all of those in the:



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and the National Academies of Science, Medicine and Engineering
Transportation Research Board's ANB10(5) EMS Safety Subcommittee



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No need to take any notes – all text slides will be awaiting you in your online Handout



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Your Handout and Additional Resources




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Jump start
A BoboRoo Series II kangaroo tests dummy is used in New South Wales, Australia, to help automobile designers study a unique Australian road safety issue — traffic accidents with kangaroos.



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Data...

- What is your transport safety record in your service?
- How can you improve if you don't have a meaningful measure of safety performance?
- Transport safety is not guesswork, it is a science



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Emergency Medical Service Safety

- What are the transport and other safety issues that pertain to this important public service and public safety industry?
- What do we know of the risks and hazards and how can we measure these ?
- How can the safety of this transport system be optimized?
- What can we learn from and share with our international colleagues

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Wildfire Ambulance Service Ambulance Safety Seminar Agenda

0745-0815	Registration/Coffee
0815-0830	Introduction/Opening Remarks
0830-0900	Dr. Nadine Levick, Seminar Introduction, Pre-Test & Initial Ambulance Assessment
0900-1030	Module 1 (Ambulance Safety Principles, Statistics, Occupant Safety Risk Analysis, Ambulance Crash Testing)
1030-1100	Break
1100-1200	Panel Discussion (Providers directly involved in or affected by ambulance crashes)
1200-1300	Lunch - Sponsored by Red Barn Restaurant
1300-1400	Module 2 (Ambulance Safety Systems, Human Factors, Safety Solutions)
1400-1430	Break
1430-1530	Small Group Breakout Session Post-Test & Final Hands on Ambulance Assessment
1600-1700	Wrap-Up/Questions

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Emergency Medical Services (EMS) An important and unique transport system

- Public safety, public health and emergency service
- Is there to save lives

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A tragic emergency health care intervention outcome

Rollover Crash Kills Medical Technician
Ambulance From 107 Jackson Rd. Dies Spilling Ben-Proprietary's Patient

It does happen....

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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.....

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Now who have we here?

- Are you –
- State EMS?
 - Volunteer EMS ?
 - State Fire?
 - Volunteer Fire?
 - Hospital based EMS?
 - Private EMS?
 - Police?
 - Nurses?
 - Physicians?
 - Administrators?
 -Other?

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Some questions I get asked

- What are the top concerns related to crashes?
- What are some of the key factors surrounding safety? Design, restraints, etc.
- What should crews demand from their agencies and what should agencies be providing? Monitoring systems, do they work?
- What doesn't work.

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A System of Safety

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So what is safety?

- condition of being protected against undergoing or causing harm, injury or loss

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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

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Safe Systems Approach



Source: Road Safety Branch, Infrastructure and Surface Transport Policy, Department of Infrastructure, Transport, Regional Development and Local Government, Australia.

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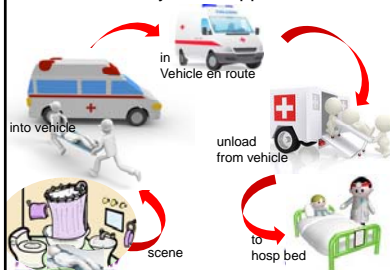
Systems safety of:

- Dispatching a vehicle
- Getting you, your patient and equipment to, in and out of the vehicle
- Providing patient care inside the vehicle
- Occupant protection in crash and near miss situations
- Public safety

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Safe Systems Approach



System Design Constraints

- Do the clinical work that is required and essential
- Not get hurt or killed
- Not hurt or kill anyone else
- So...
- Clinical need
- Human tolerance of injury

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January 2016

Patient Killed in N.Y. Ambulance Crash

By [Liz Felt](#)



Get fast, relevant product information...

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LA – March 10, 2016

CBS Los Angeles

Ambulance Crashes Into Fullerton Building; 2 Hurt

March 10, 2016 12:16 PM



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NYC - March 24, 2016

MARCH 24, 2016 7:00 AM / POLICE REPORT

Emergency services: Ambulance strikes Boro Park oldster



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Thursday July 5th 2007.....

NEWS CENTER

Paramedic Killed in Turner Ambulance Crash

By [Liz Felt](#)



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Posted By:mad at July 5, 2007 4:18 PM (Suggest Removal)
to all the people worried about how fast the emt was going, would it be fast enough if it was your loved one in there.....

| Add your comments

Posted By:concerned at July 5, 2007 4:40 PM (Suggest Removal)
To mad: It would be too fast if they ran over my family member on their way to another's family member...

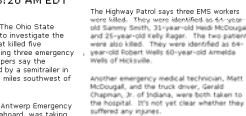
| Add your comments

Posted By:concerned at July 5, 2007 4:58 PM (Suggest Removal)
To X responder: Why can't I second guess this? A man is dead and I want to know if the actions and situation surrounding this were worth this sort loss. And I'd like to know what can be done so that this never happens again.

Friday July 20th 2007... The worst ambulance crash in USA history

Five Killed in Crash of Ambulance and Semi

July 21, 2007 08:20 AM EDT



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Van Wert, Ohio

timesbulletin.c

LIFESTYLE SPORTS CLASSIFIEDS NEWS

Village 'will never be the same' after deadly ambulance crash

By [Liz Felt](#)



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Van Wert, Ohio

Ambulance crash

By [Liz Felt](#)




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Antwerp fire chief says, 'They were doing what they loved...'

By [Liz Felt](#)



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So what are we going to cover today??

- What we know now, and need to do
- What is there for the forward thinkers
- The future horizons

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So

- What's important
- What's not important

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- What's going to save your life
- What might take your life

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- What's going to hurt you
- What's going to protect you

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- What is factual
- What is garbage

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- What is new
- What is not new

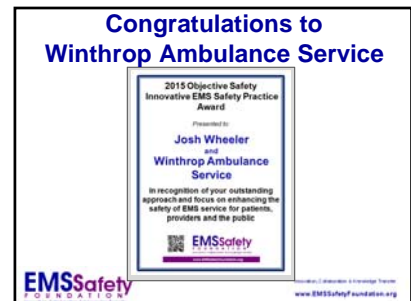
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- What we need to consider, where is the 'bang for buck' in ambulance transport safety
- Where is the low hanging fruit?

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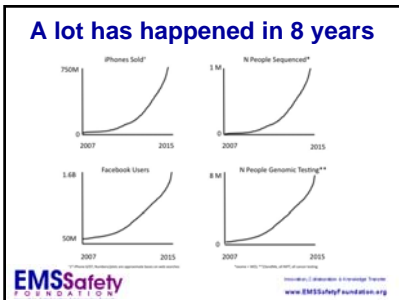


EMS Safety timeline

- Didn't know it was an issue – 60's-70's
- Knew it was an issue – but didn't really know what to do – 80's-90's
- Safety technical data rolls out – past 10 years
- Change and adoption challenges – *we are here now*

Goals

Better, safer and cheaper



Key Safety dimensions

- Clinical task performance
- Ergonomics/Human factors
- Biomechanics and crashworthiness

ALL THREE ARE INTERRELATED

Safety of the...

- Provider
- Public
- Patient

Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

In the USA there are more safety standards for moving cattle than for moving patients



Absence of standards and oversight

- Challenges in identifying best practice
- Myriad of unregulated commercial products
- No safety performance standards
- Absent national safety oversight

Safety Performance

- Measurement
- Outcomes
- Technical expertise

- What we need to consider, where is the 'bang for buck' in ambulance transport safety
- Where is the low hanging fruit?

Safety Dimensions

- Safe systems – CRM / transport system safety
- Risk perception
- Fleet and operations management
- Vehicle design safety
- Scene safety
- Patient Handling
- Health and wellness

Some new aspects

- Vehicles – smarter, sleeker, safer – CHEAPER!
- Operations – new technology tools
- Interdisciplinary infrastructure – new global platforms

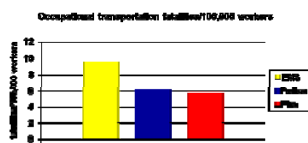
Data...

- What is your transport safety record in your service?
- How can you improve if you don't have a meaningful measure of safety performance?
- Transport safety is not guesswork, it is a science

EMS Transport General Concerns

- Consequences can be predictable & likely preventable
- Costs of these adverse events are high in loss of life, financial burden and negative impact on delivery of EMS care
- Other high speed vehicles (eg. racing cars) have a different safety paradigm
- Design of interventions to mitigate injury is predicated on a valid testing model
- Complex both engineering and public health issues

USA 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

and what is killing EMS ?

USA 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

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

Are you self insured???

Very Scary insurance data – the \$10 million dollar EMT

Year	Payroll \$million	Modified Premium \$1,000	Incurred Indemnity \$1,000	Incurred Medical \$1,000	Total Claims #
2003	14.1	540	885	9,925	93
2002	12.6	547	266	255	78
2001	11.3	454	88	128	55
2000	10.6	420	63	194	89
1999	10.1	405	115	117	56
1998	9.6	411	13	30	51

Workers Compensation Rate increased by 27 %

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A problem

2011 Insurance data –

- 35 fold more likely to have a claim based on transport than related to medical care

2007 Insurance data –

- 27 fold more likely to have a claim based on transport than related to medical care

2003 Insurance data –

- 10 fold more likely to have a claim based on transport than related to medical care

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Expensive....

The Huntsville Times

Ambulance suit gets \$3.1 million

Meridianville teen killed in wreck with speeding vehicle

Tuesday, May 01, 2007

By DAVID HALEM
Times Staff Writer david.halem@times.com

A federal jury awarded \$3.1 million in damages Friday to the family of a Madison County woman who was killed in a collision with a speeding ambulance from Tennessee in 2005.

A felony charge of manslaughter is still pending in Madison County Circuit Court against the ambulance driver, Charles Christopher Gates of Tennessee.

Dianna Christine Bowden, 18, of Meridianville died in a two-vehicle crash Oct. 13 involving the ambulance owned by Lincoln County Medical Center Emergency Services. The wreck occurred around 9:45 p.m. at U.S. 231A-71 and West Limestone Road, about seven miles north of Huntsville.

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Very Expensive

Law & Justice In ambulances

Repost on: 30 Sep 2008 09:10 am

\$24 Million Judgement Against AMR

AN ALAMEDA COUNTY, CALIFORNIA, JURY ORDERED AMERICAN MEDICAL RESPONSE (AMR) to pay nearly \$24 million damages to a man who was permanently paralyzed after a traffic accident involving one of their ambulances.

On April 16, 2007, Luis Del Barba, 85, was driving his auto and making a turn when he was broadsided by the ambulance. The ambulance's speed was measured at 43 mph in a 25 mph zone. Experts agreed that such a speed, in rush hour conditions, was reckless and unsafe.

A press statement released yesterday by the plaintiff's lawyers stated:

Mr. Del Barba had the right of way and was wearing a shoulder and lap seat belt when the crash occurred. As a result of the accident, he received numerous traumatic injuries and is paralyzed completely, save for some movement of his head and left arm. He is constantly dependent on a ventilator. Doctors believe that he can return to his 110-year-old family home if there are funds to fit a room for medical care. The jury felt strongly that Mr.

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EMS CANNOT Afford to keep paying out like this....

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Transport Medicine

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Key elements to safety

- Impact Biomechanics
- Transport Ergonomics
- Fleet Safety

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Impact biomechanics

- Crashworthiness
- Vehicle design
- Occupant protection

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Transport Ergonomics

- Operational tasks
- Human factors analysis
- Range of reach
- Patient loading and unloading

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Fleet safety

- Operational policies – dispatch, safety
- Fleet mix
- Vehicle selection – safety, ESC, loading height
- Driver performance and monitoring
- Scene safety
- Visibility and conspicuity
- Safety measurement and management

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Safer Better Cheaper is NOW

- What are the practices that are costing us
- How to identify optimal safety improvements
- How to facilitate the integration of new safer practices

Sure a Culture of Safety,
but the road map to get there is the key

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Safety concepts out there now

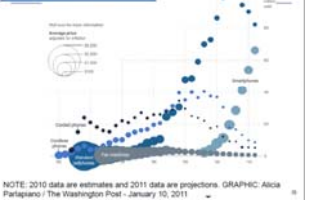
- Wireless physiological sensors
- Driver feedback technologies
- Tiered dispatch
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies – ITS
- New platforms for interdisciplinary exchange
- New Safety Standards
- Ambulance drones!

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Communication Technology trends

Rise and Fall of Gadgets

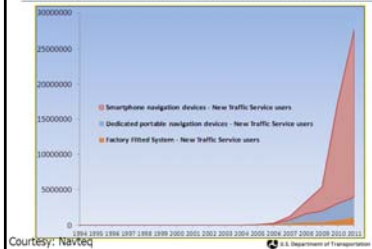


NOTE: 2010 data are estimates and 2011 data are projections. GRAPHIC: Alice Partigano / The Washington Post - January 10, 2011

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Smartphone navigation devices US New Traffic Subscribers 1996 to 2011



Courtesy: Navteq

U.S. Department of Transportation

Predicting Ambulance Demand: a Spatio-Temporal Kernel Approach

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ABSTRACT

Emergency medical services (EMS) are a critical component of the healthcare system. The demand for EMS is highly variable and unpredictable, making it difficult to allocate resources effectively. This paper introduces a spatio-temporal kernel approach for predicting ambulance demand. The model captures the spatial and temporal dependencies in the data, allowing for more accurate predictions. The approach is evaluated using historical data from a large EMS provider, showing improved performance over traditional methods.

Keywords and Subject Descriptors

Emergency medical services; ambulance demand; spatio-temporal kernel approach

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Compass process



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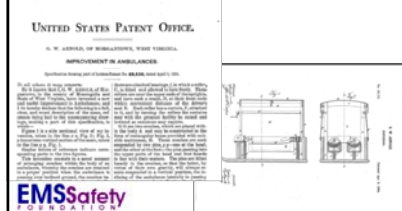
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Letter to Abe Lincoln – 1864 re: safety of ambulance design



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1864 Ambulance Design Patent and diagrams Almost 150 years ago



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1980's Then....




And NOW!...

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USA 1980's Then....




And yes now...

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Poor interior design exposes YOU to unnecessary hazards



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Equipment hard to reach



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Head ripper off Harness AND Head Strike zone hazards



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Innovation Yes Now...



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Real world answers to real world questions -

- What features will enhance safety of my new vehicle purchase?
- What color scheme do I want on my vehicle to make it safest?
- Do I need a helmet, and if so which one?
- What policies offer the safest system?
- How do I get my team to address safety issues?
- What data should I collect when something goes wrong, and how to analyze it?

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And yes, this meets KKK or NFPA



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Your work environment!!



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August 2009 – Impaired...



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He sure did not expect to be in that situation when he started his shift that day

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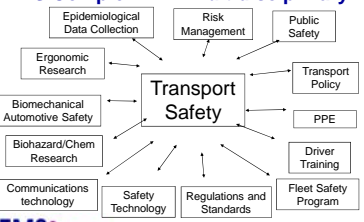
Safety oversight of what and by whom

- Vehicle Safety
- Vehicle Design
- Transportation systems safety
- Safety Equipment Design
- Vehicle and Safety Equipment Testing and Standard development
- Safety policies

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Ground Ambulance Transport Safety IS Complex AND Multidisciplinary



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Occupant protection.....?? July 2007



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Transport related aspects -

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

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Ambulance Design and Standards ??

- KKK
- NFPA
- SAE
- ASTM 1517
- NASEMSO MVDR
- CAAS/GVS
- CAMTS
- FMVSS
- FMCSA
- State required ambulance equipment

International: CEN 1789, ASA 4535, Indian St

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HOW STANDARDS PROLIFERATE: (SEE A/C CHARGERS, CHARACTER INDICATORS, INSTANT MESSAGING, ETC.)



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AMD ambulance 'safety testing' ? – Is NOT consistent with accepted automotive safety practice...

AMBULANCE TEST RECORD BROKEN

36,000 lbs **55,000 lbs on ROOF** **55,000 lbs on SIDE**

THAT WAS THEN **THIS IS NOW...**

In 2000, shattered industry records by testing and certifying the modular body to more than double the 150% curb weight Federal Standard. In addition, they performed a body side test that had never been seen before. Now has broken that record with a 55,000 body test on the top and side of the module. The ambulance body is now certified to a 500% curb weight level!

INDUSTRY LEADING SAFETY INNOVATION

Yes a “nationally recognized testing lab” – BUT - NOT an automotive/occupant safety crash test lab!!

M&M METALS & MATERIALS ENGINEERS

RESOLUTION IN ACTION
An SBA 8(a) Certified Company

SEARCHED: QUALITY SERVICES: CONSTRUCTION MANAGEMENT: PROJECTS: THE M&M TEAM

EMERGENCY SERVICES: TIRE SERVICES: CONSTRUCTION MANAGEMENT

M&M has one of the other safety services... M&M has a proven track record of providing... Through planning, design, construction and more, we focus on achieving the owner's goals for cost, schedule and health.

The Laws of Physics Prevail..

PHILOSOPHIE NATURALIS PRINCIPIA MATHEMATICA

IMPRIMATUR

Philosophie Naturalis Principia Mathematica, July 1687

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Anchorage Daily News

Paramedic injured in crash is recovering

An Anchorage Fire Department ambulance cutting a patient to the hospital was spun by a Dodge pickup this morning, injuring three paramedics, according to the Anchorage Police Department.

The Dodge bracketed the ambulance, which had lights flashing and horns on, hitting it in the back around 8 a.m. as the medic vehicle was crossing the Stearns Highway at Airport Heights Drive. Outside the ambulance were seriously injured patient Antonio Malena, his wife, Gal Malena, and four Anchorage Fire Department personnel: driver Eric Suttie, 33; EMT Sara Thomas, 40; and paramedics Dave Wallace, 43, and Tony Bragaglia, 36.

Bragaglia, who was riding with Malena in the back of the rig, was hospitalized with a head injury and in a stable but guarded condition. Werner and Wallace were treated for minor injuries and released. Suttie, 43, the driver of the pickup, and...

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When is it safe to do what... ?

- What are your policies???
- If your patient is pink, warm and talking?
- Are you required to notify the driver if you are out of your seat belt?
- Are 'routine procedures' putting you at risk?

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What is a safe speed and how do we identify that?

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What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$

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~ 30 mph - survivable

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What is a survivable impact?

$E = \frac{1}{2} mv^2$ $v^2 = 2as$

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~ 60 mph – not survivable

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A serious problem...

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Is there an acceptable rate of morbidity and mortality for pre-hospital transport systems??

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USA EMS

- EMS Systems - >19,000
- Personnel - ~1 million
(~30% F/T professional & 70% volunteer)
- Vehicles - ~80,000
(Type I, Type II, Type III, Freightliners, ?motorcycles)
- Transports - ~30 million
(to Emergency Depts ~ 50%, < 1/3 emergent)
- Cost - ~\$8 Billion annually
- Safety Oversight - ? Disparate

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USA EMS transport safety data estimates

- ~ 80,000 vehicles
- ~ 9,000 crashes a year
- ~ One fatality each week
- ~ 2/3 pedestrians or occupants of other car
- ~10 serious injuries each day
- Cost estimates > \$500 million annually

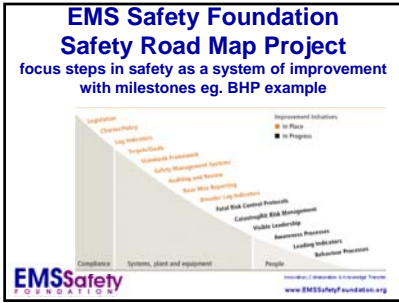
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Predictable risks

- Fatal crashes more often at intersections, & with another vehicle (p < 0.001)*
- 70% of fatal crashes EMS crashes during Emergency Use*
- 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#
- More likely to crash at an intersection with traffic lights (37% vs 18% p=0.001) & more people & injuries/crash than similar sized vehicles##

*Hahn CA, Pirralo RG, Kuhn EM. Prehosp Emerg Care 2001 Jul-Sep;5(3):261-9
 **Baker, Zlotolaya, Levick, LI. Milw. Acc. Anal Prev 2003
 ***Maguire, Kurling, Smith, Levick, Annals Emerg Med Dec 2002
 #EMSCA 2003
 ##Ray AM, Kupas DF. Prehosp Emerg Care 2000 Dec; 6:412-415

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Safety Road Map

- Not just a conceptual model
- Must have tangible steps
- Must be systems focused
- Measurable elements
- Immediate, short, medium and long term goals
- Reward and recognition driven

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this vehicle is safety crash tested by automotive experts



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Unlike this vehicle



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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?

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A tragic emergency health care intervention outcome



Rollover Crash Kills Medical Technician
Ambulance Rans Off Side and Rolls Over, Sparing Two Employees and a Patient

It does happen....

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But what about head protection?



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New EMS helmet prototypes



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Carl Craigle EMT-P, Chief Platte Valley Ambulance, CO



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Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

- Location
- Size
- Shape
- Speed
- Intended path

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Policy and practice ignorant of existing technical safety data

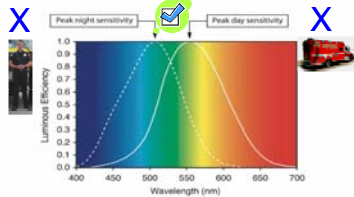


Figure 1. The scotopic (dashed line) and photopic (solid line) luminous efficiency functions, describing the spectral sensitivities of night and day vision, respectively.

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But whatever color If you run a red light someone will be killed

JEMS
Add your voice to the Voices of Lifesaving

Article
Don't Play Russian Roulette at Intersections
A.J. Hoffmann, JEM, EMT-P
Editor-in-Chief, JEMS

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- Having access to that technical knowledge supports changes to improve safety practice

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And very Predictable...

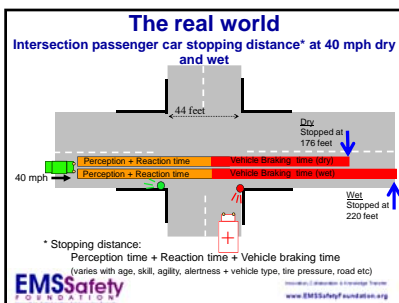
- Intersections are lethal environments

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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.....

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...in automotive safety engineering

CRASHWORTHINESS ANALYSIS OF EMERGENCY SERVICE VEHICLES
DEVELOPMENT OF PROPOSED CRASH TEST PROCEDURES FOR AMBULANCE VEHICLES

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The Crash Event - Crash Testing

- An introduction
- What one needs to know
- What do the tests really mean
- And, what tests are meaningful

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Intrusion vs Deceleration

- Intrusion
= vehicle to vehicle or vehicle to fixed narrow object
- Deceleration
= sudden stop – ie. sled test

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Intrusion



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Deceleration



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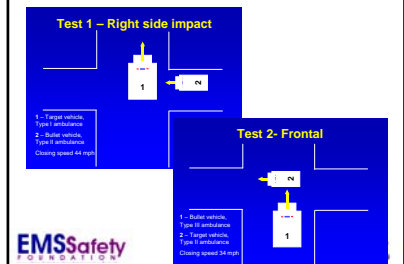
Dynamic Safety Testing

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

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Full Vehicle Crash Tests



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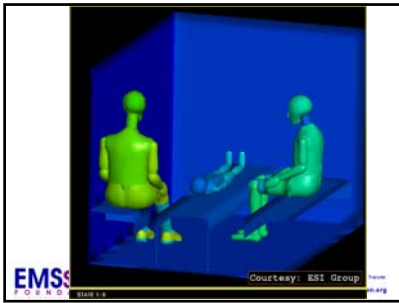
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Testing the real world



And this all takes place in 60 milliseconds – the blink of an eye





A few key words about restraint systems...

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Systems safety failure AND dangerous

Overwhelming existing evidence these practices are **HIGHLY dangerous**
NO evidence whatsoever that these practices are NOT dangerous, let alone safe

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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**

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Vehicle design and safety

- The principles of automotive safety involve a complex science, engineering technical skill, expertise, training and knowledge
- "Give the engineers a working list of our needs and let them tell us how it should be built to accomplish those tasks....."
John Russell MD, Advisory Panel, EMS Safety Foundation, 2007

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Dynamic Sled Testing of Ambulance Pediatric Restraints

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Why do we do this?



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Additionally there was a serious concern about a further...
This was the seating design that included a seating...
configuration in the rear facing seating position that...
could be modified to provide a small seatbelt system for...
use for a child. The concerns of the authors address the...
safety of a child in the seating design. Trends given that...
the modified seat did not offer lateral protection (as a...
modified child safety seat would offer) and that it also...
exposed the child to serious head neck hazards in the...
event of a side or offset impact. Secondly, should a...
child be seated in that position that there were...
could be the further increases in hazards. One that...
modified rear seats is not practical with a child seated...
in that manner with their back against the seat and...
second, there was no room way for an ambulance...
provider to provide medical care to a child patient in that...
position without getting both the child patient and the...
provider in jail. This is due to the provider facing...
seating position that would allow access to the child with...
the provider unimpeded. Thirdly, that once a child was...
seated in that modified seating position, the provider...
could not have been seated in the only other available...
seating position. These seating positions in the USA...
vehicle were only with manual operation. Furthermore...
in each of the USA states within the ambulance seating...
one that with four or four or more seat harness...
systems (now absent). These types of systems safety...
leaves where the positioning of one occupied side the...
safety system for other occupants such as the...
demonstrates that the interaction between occupants...
and their positioning can create more hazards. This...
seems to be a potential design failure aspect of the

Immobilization board



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Foldable on the stretcher, or even squad bench BUT NOT CAPTAINS CHAIR



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Basically...

- DON'T put child in the front seat
- DON'T put the child on the rear facing captains chair
- Just about anywhere else is OK!
- Use a child seat when medically appropriate and size fits, well secured

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NAEMT July 2006 Position statement



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



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Some powerful comments from the panel

- Remove the cabinets from the roadside wall
- Have your equipment on your side
- Learn to say no to unsafe practices
- Speak out with safety information
- Minimize use of code 3 response
- Regional safety forum interest

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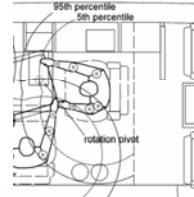
Key concept re: design of ambulance vehicle interiors

- Involves interrelationship of transportation safety and the human factors and ergonomic aspects for the patient, provider and public



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Range of reach.. This is a well defined technical science



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the result of the frequency analysis, green dots mark equipment used every time the ambulance is driven, orange



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Michael Hartford – Limington Fire Dept
https://www.youtube.com/watch?v=3T2fAVK_Xs



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Some concerning approaches

- Flawed design assumptions
- Unsafe from an automotive safety perspective
- Providers cant fit in
- Cant reach patient or equipment from seated position
- VERY expensive



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Flawed design assumptions lead to flawed design

Design Assumptions

- Designs are based on requirements and criteria
- Design is not "standard" and only serves the purpose of visualizing optional layouts
- One patient on cot, one stable back boarded patient
- Curbside & roadside seats on track
- Cables, tubing, & leads are routed along wall/ceiling
- Design does not necessarily address crashworthiness
- CPR/intubation cannot be performed while seated
- IV bag will be hung prior to transit
- Curbside workstation is the primary medic seat
- Jump bags are the primary storage for immediate care items



Occupant safety and access hazards

Conceptual Design



How many Medics have a 2 inch deep waist line ??

Roadside Seat



Most unfortunate

- These designs are:
 - very, very expensive
 - have dreadful human factors and ergonomics
 - can't reach patient or equipment
 - NO functional automotive safety features
 - many dangerous impact hazards



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Safety is Good Business

Federal Motor Carrier Safety Administration

Safety is Good Business

Whether you are a new motor carrier just starting out or an established company with years of experience, safety is good for your business. Good safety practices can save time, reduce expenses, and improve your bottom line. Use these tips to learn more about the benefits of safety and how to achieve them.

Why Safety is Good Business

- Reduces the risk of accidents, injuries, and property damage
- Improves your reputation
- Reduces insurance costs
- Increases productivity
- Reduces downtime
- Improves driver retention
- Reduces regulatory fines
- Improves customer satisfaction
- Reduces the risk of lawsuits
- Improves the overall quality of your service

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Rules/Policies Addressing Known Hazards

- Federal Motor Carrier Safety Administration (FMCSA)
 - Cell phone use – November 2011
 - Hours of Service – December 2011

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Federal Motor Carrier Safety Administration - FMCSA

- <http://www.fmcsa.dot.gov/>

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Nov 2011, Hand Held Cell Phone Ban

<http://www.fmcsa.dot.gov/brochures/news-releases/2011/Secretary-Larson-Announces-Steps-towards-Safer-Highways.aspx>

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

U.S. Transportation Secretary Lashes Out Against Hand-Held Cell Phone Use

Secretary of Transportation Ray LaHood today announced that he will be enforcing a ban on hand-held cell phone use while driving. The ban will take effect on November 15, 2011. Secretary LaHood said that the ban is a critical step in reducing the number of distracted driving accidents on the nation's highways.

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<http://www.ems1.com/ambulance/articles/1991321-Ohio-EMT-admits-to-using-cellphone-GPS-in-fatal-crash/>

November 15, 2014

Ohio EMT admits to using cellphone-GPS in fatal crash

She said she took her eyes off the road in an ambulance rollover that killed a patient onboard.

By EMS1 Staff

HOUSTON, Ohio — An EMT said in a statement that she was using the GPS on her cellphone at the time of an ambulance crash that killed a patient on board.

Patricia L. Brown, 36, of Cleveland, told Ohio Highway Patrol she was on her phone before the GPS in the ambulance went awry. She said she was traveling on the road for less than 10 minutes, the EMS1.com Staff reports.

Around 11:45 a.m. on Aug. 13, she was in the center lane of I-76 and traveling about 75 mph when she took her left hand off the wheel, through a guardrail and over an embankment. The ambulance rolled several times.

"I was looking at the GPS to see the time of arrival," Brown told a reporter. "I guess I drifted over and ended up rolling onto the embankment."

Patricia L. Brown, 36, of Cleveland, was pronounced dead at the scene. EMTs and OH State Troopers, 20, were sent to the scene. The ambulance and Brown were transported to Pennsylvania Memorial Hospital nearby with minor injuries.

Brown said in her voluntary statement that she did not have lights and sirens activated, and she was wearing a seatbelt throughout, until the crash occurred.

The speed of the ambulance and the cause of the crash are under investigation. No charges have been filed against Brown pending a forensic and autopsy report.

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Dec 2011, New FMCSA Hours of Service

<http://www.fmcsa.dot.gov/rules-regulations/topics/hos/index.htm>

Hours of Service Regulations

100% of new Hours of Service (HOS) from Rule will impact on December 15, 2013. All trucks, including 100% of all Class 8 vehicles, will be subject to the new HOS regulations, including all changes to existing rules, and other related information.

Key changes include:

- The Hours of Service regulations will apply to all Class 8 and Class 7 trucks that are used in interstate or foreign commerce, including those that are used in intrastate or local commerce.
- The regulations will apply to all trucks that are used in interstate or foreign commerce, including those that are used in intrastate or local commerce.
- The regulations will apply to all trucks that are used in interstate or foreign commerce, including those that are used in intrastate or local commerce.

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DOT HOS Rules

- Limits established for on-duty hours
- Establishes minimum levels of off-duty time- 8 hours if on duty less than 12 hours FRA or if over 12 hours then 10 hour off-duty time
- Commercial airline pilot can fly up to 100 hrs/month
- Adopts 60/70 hour weekly maximum for truck drivers, 10 hour off-duty time

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What are the solutions?

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

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A lot is now possible and for less!

- Driver behavior
- Vehicle behavior
- Roadside ITS
- Fuel consumption/Economics
- Resource modeling

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Innovation!

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Fleet Management technologies

- FleetEyes – Intermedix
- ACETech/Ferno
- Zoll roadsafety fleet management systems
- Drivecam
- Marvlis
- Telematicus
- InThinC
- Optima
- Northrop Grumman

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Telematicus

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GGD views

A smart phone App that is a safety tool

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Telematicus

Fleet Management capability

- Vehicle database
 - Individual vehicle/ data
 - Fleet mileage collection/Checklists
 - Link to other systems (SAP, Fleet)
- Maintenance & Service Plans
 - Repair history & Scheduling
 - Action planning
- Reporting
 - Export to Excel for manipulation
 - Scorecards views, Crystal Reports reporting
 - Direct Feedback

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From NASCAR to EMS

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There are now places to turn for independent safety technical info and resources

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And.. what is innovation?

- Something new, original and more effective

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EMS SAFETY COURSE

National Association of
Emergency Medical Technicians

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NAEMT Safety Course

- Crew Resource Management
- Emergency Vehicle Safety
- Scene Operations
- Patient Handling
- Provider, Patient & Bystander Safety
- Personal Health

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NAEMT EMS Safety Course

For more information on how to sponsor a course,

- ✓ go to www.naemt.org , click "EMS Safety"
- ✓ call 1-800-346-2368 (1-800-34NAEMT)
- ✓ email info@naemt.org
- ✓ visit "NAEMT EMS Safety" on Facebook

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Hot off the Press!!!

CAMTS reference entitled:
"Safety and Quality in Medical Transport Systems: Creating an Effective Culture"

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WE DO HAVE TECHNICAL DATA!!!

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TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

EMS Safety Systems Strategies and Solutions Summit, February, 29, 2012

- What are global best practice models
- Making it happen
- How can we translate global interdisciplinary best practice initiatives to North American EMS

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TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

2012 EMS Safety Systems, Strategies and Solutions Summit

- One Day event, 30 presentations
- Held in Washington DC, Keck Center
- Simulcast Live to EMS Today
- Live Webinar Access - globally
- Over 100 participants live across 3 continents
- Greater than 10,000 downloads of handouts within the first week!!

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Safety Systems, Strategies and Solutions Summit Feb 2012

- ~50 onsite – lead representatives
- Live online participation with international representation
- 7 focus areas and a panel
- >120,000 downloads of presentation handouts
- Multi-Media 'e-document' with QR tags
- You tube overview

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2012 EMS Safety Systems, Strategies and Solutions Summit

http://www.emssafetyfoundation.org/2012TRBSummitMultimediaWithLinksBW.pdf

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TRB EMS Safety Systems Strategies and Solutions Summit Session 1

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Its out there NOW

- TRB 2012 Summit – addressed the key and interdisciplinary applied solutions issues, in one day – please seek that information out. www.objectivesafety.net/TRBSummit2012.htm
- There have been two prior TRB Summits held, 2008, 2009 and both with vehicle engineering and transportation systems technical expertise
- See www.trb.org, and for the Summit archives: www.objectivesafety.net/TRBSummit2008.htm www.objectivesafety.net/TRBSummit2009.htm

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Your TRB EMS Safety Systems Strategies and Solutions Summit Multimedia Document

<http://www.emssafetyfoundation.org/2012TRBSummitMultimediaWithLinksBW.pdf>

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Some info about the

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EMS Safety Foundation

- Established in 2008 to fill a gap in
 - technical knowledge transfer
 - practical interdisciplinary R & D
 - evaluation and implementation of system safety enhancements for EMS and Medical Transport
- It is a not-for-profit institute

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The EMS Safety Foundation: A practical and functional model

Interdisciplinary and Operational and International

- Innovation
- Collaboration
- Knowledge transfer

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R & D “Ripoff and Duplicate”

- Avoid reinventing the wheel at all costs
- Where are the best practices that we need to transfer knowledge from

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Mission

- This is a team of like minded innovators across EMS Medical Transport and a number of technical disciplines, who share the common mission of enhancing the safety of EMS delivery for all involved by promoting and advancing EMS safety innovation, collaboration, research, knowledge transfer, education and safety information dissemination

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In a nutshell

- EMS Safety Foundation is a not-for-profit multidisciplinary virtual think – tank and test bed for safety innovation and knowledge transfer
- It is a virtual network integrating the end users and the technical experts
- A tool to enhance the safety of delivery of EMS services

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World Expo/EMS Safety Foundation Safety Innovation Awards

- 12 product winners
- special mentions
- Criteria
 - Safety Innovation
 - Practical/Usability
 - Cost Efficiency



2014 awards just announced at Expo 2015

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EMS Safety Foundation Ambulance Vehicle & Ergonomics Workshop



Automotive engineers addressing EMS Safety Foundation Workshop



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EMS Safety Foundation Ambulance Innovation Workshop and Design Clinic

Session A
Vehicle Safety and Occupant Protection
Gene Lukianov

Session B
Hands-on human factors operational safety and task analysis
Chris Fitzgerald

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Milestones, many...!

- INDEMO Project – INDEMO 1.0
 - @EMS EXPO 2013,14, 15 Texas EMS, EMS Chiefs Ontario 2014, Virginia EMS 2014, EMS Today 2013,14,15,16
- Andi, telepresence Robot 1.0 deployed nationally and internationally 2015 & 2016
- Voice activated Commands for INDEMO Project 2015-16
- National Academies TRB Summits 2008, 09, 12 & 17
- Rettmobil Delegations 2008- 2015
- Interschultz delegation 2015
- Medevac Vision Zero on SETONP Project Phase 1 funded 2013
- SETONP White Paper released 2015
- iRescU 2nd place, AHA Inaugural Open Innovation Challenge 2014
- Keynote @ India EMS Innovation Conference 2013
- Keynote @ Malaysia EMS Safety Conference 2012
- Above all worked with hundreds of amazing folks all over North America and the world

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Rettmobil 2016
May 11-13, Fulda, <http://www.rettmobil.org>
www.EMSSafetyFoundation.org/Rettmobil2016InterestForm.htm



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International approaches

- European, non-north American vehicles have NO squad bench nor after market structural vehicle modifications that can potentially decrease crashworthiness integrity

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A MUST READ for EVERYONE in EMS
<http://www.emsworld.com/article/10978797/ambulance-and-ems-safety-innovations-from-europe>

RETTmobil and the Future of EMS Safety

By David J. Collins & Robert J. O'Connell
October 14, 2015

What can we learn from European ambulances and equipment?



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So What is RETTmobil??

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RETTmobil is -

- A major European Emergency Rescue Congress, Trade show and Symposium
- Held in Fulda, Germany
- Established in 2001
- Attended by ~ 25,000 attendees
- Brainchild of Prof Peter Sefrin
- Over 500 exhibitors, >20 Countries!

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Birds eye view



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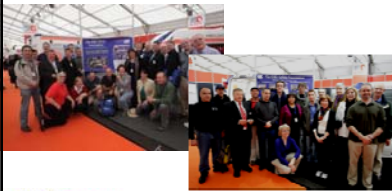
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EMS Safety Foundation Delegation seeking out International Innovation



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Live from Rettmobil 2013 Public Access – www.EMSSafetyFoundation.org



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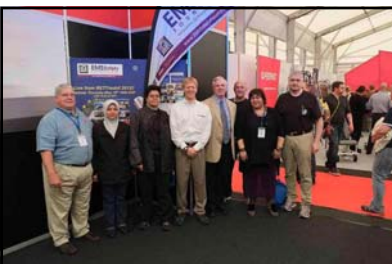
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Live @Rettmobil 2013 on YouTube!!

Click here
https://www.youtube.com/watch?v=kJw9_PyIIr0

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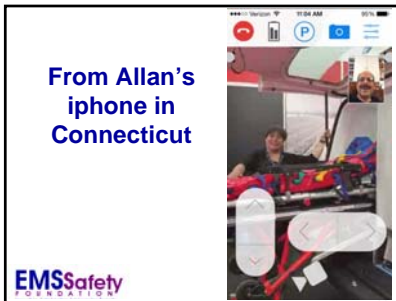
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Prof Sefrin Rettmobil 2013 Interview with Dr. Levick , AJ Heightman and Scott Craven <https://vimeo.com/67062815>



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Pensil Special platform

DESCRIPTION

Technical details

- Weight: 100 kg
- Length: 1800 mm
- Width: 600 mm
- Height: 100 mm
- Material: Aluminum

Features

- Wide of access
- Lightweight
- Easy to move
- Easy to store
- Easy to clean
- Easy to maintain

Advantages

- Wide of access
- Lightweight
- Easy to move
- Easy to store
- Easy to clean
- Easy to maintain

The platform can be installed on the stretcher or on the ambulance. It is a very useful tool for the ambulance crew. It is a very useful tool for the ambulance crew. It is a very useful tool for the ambulance crew.

The platform is made of aluminum. It is a very useful tool for the ambulance crew. It is a very useful tool for the ambulance crew. It is a very useful tool for the ambulance crew.

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Stretcher by roadside wall

Stretcher right by provider

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Awkward tasks? Develop solutions!

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Are you interested to Join the Rettmobil Delegation May 11-13, 2016?

<http://www.EMSSafetyFoundation.org/Rettmobil2016interestForm.htm>

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**Schedule
Virtual Rettmobil 2016
attendance**

<http://www.emssafetyfoundation.org/AndiVirtualRettmobilScheduleForm.htm>



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INDEMO^{1.0}
Ambulance Safety
Innovation Design Module
A project to bring cutting
edge design to you




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**Ambulance Safety Innovation
Design Module 1.0**
www.INDEMO.info
the future you can have right
now!!!
Better, safer and cheaper


INDEMO^{1.0}
POWERED BY EMS SAFETY FOUNDATION




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**Innovation Design Module
(INDEMO) 1.0**

- A full scale interactive physical model
- change in ambulance design based on technically sound automotive and ergonomic science
- improvement potential could be developed, visualized, demonstrated and evaluated.



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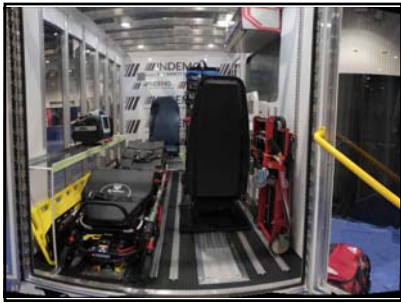


**EMS Safety Foundation's new
demonstration Project:
Ambulance Safety INDEMO 1.0**

- Designs so that you can do your work with optimum safety and efficiency.
- Based on state of the art science, practice and input from the world's leading experts in automotive safety and human factors.
- Designs that are cheaper, better, safer.



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- This project focused on system of safety as a central part of the operational process, not a parallel aspect. Vehicle dimension selection was based on automotive safety testing parameters, the interior layout based on integrating pilot task analyses with a range of ergonomic technical data across a spectrum from seating to reach parameters and across body size range.

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Workshops with INDEMO on site or offsite

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EMS Today 2016
 Feb 25-27, Baltimore <http://www.emstoday.com>

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THURSDAY, FEBRUARY 25, 2016, 8 PM
 PNE, BALTIMORE, MD - 3 MARKET PLACE

ZOLL

Interested in Pre-Care Workshops? **CLICK HERE!**

Find out what Registrations are Right for YOU!

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Self Guided INDEMO tour

Your Self Guided Design Feature QR Code Tour

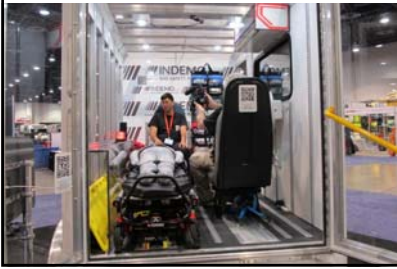
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<http://www.EMSSafetyFoundation.org/video/INDEMOstretcherlights.mp4>

<http://www.EMSSafetyFoundation.org/video/INDEMOstretcherlights.mp4>



**Don Hudson Award
presentation**

**2015 "Bill" Leonard
Commitment to EMS Safety**



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**Schedule a telepresence session
with**

INDEMO and Andi

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EMSSafety Foundation INDEMO
Virtual/Tourist Your Essential Partner

Are you interested in an online or virtual tour of the
EMSSafety Foundation's Emergency Response Module (EREM)?
INDEMO 1.0 is now available to you via the INDEMO 1.0
Virtual Tour. This virtual tour is available only to
EMSSafety Foundation members and is available only to
EMSSafety Foundation members who are currently active
EMSSafety Foundation members. For more information,
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or call us at 800-456-4663. Questions? Please contact us at
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INDEMO 1.0

I just had an  INDEMO tour!

You can too!

<http://www.emssafetyfoundation.org/INDEMOscheduleForm.htm>



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**You can have a virtual tour of
INDEMO 1.0
or
an onsite
to visit your site/conference**

<http://www.emssafetyfoundation.org/INDEMOscheduleForm.htm>



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**Working smarter
not harder!**



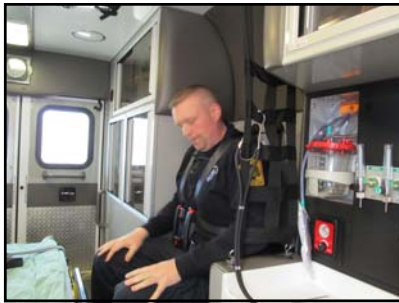
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**Innovation in Practice
American Ambulance,
Fresno CA**



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Other new tools we have now

Google Glass May Help Emergency Physicians Improve Patient Care

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From Wired August 2014

This \$500 Display Makes Your Junker Car Feel Like a Fighter Jet

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<http://www.visimobile.com/visi-product-info/>

visi MOBILE

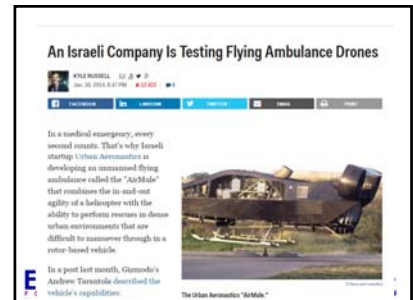
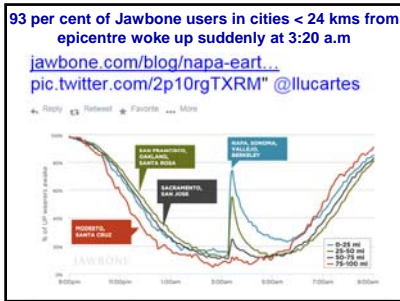
PRODUCT INFORMATION

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Wearable tech..

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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

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- What do we know now??**
- Intersection crashes are the most lethal
 - There are documented hazards, some which can be avoided
 - Occupant restraint with standard belts is effective. (Over the shoulder belts for patients, with the gurney in the upright position where medically feasible)
 - All equipment should be locked down
 - Some vehicle design features are beneficial - automotive grade padding in head strike areas, seats that can slide toward the patient
 - Head protection??
 - Electronic Driver monitoring/feedback systems appear to be highly effective
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- Solutions we know work...**
- Tiered dispatch
 - Vehicle Operations Safety Policies
 - Ideally, forward and rear facing seating
 - If not, use squad bench lap seat belts
 - Patient over the shoulder belts
 - Securing equipment
 - Fleet management electronic technical devices
 - Safety awareness
 - Cultural change
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Risk/Hazards

- Predictable risks
- Predictable fatal injuries
- Serious occupational hazard
- Public safety hazards

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Goals

- Standards for safety
- Policy based on Science
- Databases to demonstrate outcome

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Safety Management

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

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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

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Future directions

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

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Key future focus

- Data and Recent Initiatives
- Transport Technical science
- Human Factors
- Bridging Diverse Disciplines
- Testing and Standards
- New systems safety technology solutions
- Fleet management strategies
- Innovative Vehicle Design
- Operationalizing Safety

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Key dimensions

- 1) safety must be inherent to operational process design
- 2) engagement of appropriate interdisciplinary expertise in systems design and safety analysis is essential
- 3) an understanding of the complex interplay between patient, provider and public safety from a systems perspective and culture is key to addressing effective and safe operational EMS performance.

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Conclusion

- EMS transport has serious hazards and safety issues
- Major advances in EMS safety research, infrastructure and practice over the past 5 years
- Development of technically substantive EMS safety standards is a necessity and a reality
- Multidisciplinary safety issue that EMS cannot solve internally
- Failure to transfer knowledge from transportation and automotive safety is unacceptable and dangerous
- EMS is still way behind the state of the art in vehicle, transportation and occupational safety

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And....

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

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Your electronic presentation handout/resource link



Or if you are < 30 years

www.objectivesafety.net/PDFHO.htm

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Thank you!
Any Questions??

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



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