

Ambulance Transport Safety

An automotive occupant protection and system transportation safety issue

Phoenix, Arizona, January 5-6, 2009
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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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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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Now, who have we here??

- Do you transport patients?
- Are you responsible for vehicle purchases?
- Do you manage the oversight of your vehicle performance and safety?
- Do you design, 'spec out' your vehicles?
- Do you have automotive safety and crashworthiness, occupant protection and fleet safety scientific and technical data background and support?
- Do you rely on health care colleagues and aftermarket retrofitters for technical vehicle and fleet performance safety advice?

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Disclosure

- I am an Emergency Physician
- I am NOT an engineer
- Am apparently now speaking as a designated "engineering expert", at an "ambulance safety seminar" in a "vehicle section"

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Asked to speak on

- EMS crash reporting and data systems
- Crash testing of EMS vehicles
- Restraints
- Standards
- Future research directions
- All in 30 minutes

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Your Interactive Handout awaits you online at...

- www.objectivesafety.net

This WILL be FAST!!
No need to take any notes – all today's text slides will be awaiting you gratis and online – as an electronic record of the TRB EMS Summit events

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Here!... No need to write it down – it is on the card handed out

Today's Handout

TRB Summit

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A serious problem...

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



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**October 22, 2009
Provider and Patient Killed**

Thursday, October 22, 2009 - Two people have been killed after an ambulance slammed into the back of a TDOT vehicle on Interstate 65 near Wedgewood parkway.

Officials said the Rural/Metro ambulance was travelling in the northbound lanes when it hit the truck.

The two fatalities are the driver of the ambulance and the patient being transported.

An off-duty Metro firefighter, Evans Johnson, was transported to Vanderbilt University Medical Center in critical condition. Johnson was tending to the patient in the ambulance.



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April 30, 2009 - Tennessee



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Negative impact on system performance...

- 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 those involved AND wipe out a rural EMS system AND negatively impact a regions response capacity.....

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How bad is the problem

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How are we counting these events?

What/Where are the relevant data bases?

- FARS
- NASS/CDS
- GES
- State Traffic Records
- FMCSA
- BLS
- NEMSIS
- Other


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FARS – A National Data Set?

Small numbers – but NO data captured from 20% of the nation in 10 years

Total Fatalities Per 100 Million Population
1996-2006



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and what is an EMS crash?

- Definition of an EMS crash
- Definition of Emergency Response Mode

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USA EMS transport safety data estimates

- ~ 50,000 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

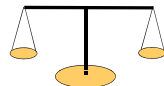
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Ambulance transport a serious USA transport safety problem...

- the most lethal vehicle on the road both per mile travelled and per vehicle
- is exempt from federal commercial fleet safety oversight (FMCSA)
- 2/3 fatalities not in the ambulance
- Exempt from most FMVSS standards

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Balance of concerns and risk during transport



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

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Haddon/Baker/Runyan Phase-Factor Matrix as applied to EMS Safety

PHASE	Paramedic/patient (host)	Vehicle (agent)	Environment (physical/regulatory)	Sociocultural	
pre crash (pre event)	driving history, driver education, speeding, abiding road laws	collision avoidance, anti lock brakes, vehicle weight, load	timed dispatch, EVID, implemented road design, marking, & surface	EMS image (coop & non), public awareness, dissemination from L & S	Effectiveness
crash (event)	seat belt, restraint, risk, child safety seat use	Non-hoodle interiors, restraint design, bumper & crumple zone design	collision speed, road side hardware	It can and does happen	Cost benefit
post crash (post event)	gender, severity, age, underlying morbidity	ease of extraction, burn resistant fabrics	EMS system quality, trauma care, traffic management system	rehabilitation, documentation and data collection	Ethics
					Social acceptability
					Societal need

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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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The laws of physics prevail...

- and they don't care what your job title is or if you are a patient, a provider or a member of the public

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Science behind Policy

- "For successful technology, reality must take precedence over public relations, for Nature cannot be fooled."

Richard P. Feynman 1988

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The Future??

- Seems that we are actually stuck in the past and are ignoring the present...

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Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

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Current accepted safety design and transport system technologies are being ignored, and worse...

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Firstly, the DANGER...

- The state of EMS transport safety research is an EMBARRASSMENT
- Lags at least 30 years behind general automotive and transportation safety research
- EMS Safety research is NOT EVEN ON THE PLAYING FIELD of state of the art automotive safety research
- 'Reinventing the wheel' – should be avoided at all costs

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Then, The OPPORTUNITY

- This is vehicles, and this is transportation safety
- Vehicle and transportation safety technology and research infrastructure exists
- Ditto drivers, and driver/fleet safety technology
- Collaboration, and the multidisciplinary model is key
- Optimal use of very scarce resource

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And...

This is in a setting where

- transport safety is the major and most costly adverse event in EMS
- And there have been all sorts of major technical and informational developments since Jan 2006

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New Information/Technical Developments Jan 2006- Jan 2010

- SAFETEA-LU, 2006 – EMS identified as one of the 4 E's – (Safe, Accessible, Flexible, Efficient/Transportation Equity Act: A Legacy for Users)
- International Ergonomists Association (IEA) - publication June 2006
- Enhanced Safety of Vehicles (ESV) - publications June 2007, 2009
- American Society Safety Engineers (ASSE) - publications June 2006, 2007
- National Academies TRB – Inaugural EMS Safety address, Jan 2007
- NEMSAC established – April 2007
- AMD Engineering Public Comments, July 2007
- KKK-F, August 2007
- OSHA September 11, 2007 EMS safety in Federal Register
- State Strategic Highway Safety Plans, October 2007
- Sporadic State EMS Council Transport Safety Policies
- AFPA EMS Safety technical abstracts – Nov 2007, 2008, 2009
- EMS Safety Foundation established – Dec 2007
- National Academies TRB – Inaugural EMS Safety Subcommittee meeting Jan 2008
- National Academies TRB – first EMS Safety Publication Jan 2008
- Transportation Safety Advancement Group (TSAG) – Feb 2008
- Society for Automotive Engineers (SAE) – publications Oct 2007, 2008, 2009
- Worker visibility Act - Nov 2008
- SAE Ambulance Standards development – April 2009
- NFPA Ambulance Standards Committee – June 2009
- National Academies TRB EMS Safety Summits – Nov 2008, Oct 2009

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A challenge we know now...

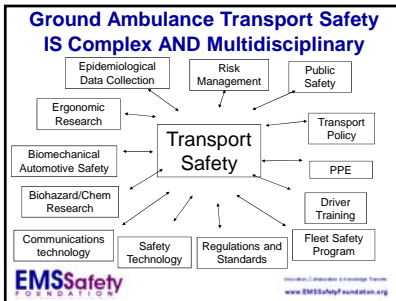
- ...is that there is a major problem with the present approach and what is being done currently
- and many practices are in conflict with, or not supported by, existing technical engineering science

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What is known

- Ambulance transport is part of a system of integrated elements, as is an ambulance vehicle a microcosm safety system of interrelated occupant and safety issues
- The laws of physics prevail -

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Would we...?

Seeing that we are health care providers – lets look at it this way –

- Would we use medical equipment that was built by folks who were not technically qualified or trained biomedical engineers and who just said – “this device is safe”?
- Or would we expect them to be qualified in this field and that their products were tested in a meaningful way to ensure that they were safe?

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What the independent technically expert occupant protection and automotive safety engineers say about our current ambulances and 'safety' approaches:

- "The rear compartment Death Vault"
- "The Kitchen Design must go"
- "The Kill, Kill, Kill (KKK) spec"
- "The organ donor harness system"



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Independent Technical Expertise

- The "kitchen design" is completely unacceptable and a failure in health care delivery, occupant protection and ergonomics.
- Independent technical expertise must be here and involved



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National Academies Transportation Research Board Ambulance Transport Safety Summit – October 29, 2009

- Bridging the gap between what we do and what is known
- Enhancing ambulance transport safety through shared knowledge of technical data
- Open access, all EMS related organizations notified and invited, and beamed to EMS Expo!



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October 29, 2009?

- This is where the technical experts were, operational EMS providers and the government agencies too



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What could you learn from the National Academies – right NOW and gratis

- The realm of burden and benefit
 - measuring the safety of the system
 - determining the economic, ethical and risk benefit challenges
- Transport System Management
 - fleet safety and oversight technologies and policies
 - operations management – dispatch, congestion routing, deployment of resources, benchmarking
- Vehicle safety
 - occupant protection design and testing
 - Vehicle performance safety
 - vehicle and personnel human factors issues
- Dissemination and Policy
 - Knowledge transfer
 - Standards, specifications and policy



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October 29, 2009 TRB Summit



2009 TRB Summit Participants

<http://www.objectivesafety.net/TRBSummit2009.htm>

- Technical experts
 - Automotive safety engineering, occupant protection
 - Automotive and EMS operational ergonomics and human factors
 - Transportation systems safety engineering.
- Government agencies
 - National Highway Traffic Safety Administration (NHTSA)
 - Department of Transportation (DOT)
 - National Transportation Safety Board (NTSB)
 - Federal Highway Administration (FHWA)
 - Federal Motor Carrier Safety Administration (FMCSA)
 - Bureau of Labor and Statistics (BLS)
 - Department of Homeland Security (DHS)
- EMS State Directors
- EMS Services
 - Private and municipal from across North America
 - FireEMS
 - Volunteer EMS
- Industry partners
 - EMS Equipment
 - Vehicles, both OEM and aftermarket
- Academics



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Please do go and access this information, it comes from technical and operational experts and it is gratis



Its out there NOW

- TRB 2009 Summit – addressed the key and interdisciplinary issues, in one day – please seek that information out.
- There have been two 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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NAEMSP 2009

- Take a look at last years three posters – three pages to steer you toward some key issues
- Concept safety vehicles
- Wading thru the MUCC
- Commercial Comparisons

Nb. You can download them gratis too from www.objectivesafety.net

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How did we justify this \$2million+ debacle taking place outside of technical expertise???

Engineering analysis of 'safety concept' ambulances

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NAEMSP 2009 – the back of the back wall of the poster hall...

- Ambulance design is a vehicle and automotive safety engineering issue and is a technical field of expertise outside of EMS practice.
- Based on peer reviewed and established automotive safety principles and data there are major deficiencies in the safety of the design of these ambulances.

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Would the NIH tolerate research funds being spent like this in any other area of health care 'research' and in conflict with valid science???

- An ~\$2 million + expenditure on alleged 'safety concept' vehicle development by EMS providers and aftermarket manufacturers, outside of - and in conflict with - accepted automotive safety technical data and expertise is completely unacceptable and should not be tolerated.

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Sadly stated at NAEMSP 2009/08/07/06/05/04/03/02/01/00/99.. And yet where are these essential experts today....???

- Automotive safety, crashworthiness and transportation safety expertise, technical data and oversight must be centrally integrated into ambulance vehicle safety concepts, assessment and development.

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Just what is an ambulance ?? and how is a crash defined ??

EMS Transport Safety Data – Wading thru the MMUCC

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MMUCC (2008) & ANSI D16.1 (2007)

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2008 MMUCC-Definitions Ambulance

Attribute Detail: Police, Ambulance

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MMUCC-Definitions Fire Truck

Attribute Detail: Fire Truck, Military

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Definition Emergency Response mode

Element Definition and Rationale

Element Attributes

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Data pitfalls and failures

- Current data capture system for traffic records data collection creates unidirectional bias towards identifying ambulance vehicles, resulting in inaccurate and underreporting of ambulance crash events
- Designation of 'emergency response' is almost arbitrary.
- It is the responsibility of the leadership in the EMS community to ensure that there is proper EMS input to the ongoing development of these transport data bases.

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Grim comparative data

Transportation safety performance – how does EMS compare to commercial fleets

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Ambulance transport is hazardous when compared to other commercial vehicles

- both per ambulance vehicle and per estimated ambulance mile travelled
- FMCSA provides extensive detail, denominator data and oversight of commercial carrier safety data and performance for which EMS is exempt.
- Thus monitoring the safety of any interventions in EMS transport is severely hampered

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Technical information available

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Ambulance Vehicle Standards??

- KKK?
- AMD?
- FMVSS?
- NFPA?
- SAE...?
- ASTM...?
- International
 - ASA
 - CEN

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30 years later and still the same problem

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WASHINGTON, D.C.

1989: Oct 17, 1995

The interior of the ambulance body was severely damaged. The flooring, oxygen bottles, litter, cabinets, and bench were either destroyed or ejected from the ambulance. Because the forward flooring was not secured to the floor or chassis, everything attached to or resting on it came loose when the ambulance rolled over. All body structures were deformed downward and to the right.

A review of the Federal Motor Vehicle Safety Standards (FMVSS) revealed that there was no guidance or specification which covers the total design and construction of ambulances as modified by the manufacturer to meet the performance, structural strength and stability requirements of the Federal Motor Vehicle Safety Standards (FMVSS) for ambulances. FMVSS 208, "Occupant Crash Protection in Passenger Cars, Multipurpose Passenger Vehicles, Trucks and Buses," applied to the 1974 Chevrolet Suburban Custom 10 Van as manufactured. However, this protection was not extended to the patient(s) or medical personnel occupying the body of the ambulance since it did not apply to the modifications made after the vehicle was sold by the manufacturer.

There are no performance requirements for the after-market modifications to vehicle structural strength, occupant/cargo restraint occupant protection, and the anchorage of items such as litter, benches, cabinets, oxygen bottles, or flooring. The only guidance concerning these safety

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Global EMS Vehicle Safety Standards v Specifications and Guidelines

- EMS Safety and Performance Standards
 - Australia & New Zealand 4535
 - Common European Community (CEN) EN1789
- Non EMS Specific USA Standards
 - [Aviation - FAA/CAA/JAA]
 - [Fleet vehicles - ASSE/ANSI Z15]
- USA Other
 - Purchase Specification: KKK
 - "Standards" - NTEA - AMD, ASTM F 20
 - Guideline: EMSC Dos and Dents, and (ASTNA, CAAS and CAMTS)

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What KKK-A-1822F, AMD and FMVSS state and don't state...

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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)
(RIN No. 2127-AD85)

Federal Motor Vehicle Safety Standards:
Rear Impact Protection

16.1 Vehicles manufactured on or after September 1, 2002, and vehicles manufactured on or after September 1, 2002, and vehicles manufactured on or after September 1, 2002, are exempt from the requirements of 49 CFR 571.17, 572.17, and 589.17 for the purpose of the rear impact protection test. The purpose is to reduce the number of injuries to occupants in the rear of the vehicle in the event of a rear impact collision. The purpose is to reduce the number of injuries to occupants in the rear of the vehicle in the event of a rear impact collision. The purpose is to reduce the number of injuries to occupants in the rear of the vehicle in the event of a rear impact collision.

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USA KKK ambulance purchase specifications GSA:KKK-A-1822F, Aug 2007

- Specifications for the purchase of a Star of Life Ambulance
- Static Pull test
- 2200 Lbs. static stretcher test in longitudinal, lateral & vertical
- No dynamic test for vehicle, occupants or equipment
- No automotive test manikin
- Voluntary www.ntea.com/WorkArea/downloadasset.aspx?id=1352



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USA Ambulance Manufacturing Division (AMD) Ambulance Standards – August 2007

- No dynamic or impact test
- No automotive test manikin
- Mandates NO 'crumple zone'
- No impact tested anchorages for occupant restraint or equipment
- Internal, not independent



<http://www.ntea.com/WorkArea/showcontent.aspx?id=1350>

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Occupant protection.....?? July 2007

Medic Survivors

Medic Fatality



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KKK/AMD – static 'safety testing'

- Ignorant of automotive safety principles – and specifies -
 - No structural damage to any load bearing or supporting members, i.e., torn or broken material, broken welds, popped or sheared body rivets, bolts, and/or fasteners, shall be evident during the application of the force and after the release of the force.

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KKK Specification and AMD Standards both default to the FMVSS for safety – however..

- FMVSS has a specific exemption for ambulance vehicles once you are 600mm or 2 feet positioned rearward of the driver
- KKK require a 'national test lab' to conduct AMD 'tests' BUT NOT an automotive test lab!
- No dynamic impact tests AT ALL
- No crashworthiness tests

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Ridiculous current 2009 USA 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

No 'a'... then NO 'F' !!!!!

- $F = ma$

where F – force
m – mass
a – acceleration

Sir Isaac Newton (1642-1727), Philosophiæ Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy), published in 1687. http://en.ck12.org/wiki/Newton's_Laws_of_Motion

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

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RESOLUTION IN ACTION
An SRA 8(e) Certified Company

Customer Satisfaction

100% Satisfaction

Construction Management

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Australia & New Zealand Ambulance restraint standard AS/NZS 4535:1999

- "Restraint systems shall apply to all equipment and people carried in an ambulance..."
- Dynamic Testing - 50th & 95th percentile manikins
- 24G in Forward and Rearward
- 10G in Transverse

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Common European Community (CEN) EN 1789:1999/A1:2007

European Committee for Standardization

Medical vehicles and their equipment - Road Ambulances

- "Without exception, all persons, medical devices, equipment, and objects normally carried on the road ambulance shall be maintained to prevent them from becoming a projectile when subject to a force..."
- 50th percentile manikins - 10 G in Forward, Rearward, Transverse, & Vertical directions
- Certified by Notified Body and Ambulance Mfg.

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CEN testing - 2007

AH05ZB02 - 80608402 - 27 02 2007, VSC

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Standards Development Update

- NFPA – Meetings June and December 2009
- SAE – x2 standards underdevelopment
 - General vehicle crashworthiness and occupant safety standard
 - Specific equipment and occupant restraint standard
- ISO - ISO/AWI 39001 - Road-traffic Safety management systems
 - Recent update meeting in Canada

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The Future...??

- Lets just look at 10 years ago ...
- And even information presented previously here

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1995- Deceleration Sled test (upon impact) 24 G, 30mph

TYPE RESTRAINT P3 TEST 431

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What is actually happening during an actual ambulance crash

1 - Target vehicle, Type I ambulance
2 - Full vehicle, Type II ambulance
Closing speed 44 mph

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2000 Full Vehicle Crash Testing

Pre-impact CTD positioning

Preparation of test vehicles

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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 over both shoulders for sidefacing occupants are potentially lethal – and in NO WAY SUPPORTED BY ANY DATA OR INDEPENDENT AUTOMOTIVE SAFETY EXPERTISE

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SAE J833 or SAE J1522 ??

- Are these meaningful terms to you?
- The pitfalls of health care providers and non-automotive folks trying to glean info from technical journals

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Misleading use of ergonomic design dimensions to suggest occupant crash survivability envelopes

- Inappropriate standards are being used in this instance to assess the crashworthiness of the crash tested ambulances.
- Neither SAE J833 nor J1522 are occupant protection or crashworthiness standards. These standards are essentially ergonomics standards.
 - SAE J833 is an ergonomic standard specifying human physical dimensions to be used in construction, general purpose industrial, agricultural tractors, forestry and specialized mining machinery categories.
 - SAE J1522 is the recommended practice for describing the two-dimensional 95th percentile truck driver side view, seat stomach contours for horizontally adjustable seats.
- To assess risk to occupants of vehicles, it is essential that crash test dummies and generally accepted injury criteria such as those provided by Eppinger et al [36] are used.
 - Any crashworthiness assessment must be injury performance based."

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'Safety' approaches being driven by manufacturers marketing claims and sales rather than by science and data

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Rash of "Safety Concept" vehicles....
Devoid of substantive automotive safety engineering input or testing



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NO automotive safety crashworthiness and occupant protection engineer
NO ergonomist
NO reference to ANY existing or relevant automotive safety or crashworthiness technical publications....
yet multiple occupant fatalities and injuries annually....



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Systems safety failure AND dangerous

The innovative **EVS High-Mobility-HMR** Harness System for Emergency Vehicles

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

WHAT'S THE PLUS IN THE MOBILITY??


The Belt Can Save With the Attendant!



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



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NOT new technical data...



Richardson S.A., et al, *Int. J. of Crash.*, 4:3, 239 – 259, 1999
Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

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Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

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Yet another potentially lethal example marketed as a 'safety innovation' YET outside of automotive safety practice



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Airbags in the back....??

Absent safety testing standards, any meaningful crash or injury mechanism data or effective occupant positioning – rear compartment airbags are likely to be hazardous

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We should be embarrassed...

- Mast pants – a design that was largely a mistake – that we were able to see didn't work as we were measuring outcomes –
- We are not measuring outcomes with ambulance design – we don't even have a denominator let alone a numerator.
- How many ambulances are there really, what is the distribution of the type of vehicle, how many patients are transported annually in which vehicles – by whom -where?

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Garbage in Garbage Out

- Without the involvement of the appropriate technical experts in the field we at risk of far more egregious hazards than mast pants
- Why is it that we wont listen to the experts on this one – it would save lives, time and money

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Yes, the ride of your life....

- Sure... these vehicles all parade around the EMS and Fire shows
BUT...
- NOT ONE of these vehicles has been to the automotive safety shows or scrutinized by the automotive safety industry

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Technical Collaboration is key

- We are NOT the experts in this science
- We cannot afford to play the silo game here, it is costing lives, time and money
- We MUST have a meaningful evidenced based approach to operations and policy
- We must be outcomes driven
- We MUST cease to be a fiefdom in a discipline we have no technical background or expertise in

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Vehicle Safety Design 101

- What makes a vehicle design safe, with both active and passive safety approaches?
- Basically three things
 - Vehicle handling and stability control
 - Crashworthiness - Occupant protection design
 - Vehicle visibility and conspicuity

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Crashworthiness

- Crashworthiness – a technical automotive science driven by laws of physics and real world crash mechanics and injury biomechanics – NCAP
- Absent real world crash injury and fatality data it is not possible to develop meaningful safety interventions.
- Standards exist for automotive passenger vehicles, but ambulances are exempt (AMD propaganda)

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Crash Dummies aren't smart



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So...

- Crash dummies are not smart – absent meaningful standards there is risk of garbage in and garbage out
- There are side impact dummies for side impact crashes, tests for intrusion
- No dummies to meaningfully model standing up in a moving vehicle –

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Automotive engineers addressing EMS Safety Foundation Workshop



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VEHICLE DESIGN and SAFETY

Extensive Passenger Car and Light Truck Vehicle Safety Standards apply to vehicles below 10,000 Gross Vehicle Weight (GVW)

VEHICLES over 10,000 GVW have a reduced set of Federal Safety Standards

VEHICLE SELECTION IS CRITICAL



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VEHICLE DESIGN and SAFETY

ACTIVE Vehicle SAFETY

PASSIVE Vehicle SAFETY



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VEHICLE DESIGN and SAFETY

ACTIVE Vehicle SAFETY

- ESC (Electronic Stability Control)
- ABS (Anti Skid Braking System)
- Advanced Safety Systems



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VEHICLE DESIGN and SAFETY

- ESC ELECTRONIC STABILITY CONTROL




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VEHICLE DESIGN and SAFETY Mitigating Consequences

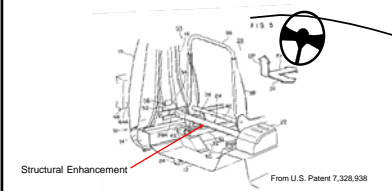
PASSIVE SAFETY: Crashworthiness

- Vehicle Structural Design
- Front and Rear Compartment Design
- Seating and Restraint Systems
- Occupant Containment
- Impact Friendly Surfaces




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Passive Safety-Seat Structure



From U.S. Patent 7,328,938



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Passive Safety- Vehicle design



Fold-in ridges on subframe

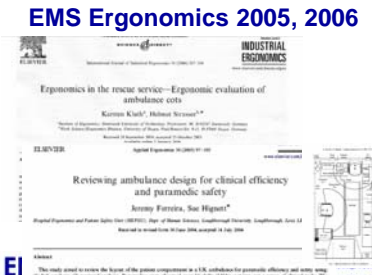
Front axle module

- A main feature in a front-end crash is the "disconnectable" front axle, which releases additional deformation zones in the longitudinal frame member when a particular force level is reached.
- On a frontal crash, transmission and engine will be pushed underneath front occupants.



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EMS Ergonomics 2005, 2006




Ergonomics in the rescue service—Ergonomic evaluation of ambulance cots

Kerem Kılıç*, Hilmiye Savaş*

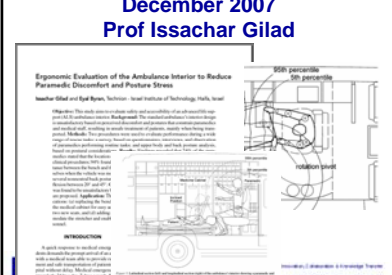
Reviewing ambulance design for clinical efficiency and paramedic safety

Jonny Ferreira, Sue Hignett*




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December 2007 Prof Issachar Gilad



Ergonomic Evaluation of the Ambulance Interior to Reduce Paramedic Discomfort and Posture Stress

Issachar Gilad and Rafi Ryan, Technion - Israel Institute of Technology, Haifa, Israel



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Vehicle type/selection also has bearing on hazards to loading and unloading

- Lowering the loading height to 27 inches or below, can result in a major reduction to injury causing forces during loading and unloading

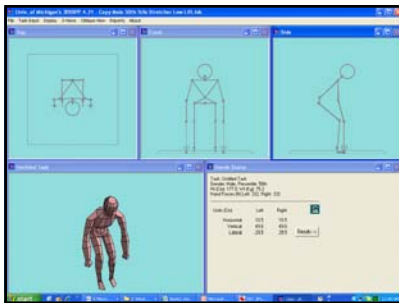
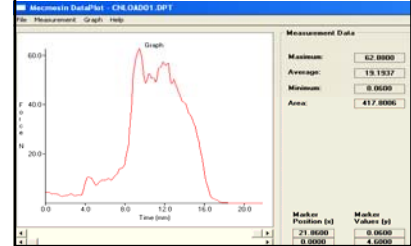
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Stretcher lifting & loading



Stretcher Load - # 1 (CNLOAD01)



Univ. of Michigan's 3DSSPP 4.21 - Copy Male 50th %ile Stretcher Low Lift.tsk - [Analysis Sum]

Description: Company Risk Injury Management Services, Analyst Unknown, Date: 10/28/09
Task: Unlifted Task
Gender: Male, Percentile: 50th, Height: 177.0 Cm, Weight: 75.2 Kg
Comment:

Hand Load			
Face(s)	Left	Right	Mag
X	0.0	0.0	332.0
Y	0.0	0.0	332.0
Z	0.0	0.0	332.0

LS/ST Disc Compression(N) ██████████ 5964 +/- 420

Percent of Population Capable		SDCL(%)	T + @CL	Feet
Elbow:	██████████	99		% Load Left: 50
Shoulder:	██████████	96	SDL	Right: 50
Torso:	██████████	70	SDL	SC Balance: Acceptable
Hip:	██████████	66	SDL	CG Balance: False
Knee:	██████████	99	SDL	
Ankle:	██████████	99		Coef of Friction: 0

3DSSPP4.21. Copyright 2000. The Regents of the University of Michigan. ALL RIGHTS RESERVED

Policy and practice ignorant of existing technical safety data

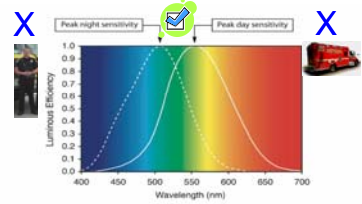


Figure 1. The scotopic (dashed line) and photopic (solid line) human eye efficiency functions, describing the spectral sensitivities of night and day vision, respectively.

Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

- Location
- Size
- Shape
- Speed
- Intended path

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

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Invehicle technologies to enhance vehicle safety

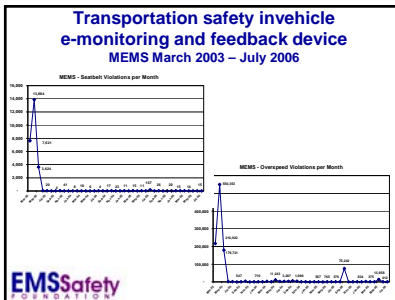
- Aftermarket in vehicle electronic e-safety devices with monitoring and feedback

Business Wire

intheic Delivers tiwi Driving Safety and Fleet Management Solution

intheic.com, a developer and manufacturer of best-in-class solutions to improve driving safety, today announced it has begun production of its full production for light commercial fleets as well as heavy duty and general purpose applications. ICB Inc. companies get the only comprehensive system that changes driving behavior in real time to improve safety and fuel efficiency.

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Goals

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

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Collaboration and Outcomes

- Interdisciplinary Collaboration is what is key – not orthopedic folks talking to cardiologists – BUT collaboration between the health care folks appropriate automotive and occupant protection engineers and transportation system design and industry standards that make sense – and
- Meaningful measures of outcome and performance

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The EMS Safety Foundation: A practical and functional model

Interdisciplinary and Operational

- Innovation
- Collaboration
- Knowledge transfer

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The EMS Safety Foundation November 2009 Webinar for Public Access

www.EMSSafetyFoundation.org and www.objectivesafety.net

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2009 EMS Safety Foundation Rettmobil Delegation

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FORWARD FACING ATTENDANT SEATS
EVERYTHING WITHIN ARMS REACH WHILE REMAINING BELTED

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JUMP PACK
BACKPACK LIKE EQUIPMENT BAG CONTAINS 90% OF PATIENT CARE ITEMS

CARE IN A BAG

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Awkward tasks? Develop solutions!.. Collaboratively with appropriate technical experts

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Texas' Careflite's new vehicles

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Careflite's new vehicle

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Careflite's new vehicle

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EMERGENCY JOURNAL

Local News

IRHA selected to test new ambulance
New design smaller, more cost efficient, say health officials

Sanfida Health is looking to get on its original plan by implementing a pilot project, giving the IRHA a year to test the prototype design to see if it could be a replacement to the current fleet of ambulances.

According to Christenson, the Sprinter design looks similar to delivery vans, and boasts a whole new set of safety and technology features such as GPS.

It's a lot smaller, so that makes it a lot easier for paramedics to be strapped in but still be able to reach all the equipment needed to tend to a patient," said Christenson.

Christenson also explained that the new ambulances require less maintenance, and have an overall smoother, quieter ride. They also are lower to the ground and come equipped with new "no-lift" stretchers, that eliminate 95 per cent of strenuous lifting paramedics do to get patients in and out of the vehicle.

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Manitoba's new fleet



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Why...?

- We don't ask engineers to write cardiac arrest protocols..
- ...then why are we specking out and designing the layout of vehicles – ??? occupant protection environments – it is happening on a daily basis.

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- Operating in an environment where many aspects of safety are still devoid of safety standards – requires technical knowledge and understanding

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Which of these two vehicles would you want? Sprinter v Ford Transit crash test

<http://www.youtube.com/watch?v=C-3AN5WFSVAA&feature=related>

Sprinter V Transit Crash Test



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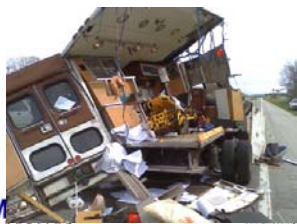
this vehicle is safety crash tested by automotive experts



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Unlike this vehicle



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Is this acceptable...?

- There are ambulances rolling out of the show room on a daily basis – as we speak – being designed by health care providers and built by after market retrofitters, who are not at all governed as are other passenger vehicle manufacturers by existing occupant protection standards

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So what do we need to do ??

- Reach out to the appropriate experts – they sure do want to help us
- STOP being philistines and be the scientists we are trained to be and at least seek a scientific approach
- Get your heads out of the sand – there is plenty of valid technical information – FMCSA, TRB, SAE
- Make policy and purchase decisions on technically sound data, not a marketing brochure
- HAVE MEANINGFUL AND TRANSLATABLE OUTCOME MEASURES FOR YOUR SERVICES SAFETY PERFORMANCE

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What is the EMS Transport Safety Research Agenda?

- Shouldn't it be driven by data, and appropriate technical expertise

And what is the EMS Transport Safety Research budget??

- What has been spent by whom, on what and how, and with what oversight??

What now?

- We need to stop and take a serious look at what we are doing
 - Reach out to the automotive and transportation technical experts for interdisciplinary collaboration
 - Mainstream sessions on transport safety at NAEMSP??
- To wrap up - here is the exact closing slide from 2006 – It is still the future, as we are still trapped in the past and ignoring the present

Future Directions

- Rational use of limited resource
- Avoid reinventing the wheel
- Formal safety research agenda
- Framework bridging key research and infrastructure
 - Society of Automotive Engineers
 - Involvement with ESV activities
 - EMS safety research funding
 - Foster evidence based initiatives

GOALS...

- To cut mortality by half ?....
- How?
- ?Interdisciplinary Collaboration
- Use the RBHPSA
(Runge Big Hairy Problem Strategic Approach)

National Academies TRB Ambulance Transport Safety Summit October 29, 2009 -



Thank you! Any Questions??

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

