Safety inside the “Box” – what really makes a difference

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CEO, Objective Safety
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To quote Steve “Sid” Caesar – Director IHS ES
“We want everyone to get home safely each day”


Leading Edge

Dan Berry (1948-1998)

Dan E. Berry, P.ENG. (1948 - 1998)

- Dan Berry graduated in mechanical engineering from Queen’s University, Ontario in 1972, embarking on a career in mining, transportation and EMS.
- In 1984, Dan joined the Emergency Health Services Branch of the Ontario Ministry of Health.
- In 1981, Dan initiated a series of projects to evaluate the handling, stability and crashworthiness characteristics of ambulances as vehicles carrying patients and personnel.
- Crash testing and frontal crash testing of Van and modular ambulances was completed at Transport Canada facilities in Blainville, Quebec.
- Further safety improvements as the result of analysis of the extensive information base of Ministry ambulance accident statistics, a program of user survey feedback and research of industry initiatives.
- The ambulances now in operation in Ontario are a confirmation of the professionalism and innovative skills of Dan Berry.

Safety - Why now?

- Operating optimally in a transportation environment that is largely devoid of specific safety standards for the hazards and risks present
- Bridge the gap between what technical information exists and what is accessible and applied to EMS

So...

- what policy changes could enhance transport safety?
- what do you see as obstacles to improving transport safety?
- what are ways to enhance awareness and understanding of transport safety issues?
- what devices could be considered to enhance transport safety?
- how is data on transport safety captured?
- how can you identify predictable and preventable risks during transport?
Safety process
- Identify hazards
- Raise awareness of safety issues
- Create a safety attitude
- Promote Teamwork
- Provide motivation
- Accolish established goals

Safety Management
- Culture of Safety
- EMS Practice and Policy
  • Travel dispatch
  • Safe driving policy and practice
  • Driver selection and training
  • Fleet safe use policy - for providers, patients and passengers
  • Safety monitoring and feedback
  • Stop at red lights and stop signs
  • Emergency Vehicle Operators Course (EVOC)
  • Secure all equipment
  • Use portable communications
  • Notify driver if rear occupants are in vulnerable positions
- Fleet Management
  • Fleet Safety program
  • ANSI/ASSE Z.15

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

Creating a Safety Culture
within a company must start with upper management's commitment to safety
- Awareness
- Training
- Incentive

Tragedy you don't want to be involved in

New paradigm - Integration of EMS
- Public health departments
- Social service agencies
- Community outreach
- Hospitals
- Health care networks / Insurers
- Industry

EMS is multidisciplinary
- Primary focus has been physician driven - optimizing acute health care and practice
- But.... NOT optimizing
  • Communications/data -- administrative and health care
  • Transportation aspects and safety

Issues
- Patient, provider and public safety
- Key issues
  • Essential Emergency service
  • Low budget
  • All environments
  • Recruitment and retention issues
  • Technology dark ages
  • Communication, administrative, transportation and health care data challenges

Did someone design this system as a stationary one - that didn't move??
- This IS acute health care, communications AND transport
What a novel idea…

EMS Transport Safety

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

New Information 2006-2008

- Enhanced Safety of Vehicles (ESV), June 2007
- American Society Safety Engineers (ASSE), June 2006 & June 2007
- Transportation Research Board – EMS Safety address, Jan 2007
- ASD Engineering Public Comments, July 2007
- KAKK August 2007
- COSH September 11, 2007 Federal Register
- SAFEREA 12, 2008
- Transportation Research Board – Inaugural EMS Safety Subcommittee meeting Jan 2008
- NIOSH Emergency Responder Round Table March 2008
- OSHA EMS best practices late 2008
- Worker visibility Act, to be implemented, Nov 2008

Firstly!

- An accident?
- or a predictable and preventable event

In a nutshell

- Am here to try to save you
- Lives
- Time and
- Money

http://www.objectivesafety.net

C45 - A criminal offence to not act in a way that protects the worker

Canada - Corporate Manslaughter
Corporate Homicide Act: 8th April, 2008

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 systems?
- How do I get my team to address safety issues?
- What data should I collect when something goes wrong, and how to analyze it?

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.

A tragic emergency health care intervention outcome
It does happen……

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……

And Nov 10ths 2007 obituary……

Thursday July 5th 2007……
Paramedic Allan Parson's killed

"...I'd like to know what can be done so this never happens again...."
2 weeks later… Friday July 20th 2007
The worst ambulance crash in USA history

Five Killed in Crash of Ambulance and Semi

July 21, 2007 06:20 AM EDT

The high-speed crash was deemed fatal for the driver and two of the four patients in an ambulance that hit a semi-truck on a Florida highway.

The driver died at the scene, and all four patients were declared dead at the hospital. The crash occurred on a straight stretch of road, and the ambulance was not reported to be on an emergency run.

January 10, 2008

This is not a crashworthy environment

Jan 28th, 2008

April 14th, 2008

April 20, 2008 ??

The newspaper column pictures show the dramatic scene of the crash, with the ambulance on its side and the patients being transported to the hospital. The column mentions that the ambulance was not crashworthy and that the crash occurred on a straight stretch of road.

Emergency personnel throughout the region are also affected and scooping their own. “This is our worst scenario when it’s one of our own,” said Dan Stahl of the Paramedic Fire Department.

“Everyone is in shock,” said Fr. Bill Ryan, a resident of the region, “but we must press on.”

Barry Shaffer, director of Bellingham Emergency Management Agency, said the accident has had a major impact.

“I have offered our emergency personnel at the county,” he said. “We have a few more hours and then we will be able to return to the normal routine.”

The driver said there is a need to review the ambulance and improve its safety features.

1 dead, others injured in Sussex crash involving ambulance

Citation happened at the intersection of Delaware Corn and Indiana between two miles north of town.

In some areas, NJ, was sent for evaluation by the Intensive Care Unit in the United States, 12 miles north of town.

Two of the patients, both minor, were then taken to the hospital. The driver of the ambulance and the remaining patient were transported to the hospital. The cause of the accident is still under investigation.

April 20, 2008 ??
May 19th, 2008

An interhospital transport

FATALITIES AND FUNERALS

An Interhospital Transport

What's important

What's not important
- What's going to save your life
- What's going to hurt you
- What's going to protect you
- What might take your life
- What is factual
- What is garbage

- What is new
- What is not new

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

**Unique workplace**
- In vehicles
- At roadside and other emergency scenes

**The 'workplace' IS a vehicle**
- EMT's often in vulnerable positions during transport.
  - Bench seat
  - Captain's chair
  - Standing or kneeling

**The 'workplace' is also a crash scene**

**Absence of standards and oversight**
- Challenges in identifying best practice
- Myriad of unregulated commercial products
- No safety performance standards
- Absent national safety oversight
What we need to consider, where is the 'bang for buck' in ambulance transport safety:

1. Challenges to Optimizing EMS Transport Safety
   - Disparate and fragmented safety infrastructure
   - Lack of a centralized EMS Safety oversight or data
   - A large number of small groups of end users, with a mix of volunteers and professionals
   - Ambulances are hybrid non-standard vehicles, a truck chassis and an after market box or a modified van
   - EMS vehicle safety is not integrated as a part of the transport safety industry

2. USA 1960’s

3. 1960 to 2007
   - A passenger vehicle - yes!

4. Some recent adverse outcomes
   - UPS and Laundry trucks have very similar design and even more stringent safety requirements to EMS vehicles
   - BUT very different cargo......
   - People are passengers and NOT packages or parcels

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

6. 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
Ground Transport Safety IS Complex AND Multidisciplinary

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

There are more safety standards for moving cattle than for moving patients

The National Transportation Safety Board (NTSB)

NTSB 1979 Accident Report

Emergency Vehicle Operator Course (Ambulance)
National Standard Curriculum

EMS transport process

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

The Emergency Department (ED)
An ambulance is not an ED/ICU on wheels.

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

USA EMS data
- In the USA:
  - ~ 50,000 vehicles
  - ~ 5,000 crashes a year
  - ~ One fatality each week
  - ~ 25 pedestrians or occupants of other car
  - ~ 10 serious injuries each day
  - Cost estimates > $500 million annually
  - USA crash fatality rate/capita 35x higher than in Australia

USA crash fatality rate/capita 35x higher than in Australia

Canada EMS
- EMS Systems - ~? in each province
- Personnel - ~723,000
  - (~70% FT, 30% PT, 7% volunteer)
- Vehicles:
  - ~72,000
  - (Type I, Type II, Type III, Freightliners, motorcycles)
- Transports:
  - ~72 million
  - (30 Emergency, 50% FT, 70% PT)
- Cost:
  - ~?$500,000,000 annually
- Safety Oversight:
  - ~Disparate

Is it your service’s tragic year?
- ~ 50 fatalities a year
- 15,000 EMS services
- Each year one in 300 services experiences a fatality

NOW.. that’s an Emergency...

So for EMS personnel...
- What’s going to kill you?
- What’s going to injure you?

This is not how you want to see your partner during a transport.
James Woodman
- is a paramedic who, on his first day as a paramedic, suffered a severe TBI when the ambulance he was riding in (in the back) was t-boned and rolled onto its side.
- He remains in a persistent vegetative state in an ECF in Colorado.
- It is assumed that when the ambulance rolled onto its side, the lifepack 10 struck James in the head.......

It is assumed that when the ambulance rolled onto its side, the lifepack 10 struck James in the head.......

and what is killing EMS?

EMS personnel fatalities*
- 74% transportation related
- 15% of ground transport fatalities were struck by moving vehicles
- 11% were cardiovascular
- 9% were homicide
- 4% needle sticks, electrocution, drowning and other


"Ambulance transport has a death toll....."

Carl Craigle EMT-P, Chief Platte Valley Ambulance
Colorado Springs, April 2007

"Real world" head-on post crash
Clinical Care? Occupational Health and Safety…..?

- This IS a Transportation and Automotive Safety issue
- This is a Systems safety issue

What do ambulance crashes really cost?
- Loss of life and injury
- Negative impact on EMS system
- Collisions are the largest liability cost and exceeds malpractice or negligence
- Besides the direct financial costs of replacing a damaged ambulance and equipment, there are additional hidden costs incurred:
  - investigating the ambulance collision
  - litigation/mediation/lawsuit
  - medical/disability costs of injured EMTs
  - hiring of new employees to replace injured personnel
  - retraining and psychological counseling of personnel involved and others
  - increased insurance rates

Safety is Good Business

June 2007

A problem

2007 Insurance data –
- 27 fold more likely to have a claim based on transport than related to medical care

Expensive….

The inevitable bottom line….
Safety saves time, lives AND money
Canada, Nova Scotia

- Since 2000 working towards a goal of zero loss ratio with insurance provider
- 10 million kilometers per year
- 150 emergency response ambulance units
- Collision claim history measured in dollars per 100,000 kilometers traveled:
  - 2000/2001 $1725.00
  - 2001/2002 $1049.00
  - 2002/2003 $751.00
  - 2003/2004 $416.00
  - 2004/2005 $229.00

Very Scary insurance data

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Workers Compensation Rate increased by 26.5 %
Was $5.86/$100 payroll in 2005-2006
Now it is $7.41 for 2006-2007

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

EMS Transport Safety
- ‘patient safety’
  AND also
- ‘provider’ and ‘public safety’

Key Elements to Safety
- Data Capture
- Vehicle Biomechanics and Crashworthiness
- Ergonomics and Biohazards
- Transportation Environment
- Safety Management – evaluation and analysis

Vehicle Biomechanics & Crashworthiness
- Vehicle
  - Compact crashworthy vehicles (i.e., vans)
  - Non-hostile interiors
  - Lock down positions for equipment
  - Seat belts for all occupants
  - Over-shoulder harnesses for all patients on the stretcher

Ergonomics and Biohazards
- PPE
  - Head protection
  - Protective Clothing
  - Visibility
  - Biohazard protection
- Equipment and Vehicle Layout and Design
  - Equipment interface ergonomics
  - Vehicle interface ergonomics and human factors
  - Vehicle visibility and appropriate warning signals

Data Capture
- Vehicles
  - Total number and type
  - Total number of runs
  - Total number of miles traveled
- Providers
  - Total number and type
  - Hours worked
- Transportation adverse events, including mechanism - both injuries and fatalities
  - The vehicle
  - Patient
  - Provider
  - Public

Transportation Environment
- Integration with Highway Safety strategies
- Partnerships/collaboration and Information sharing
- Intelligent Transportation System (ITS) Technologies
- Driver/vehicle performance monitoring & feedback devices
- Collision avoidance vehicle technologies
- Signal systems
- Roadside safety design and planning technologies
- Vehicle positioning and scene safety issues
- Hospital ambulance bay access and egress
- Fleet mix
  - Rapid response vehicles
  - Vans, Trucks, Motorcycles, other
A number of potential interventions to enhance safety have been identified:

- Safety Policy
- Safety performance standards
- Vehicle crashworthiness
- Vehicle interior ergonomics
- Personal Protective Equipment design
- Driver selection, training and simulation
- Safety and risk awareness modification
- Risk behavior modification
- Intelligent Transportation Systems (ITS)

Some challenges

- No accepted national safety standards for -
  - EMS fleet management or safety practice
  - Ambulance vehicle rear compartment design and performance
  - Provider occupational injury protective equipment
  - Yet convincing data for injury risk and hazard
  - Need for patient, provider and public safety focus

Safety data on EMS transport and its oversight

- EMS vehicle crash rates are in excess of similar sized vehicles
- EMS worker transport fatality rates are well above other emergency services
- Is exempt from Federal Motor Vehicle Safety Standards (FMVSS), and not covered by other national transportation system safety oversight (ie. FMCSA)
- Almost non existent ergonomic research or data
- The findings of limited research conducted to date suggest EMS transportation safety is in need of urgent focus and has been left behind commercial truck and bus safety.
Priorities......
Research papers in the past 30 years
- EMS Safety
  - 40 papers - on ambulance safety
  - 2 papers - on ambulance ergonomics
  - 1 paper - on stretcher ergonomics
- Computer Workstations
  - 30,000 papers - on ergonomics of computer work stations
- Erectile Dysfunction
  - 100,000 papers - on Erectile Dysfunction

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

Increasing awareness...

Risk/Hazards
- Predictable risks
- Predictable fatal injuries
- Serious occupational hazard
- Public safety hazards

EMS Best Practice, Sept 2006
- It does happen....

IMPORTANT ADVISORY
- Due to respect for the wishes of the families of medics killed in the line of duty there is to be NO PHOTOGRAPHY of any aspect of the images in this presentation - that is NO video, NO photography, NO digital images of any type

But what about head protection?

New EMS helmet prototypes for 2008
Problems
- No Standards
- Unique safety and hazard protection needs
- A number of less than appropriate devices out there

EMS has unique head protection needs – not well met by a ‘truncated’ fire helmet...

What are the solutions?
- Training?
- Practice Policy?
- Transportation Systems Engineering?
- Automotive Engineering?
- Education of other road users???

“The best driver safety device is a rear view mirror with a cop in it”
Dudley Moore

Dynamic vs. Static Safety Testing

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

The Crash Event - Crash Testing
- An introduction
- What one needs to know
- What do the tests really mean
- And, what tests are meaningful
Intrusion vs Deceleration
- Intrusion = vehicle to vehicle or vehicle to fixed narrow object
- Deceleration = sudden stop – i.e. sled test

Dynamic Safety Testing
- Requires sophisticated, expensive equipment
- Measurably demonstrates forces generated during collision
- Accepted international standard for vehicle restraint systems

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

Why do we do this?

Full Vehicle Crash Testing
Test 1 – Right side impact

Why do we do this?

- Target vehicle, Type I ambulance
- Bullet vehicle, Type II ambulance
- Closing speed 44 mph
And this all takes place in 60 millisecs – the blink of an eye.

NIOSH Ambulance Occupant Safety Crash Testing

‘Safety’ approaches being driven by manufacturers’ claims and sales rather than by science and data.

A few key words about restraint systems...

NIOSH Ambulance Occupant Safety Crash Testing

Not new technical data...

The Ride of Your Life....

NIOSH Ambulance Occupant Safety Crash Testing

Being seated IN an automotive seat is what will protect you.

How many predictable lethal features can we see here??

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 side-facing occupants are potentially lethal – and is in NO WAY SUPPORTED BY ANY DATA OR AUTOMOTIVE SAFETY EXPERTISE.

Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds.
Dangerous seat belt anchorages

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

concept vehicles I & II ??

Dangerous failures of both occupant protection and systems engineering

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

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

JEMS and EMS Responder ARE NOT automotive safety journals
► And the reviews in them are completely inappropriate, misleading and outside of what is known in automotive safety
► We should NOT TOLERATE this as it is both completely irresponsible and very dangerous .......

Innovation
Safety concepts out there now
- Driver feedback technologies
- Tiered dispatch
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies - ITS
- New Safety Standards

The Driver
- Driver selection
- Driver monitoring and feedback
- Driver Impairment
- Driver training

Driver issues
- Which is best, how many hours...??
- What about changing driver behavior in the real world??

What about changing driver behavior in the real world??
- Purpose of ‘Feedback box’ Program
  - Enhance Safety
  - Improve Driver Performance
  - Save Maintenance Dollars
  - Aid Accident / Incident Investigation

How the Device Works
- Computerized monitoring device installed on each vehicle to measure parameters
- Each driver has individual key “fob”
- Data collected every second
  - including: vehicle speed and performance, driver behaviors and emergency mode
- Auditory feedback of warning ‘growl’, and penalty tones
- Data downloaded automatically every day

Demonstrated Effectiveness
- MEMS MONTHLY OVER SPEED VIOLATION TREND 2003/2004
- Demonstrated Effectiveness

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

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

You want a system that works!!
- Does the system really work
- Is it going to be a major burden on your staff to implement
- What are the real costs
- Are you going to have video of your company vehicle on youtube??

The jury is out on
- Opticon
- Simulators

And very Predictable...
- Intersections are lethal environments

So.. The real world for an EMS vehicle approaching a red light
- You think they heard you...
- You know they must have seen you...
- And maybe they did
- ......But...
- There is NO way humanly possible that they could stop.....

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

The EMS Safety Foundation
Intro and Logistics Webinars from December 11th 2007 & Jan 8th 2008
EMS Safety Foundation tab at www.objectivesafety.net

International approaches
- The state of the art non-USA vehicles have NO squad bench nor the after market structural vehicle modifications that can potentially decrease crashworthiness integrity that were seen in study vehicles.
RETTmobil – ‘Mobile Rescue’
Major European event for EMS innovation
Fulda, Germany May 2008
http://www.rettmobil.com/

Innovative safety design and ergonomics

Some creative seating approaches
And here are some more

Important…
- Ergonomics and automotive safety issues are interrelated

Australia, Melbourne

One patient or Two patients and you can reach both AND your equipment…

a fleet based initiative
Custom is expensive – Fleet is not

These vehicle features have been developed and used very successfully in other countries ambulance fleets

But what about US?

What are some of the challenges of transferring these approaches to North America

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

USA KKK ambulance purchase specifications


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


What KKK 2007 states – and some Type II Exemptions

3.10 AMBULANCE BODY AND PATIENT AREA

3.10.1 EMERGENCY MEDICAL SERVICES PROVIDER (EMSP) SEATING

3.10.2 EMERGENCY MEDICAL SERVICES PROVIDER (EMSP) SEATING

3.10.3 PATIENT COMPARTMENT INTERIOR DIMENSIONAL PARAMETERS

3.10.4 BODY, GENERAL CONSTRUCTION

3.10.5 BODY, GENERAL CONSTRUCTION

3.10.6 AMBULANCE BODY STRUCTURE

3.11.1 INTERIOR STOWAGE ACCOMMODATIONS...

Further KKK information

4.3.3 CRITERIA OF "STAR OF LIFE" CERTIFICATIONS.

The initial testing and inspections required for certification shall be performed by a nationally recognized independent testing facility...

Each ambulance constructed shall be tested by the FSAM to demonstrate compliance with AMD Standards 5, 9, 10, 15, 21 & 25.

4.3.5 CERTIFICATION VERIFICATION DATA REPORTS.

The testing facility for each certification shall supply supportive verification data and information on letterhead stationery in electronic format (PDF files):

1. For whom tested
2. Report date
3. Name of sample product or device
4. FSAM's address
5. Serial and model number(s)
6. Specification referral and amendment number(s), and test requirement(s)
7. Test facilities used and location
8. Test equipment used
9. Test procedure
10. Test results
11. Verifying test data
12. Photographs
13. Test conclusion(s)
14. Witness(es), and authorized signature

4.4.1 TEST CRITERIA.

The ambulance shall be prepared for operation in accordance with OEM's recommendations, and AMD Standards 001-025.

6.5.1 LITTER FASTENERS AND ANCHORAGES.

All areas of the litter retention system shall be tested to confirm the retention system is safe for the patient.

6.5.2.1 PATIENT SEATING...

All seating positions in the patient compartment shall be provided with a vertical overhead clearance measurement of 43"...
- No dynamic or impact test
- No automotive test mankin
- Mandates NO ‘crumple zone’
- No impact tested anchorages for occupant restraint or equipment
- Internal, not independent

[Link to NTEA]

**AMD – static ‘safety testing’**

- Inconsistent with automotive safety principles – and specifies that a ‘successful test’ is:
- 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.

**FMVSS exempt….**

- Unacceptable, and non-automotive AMD/KKK-F ‘safety testing’ practices and standards !???
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

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

USA Ambulances: FMVSS Exemption

FMVSS has a specific exemption for ambulance vehicles once you are 600mm or 2 feet positioned rearward of the driver.

K-KK require a ‘national test lab’ to conduct AMD ‘tests’ BUT NOT an automotive test lab!

No dynamic impact tests AT ALL

No crashworthiness tests

NFPA Ambulance Standard Development

- NFPA Ambulance Standard Development Public Comment
- The Public Comment period for the development of the new NFPA Ambulance Standard – is open until October 15, 2008

NFPA Ambulance Standard Development Public Comment Request

- NFPA Ambulance Standard Development Public Comment
- The Public Comment period for the development of the new NFPA Ambulance Standard – is open until October 15, 2008
Vehicle Occupant Safety design

2008 European design
Safety technology is a key focus.
Ergonomic design

27 inch loading height - Sprinter

Interior height - Sprinter

Australia, Melbourne

NSW Australian vehicles

Flexibility to manage two patients

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

Norway initiatives
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?

Were we safer in the Cadillac???

Other successful models

Ergonomic layout and equipment

Securing equipment

Safety concepts out there now
- Fleet Safety Management
  - Z-15
  - Driver monitoring and feedback
- Enhanced ambulance vehicle design
- Intelligent Transport Technologies - ITS
- Visibility and Conspicuity
- New Safety Standards
- Life Safety Initiatives
- Resources and information

Safe Practices for Fleet Motor Vehicle Operations
What Z15 encompasses
- Safety Program
- Safety Policy
- Responsibilities and Accountabilities
- Driver Recruitment, Selection and Assessment
- Organizational Safety Rules
- Orientation and Training
- Reporting Rates and Major Incidents to Executives
- Oversight

Incident Rates
- Incident rate based on number of vehicles operated:
  Incident rate = \( \frac{\text{Number of incidents}}{\text{Number of vehicles}} \) x 100
- Incident rate based on vehicle mileage:
  Incident rate = \( \frac{\text{Number of incidents}}{\text{Vehicle mileage}} \) x 1,000,000
- Injury incident rate based on vehicle mileage:
  Injury incident rate = \( \frac{\text{Number of incidents with injury}}{\text{Vehicle mileage}} \) x 1,000,000
- Incident rates based on service activity:
  Incidents per 10,000 transports = \( \frac{\text{Number of incidents}}{10,000} \)
- Vehicle injury rates based on work hours:
  Incident rate per 200,000 hours = \( \frac{\text{Number of incidents}}{200,000} \)

Some new challenges
- Crash reporting to whom?
- Crashworthiness to what standard?
- Ergonomics based on what ergonomic requirements?
- Driver selection/training and monitoring - based on what guidelines?

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

Use proven safety tools

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

Hmm...

So why is it...
- That the EMS providers -
  - Were wearing navy blue – one of the most difficult colors to see at night
  - Had no head protection, when all other emergency personnel at the scene did
  - Had no protective clothing, when other emergency personnel at the scene did???
News we don't want to see

Caught On Video: EMT Struck By Car

Worker visibility Act:
Help is on the way!! November 24th 2008

There are grants to assist you...

Policy and practice ignorant of existing technical safety data

Night visibility

Visibility and lighting issues

Warning Light Glare
Disability glare
-> A bright light source in the visual field reduces the ability to see objects
  - (windscreen, rain & spectacles)
Discomfort glare
-> Irritating or painful glare that may cause drivers to avert their gaze
  - (headlights in the mirror or rear-facing red fog-light)
Under Way...
Emergency Vehicle Visibility and Conspicuity Study
- Funded by the USFA
- Conducted by IFSTA
- Looking at the effectiveness of reflective markings used on emergency vehicles
- Doing best practice research and working with manufacturers

“Anything that lengthens reaction time increases the chance of an unwanted event” Virginia Solomon

“...the multicolored (patterned) ambulance while distinctive, may suffer decreased conspicuity because of the effects of camouflage” (De Lorenzo & Eilers Annals EM 1991)

Color-blindness affects 10% of the population
- As seen with normal vision
- As seen with color blind vision

No uniform standards....

Emergency Vehicles – Viewer Awareness
For a timely, appropriate and safe response
- Location
- Size
- Shape
- Speed
- Intended path

This looks cool AND SAFE!

From this..... to this
This is AWESOME – and addresses some very real risks, very creatively – and currently ONLY available in London Ontario!

Another excellent example - From this to … this!

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

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

But whatever color …. If you run a red light some will be killed

R & D “Ripoff and Duplicate”

Avoid reinventing the wheel at all costs

Where are the best practices that we need to transfer knowledge from

Air EMS is a role model for safety initiatives and focus
Integration and Collaboration

State Strategic Highway Safety Plans
- Required as part of the SAFETEA-LU legislation
  - (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users)
- Effective October 1st, 2007
- Focus is the 4 'E's
  - Engineering
  - Education
  - Enforcement
  - Emergency Medical Services
- EMS is a core theme

Oklahoma, where is your SHSP EMS Chapter!!

Ambulance Safety Summit November 7th, 2008
- EMS Transportation Safety Subcommittee of the National Academies Transportation Research Board (TRB)
- Onsite panel of invited technical experts, in addition to policy makers and EMS leaders:
  - Safety data capture
  - Transport fleet management, EMS vehicle operations
  - Automotive safety and occupant protection
  - Ergonomics and human factors
  - Hydraulics
- Will be beamed live via Webinar and recorded electronically and TRB e-circular produced
- Access to live participation requires pre-registration
- Pre-registration info disseminated in early October

TRB Jan 2009 EMS Subcommittee Meeting and Seminar
- The Subcommittee on EMS Transportation Safety of the National Academies Transportation Research Board winter subcommittee meeting and seminar is in DC during the 2009 January TRB symposium
- Your input and participation (onsite or online) is valued
- You can submit your suggestions/input for the TRB EMS Subcommittee meeting online -
  - http://www.emssaftysfoundation.org/TRBpriority.htm

New NHTSA EMS info link
- There is a new Federal link to EMS info - a great resource!
- www.EMS.gov

Ambulance Manufacturer Division (AMD) 2007 Standards
- Public Comment, July 2007
- Engineering Analysis, Jan 2008
- Engineering Analysis, Feb 2008

TRB Jan 2008
- Goal: "Safeguard the Public and the EMS Professional"

ICEM April 2008
- ICEM 2008 - International Conference on EMS and Transportation Issues
- ICEM 2008 - International Conference on EMS and Transportation Issues
- ICEM 2008 - International Conference on EMS and Transportation Issues
Traffic Incident Management Systems (TIMS)

- Just released April 2008
- FEMA, USFA, IFSTA
- Covers setting up safe roadway incident work areas and using unified command at these incidents

What do we know now??

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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
Risk/Hazards

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

Creating a Safety Culture

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

- Awareness
- Training
- Incentive

Some simple and available solutions out there now

- Intersection Policy
- PPE
- “Feedback” boxes

What do we know works...

- Vehicle Operations Safety Policies
- Squad bench lap seat belts
- Patient over the shoulder harnesses
- Securing equipment
- Forward and rear facing seating
- Some electronic technical devices
- Safety awareness
- Cultural change

What you can do now

- Have a written and implemented ‘safety program’
- Secures all equipment
- Secure occupants with standard belts
- Don’t drive through red lights/stop signs
- Use properly implemented “Feedback Boxes”
- Monitor crash events with common denominators (i.e. per 100,000 miles and per trip)

Important Principles!

1. A culture of safety
2. Drive cautiously
3. Wear your belts & restrain all occupants
4. Secure all equipment
5. Integrate scientific data into your policies and procedures

- Unrestrained occupants and equipment are a potential injury risk to all occupants

Very Important Principle

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

small changes can make a BIG DIFFERENCE

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

PREDICTABLE PREVENTABLE and NO ACCIDENT
Conclusion

- EMS transport has serious hazards and safety issues
- Major advances in EMS safety research, infrastructure and practice over the past 5 years
- New technologies for vehicle design, occupant PPE and equipment restraint and driver performance are now available
- Development of substantive EMS safety standards is a necessity and a reality
- 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 safety and occupant protection

And....

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

Thank you!
Any Questions??
Electronic handout available online
http://www.objectivesafety.net