What is the scope of EMS?

- Emergency care, public health, public safety and patient transport
- Bridge between the community and the hospital
- Volunteer – professional
- Urban – rural
- Disaster response
- Majority of transports NOT critical or life threatening

EMS Transport Surprising FACTS

- 97% of transports are routine
- ONLY <3% are life threatening critical
- 25% of calls NO Patient is TRANSPORTED

Why??

Ambulance Safety design modeling?

Outcomes are of concern

- EMS operations are identified to be high risk
- High fatality rates in vehicle crashes and decelerations – highest of any fleet
- High injury rates in patient handling in and around the vehicle.
Some adverse outcomes

Key EMS Safety Dimensions
- Safe systems – CRM / transport system safety
- Risk perception
- Fleet and operations management
- Vehicle design safety (Occupant protection and ergonomics)
- Scene safety
- Patient Handling
- Health and wellness

Vehicle Design Safety
This presentation covers just one aspect of the systems engineering safety approach to addressing the key determinants of the safe operation of an EMS system.


We now have
- Disruptive technologies
- Design innovation
- New tools
- Lean platforms

How to design an operational environment where the EMT can safely do the work that is key to improving patient outcomes??
Ask the end user...?

- Well obviously YES – but they are health care providers and are trained to make do with what they have
- They know what the are required to do, and they have wish lists based on their experience – both good and bad

BUT THEY ARE NOT TRAINED IN AUTOMOTIVE OCCUPANT PROTECTION OR HUMAN FACTORS AND ERGONOMICS!

- user involvement is key BUT in combination with technical expertise in those specialist areas

Core safety concepts have been clear for many years now.. And accessible to the industry gratis.. But largely ignored even in this setting of high morbidity and mortality

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

1864 Ambulance Design Patent and diagrams
Almost 150 years ago

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

The Laws of Physics Prevail.

Philosophiæ Naturalis Principia Mathematica, July 1687

USA 1980’s Then….

And NOW!...

USA 1980’s Then….

And now almost 40 years later…

Real world crash performance…

Full Vehicle Crash Tests

Test 1 – Right side impact

1. Target vehicle
2. Bullet vehicle
3. Target vehicle
4. Bullet vehicle

Test 2 – Frontal

1. Target vehicle
2. Bullet vehicle
3. Target vehicle
4. Bullet vehicle

Closing speed 44 mph
2000 Full Vehicle Crash Testing
Pre-impact CTD positioning

Testing the real world

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

Impact residue

During impact

CTD dynamics
Equipment hard to reach

Innovation Yes Now...

Europe and Scandinavia

But avoid repeating old mistakes!
‘Safety’ approaches being driven by manufacturers claims and sales rather than by science and data

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

Ambulance Vehicle Standards??

- KKK?
- AMD?
- FMVSS?
- NFPA?
- SAE…?
- CAAS?
- ASTM…?
- International
  - ASA
  - CEN

current ambulance ‘safety testing’ ? – Is NOT consistent with accepted automotive safety practice...

The Laws of Physics Prevail..
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

Some concerning approaches

- Flawed design assumptions
- Unsafe from an automotive safety perspective
- Providers can't fit in
- Can't reach patient or equipment from seated position
- VERY expensive

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
- Cot/bed is combing related on incline
- Cables, tubing, & leads are routed along wall panels
- 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

Do any adult humans have a 2 inch deep waist line ???

Roadside Seat

Oversimplified unrealistic graphics

Curbside Seat
Concepts
- Being creative is good
- Trying to advance design is good
- Doing it in conflict with what is demonstrated to be safe and functional is a major problem
- Doing it outside of known principles of automotive safety and occupant protection is at best dangerous

Major Issues
- The majority of medics in the USA could not get in or out of this contraption
- There is no evidence to support the use of all this cabinetry, most of which is both unreachable and an occupant protection hazard
- This environment is very unsafe from an automotive occupant protection
- The cost is prohibitive to build all this cabinetry

Clear benefit in building a configurable physical environment
- Computer models are good for conceptual sharing – we began with them
- Physical models can test and demonstrate real world accessibility, reach and comfort – rapidly and for a range of body sizes and shapes

There appeared to be a need for a different tool to engage and educate the end user and to be providing a platform for change within a service/industry
Ambulance Safety Innovation Design Module 1.0

www.INDEMO.info

Based on technically sound automotive safety and ergonomic scientific principles

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.

Vehicle Crashworthiness Performance Sprinter v Ford Transit crash test
http://www.youtube.com/watch?v=C3kN5WF5vAA&feature=related

this vehicle is safety crash tested by automotive experts
Unlike this vehicle

The result of the frequency analysis, green dots mark equipment used every time the ambulance is driven, orange is used every day, red every week & white seldom.

And what is the loading height of your ambulance??

Size matters.... Less than 27 inches will save your back!!!!

Integrated Systems Engineering

- System of safety - a central part of the operational process, not a parallel aspect

Process

- Vehicle dimension selection was based on automotive safety testing parameters
- 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.
Our initial tools-
from some interdisciplinary, and international collaboration and design input

Ambulance Safety INDEMO 1.0

EMS Safety Foundation
New Ambulance Safety Innovation Design Module
INDEMO 1.0
Go to the target audience

- Bring the INDEMO 1.0 project to EMS conferences, national and regional
- Install PTZ cameras to share the concept remotely
- Make friends with EMS Media
- Publish in scientific journals
Science behind Policy

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

Richard P. Feynman 1988

Key dimensions

1) Safety must be inherent to operational process design
2) Automotive safety and ergonomics are key and inter-related for safe design
3) Engagement of appropriate interdisciplinary expertise in systems design and safety analysis is essential
4) 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.

Your electronic presentation handout/resource link

http://www.objectivesafety.net
Your Handout and Additional Resources

www.objectivesafety.net/PDFHO.htm

Or if you are < 30 years
Thank you!
Any Questions??

a .pdf handout of this presentation awaits you all online!
www.objectivesafety.net/PDFHO.htm