Mile High RETAC
EMS Safety Summit, Denver 2015

August 28th, 2015

EMS Safety and Innovation:

The Cutting Edge and You!

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

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outline

1. Review of data on ambulance crashes and safety standards and guidelines that exist and are being developed for ground EMS
2. Identification of ground EMS transport safety issues, hazards and areas of risk to patients, providers and public
3. Profile innovation, new safety technologies and strategies and knowledge transfer to enhance safety and reduce risks of ground EMS and patient transport

So what is safety?

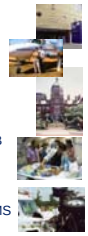
- condition of being protected against undergoing or causing harm, injury or loss

And.. what is innovation?

- Something new, original and ? more effective

Who am I?

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



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

EMSSafety FOUNDATION

www.EMSSafetyFoundation.org

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

A huge thank you to all those from all aspects of the industry and operations who have made all this special work possible

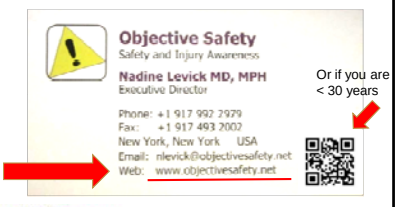
Your electronic Handout awaits you online at…

- www.objectivesafety.net

This WILL be FAST!!

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

Your electronic handout



Your electronic presentation handout/resource link

Or if you are < 30 years

www.objectivesafety.net/PDFHO.htm

So what are we going to cover today??

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

EMS operations are identified to be high risk

- The concept of a systems engineering safety approach and innovations developed and developing to address the key determinants of EMS transport safety.

Safety Dimensions

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

Things can go wrong –

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

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

- National Academies TRB
- NAEMT
- EMS Safety Foundation

Safer Better Cheaper is NOW

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

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

Safety Road Map

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

EMS Safety timeline

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

Goals right now

Better, safer and cheaper

Key Innovation - NOW

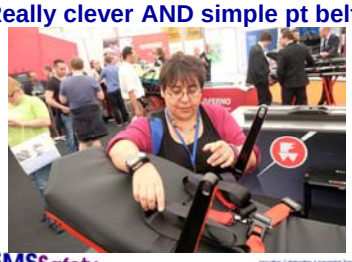
- Achievable today
- The only thing keeping us from it ….. IS US!!

Fleet management tech tools

- Fitted Invehicle

- Smartphone based

Really clever AND simple pt belts



Smarter stretcher platforms

Stretcher by roadside wall

Stretcher right by provider

Science based design

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

INDEMO 1.0
POWERED BY EMS SAFETY FOUNDATION

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

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

1864 Ambulance Design Patent and diagrams

Almost 150 years ago


UNITED STATES PATENT OFFICE.

S. W. ARNOLD, OF MORGANTOWN, WEST VIRGINIA.

IMPROVEMENT IN AMBULANCES.

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1980's Then….

And NOW!…

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USA 1980's Then….

And yes now…

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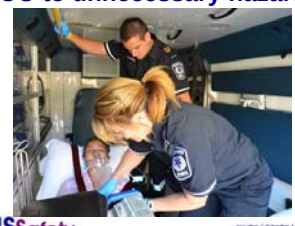
Poor interior design exposes YOU to unnecessary hazards



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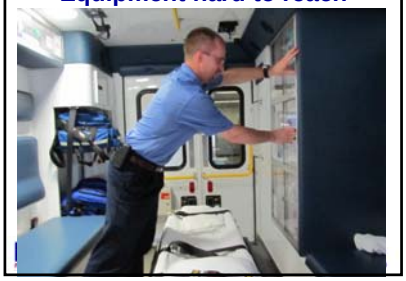
Equipment hard to reach



Innovation Yes Now…

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But avoid repeating old mistakes!

A System of Safety

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Very Important Principle

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

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Safe Systems Approach

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

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Systems safety of:

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

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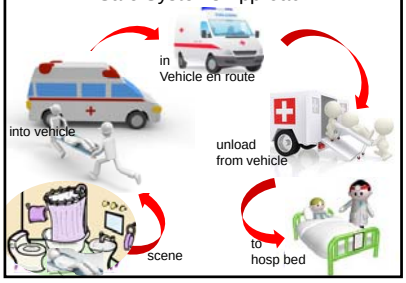
Safe Systems Approach



System Design Constraints

- Do the clinical work that is required and essential
- Not get hurt or killed
- Not hurt or kill anyone else

So…

- Clinical need
- Human tolerance of injury

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Real world answers to real world questions -

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

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July 2015

Child killed in vehicle collision with ambulance on Va. interstate

A car lost control, crossing into the path of an oncoming ambulance; other passengers in critical condition

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January 2014


Doctor killed in latest mowdown horror

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This could be you….

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

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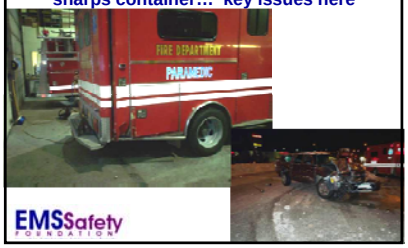
Anchorage Daily News

Paramedic injured in crash is recovering

Operational practice decisions, vehicle choice, visibility and the location of the sharps container… key issues here



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When is it safe to do what… ?

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

  and… where IS your sharps container??

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

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What is a survivable impact ?

IRMRC

12 mph (20 km/hr)?

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What is a survivable impact?

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

IRMRC

~ 30 mph - survivable

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What is a survivable impact?

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

~ 60 mph – not survivable

A survivable impact??

A serious problem…

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

A tragic emergency health care intervention outcome

Rollover Crash Kills Medical Technician

Ambulance Runs Off I-66 and Rolls Over, Injuring Two Employees and a Patient

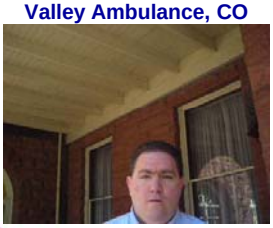
It does happen….

But what about head protection?

New EMS helmet prototypes

Head protection @ EMS Expo

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



Visibility and lighting issues

Day visibility

Night visibility

Policy and practice ignorant of existing technical safety data

X X

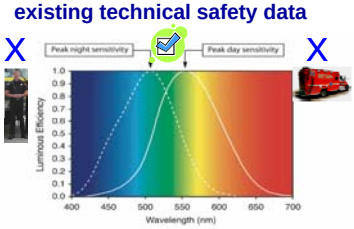


Figure 1. The scotopic (dashed line) and photopic (solid line) luminous efficiency functions, describing the spectral sensitivities of night and day vision, respectively.

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

Emergency Vehicles – Viewer Awareness

For a timely, appropriate and safe response

- Location
- Size
- Shape
- Speed
- Intended path

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

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

And very Predictable…

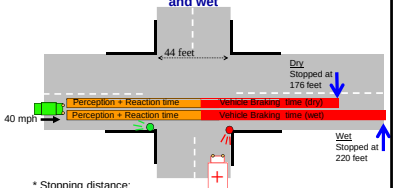
- Intersections are lethal environments

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



* Stopping distance:
Perception time + Reaction time + Vehicle braking time
(varies with age, skill, agility, alertness + vehicle type, tire pressure, road etc)

20 years ago…

and now… July 2015

automotive safety engineering data

2000 Full Vehicle Crash Testing

Pre-impact CTD positioning

Preparation of test vehicles

Testing the real world

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

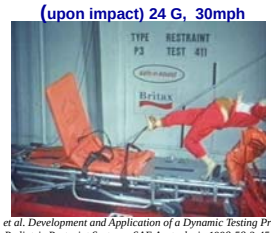
A few key words about restraint systems…

Dynamic Sled Testing of Ambulance Pediatric Restraints

(a resident research project)

Deceleration Sled test

(upon impact) 24 G, 30mph



Levick NR, et al. Development and Application of a Dynamic Testing Procedure for Ambulance Pediatric Restraint Systems, SAE Australasia 1998;58:2:45-51

Immobilization board

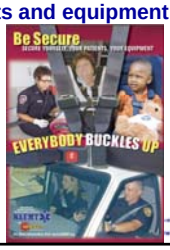
Foldable on the stretcher, or even squad bench BUT NOT CAPTAINS CHAIR

Basically…

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

NAEMT July 2006 Position statement

Stretcher patients must be in the over the shoulder belts, medics restrained in seat belts and equipment secured



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Clever pt shoulder belts

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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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Beware some provider restraint systems are dangerous

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

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

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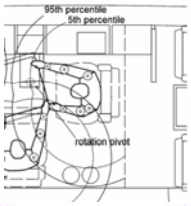
Systems safety failure AND dangerous

Overwhelming existing evidence these practices are HIGHLY dangerous

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

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



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Key concept re: design of ambulance vehicle interiors

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

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Which of these two vehicles would you want?

Sprinter v Ford Transit crash test

http://www.youtube.com/watch?v=C3kN6WF5vAA&feature=related

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this vehicle is safety crash tested by automotive experts

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Unlike this vehicle

So….

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

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Some concerning approaches

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

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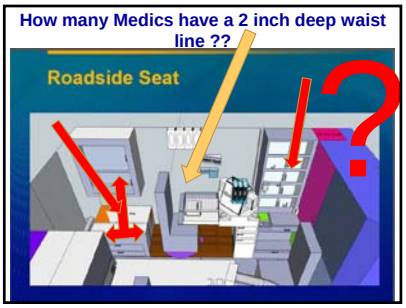
Flawed design assumptions lead to flawed design

Occupant safety and access hazards

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



WE DO HAVE TECHNICAL DATA!!!

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TRB TRANSPORTATION RESEARCH BOARD OF THE NATIONAL ACADEMIES

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

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

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Safety Systems, Strategies and Solutions Summit Feb 2012

- ~50 onsite – lead representatives
- Live online participation with international representation
- 7 focus areas and a panel
- >230,000 downloads of presentation handouts
- Multi-Media 'e-document' with QR tags
- You tube overview

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

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TRB EMS Safety Systems Strategies and Solutions Summit

Session 1

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Its out there NOW

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

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Your TRB EMS Safety Systems Strategies and Solutions Summit Multimedia Document

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

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So scientific evidence clearly shows !

- Use fleet management tech
- Use patient stretcher shoulder straps
- Wear your lap belts

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Some info about the

EMSSafety FOUNDATION
Innovation, Collaboration & Knowledge Transfer

www.EMSSafetyFoundation.org

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EMS Safety Foundation In a nutshell

- is a not-for-profit multidisciplinary virtual think – tank and test bed for EMS safety innovation and knowledge transfer
- It is a virtual network integrating innovative forward thinking end users and the technical experts from diverse non-clinical disciplines
- A tool to enhance the safety of delivery of EMS services

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R & D

Reuse

"~~Rip~~off and Duplicate"

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

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EMS SAFETY COURSE

National Association of Emergency Medical Technicians

NAEMT

EMSSafety FOUNDATION

NAEMT EMS Safety Course Committee

NAEMT EMS Safety Course

For more information on how to sponsor a course,

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

EMSSafety FOUNDATION NAEMT

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

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Innovation!

Out there now!!

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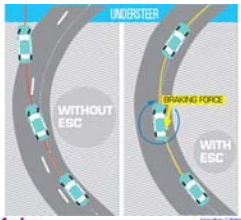
Vehicle Electronic Stability Control - ESC



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Smart stretchers - hightech

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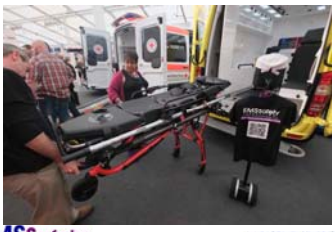
Clever Stretchers – low tech



Smart Loading systems

Clever bag design

International approaches

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

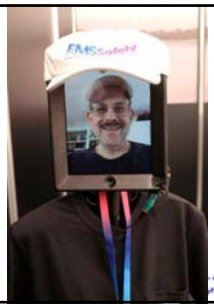
Rettmobil 2015, May 6-8

http://www.rettmobil.org/index.php/en/

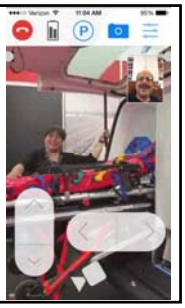
EMS Safety Foundation Delegation

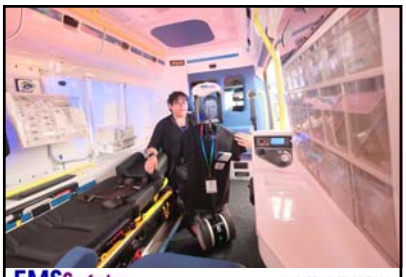
seeking out International Innovation

EMS Safety Foundation Robot, Andi



From Allan's iphone in Connecticut



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Pensi
Special platform
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Awkward tasks? Develop solutions!
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The old expensive and not versatile
and the new…
Rapidly and game changing technology and cheaper, better, very versatile
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Ambulance Safety Innovation
Design Module 1.0
www.INDEMO.info
the future you can have right now!!!
Better, safer and cheaper

INDEMO 1.0
POWERED BY EMS SAFETY FOUNDATION

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Innovation Design Module (INDEMO) 1.0

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

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

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

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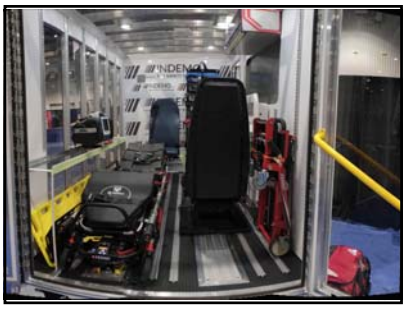

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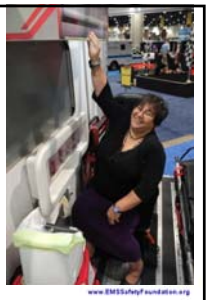

INDEMO 1.0

You can have a virtual tour of INDEMO 1.0 with Andi at EMS Expo
or
schedule INDEMO to visit your site/conference

http://www.emssafetyfoundation.org/INDEMOScheduleForm.htm

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http://www.emssafetyfoundation.org/INDEMOScheduleForm.htm
The EMS Safety Foundation
EMS Safety Foundation INDEMO Onsite/Virtual Tour Interest Form
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www.EMSSafetyFoundation.org


INDEMO 1.0
I just had an
INDEMO tour!
You can too!
http://www.emssafetyfoundation.org/
INDEMOScheduleForm.htm
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Other new tools we have now
Google Glass May Help Emergency Physicians Improve Patient Care
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From Wired August 2014
This $500 Display Makes Your Junker Car Feel Like a Fighter Jet
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Wearable tech..
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www.EMSSafetyFoundation.org


Wireless Physiological Monitoring
http://www.visimobile.com/visi-product-info/
ViSi MOBILE
PRODUCT INFORMATION
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AED Drones!
Ambulance Drone Delivers Defibrillator by Air (VIDEO)
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A lot is now possible and for less!

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

Tech advancements

- CAD
- Resource allocation
- Fleet performance –
  - Monitoring: System that gives management data of vehicle efficiency and use
  - Feedback: Directly to drivers at the wheel
- Public Alerts

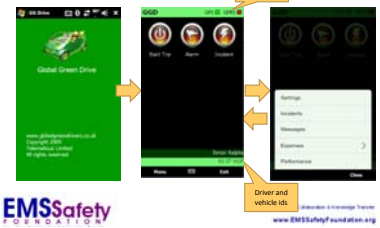
Cutting edge Technology for fleet management

- Invehicle fitted technologies
- Smartphone based technologies

Fleet Management technologies

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

A smart phone App that is a fleet safety tool



Telematicus

Fleet Management capability

Vehicle database
- Individual vehicle/ data
- Fleet mileage collection/Checklists
- Link to other systems (SAP, Fleet)

Maintenance & Service Plans
- Repair history & Scheduling
- Action planning

Reporting
- Export to Excel for manipulation
- Scorecards views, Crystal Reports reporting
- Direct Feedback

Future horizons – the Ferno IPTS platform

New vehicle modalities

The ambulance response vehicle of the future?

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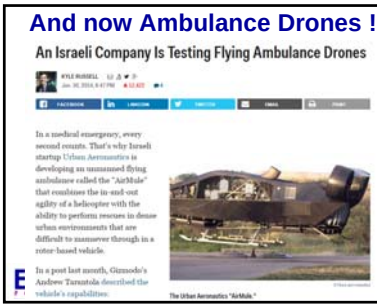
And now Ambulance Drones !

An Israeli Company Is Testing Flying Ambulance Drones



EMSSafety FOUNDATION

are you interested in the

EMSSafety FOUNDATION

Innovation Consortium?

Save lives, time & money!

Innovation, Collaboration & Knowledge Transfer

www.EMSSafetyFoundation.org

Your electronic presentation handout/resource link

Or if you are < 30 years

www.objectivesafety.net/PDFHO.htm

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Key dimensions

1) safety must be inherent to operational process design – interplay between patient, provider and public safety from a systems perspective is key for innovation in addressing effective and safe operational EMS performance
2) engagement of appropriate interdisciplinary expertise in systems design and safety is essential
3) USE fleet management tools, USE your lap belts and pt shoulder belts AND USE science based design!
4) We HAVE innovative technical safety info now
5) Get ready for adoption of rapid innovation!! .

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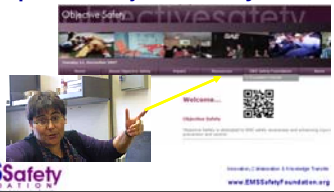
Thank you!

Any Questions??

Electronic handout and resources available online

http://www.objectivesafety.net



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