

Mile High RETAC
EMS Safety Summit, Denver 2015
August 28th, 2015

EMS Safety and Innovation: The Cutting Edge and You!


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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



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So what is safety?

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



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And.. what is innovation?

- Something new, original and ? more effective



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Who am I?

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




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



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



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



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- www.objectivesafety.net

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



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Your electronic handout





Objective Safety
Safety and Injury Awareness

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Or if you are < 30 years

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So what are we going to cover today??

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

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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.

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Safety Dimensions

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

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



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

- National Academies TRB
- NAEMT
- EMS Safety Foundation

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Safer Better Cheaper is NOW

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

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

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Safety Road Map

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

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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*

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Goals right now

Better, safer and cheaper



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Key Innovation - NOW

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



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Fleet management tech tools

- Fitted Invehicle 
- Smartphone based 



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Really clever AND simple pt belts




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Smarter stretcher platforms

Stretcher by roadside wall

Stretcher right by provider





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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



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



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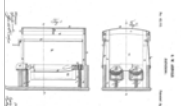
Letter to Abe Lincoln – 1864 re: safety of ambulance design

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1864 Ambulance Design Patent and diagrams
Almost 150 years ago

UNITED STATES PATENT OFFICE
 A. W. JENNISON, OF BOSTON, MASS., FOR THE TITLE
 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



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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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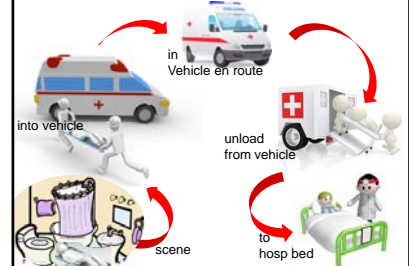
Systems safety of:

- 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

July 5, 2015 | Email | Print | Comment | RSS

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



January 2014

Doctor killed in latest mowdown horror

By Steve Swanson and Glenn Collier January 17, 2014 11:48 AM

The ambulance that was involved in the mowdown of Dr. Lee and his wife was seen on Tuesday morning, Jan. 14, 2014.

A 36-year-old doctor was fatally struck by a truck on Tuesday morning, Jan. 14, 2014.

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This could be you....

An EMS worker is seen after the ambulance mowdown from the car park.

Lee had graduated from the University of California, San Diego School of Medicine this past June. Hospital and school officials said Monday.

He grew up in Berkeley, Calif., and did his undergraduate work at the prestigious University of California, Berkeley, UCSD officials said.

"Tommy was an outstanding student whose warmth and compassion highlighted the lives of his patients and our school community," said Dr. Caroline Kelly, associate dean for admissions and student affairs at the UCSD School of Medicine.

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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

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Paramedic injured in crash is recovering

By Julia O'Byrne Anchorage Daily News Published December 28, 2014 at 10:07 AM

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

The Dodge bracketed the ambulance, which had lights flashing and horns on, hitting it in the back around 8 a.m. as the medic vehicle was crossing the Stearns Highway at Airport Heights Drive. Outside the ambulance were seriously injured patient Andrew Malara, his wife, Gal Malara, and four Anchorage Fire Department personnel: driver Eric Tuitt, 33; EMT Lisa Thomas, 42; and paramedics Dave Wallace, 43, and Tony Bragaglia, 36.

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

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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 ?

12 mph (20 km/hr)?

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What is a survivable impact?

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


~ 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

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A survivable impact??



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A serious problem...

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

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A tragic emergency health care intervention outcome



Rollover Crash Kills Medical Technician
Ambulance Rans Off 100 and Rolls Over, Injuring Two Employees and a Patient

It does happen....

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But what about head protection?



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New EMS helmet prototypes



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Head protection @ EMS Expo



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



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Visibility and lighting issues



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Day visibility

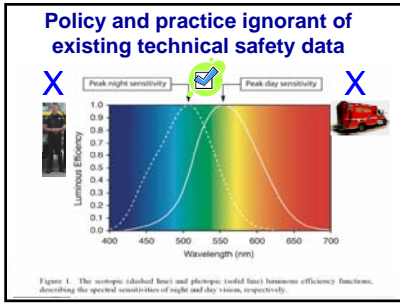


EM

Night visibility



EM



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




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And very Predictable...

- Intersections are lethal environments



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So.. The real world for an EMS vehicle approaching a red light

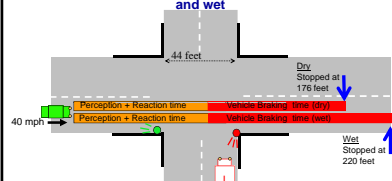
- You think they heard you..
- You know they must have seen you..
- And maybe they did
- But..
- There is NO way humanly possible that they could stop.....




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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)



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20 years ago...




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and now... July 2015

NJ EMT killed in ambulance crash laid to rest

Hundreds of family, friends and first responders attended the funeral service for Alina Patel, 29, who planned to attend medical school in the fall

By EMS1 Staff

Alina Patel, 29, a family and friend mourned a late Jersey EMT who was killed when a car crashed into an ambulance at an intersection.

EMT Alina Patel, 29, died on July 10 in an intersection crash. The crash led to the funeral of hundreds of family, friends, neighbors and emergency responders from across the state attended the service.

At the funeral at Republic Memorial Park in South Brunswick, East Brunswick Rescue Squad Captain A.J. Ciommi called her death tragic, and difficult for her many EMS colleagues.

"This was a tough week for local first responders," Ciommi told EMS1.com.

Doris Brown-Rivers, president of the Spokesman Board of Education, said that Patel "lived a short life, but one that was full of meaning and impact."




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automotive safety engineering data

QUANTITATIVE ANALYSIS OF THREE PROTOTYPE AMBULANCE VEHICLES

DEVELOPMENT OF PROPOSED CRASH TEST PROCEDURES FOR AMBULANCE VEHICLES

Author: [Name], [Title], [Company]

Abstract: [Summary of the report's findings and objectives]





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2000 Full Vehicle Crash Testing

Pre-impact CTD positioning

Preparation of test vehicles

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Testing the real world




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

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A few key words about restraint systems...

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Dynamic Sled Testing of Ambulance Pediatric Restraints (a resident research project)

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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

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Additionally there was a serious concern about a further system failure in the design of the USA vehicle. This was the seating design that included a seating configuration in the rear facing seating position that could be modified to provide a small restraint system for use for a child. The concern of the authors address the safety of a child in that seating design. First, given that the modified seat did not offer lateral protection (as extended child safety seats would offer) and thus it also exposed the child to serious head spine hazards in the event of a side or offset impact. Secondly, should a child restraint be seated in that position that there would be less lateral protection in that position than there would be in that position with a child seated in that manner with their back against the wall, and second, there was no table for an ambulance provider to provide medical care to a child patient in that position without putting both the child patient and the provider at risk. This is due to the provider having no seating position that would allow access to the child with the provider unobstructed. Thirdly, that since a child was seated in that modified seating position, the provider would be forced to be seated in the only other available seating position. These seating positions in the USA make the use of a child restraint in that position, as well as the USA study, address the side facing seating seat. It will not be used in low or even use prior to the agreement (see above). These types of systems safety systems, when the conditions of use are not fully met, demonstrate that the interaction between occupants and their restraining seats create real hazards. This represents a low or repeated danger. Future research of the

2006-01-2699
Ambulance Vehicle Crashworthiness and Passive Safety Design: A Comparative Evaluation

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Immobilization board

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

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Basically...

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

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NAEMT July 2006 Position statement

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

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Richardson S.A., et al. Int. J. of Crash, 4:3, 239-259, 1999
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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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Richardson S.A., et al. Int. J. of Crash, 4:3, 239-259, 1999
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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

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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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Richardson S.A., et al. Int. J. of Crash, 4:3, 239-259, 1999
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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>

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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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

Design Assumptions

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



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Occupant safety and access hazards

Conceptual Design



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

Roadside Seat



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WE DO HAVE TECHNICAL DATA!!!

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TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

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

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

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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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2012 EMS Safety Systems, Strategies and Solutions Summit

Summit Overview (Feb 29, 2012)

Summit Agenda (Feb 29, 2012)

<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

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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
“~~Ripoff~~ and Duplicate”

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

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EMS SAFETY COURSE

National Association of
Emergency Medical Technicians

NAEMT 

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NAEMT EMS Safety Course

For more information on how to sponsor a course,

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

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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



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Smart Loading systems



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Clever bag design



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International approaches

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

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Rettmobil 2015, May 6-8 <http://www.rettmobil.org/index.php/en/>



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EMS Safety Foundation Delegation seeking out International Innovation



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Special platforms

Technical specifications

- Length: 1900 mm (standard) and 2000 mm (optional)
- Width: 600 mm
- Height: 800 mm
- Weight: 120 kg (standard) and 150 kg (optional)
- Load capacity: 200 kg

Risks of unaided movement:

- Unstable load
- High velocity when shifted or pushed
- High acceleration
- High deceleration
- High vibration

Wrong movement profiles and force transfer generate overall poor operation.

The platform can be modified about any size, dimensions and load capacity. There are no restrictions on the number of platforms and their use in different settings.

The platform is used worldwide by the EMS industry and is certified for different kind of applications.

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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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Innovative | Ambulance | Knowledge Transfer
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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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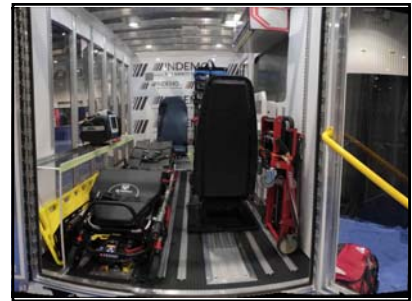


EMS Safety Foundation's new demonstration Project: Ambulance Safety INDEMO 1.0

- 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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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

EMSSafety Foundation INDEMO 1.0 Quality/Wired Tour Schedule Form

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I just had an INDEMO 1.0 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

By Scott Hines | January 9, 2014 | 4 Comments

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From Wired August 2014

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

By Alexander Grosse | October 1, 2014 | 10 Comments

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Wearable tech..

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Wireless Physiological Monitoring

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

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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




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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



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Cutting edge Technology for fleet management

- Invehicle fitted technologies
- Smartphone based technologies



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Fleet Management technologies

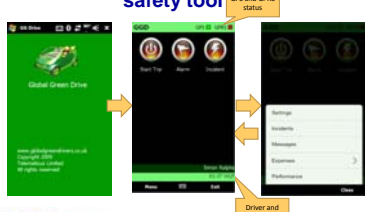

- ACETech/Ferno
- FleetEyes – Intermedix
- Zoll rescuenet and roadsafety fleet management systems
- Marvis
- Telematicus
- Optima
- Northrop Grumman



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A smart phone App that is a fleet safety tool

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Telematicus

Fleet Management capability

Vehicle database


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

Maintenance & Service Plans

- Repair history & Scheduling
- Action planning

Reporting

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

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Future horizons – the Ferno IPTS platform




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New vehicle modalities




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The ambulance response vehicle of the future?

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And now Ambulance Drones !

An Israeli Company Is Testing Flying Ambulance Drones

BY KYLE BURGESS | 12.18.15
Jan 30, 2016, 8:47 AM

In a medical emergency, every second counts. That's why Israeli startup Uziqon Aeronautics is developing an unmanned flying ambulance called the "Aurilia" that combines the in-and-out agility of a helicopter with the ability to perform rescues in dense urban environments that are difficult to maneuver through in a rotor-based vehicle.

In a post last month, Gizmodo's Andrew Tanenholz described the vehicle's capabilities.

The Uziqon Aeronautics "Aurilia."

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are you interested in the

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Innovation Consortium?

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Innovation, Collaboration & Knowledge Transfer

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Your electronic presentation handout/resource link

Or if you are < 30 years

www.objectivesafety.net/PDFHO.htm

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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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