

September 24, 2022

EMS LEADERSHIP SUMMIT

September 29 - 30, 2022

The Fourth Annual EMS Leadership Summit

How to Advocate, Innovate & Inspire for the Future


EMS Safety and Innovation- new horizons!

Nadine Levick, MD MPH
 Research Director, EMS Safety Foundation
 CEO, Objective Safety
 Director of Research and Innovation, Emergency Health Services




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




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



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What are we going to cover ??


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



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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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The Future is NOW!



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eVTOL, XR and the median ambulance

electric Vertical Take Off & Landing and mixed reality



URBAN AERONAUTICS SWITCHES TO REDESIGNED HYDROGEN-POWERED eVTOL AIRCRAFT



Online VR EMS Training you can build yourself

Real life training without real life consequences

Safety of the...

- Provider
- Public
- Patient

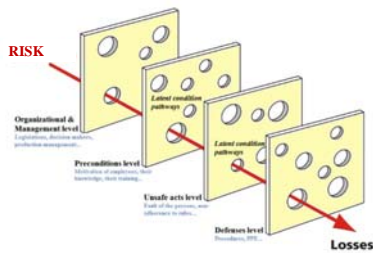
Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

Work Smarter NOT Harder

Swiss Cheese risk and losses



Next is now!

- Fleet mix
 - Vertical take off vehicles
 - Drones- manned and unmanned
 - Propulsion technologies – electric, hydrogen
- Smart Technologies
 - AI dispatch
 - AI Ultrasound
 - Voice activated commands
 - Advanced Smart phone technology
 - XR - Mixed reality
- Covid PPE and innovation
- Connected health
- Wireless patient monitoring
- Health Information Exchange (HIE) Applications

Be ready to deploy new and effective tools for both training and operations

Leadership and Innovation

“Being responsible sometimes means pissing people off... By procrastinating on the difficult choices, by trying not to get anyone mad, and by treating everyone equally "nicely" regardless of their contributions, you'll simply ensure that the only people you'll wind up angering are the most creative and productive people in the organization.”



A Leadership Primer from General (Ret.) Colin Powell,
Former Secretary of State, USA

New Solutions

- Training and education
- Operational tools
- PPE innovation
- New Transport Vehicles
- AI Support tools and adjuncts
- Community Engagement
- Scope of practice

Chris Cebollero, 2020

- "Leadership is not about position, it's about professional development."
- Leadership as a verb, it's an action not a position and everyone will influence someone else... for the good or the bad.

An All Hazard Safety Approach

- Multidisciplinary Hazard Analysis
 - Biological
 - Physical
 - Chemical
 - Psychological
 - Operational
- Applied use of state of the art technology to address and neutralize or minimize hazards

Designing a safe system

Safety in EMS is INTERDISCIPLINARY
 clinical practice
 public health
 automotive safety
 new technologies
 impact biomechanics
 human factors
 fleet safety

How do you frame safety?

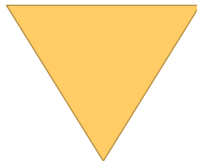
To quote Chief Justin Reed

- “if there is a failure in a system that you design, then it IS leaderships fault”
- “How did someone fail in a system YOU designed?”

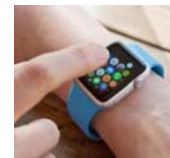
This changes the way you frame a problem – and enhances the process to build a solution

How does design happen in EMS

- Tradition
- Experience
- Vision
- Interdisciplinary



1980's Then....



And NOW!...

USA 1980's Then....



And 2022...
 for much of USA EMS

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



EMS vehicle is a work and patient care environment!!



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Richardson, J. et al. *Journal of Emergency Transportation*
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April 9, 2022 –
EMT killed in ambulance crash



Firefighter EMT killed, 2 others injured in ambulance crash on SR-87 in Mesa

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June 12, 2022
Patient dies after ambulance crash



Safety in this vehicle...?



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Testing the real world



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



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NOT new technical data... Beware some provider restraint systems are dangerous

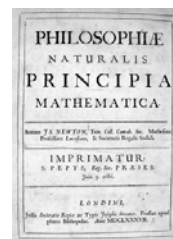


Richardson S.A., et al. *Int. J. of Crash*, 4:3, 239 – 259, 1999
Side facing 4-point harnesses demonstrated to be lethal, even at low ground vehicle speeds

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Richardson, J. et al. *Journal of Emergency Transportation*
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The Laws of Physics Prevail..



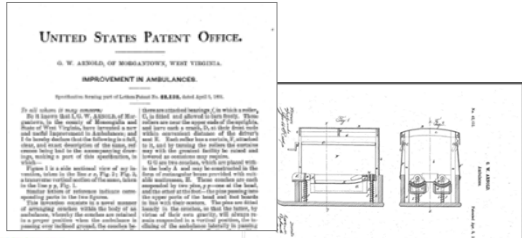
Philosophiæ Naturalis Principia Mathematica, July 1687



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1864 Ambulance Design Patent re: safety of ambulance design > 150 years ago



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If you were to survey for what would enhance safety and efficiency then....

- Likely "more rest stations"
- Not likely – "the combustion engine"
- Let alone the Hydrogen powered eVTOL

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to quote David Daniels, 2022

"it's easier to remember than it is to imagine"

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EMS Safety timeline

- Didn't know it was an issue – 60's-70's
- Knew it was an issue – 80's-90's, but didn't really know what to do
- Safety technical data rolls out – from 2000 but....
- **Change and adoption challenges – we are here now**

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To Do...

- The right thing:
 - At the right place
 - At the right time
 - For the right person
- How best to achieve that goal now and for the future??

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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

As a leader – how do you create change

The late Chief Alan Brunacini

- “If you want to make changes in the workers’ behavior, change the behavior of the boss.”



How far upstream can we go for minimizing risk

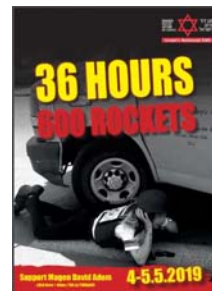
- The Boss
- The Manufacturers
- The State?
 - ie - In Israel 95% of rockets fired at civilians are deactivated by the Iron Dome -
if not for that technology the EMS and Emergency Health care system would frequently be rapidly overwhelmed

An Iron Dome for EMS....



Rockets (R) are seen in the night sky fired towards Israel from Beit Lahia in the northern Gaza Strip on May 14, 2021, while Iron Dome interceptors rise to meet them. (Photo by ANAS BABA / AFP)

Constant preparedness a reality



Iron Dome - Effective technology to 24/7 minimize casualties and EMS burden September 12, 2021

Home / Israel News

Gaza Rocket Intercepted Over Southern Israel for Third Consecutive Night

No casualties or damage reported



Alon Ben Elzei

Follow

Wed, 12, 2021 8:58 PM

A rocket fired from the Gaza Strip was intercepted Sunday over southern Israel, the Israeli military said in the third consecutive night of cross-border fire. No casualties or damage were reported.

Tension between Israel and the Palestinians has risen over the past week, after six Palestinian militants escaped from a maximum security Israeli jail on Monday. Israeli forces have since

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Today's Challenges

- Doing what we already know works!!
- Adopting new technologies and practices that augment EMS performance and safety
- Embracing decentralization of health care
- Doing more with less – money and workforce
- Cross skilling EMS, industry and the community
- Systems thinking and practice

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Innovation!!

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Joe Bourgraf, President, Ferno Group

- “To create an innovative and model EMS system..., we must engage in a collaborative and cross-functional conversation among the many contributing partners in the EMS industry. EMS suppliers should embrace and drive new innovation.. to improve the process and efficiency of delivering service, while advancing the level and outcome of emergency care”

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From low tech to high tech

- System of Safety
- Think of the overall impact
- Small low cost changes in practice
- Policies that augment safety
- Innovation in design from micro to macro
- Preparedness and Training

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EMS Safety's frontier -

- the interface of disruptive new tech and operational practice at all levels of the EMS system and across disciplines

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2001- 2022: a 20 year window Predicting EMS Safety innovation

Sept 11, 2001.... 21 years on



TOPTEC, September 11th 2001

- Risk Management Strategies
- Biomechanics
- Accident Analysis
- Ergonomics / Human Factors
- Crashworthiness
- Training Programs
- Legal Perspectives

From 2001 Toptec - Needs

- Need for morbidity and mortality surveillance system
- National and International collaboration is key
- Current funding base is rate limiting to progress
- A defined pathway for translation of problem identification to resolution and policy implementation
- Need for appropriate overseeing infrastructure with development of safety performance standards

From 2001 Toptec - Needs

- Focus on safety of ALL aspects of the ambulance environment
- Real dangers exist in some current practices
- Safer patient transport practices exist & should be used
- Importance of dynamic vs static safety testing
- Collaborative, interdisciplinary approach (bridging all involved disciplines) for design initiatives & setting of transport safety standards is essential

TRB EMS Safety Summit

<http://www.EMSSafetyFoundation.org/2012TRBSummitMultimediaWithLinks.pdf>



TRB TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

The 2012 TRB EMS Safety Summit

print this page & your smart phone will play the 8 sessions from the QR codes



- 1: Intro & Data and Recent Initiatives
- 2: Transport, Human Factors - Bridging Diverse Disciplines
- 3: Testing and Standards
- 4: New systems safety technology solutions & telematics
- 5: Fleet management strategies
- 6: Innovative Vehicle Design
- 7: Operationalizing Safety
- 8: Panel: How to optimize the safety of your existing fleet
Wrap up – from Prof. Art Cooper

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Safety Dimensions we know

- Safe systems – CRM / transport system safety
- Risk perception
- Fleet and operations management
- Vehicle design safety
- Scene safety
- Patient Handling: physical & biological hazards
- Health and wellness
- Hours of service

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Promoting Innovation in EMS – 2018



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So....., 2022 to 2050?

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EMS Agenda 2050

https://www.ems.gov/pdf/EMS_Agenda_2050_Summary.pdf

- Adaptable and Innovative
- Inherently Safe and Effective
- Sustainable and Efficient
- Integrated and Seamless
- Socially Equitable
- Reliable and Prepared



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New Tools, New Vehicles new industry relationships

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Now we have many new technologies

- Fleet management tools
- Diverse vehicle types and design: including Drones and eVTOL manned and unmanned
- Robotic tools
- AI augmented Dispatch
- AI Ultrasound
- XR – AR, VR
- Connected Digital Health
- The Cloud
- The Crowd

..... that we need to harness

Be ready to deploy new and effective tools for both training and operations

Goals

Better, safer and cheaper

Risk Perception

Communicating Risk

Which image of hurricane Sandy communicates better risk perception



Communicating risk



Safety Data

- A medics career lasts as long as his back does
- An ambulance crash is the most likely cause of EMS occupational fatality
(asides from 2020-2021, when Covid took over)
- Violence and PTSD are an increasing EMS burden

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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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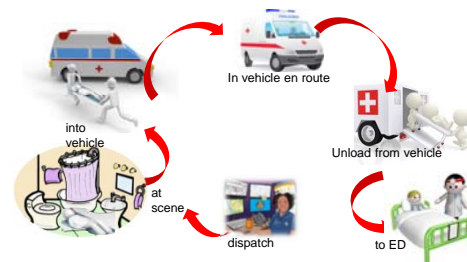
Systems safety of:

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

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A systems approach



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Work Smarter NOT Harder

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Change, Adoption and Sustainability



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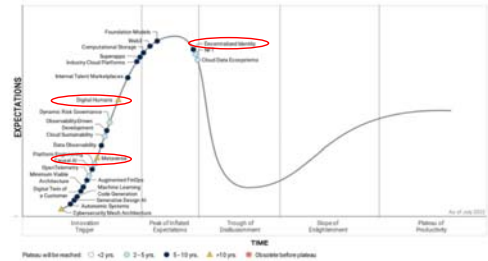
Gartners Hype Cycle 2017



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Gartners Hype Cycle 2022



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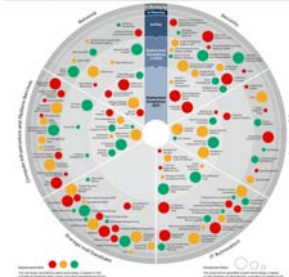
Gartner 2021

Emerging Technologies and Trends Impact Radar



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Gartner 2021-2023 Emerging Technology Roadmap for Midsize Enterprises



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Real world answers to real world questions -

- What policies offer the safest system?
- How do I get my team to address safety issues?
- What features will enhance safety of new vehicle purchase?
- What is the optimal loading height to protect my back?
- What color scheme do I want on vehicles and clothing to make it safest?
- Why don't all stretchers have lights?
- Do we need helmets, and if so which one?
- What data should I collect when something goes wrong, and how to analyze it?

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

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We know a lot right now about how to optimize safety and minimize risk

Safety Dimensions we know

- Safe systems – CRM / transport system safety
- Risk perception
- Fleet and operations management
- Vehicle design safety
- Scene safety
- Patient Handling: physical & biological hazards
- Health and wellness
- Hours of service

Transport safety – What do we know works...

- Safety awareness
- Cultural change and safety leadership
- Vehicle Operations Safety Policies – (ie Z 15)
- Technical science based vehicle interior design
- Securing equipment
- Patient over the shoulder belts
- Forward and rear facing seating
- Lap seat belts, if you have a squad bench
- Fleet management tools with electronic feedback
- Some electronic technical devices

Safety Road Map Project

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focus steps in safety as a system of improvement with milestones eg. BHP example



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

Innovation Yes Now...



Next is now!

- Fleet mix
 - Vertical take off vehicles
 - Drones- manned and unmanned
 - Propulsion technologies – electric, hydrogen
- Smart Technologies
 - AI dispatch
 - AI Ultrasound
 - Voice activated commands
 - Advanced Smart phone technology
 - XR - Mixed reality
- Covid PPE and innovation
- Connected health
- Wireless patient monitoring
- Health Information Exchange (HIE) Applications

2022 Disruptive Innovation

- eVTOL - Drones manned and unmanned
- New propulsion technologies
- Optimized ground vehicle designs
- New – tech innovation
- AI in multiple domains
- Scope of practice expansion
- Dispatch innovation

New propulsion systems

Space based solar power, million mile battery

Morning Brief: Secret Air Force space plane to beam solar power to Earth, Tesla's 'million-mile' battery

Also in the brief: DOE kicks off \$230 million advanced reactor demonstration program, and the global coal industry will never recover from the Covid-19 pandemic.

MAY 18, 2020 ERIC WESHOFF

The U.S. Air Force launched its secret \$1.6B space plane on Sunday for a long duration mission in the Earth orbit. Ahead of its sixth launch, the Air Force just announced its design of a solar panel developed by the Naval Research Lab and the first orbital experiment with space based solar power. The promise is a high energy, high frequency and low cost power, an idea that science fiction authors in the 1940s.

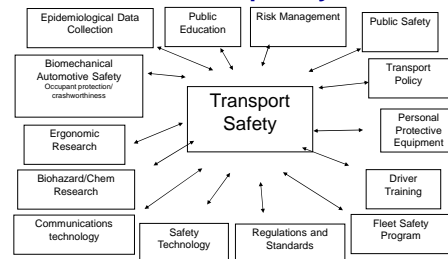
This experiment is closely related to the Air Force Research Lab's Space Solar Power (SSP) program, which is a joint effort with the Navy to collect solar energy and beam it to Earth with a laser. It is a technology – providing an energy source to forward operating bases with traditional power sources. At 10, awarded Northrop Grumman a \$100M on board experiment supporting the program. Source: U.S. Space Force, AF.

Tesla CEO Elon Musk has been teasing investors and rivals with promises to reveal significant advances in battery technology at a "Battery Day" this month — now postponed. The new "million mile" battery at the center of Tesla's strategy was developed with China's Contemporary Amperex Technology Ltd (CATL) and a team of battery experts recruited by Musk. Tesla's new batteries rely on low-cobalt and cobalt-free battery chemistries, and the use of aluminum, stainless steel and coatings that will reduce internal stress and enable longer durations. The cost of CATL's cobalt-free lithium iron phosphate battery packs has fallen below \$80/kWh. CATL's low-cobalt NMC battery packs are close to \$90/kWh. Source: Reuters

New Safety Solutions

- Training and education
- Operational tools
- New Transport Vehicles
- PPE innovation
- AI Support tools and adjuncts
- Community Engagement
- Scope of practice

Ambulance Transport Safety IS Complex AND Multidisciplinary



Goals

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

- Innovation
- Collaboration
- Knowledge transfer

All hazards Types of EMS Injury Risks

- Physical
 - Ergonomic/Mechanical/Falls/Crash-impact/Violence
- Biological
 - Biohazards
- Physiological
 - Exertion
- Psychological
 - Stress/Sleep deprivation/PTSD
- Environmental
 - Thermal (Heat/Cold)/Chemical/Radiation
- Operational
 - Dispatch/Policies/Procedures/Fleet management/Culture

Physical Risks and Hazards

- Ergonomic
- Crash-impact
- Falls
- Mechanical
- Violence

And what is the loading height of your ambulance??

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



Challenging design related Human Factors

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Equipment hard to reach



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Interior design exposes EMS to unnecessary biological, automotive and ergonomic hazards



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Stretchers –

Independent leg stretchers

Clever and cost effective

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Can even do stairs



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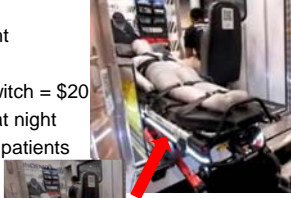


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LED lights on the stretcher? Why not???

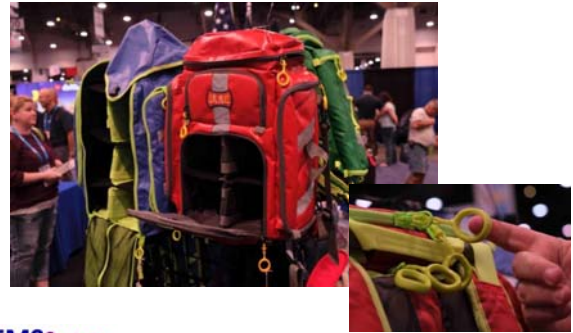
Simple equation

- Tripping injuries are more likely at night
- EMS is 24/7 – half the time it is dark!
- Strip of LED lights + small battery + switch = \$20
- Can see where the stretcher is going at night
- Fewer tripping injuries, fewer dropped patients



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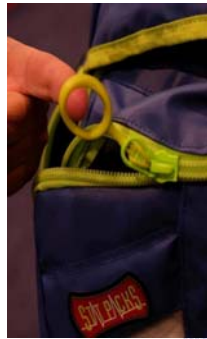
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One finger zipper action



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Patient Transferring Slides



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Slide sheets



Two Caregiver Boost with Slide Sheets

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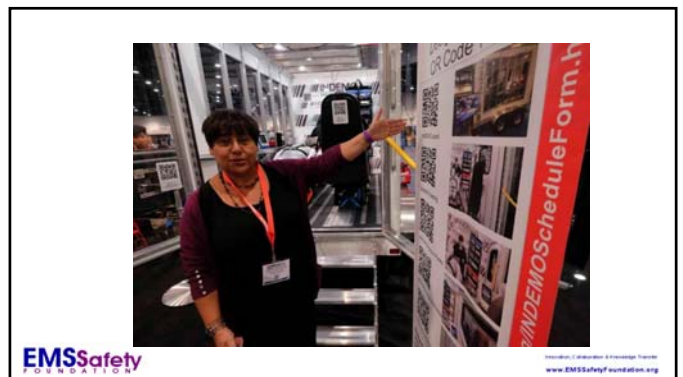
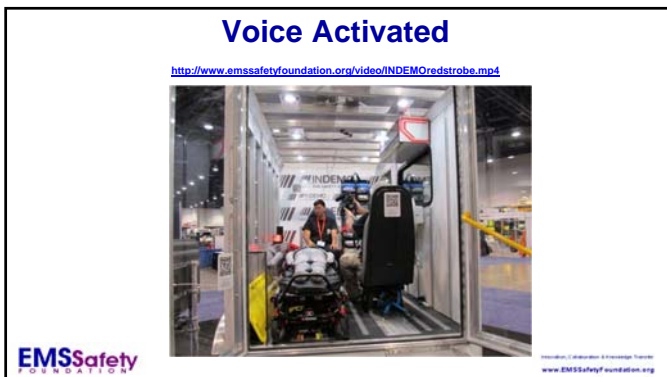
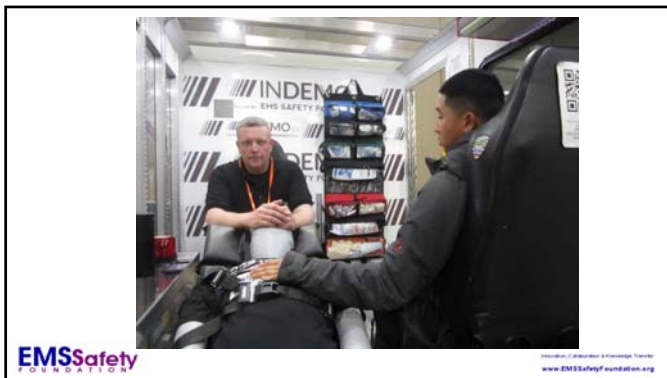
Floor lift devices



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Ambulance Safety Innovation
Design Module 1.0
www.INDEMO.info
 the future concepts you can have right now!!!
 So
 you can reach your patient and your
 equipment!!
Better, safer and cheaper



Biological Hazards

- Biohazards – Pandemic and day to day

New World Order

September 10, 2021 – Pandemic Occupational Recommendations <https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>

The screenshot shows the CDC website page for COVID-19 infection control recommendations. The main heading is "Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic". Below this, there is a "Summary of Recent Changes" section dated September 10, 2021. The page includes a navigation menu with options like "Your Health", "Vaccines", "Cases & Data", "Work & School", "Healthcare Workers", "Health Steps", "Science", and "More".

First Responders <https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-for-ems.html>

The screenshot shows the CDC website page for COVID-19 guidance for EMS. The main heading is "First Responders: Interim Recommendations for Emergency Medical Services (EMS) Systems and 911 Public Safety Answering Points (Emergency Communication Centers (E911/ACCs) in the United States During the Coronavirus Disease (COVID-19) Pandemic". Below this, there is a "Summary of Recent Changes" section dated September 10, 2021. The page includes a navigation menu with options like "Your Health", "Vaccines", "Cases & Data", "Work & School", "Healthcare Workers", "Health Steps", "Science", and "More".

Solutions out there

- PPE
- Handwashing
- Patient Barriers
 - Spectrum – high and low tech
- Air filtration systems - ?



EMS Triage... no.. Voting booth



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Dynamics of isolation chamber transports



Forget about the challenges of getting the patient in or out
BUT.... is this cleanable – how? and by who?



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EMS Patient Isolation Design requirement/constraints

- Easy to get the patient in and out
- Contain aerosol pathogens
- Tolerable for the patient
- Cleanable or disposable
- Cost effective
- Time effective
- Does the WHOLE patient need to be contained???

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Whole Vehicle Air Filtration Systems

- Is this a realistic tool in the time and physical constraints of an EMS system
- ? Practical
- ? Effective
- ? Cost effective
- ? System of solutions

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A Simple Practical Solution compact patient barrier –

Ferno Covid Shield



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Physiological Risks and Hazards

- Exertion
 - Optimize physical fitness
 - Are now wearable provider monitors to assess physical stress
 - Adjuncts and special tools - but are they effective

Wearable tech for providers..



and patients

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



Psychological Risks and Hazards

- Stress
 - Preventive interventions and skills
- Sleep deprivation
 - Optimize scheduling styles
 - Follow existing recommendations
- PTSD
 - Pre-emptive intervention
 - Early identification
 - Early intervention

VR EMS violence training

- AmbulanceVic,
 - Feb 2017, Virtual Reality training for all Ambulance Victoria paramedics to better protect them from violence as they respond to medical emergencies.
 - Ambulance Victoria is using Virtual Reality to help paramedics manage violence and aggression in the workplace.
www.globalfrontline.com.au
<https://www.youtube.com/watch?v=IQhxrF5tvFA>

INTL NEWS Ambulance Victoria Offers Virtual Reality Training on Violence Prevention

Video Mar 01, 2017
[Print Version](#)



Environmental Hazards

- Thermal (Heat/Cold)
- Chemical
- Radiation

All 3 very real current issues in the Ukraine for EMS

Operational

- Dispatch
 - Optimize dispatch approaches
- Policies/Procedures
 - Use existing operational standards (incl Z 15)
- Fleet and equipment management
 - Choice and management of vehicles and equipment
- Culture
 - an open culture to encourage awareness and focus on hazard and safety issues.

Spectrum of dimensions

- Vehicle design innovation
- Innovative CAD
- Resource allocation
- Fleet performance –
 - Monitoring: System that gives management data of vehicle efficiency, safety and use
 - Feedback: Directly to drivers at the wheel
- Public Alerts (interactive technologies)

Safe Practices for Motor Vehicle Operations ASSE/ANSI Z15.1 2017

https://ansi.cachefly.net/preview-pages/ASSE/preview_ANSI+ASSE+Z15.1-2017.pdf



What Z15 encompasses

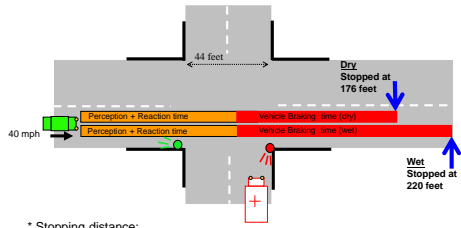
- Safety Program
- Safety Policy
- Responsibilities and Accountabilities
- Driver Recruitment, Selection and Assessment
- Organizational Safety Rules
- Orientation and Training
- Reporting Rates and Major Incidents to Executives
- Oversight

Intersections

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)



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



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Learning from our international colleagues
www.Rettmobil.com



The old
 expensive and
 not versatile

and the new...
 Rapidly and
 game changing
 technology and
 cheaper, better,
 very versatile



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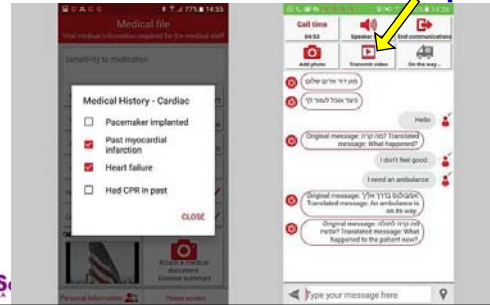
Israeli Innovation



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Magen David Adom MDA App – Medical Hx & Video transmit capacity



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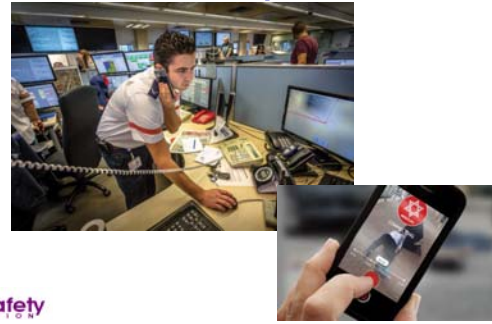
MDA App with scene video connect



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MDA Dispatch



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Mass casualty drills & Eli Jaffe EMT-P, PhD's moulage T-Shirts



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SimRec - Ben Gurion University's State of the Art Healthcare Simulation & Training Center – opening 2022

Brainchild of Dr. Oren Wacht PhD Paramedic
<https://in.bgu.ac.il/en/simrec>



SimRec - The research center for simulation in healthcare
Announcements

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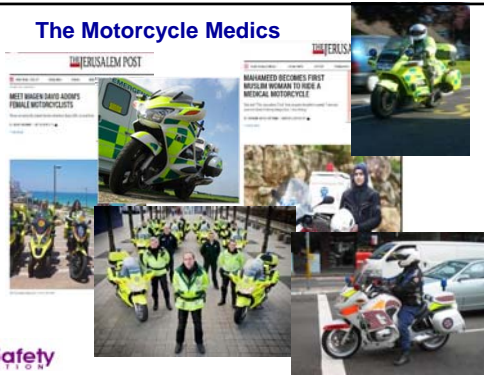
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Work Smarter NOT Harder

Fleet Mix ?



The Motorcycle Medics



Avoid policy and practice ignorant of existing technical safety data

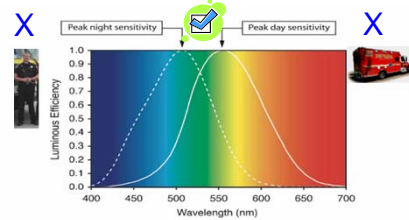


Figure 1. The scotopic (dashed line) and photopic (solid line) luminous efficiency functions, describing the spectral sensitivities of night and day vision, respectively.

High visibility clothing - retroreflective



Fleet telematics tools

ORBCOMM NETWORKS | EQUIPMENT | SOLUTIONS | NEWS

Beyond Compliance: Driving Fleet Safety and Operational Performance with Trusted Telematics

From: 10/20/2015 to: 10/20/2015 | No Comments



There's been a lot of coverage in the media recently about commercial vehicle telematics thanks to the new EU ELD (Electronic Logging Device) mandate that came into effect last December by FMCSA, the US Federal Motor Carrier Safety Administration. The new rule, fully enforced from April 1, affects all professional drivers and motor carriers who are required to provide hours of service (HOS) records of duty status (RODS), although fleets with existing automatic on-board recording devices (AOBRDs) have until December 2015 to upgrade.

But regulatory compliance is only a part of the telematics story. Fleets of all shapes and sizes – from large enterprises up to the most remote job handler – can benefit from significant increases in driver performance, safety and operational effectiveness by correctly selecting and implementing a telematics solution. Experience of whether this is achieved by the ELD, or not, that's especially the case for anyone working in and with the high-risk and safety-conscious hydrocarbon and mineral extraction industries, where compliance is simply a given and it's "time to operate."



Telematics

- How much technology and data and of what type do you need to improve fleet safety performance

CAD - Crowd and the Cloud



Integrated crowd sourcing



Community Outreach –2020 Crowdsourcing intervention



Cardiac Arrest.... Engage bystanders!

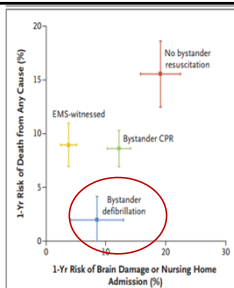
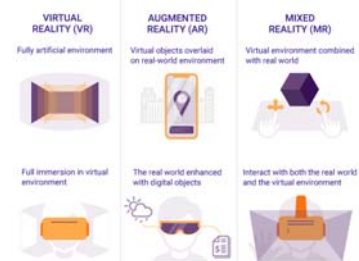


Figure 4. Absolute Risk of Anoxic Brain Damage or Nursing Home Admission and Death from Any Cause at 1 Year of Follow-up According to EMS-Witnessed and Bystander-Intervention Status.

The Virtual World XR (VR, AR, MR) – and EMS



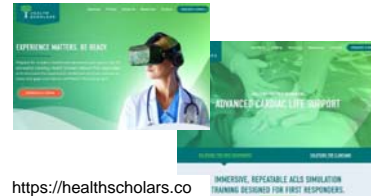
Virtual Reality First Aid/EMS

- VR Patients - Virtual Reality Scenarios that you can build, April 2020 – and with gratis Covid19
<https://www.youtube.com/watch?v=3k1b1k1k1k1>
- Real First Aid, First Aid and MCI VR both physical simulation scenarios Jan 2018
<https://www.youtube.com/watch?v=3k1b1k1k1k1>
- Haseeb Iqbal, Published on Jan 27, 2018
 – Virtual Reality CPR created for the Oculus Rift using Unreal Engine 4. Integrated with Leap Motion technology
<https://www.youtube.com/watch?v=3k1b1k1k1k1>
- IRC (ouncil), Published on Oct 10, 2017
 – Project by Italian Resuscitation Council
 – Scientific Supervisor: Federico Semeraro, Andrea Scapigliati & Giuseppe Rostagno
 – VR development: Studio Evit s.r.l.
<https://www.youtube.com/watch?v=3k1b1k1k1k1>
- ResusCouncilUK, Published on Sep 8, 2017
 – A virtual reality game-in-a-film that teaches you to save a life. Step inside, save a life.
 – This video is showcasing the abilities of VRPatients.
 – Play now: <http://resuscouncil.org.uk/> <https://www.facebook.com/resuscounciluk/vr-training/> <http://dualgoodhealth.com/info/>
<https://www.youtube.com/watch?v=3k1b1k1k1k1>
- Virtual Education Systems, Published on May 16, 2017
 – This video is showcasing the abilities of VRPatients.
 – <https://www.youtube.com/watch?v=3k1b1k1k1k1>
<https://www.youtube.com/watch?v=3k1b1k1k1k1>
- Marco Vettorello, Published on Sep 3, 2017
 – First test of teaching defibrillation (AED) with the HTC Vive in a homemade Unity scenario
<https://www.youtube.com/watch?v=3k1b1k1k1k1>

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VR Training for ACLS



<https://healthscholars.com>

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VR – CPR training <http://dualgoodhealth.com/info/>



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VR EMS violence training

- AmbulanceVic,
 - Feb 2017, Virtual Reality training for all Ambulance Victoria paramedics to better protect them from violence as they respond to medical emergencies.
 - Ambulance Victoria is using Virtual Reality to help paramedics manage violence and aggression in the workplace.
www.globalfrontline.com.au
<https://www.youtube.com/watch?v=IqXhrF5tvFA>

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AMB VICTORIA Ambulance Victoria Offers Virtual Reality Training on Violence Prevention



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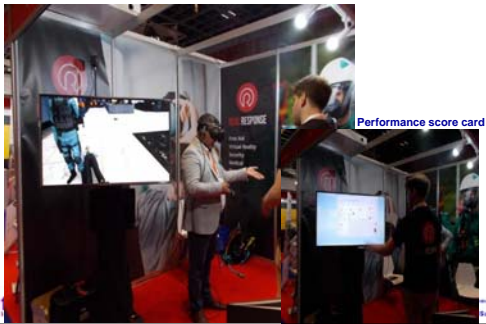
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VR MCI – www.RealResponse.com.au



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SafetyFoundation.org

The NEXT LEVEL VR
Scenario Training
AUTHORABLE – by
YOU!!

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Virtual Reality Patients – EMS DIY VR Training and evaluation tools Just like making a Power Point



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www.VRpatients.com

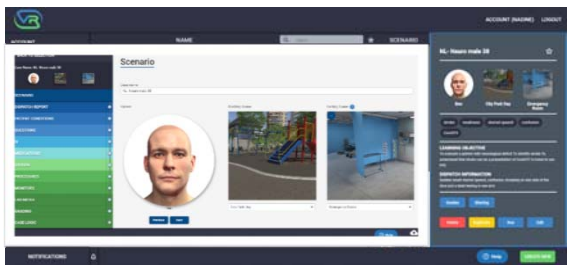


87 institutions using it with 312 instructors building over 1200 scenarios to date.

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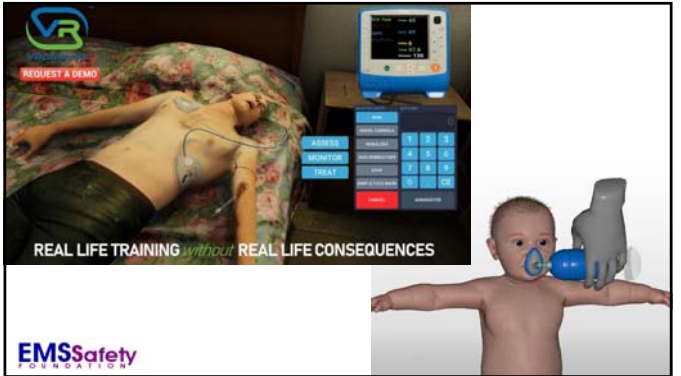
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VR Training that you can create



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Virtual Reality A new design tool too

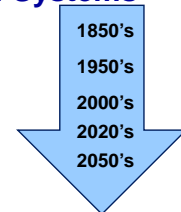
Exploring the inside
of a virtual
ambulance



Propulsion systems in EMS and Innovation

Timeline of Ambulance Propulsion Systems

- Horse and buggy
- Gasoline
- Diesel
- Electric
- Hydrogen
- Other.....



Electric propulsion in EMS

- New ambulance vehicles now being developed on electric platforms
- Electric mini Ambulance - 2017
- Initial USA deployments as of March 2022
- Benefits?:
 - Clean
 - Lower loading height
 - Cost saving

Electric Mini Ambulance - 2017



Canadian Electric Ambulance Development October 2021

electrive.com

News, analysis, and commentary on electric vehicles, autonomous driving, and other transportation technologies.

Lion & Demers present first fully-electric purpose-built ambulance

Demers Ambulances and Lion Electric have unveiled the first all-electric ambulance. The vehicle is designed to be a purpose-built ambulance, not a converted gas ambulance.

The vehicle is designed to be a purpose-built ambulance, not a converted gas ambulance. It features a range of 100 miles and a top speed of 100 mph.

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Design Challenges – Paramedics are not automotive engineers

The first all-electric and purpose-built ambulance.



Designed by paramedics, for paramedics.



A collaboration with Demers Ambulances, the eFX Ambulance is purpose-built to be 100% electric. Based on a Lion's chassis, the eFX Ambulance is specifically engineered to enhance the comfort and safety of paramedics, allowing them to remain focused and to provide optimal care to their patients at all times.



Some predictable issues



New propulsion – but old design mistakes



Lightning Motors - 2022

- Engineered and built in the USA
- Battery electric vehicle
- Remotely track and update
- Class-leading efficiency
- Additional 100VDC converter to operate 12V auxiliary power for medical equipment and lighting
- 12-point cabin suspension with ballbein fully under the floor
- CEM6 and CEH2 certified
- Available in USA Fleet EPA 213E
- Available, maintenance and service performed by certified technicians
- Lighting, signaling, and fire suppression

Lightning ZEV3 Transit Ambulance Type II

The Lightning ZEV3 Transit Ambulance Type II is designed with a focus on the electric drive train, which allows for the best efficiency of any vehicle in its weight class, while providing a quiet, smooth and familiar driving experience that your EMS® and patients will love.

Available in 140-inch and 200-inch wheelbases, this new purpose-built, vehicle service while providing new efficiency on the road. Charging is simple and quick, with both Level 2 AC charging and DC Fast Charge (optional). Lightning supports on-battery integration for direct connection to supplemental HVAC components.

Most of its equipment and emergency lights are supported with an additional power providing auxiliary 12V DC system.

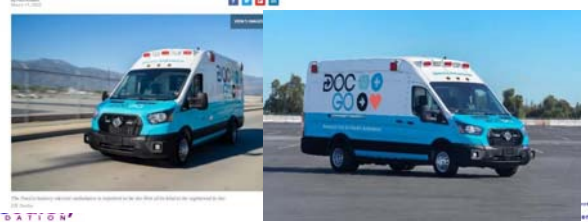
We use the highest quality components available, including our proprietary suspension hardware, which deliver the best range, efficiency and lifetime of any ambulance in the market.

Model Name	Lightning ZEV3 Transit Ambulance Type II
Length	140-inch / 200-inch versions
Wheelbase	140-inch
Charging system	Level 2 AC (up to 11.5 kW) and DC Fast Charge (up to 60 kW) with ATTO 222S, Tesla
Efficiency	21 kWh/100 miles (up to 140 miles) range
Driving range*	140 to 140 miles / up to 100 miles
Vehicle capacity	100 seats
Change Time	3 hours (Level 2 AC) or 15 to 30 min (DC Fast Charge) (up to 60 kW) (Charge up to 60 kW)
Maximum Speed	80 mph (130 km/h)
Peak Power	200 kW (270 hp)
Output Power (100% efficiency)	170 kW (230 hp)
Warranty	Basic Chassis: 5-year, 100,000-mile warranty (limited powertrain and battery, lighting, additional details available) (Class: 100,000 miles)
Options	Proactive Maintenance, Range Extender, Solar, Adaptive Cruise Control, etc.



USA, First all electric ambulance deployed March 2022

Mobile healthcare provider welcomes first all-electric ambulance to its fleet





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SOMA SAN FRANCISCO CALIFORNIA

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Litmotors- electric gyrotech



Technology

Self-Balancing Gyro-Technology Stabilizes the Vehicle

Allows acceleration from 0 to 60 miles per hour in under 5 seconds while leaning freely up to a 45° angle around a sharp corner.



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Ree Automotive electric platform

- Clean
- Energy efficient
- Low loading height



PROXIMA POWERED BY REE

IP7 CAB CHASSIS

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Hydrogen

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Hydrogen powered Ambulances now exist, but is it the propulsion system of choice??

ULEMCo Shows World's First Hydrogen Powered Prototype At COP26

November 2, 2021

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Hydrogen-electric - November 2021

electrek

UK's NHS unveils new hydrogen-electric ambulances at COP26



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Autonomous vehicles and drones



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Thought leaders – Urban Aeronautics Ambulance Transport Safety since 2002

*X-Hawk:
The Revolutionary, Modular, Aerial Vehicle*



Whereas most designs for new, aerial vehicles offer incremental improvements in the state of the art, the X-Hawk flying platform presents a revolutionary advance in both the mobility and utility of aerial vehicles. Simply put, nothing like it has ever hit the market before.

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Urban Aeronautics, eVTOL 2021 (electric Vertical Take Off and Landing)

Hatzolah Air orders four Cityhawk aircraft from Urban Aeronautics

URUSALIM POST

Urban Aeronautics CEO has designed a made-in-Israel flying car



Urban Aeronautics To Develop Emergency Response Flying Vehicle With Hatzolah Air

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Unmanned operational Prototype



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EVTOL, Hydrogen powered, 2021

FutureFlight PROGRAMS LATEST NEWS SPECIAL REPORTS ON THE RADAR LOGIN REGISTER



URBAN AERONAUTICS SWITCHES TO REDESIGNED HYDROGEN-POWERED CITYHAWK EVTOL AIRCRAFT

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eVTOL and EMS – February 2022

What are the ideal applications?

- When
- Where
- What and for
- Which medical conditions
- How to calculate cost and risk benefit

Urban Aeronautics study analyzes eVTOL operations in EMS response

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Other

EMS Jet Suit - September 29, 2020

- British inventor Richard Browning founded the pioneering aeronautical company Gravity Industries in March 2017
- 1,050-horsepower system
- 5 mini jet engines –
 - 2 each built into units attached to the hands
 - 1 built into a backpack

Jet suit paramedic takes Lake District test flight

Inventor Richard Browning puts potentially life-saving suit through its paces in ground-breaking exercise



Defying gravity as they hover over water before zipping across mountainside landscapes and landing with pinpoint accuracy, the jet suit paramedic could soon bring just as much speed to an extraordinary new service being trialled in the Lake District.

If given the green light by ambulance service chiefs, the paramedic powered by lightweight jet packs would fit across treacherous terrain within minutes to reach stranded casualties.

In an awe-inspiring test flight, the inventor Richard Browning, looking distinctly like Michael Bay's Iron Man, just the suit through its paces on the

The Median Ambulance

Hong Seonghwan, Lee Hyungtaek, Lee Taekkyung & Song Yoojin - South Korea



Unmanned Ambulance drones



Manned Drones



eHang passenger drone



? The ambulance of the future ?Median,?Electric, ?Hydrogen, ?eVTOL

First passenger drone makes its debut at CES

Chinese entrepreneurs bring their own version of a self-driving car to the annual technology convention.



A Chinese company claimed a world first on Wednesday by unveiling a drone capable of carrying a human passenger. URBAN AERONAUTICS SWITCHES TO REDESIGNED HYDROGEN-POWERED eVTOL AIRCRAFT

AI

the good the bad and the ugly



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AI and EMS

AI ambulances and robot doctors: China seeks digital salve to ease hospital strain



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AI and EMS Dispatch

Becoming The Best In The World At Detecting Cardiac Arrest



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AI is good, and so are dispatchers

Open
Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services: A Randomized Clinical Trial

OBJECTIVE: Emergency medical dispatchers (EMDs) identify approximately 25% of cases of out-of-hospital cardiac arrest (OHCA). We sought to evaluate the effect of machine learning (ML) on EMD recognition of OHCA during calls to emergency medical services (EMS).

DESIGN: Randomized clinical trial.

SETTING, PARTICIPANTS, AND MEASUREMENTS AND MAIN RESULTS: The study included 100 EMDs who were randomized to either a control group (without ML) or an ML group (with ML). The ML group used a machine learning algorithm to identify OHCA during calls to EMS. The ML group had a higher rate of OHCA recognition compared to the control group.



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AI, Ultrasound and EMS



www.EMSSafetyFoundation.org

.... AI, a work in progress

Tesla AI and Emergency Vehicles September, 2021

September 2, 2021
10:58 AM EDT
Last updated 7 weeks ago

Autos & Transportation

U.S. identifies 12th Tesla Autopilot car crash involving emergency vehicle

WASHINGTON, Sept 1 (Reuters) - U.S. auto safety regulators on Wednesday said they had identified a 12th crash involving Tesla Inc. (TSLA) vehicles using advanced driver assistance systems in incidents involving emergency vehicles and demanded the automaker answer detailed questions about its Autopilot system.



Tesla Autopilot crashes into stopped fire truck but fails to safety investigate for driver control

Tesla crashes, causes chain accident with police car, ambulance

Tesla car the Tesla was possibly on "Autopilot" at the time of the crash and was investigating whether the driver was at fault



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

Today's Challenges

- Adopting new technologies and practices that augment EMS performance and safety
- Embracing decentralization of health care
- Doing more with less – money and workforce
- Cross skilling EMS, industry and the community
- Systems thinking and practice

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



EMS Systems Safety

- All Hazards Approach
- Technical Collaboration is key
- We cannot afford to play the silo game here, it is costing lives, time and money
- We MUST have a meaningful evidenced based approach to design, operations and policy
- We must be true outcomes driven

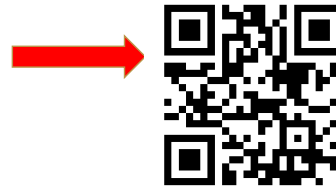
Conclusion

- Future is now!
- All Hazards Approach is Key
- Safety must be inherent to operational process, design and practice
- Adoption challenges of new disruptive technologies and applied innovation exist
- Cross skilling industry, providers and community
- Interplay between patient, provider and public safety from a systems perspective is key to effective and safe operational EMS performance

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Your electronic handout/resource link with all text slides



Or if you are
> 45 years

www.objectivesafety.net/PDFHO.htm

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