



## EMS Safety and Innovation- A New World Order!

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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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## Today's Outline

- New World Order
- Bio-Pandemias
- Military - Civilian
- Cross skilling Industry and providers and citizens
- Smart technologies
- Innovation dimensions
- Novel power systems
- Cheaper Better Safer
- Open source
- Challenges

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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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## EMS Safety Innovation as per Chat GPT

- "EMS (Emergency Medical Services) safety innovation is an essential aspect of improving emergency response and patient care."



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## Chat GPT's Top 10 EMS Safety Innovation realms

1. Telemedicine Integration:
2. Augmented Reality (AR) and Virtual Reality (VR):
3. Advanced Vehicle Safety Features:
4. Body-Worn Cameras:
5. Predictive Analytics:
6. Personal Protective Equipment (PPE) Innovation:
7. Drone Technology:
8. High-fidelity simulation training:
9. Data Integration and Interoperability:
10. Mental Health Support Programs:



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## Safety of the...

- Provider
- Public
- Patient

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## Safety is a tool to save

- Lives
- Time
- Money

must be evidenced based

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## Work Smarter NOT Harder

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## Swiss Cheese risk and losses

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## Next is now!

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

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## The Future is NOW!

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## Space based solar power, million mile battery, hydrogen propulsion, eVTOL, XR, AI & robots

### New Study Updates NASA on Space-Based Solar Power

**Executive Summary**

<https://www.nasa.gov/wp-content/uploads/2024/01/otps-report-final-tagged-approved-1-8-24-tagged-v2.pdf>

### CATL launches new EV battery with close to a 1 million mile, 15-year lifespan

**CATL, Vitoring launch new long-life EV battery**

<https://electrek.co/2024/04/03/catl-launches-new-ev-battery-last-1-million-miles-15-yr/>

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## Hydrogen Powered Ambulance November 2023

### Flying Vehicle Startup Funded for Air Ambulance: Hydrogen-Powered

The vehicle is designed to aid first responders and emergency personnel in reaching Australian Br...

**IPU DISPLAY FEATURED IN HYDROGEN-ELECTRIC AMBULANCE PROTOTYPE**

22 NOV 2023

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## eVTOL, XR and the median ambulance

electric Vertical Take Off & Landing and mixed reality

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## eVTOL deployed September 14, 2023

(September 14, 2023 / IAS) An autonomous helicopter taxi made its first 30-minute test flight over Jerusalem as part of an Israeli-government led initiative to reduce traffic jams on the country's roads, the Israel Innovation Authority announced on Wednesday.

The Chinese-made eVTOL autonomous electric two-seater took off from the capital's Hadassah Ein Kerem Medical Center and flew over the city's hills before landing back at the hospital grounds.

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**eVTOL SUMMIT 2024**  
August 19 - 20, 2024  
Los Angeles, California, USA

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### Mixed reality AI powered Ambulance Singapore & Sri Lanka - December 2023

Mediwave Unveils World's First Mixed Reality & AI-Powered Connected Ambulance

Mediwave's Emergency Response Suite automates and enhances the efficiency of the emergency healthcare ecosystem by digitizing critical processes, ensuring quick response times, while ensuring patient safety and connectivity with hospital facilities. With these emergency response capabilities, Mediwave's Emergency Response Suite (ERS) can identify critical cases, monitor vital signs, and provide specialized care before reaching the hospital.

<https://www.ft.com/content/1990-Suwa-Seriya-innovates-with-Connected-Ambulance-powered-by-Mixed-Reality-and-AI-in-Asia-first/44-756275>

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### Median Ambulance

- Integrating EMS System design with city and road planning and design – South Korea

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### Authorable Virtual Reality training

Online VR EMS Training you can build yourself

Build immersive patient scenarios, same day.

Author. Assign. Grade.

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### AI

the good the bad and the ugly

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### AI and EMS

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

Revealed: how AI will transform Dubai ambulance services

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### AI and EMS Dispatch

Becoming The Best In The World At Detecting Cardiac Arrest

AI detects cardiac arrest

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### AI Dispatch

Emergency dispatchers are using AI and cloud-based tools to help those in need faster

AI bots are helping 911 dispatchers with their workload

Saving Lives With AI in an Emergency Dispatch Center

Source: Magen David Adom

04/03/2023

<https://www.hmpgloballearningnetwork.com/site/emsworld/news/saving-lives-ai-emergency-dispatch-center>

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### AI is good, and so are dispatchers

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

Open

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## AI, Ultrasound and EMS



With industry-leading AI to help you diagnose with confidence, EchoSight isn't just another ECG tool. It's a [www.emssafety.org](https://www.emssafety.org) for patient care.

**Full Toner Imaging**

Full Toner Imaging provides high-quality, high-resolution images that are easy to interpret and share with your team.

**AI Powered POCUS Workflow**

AI-powered POCUS workflow streamlines your workflow, reducing time to diagnosis and increasing patient care.

**More than just Ultrasound**

More than just ultrasound, EchoSight provides a comprehensive suite of diagnostic tools to help you diagnose with confidence.

**Easy to Carry, Handle, and Clean**

Easy to carry, handle, and clean, EchoSight is the perfect solution for your mobile EMS practice.

**Any Provider Education Platform**

Any provider education platform, EchoSight provides a comprehensive suite of diagnostic tools to help you diagnose with confidence.

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## Tesla AI and Emergency Vehicles September, 2021

**Autos & Transportation**

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

WASHINGTON, Nov. 18 (Reuters) — U.S. auto safety regulators on Wednesday said they had identified a 12th Tesla Autopilot car crash involving emergency vehicles, although their database system is tracking ongoing emergency vehicles and identified the automatic sensor sensor questions about its Autopilot system.

**Tesla crashes, causes chaos on road with police car, ambulance**

Police on the New York road on Tuesday night at the time of the crash, said an emergency vehicle was on the road.



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## EMS Robots the lifesavers of tomorrow

**Disaster robots: Reshaping emergency response with autonomous robots**

9 ingenious rescue robots set to become the lifesavers of tomorrow

These robots are designed to help emergency responders in disaster zones, such as search and rescue, and they can be used in a variety of ways.

**FDNY deploys robot dog to search for survivors in NYC garage collapse**

FDNY deploys robot dog to search for survivors in NYC garage collapse

FDNY deploys robot dog to search for survivors in NYC garage collapse




<https://www.sciencefocus.com/future-technology/rescue-robots>

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

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## New Solutions

- Training and education
- PPE innovation
- New Transport Vehicles – manned and unmanned
- Operational tools
- AI Support tools and adjuncts
- New Tech Device Innovation
- Robotic Engineering – Robo'dogs' & Humanoids
- Community Engagement
- Scope of practice

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## 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

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## Remembering an EMS Research Colleague

Remembering E. Brooke Lerner, PhD, FAEMT

Published October 31, 2023

E. Brooke Lerner, PhD, FAEMT, passed away Oct. 4 after a battle with pancreatic cancer. Lerner was a pioneer in the field of prehospital pediatric research, and served as co-principal investigator for the Pediatric Emergency Care Applied Research Network's (PECARN) 27 "dedicated EMS research node: ChildP-ERN" (Charlotte, Houston, Milwaukee Prehospital EMS Research Node Center) (2).

Last spring, Lerner sat down for an interview about her career, which you can read here. Below, her colleagues share their thoughts on her impact.

"Our lights have dimmed while Brooke passes into the heavens. But her legacy of protecting the lives of our children will forever burn brightly! We remember her gratefully!"




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## New World Order

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## When even Waze knows that driving home isn't a safe destination....



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## Some new challenges for EMS Systems Safety

- And sometimes civilian tools like Waze become part of a military GPS protection system - when suddenly your phone thinks you are in Cairo, Egypt, but you are really in Eilat, Israel and just 4 minutes from your destination – not 4 hours



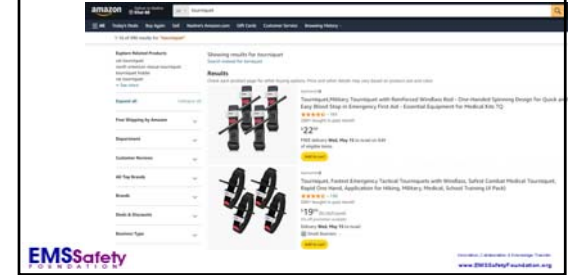
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## Personal First Aid kit –then..?



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## Personal First Aid kit... and now?



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## Realms of EMS Safety

- Patient
- Occupational safety
- Biohazard Safety
- Scene Safety
- Vehicle Safety
- Fleet Safety
- System Safety
- Regional safety

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## September 10, 2021 – Pandemic Occupational Recommendations

<https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html>



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## EMS Agency Safety Program



<http://www.naemt.org/docs/default-source/ems-health-and-safety-documents/nemssc/ems-safety-program-guide-10-11-17.pdf>

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## An All Hazard Safety Approach

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

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## Designing a safe system

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## Safety in EMS is INTERDISCIPLINARY

- clinical practice
- public health
- automotive safety
- new technologies
- impact biomechanics
- ballistics
- human factors
- fleet safety
- regional safety

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### 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.

### 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 an escalating reality – May 2019 600 rockets in 36 hours



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




### October 7, 2023 "Operation Al-Aqsa Flood", 5,000 rockets from Gaza into Israeli Civilian targets in 20 minutes

### David's Sling part of multi-tiered missile defense system, which also includes Arrow 2, Arrow 3, Iron Dome, and Iron Beam.



## Ship mounted missile defense system April 9, 2024




**In first, IDF says ship-mounted Iron Dome downs 'suspicious' target over Eilat**

In first, IDF says ship-mounted Iron Dome downs 'suspicious' target over Eilat

Suspected drone taken out by C. Dome. Destroyed by IDF's ship-mounted Iron Dome. Drone hit Eilat. Iron Dome missile downed Iron Dome at Eilat.

Israel's C-Dome air-defense system intercepted a suspected drone over the Red Sea near Eilat shortly before midnight on Monday. The incident marked the first operational interception of the system, the naval equivalent of Israel's ground-based Iron Dome.

"Following the sirens that sounded in the area of Eilat regarding the activation of a hostile aircraft, IDF Naval forces identified a suspicious aerial target crossing into Israeli territory. The target was successfully intercepted by the 'C-Dome' naval defense system," said the Israel Defense Forces.



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## Layers of Protection of EMS System civilian utilization in War time

Primary prevention:

- I. Peace
- II. No hate indoctrination
- III. No terrorism

Secondary Prevention:

- IV. No rocket launchers
- V. Terrorist containment

Tertiary Prevention:

- VI. Air raid Sirens
- VII. Air raid shelters in every home and playground
- VIII. Iron Dome – David Slings

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## Cascade towards civilian EMS system being overwhelmed

- If Primary prevention I- III cant be achieved
- Then Secondary Prevention, IV- V is essential
- If Secondary prevention fails, then Tertiary Prevention VI- VIII is essential
- If then Tertiary Prevention fails - then civilian EMS is potentially overwhelmed

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## Tertiary Prevention

Iron Dome and David Slings

- Intercept 95% of civilian targeted rockets
- Very expensive and technology intense

Air raid Sirens

- Provide 15 seconds to 45 seconds warning to seek shelter

Bomb Shelters and protected-safe rooms

- In many homes and parks – but not all
- Protected rooms – mainly for shrapnel, not effective like an underground fortified bomb shelter
- The elderly or disabled are unlikely to reach a safe area in time

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## Zibar Tactical Military Ambulance



Zibar Vehicle  
All-Terrain Tactical Utility Vehicle

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## How do you frame safety?

To quote Chief Justin Reed

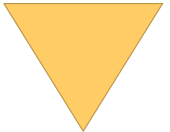
- "if there is a failure in a system that you design, then it IS leaderships fault"
- "How did someone fail in a system YOU designed?"

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

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## How does design happen in EMS

- Tradition
- Experience
- Vision
- Interdisciplinary



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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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## Adoption – 30 years ??

- Commonsense
- Politics
  - 1991: Bill Leonard "EMS Systems Failure"
  - 2002: As Jeff Clawson puts it in his passionately-written article against L&S use: "The concept of reducing lights and siren use is just slightly more popular in our nation's fire and ambulance services than gun control is with the National Rifle Association".
- Science
  - 1994: Doug Kupas -
  - 2013: Brett Richard Murray - "EMS Medical Directors, company administrators, chiefs, and providers across the country need to take a hard look at the evidence against L&S use, and come to the realization that it is a practice rooted not in science, but tradition"
  - 2017: Doug Kupas - Lights and Siren Use by Emergency Medical Services (EMS): Above All Do No Harm
- Policy
  - February 2022: Joint Statement on Lights & Siren Vehicle Operations on Emergency Medical Services (EMS) Responses

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## Lights and Sirens Use

## February 14, 2022

**Joint Statement on Lights & Siren Vehicle Operations**  
 Emergency Medical Services (EMS) Responders

In most settings, EMS response or transport times less than a few minutes during an emergency medical response, and there are few time sensitive medical emergencies where an immediate intervention or treatment is those minutes is missing. These time sensitive emergencies can usually be identified through utilization of high quality dispatcher call prioritization using approved EMS protocols. For many medical calls, a prompt response by EMS practitioners without lights and sirens (L&S) provides high quality patient care without the cost of L&S-related crashes. EMS care is part of the much broader spectrum of acute health care, and effectiveness in the emergency department, hospital, and health systems of care can be compared by an increase in non-L&S response or transport.


**Supporting Organizations and Representatives:**  
 Academy of International Mobile Healthcare Integration  
 American Ambulance Association  
 American College of Emergency Physicians  
 Center for Patient Safety  
 International Academies of Emergency Dispatch  
 International Association of Fire Chiefs  
 National Association of EMS Dispatch  
 National Association of EMS Physicians  
 National Association of Emergency Medical Technicians  
 National Association of State EMS Officials  
 National EMS Management Association  
 National EMS Quality Alliance  
 National Volunteer Fire Council

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**Valatie ambulances will limit use of sirens for safety's sake**

The change comes after a report by medical and first responder groups suggested that using sirens and lights is often unnecessary.

By Roger Matthews, Editor  
 Feb. 14, 2022, 10:00 AM EST



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## 1980's Then....



And NOW!...

## USA 1980's Then....



And 2024...  
 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!!



## April 9, 2022 – EMT killed in ambulance crash



## June 12, 2022 Patient dies after ambulance crash



## Safety in this vehicle...?





## Testing the real world



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

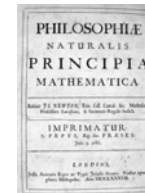
## NOT new technical data...

Beware some provider restraint systems are dangerous



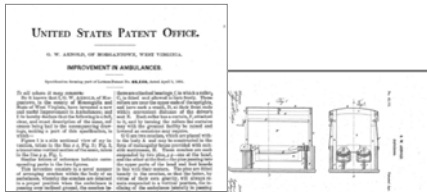
Richardson S.A., et al. *Int. J. of Crash.*, 4:3, 239 – 259, 1999  
Side facing 4-point harnesses demonstrated to be lethal, even at slow ground vehicle speeds

## The Laws of Physics Prevail..



Philosophiæ Naturalis Principia Mathematica, July 1687

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



## 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

to quote David Daniels, 2022

*“it’s easier to remember than it is to imagine”*

## 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**

## 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??

## 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

## 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

## Innovation!!

## 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"

## 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

## 2000- 2025: a 25 year window Predicting EMS Safety innovation

## Sept 11, 2001.... 23 years on



## TOPTEC, September 11<sup>th</sup> 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>



## 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

## 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

## Promoting Innovation in EMS – 2018



So...., 2024 to 2050?

## EMS Agenda 2050

[https://www.ems.gov/pdf/EMS\\_Agenda\\_2050\\_Summary.pdf](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



## New Tools, New Technologies, New Vehicles, New systems, New industry relationships

## 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

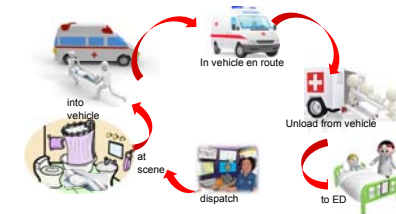
### Very Important Principle

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

### Systems safety of:

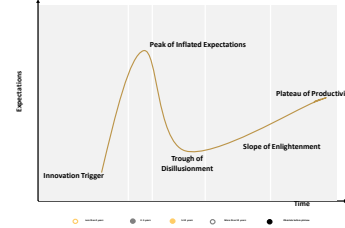
- Dispatching a vehicle
- Getting you, your patient and equipment to, in and out of the vehicle
- Scene safety
- Providing patient care inside the vehicle
- Occupant protection in crash and near miss situations
- Biological and chemical hazards
- Personal and psychological safety
- Public safety

### A systems approach



## Work Smarter NOT Harder

## Change, Adoption and Sustainability



## Gartners Hype Cycle 2022



## Gartner Hype Cycle 2023 – Digital health

### Hype Cycle Of The Top 50 Emerging Digital Health Trends



## 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?

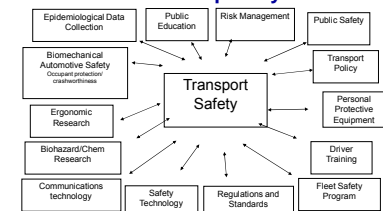
- What we need to consider, where is the 'bang for buck' in EMS safety
- Where is the low hanging fruit?

## 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

## Ambulance Transport Safety IS Complex AND Multidisciplinary



## 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

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## Safety Road Map Project

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



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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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## Innovation Yes Now...



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## Next is now!

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

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## 2024 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

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## New Safety Solutions

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

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## Goals

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

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- Innovation
- Collaboration
- Knowledge transfer

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## 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

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## Physical Risks and Hazards

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

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And what is the loading height of your ambulance??

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



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## 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



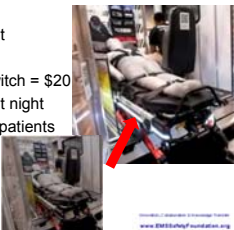
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### LED lights on the stretcher? Why not???

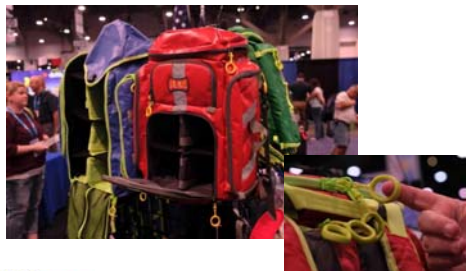
Simple equation

- 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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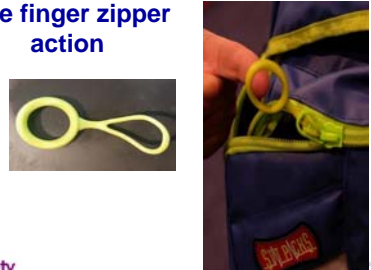
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### One finger zipper action



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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



Drive Medical Whisper

Manger lifting cushions

Binderlift

Indeelift

Hoverjack

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### Ambulance Safety Innovation Design Module 1.0

[www.INDEMO.info](http://www.INDEMO.info)  
the future concepts you can have right now!!!  
So  
you can reach your patient and your equipment!!  
*Better, safer and cheaper*

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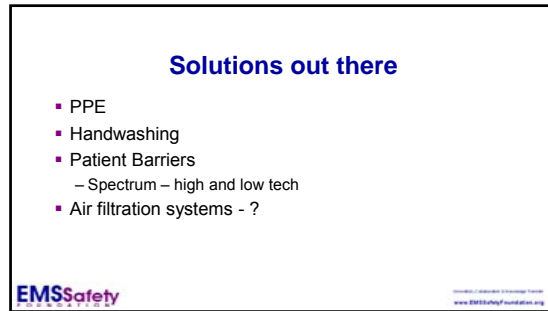
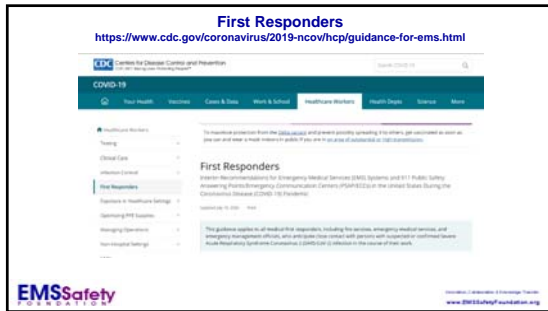
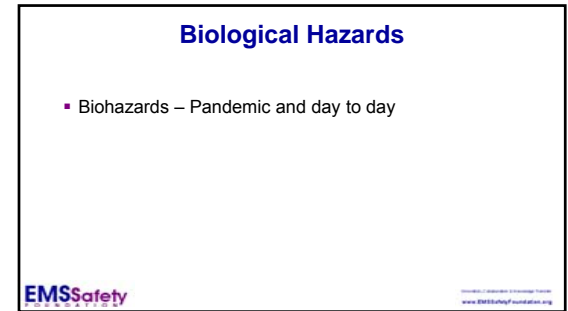
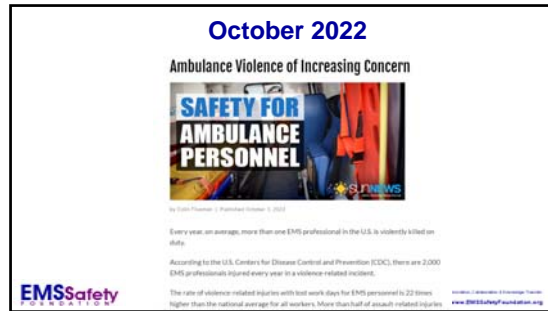
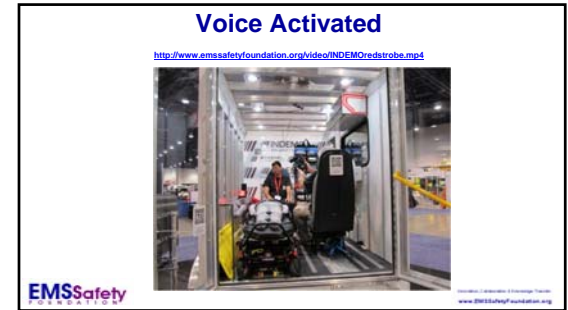
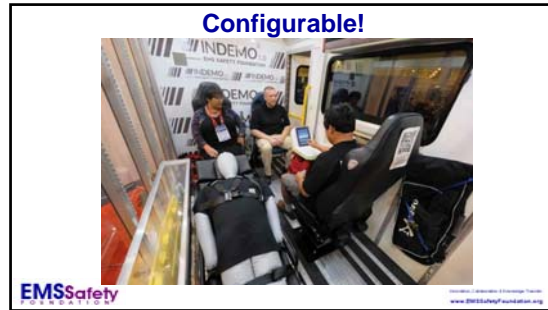
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### EMS Patient Isolation Design requirement/constraints

- 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

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### Wearable tech for providers..

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### and patients

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

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## 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

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## Environmental Hazards

- Thermal (Heat/Cold)
- Chemical
- Radiation

*All 3 very real current issues in the Ukraine for EMS*

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## 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.

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## 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)

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

[https://ansi.cachetly.net/preview-pages/ASSE/preview\\_ANSI+ASSE+Z15.1-2017.pdf](https://ansi.cachetly.net/preview-pages/ASSE/preview_ANSI+ASSE+Z15.1-2017.pdf)



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## 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

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## Fleet telematics tools

ORBCOMM

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

ORBCOMM

ORBCOMM



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## Telematics

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

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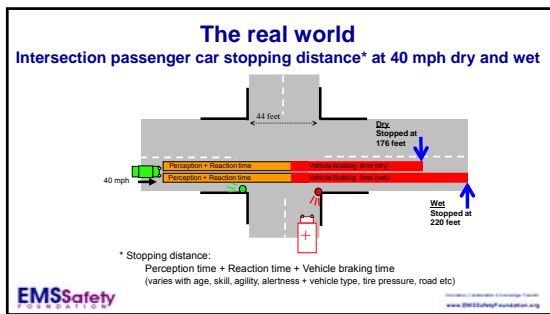
## Intersections

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.....

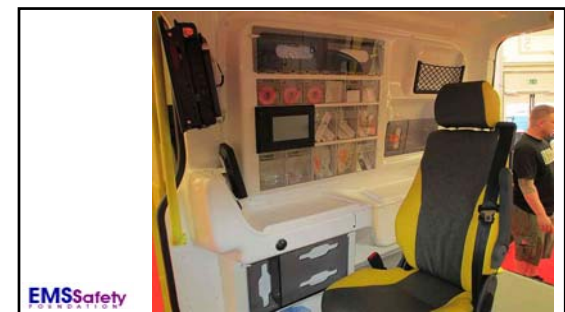
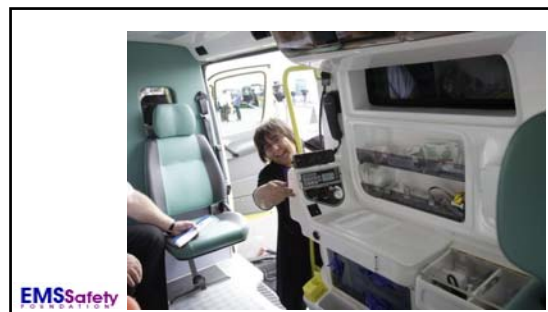
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### But whatever color .... If you run a red light someone will be killed

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

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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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### Work Smarter NOT Harder

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### Fleet Mix ?

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### The Motorcycle Medics

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### Avoid policy and practice ignorant of existing technical safety data

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### High visibility clothing - retroreflective

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### CAD - Crowd and the Cloud

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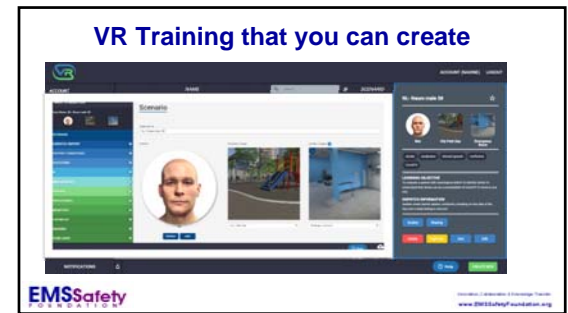
### Integrated crowd sourcing

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



Virtual Reality  
A new design tool too

Exploring the inside  
of a virtual  
ambulance



Propulsion systems in EMS  
and Innovation





## Ree Automotive electric platform

- Clean
- Energy efficient
- Low loading height



P7 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 Ambulance Prototype 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



When 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)

Hitachi Air orders four Cityhawk aircraft from Urban Aeronautics



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## Unmanned operational Prototype



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## eVTOL, Hydrogen powered, 2021



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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## 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

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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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## 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

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## 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](http://www.objectivesafety.net/PDFHO.htm)

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www.EMSSafetyFoundation.org

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



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