AEAI Propulsion

Sept 13, 2022

It takes a system to save a life - Next is now!

The interface between propulsion technologies and the challenges of Emergency Medical Services

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Innovation, Collaboration & Knowledge Transfer
www.EMSSafetyFoundation.org

Disclaimer

Nadine Levick MD, MPH, FACEM, FRACGP, Israel EM, Israel PEM

- **I am a doctor, not an engineer**
- Conducted the worlds first ambulance crash tests
- Chair, National Academies Science, Medicine & Engineering Subcommittee TRB EMS Transport Safety ANB10(5), USA
- Founder of EMS Safety Foundation
- Recipient, International Society of Automotive Engineers, Women's Leadership Award

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Emergency Medical Service (EMS) Roles

- Emergency medical care and transport
- Communications and dispatch
- Disaster management
- First Aid education

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EMS

- like the fire department, is a revenue sink
- does not generate revenue like commercial trucking
- it is a passenger vehicle 'work environment'
- Historically disconnected from the automotive industry

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a passenger vehicle 'work environment'

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Safety in EMS is INTERDISCIPLINARY

- clinical practice
- public health/disaster management
- communications/dispatch
- automotive safety
- impact biomechanics
- human factors
- fleet safety
- **?new propulsion technologies?**

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EMS transport special requirements

- Most are short trips ~ 10 mins in urban areas
- Vehicle occupants oriented in multiple configurations, including recumbent
- In an urban area, vehicle staging and positioning - occasionally requires idling
- On scene vehicles have medical equipment that requires power, and also AC or heating
- A small minority of trips are longer distance

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Most EMS trips are NOT critical

- < 3% of EMS runs are critical
- 97% of transports are routine, non-critical
- 25- 30% EMS runs are non transport
- 30% of EMS transports to the ED are discharged home within 4 hours
- 24/7 national physician video interactive telemedicine support for these cohorts

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An important Fact….

- **ONLY** <3% of transports is it a life threatening emergency
- 97% of transports are routine and NOT a critical emergency

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So ambulance design technical science…. Not really a new issue

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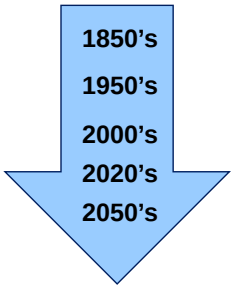
Timeline of Ambulance Propulsion Systems

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



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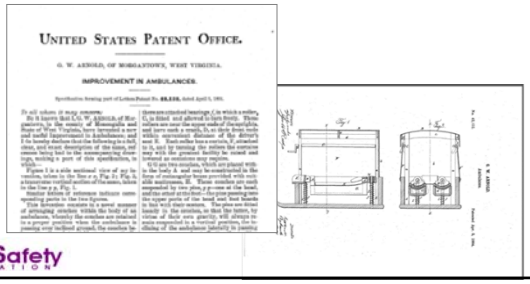
1864 Ambulance Design Patent

re: safety of ambulance design

> 150 years ago



UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN AMBULANCES.

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If you were to survey paramedics 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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Innovation and designing a safe system

the reality of change in EMS is

challenge to the adoption and integration of transportation innovation

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1980's Then….

And NOW!…

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USA 1980's Then….

And 2022…

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Ambulances currently are primarily Diesel/Petrol

- Is the mainstream for EMS vehicles globally

Limited design and safety standards largely due to exemptions

in USA the Ambulance Manufacturing industry is outside of the mainstream automotive industry

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

Testing the real world

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

Propulsion systems in EMS and Innovation

Electric propulsion in EMS

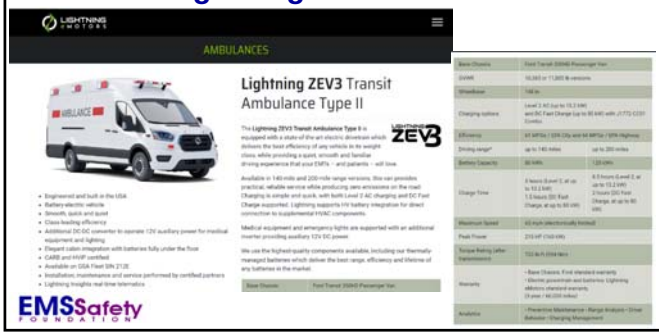
- New ambulance vehicles now being developed on electric platforms
- Electric mini Ambulance - 2017
- Initial USA deployments as of March 2022
- Benefits?:
  - Clean
  - Lower loading height
  - Cost saving

Electric Mini Ambulance - 2017

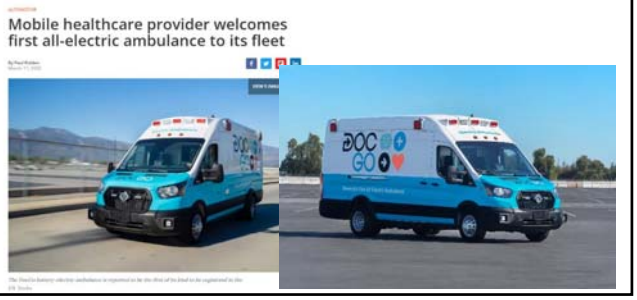

World's first narrow electric ambulance inaugurated by United Hatzalah

UH has treated 2.5 million people in the last quarter-century, around 300,000 per year, or 900 to 1,000 a day, all at no cost to the patient.

Lightning Motors - 2022



USA, First all electric ambulance deployed March 2022


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

Canadian Electric Ambulance Development October 2021

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 Lion5 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.

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LITMOTORS

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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The ambulance response vehicle of the future?

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Israel's Ree platform?

Ree Automotive

- Clean
- Energy efficient
- Low loading height

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Hydrogen

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

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Hydrogen-electric - November 2021

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Thought leaders – Urban Aeronautics Ambulance Transport Safety since 2002

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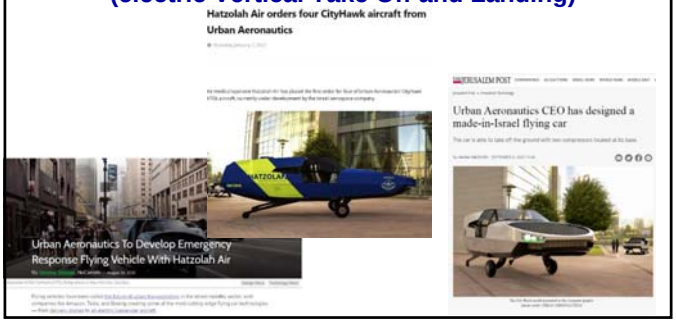
Urban Aeronautics, eVTOL 2021 (electric Vertical Take Off and Landing)



Unmanned operational Prototype

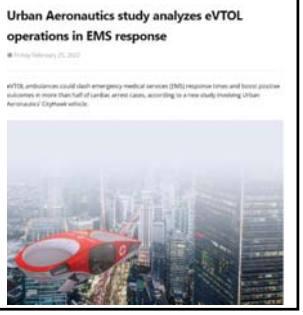
eVTOL, Hydrogen powered, 2021

URBAN AERONAUTICS SWITCHES TO REDESIGNED HYDROGEN-POWERED CITYHAWK EVTOL AIRCRAFT

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

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

- Power: 1050bhp
- Turbines: 5
- RPM: 120,000
- Fuel: Jet A1 or Diesel
- Dry weight: 27kg
- Flight time: 5-10 minutes
- Current speed record: 85 mph

Autonomous vehicles and drones

Unmanned Ambulance drones

And even now AED Drones!

Ambulance Drone Delivers Defibrillator by Air (VIDEO)

Automatic external defibrillators (AEDs) are now a common sight at airports and sports venues, but they're nowhere near to being ubiquitous. Alec Momot, a graduate industrial design student at TU Delft University in Holland, developed a drone with a built-in defibrillator that can quickly fly exactly to where it's needed.

Manned Drones

designboom

argodesign's drone ambulance quickens emergency responses

eHang passenger drone

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

First passenger drone makes its debut at CES

URBAN AERONAUTICS SWITCHES TO REDESIGNED HYDROGEN-POWERED CITYHAWK EVTOL AIRCRAFT

New Tools, New Vehicles
new industry relationships

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Summary

- EMS ambulance is a unique transportation sector
- Increasing recent interest in new propulsion systems
- Electric and hydrogen ambulances are now being developed and deployed
- Collaboration between new propulsion technologies expertise and EMS is key to optimized development and outcomes

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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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http://www.objectivesafety.net

Your Handout and Additional Resources

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