

Can emergency vehicles go electric feature

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CALL OF DUTY



Various automotive sectors are making strides towards lowering vehicle emissions, but emergency services face unique challenges when considering the switch to electric

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1. Though emergency services have begun introducing electric and hybrid vehicles, they typically tend to be limited to support roles

2. The electric motor of the WAS E-Concept and integrated battery management system is installed in the space in the engine bay created by the removal of the traditional IC engine

3. The WAS E-Concept's normal instrument panel is replaced by a battery monitor that enables the driver to monitor battery status, the battery management system, speed, revs and range



Pressure to convert to electric power in the automotive world is increasing – the UK plans to stop selling new petrol and diesel cars by 2040, and a number of European countries, including Germany, are considering implementing a ban in 2030.

Emergency services are not immune to the demands to change to ultra-low-emissions vehicles (ULEVs), despite making the greatest demands on those vehicles – and their powertrains – on a daily basis.

In September 2018, the UK's National Institute for Health and Care Excellence (NICE) published draft guidance which recommended public sector organizations, including National Health Service Trusts, should identify ways to reduce air pollution from their vehicle fleets – emissions should be “one of the key criteria when making routine procurement decisions.”

Police, fire and ambulance services have already introduced hybrid and full-electric vehicles to non-critical roles such as pool cars



and patient transport. The BMW i3, for example, has proved popular in such roles – the London Fire Service and Metropolitan Police now routinely use the i3, and in August 2018, the Surrey and Sussex police forces each took delivery of 30 of the cars in a three-year pilot scheme.

However, all of these i3s are range-extender versions, with gasoline engine backups that remove the range anxiety that still exists around full-electric vehicles.

The UK's North East Ambulance Service replaced five of its pool cars with Nissan Leafs, but has since changed to range-extender BMW i3s. “The Nissan Leafs worked well over short journeys, but our organization covers more than 3,200 square miles [8,300km²] and most staff did not have confidence in driving them over long distances,” fleet manager David Parkin says.

In 2016, BMW won a bid to supply the Los Angeles Police Department with 100 all-electric i3 models, with the then-president and CEO of BMW North America, Ludwig



4. Los Angeles Police Department's fleet of 100 fully electric BMW i3 vehicles was unveiled in June, 2016. Photo: Danny Moloshok/Newscast US



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CELL DIVISION

Challenges over EV charging times and range could open the door to hydrogen fuel cell technology.

In addition to emitting only water, the fuel cell vehicle does not require charging, but rather an infrastructure of hydrogen filling stations where it can have its tank replenished in minutes, in similar fashion to refueling a gasoline or diesel car.

In March 2018, a program aided by a European Union grant saw the Metropolitan Police in London equipped with a fleet of 11 Toyota Mirai FCEVs, as part of the force's stated aim to have 550 ULEVs or EVs in its fleet by 2020.

The Mirai FCEVs serve as unmarked and fully marked-up front-line police vehicles, in overt and covert response roles as well as general duties. Five hydrogen refueling points are available in London, with more to come. When fully fueled, the cars have a 480km (300 mile) range.

A newly announced five-star Euro NCAP crash test rating for the Hyundai Nexo is helping to dispel public concerns over hydrogen vehicle safety, but there remain doubts as to how quickly the technology can be applied to heavier, more demanding roles, such as fire appliances or ambulances. "We are not aware of any [fuel cell] vehicles that currently fulfill our needs due to the amount of equipment we need to carry," says David Parkin of North East Ambulance Service.

"Once you add telematics, mapping systems, communications equipment and, of course, blue lights and a siren, the extra weight of a vehicle reduces its range"

David Parkin, fleet manager,
North East Ambulance Service

(75 to 120 miles) between charges and a maximum speed of 120km/h (75mph).

In Austria, Kreisel Electric has produced a small electric fire appliance based on the Mercedes Sprinter van. Its 120kW motor enables a range of 160km (100 miles) between charges. Charging can be done overnight or using a fast charger and Kreisel CEO Markus Kreisel says such appliances are ideal for electric propulsion. "They only have to cover short distances and charging can be done between use – I am particularly thinking of stations in the districts of large inner cities, in town centers and small communities in the countryside or at airports," he says.

However, such performance and range capabilities make these vehicles non-starters with UK emergency services, where ambulances routinely cover 240-320km (150 to 200 miles) per day, and can exceed 160km/h (100mph) on an emergency call.

Moreover, these vehicles are in continuous demand with no

Willisch, championing the i3's attributes, which "position it to excel as the ideal vehicle for municipal organizations". But once again, the all-electric i3 variant was only put into service in a non-emergency, support capacity.

A far greater challenge is to electrify front-line vehicles such as ambulances, police pursuit vehicles and fire appliances, due to the demands placed on such vehicles during high-intensity and (potentially) critical applications, as well as the often prohibitive cost of buying EVs.

First responders

Development of such vehicles is proceeding. In Germany the WAS E-Concept, a conversion of a five-ton emergency ambulance with an 87kW electric motor, has quickly developed from a pilot project to a working vehicle. It offers a range of between 120km and 200km





Ford's Police Responder Hybrid sedan is based on the Fusion. The OEM will introduce a hybrid version of its Interceptor Explorer SUV in late 2019

downtime for recharging – unavailability due to an ambulance being plugged in at a charging station would be unthinkable, particularly given that emergency response times are under constant scrutiny.

Fire appliances tend to have much lower mileages, but are typically heavier, often weighing 12 tons or more, which eats into EV range. What's more, certain situations can require emergency vehicles to remain at an incident, in operational mode, for several hours – sometimes even days.

Power struggle

According to Parkin, the three main criteria followed when selecting a new front-line vehicle are its size, range and 4x4 ability. "Emergency vehicles need to be fast, safe, capable of carrying the amount of equipment we need and come within our revenue or capital budget," he says.

Ambulances have been steadily gaining weight as they gain more equipment – in 2017 the UK's South East NHS Trust initiated a vehicle weight program after discovering that several of its ambulances were perilously close to their gross vehicle weight limit.

"Once you add telematics, mapping systems, communications equipment and, of course, blue lights and a siren, the extra weight of a vehicle reduces its range," Parkin says.

The other major issue is electrical demand and recharging times. Most conventional ambulances, for example, employ two batteries

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for the engine and three large batteries for medical and ancillary equipment and lights, while paramedic cars have two, again adding to the weight.

A vast range of equipment, from stretcher batteries to defibrillators, is charged while on the vehicles, and the vehicles also carry 12V/240V inverters to power equipment such as incubators. Plug-in charging for this equipment is available at ambulance stations, but not typically at hospitals. Recharging the EV itself would therefore be highly challenging due to constant use.

"Often there is no downtime between incidents," Parkin says. "Although our fleet of cars do fewer miles overall, the majority are operational 24 hours a day, and only the specialist roles would have a chance to charge overnight."

Alongside range-extender vehicles, hybrids are being pursued as a means for organizations to reduce their carbon footprint. In the USA, Ford offers a Police Responder Hybrid sedan, based on its Fusion saloon, which combines a 2-liter petrol engine with

an 88kW electric motor. Recently unveiled is a hybrid version of the best-selling Ford Police Interceptor Explorer SUV, set to enter service in late 2019. While full details of its powertrain are yet to be revealed, the hybrid claims a combined fuel economy of 9.8 l/100km (24mpg) compared with the petrol Interceptor's 13.8 l/100km (17mpg).

Parkin is less convinced by the value of hybrids. "The MPG is no better than a diesel when the vehicle is in constant use and, because we have our own fuel bunkers, we can maximize a reduction in spend. We have tested a number of vehicles and will continue to look at alternative options as more vehicles become available."

In a view that will no doubt be echoed across other services, Parkin does not foresee early major uptake of EVs on the emergency frontline. "Ambulance trusts are struggling to design a suitable vehicle that is fast, safe, capable of carrying the amount of equipment we need to, and comes within our capital or revenue budget for the year. We would also need the correct infrastructure in place." 