ELECTRIC VEHICLES: A STRATEGIC ADVANTAGE FOR MILITARY APPLICATION

Military Africa

Russian logistics convoy headed towards Kyiv in March 2022

In today's battlefield, advantages relies on sustainment

Electric Vehicles for military application are essential for future-proofing strategic advantage. As the world continues to move to a newer, better form of energy generation and consumption, particularly in the area of mobility, focus is now on Electric Propulsion.

Despite several decade-long stints with combustion engines, the automobile industry is now shifting its attention towards electric vehicles. Such a move could likely see an increase in the price of internal combustion engines and their associating parts.

Although still at an early stage of development, and due to the limitations of battery cells, electric vehicles have not gained as much popularity compared with other forms of vehicles. However, that seems to have changed a bit.

Since the beginning of the last decade, several environmental factors, especially the impact of fossil fuel, and the unpredictability of the petroleum sector, has forced militaries to explore opportunities in electric vehicles application. Moving to a military adoption of electric vehicles early on will deliver future strategic battlefield advantages, reduce burdensome maintenance overhead, and, more importantly, save lives.

Nevertheless, even with the inherent benefits of Electric vehicles, military leaders should understand that as developing technology, some challenges still exist, particularly as battery technology is presently lagging behind comparative technologies and has not really grown and matured as expected.

This issue has negatively impacted electric vehicle ecosystem, in the area of cost of development, weight of vehicles, and operating range limitations.
The most conservative prediction puts electric vehicle technology maturity in about one or two decades. However, the most significant benefit of electric vehicle adoption by militaries is the strategic alterations to battlefield sustainment assets, logistics support, military supply chain, and unmanned vehicles.

Electric Vehicles offers advantages in logistics support and supply chain

In today's battlefield, advantages relies on sustainment, such as logistics support assets and military supply chain with emphasis on the importance as well as the complex tasks of equipment maintenance, transportation to remote and austere locations.

And with the current global downsizing of military resources, effective logistics operations in far distances from the national industrial base, could very well decide the outcome of a military campaign. Failure to modernize the logistic aspect of a military, especially in today's rapidly changing technological backdrop, could spell doom

for even a vastly modernized force.

"You will not find it difficult to prove that battles, campaigns, and even wars have been won or lost primarily because of logistics."
– General Dwight D. Eisenhower.

In today's technological equation, fuel is the life's blood of logistics, and according to the United States Military, for every main battle tank in theater, three support fuel tankers are in the rear echelon. 600,000 gallons of fuel are consumed by a US armored division daily.

One of the importance responsibility of logistics is supporting air bases and other forward operating points. These airbases directly support efforts to achieve aerial superiority which in today's battlefield disposition means strategic advantage. Achieving aerial superiority comes at a price, as airbases require a massive logistics ventures, and absence of these air superiority, the logistics convoys becomes massively vulnerable.

Harassing logistics convoy and static petroleum dump is one of the easiest ways of destabilizing a belligerent's strategy, seeing as moving fuel to an operating base in the frontline requires a large convoy of oil tankers, utility, and military escort vehicles.

NATO war games have shown some alarming vulnerabilities in the fuel supply. For instance, fuel reserved in remote bases is hard to conceal and incredibly vulnerable to aerial attack. Besides that, fuel logistics personnel will require sustainment like food, protection and living spaces which will put a strain on the overall campaign resources.

What's more, logistics resupply convoy comes at a high human cost; according to the United States Army Environmental Policy Institute, the casualty factor for fuel resupplies in Afghanistan was almost one casualty for every 24 fuel resupply convoys.

Furthermore, forward operating bases use a large amount of electricity, often thousands of kilowatt-hours per day; this demand is currently met almost entirely by generators fuelled with diesel.

Thus, Electric vehicles can reduce the military's dependency on petrochemical fuel; streamline the complex logistical supply chain, maintenance, and support thanks to the fact it is simpler to maintain because they are threefold far fewer parts than combustion engines.

Military planners would only have to situate tactically deployable power generating nodes to recharge forward-deployed combat vehicles, thereby eliminating the need for constant fuel resupply convoy operations. Adoption of electric vehicles in the near term provides innumerable benefits to militaries as logicians and engineers could now focus their time and efforts on more pressing maintenance or even combat concerns.

Electric Vehicles offers advantages over internal combustion engines

Besides decoupling the complicated mili-

tary logistics operations, electric vehicles offer significant advantages over those powered by internal combustion, including being quieter in tactical settings hence enhancing stealth ground operations in a contested environment.

An electric vehicle produces less noise than conventionally fueled vehicles which is a huge advantage when it comes to special operations, which requires a high degree of acoustic stealth. Forward deployed personnel can quietly approach a target environment without generating substantial thermal signature that an infrared weapon can track and home into.

Moreover, electric vehicles accelerate quicker, produce less heat than internal combustion ones; these are especially valuable for stealthy scouts' long-range vehicles (LRV). They can also generate sufficient energy to power high-tech next-generation systems, from sensors to lasers, without needing a bulky auxiliary power unit.

Additionally, electric engines can provide a large amount of torque at rapid speeds. The ability of an electric engine to provide on-demand torque immediately is substantially better than a diesel or gasoline engine. In cases where speed and instant acceleration are required, whether in pursuit of a mobile target or under pursuit by advancing forces, electric vehicles can provide the necessary energy, A clear tactical advantage.

Electric vehicles owing to their efficient

An Oshkosh Defense eJLTV (credit: Oshkosh)

design, offer a higher operational range, and even if they were to be recharged from traditional fuel generators, they would actually get more miles per gallon than putting the same fuel directly into an internal combustion vehicle. Thus, electric power could reduce dependence on supply lines and convoys of fuel tankers and trucks, which are vulnerable and prime targets for adversaries.

Even with its long and complicated logistical footprint, fuel is still the centrepiece of today's battlefield nevertheless, technological evolution in batteries and alternative fuels could shake up the status quo in the nearest future.

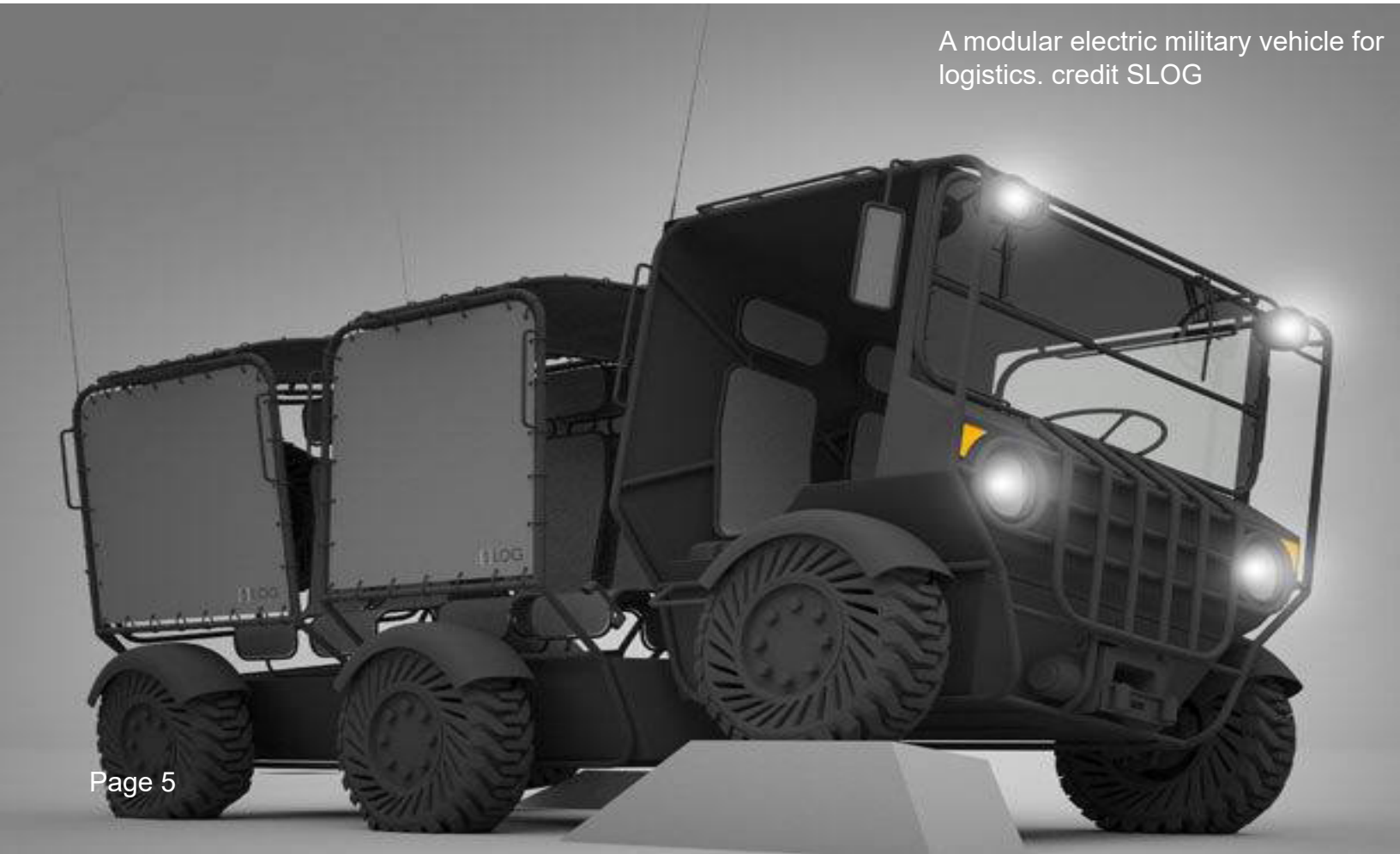
Electric Vehicles: The future of Next-Generation Combat Vehicle.

By next year -2022, electric vehicles for military, security, and police duty will make up 15% of the total market globally, that's according to research by IDTechEx.

With electric motors, military vehicles designers and engineers can forgo a centralized engine. Instead, the vehicles could have numerous engines, including one for each wheel, which allows the weight to be evenly spread, making the vehicle to be more resilient. If one engine is lost or damaged, it won't immobilize the whole vehicle.

Although, it may likely take several years before the electric technology matures enough to power heavy combat vehicles such as the Next-Generation Combat Vehicle, armored personnel carriers, infantry combat vehicles, light tanks, and even unmanned ground combat vehicles.

Technologies like electrical inverters, DC-to-DC converters, power distribution,



A modular electric military vehicle for logistics. credit SLOG

both high voltage and low voltage, and low-voltage energy storage will have to be mastered before electric vehicle adoption become widespread.

Battery capacity: a challenge for electric vehicles adoption

But one challenge the military must overcome is how to reliably charge electric vehicles in remote forward operations areas because, for now, electric vehicles' battery life is a limiting factor. However, it is expected that in the short term, militaries will likely adopt electric vehicle technologies on support systems as the initial focus.

Progress in battery technology will soon help make electric vehicles for the military a reality, as a new material -silicon carbide — a wide-bandgap switch is now being used in high-temperature applications, which has enabled electric vehicle manufacturers to make systems smaller, compact with more thermal resistance.

In no distant time, devices to provide the kind of power densities that are needed to be able to package electric engines and other electrical components inside of a combat vehicle would be produced.

Conclusion

As outlined above, there are significant advantages in adopting electric vehicles in military operations, but realizing these benefits now and into the future requires a systematic change to the supply chain and logistics processes.

The current support model in today's military operations is quite complex and multi-layer; however, this is likely to get less broad as equipment and inventory become more uniform following widespread multi-domain acceptance of electric vehicles. Thus, it is advisable that defense and in-service support organizations need to adapt these eventualities in both the short and long term.

For the military, the entire processes of military operations need to prepare for new flexibility, which will rely on enterprise asset management solutions for assets procurement, and logistics principles, frontline maintenance, and support.

With that being said, the success or failure of electric vehicles in military operations will depend on the quality of the technical support infrastructure, which will focus on the multi-facet supply chain and not just the charging stations.

Notwithstanding, it will take some years, if not decades, to field electric vehicles, as there are some major engineering challenges to overcome, especially in the area of battery technology. Adapting electric vehicles to military applications can deliver strategic, operational advantages, including logistics efficiency, safety, stealth, and longer range mobility to any modern fighting force.

Also, integrating these potentials with unmanned and artificial intelligence capabilities could potentially change the way militaries fight. Additionally, support industrial complexes that first successfully develop tactically deployable power generating stations will enjoy a massive commercial advantage.

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