ENSURING A ROBUST AND FUNCTIONAL POWER SYSTEM

In conversation with

Tom Spinks

EnerSys®

Published on: 18 November 2020

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BIOGRAPHY

Tom Spinks
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Thomas Spinks has been working in the development of off-road and specialist applications for the past 20 years.

For the past five and a half years Thomas has been working for EnerSys UK Ltd, based in Newport - South Wales, as Land Product Manager within their EnerSys Advanced Systems (EAS) division. Thomas's primary focus is on the ArmaSafe+ product range of batteries and associated power systems, which are designed and qualified for the rigors of use on defence vehicles. In addition, he is deeply involved in the development of new products to support the defence industry, as it focuses on addressing the increasing demands for on-board power.

Prior to working for EnerSys, and following Thomas's degree in Mechanical Engineering from the University of Bath, he initially started working for the FIAT group where he developed diesel engines for their off-road vehicle group. After that he joined CNH within the Engineering platform team responsible for developing a new heavy tractor platform. As of 2010, Thomas moved to a tier 1 supplier of driver controls systems for the off-highway and military vehicle industry.

EnerSys® produces an extensive range of theatre proven batteries and energy management systems that can deliver dependable information and control of vehicle electrical power. With a long and rich history of supplying defence customers, EnerSys® understands the exacting needs of armoured vehicle OEMs and armies. With this knowledge we can provide close and tailored customer service and support to meet those needs whether they be for the development of new platforms or upgrades.

INTERVIEW

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Q1. How would you describe EnerSys' ethos and values as they relate to supporting the Armed Forces?

Recent years have seen significant changes in the Armed Forces industry, and on the requirements of batteries in military equipment. These changes have also driven an increased demand for value, while continuing to maintain expected levels of performance and reliability. These changes are not exclusive to the defence industry. In other industries, the availability of power may ensure that palletised, critical equipment can be moved throughout a factory operation – potentially with a requirement for no downtime – or maintain essential server accessibility in the event of a power outage. When considering military applications, power availability helps maintain deployments for longer periods, securing targets and achieving mission objectives.

In response to this need for a greater understanding of power in the Armed Forces market, EnerSys® has established itself as a reputable partner to military organisations and OEMs across the globe. Whether there is a requirement for on-site product installation assistance, operational performance and usage data, or ongoing maintenance, EnerSys® is positioned to recognise and accomplish our customer's power requirements.

Furthermore, to ensure that best-practice is thoroughly adopted and implemented, EnerSys® has introduced an ongoing programme of learning and development – on-site at our customer's facilities – that highlights the importance of battery maintenance and the mission advantages that may be possible through the correct application of stored energy and power management.

Q2. What are the biggest challenges facing your defence customers today, and how is EnerSys working with end users to solve these?

Through our ongoing engagement with global military organisations and OEMs, EnerSys® has identified the growth in electronics, and the associated complexity of effective power management created by the additional equipment, as the primary challenge defence customers will face in the next decade. Condensed implementation timelines and the adoption of modular, pre-tested systems to simplify development cycles, are often implied to be their secondary concerns.

Yet, despite the defence industry being faced with many recent vehicle platform constraints, specifically around payload, performance and protection, the availability of reliable power, is firmly established in its principal significance. This is particularly evident when acting to ensure the successful achievement of mission objectives. Whether it is generated on the vehicle, or consumed from the batteries, safeguarding adequate power supply is essential for the near-instantaneous response that is expected from onboard electronics when they are called upon by the vehicle commander.

Power issues on a military vehicle deployed in the field, will manifest as a series of often repeated symptoms such as; increasingly regular brownouts, unrectified parasitic loads, or, following a commander's previous negative experiences, sessions of prolonged engine idling to ensure the maximum battery charge when the vehicles are called upon to deploy.

In response to these challenges, EnerSys® has introduced the three pillars for successful power management; **Store, Monitor, and Switch**. Factors affecting the amount and availability of stored power supplied by the battery is the first element of the approach to getting the most out of an armoured vehicle's batteries. The next is accurately monitoring the charge level, state of health, and related battery parameters to enable informed decision making. The third is switching the current inflow or outflow between two or more battery banks to achieve optimum effectiveness. This is achieved using techniques such as prioritised charging, sharing of electrical capacity between battery banks or the shedding of secondary loads to enable primary systems to remained powered for longer. By considering and implementing all three pillars, the vehicles power can be managed successfully.

"It is worrying to note that… the accuracy of electronic information Commanders expect from a modern car is not available on the vehicle in which they go to war."

Q3. There have been considerable advances in battery technology recently and some suggestions that Lithium-ion battery technology could produce significant benefits for the Armed Forces. Could you outline some of the advantages and disadvantages for the technologies that are most relevant to armoured vehicles?

As a global leader in stored energy, EnerSys® have many years' experience in supplying Lithium-ion cells and batteries into some of the most demanding applications, including inter-planetary and solar satellites, as well as other defence and medical markets.

These battery technologies may work well in other applications, but they might be unable to meet the specific requirements for operating in military vehicles. Characteristics such as cyclic loading, vibration, shock or Electro-Magnetic Compatibility (EMC), all require significant consideration. When selecting a battery, it is important to pay attention to its expected lifespan, charging speed, and ability to recover from deep discharge. It is also vital to assess the features that define its suitability for use in the field, such as vulnerability to damage and ease of transport by air, sea or land.

Traditional Lithium-ion (Li-ion) batteries, for example, can deliver high performance, but cannot be carried by aircraft without special exemptions, or secondary preparation activities to meet the requirements of IATA for transportation by air. If damaged, they can cause fires characterised by extremely high temperatures and the release of toxic gases. Other complications exist around introducing a Lithium-ion solution onto an existing platform and the additional controls for onboard generating systems, and battery operation in extremes of temperature. At the other end of the performance scale, flooded lead-acid batteries require regular maintenance and inconvenient frequent water top-ups.

To overcome such issues, EnerSys® recommends a battery technology that has been designed for use in armoured land vehicles, such as Hawker® ArmaSafe® Plus batteries. These absorbent glass matt (AGM) batteries from EnerSys® leverage Thin Plate Pure Lead (TPPL) technology to extend their lifecycle to offer superior performance compared to even the best traditional alternatives. They can be safely transported by air, deep-cycled down to 20 percent of their nominal capacity and recovered safely in the event of deep discharge.

Adopting a solution with advanced TPPL battery technology can also yield performance benefits over other traditional lead-acid battery products, and to those MODs not yet ready to explore and invest in alternative battery chemistries, such as Li-ion. There is an increase in available power, helping to extend silent watch, and longer storage time. Additionally, there are financial benefits through an improved Total Cost of Ownership. When combined with battery monitoring and management systems, these benefits can be enhanced to achieve more significant improvements for military vehicle applications.

Finding the right battery solution is becoming increasingly difficult due to the growing number of power options. With a specialist understanding of the global energy storage and power market, EnerSys® can advise military organisations or OEMs to help them select the most appropriate battery and power management solution for their application or fleet requirements.

Q4. What would you highlight as the most significant enhancements in EnerSys' capabilities for the defence industry over the past decade and how has this helped to improve mission success?

During a mission, the vehicle crew needs to be able to turn their full attention to the task at hand. With little attention to spare, the battery status and amount of power available must be communicated as clearly as possible to enable quick and well-informed decision-making.

Battery monitoring is more complex than that of other on-board vehicle systems, such as fuel tanks. Several techniques can be employed to provide vehicle battery data, for example; Amp-hour counting, Ohmic testing and model-based algorithms. The method used to both develop, and report information is critical, with each approach presenting its own pros and cons, including level of accuracy or a lack of current flow information. The right solution can also help prevent the battery monitor contributing to the parasitic loads of a vehicle, which is one of the most influential factors affecting battery life in modern military vehicles. Many manufacturers rely on only one of these methods to obtain data. EnerSys® DataCell II® battery monitoring system, however, combines Amp-hour counting and mathematical modelling to deliver unrivalled accuracy.

There is no room for guesswork when it comes to evaluating vehicle performance in the field. An easy-to-read battery monitoring and management system is crucial for effective operation. Some solutions, such as EnerSys® VBMS™ battery management system, use smart sharing and switching techniques to improve recharging, enhance performance, and extend battery use. This gives the crew better control over power usage, enabling it to be utilised where and when it is needed. EnerSys® VBMS™ battery management system also provides alerts when decisions are needed. For example, as a discharging battery approaches a critical charge level, a solid icon may be displayed. As it gets closer, a flashing icon may appear on multiple screens. Before automatic protection engages, an audible warning may sound. Delivery of information in ways like these can be flexibly programmed to meet the end users' needs.

By looking at 'time remaining' on the display, a commander sees how long the mission can continue without starting the engine or APU, withdrawing to a safer position or taking other appropriate action for their mission objectives. It is worrying to note that most armoured land vehicles today do not provide this certainty. Instead, commanders must rely largely on guesswork. In effect, the accuracy of electronic information they expect from a modern car is not available on the vehicle in which they go to war.

Integration of ArmaSafe® Plus batteries, a DataCell II® battery monitoring system and the VBMS™ battery management system into an application's design helps to meet the mobility, survivability and firepower trade-offs of the armoured vehicle 'Iron Triangle'. It gives confidence, especially, in the availability of power to start the vehicle and operate both defensive and weapons systems.

"OEMs and MODs should pay attention to the power needs of a vehicle on silent watch"

Q5. Energy requirements and power management should be critical components of platform design - driving cost efficiencies and longer-term capability sustainment. How does EnerSys work with both the military customer and the prime manufacturers to advise and support capability development? How important is early engagement when it comes to platform design and manufacturing?

The array of electrically powered systems fitted to military vehicles has expanded far beyond the level anticipated a few years ago. Most vehicles were not designed to cope with the additional power need.

Incorporating the latest technologies in product design will help ensure that armoured land vehicles continue to meet the evolving mobility, survivability, and firepower requirements. As addressed throughout this interview, vehicle battery monitoring and management can play a key role in the safety and success of operations. Consideration of the loads expected within the vehicle throughout its life; power requirements at commissioning and any future capability growth, should be accounted for when determining a suitable power system. OEMs and MODs should pay attention to the power needs of a vehicle on silent watch, as well as the physical space available to house the batteries and associated management systems.

EnerSys® can support at any stage of an armoured vehicle's life, but when engaged during the project conception and initial production phases, it is possible to ensure that a robust and functional power system – capable to support the vehicle throughout its life – can be developed. With years of experience in power management EnerSys® can help with simulating the expected life of a battery system for a given loading profile, validating power system sizing calculations or consulting on the structure of a battery management system to provide increased discharge durations and battery protection functionality.

Correct vehicle power management is not easy to highlight. Far more understandable are the consequences of a vehicle that suffers from power difficulties. These issues might include unexpected brownouts, a reduced mission capability, or an excess

replacement battery stock. More obscure examples of a compromised power management approach may be a requirement for complicated maintenance procedures, or battery racks located in areas of the vehicle with poor access.

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KEYNOTE SPEAKERS INCLUDE:

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Deputy Chief of the General Staff
British Army

General Tim Radford CB DSO OBE
Deputy Supreme Allied Commander Europe
NATO SHAPE

General Sir Adrian Bradshaw, KCB, OBE
DSACEUR, NATO SHAPE (2014-2017)
Conference Chairman

Lieutenant General Ivan Jones CB
Commander Field Army
British Army

Lieutenant General Martin Wijnen,
Commander
Royal Netherlands Army

Lieutenant General John Kolasheski, Commanding General, V Corps,
US Army FORSCOM

Lieutenant General Eric M. Smith,
CG, MCCDC; DC CD&I,
United States Marine Corps

Lieutenant General Sir Edward Smyth-Osbourne KCVO CBE, Commander,
HQ Allied Rapid Reaction Corps

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As such, Defence iQ welcomes the contributions from thought leaders across the defence community, to help inform, educate and inspire the current and next generation of disruptive thinkers, innovators and smart customers in defence.

Please get in touch with the Editor, Alex Stephenson, at alexander.stephenson@defenceiq.com to discuss submission proposals.