

Emerging technologies, whether that's artificial intelligence, the use of big data analytics, or smart wearable devices and drones, are being appropriated by the world's military to help improve the effectiveness and capabilities of their armed forces.

As the technology landscape continues to evolve and becomes ever more complex, so more traditional electronic components are having to evolve to support new capabilities.

Connectors may not be considered the most technological of products, but they haven't been immune to the mega trends sweeping through many industries, not least the need to supply components that are smaller but also lighter and smarter.

In the military space, those changes are significant with product performance and electrical integrity having a huge impact on connector systems and their design, whether in terms of the equipment being used by soldiers, rugged displays, communications equipment or in vehicle electronics.

"Today's newer electronic instruments can neither afford the space or the weight required by older cabling and connector systems," says Bob Stanton, technology director at Omnetics. "High performance product is required and it needs to offer customers space and weight benefits but without impacting on performance, reliability or functionality."

A growing list of connector suppliers are working on replacing two or three connectors with one miniature, dense multi-functional connector, for example, and that is having an impact on the kinds of cables people are looking to choose.

ODU, a supplier of connector system's, has been working on developing connectors suitable for use with multiple interfaces that will be connecting the soldier of the future with their weapons and

Smaller, lighter and faster

As the military gets smarter so demand for innovative connector solutions continues to grow. By Neil Tyler.



communications as well as with military vehicles and, according to the company's managing director, Nick Harper, has been focused on developing one connector family capable of meeting the requirements for every application. (ODU has been heavily involved with supplying over 100,000 helmet connectors as part of the Ministry of Defence's Bowman programme.)

While engineers are looking to supply smaller, more compact,

Above: The Black Hornet Nano is a military micro unmanned aerial vehicle (UAV)

connectors they have to also ensure that they are able to withstand temperature extremes, vibration, and be able to operate in an environment that might be sandy, wet or dirty – all of which could compromise the integrity of the connector.

New surface treatments and technologies are being developed specifically to address the extreme environmental conditions expected in the military space.

For example, connector manufacturer, LEMO, has developed NiCorAl a corrosion resistant conductive surface treatment that offers an alternative to Cadmium.

Miniaturisation

"New technologies are driving continuous miniaturisation of electronic equipment for communications, computing, surveillance, sensing and navigation," says Stanton. "Whether soldier-worn or on-board a unmanned aerial vehicle (UAV) or unmanned ground vehicle (UGV), small size and light weight are demanded – but no performance compromises can ever be accepted."

Many of the older military specification models are becoming outdated in the face of growing demands for micro- and nano-sized connectors that are needed to address the requirements of higher-technology electronics.

"Trusted military connectors like MIL-DTL-24308 D-sub's are being superseded by smaller, lighter alternatives like 83513 and 32139 Micro- or Nano-Ds," explains Stanton.

"Smaller can never mean weaker, though," he warns. "Although they have very fine pitch (0.64mm for the Nano-Ds), they must be able to withstand environmental hazards like extremes of heat and cold and exposure to corrosive chemicals."

In order to address this, Omnetics uses open-ended beryllium-copper pins, which are shaped to maintain four continuous points of contact and

are tempered for continuous spring force.

“These have actually exceeded 2000 mate/de-mate cycles in testing, and the design gives extra travel in compression and expansion to ensure continuous electrical contact even during extremely harsh vibration,” says Stanton. He continues, “Sockets are copper-alloy, and designed to increase contact pressure as they expand at higher ambient temperatures. When cold, the socket contracts without overstressing the spring. Contacts are nickel/gold plated after forming, meeting ASTM B488 Type II, giving high corrosion resistance.”

Soldiers can be under huge pressure in action, so speed and convenience are also critical.

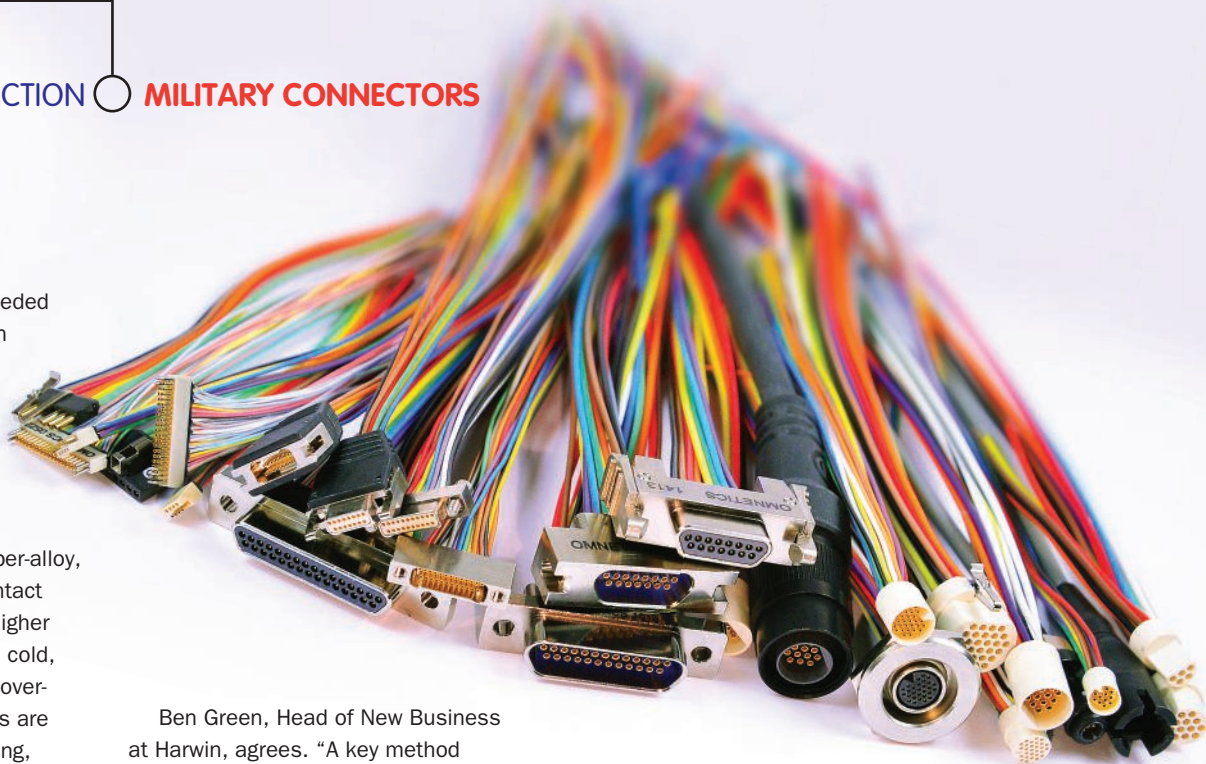
“At Omnetics we have designed innovative latching Nano-D families that connect securely without fiddly jackscrews, and which pass the stringent MIL-DTL-32139 shock and vibration specifications,” Stanton explains.

Military connectors are also having to contend with another important trend and that is the dramatic increase in the amount of data that is being routed between devices and people.

More data requires more sensors and where data is time critical and where interference is unacceptable connectors that are smaller and more rugged are required.

Technological arms race

“Keeping the technological upper hand is critical to ensure military success,” explains Stanton. “Today’s military forces need to maintain their superiority in unfamiliar environments from mountainous deserts to urban areas and, accordingly, soldiers need to be quick on their feet, and unmanned aerial and ground vehicles are increasingly in demand for dangerous missions, close to the enemy.”



Ben Green, Head of New Business at Harwin, agrees. “A key method for protecting frontline troops and ensuring that lives are not placed into unnecessarily dangerous situations is through greater use of smart technology. The interest in UAVs and UGVs has grown significantly, as a result.”

UAVs and UGVs enable the military to undertake a number of operations - including detailed surveillance, the transportation of vital supplies and even recovery missions - without placing service personnel at risk.

“These types of vehicles have to rely on the incorporation of sophisticated electronic circuitry and, in turn, the support of high reliability cabling/interconnects - so that the power needed to drive the motors for propulsion purposes and data from an array of different sensors to allow timely manoeuvring can be delivered,” Green says.

“The constituent components all need to be compact and light in order to deal with space and weight constraints, so that less impact is placed on their limited energy reserves and the vehicles can cover longer distances before they have to return.”

These trends are combining to drive continuous miniaturisation of electronic equipment for communications, computing, surveillance, sensing and navigation Green says.

Above: Military connectors are having to contend with a dramatic increase in data rates

“Whether soldier-worn or on-board a UAV or UGV, small size and light weight are demanded.”

To address these demands, defence agencies and their military contractors need to be able to collaborate with suppliers who can provide them with robust, high performance components in small form factors.

“The connectors specified as part of UAV/UGV design and development activity, for example, as with any other military-related application, need to possess elevated levels of reliability, as well as exhibiting high degrees resilience to electro-magnetic interference (EMI),” Green contends.

“Dealing with all these different aspects is clearly challenging, so engaging with the right supplier is absolutely critical,” he concludes.

But there is another reason why equipment needs to be compact, lightweight, and technically advanced, according to Stanton.

“Today’s arms races increasingly pit professional armies against militias that are adept at harnessing powerful consumer technologies, whether that’s smartphones, mobile data, GPS or quadcopters.

“Overcoming these challenges demands smart thinking about even the finest of details – and that includes the connector.”



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