THE FUTURE IS NOW... TECHNOLOGY AND FUTURE SOLDIER SYSTEMS

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There is no doubt that the world we live in has incredible technology. The dreams of science fiction from just a few years ago have now in many ways become reality. The tools available only to the imaginary characters like James Bond and Dick Tracy have revolutionized human capabilities. Smart phones, smart cars, drones, smart televisions, smart watches, and other wearables such as smart eyewear have integrated themselves to seemingly essential and affordable elements of our everyday lives. Virtual reality and augmented reality are no longer just for gamers and have real business value with practical use applications. Many of the dreams of technical possibilities are available today thanks to the evolution of sensor technologies and wireless devices. Now imagine the combination of these technical capabilities with data collected in the Internet of Things (IoT). Virtually everything on planet earth is observed and monitored to some degree, including landscape changes (ice caps, coastlines, erosion), weather patterns and temperatures, energy deposits, airplane and vehicle traffic, military activity, people and population density, and even facial recognition. Positioning devices now make it possible to find almost anything or anyone. And the popularity and capabilities of drones provide persistent surveillance to enable real-time video access to previously inaccessible areas.

In this context, we consider the modern-day soldier. The range of roles that must be performed by the military and even first responders is much wider than it ever was. Jobs can vary from deployments in harsh conditions and environments combating hostile threats in both rugged and urban situations, to military and humanitarian support to provide aid and clean up after natural disasters. The equipment and the gear they need to do their job evolves as the threats and job requirements change. Technically advanced products that have adopted the latest technology are greatly capable of protecting of people and helping them do their jobs better. These products can provide enhanced communication, detection, protection, real time situational awareness, and data analysis. The soldier can now be more capable and confident and becomes a greater value as an asset in his environment.

Imagine being on the battlefield and being able to flip down a transparent screen from your helmet, scanning the landscape to identify friend or foe. And not just identification and location, but with a visual scan you can determine their health and readiness status. Biometric sensors embedded in the uniform and other wearables gear can detect much more than just vital signs. You can obtain information about how much rest, hydration, focus, alertness, blood sugar, metabolic status and energy reserve, altitude adaption, how much ammo, battery levels, and potential exposure to toxic chemicals and materials, just with a visual scan of your situation. Algorithms can take data from the environment coupled with data from biometric sensors and extrapolate the need for supplies and other reinforcement criteria. Availability of real-time answers to questions such as:

Where is the enemy? In what location are my troops? Are my troops prepared to engage? Do they need hydration, food, or ammo? Should they take a break, change shifts, need other supplies? Have they been exposed to chemical or biological hazards? Imagine the strategic advantage with this capability. A soldier's role now expands from a tactical combat operator and fighting role to a complex human "sensor" with greater cognitive capabilities.

At recent trade show events such as the Association of the United States Army Annual Meeting in Washington DC, this type of soldier system technology has already been on display, primarily in

aspects of the Nett Warrior system. Augmented reality equipment has been demonstrated and many tactical peripherals are available for field evaluation. These displays of technology provoke questions such as:

- What other capabilities could be available? With sensors and the IoT, what are the possibilities?
- How does it all work and on what networks?
- Is it reliable and secure? - can it be detected, intercepted, compromised?
- What if the technology falls into the wrong hands?
- What ruggedized components are required for this technology?
- What powers this technology? Can we harvest energy with innovative materials or kinetic motion?

These are just some the questions that must be answered for successful use and deployment and risk mitigation in soldier systems applications. As a supplier of antennas, sensors, interconnect, wire and cable, and harnessing accessories, TE Connectivity (TE) has supported these advanced applications and is poised to enhance the next generation of battlefield technologies. These products include connectivity and harnessing components and accessories on the soldiers themselves, through to the data centers, and exist at every part of the data transmission link. Whether its worn on a human, fastened on a vehicle, part of an antenna or satellite, or in a climate controlled building, TE is part of the connectivity ecosystem. Most recently, the Army has approved and authorized TE's O.C.H. Micro Circular connector in the Nett Warrior system following rigorous product qualification testing and field trials.

Figure 1: TE Connectivity's O.C.H. Micro Circular Connectors

Embedded electronic products may be required to work in High Altitude Low Oxygen (HALO) skydiving missions, desert sandstorms, jungle and mountain excursions, urban situations, and SCUBA dives to name a few. As new product concepts are identified for these situations, product requirements are defined and documented through close engagement with customers and end users. This involves the consideration of the environments in the wide range of use for these soldiers. Ease of use and ergonomics with full battle gear, mechanical and environmental robustness, and electrical performance and signal integrity are evaluated throughout the design process. Product testing and qualification expectations must all have definition and detailed design requirements and test procedures. Connectors must transmit the signals and data with high fidelity, charge or supply power to the connected devices effectively, they must withstand the weather and environmental conditions in rugged, tactical situations, and break-away when snagged or required to quickly release. In addition, compatibility must be proven with other suppliers to these standards.

In the product concept phase, three-dimensional models and rapid prototyping tools are used to solicit early feedback to optimize the designs. With today's manufacturing development technology, design iterations which previously took weeks to months to produce can now occur within hours. Engineers today have the capability to quickly and accurately print functional parts to scale vs just cartoons and paper design drawings. Ultimately, after extensive design reviews, risk mitigation analysis, and product design verification testing, field trials will provide a statement of technical readiness. Furthermore, multiple component suppliers must be evaluated for performance to the design requirements and evaluated for the ability to intermate and functionally operate properly.

Companies in the video gaming industry have been pioneers in the capability to produce chips and processors that enable realistic, high-definition graphics. The cloud computing companies have developed the hardware and software with capability to process and store "big data" and produce real-time access to this information. Chipsets from the commercial or industrial world, with their cutting-edge performance, are often leveraged and introduced into military and rugged applications. But the available Commercial Off The Shelf (COTS) products are typically not initially intended to operate in rugged conditions and harsh environments. Experienced connectivity companies that serve the Aerospace and Defense industries have the expertise to design ruggedized and hardened components through the careful and proper selection of materials and the incorporation of proven design features for these environments. The materials must survive enhanced shock, vibration, and thermal conditions and be compatible with fuels, hydraulic fluids, and chemicals that can be encountered in battlefield environments.

In the age of cyber security and electronic warfare, risk mitigation in technology with systems this complex and powerful cannot be understated. Additional thoughts and considerations are relevant for this next generation of technology. The battlefield involves camouflage and deception so soldier systems must ensure secure networks and ideally use products undetectable and invulnerable to cyber-attacks and jamming. Shielded electronics and high-speed data link cables are required in these systems. Ruggedization of

connectivity will enable product performance and each element in these electronic systems must be proven reliable.

In conclusion, as we admire today's capabilities with state of the art in embedded electronics for soldier systems, it is exciting to see what is possible and available and it is reasonable to believe what seems impossible today may be part of tomorrow's reality. The connectors, cables, and accessories for these soldier systems are available and in production, although it will be interesting to see how to provide these total system capabilities to soldiers in a reliable, affordable, lightweight and cost-effective manner. Soldier systems must be scalable to multiple diverse users, operate effectively in close proximity, and must also scale in range of operation. Hardware, system, and infrastructure costs must bring the proper value for the investment in these technologies. The connector industry is prepared to engineer solutions that meet these market needs and is currently working with the defense industry to develop solutions that will meet both current and future challenges.

ABOUT THE AUTHOR

With a degree in mechanical engineering, Matt has more than 23 years' experience in the aerospace & defense and electronic computing industry. Matt holds over 35 patents in connectivity-related technology, and Black Belt certification in Lean Design for Six Sigma.

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