WEBINAR SUMMARY

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ElectronicDesign

Combat-Ready Interconnects: Essential Design Strategies for Tactical Gear

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KEY TAKEAWAYS

- Soldier-worn architecture must meet increasingly complex requirements.
- Different types of interconnect solutions are used in soldier-worn systems.
- ITT Cannon prioritizes mission enablement when designing soldier-worn architecture.
- ITT Cannon's next-generation solutions enable the future of soldier-worn technology.

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OVERVIEW

As modern warfare evolves, the demand for more advanced, reliable, and efficient soldier-worn technology is higher than ever. Engineers and manufacturers must prioritize critical design considerations for interconnect solutions, including power management, weight minimization, and tactical gear integration, to meet rigorous military standards and ensure peak performance in the field.

ITT Cannon leverages expertise in the latest advancements and considerations in soldier-worn technology to provide solutions that support the design, development, and deployment of military-grade tactical gear and interconnects. ITT Cannon is a longtime partner of TTI Group, a Berkshire Hathaway company founded in the 1970s, with 8,000 employees in over 160 global locations today. TTI is a specialty distributor focused on interconnect passive and electric mechanical components and discrete semiconductors. TTI and ITT Cannon's joint commitment to quality and support is unparalleled.

CONTEXT

Paul Alpers discussed components of soldier-worn architecture and explained how ITT Cannon's interconnect solutions meet today's needs and enable the future of soldier-worn technology.

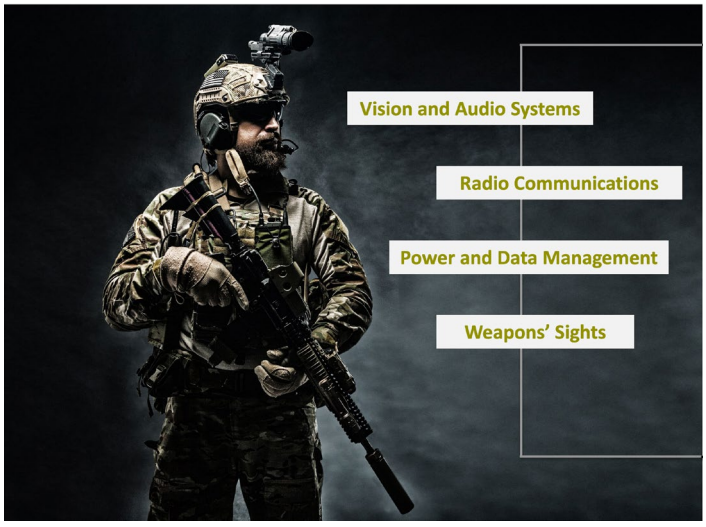
KEY TAKEAWAYS

Soldier-worn architecture must meet increasingly complex requirements.

Soldier-worn gear includes devices, sensors, optics, and other electromechanical components worn by soldiers to enhance their field capabilities. Today's soldier-worn architectural needs are focused on the dismounted soldier's overmatch capabilities, which include situational awareness, communications, lethality, and blue force tracking. Improving these capabilities supports a much higher level of combat mission execution and success.

Soldier-worn electronic systems include vision and audio systems, radio communications, power data management, and weapons' sights. These are often integrated, with power and data hubs for power management—including charging and scavenging—and data streaming throughout the interconnected system. Thermal and night vision systems, as well as visual augmentation for navigation, can be worn at the helmet or wrist, or integrated into the overall system to display on end-user devices. All of these elements rely on a cabling system that connects them together.

Figure 1: Soldier-worn electronic systems



Soldier-worn architectural needs include several sub-segments:

- **Power management.** A 72-hour mission life is critical to many of the missions run by soldiers today, which often last for several days. Optimized power management enables soldiers to both preserve the power of electronic equipment for when it is needed most and to access different types of charging systems to regenerate system power.
- **Day-night operations** in different types of displays, including helmet-mounted heads-up displays (HUD) and chest-rig-mounted heads-down displays (HDD), and system-integrated night vision goggle systems and laser aiming devices support soldiers in a wider range of missions.
- **Ease of use.** Many austere environments, such as the Arctic or desert environments, will include gloved-hand operations that require soldiers to properly connect or disconnect a component on the electronic system. To ensure accurate connection, different types of mating options are available to achieve greatest ease of use within a given application and/or environment.
- **Functionality in all environments.** In environments such as the Arctic, desert, or oceanic environments, devices are required to have ingress protection. Today's devices are typically protected for one meter for 2-3 hours, but requirements are shifting, extending to 20 meters for 2-3 hours or longer.
- **Denied access in electronic warfare environments.** Soldier-worn systems must be resilient to EMI and EMF signatures. Systems, therefore, need to be quiet—not radiating any signature. Systems must also be designed so they cannot be jammed through an exterior source.

Nett Warrior System (NW)

The NW system is one standard for soldier-worn architecture. NW is an integrated dismounted leader situational awareness system for use during U.S. Army combat operations. The NW system is composed of a radio, a power and data hub, a conformal wearable battery, and an end-user device.

Figure 2: Cannon Nett Warrior connectors

- Robust coupling mechanism with Breakaway coupling, a canted-spring retention system
- "First-mate-last-break" pin ground for hot-swap USB requirements
- Selectively plated with Electroless Nickel and Black Zinc Nickel
- Contacts: 5 Amp standard, 8 Amp optional
- Durability: 2,000 mating cycles

Different types of interconnect solutions are used in soldier-worn systems.

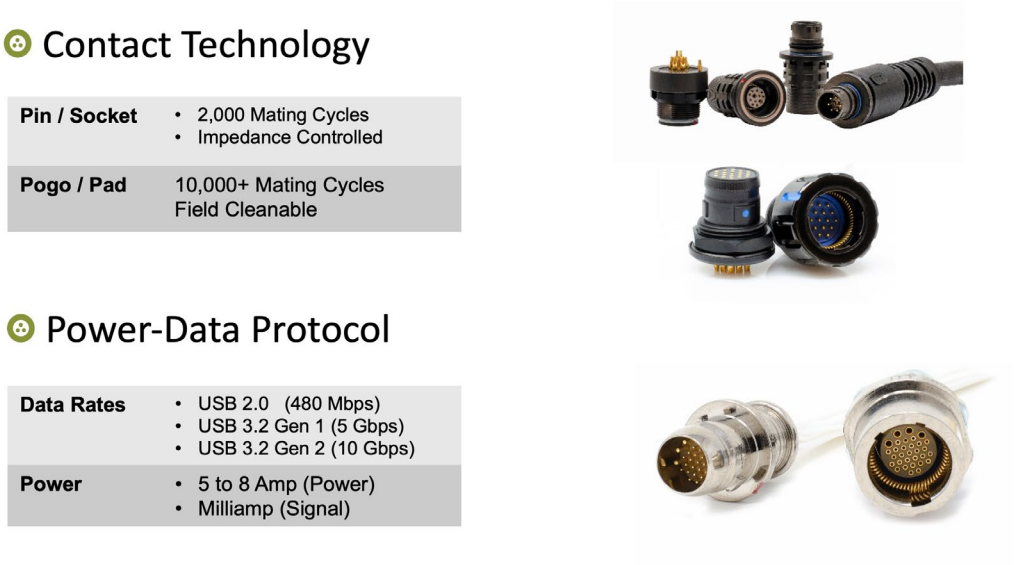
Today's soldier-worn systems use a variety of interconnect solutions, which include different types of contact technology and power-data protocols.

- **Contact technology. Pin and socket** technology is deployed in popular Mil Spec connectors such as MIL-DTL-38999 and MIL-DTL-32689, which are miniature circular connectors with 500 mating cycles (heavier gold can be applied in the mating area to achieve up to 2,000 mating cycles). Pin and socket contacts make it easier to control data lines from an impedance control perspective.

Some components are shifting toward the use of **pogo and pad** technology. Pads in the connector are typically on the box side of the receptacle and prevent the ingress of moisture contaminants into the socket. The connectors are easy to clean—debris on the pad can be simply wiped away. The durability of pogo contacts is much higher than pin and socket, with up to 10,000 mating cycles.

- **Power-data protocols.** Today's NW systems use USB 2.0 protocol, with a 480 Mbps data rate and 5-Amp power. Some newer NW systems are moving to USB 3.2 Gen 1 protocol for a 5 Gbps data rate using the same 5-Amp technology with battery charging. And requirements continue to evolve, with demand growing for higher amperage charging and 8-Amp power for the size #23 contacts used in NW products.

Figure 3: Today's interconnect solutions



ITT Cannon prioritizes mission enablement when designing soldier-worn architecture.

When developing soldier-worn technology, ITT Cannon designs for multiple considerations, including product functionality in different environments, product longevity, product performance, and other critical product qualities that support mission success.

> "We put a big focus on size, weight and power, and body conformal solutions. . . we don't want a lot of different types of cables that are encumbering the mission the soldier might be on."
>
> *Paul Alpers, ITT Cannon*

ITT Cannon offers a range of interconnect solutions with a variety of features to meet the needs of any application. Key features include:

- **Low profile,** body conformal designs reduce snagging of the cable routing on the soldier system. Connector geometry allows them to be fed through MOLLE loops to help with cable management and routing.

- **Magnetic coupling** allows for quick disconnect in any direction, including omni-directional. Often used for charging in systems such as power on the go, magnetic connectors can be easily latched and unlatched to avoid entanglement.
- **Positive latching.** In certain applications such as HALO (high-altitude, low-opening) missions (e.g., a nighttime parachuting jump), it is critical that nothing is disconnected. Systems used for secure application require positive latching or secondary latch.
- **Breakaway.** Frequently found in traditional NW products, these connectors typically have a 10-pound breakaway in case of snagging or entanglement.

ITT Cannon's next-generation solutions enable the future of soldier-worn technology.

As modern warfare continues to evolve, so will requirements for soldier-worn equipment. The sector continues to see demand for day-night overmatch capabilities and improved situational awareness in any region of the world, including Arctic, desert, mountainous, and oceanic environments.

Soldiers are relying more on unmanned air and ground vehicles, doing those type of missions with soldiers operating a UAV or UGV to carry out a mission or gather intelligence and data. The use of UAVs and UGVs, coupled with a growing need for sensing equipment, such as ground sensors, counter IED systems, and counter swarming UAVS systems, captures the increasing demand for machine-human interface technology using **next-generation computing**. To support equipment performance and longevity in a rapidly changing environment, the industry is trending toward development using an **open architecture environment**, which allows for system upgrades without a full redesign.

Soldier-worn interconnects are likewise evolving to support these next-generation trends. At the system level, the focus is on continuous reduction of size, weight, and power while **increasing bandwidth**. ITT Cannon is developing higher-bandwidth connectors to support next-generation computing applications, including the use of artificial intelligence, as well as connectors with improved mechanical properties.

Power management continues to be an area of strong focus for next-generation capabilities—both in terms of managing power consumption of lower-power electronics and advancing **battery technology.**

Cabling is always a concern in soldier-worn technology, with a constant focus on **improved cabling** to increase data rates and improve body conform for unencumbered operations. ITT Cannon designs high-flex and high-strand-count cables with a flat profile to be more body conformal, while at the same time reducing wire diameters to increase data volume and speed. Smart cables have embedded electronic systems in the cable itself to support more complex applications.

In partnership with TTI, ITT Cannon provides a robust supply chain, with multiple suppliers that support a variety of products both directly and through a variety of distributors. TTI offers extensive support for the ITT Cannon product series with a quick turnaround—typically within 24 hours—and a supply chain for materials needed for longer-range forecasts.

Figure 4: Coming next in soldier-worn interconnects

Systems

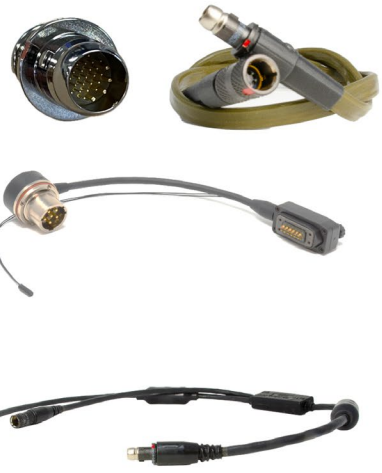
- Continued Focus on SWaP-C
- Increased Bandwidth
- New technologies compliant with MIL-STD-810 Environmental

Connectors

- Higher Bandwidth (10 Gbps Copper and Optical?)
- Field Cleanable (Spring Probe and Pad)
- Coupling Options: Low-Profile Magnetic Breakaway and Positive-Latching
- Higher Amperage Contacts (Fast Charging)

Cable Systems

- Highly Flexible, Flat and Body Conformal
- Smart Cables with Embedded Electronics
- Potential for Optical Solutions (SWaP-C and EMI focus)



ADDITIONAL INFORMATION

To learn more, visit ITT Cannon at TTI

BIOGRAPHY

Paul Alpers
Regional Sales Manager
ITT Cannon

ITT's Paul Alpers has been a stalwart in the harsh-environment electronics market for over 35 years, with the past 17 years dedicated to advancing ITT Cannon's interconnect solutions. His extensive career has spanned multiple disciplines, including Engineering, Product Research and Development, and Sales and Marketing, with a concentrated focus on the aerospace, military, and space sectors.

At present, Paul spearheads a product management team devoted to New Product Development and plays a pivotal role in ITT's collaboration with various interconnect standards committees, such as SAE, AEEC, SOSA, and VITA. His responsibilities extend beyond internal product development, as he actively engages with military and aerospace system designers to anticipate and shape future trends, directly influencing ITT's product and technology roadmaps and its broader strategic vision.

Paul holds a Bachelor of Science in Electrical Engineering (BSEE) and an MBA, credentials that underpin his leadership and innovative contributions to the industry.