

Making Connections in Ruggedized UAVs

Derek Hunt, Director of North American Sales, Omnetics, talks to Soldier Mod about connectors in extreme environments

The world of UAVs – especially those in the military sector – is one of constant evolution, with their size and capability subject to constant innovation to adapt to growing usage. As sensor and detector electronics develop to support greater operational capabilities, so too do the connectors within them.

But while the focus is often on miniaturization, equally important is ensuring that connections in military UAVs can cope with the extreme environments in which they are often deployed, says Derek Hunt, director of North American sales at Omnetics. “When we’re talking about this kind of technology, everything’s about miniaturization and portability because everything’s on the move now,” says Hunt. Such miniaturization includes the physical integration of connectors into soldiers’ uniforms, as well as the accompanying need for lighter equipment requiring lower power, but also has seen the use of increasingly smaller UAVs compared to their predecessors. “They’ve almost become a little bit more expendable,” says Hunt. “If you look at the way the UAV market has grown, it started with the Predator drone and Global Hawk.” Such drones were larger, costing tens of millions of dollars to produce, he adds, but in reality their functionality was not ideal for the masses because of their size and cost. “So now you’ve gone down to as far as UAVs the size of insects. You’ve got hummingbird shaped UAVs flying around, sending close to 1080p video back to control stations.” Such tiny UAVs are doing more than ever despite their size, but the environments in which they operate are no less extreme, explains Hunt. “One minor thing to take into consideration with UAVs is that they don’t have landing gear or ruggedized wheels that come down to ensure a soft landing. It’s a product that has to operate in a very rugged environment and it has to handle the shock and vibration that comes associated with that.”

With that in mind, ruggedization is another important consideration in the innovation of connectors for military UAVs. When Omnetics works with customers, it has to take an array of requirements into account, says Hunt, from size to power needs. “It’s about understanding the user’s requirements. Is size important to them? Is power? What are they trying to accomplish with their drone? Is it more of a quadcopter that’s just doing surveillance or is it

something that needs to be more invasive – as a number of drones are now capable of carrying ballistics these days.” Understanding exactly what purpose the UAVs will be used for and the conditions they will be subjected to helps decide what interconnect options should be proposed, says Hunt. “If it’s higher current, we’re going to offer up either connectors with wider pin count array in order to spread the current across a number of contacts or simply integrate larger contacts to keep the overall footprint at a minimum.”

At Omnetics, the development process focuses on engineer-to-engineer communications early in the design process, taking into account not only what the connector will be used for but also the environment that the connector will be subjected to. “Certain materials just aren’t going to perform well in certain environments,” he explains. “Look at the cables we use on a daily basis; certain cable jacketing materials won’t fare well in a high temperature environment, conversely, others won’t survive in a low temperature environment. We also have to look at the fact that the solution itself, maybe cycling between those two very extreme temperature bases. So it’s about trying to make sure that we find the right solution by putting it in front of a prospective designer who has experience designing around mission critical applications and environments – so we’re putting our best foot forward in terms of the solution we’re designing.”

One issue can be dealing with misconceptions when it comes to the relationship between size and ruggedization within connectors. Omnetics sees a common misunderstanding that the smaller things get, the less rugged they will be, says Hunt. “That’s not necessarily true. Because if we are looking at shock and vibrational elements, lower mass is going to handle shock and vibration elements better in their prospective footprints.” He cites Omnetics’ core milspec products, the Micro-D and Nano-D. “Although the Micro-D is bigger, the Nano-D handles shock and vibration better just because it is indeed smaller.” Changing such misconceptions is about communicating that ‘a smaller connector doesn’t necessarily make it less robust or less rugged’ and overall simply educating potential designers of the benefits associated within Nano-miniature interconnectivity, he adds. That means spending time and

energy providing potential users with physical samples and 3D models of products to allow them to see firsthand the size and capabilities of such connectors. "When it comes to the idea that something is smaller than a thumbtack or paperclip, customers truly need to see these connectors in their hands in order to understand the space savings that they get with these. So putting samples in front of a prospective user is one of the best ways we can market ourselves."

The potential for development in ruggedized interconnects for military UAVs may be vast, but the focus remains on reducing size and ensuring those connectors can withstand the environments where they are deployed. "In reality, the big thing that we continue to do is to shrink sizes down because there's traditional mil spec and contact types that have been used and proven by designers for decades, says Hunt. "Engineers are creatures of habit - if something works, it's going to take a lot from them to move away from it." The key lies in being able to take proven concepts of the past and integrate them into a more robust, smaller form factor suitable for today's interconnect challenges", he says, such as taking contacts from larger connectors such as a MIL-38999 or MIL-24308 connector type and integrating them into a Micro-D sized-shell which is half the size. "Now a user can run power and signal in a singular footprint, as opposed to using two different connectors, quite possibly from two different vendors. So it's really trying to shrink down the form factor all in the name of SwaP (size, weight and power) as well as shortening the overall supply chain time-line. That's a big thing that we continually try to do. We

try to push the limits in terms of the envelope of connectors. While our focus is traditionally within the Micro-D and Nano-D realm, we also make it easier for a customer looking to integrate larger connector types into smaller foot-print."

The possibilities may seem infinite, but the need for connectors that can enable a growing range of military UAVs, all with different purposes and requirements yet operating in the same extreme environments, can be a double-edged sword. While it may be possible to miniaturize, develop, add capabilities and ensure high quality, low power communications, the development of bespoke connectors for ruggedized UAVs needs to be balanced with a certain level of standardization when it comes to military specifications, argues Hunt. "Just as much as every connector company out there could create a new concept that might solve one person's problem, you also now create a possible supply chain issue because you've single sourced yourself into a very unique connector concept that only one supplier can support you on. So now you're going through COVID affected lead-times times and supply chain issues start arising, you can potentially cause yourself problems. So we try to balance that out with having customizable options for our customers when needed, all the while leveraging our COTS and standard designs direct as well as through distribution channels to ensure Omnetics Connectors stay as competitive as possible when it comes to connector availability." ■

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