OMNETICS
CONNECTOR CORPORATION

Optimizing Connector Designs for **Spaceborne Electronics**

Low-Earth orbit (LEO) satellite systems are providing the world significant new methods of surveying, communicating, and sharing information. With increased focus on LEO, a constant design evolution is occurring from deep space exploration to LEO-based constellations. Satellite systems are moving rapidly from single units or devices to fully interconnected electronic networks operating on centralized computers. In this interview, Travis Neumann, Special Project Manager at Omnetics Connector Corporation, discusses how connector designs are evolving to meet the needs of spaceborne electronics.

Tech Briefs: New satellites and space electronics now require interconnection design planning for each individual function and where they will be performing. What are some of the key environmental factors designers need to keep in mind while planning circuitry for satellite systems?

Travis Neumann: We already know that in satellite applications size and weight are a big deal. We want the electronics to be small and lightweight and the first thing to ask as a designer is what do I need? When you consider power and signals, there are really two ways to slice this. It's in terms of the current or voltage needs. Current will dictate the size of the conductors where voltage can affect spacing. Next question relates to how many of these connections do we need? Using the number of connections you need, what the voltage or current rating of those connections is, or signal in terms of speed, and work from there to determine what's going to be your best solution.

TRAVIS NEUMANN
SPECIAL PROJECT MANAGER

Tech Briefs: Satellites collect and transmit data to a main system as well as provide constant communication and information back down to Earth. Increased data volume often poses a challenge. How are new materials and circuit designs solving this problem?

Neumann: Increased data is definitely a challenge. The other thing that's been happening in the last couple of decades is data compression. They process as much as they can right at the sensor as there has been a push to do as much processing as you can locally. Increased data drives the movement toward higher data rates in terms of transmission. Low loss board materials are used for the high-speed digital data transmission we see today. Spacing of the circuits through use of digital electronics locates processing power near the sensor(s). Impedance controlled traces and wires, surface finishes and the materials used have all shifted to support our modern day data consumption needs.

Tech Briefs: As engineers design and build newer space devices they are cramming additional functions and applications into extremely tight spaces. How have connector and cable designs evolved to meet the needs of spaceborne electronics?

Neumann: Omnetics has been manufacturing small cables and connectors for quite some time and we see customers moving down in size. Where they might have used the traditional large military connectors, there is a transition into high reliability micro and nano types. Technology like what is used in servers such as blade mount or stackable connections promotes assembly for those looking to create large constellations. Additionally, there are users of wired investigating flex circuit solutions for their CubeSat for better management of the harness and connections between boards.

Tech Briefs: Besides size, space, and weight what are additional environmental effects to consider?

Neumann: A popular one is shielding. There is significant radiation in space, and the further out you go, the more aggressive it becomes. We get a lot of requests for back shells and plated braiding. As shielding is an "in addition" type of solution, weight starts to come into play. Thermal cycling is another consideration. Materials should be chosen with a wide enough operating range that they don't fatigue from repeated hot/cold cycles when orbiting the Earth. Outgassing is another consideration to prevent deposition of material onto optics and controls.

Tech Briefs: As the LEO-based space economy progresses, what's the outlook for nano-connectors in space-grade electronics?

Neumann: I think we're on the front end of significant growth. In 2015, there were 9,000 to 10,000 satellites in orbit. Today numerous companies are sending up hundreds or even thousands of satellites to create constellations to deliver images, high-speed data, GPS, and more to the world. There are many connections from board to board and board to component for power signal, flight controls, communications, and far more uses than I can think of that have need for small, ruggedized connectors.

Watch the full interview with Travis Neumann.