Meet Jim - Not Your Average Joe
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New Dawn for US Manufacturers
Wire Wisdom - Cable Jacket Types 101
Partnering with Customers: Myth or Reality?
Strategies to Strengthen Subassembly Sourcing
25 Years of Quality Lacing Tapes and Yarns at Breyden Products
Augmented Reality Manufacturing - Delta Sigma's Harness Works

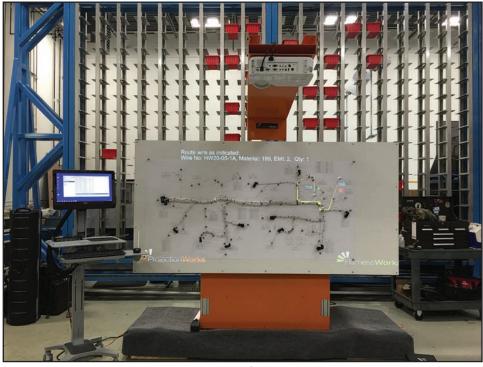


21st Century Wire Harness Assembly - Delta Sigma Rolls Out Pilot Program

rith few exceptions, wire harness assemblies have been built using the same methods ever since people have been building wire harnesses. That is about to change. Delta Sigma Company (DSC), working on a USAF grant with several aircraft manufacturers, has just released the next generation of their Augmented Reality (AR) system called Harness-Works[™], this time specifically for building wire harnesses. DSC's CEO Roger Richardson, noted "After seeing enormous savings using Assembly Works[™] on the F-35 for mechanical assemblies where returns of 4,000% on the initial investment were being generated, the Air Force asked DSC if a similar concept would work for electrical assemblies.We looked into the requirements that such a system would have, found some OEM

partners that could define system requirements, and determined that it was not only feasible, but our early indications were that the cost benefits would likely be similar to the benefits seen for mechanical assembly."

With that, the project was under way. "The data used to build wire harnesses is significantly different today, in most cases, than the data available for mechanical assemblies. Design technology moved faster and has been much more broadly accepted in the mechanical world than the electrical world. The aviation industry is moving fast to catch up, but there are other industries where the only fundamental difference between the documentation methods used by the Egyptians in 3,500 BC to build a fleet of boats and the methods used today is that it is written on paper



HarnessWorks Projector and Board

instead of papyrus. When we first started developing AR work instructions in 2005, technologically speaking, documentation for assembly instructions had not advanced much in 5,500 years" commented Dr. Brett Haisty, Chief Technology Officer at DSC.

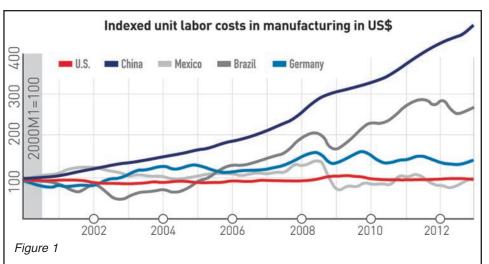
The folks at DSC thought that it was time to change that. Virtual Reality (VR) is a computer generated world sometimes containing virtual beings called avatars that move around in an environment that is completely created by a computer. Augmented Reality is the application of VR onto physical reality. That is, physical reality is *augmented* by virtual reality so that the user sees at the same time things that are real (physically present) and things that are virtual (computer generated). Properly used, AR opens up a world of opportunity never before available to explain things, especially things that are long, tedious, and somewhat complex – yet require absolute perfection in production. Aircraft wire harnesses would be a good example.

"The first issue is scale. It is essential that we display the data in exactly oneto-one scale, so that the virtual part will match the physical part. The process of scaling the data through the optics is called calibration. Once the scaling problem is solved, the next challenge is to place that perfectly scaled virtual object onto a physical object so that they are perfectly aligned – a process

Continued on page 19

New Dawn for Manufacturing Careers in America

(Wiring Harness News recently attended IMTS 2016 in Chicago where Harry Moser of Reshoring Initiative[®] gave an update on reshoring efforts in America. Mr. Moser was a past speaker at the WHMA Annual Conference. His organiing the availability of a new infographic, "New Dawn for Manufacturing Careers in America", to support the goals of Manufacturing Day 2016. Manufacturing Day, Oct. 7, 2016, "is a celebration of modern manufacturing meant to inspire



zation has released a new infographic on reshorenow.org. Following is his summary and a breakdown of some of the key components.)

A Reshoring Initiative Infographic Supports Manufacturing Day 2016

Chicago, Illinois, September 23, 2016 - The Reshoring Initiative[®] is announcthe next generation of manufacturers,", said Harry Moser, founder/president of the Reshoring Initiative. He went on to say, "A strong skilled workforce is key to reshoring and manufacturing growth, and development of a skilled workforce begins with motivating a higher quantity and quality of recruits." Moser asserted that by demonstrating that the trend is now away from offshoring and

towards reshoring, we make the case that manufacturing is once again a great choice for career stability and growth. The Infographic mirrors the Reshoring Initiative's Workforce Development programs, which are designed to motivate recruitment.

By balancing the \$800 billion per year manufactured goods trade deficit, the U.S. will add 5 million manufacturing jobs, an increase of 40%. Workforce development is key to the required capacity and competitiveness as explained by Mr. Moser in his recent IMTS press briefing.

Shrinking Wage Gap

The wage gap *(shown in Figure 1)* with China is rapidly shrinking. In fact, the labor cost savings that drove many companies to offshore have narrowed, causing many to reevaluate the total cost of offshore manufacturing.

<u>Continued on page 35</u>

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Read about the latest products on the market and points of interest about companies and people in the industry.



Look into the thinking of OEM's as they select subassembly suppliers.



Panduit, Schleuniger, Cirris, GEM Gravure, Telsonic, and Delta Sigma host an information/exhibition event.

> Wire Wisdom **Cable Jacket** Types 101

This Wire Wisdom explores some of the different cable jacket types and provides an overview on the jackets' mechanical and chemical properties.

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Inside look at this solid producer of mil-spec lacing tapes, twines and cords.

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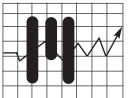


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Meet Jim - not your average 'Joe'

By Paul Hogendoorn

met Jim last year when I visited the plant he works at, near Ottawa. He's a down to earth guy, about my age, (getting up there!), and has a knack for figuring things out and getting things done. He's been doing it for 38 years.

At first glance, he's the kind of guy you wish you had in your plant, or perhaps think you already have, but as you read on, you'll see his story is much more than that. Jim is now intentional and committed to the continuous improvement process, but he wasn't always that way. He started his first job at 9 years old - delivering papers - and he has worked every year of his life since. He heeded his mother's advice that "it's work and work ethic you need to worry about", and for many years that was enough. In his youth and early years, he spent all of his weekends and summers working, and was never out of a job. From washing dishes, cooking food, stocking shelves, renting cars, and doing oil changes, to steadier and higher paying factory jobs, he progressed to the point of operating the big machines.

About 6 years ago, 15 years into his job running the big machines, he reached the top of his pay scale as a "lead hand". There was not much left to learn and nowhere else to go. After much reflection, and with encouragement and support from his wife, he decided to pursue other positions at the



Paul Hogendoorn

company, but it soon became apparent that his computer skills were inadequate. Excel and Power Point were a mystery to him, and Word was equally daunting. Younger people with more computer skills, but not near as much manufacturing skill, had the clear advantage.

At the time, his daughter was attending a local school that had courses for adult alternative and continuing education, where she was finishing her grade 12. He decided to check with them, and to his surprise, found they had courses running that suited his needs. On his days off, and on his own volition, he enrolled. (It was his "personal continuous improvement" initiative.)

Continued on page 7

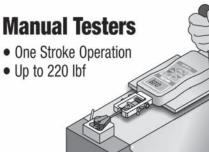
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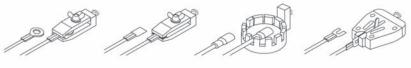
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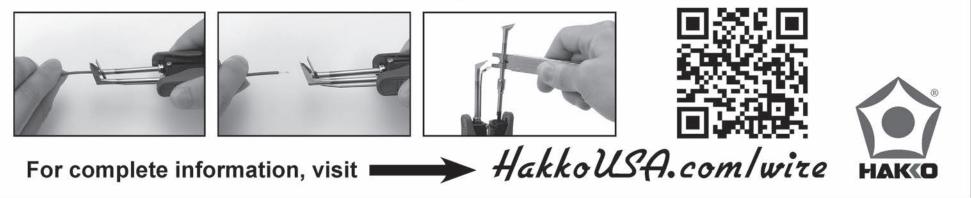
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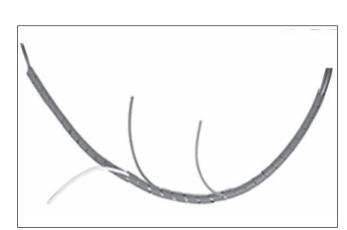
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Meet Jim - not your average 'Joe'

Continued from page 5

He was nervous and intimidated at first, but he soon felt comfortable. There were about a dozen people in the class, including high school students, new immigrants, and other people his age there for a reason similar to his - to face their fear of computers and all things IT. After that initial course, he felt confident enough in his abilities to take a position within the company's CI (Continuous Improvement) department. He worked in a process technician role for 2 years, and then in 2012, moved into a management role.

That by itself would be a great 'Continuous Improvement' story, but this story doesn't end there.

As a manager, he took a keen interest in the development of others, especially people around his age or a bit older - people that had been there for 2 or 3 decades; people with great working skill and experience, but little or no exposure to new technology. Some did not have cell phones or computers or experience with email and messaging systems. In my mind, this is perhaps the biggest single lost continuous improvement opportunity in many manufacturing companies today. The tactile experience that our seasoned people have is overlooked and not taken advantage of because they lack basic computer skills skills that are quite easily taught.Whatever risks there are to training them are quickly mitigated by the fact that most of these people have already demonstrated their loyalty and dependability - things that can't be taught or calculated. (Someone that has been with you for 20 years, and still has 10 or 20 in the tank, is a far safer bet to stay with the company than someone hired fresh.) Jim had an individual on his team that needed to be moved to an office position to accommodate a health condition. The person was basically computer illiterate, but the new role was 80% computer related. Remembering his own experience, Jim recommended that this person be sent to a program similar to the one he attended. The company agreed. A couple weeks later, the individual returned to work like a new man, competent and confident that he could find answers to any computer related issues that might

crop up for him. More than new computer skills, he gained a confidence that transformed his attitude from fear of failure to one where new challenges were welcomed and learning opportunities embraced. He now routinely creates complex excel spread sheets, edits documents in the company's document control system, and effortlessly communicates with coworkers electronically.

The change was so dramatic that it wasn't long before other managers and coworkers started to notice. Some wanted to know where to send their people, while others wanted to go for the training themselves. Other departments began to send people, and the story repeated; every person that received the training became a more valuable employee of the company. Jim made sure that all employees in his department went through the same program he did.

Every plant I visit has a lot of people with a tremendous wealth of experience and potential, ready to be tapped into. All they need is the chance to learn a few new skills. And all it may take to get started is one person like Jim to make it his mission in your plant. Jim may be your average guy, but he's no ordinary Joe.

Paul Hogendoorn is co-founder of FreePoint Technologies. "Measure. Analyze. Share." (Don't forget to share!) For more information on this topic, he can be reached at paulh@getfreepoint.com



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Partnering with Customers: Myth or Reality?

By Loren Smith

The concept of a "partnering" relationship with a customer has been around for a while, and it is often met by harness makers with skepticism. "Partnering" can come across as just another corporate platitude designed to achieve price reductions from suppliers. Given the long life of the phrase "three quotes and a cloud of dust"--referring to the use of competitive leverage to squeeze the last penny out of every quote--it is not hard to understand this wary attitude.

I, too, used to be a skeptic. But then I had the eye-opening experience of interacting with a construction equipment company who, after embarking on a global best purchasing practices study, had decided to go down the road of truly partnering with his suppliers. Because this customer had previously directed teams of engineers to extract fractions of a penny from supplier revenue, his turnaround was remarkable.

Here's how the company partnered: First they sought buy-in from the highest levels of a select number of suppliers so they could describe their concept in the finest detail. They did this by explaining that they had adopted their new



Loren M. Smith, CEO **Blue Valley Capital**

approach because they were convinced it would yield them the highest quality and best service at the lowest priceand that their adversarial approach had not consistently yielded those desirable outcomes. They said that, instead, the former relationships had yielded questionable quality and service, and that while purchase prices may have appeared optimal, when they measured component cost, they often discovered costs were excessive.

Continued on page 10



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Partnering with Customers: Myth or Reality?

Continued from page 8

Their dialogue initially focused on gross margin, which is often misunderstood. It is, according to a generally accepted accounting principle (GAP), the dollars the supplier has left after covering material, labor and factory overhead.

Once the hurdle of identifying a product's gross margin is surmounted, the harness user and harness manufacturer engage in a collaborative, intensive exercise focusing on the cost drivers. How can they work together to minimize the "cost of goods sold": material, labor and overhead? If this can be accomplished without attacking the gross margin percent, the exercise allows for the harness maker to realize true cost optimization--a result that should vield a lower cost base without affecting the supplier's bottom line

Okay, so you're thinking this all sounds good, but it also sounds like something out of a textbook as opposed to real life. But I can tell you I had the experience of this actually

working-with amazing results. The world-class construction equipment company concluded that it did not need a half-dozen wire harness suppliers; it needed only one. We were exceptionally fortunate to be chosen as that supplier, and we went on to be selected as the company's first "vendor of the year."

That designation, however, did not mean we could then coast. We were expected to play an active role in the early design process for new products, as well as in finding ongoing cost reductions for existing products. To meet expectations, we had to have people who were thoroughly dedicated to this new way of doing business.

But on the plus side we weren't worried we'd encounter a flurry of quoting every year that could put our volume of business with this customer in jeopardy. Our partnership with the company stood the test of time, and it is still in place.

Loren Smith can be reached at lms@blvcapital.com or www.bluevallevcapital.com

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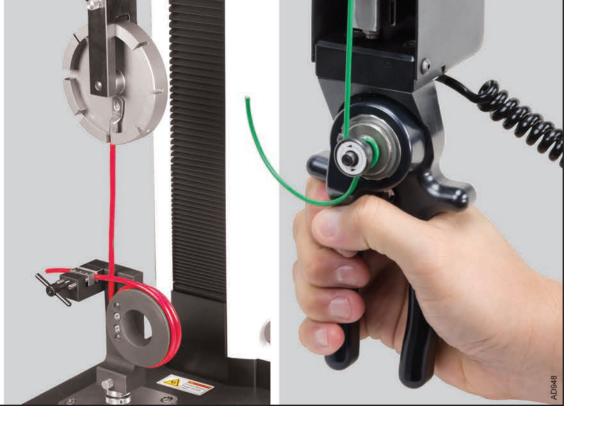
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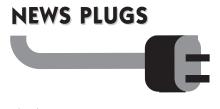
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Cicoil, the leading manufacturer of Flexible Flat Cables and Assemblies, is pleased to announce its New EZ-Flexx[™] Flat Cable Configurator. Located at www.cicoil. com/flatcable/configurator, an entire section of the website is dedicated to this Free Web-Based Tool, which allows a user to easily design a cable in minutes and possibly seconds.

And the new EZ-Flexx[™] cable design makes Cicoil flat cables easy to separate and strip, just like any round cable, and also makes the flat cable more light and flexible. With a few simple mouse clicks or touch of a screen, Flat Cables can be con-

structed of many elements, including power conductors, shielded signal pairs, video & coax wires and tubing for liquid and air. To make the process even quicker, Cicoil has added Specialty Modules (Camera Link®, Cat 6A, FireWire, USB 3.0) to the Configurator. Any of these elements can be combined in any position within the flat cable profile, which means that over 1 million flat cable designs are available for immediate production and quick delivery. In addition, users can move around, add and remove any elements in their flat cable, in any variation up to 3.75 inches wide.

Once the flat cable is designed, users receive a price quotation, custom part number and an engineering drawing delivered to their e-mail inbox within seconds. Once the cable is ordered, Cicoil guarantees a 1-2 week delivery on any cable designed using the Cable Configurator.

If you are new to the website or the world of Cicoil Flat Cables, they have

components as well as electromechanical assemblies. Olson was most recently the Sales and Marketing Director of TLC Electronics, Inc. Prior to TLC he was a Regional Manager for Winland Electronics, an account manager for manufacturer rep firm Murnco, and direct sales for Lambda.

Reptronics' President Dana Fredrickson stated, "Steven's sales and marketing experience in direct OEM sales, distribution sales and support, and manufacturing will make him a great asset to the Reptronics team. I am confident that his skills will greatly contribute to providing an exceptional customer experience while increasing new growth opportunities for the manufacturers we represent."

Olson may be reached at 763-360-3746 or steve@reptronicsllc. com.



Steven L. Olson, Vice President of Sales

Reptronics manufacturer representative of electromechanical components, interconnects, electromagnetic components, passive components and sensors.





put together a Quick Tutorial on the website to walk you through the process and help you to become a Flat Cable Designer in just a few minutes.

Reptronics Announces Steven L. Olson as VP of Sales

Reptronics is pleased to announce that effective September 6, 2016, Steven L. Olson joined the Reptronics team as Vice President of Sales.

Olson has over thirty years of experience in sales and marketing of electromechanical and passive

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NEWS PLUGS continued



Digicom Electronics Incorporates Nitrogen in Soldering and Reflow Processes to Maximize Device Reliability

Digicom Electronics, Inc., a technology and quality-driven electronics manufacturing services company, now generates its own nitrogen to use in its solder reflow, selective soldering, and hand soldering manufacturing processes to strengthen the bonds and improve solder adhesion. Adding nitrogen minimizes device failure and ensures printed circuit board integrity, especially for mission critical products for the medical, military and aerospace, industrial, and RF wireless industries. The addition of nitrogen is part of Digicom's Diamond Track Manufacturing Processes.

"Manufacturers must seek every way possible to eliminate failures of the devices they manufacture," said Mo Ohady, general manager, Digicom Electronics. "Many major

failures result from a weakness in the solder joint that connects the wire bond to the PCB or the solder connecting the device or package to the board. Processes that seem to benefit the most are the ones that have a narrower pitch, so the narrower the pitch, the more that nitrogen use is recommended. Studies show a 50-60% reduction in defect level when using nitrogen in the reflow process. Digicom seeks to employ technologies that produce products of the highest quality. Towards that end, we have implemented nitrogen in our manufacturing process." The nitrogen is generated and piped directly to machine inputs and work areas at a prescribed volume and pressure to achieve optimized saturation of the inert gas and to eliminate oxidation at critical moments of the soldering operation.

Digicom's white paper, **Can Nitrogen Reduce Failures in Medical Devices**, explores the use of nitrogen in the manufacturing process and ways to minimize device failure.

A copy is available for download on the Digicom.org website at www.digicom.org



Adding nitrogen minimizes device failure and ensures printed circuit board integrity

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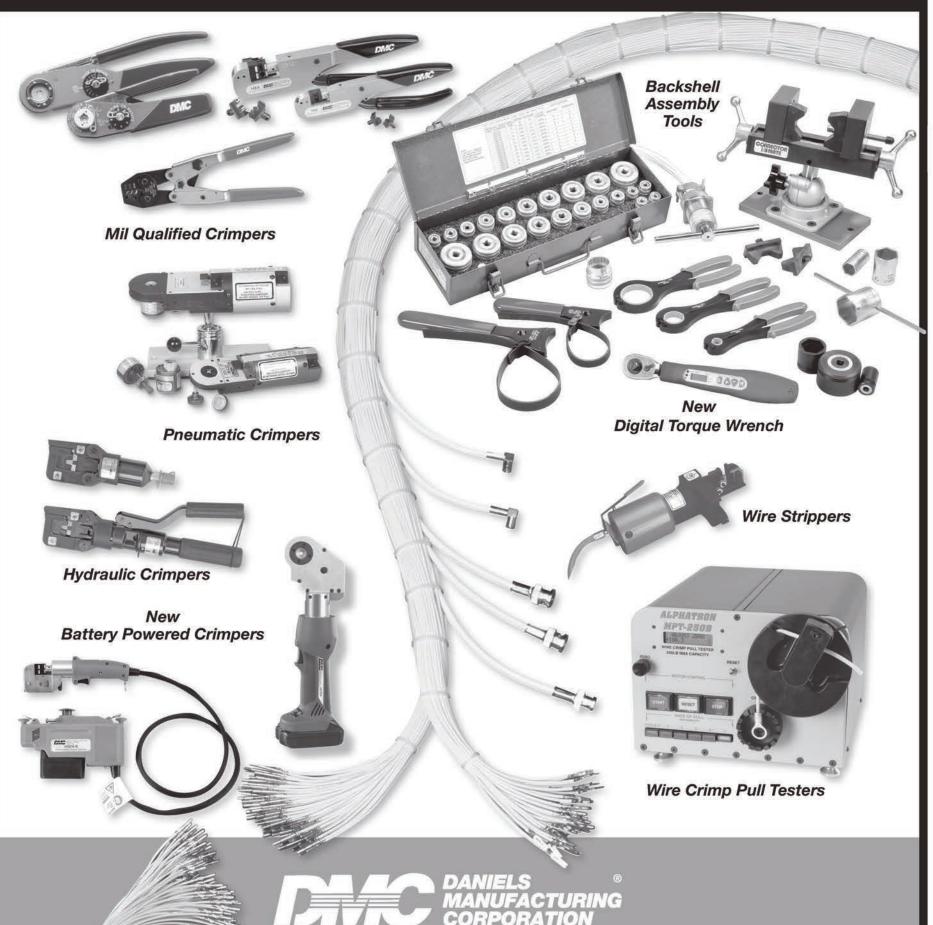
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UL 94 V-0 Rated Potting & **Encapsulating Compounds**

Today's electronic assemblies must perform in some of the harshest environments. Many highvalue designs require the use of an Underwriters Laboratory (UL) Listed Potting and Encapsulating Compound. Engineers can now select from several different products that have passed the difficult self-extinguishing UL test.

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NEWS PLUGS continued tive and thermal shock resistant urethane.

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• 50-3152 FR - Thermally conductive epoxy with an easy to use 1:1 mix ratio and CTI rating of >600 volts.

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More information about the UL Listed Products is available the web site at epoxies.com.

Technical Support can be reached by phone 401-946-5564 or sales@epoxies. com Samples are available.

Zuken and Aras Partner to Deliver Ideal EDM/PLM Environment

New approach improves crossdiscipline product development processes and data integrity from design to manufacturing Zuken®, and Aras[®], a leader in enterprise Product Lifecycle Management (PLM) software, have entered into a partnership to develop a new approach for managing cross-discipline product development processes that include electrical and electronic design data from design creation to manufacturing. The new solution will span enterprise processes across the lifecycle, as well as detailed electrical design and manufacturing.

The partnership will deliver functionality that couples a domain-specific work-in-process (WIP) library and design data management system, with the enterprise PLM plat-

form. The result will replace traditional "zip-up-thedirectory" functionality with significant new capabilities that include where-used traceability for IP blocks and components, merging of design and manufacturing processes, and enhanced ECO processes.

"Zuken and Aras see a future where the electronic and mechanical design processes are coordinated more effectively to enable true systems engineering," said Peter Schroer, CEO of Aras. "We believe that by working together we can provide a more holistic approach to support the business of engineering."

Zuken will provide DS-2[™], an engineering data management (EDM) solution for managing work-inprocess library and design data for circuit/board development. DS-2 is a domain-specific solution for managing native design data across multiple sites in a project-oriented fashion.

"Manufacturers are using digital solutions in increasingly sophisticated ways to dramatically boost productivity," said Kazuhiro Kariya, Managing Director and Chief Technology Officer at Zuken, Inc. "We are partnering with Aras to enable new processes for multi-disciplinary collaboration across the enterprise." Aras will provide Aras Innovator, an enterpriselevel PLM platform and suite, for the complex systems engineering processes in product development, manufacturing, quality and the supply chain. The combination will provide engineers across the organization with improved data integrity and more efficient processes from design

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3M[™] Cable Assemblies for SFP+ Applications

Note:assemblies are available with red/blue and black jackets

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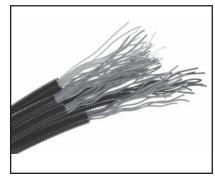
The new solution is planned to be available early in the 2017 calendar year.

For further information see www.zuken.com/ds-2 and www. aras.com.

Teknor Color Concentrates For Halogen-Free Applications Receive UL Certification of Compliance

PAWTUCKET, RI, U.S.A., October 3, 2016: A series of color concentrates for wire and cable and other electronics applications required to be halogen-free (HF) has been certified by UL as conforming to its standard for HF materials, it was announced today by the Color Division of Teknor Apex Company.

The UL certification applies to 14 concentrates supplied by Teknor



Teknor Color Concentrates for Wire and Cable

Color in pellet form, using ethylenevinyl acetate (EVA) and polyethylene (PE) polymers as carrier resins. These new concentrates can be used with the EVA or polyolefin-based halogen-free flame retardant (HFFR) compounds currently available.

"Compliance with HF requirements has become increasingly important in North America, particularly for electronics, cables, and cords used in confined spaces in office, building and construction, automotive, public transit, marine, and military installations," said Edwin Tam, manager of marketing and business development. "The HF requirements for these applications include the concentrates used to color the HFFR compounds. We worked closely with our wire and cable customers to develop the new concentrates specifically for this market."

EIS, Inc., Acquires Communications Products and Services

EIS, Inc., a wholly-owned subsidiary of Genuine Parts Company (NYSE: GPC), has acquired Communications Products and Services (CPS), headquartered in Englewood, Colorado on October 3, 2016. CPS is a leading distributor of outside plant product solutions for both aerial and underground broadband cable and wireless network infrastructure. CPS primarily services the western USA from their single location in Englewood, Colorado.

Bob Thomas, Chief Executive Officer of EIS, said, "We are very pleased to bring Communications Products and Services into our Genuine Cable Group and the EIS family. CPS is one of the most successful distributors in the markets they serve and their team has built a great regional business since their founding in 1986. This acquisition will strengthen our business in the west and is a very important business building opportunity for the Genuine Cable Group and EIS".

Fred Briggs, CEO of CPS, commented, "I strongly believe that this is an excellent opportunity for both organizations. CPS brings more than 30 years of product and application knowledge and an established position in the markets we serve. CPS will complement the Genuine Cable Group / EIS reputation for customer service and geographic reach and Genuine Cable Group / EIS will enhance the ability of CPS to service our national accounts as well as expand our product offering and service capabilities. I believe this is a win for our companies and our customers".

EIS is a wholly-owned subsidiary of GPC and a leading distributor of process materials, production supplies, specialty wire and cable, and value added fabricated parts supplying the electrical OEM, apparatus repair and various assembly markets with over 100,000 critical products from 39 branches and 7 fabrication facilities located in North America.

For more information on EIS, please visit www.eis-inc.com.





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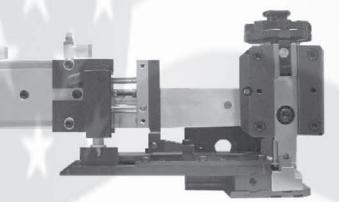




Model 1700

Model 2000

Pneumatic feed mini-style applicators can accommodate terminals with center to center distances up to 2 inches.



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Visit our web site: www.applitek-usa.com

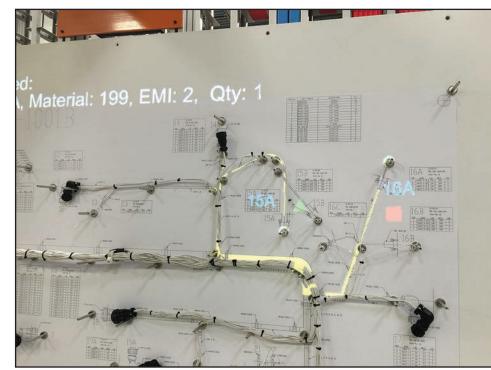
Applitek Technologies Corporation, 174 Georgia Avenue, Providence, RI 02905 Tel: 401-467-0007 Fax: 401-467-5525

21st Century Wire Harness Assembly Continued from page 1

called registration. We figured out how to do both of these processes concurrently in 3D and it is very fast and accurate. Migrating that concept from 3D to 2D for wire harnesses was more challenging that we had expected. But, that has been completed for well over a year and our attention has been focused on developing easy-to-use methods of

importing data that people already have and converting it into something that can be displayed in an AR format" says Dr. Haisty.

Continued on page 21



System execution of HarnessWorks.

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- KOMAX Alpha 411 Automatic Crimping Machines
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 PANDUIT CP-861 Crimp Press
 SCHLEUNIGER CC36S Automatic Crimping Machine - SCHLEUNIGER CC1000 Coilers 1 - SCHLEUNIGER CP1500 Heavy Duty Coiler - SCHLEUNIGER CS5300 Coax Stripper SCHLEUNIGER CS9100 Cut/Strip Machine w/PF2000 Prefeed
 SCHLEUNIGER CT32 Crimp Press, 2008
 SCHLEUNIGER EC9300 EcoStrip Cut/Strip - SCHLEUNIGER ES9320 EcoStrip Cut/Strip, 2006 - SCHLEUNIGER JS8300 Jacket Strippers 1 - SCHLEUNIGER MP257 Stripper - SCHLEUNIGER PS9500 Power Stripper 1 - SCHLEUNIGER PT26 Pull Tester, 2008 - SCHLEUNIGER US2100 Bench Strippers 4 - SCHLEUNIGER WS1000 Wire Stackers 2 - SCHLEUNIGER Uni-A Applicators - SM CONTACT Splice Machine, SM CRIMP 2000 1 - SPECTRUM 'Sienna 210S' Radial & Axis Laser Wire Stripper (modified to Model 210D) T&B Electric Hydraulic Pump, Model 13810
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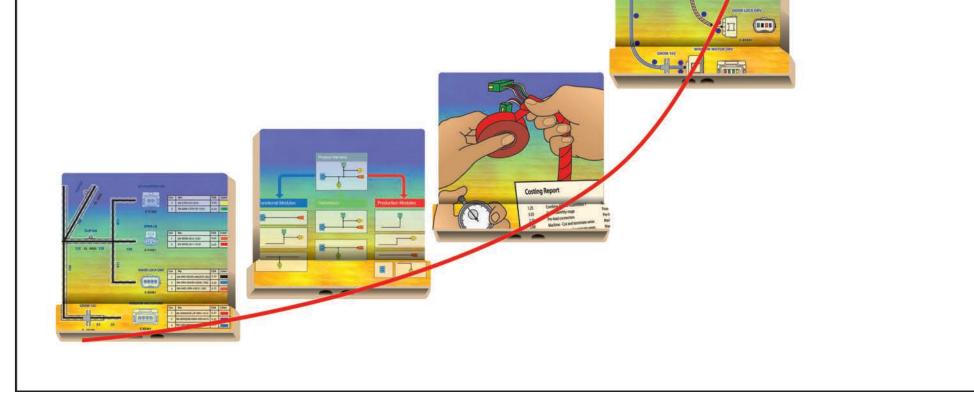
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21st Century Wire Harness Assembly Continued from page 19 _____

High Mix, Low Volume – Fast Reconfigurable Wire Board

But, long and tedious are not the only applications that can benefit from AR. One of the ideas that came up in the earliest concept was the notion of a quickly reconfigurable board. For companies that build just one or a few units of a large number of different harnesses, the reconfigurable board concept can

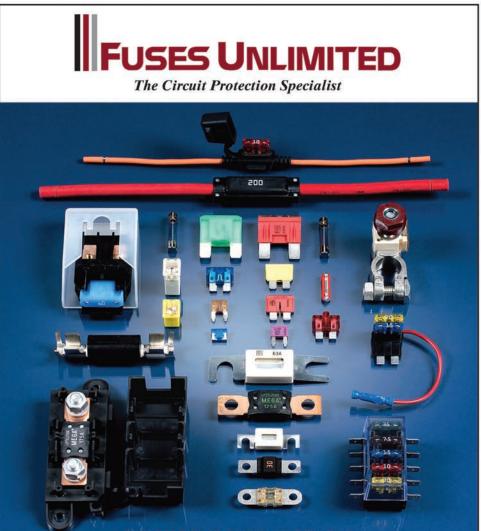
streamline the build process, even for fairly simple harnesses. This was a benefit that was not originally anticipated by

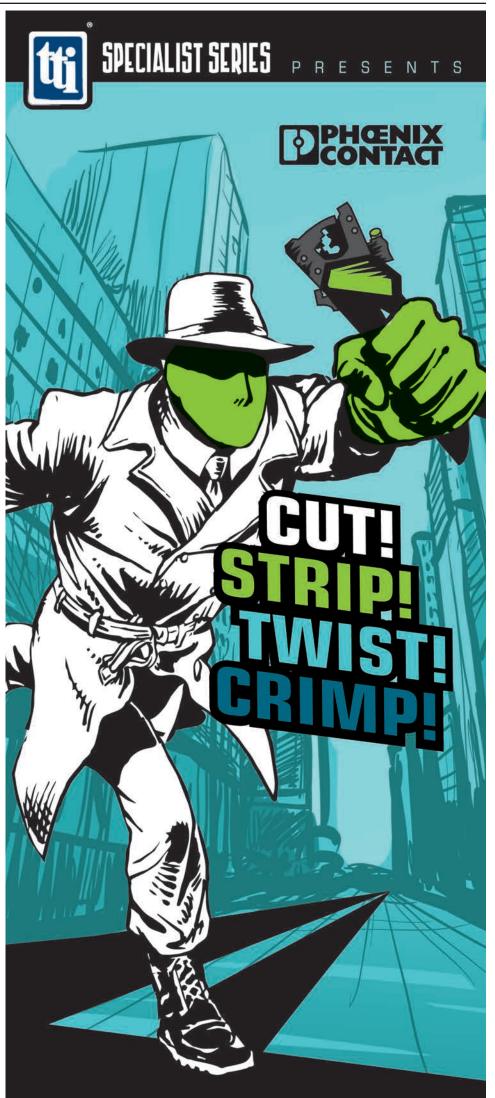
fit that was not originally anticipated by the development team, as they we focused on process optimization of harnesses ranging from 20 to 200 hours of assembly time.

Continued on page 23



Multiple system usage.





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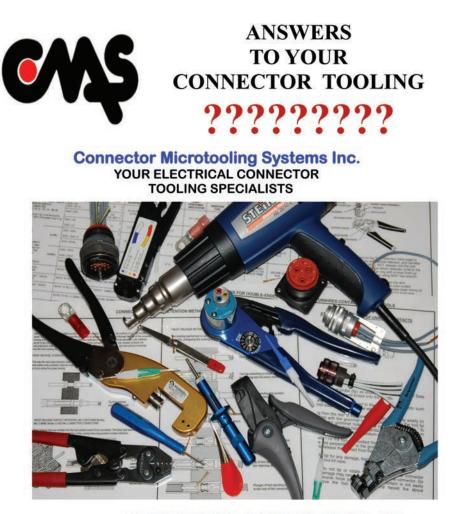
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21st Century Wire Harness Assembly Continued from page 21

One of the development partners had over 4,000 harness boards in storage for aircraft that were no longer in production – all of which must be maintained as long as there is still at least one aircraft of that type flying. The prospect of being able to digitize all those harnesses and replace 4,000 boards with one single board that can be configured to make the needed harness in a couple minutes was extremely appealing.

Later as non-aerospace partners joined the group, DSC quickly realized that even harnesses that take less than one hour to build can benefit from the technology - but for them the bigger benefit is the reconfigurable board. Working on the same board all day and not having to file away a completed board and retrieve the next board can be a real time saver, as well as space saver. In mid-2016 DSC and Panduit teamed up to integrate the Panduit Quick-Build system with HarnessWorks. Panduit made some modifications to some of the Quick-Build components to facilitate the AR instructions, and DSC created a library of Panduit components for fast board layout. The combination makes for a fast system setup that is highly repeatable.

Data Sources

In 2015, DSC partnered with Mentor Graphics using their Capital software to project harness assembly instructions. Work instruction files created in Capital can be executed by *HarnessWorks* directly, with only a mouse click or two required to generate the entire work sequence. In July 2016, DSC partnered with EPLAN to present their harness assembly instructions in *HarnessWorks*. That integration is scheduled to be available in 2017 and will even allow legacy documentation that was hand drawn onto a board to be digitized quickly, accurately and easily. Once the information is digitized, the world of Augmented Reality opportunities opens up.

Traditional 2D CAD drawings can also be used along with wire lists in a spreadsheet or csv format to create sequenced work instructions. This process can be somewhat automated with the templating feature in the authoring software package called *ManuScript*[™]. This feature allows the manufacturing engineer to create a template by writing a script that defines how to use the selected data and how to sequence the work and display the data. Once legacy data is in a sequenceable format the template can create assembly instructions in a few seconds.

Harness Testing

HarnessWorks can integrate harness testing in with the build as well. An integration with DIT-MCO is complete, and an interface with Cirris is underway, which will be complete in 2017. *Har*-



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nessWorks provides instructions where the user can see not only exactly what to do, but exactly when and where to do it. Test data, particularly a failure can be immediately shown, including the wire route of the problem.

Time Saved, Errors Reduced

There is no data yet for how much time can be saved and how much error can be reduced specifically for wire harnesses, but a controlled experiment was conducted by DSC over about 6 months in 2016. The experiment was simply to compare how long it took to build a small assembly and how many errors were made when the same object was built using traditional methods (drawing and words) verses using AR instructions. With 110 participants the results of the experiment are:

- Labor is **0.29x** using AR or **71% less** than using traditional methods
- Standard Deviation of build time is
 0.28x or 72% tighter than traditional methods
- Errors were a mind boggling 0.07x
 yes, a 93% reduction from traditional methods

"The numbers above can be a bit hard to accept - a person is working over 3 times faster and making well less than 1/10th the errors. But it is true, and the data from this controlled experiment correlates well with actual use on production lines. Not only are technicians faster and make far fewer errors, they are not working as hard, and are less fatigued at the end of a day. Augmented Reality accesses a part of the brain that it not available via traditional documentation methods. Direct access to the visual cortex is what makes these astounding results possible. There is good reason to expect that we will see similar results with harness building" reports Richardson. A white paper on the experiment can be found at www.projectionworks.com/downloads.

Pilot Program

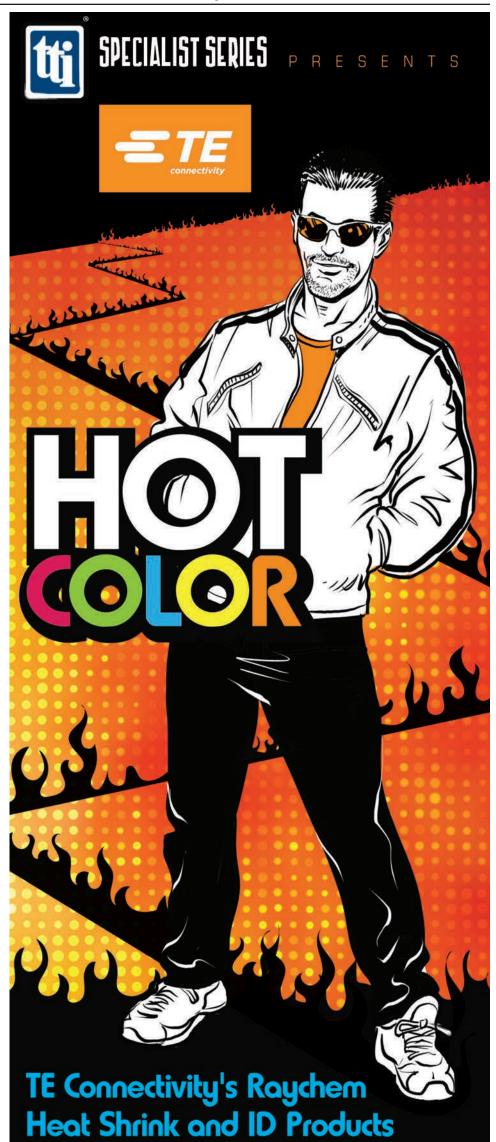
"The Air Force has a rigorous set of rules for a development program like this. We had weekly teleconferences to discuss progress and exchange ideas to keep the direction of the development on track. Things like data input formats, what the users sees, and how the user interacts with the system were discussed regularly to ensure that all stakeholders needs were being met all along the way" noted Haisty.

As the last step before the general rollout of HarnessWorks, DSC has created a beta test program where qualified candidates can participate in the last stage of development. Partner companies can submit the candidate pilot project to DSC for review. DSC will evaluate the projects and select a few that provide a variety of installation scenarios. The selected Partners would purchase the appropriate HarnessWorks hardware/software package for their pilot project. DSC will provide, at no cost, up to 100 hours of engineering support to aid in the integration of the pilot system with the partner's existing infrastructure. DSC will provide an additional year of warranty support for the pilot system.

"We believe HarnessWorks is ready to go to work in a production environment, but, as with any new product launch, there may be bumps in the road on the first systems. We are looking for partners that are willing to work with us to smooth out those bumps, and save some money doing it. Ideal candidates are companies that already intend to buy HarnessWorks systems, but want to start early and evaluate the system, calculate the ROI, and perhaps provide feedback into product improvement. Once the pilot program has been successfully completed, we will release the system for general sale." reports Cappai.

If you are interested in becoming a partner in the *HarnessWorks* pilot program, please contact Craig Cappai at craig@deltasigmacompany.com.





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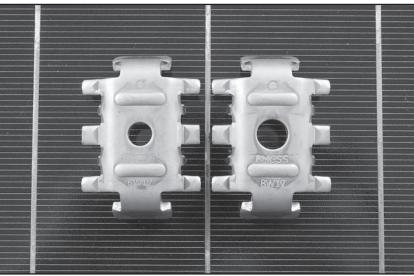
NEWS PLUGS continued



BURNDY® Announces the Release of the BMCSS line of **Integrated Bonding Clamps**

BURNDY[®], a leading manufacturer and provider of bonding and grounding solutions to the Solar PV industry, announces the addition of the new BMCSS integrated bonding clamps to their WILEY line of products.

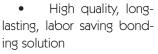
The BMCSS integrated bonding mid-clamps are made of corrosion resistant 304 stainless steel, which makes them a durable, long lasting and reliable solution for all environ-



BMCSS integrated bonding clamps

designed to pierce the anodized coating of the module frame. The result is excellent conductivity bonding the PV modules together. Essengular piece of metal, creating a clear electrical path to the ground.

Innovative design that ٠ allows for quick and easy installations



Corrosion resistant 304 stainless steel provides outstanding durability and performance in all environ-

Down-turned ٠ points pierce the anodized coating and make electrical

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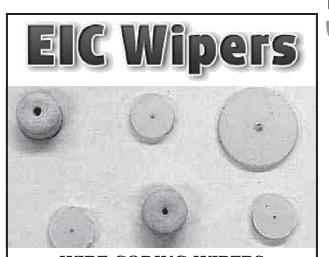
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NEWS PLUGS continued



Siemon Interconnect Solutions Exhibiting at SC16

Siemon Interconnect Solutions, a business unit of Siemon that provides custom network infrastructure solutions to OEMs, value-added resellers and system integrators, is pleased to announce participation in Super Computing 2016 in Salt Lake City, Utah.

SC16 is the world's largest marketplace for high performance computing professionals. Super Computing attracts scientists and engineers, software developers, policy makers, corporate managers, CIOs, and IT administrators from universities, industry, and government agencies. SIS will be showcasing their V-Built™ Solutions including preconfigured Top of Rack, Aggregation Rack and Cable Tray Rack solutions. Also on display in exhibit booth #3462, will be the newly launched 100G QSFP28 and 25G SFP28 as well as a large display of copper and fiber interconnects, intelligent PDU's and cable management solutions.

"We are excited to launch the V-Built[™] series of preconfigured solutions at SC16", says SIS Sales and Marketing Manager, Robert Lockwood. "V-Built[™] addresses the needs of today's mega-scale data centers that require custom preconfigured solutions to maximize efficiencies and increase throughput. For example, one part number from the V-Built[™] series specifies a server rack completely integrated with PDUs, cabling, cable management, airflow management and any other complimentary product our customer needs for their rack buildouts".

SIS is a proven supplier in rapid deployed system builds offering: quality, service, innovation and value as well as in-stock availability of most common products needed for today's mega scale data centers. As an industry leader, SIS also supports OCP: End Users, OEM's, VAR's and SI's of all sizes with the most comprehensive offering of data center infrastructure products available.

Siemon Interconnect Solutions (SIS) is a business unit of Siemon comprised of a team of dedicated technical sales professionals supported by Siemon Labs, mechanical, electrical and signal integrity engineers, committed to solving industry and customer driven interconnect challenges. SIS provides custom network infrastructure solutions to OEMs, value-added resellers and system integrators. Established in

1903, Siemon is an industry leader specializing in the design and manufacture of high quality, high performance low voltage infrastructure solutions and services for Data Centers, Enterprise and Intelligent Buildings. Headquartered in Connecticut, USA, with global sales, technical and logistics expertise spanning 100 countries, Siemon offers the most comprehensive suite of copper and optical fiber cabling systems, cabinets, racks, cable management, data center power and cooling systems and Intelligent Infrastructure Management solutions. With more than 400 patents specific to structured cabling, Siemon Labs invests heavily in R&D and the development of Industry Standards, underlining the company's longstanding commitment to its customers and the industry. Through an ongoing commitment to waste and energy reduction, Siemon's environmental sustainability benchmarks are unparalleled in the industry, including 179% global carbon negativity and zero-landfill status.

For more information about Siemon Interconnect Solutions (SIS) please visit: www.siemon.com or contact Siemon Interconnect Solutions, 101 Siemon Company Dr, Watertown, CT 06795.



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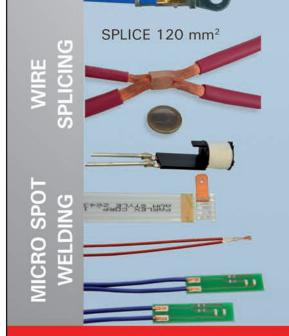
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Mando Can Do.



When Armando Zacarias goes out on a Eubanks service call, unusual things happen.

"Once I helped round up a cow that got loose in a customer's plant.

"Another time, while driving to a customer's site, our rep's car caught fire. We eventually arrived there that night and finished the job in time for the morning shift," Mando reports.

Customers report something unusual too: Mando's "can-do" attitude.

George Price, vice president of J&M Products, for example, writes how Mando takes time to answer questions, explain machine operation and even gave "tips on stripping some shielded cable that others said could not be done."

"Can't be done" is not in Mando's vocabulary—either English or Spanish. On his own initiative, he solves problems, leads training classes, helps boost plant

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Subassembly Sourcing - How OEM's Plan Strategy

Selecting subassembly manufacturers with specific capabilities can speed turnaround, improve product performance and functionality, and increase an OEM's bottom line.

With electrical and electronic components and features like touch screens, flex circuits, keypads and membrane switches becoming more technologically advanced, OEMs are becoming increasingly dependent on sourcing subassemblies to expert third-party suppliers.

At the same time, subassemblies are critical to the OEM's finished product and must be sourced carefully to achieve consistent quality, timely turnaround and competitive pricing. In many cases, contracting with suppliers that offer access to global manufacturing facilities and in-house engineering support can be instrumental to the success of an OEM.

One of the most significant challenges is locating reliable suppliers that can meet these qualifications with pricing that can improve profitability. Some of the more successful OEMs point to a few uncomplicated strategies that help strengthen subassembly sourcing, achieving faster turnaround, ensuring product quality and functionality, and increasing added profitability.

1. Access to Global Resources

Selecting a domestic subassembly supplier with global manufacturing resources can provide OEMs with significant economic advantages – provided the manufacturing processes are well managed by the supplier. For example, many OEMs that contract directly with offshore suppliers experience communication difficulties that can lead to errors with subassembly materials or dimensions, avoidable logistical difficulties, or even cost miscalculations.

However, some OEM suppliers have no problem in providing high quality products through relationships with offshore fabricators that work seamlessly with the domestic supplier's engineering and management team.

"We have found that offshore fabricators can be effective partners in manufacturing for North American subassembly suppliers, provided the proper communications and management controls are in place," says Hector Macias, director of Northpoint Technologies, El Paso, Texas. Macias adds that such fabrication partnerships can also be financially beneficial to OEM customers by providing saving on costs and eliminating the need for capital investments.

Northpoint Technologies is a manufacturer of components and subassemblies used in electronic and electric devices used in the medical, automotive, defense, telecommunications, industrial and consumer markets. The company's expertise includes silicon and membrane switches, flexible PCBs and assemblies, touchscreens and wire harnesses.

When Justin Blush was in search of a silicon membrane for a microscope control switch, he found Northpoint Technology. Blush, lead technician at Prescott's Inc., a remanufacturer of surgical microscope, says his company's own molding and machine shop was unable to fabricate the membrane,

> which was incorporated into a switch that enabled a model of microscope to zoom in and out on a subject.

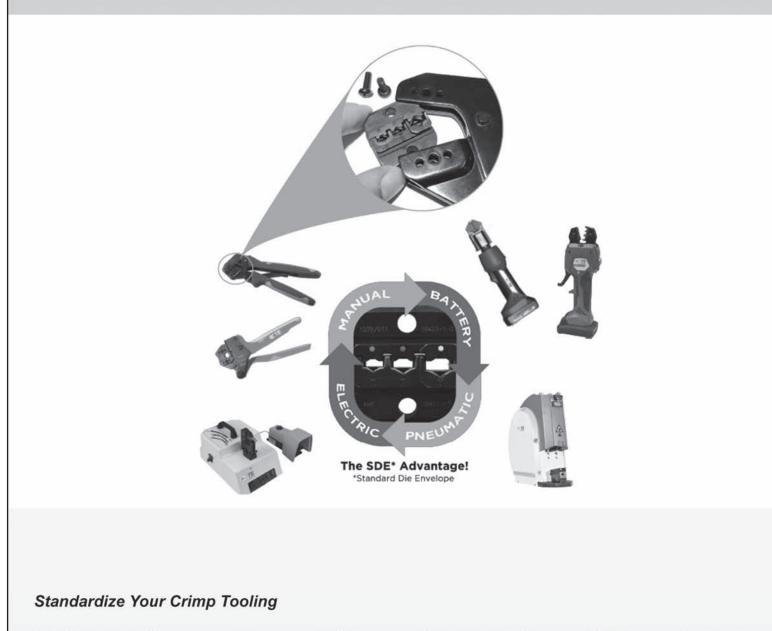
> Northpoint advised Blush that the membrane would be designed at its headquarters in El Paso, but would be fabricated at a plant in Asia.

> "I was happy just to have a supplier and expected the fabrication and shipping process to take at least six-to-eight weeks, as with our traditional suppliers," Blush explains. "I was amazed to learn that the membrane required only a two-week turnaround, and at a fraction of the price I expected."

2. Faster, Functional Prototypes

The timely delivery of prototypes and quick turnaround of revisions are vital to expediting the manufacturing process. When subassembly suppliers with offshore manufacturing facilities can produce prototypes in-house with quick turn-around times, the process is much more efficient.

SDE STANDARD DIE ENVELOPE CRIMP TOOLING



SDE (standard die envelope) is a new, flexible approach to crimp tooling, from TE Connectivity, that allows use of the same dies on tooling across a range of application platforms. Dies are interchangeable in tools from portable hand tools—manual or battery-powered—to pneumatic hand tools and electric bench terminators. It's a family of tools that you can take from bench to production or into the field, without the need for dies fitted to each kind of tool. They're ideally suited for R & D, networking applications and on-site maintenance work.

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Due to those factors, prototyping is one of the functions that successful suppliers seldom outsource. Macias considers prototyping a critical step in product development. These are produced via aluminum or "soft" molds, and are of such quality that they are usually considered to be product samples or the equivalent of first article production pieces.

"The prototypes we require are real, functional samples that we send to customers to inspect and test," says Terry Swick, president and co-founder,



Swick-White Inc. (Davisburg, MI), a manufacturer of electric enclosures, control panels, membrane switches and graphic overlays. "Assuming they meet specifications, they can install them as finished subassemblies in products and ship them out to customers with confidence."

At other times OEMs will have requirements that are outside of the usual request. Suppliers who have the in-house capabilities produce complex items domestically satisfy the extra can demand by producing additional functional prototypes that have been approved for production.

For example, Stoehr says that on occasion, he made such a request. "I said, 'We're doing a prototype run of 10 control panels, so can you provide 10 sample keypads?' And they were able to do that with no delays."

3. Look for Volume Flexibility

Whether subassemblies or piece parts are fabricated domestically or overseas, minimum volume requirements can force OEMs to purchase more parts than they require. However, a few subassembly suppliers are moving away from volume requirements to better serve the OEM.

want high-volume orders, just like other industries," explains Stoehr. "Five or six years ago we found Northpoint Technologies, which has been very good about taking on even low volume projects. That's a real plus for us and our customers."

4. Adding Significant Value

Finally, many OEMs are finding suppliers that provide significant value-added services, with offerings ranging from engineering assistance to recommendations for streamlining the manufacturing process.

In some cases, graphic design assistance, such as special icons or other symbols on keypads and other controls, can provide important safety or security features.

In another example, GSGR's Stoehr found that subassembly suppliers could bring important value added through the kitting of loose piece parts. He arranged with Northpoint to have special kits, containing 20 loose keypad buttons, to be packaged in order to expedite assembly on the production line.

"Getting great value-added services through a single source is important to GSGR," Stoehr says. "It is not only more convenient, but when you couple that with consistent quality, quick turnaround and competitive prices, it helps us provide better service to our customers, as well."

For further information contact Northpoint Technologies, Inc.; 13321 Tobacco Rd., El Paso, TX 79938. Phone: (915) 591-6300 or visit website northpointech.com





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Verify the bar code label is applied to the harness?



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When Steve Stoehr, Engineering Manager at GS Global Resources (GSGR) was sourcing a keypad as part of switch and control panels installed on some heavy-duty equipment agricultural such as machinery or fire trucks, he expected to make a sizable volume commitment to the keypad manufacturer.

Based in Mukwonago, WI, GSGR develops and implements a broad range of electronic and hydraulic control systems for various OEMs.

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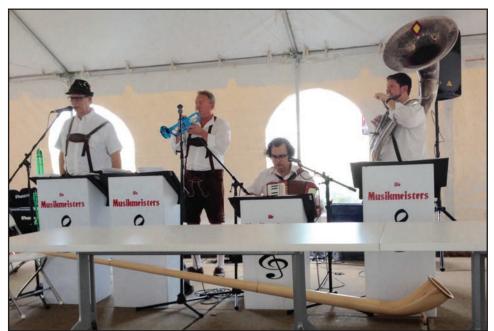
Six Suppliers Host Octoberfest

Joe Tito Wiring Harness News

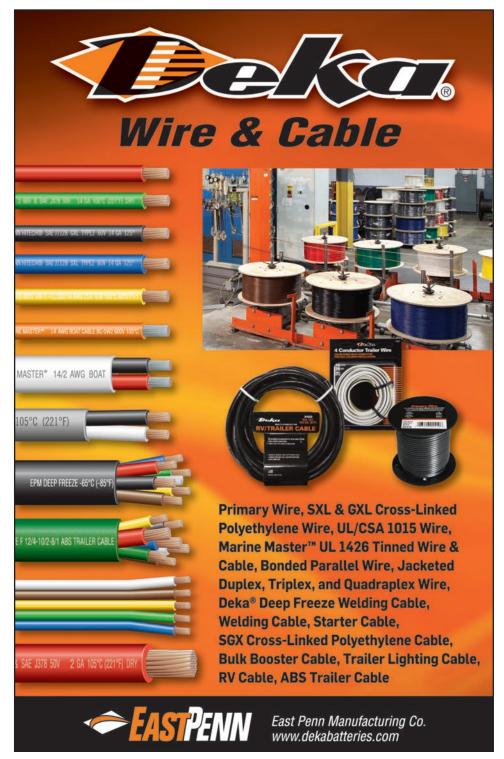
ix world class providers of wire processing equipment teamed up for a fun and informative Octoberfest themed trade event on September 22. The event was hosted by Panduit at their world headquarters in Tinley Park, IL, and co-hosted by partners Schleuniger, Cirrus Systems, GEM Gravure, Telsonic, and HarnessWorks. Panduit's impressive LEED Gold Certified facility houses an expansive exhibit area where each company set up live demonstrations of their products. The suppliers had lively one-on-one interactions with well over 100 harness manufacturers. Each vendor to gave short presentations focused on new and evolving wire processing technologies and solutions.

The combination of the festive atmosphere, active displays, and informative presentations, meant visitors could delve deeper into conversations with these select partners. Attendees were treated to an excellent array of traditional German foods and deserts, and there was plenty of Warsteiner beer on hand to raise a toast. Music was provided by Der Musikmeisters, a local German band, who really got everyone in the spirit of Octoberfest. The event was complete with a beer stein holding contest and festive sing-alongs.

Continued on page 34



Der Musikmeisters got the crowd rolling.



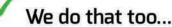
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Schleuniger

"The displays and software are similar from machine to machine. This makes integrating a new piece of equipment into production a smooth transition." JR Palumbo, Owner, Royce Electronic Sales

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"The training provided by Schleuniger employees exceeded our expectations. We are beyond impressed. They quickly got us up and running and most importantly comfortable with technology we had little prior experience with." **C.H., Jabil**

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Octoberfest

Amid the food and fun, the hosts dug into their presentations. Adam Simms outlined Panduit's commitment to develop equipment designed to save space and reduce capital investment. He described how Panduit relies heavily on the partnerships they have developed with the other host companies. In support of this notion, he reviewed Quick-Build 2.0, the modular alternative to cumbersome harness nail boards that works well with HarnessWorks, and also the new PAT 4.0 Cable Tie System.Adam also highlighted the interchangeability of dies across automated and bench top platforms. He concluded with Panduit's Test Drive program where manufacturers can take temporary delivery of equipment for a no-risk evaluation. Panduit provides two weeks of consum-

Continued from page 31

ables, and offers free training for the evaluation period.

Rob Boyd of Schleuniger discussed the latest in crimp quality management, and gave an update on the LV 214-4 German Automotive Connector Test Specification. Rob spoke about this back in May at the EWPT Expo in Milwaukee and thinks the specification, which is still in draft form, will become an important component of crimp quality monitoring for OEM suppliers. The specification deals mostly with in-process crimp monitoring. In support of this and other crimp monitoring strategies, Rob outlined the MicroGraph modular crimp cross-sectional analysis system that is scalable to individual needs, and small

Continued on page 34



From left, Greg Wilson, Event Manager and Ralph Liebner VFI Marketing take charge of Panduit's exhibit trailer.



molex

it around an object in about One Second. Object Diameter: 1/16" to 2" Intervention of the second o

Continued from page 1

New Dawn for Manufacturing Careers in America



Manufacturing Jobs/Year 2015									
	2000 - 2003	2015	% CHANGE						
New Offshoring	~ 240,000*	60,000*	- 75%						
New Reshoring & FDI	12,000*	67,000**	+ 400%						
Net Jobs Gained	~ -220,000	~+0	N/A						
Figure 3									

U.S. Advantages

Companies are starting to use Total Cost of Ownership (TCO) to qualify these and other costs (*See Figure 2*). They are reducing cost via lean improvements, product design, and automation. They are finding they can often manufacture more profitably in the United States

U.S. No Longer Losing Jobs to Offshore

Net annual job loss to offshoring went from around 200,000 in 2003, to zero today! *(See Figure 3)*

Top 10 Reasons Companies Are Coming Back

Many companies are using the Total

Cost of Ownership Estimator found on reshorenow.org to calculate the actual cost of their offshore sources. *(See Figure 4)*

About the Reshoring Initiative

The Reshoring Initiative offers many tools and resources to help companies make supply chain sourcing decisions. The Reshoring Initiative's Total Cost of Ownership Estimator[®] is the best-known tool for this purpose. It uses advanced metrics that allow users to easily determine the total cost of offshoring by accounting for and understanding the relevant offshoring costs, which include inventory carrying costs, shipping expenses, intellectual property risks and more.

REASON 1 Quality/rework/warranty 6 Lead time/time to market Freight cost 7 2 Eco-system synergies/localization Rising wages offshore Proximity to market/customers 3 8 4 Government incentives 9 Image/brand: Made in USA 5 Skilled workforce availability/training Automation/technology (including 3D) 10 Figure 4

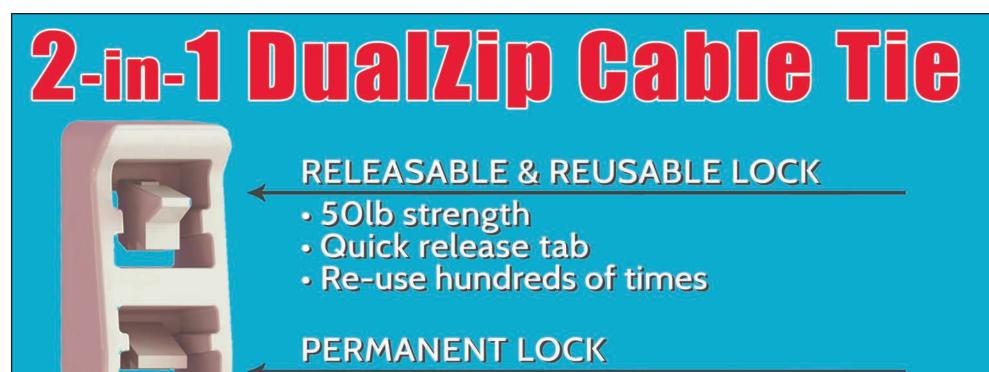
Wire & Cable Management Solutions

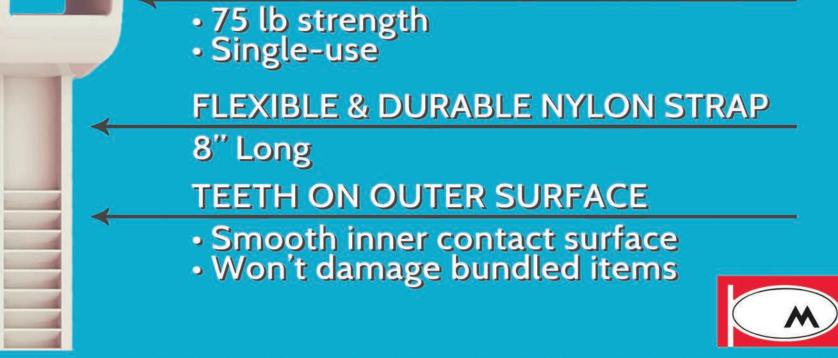
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- Large cross section
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- Cross section from 0.26–100 mm²
- Quality monitoring
- Versatile for Al and Cu cables



Wiring Harness News NOVEMBER/DECEMBER 2016 37

enough to reside on the shop floor close to crimp stations.

Complex wiring systems with non visible components, increasing reliability standards, and increased testing requirements are all reasons for a heavier reliance on non-destructive test systems. Kevin Denning of Cirris Systems outlined many of the surprisingly affordable systems that meet these needs. As with the other host partners, Cirris has embraced the ideas of scalability and mobility in the development of new systems.

Telsonic Ultrasonic Welding equipment is used across many industries, but the metallurgic bonds created by this technology make it ideal for wire harness production. Nader Denning went in-depth to describe the technology behind ultrasonic welding and described some of the applications, especially in areas where dissimilar metals are involved. He highlighted the

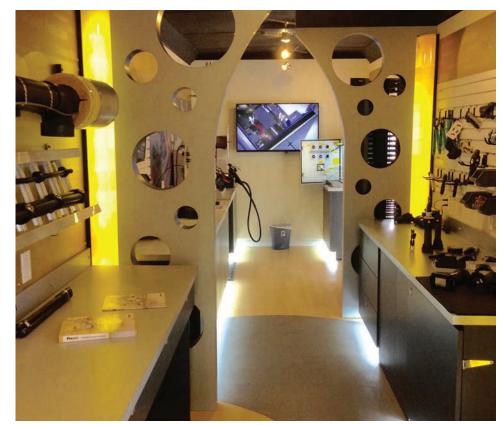
importance of this by noting that BMW has informed the industry that by mid 2020's, 50 percent of the wire and cable used in their vehicles will be aluminum. Nader followed the scalability theme by noting the generators on their newer systems can be upgraded in 1.2 kW increments to accommodate any future expanded needs.

Huck Hyde of GEM Gravure spoke of the differences and applications of pigments and dyes, and outlined their applications for wire marking. He also outlined the challenges of developing ink colors that can be visible against a vast array of insulation colors. Following the theme of portability and scalability of equipment, Huck spoke about the alphaJet line of Continuous Ink Jet printers for wire and cable marking. This equipment boasts space saving attributes and is versatile enough to print font sizes from 10mm, all the way down to 0.7 mm.

Finally, Roger Richardson of HarnessWorks spoke about their system for harness board assemfull working displays of the latest Panduit products. The unit spends 300 days a year traveling throughout the US and Canada stopping at distributors, OEM's, and other locally scheduled events.

Wiring Harness News caught up with Todd Maines of TACK Electronics to get his impression of the event. He felt it was a really good intimate event which allowed for more in-depth conversations with the suppliers that were there. "I enjoyed the tour of Panduit and the hospitality was amazing. The flow of the event was great and I would definitely attend next year of they held it again."

In previous years, the Octoberfest was hosted by Schleuniger, and these partners intend to build on the success of this year's function with other localized events. If you would like to be included in one of these events, or would like to see the Panduit rolling exhibit, contact your company representative at one of the hosting companies.



Full working displays inside the trailer.

UNIFORM TERMINATION JUST GOT EASIER - AND FREE

TE Connectivity's (TE) PIDG, PLASTI-GRIP, SOLISTRAND and FASTON Terminals and Splices are designed for complete and uniform reliability in the most difficult circuit environments. The many millions of TE terminals that are still deployed twenty years after installation are a testament to the rigorous testing and research that went into their design and manufacturing. Many of the TE PIDG terminals meet or exceed the requirements of SAE AS7928, Type II, Class 1 and 2.

TE's design of the crimping dies and construction of the terminal allows for uniform insulation thickness under crimping pressure, transmitting pressure evenly to the center of the crimp area. This produces a crimp and terminal that are alike in appearance and performance. PIDG products are available as rings, spades, flanged spaded, slotted rings, splices in several other varieties and sizes.

PIDG Terminals & Splices

- · Terminals are made of high conductivity copper
- · Most product is UL and CSA approved Insulation is UL 94V-2 rated
- Product is rated for use up to 105 degrees C and 300 Volts for terminals and 600 Volts for splices
- · PIDG terminals have copper sleeve for improved wire insulation support
- · The body has serrations for maximum contact and tensile strength
- Insulation sleeves and the corresponding tooling are color-coded by wire-size for easier identification

PLASTI-GRIP Terminals & Splices

- Vinyl insulation sleeve provides good dielectric strength and supports the wire insulation so that no bare wire is exposed
- · Most product is UL and CSA approved
- Most product rated to 105 degrees C, with an operating voltage of 600 V
- Insulation is 94V-0 rated
- Funneled wire entry on terminal prevents turned back wire strands and permits rapid wire insertion during high speed production
- · Serrations in the crimp barrel provide maximum contact and tensile strength after crimping





bly. It has been in development for a few years, and is now ready for rollout. The system uses an overhead projector to provide stepby-step harness build instructions on scalable, reusable boards. As mentioned, it works well in conjunction with Panduit's Quick Build 2.0 and represents a revolution in aerospace harness manufacturing. Look for more indepth coverage of HarnessWorks in a feature article in this issue.

Panduit also had their mobile display unit on hand for all to tour. This rolling exhibit is updated at least once a year and has

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- Constructed of fine grade high conductivity copper for optimal electrical performance
- The brazed seam increases metal strength around the entire barrel area assuring withstanding harsh industrial environments. It also prevents pinched and stubbed wires.
- Product is rated for 170 degrees C maximum and therefor suitable in all standard applications.
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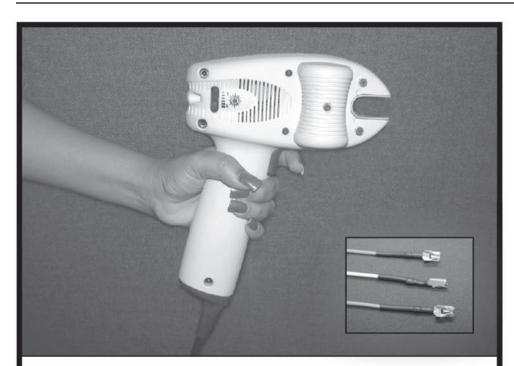








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*polyolefin, 5" length

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the target zone. What you will see is an amazing difference in shrink time!

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NEWS PLUGS continued



CMC Introduces the ROTO-LUG™ Line of Electrical Connectors Featuring Turning Point Technology

Connector Manufacturing Company (CMC) has introduce the new ROTO-LUG™ connector product line. ROTO-LUG™ connectors have the built-in Turning Point rotational feature that allows up to 219° positioning in all directions: frontand-back and side-to-side.

The built-in rotation feature significantly reduces installation time and the amount of conductor needed as it allows the installer to bring the connector to the conductor by quickly adjusting the angle of the connector to accommodate the conductor. ROTOLUG™ connectors are range taking and accommodate both copper and aluminum conductors. ROTO-LUG™ connectors are cULus Listed for wire terminations.

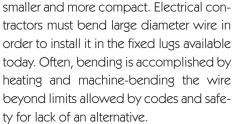
Over the years, wire has become larger in size while at the same time switchgear boxes and breaker boxes have become

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ROTO-LUG™ Electrical Connectors



CMC's ROTO-LUG™ connectors provide a superior connection in 50% less time as standard termination methods where the need to bend the wire is present.

Acquired by BURNDY in 2013, CMC was established in the early 1940s and relocated to Cincinnati, Ohio, in 1976. CMC has 3 primary sites totaling over 206,000 square feet of production. CMC is a full line manufacturer of aluminum and copper connectors, offering both mechanical and compression designs. In addition to its utility products, CMC manufactures connectors for meter socket terminals, load center neutral bars, switch gear terminations, commercial panel boards, circuit breakers, motor controls and pole line hardware, wind energy products, solar energy products, and enclosures.

For additional information contact 513-860-4455 or visit: www.cmclugs.com.



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applicator changer, change over time

Machine with Great Variety of

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ShinMaywa automatic wire terminating machine guarantees high quality not only in automotive industries but in household appliances. Halogen free wires can be processed by above all series.

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In every issue of Wiring Harness News Anixter will bring you informative articles about wire and cable technology.

CABLE JACKET TYPES 101

lmost every cable has a jacket and for good reason: jackets help mechanically protect the insulation and conductor core of the cable. Without a jacket, cables are susceptible to abrasion, heat damage and oxidation damage, as well as weatherrelated damage. But not every jacket is created equal; it is imperative that each cable have the correct jacket type for each application in order for the cable to operate properly. This wire wisdom will explore some of the different cable jacket types and provide an overview on the jackets' mechanical and chemical properties.

WHAT IS A CABLE JACKET?

A jacket is the outermost layer of a cable whose primary function is to protect the insulation and conductor core from external physical forces and chemical deterioration. In a sense, the cable jacket is the first line of mechanical defense for a cable by protecting the cable's inner components. Cable jackets offer mechanical, moisture, flame and chemical protection, while also protecting the cable from damage during or after installation. It is important to note that the cable jacket has little to do with the electrical performance of the cable.

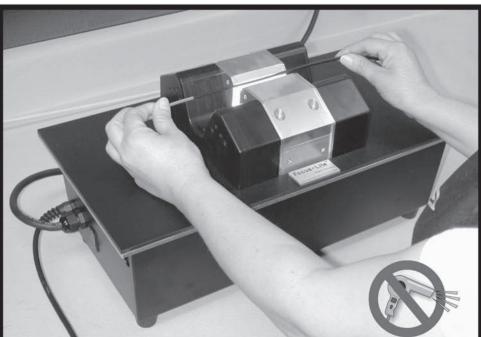
CABLE JACKET TYPES

Cable jacket types can be broken down into two categories: thermoplastic jackets and thermoset jackets. A thermoplastic jacket is a type of material that when hot enough will melt and reform, whereas a thermoset jacket is a "set" material – it doesn't have the ability to reform when heated. There are many different types of both thermoplastic and thermoset jackets, and the options listed below are only a small array of the choices one has with cable jacket types.

Thermoplastic

PVC – Polyvinyl Chloride (PVC) jackets, while not exhibiting a wide range of thermal characteristics, do have the ability to resist oils, acids, sunlight, heat, weathering and abrasion. By having such strong physical assets, PVC is an ideal jacket for cables that will be used for direct burial, street lighting and control cable. Since PVC is inherently flameretardant, it is the most common jacketing material for electronic cable.

Polyurethane – A polyurethane (PUR) jacket has excellent oxidation, oil, and ozone resistance, and when specially formulated, a polyurethane jacket can also have good flame resistance. These types of jackets also have great "memo-<u>Continued on page 40</u>



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WREwisdom[™] Continued from page 39

ry" properties, which make it an ideal jacket for retractile cords.

CPE - Chlorinated Polyethylene (CPE) is one of the few polymers that is available as both a thermoplastic and a thermoset jacket (thermoset CPE would be a cross-linked version). The thermoplastic CPE jacket has excellent oxidation, heat, oil, weather/sun and flame



resistance. Although the thermoset version has better high-temperature properties, the thermoplastic version contains other excellent properties.

Thermoset

Neoprene - Neoprene is a synthetic rubber that allows for a resilient jacket. By not embrittling at cold temperatures,

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resisting permanent deformation under heat, and resisting aging due to oxidation and sunlight, neoprene jackets are suitable for cables in rugged environments, such as mine trailing cables and dredge cables.

EPR - Ethylene Propylene Rubber (EPR), another form of synthetic rubber, is a type of jacket that is a modified form of the EPR insulating compound. EPR jackets have excellent heat, abrasion, oxidation resistance and can also withstand cold temperatures down to -60°C. With fairly good high-temperature characteristics overall, when formulated correctly, EPR can be fairly flame retardant as well.

CPE - The thermoset CPE jacket (cross-linked) has excellent physical properties that make it suitable for many cable jacket applications. This polymer is resistant to ozone and ultraviolet degradation, and if properly compounded, can also withstand prolonged immersion in water. With strong resistance to most acids, bases, and solvents, thermoset CPE jackets are well-suited for chemical plant use.

PROPERTIES OF CABLE JACKETS

As stated earlier, jackets provide mechanical protection to the insulation and conductor core. In order to provide the best possible protection for the cable, a jacket can be modified by the addition of fillers, plasticizers, activators, and inhibitors to enhance a particular physical characteristic. Some of those physical characteristics are as follows:

- · Toughness, tear and abrasion resistance
- Flexibility during cable installation, at low temperature
- Stability over a range of temperatures
- Resistance to heat aging
- Resistance to cable deformation
- Flame resistance
- Oil resistance Low moisture absorption
- Resistance to abnormal
- concentrations

If you would like more information on cable jackets, please see the Anixter Wire and Cable Technical Information Handbook, as well as the IEEE 532 guide.

	Thermoplastic			Thermoset		
	PVC	Polyurethane	CPE	Neoprene	EPR	CPE
Oxidation resistance	E	E	E	G	E	E
Heat resistance	E	G	E	G	E	E
Low-temperature flexibility	P-G	G	E	F-G	G-E	F
Weather/ sun resistance	G-E	G	E	G	E	E
Abrasion resistance	F-G	0	E-0	G-E	G	G-E
Flame resistance	E	Р	E	G	Р	G
Water resistance	F-G	P-G	0	E	G-E	G-E
Underground burial	P-G	G	E-0	G-E	E	E

P = Poor, F = Fair, G = Good, E = Excellent, O = Outstanding



Wire Processing Blades

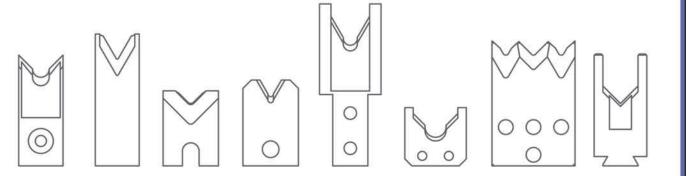
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- GTS-E and GTH-E cable tie tools offer leading ergonomics and durability for greater comfort, safety and less downtime.
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For more information on Panduit wire harness solutions, visit www.panduit.com/wireharness-wh Contact us by email at: OEM@panduit.com

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NEWS PLUGS continued

TE Connectivity's New Single Wall Heat Shrink Tubing Products Meet the Halogen-Free Requirement and UL VW-1 Flammability Test

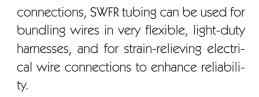
TE Connectivity (TE), a world leader in connectivity and sensors, introduces its new single wall, flame retardant (SWFR) product line. These single wall heat shrink tubing products are rated for the UL VW-1 flammability test specified by the UL 224 standard. Because the highly flame-retardant polyolefin jacket is non-halogenated, SWFR tubing can be used in confinedspace applications where it is unacceptable for materials containing halogen to burn and potentially emit toxins. SWFR insulating and mechanically protecting components, connections and terminations across many applications – from industrial controls to home appliances and mass transit vehicles.

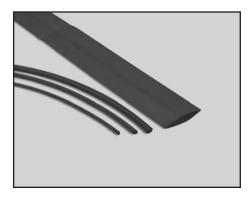
"Advances in material technology and manufacturing processes have allowed us to introduce this relatively low-cost, single wall tubing product that is halogen-free and meets the UL VW-1 flammability test," said John Sandwell, tubing product management director, TE's Appliances business unit. "As a Zerohal tubing product, it's particularly suitable for applications in confined spaces that must maintain air quality. With its combination of highly attractive properties, our new SWFR tubing is a key addition to our already broad line of Raychem heat shrink tubing products."

SWFR tubing products are offered in either thin wall (X2) or very thin wall (X4) versions. The products shrink at a 2:1 ratio and install quickly, due to their relatively low full-recovery temperature of 90 degrees Celsius. Both types of tubing products are very flexible and can be used across operating temperatures ranging from minus 30 degrees Celsius to 125 degrees Celsius.

The SWFR thin wall X2 products are available in 17 sizes ranging from 1.0 to 30mm. The very thin wall X4 tubing products come in 13 sizes ranging from 0.8 to 25mm. (The sizes refer to approximate unrecovered inside diameter.) Thin wall X2 versions afford somewhat better resistance to physical abuse. The very thin wall X4 tubing products enable protected components to be packed more closely together. The X4 versions also shrink more rapidly to reduce application time, which may be helpful in preventing the overheating of temperature-sensitive components.

In addition to insulating and mechanically protecting in-line components and





Single Wall, Flame Retardant (SWFR) Tubing

All TE's Raychem tubing products can be easily installed using many different types of heating tools, which are also available from TE. These range from basic

> heat guns for low-volume requirements to conveyorequipped ovens for highvolume production environments.

TE Connectivity (NYSE: TEL) is a \$12 billion global technology leader. Our connectivity and sensor solutions are essential in today's increasingly connected world. We collaborate with engineers to transform their concepts into creations redefining what's possible using intelligent, efficient and high-performing TE products and solutions proven in harsh environments. Our 72,000 people, including over 7,000 engineers, partner with customers in close to 150 countries across a For further information visit www.TE.com.

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25 Years of Quality Lacing Tapes and Yarns at Breyden Products

By Greg Miller Breyden Products

the curing oven looks solid if unimpressive, almost the same way it looked 25 years ago in a garage 2,200 miles away the day it was built. It sits waiting in a building on Radio Road-so named because the building was originally the police radio post in town-in Columbia City, Indiana. Millions upon millions of feet of polyester, nylon, Nomex, Teflon, and Kevlar lacing tapes and over-braiding yarns passed through that garagebuilt oven on their way to being sold across the world by a company named in a kitchen with the help of a bottle of wine, a few beers, and a dictionary.

The word "Breyden" has its roots in old English, and it means "to braid or twist quickly." For a new company specializing in braided and twisted products, the name that Jay and Janice Miller found late at night in a Webster's New American dictionary just made sense. Breyden Products was founded soon thereafter in Hesperia, California, squeezing that brand new



The Breyden Team

garage-built oven into a rental unit along with a few lines of braiding machines that were decidedly not new. As the Millers organized and prepared the facility, one of the other founding parties set out to generate sales, developing relationships with distributors that he and Jay had started in their previous years in the industry.

The first years were lean years. Jay and Janice were the entire workforce and performed every task in the office and factory. The company got lonelier within the first two years, as the two other founding members opted out, discouraged by the slow start and unable to continue financially. If things continued as they'd been, the Millers would have to fold, too.

Breyden's luck soon turned around. A revolutionary highstrength, low elongation fishing line became an overnight sensation. Demand was high, supply nonexistent. At around the same time, Juan Flores joined Breyden. He had worked as a production manager with Jay for ten years at another

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braiding company. Originally an immigrant from Mexico, Flores devoted himself to Breyden's success, even foregoing a salary for a time. With the additional experience and labor, Breyden capitalized on the growing fishing line market. Revenues doubled in one year and nearly tripled in two. Eventually the growth cooled, then slowed, then stopped. Major players in the fish line industry moved in and soon dominated the market, but success there allowed Breyden to develop its core business in the electrical and aerospace industries. A small

number of employees had joined the business, and there was even enough money to pay the Millers a small salary.

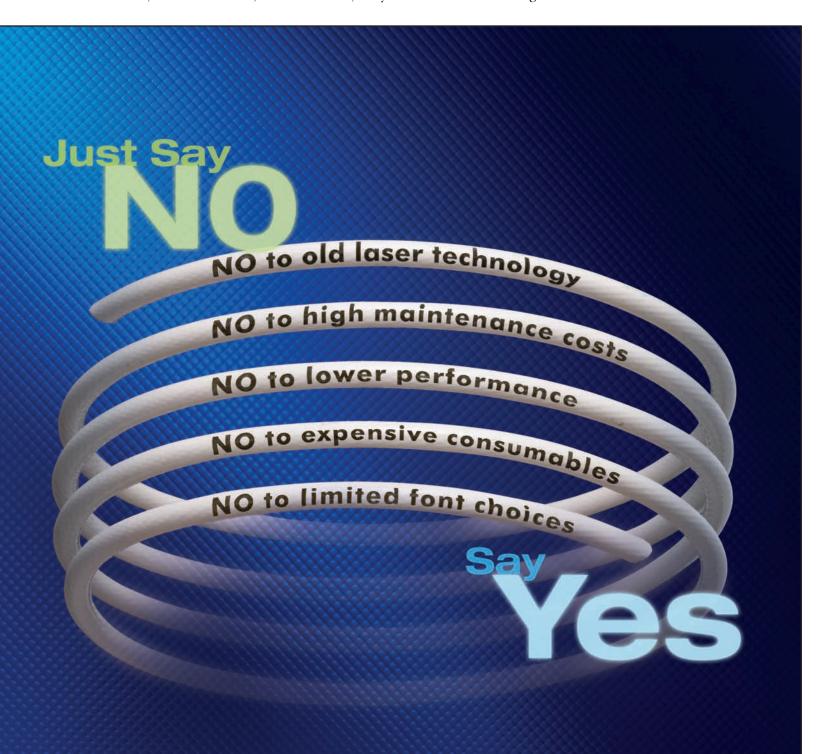
Growth slowed as Breyden grew and by 2001, it was clear that to grow at anything faster than an incremental, plodding pace, Breyden would have to add a full time sales professional. A chance meeting on a cruise led to the addition of Mike Zuber, who had spent 14 years at Phelps Dodge culminating in his position of head of distribution sales. Zuber came equipped with a strong relationship with Breyden's major distributor, and he was able to parlay that relationship into a significant increase in business. Zuber's salesmanship also helped to enable Breyden to enter new markets and find other outlets for their goods.

By the mid-2000's, Breyden grew into another issue: the business climate in California. High taxes, expensive insurance, and a growing cost of living all limited Breyden's growth. In 2004, Jay and Janice Miller and Mike Zuber agreed to relocate the manufacturing operation to Indiana, where Zuber lived. A building was found-the former police radio post in Columbia City-and by the end of 2005 the company operated solely in Indiana. The Flores family, who by that time handled various important functions in the factory, followed the company to Indiana along with a few other employees. In 2010, a rumor that a competitor was struggling turned over the course of six months into Breyden's acquisition of the assets of Gudebrod Electronics, one of Breyden's two major USbased competitors. Long considered the premier producer of lacing tape, Gudebrod had fallen on hard times after its entry into the dental floss industry. The acquisition allowed Breyden to improve its products and production techniques and connected Breyden with a number of new distributors to sell through, primarily in the European market.

Breyden Products has always been a family company, and as the company grows, the values that brought it to this point are as important as ever. The past, present, and future success are owed to the sacrifices and cooperation of many: families from Southern California, from Latin America, from the Midwest, distributors and suppliers and end users all over the world.

At Breyden's new facility a few miles away from the old radio post, the new ovens fit in better than the old, original garage-built oven. They were custom built in a machine shop, engineered with computerized help to maximize airflow and minimize heat loss. They were built to look good, and when they run a multitude of various colors and sizes of tapes and cords, it's impressive. It looks slick. But that slickness has roots, and you can seem them looking at that garage-built oven that's gone 25 years without a problem. It was built to last, and it has.





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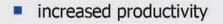


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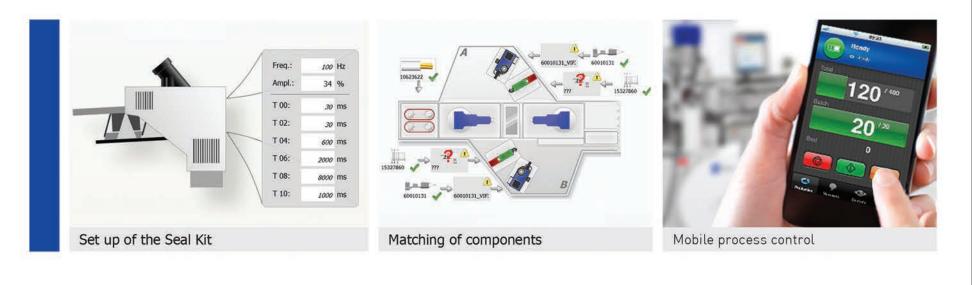
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NEWS PLUGS continued

New XLPE Control Cable Joins HELUKABEL Product Portfolio

HELUKABEL, a leading cable manufacturers, formally launched its latest cable product offering at the bi-annual International Manufacturing Technology Show (IMTS), held in Chicago, IL in September.

The new TRAY X is a NFPA 79-2012 conformant flexible control power cable with cross-linked (thermoset) polyethylene (XLPE) insulation. These tray cables are suitable for all machinery in tool and plant construction, and can be installed in dry, humid and damp environments, in pipes, underground, and for open, unprotected installation from the cable rack to industrial plant machinery. They are 600 V and WTTC 1000 V rated allowing

them to be used in 1 kV wind turbine cable tray applications. Additionally, it is CE approved for machine builders exporting to Europe.

The XLPE insulation is ideal for applications that require long cable runs due to its low capacitance. A higher current load rating is possible due to the conductor temperature resistance of 105°C. This enables a smaller cross section to be used when designing electrical networks in machines or systems. In addition to the resulting lower costs and use of copper, the much smaller outer diameter offers advantages for installation in tight spaces due to an increase in the cable's maximum bending radius.

Additional TRAY X specifications:

Temperature Range: -40°C to +105°C

Nominal Voltage: TC – 600V / WTTC – 1000V

Min. Bending Radius: 10x the cable O.D.

Approvals: UL – TC-ER (AWG 18 & larger), ITC-ER, PLTC-ER (AWG 12 and smaller), Type WTTC (AWG 18 & larger), Type XHHW-2 (AWG 14 & larger) 13, 44, 1202, 1277, 1581, 2277, 2250, AWM 2586 - 105C 600V, NFPA 79 2012, Oil Res I/II, 90°C dry / wet, Class 1 Div. 2 per NEC Art. 336, 392, 501 / CSA – c(UL) CIC-TC FT4 (AWG 18 & larger) CSA AWM I/II A/B FT4 international manufacturer of cables and wires with 26 locations throughout the world. In its 45,000-square-foot, suburban-Chicago facility HELUKABEL USA stocks over 4,000 cables, wires and accessory line items for a multitude of industrial and commercial applications across a wide range of vertical market segments. Direct access to a 1.72-millionsquare-foot, fully automated warehouse with 33,000 line items, enables HELUKA-BEL USA to provide extremely short delivery times.



HELUKABEL Tray X Cable

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Mini End Feed



Med. Duty Air End Feed Quick Change Tool Pack



Med. Duty Slide Quick Change Tool Pack



Mini

Mini (2 Post) Air Left to Right



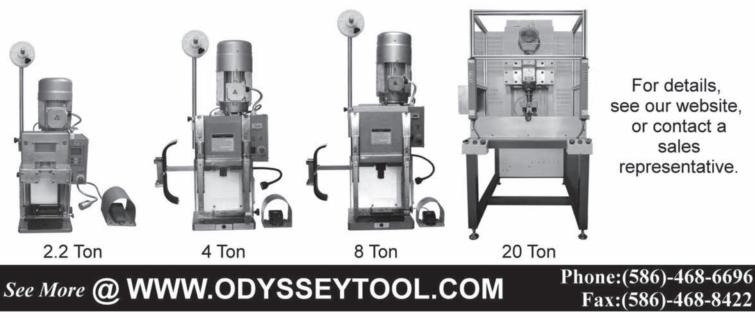
Heavy Duty Slide Quick Change Tool Pack

It is currently available in sizes 20 AWG - 500 kcmil with various conductor configurations. For customers working in facilities where high levels of electromagnetic interference are prevalent, a shielded variant is available upon request.

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NEWS PLUGS continued based Cable & Wire Harness Test



CableEye® Generic Surface Mount & TH Connectors, CB51

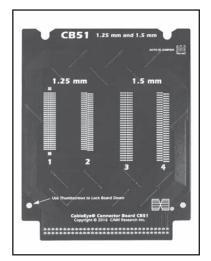
CAMI Research Inc. (Acton, MA) announces another new board for its CableEye cable and harness testing systems. Populated with solder pads to accept both aligned and staggered, 1.25mm and 1.5mm pitch, surface mount and through hole (TH) connectors, the board addresses any market with a demand for board-toboard connections. Rated to 700Vdc/500Vac, the CB51 may be used on all CableEye models.

Configuration

A leader in development of PC-

Systems for over 20 years, CAMI offers the CableEye suite of Low and High Voltage products complete with accessories including connector boards. The selection of boards is constantly growing and is currently numbering over 60 most of which are populated with 'families' of connectors. These connectors are shown graphically correct with CableEye's standard dynamic user interface.

The CB51, sold without connectors, contains four sets of 60 solder pads accommodating numerous configurations of surface mount and TH connectors - aligned or staggered pins at 1.25mmm and 1.5mm pitch. There are four preset locations for automatic detection & display of any-pin-count connector up to 60- pins. Yet, any single set may be fitted with any



CableEve® Surface Mount and TH Board

combination of lower pin count connectors that total to 60 or less (e.g. a 40-pin with a 10-pin). Connectors soldered in non-preset positions will also appear graphically correct once they are mapped with PinMap™ (optional software).

> Sold as a set of two boards, each test board may be paired with other CableEye adapter boards to accommodate any combination of connectors.

Application

Customers requiring this board typically have products that may need HiPot testing and that have boardto-board connections such as box builds or other contained devices e.g. AV Equipment & Telecom products.

<u>Warranty</u>

Connector boards are included in CableEye's standard, renewable one-year warranty of the tester for which it was purchased.

CAMI Research produces expandable and upgradable diagnostic Cable & Harness Test Systems for assembly, prototyping, production, and QC of standard or custom cables. CableEye® Testers display, and document basic electrical properties such as continuity, resistance, dielectric breakdown, insulation resistance, miswires,

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Higher Engineering Horsepower in Higher Education

entor Graphics Corporation announced it has joined the Partners for the Advancement of Collaborative Engineering Education (PACE) program and the General Motors and U.S. Department of Energy (DOE) sponsored EcoCAR 3 program. The move is part of Mentor Automotive's

ongoing effort to accelerate productivity of automotive engineering R&D efforts, from OEMs and Tier 1 suppliers to many of the world's leading automotive engineering universities.

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4705 S. Coach Drive Tucson, AZ 85714 (520) 747-4500 (520) 747-5800 fax tomatlas@worldnet.att.net lars' worth of industry-leading software, support and training to universities and student teams in both the PACE and Eco-CAR 3 programs. This enables students to be proficient in today's skills and methodologies before graduation and be ready to contribute to leading automotive companies immediately.

PACE

The PACE program was established by General Motors to develop the automotive Product Lifecycle Management (PLM) team of the future. Each of the 65 PACE universities worldwide, which General Motors targets in its recruiting efforts, will be offered the same set of Mentor Automotive engineering tools adopted by General Motors. These include the Capital[®] product line for electrical systems and harness design with SystemVision® for electrical systems simulation, FloEFD[™] 3D thermal and fluid analysis software (integrated with the Siemens NX 3D CAD package), and FloTHERM® software for electronics cooling analysis, plus the Xpedition® printed circuit board (PCB) design platform with HyperLynx® software for high-speed design reliability verification. In addition to General Motors leadership, PACE is supported by Autodesk, HP, Oracle, MathWorks, Siemens PLM Software and Mentor Automotive. Through PACE, engineering students develop practical skills in the core software and processes they will use in high-technology careers in industry.

EcoCAR 3

EcoCAR 3 is the latest DOE Advanced Vehicle Technology Competition (AVTC) series, sponsored by DOE and General Motors and managed by Argonne National Laboratory. The 4-year program challenges 16 North American university teams to redesign and convert a 2016 Chevrolet V6 Camaro into an advanced hybrid car to reduce its environmental impact, while maintaining the muscle and performance expected from this iconic American car. The teams even design in new Advanced Driver Assistance (ADAS) functions. Mentor Automotive is providing EcoCAR 3 a wide range of tools from its automotive product portfolio, including tools for electrical system and harness design (Capital, VeSys® and SystemVision), mechanical analysis tools (FloEFD, Flowmaster®, FloTHERM), vehicle networking tools (Volcano[™]), embedded software tools (Sourcery[™] CodeBench, Nucleus[®]), and PCB design and verification tools (PADS®, Xpedition, and HyperLynx).

"Mentor's Capital software suite has greatly improved our electrical design and documentation practices. Its deep configurability has allowed us to capture the finest details of our hybrid power-

_Continued on page 52





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Higher Engineering

Continued from page 50

train electrical system design," said Jonathan Moscardini, electrical team lead engineer for McMaster University's EcoCAR 3 Team. "Capital has given us enterprise-grade collaboration and user management tools without any of the usual enterprise-grade IT headaches. The MCAD integration enables us to more accurately define and route our custom harnesses for the 2016 Chevrolet Camaro. The Mentor tools revealed multiple design insights, before we touched a single physical wire. The ease-of-use of the entire suite has helped us complete



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"EcoCAR 3 is one of the world's premier vehicle technology competitions," said Nick Smith, business development director at Mentor Automotive. "The fact that in just four years students can build cars that perform as they do is testament to the ingenuity of these engineering students, but also to the increasing power of advanced design tools and software, such as those supplied by Mentor Automotive." Mentor Automotive has built a reputation for solving the most complex design challenges, earlier, more efficiently and with less program risk. Our solutions span software, hardware, integration, connectivity and compliance and are used by nearly every major automotive OEM and Tier 1 supplier. Mentor Automotive focuses in four key areas of the industry:

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Wednesday, February 15, 2017 | 8:00am-9:00am Mary (Missy) Cummings, Naval Officer, Military Pilot & Professor, Duke University "The Future of Drones"

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Meeting Increasing Demands for Broadcast & AV Applications

the wide use of HD video, emergence of 4K and 8K ultrahigh broadcast standards, and increasing popularity in the audio-video sector is placing greater demands of data transmission systems. Fiber optic technology, with its ability to deliver digital, high-bandwidth and low signal-loss streams, provides an ideal solution for coping with those demands.

However, when it comes to remote broadcasting from harsh conditions, the advanced needs of permanent broadcasting studio infrastructures, and the increasingly popular use of audio-video technology among businesses and government agencies, a new set of demands is being placed on the fiber optic cable industry.

Field deployment applications

Sporting events are among broadcast's toughest venues, requiring the rapid pulling of miles of field-deployable fiber optic cable across fences, through water, around rough-hewn rodeo arenas and along frozen ski slopes or blazing racetracks.

Continued on page 57



Broadcasting from remote venues like the Professional Bull Riding (PBR) event in Las Vegas, seen here, required 15,000 ft. of OCC cble to be unspooled by hand around a ring where it is exposed to considerable foot traffic, rough fences, water, and a wild bull or two.

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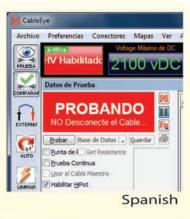
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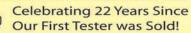
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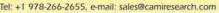
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Meeting Increasing Demands for Broadcast & AV Applications

Continued from page 55

Remote broadcasts demand the brisk deployment of dozens of strands of cable to cameras that fly over football fields, hang from cranes, and are then regathered and tossed into crates to be shipped to the next tough venue. Most important, in all of these harsh broadcasting environments, it must survive again and again.

Remote broadcasting specialists such as IMS Productions are involved with such rigorous field environments throughout the year. Headquartered across from the famed Indianapolis Motor Speedway, IMS Productions Mobile Unit Group travels the nation in heavy-duty

trucks equipped with studios and satellite uplinks that provide live production

services for national sports and entertainment broadcasts and events.

"Our fleet of mobile studios travels to hundreds of events across the country throughout the year, sometimes having to set up and tear down the same day before heading to the next venue," says Paul Nijak, IMS Productions Director of Engineering. "Even with all the rigors of meeting this schedule, remarkably little fiber cable gets broken – perhaps one or two pieces a year."

One of IMS Productions typical weeks includes providing broadcast production for the Verizon IndyCar Series, in locations such as St. Petersburg, where the 1.8-mile, 14-turn circuit incorporates city streets and a section of airport runway where 100,000 ft. of broadcast cable are laid behind temporary walls and fences, flown across sections of track and sometimes pulled through swamps and waterways.

Immediately following the race, IMS Productions crew will gather up the cable and head cross country to a PBR (Professional Bull Riders) Built Ford Tough Series event, where an average of 15,000 ft. of cable is unspooled by hand around a ring where it is exposed to considerable grime and foot traffic. The cable that IMS Productions utilizes for all the field events it covers is deployable broadcast-quality fiber manufactured by **Optical Cable Corporation** (OCC). Nijak says the cable looks and feels like OCC's acclaimed MilTac, 12strand, field deployable tactical grade cable, but is somewhat lower in cost.

The broadcast quality of this fiber cable is high enough to meet the 4K ultra-high-definition broadcasting standard that IMS Productions is currently field testing with Time Warner Cable Sports.

"Our installations range from extremely hot to extremely cold temperatures," Nijak explains. "For example, this year we covered the Alberta Alpine Ski event in Calgary, Canada. At that venue we trenched down into the snow with a chain saw to bury the cable so that groomers could pack snow over the top to help protect the cable. In total, we laid about 50,000 ft. of OCC fiber running all the way up the side of the mountain."

Nijak adds that OCC invests time with his group, going out into the field and seeing firsthand how installers handled the cable.

"OCC has also begun making their cable specifically tailored for us so that we can deploy and connect it more quickly," Nijak says. "So, they're partnering with us, as opposed to just saying, 'Here's our product, go use it.'"

Permanent broadcast infrastructures

Permanent broadcast fiber installations, such as TV production facilities, require the pulling of cable through a conduit that will stay in place as lasting infrastructures.

Diversified, a leader in custom mediarelated solutions, has a deep heritage in broadcast systems. The company provides design and integration services for TV stations, broadcast and cable networks, professional and collegiate sports venues, mobile production units, as well as production and post-production facilities.

Many facilities require unique cable infrastructure so Diversified has a strong appreciation of the advantages fiber optic cable offers for greater durability and ease of installation. OCC's 6- and 12strand DX Series indoor/outdoor distribution cables are often a good solution for many challenging installations.

"OCC's fiber cables are very easy to pull and manage," says Justin Guzman, Project Engineer. "This saves time and keeps our projects on track." The OCC cable has the inclusion of a rigid central strength member, which is of vital importance in permanent installations. Fiber cable is pulled through conduit

___ Continued on page 58

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Applications:



- Appliance industry
- Medical equipment
- Wire sizes ranging from 12 AWG 26 AWG
- · Anywhere manufacturers want to keep labor costs down without a large capital investment

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Meeting Increasing Demands for Broadcast & AV Applications

Continued from page 55

and is often exposed to 10 times the tension that it would normally incur. Guzman adds, "Our team has total confidence in handling OCC cable and knows signal continuity is maintained in the toughest installations."

On one project, Guzman's team had a situation where the cabling in the build-

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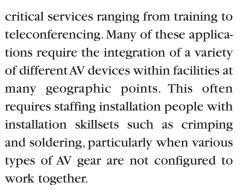
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ing needed to be plenum rated. However, the final 200 feet of cable was in an underground conduit that was subject to flood-out. "For our copper cable types we had to run both an undergroundrated cable and a plenum-rated cable," Guzman explains. "Where the conduits emerged from underground we spliced them together. For the fiber, we were able to utilize the OCC DX indoor/outdoor cable series, which met the criteria for water blocking and plenum rating. This enabled us to forgo a lot of additional fiber splicing and management."

Guzman added that the unique capabilities of OCC cable met both criteria and saved tremendous labor and unnecessary splicing.

Expediting AV applications

Companies large and small are dependent on using AV applications for



When the companies transition AV facilities from analog to digital, it requires a new type of cabling to carry digital signals. This means a different type of installation technician is needed - IT integrators. These technicians have the tools and skillset required to install fiber optic cable to transport packetized data, alongside cable to power the equipment. Performing this type of installation entails pulling both types of

cable, cutting it to length, terminating it and then plugging it into AV gear.

However, if this process can be simplified, installation becomes more efficient and less expensive. In some instances, OCC has provided AV users hybrid cables that included both the fiber optic and power cable all in one. Additionally, OCC has provided the cabling in kit form, with each kit containing pre-terminated, pre-cut cabling for connecting specific equipment housed in each of multiple (sometimes hundreds of) AV rooms. Each "plug & play" hybrid cable is labeled with a specific part number and each cable box would be designated for a specific AV location, such as a conference room, lab or command center.

This "kitting" of the plug & play cable for specific AV locations room has allowed standard installation contractors to handle the installation tasks rather than requiring the expertise of IT or AV contractors. This result has been a reduction in of as much as 25 percent in installation time as well as saving significant money on labor. Additional savings on the plug & play cable can also be realized when it is pre-terminated at the factory, which means it has also been pre-tested by factory technicians. This provides a greater degree of reliability, reducing the time to certify the installed system. For further information congact Optical Cable Corp, 5290 Concourse Dr, Roanoke, VA, 24019; Visit the web site www.occfiber.com.





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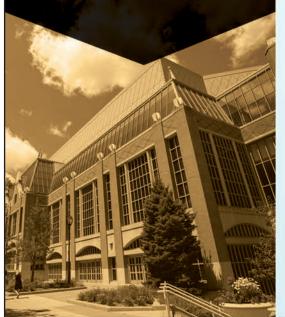
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