



# DPN DESIGN PRODUCT NEWS



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**INSIDE:** Sensors | Adhesives & Fasteners | Power Transmission | Enclosures



Coronéo's Anthony Paolitto (left) and Valerio Valentini at Renishaw's headquarters in Mississauga, ON. Inset: Part made on the Renishaw AM 250 system.

## Additive manufacturing technology medical part test-drive

Montreal's Coronéo assists dental instrument client

By Rob Colman

**M**aking an investment in metals additive manufacturing technology requires a fair amount of number crunching.

Business owners need to determine whether such an investment can deliver tangible results in a reasonable period of time.

But determining the real cost of a system can be difficult if you've never had any interaction with such a system. It isn't like purchasing a machine tool for subtractive manufacturing; while a new five-axis machine may function differently than the mill or lathe, it's still a known quantity.

For this reason, Renishaw Canada ([www.renishaw.ca](http://www.renishaw.ca)) has given a couple of its clients a chance to become acquainted with its AM 250 additive manufacturing at the company's facility in Mississauga, ON. Over the course of a couple of days it has worked with these clients to run parts of theirs on the machine, and experience what it means to handle the machine itself and work with its software capabilities.

"This isn't a case where someone is coming to us with a part and asking us to build it for them," said Mark Kirby, Renishaw's additive manufacturing manager.

"We have reviewed with these clients their business plans and part needs for such a machine and are looking at the viability of the technology with them. When we have a client that has a clear business case for such an investment, this is the next step in making

*Continued on page 8*



**2000 W rated servo motor**  
Servo motor EMME-AS from Festo features 8 output classes ranging from 100 to 2000 W and diverse compatible interfaces. The IP65 units include a digital absolute displacement encoder for single-turn or multi-turn operation.

[www.festo.ca](http://www.festo.ca)



**EtherCAT motion systems**  
With the EL7211 servo terminal, the EtherCAT I/O system from Beckhoff now offers a servo drive with an output current of up to 4.5 A<sub>RMS</sub> integrated into a 24-mm wide housing. The product is available with integrated resolver interface or with One Cable Technology.

[www.beckhoffautomation.ca](http://www.beckhoffautomation.ca)



**Digital multimeters**  
Lovato Electric has added DMG600 and DMG610 digital multimeters that display voltage and current values, meters for active and reactive energy, both imported and exported, harmonic distortion. A Wi-Fi dongle with the SAM1 app for Android and iOS.

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## Canadian Fluid Power Association inspires members



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Jayna Hefford, Sochi Olympics women's ice hockey gold medalist, inspired CFPA members at the association's annual general meeting.

## Investment casting offers much to product designers



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The ancient technique of investment casting has not gone out of fashion for new product development and production.

## Precision bearings provide rapid production rewards



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Dampening noise is a priority of most new equipment, something that precision bearings help to address early in the design process.

## Extending the scope of smart phones into surgery



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### EXCLUSIVE ONLINE BLOGS

#### CAD Industry Watch Blog

Greg Dohrman of IMAGINiT Technologies on the four high-level reasons for CAD data management

#### SEO Blog

Jeff Quipp, founder of Search Engine People examines the impact of the Internet and the business of marketing

# CFPA general meeting inspires members to act

NIAGARA-ON-THE-LAKE, ON – The inspirational voice of Olympic gold medalist Jayna Hefford graced this year’s annual general meeting of the Canadian Fluid Power Association. Hefford spoke of “calculated chaos” on the road to the women’s ice hockey championship

in Sochi, but she also left AGM delegates with advice on how to succeed: preparation, preparation and more preparation.

Preparing CFPA fluid power specialists for the future will require cooperation, education, communication and market analytics, judging by the presentations.

Eric Lanke, CEO of the National Fluid Power Association, said that the NFPA is always looking for partnerships to achieve member objectives more effectively. The U.S.-based organization includes working with the

CFPA, in addition to its regular programs such as member market condition forecast polls, data mining from outside sources like government statistics and producing “voice of the customer” technology trend reports.

Roy Pietila, VP Finance at Festo Canada, provided the Market Insights committee report to the meeting and mirrored some of Lanke’s thoughts. “Multiple data sources are best for creating forecasts,” said Pietila.

The CFPA has worked to improve its communications over the last year, according to CFPA director Alan Wheatley of Hydraflow-Pumptech. “The website redesign and social media initiatives on Twitter (@canadianfpa) and LinkedIn” have been launched, said Wheatley.

Education committee director John Bachmann appealed to members

for more involvement in the CFPA’s student Fluid Power Challenge series.

For members with technical talent that could use practical business knowledge, Bachmann pointed to a mini-MBA program – the online Industrial Distribution Leadership Certificate Program at Mohawk College. Assisting students with additional scholarship awards in their fluid power education would also help, Bachmann said.

[www.cfpa.ca](http://www.cfpa.ca)  
[www.nfpa.com](http://www.nfpa.com)  
[www.mohawkcollege.ca](http://www.mohawkcollege.ca)



CFPA celebration: George Connell, Kinecor (left); Frank Pirri, Flodraulic; John Bachmann, CFPA; Trish Torrance, CFPA; and, Alan Wheatley, Hydraflow-Pumptech. Photo: John Bachmann.

## E-T-A appoints Bay Technologies as representative



E-T-A appoints Bay Technologies as representative

RICHMOND HILL, ON – E-T-A Circuit Breakers has announced it has appointed Bay Technologies to represent E-T-A’s line of factory automation, industrial controls and process automation protection equipment.

The principal of Bay Technologies is Nicolas Haiduc, former E-T-A automation specialist.

Haiduc has spent the last year at E-T-A becoming an application expert with its line of automation electronic protectors and circuit breakers that provide the latest state-of-the-art protection, for even the most complex applications.

[www.e-t-a.ca](http://www.e-t-a.ca)

## Festo inaugurates new premises in Montreal

Festo Canada recently held an open house to mark the opening of its new offices serving Eastern Canada in the Montreal suburb of Saint-Laurent, QC.

At the same time, Festo used the occasion to celebrate the acquisition of Lab-Volt, a Quebec-based company it acquired on June 20.

Lab-Volt is now officially part of the Festo Didactic division that specializes in vocational/educational training equipment (story on page 7).

“We want to mark the year 2014 in a very special way because we have renewed our commitment to Quebec by increasing our training capabilities there. We have also created an internship for a Quebec student graduate at our R&D laboratory in Esslingen in the federal



Thomas Lichtenberger (left), president of Festo Canada, Alan DeSouza, Mayor of the Borough of Saint-Laurent in Montreal, and Patrice Charlebois, Festo managing director for Eastern Canada.

states of Baden-Württemberg in southern Germany,” said Thomas Lichtenberger, president of Festo Canada.

Festo Canada has put in place this internship course for the 2015 year. The Quebec student selected must be enrolled in a college or university professional program of

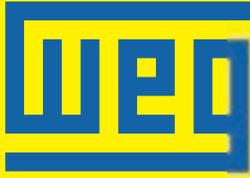
study related to automation. More details on this course will be announced later.

This R&D laboratory is part of Festo’s Bionic Learning Network that is based on principles found in nature to create technical and industrial applications.

Festo draws inspiration from the wonders of nature and has undertaken to reproduce the most complex movements of this kind, such as jumping and flying in particular, by creating a robotic kangaroo or bionic gull.

“These masterpieces of technology,” said Thomas Lichtenberger, “are used to improve energy efficiency and aerodynamics of the automation process for our 300,000 customers worldwide.”

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## Ancient and space age technologies collide

Investment casting and additive manufacturing each state their case

**D**esign engineers have to agonize over every little detail in the course of their work. Functionality, dimensional tolerances, radii of fillets and bosses, collisions and interferences all play into a component or assembly design.

But what process should I choose to make it? Injection molding, investment casting, machining or, increasingly, additive manufacturing?

In this issue, the latter three choices are discussed in-depth by contributing editor Rob Colman (cover story) and by Investment Casting Institute executive director Joseph Fritz (pages 12-13).

Both articles debate the merits of investment casting, machining and 3D printing for production and prototyping. Fritz asks, "Is investment casting the right solution?"

He recommends talking to a foundry that is suited to your needs. "There are numerous metal forming processes in use today, and each of them has its place, but all too often, components currently in production are not being manufactured with the most cost effective process," notes Fritz.

For Coronéo of Montreal, Colman reports, one of its clients wanted a medical component made out of investment castings made from aluminum. "However, to get a proof of concept, it would have required around \$30,000 or more in investments from day one, plus a

**Tolerances, fillet radii and interferences all play into design choices**

lead time of two to three months at least, and typically longer," says Coronéo president Anthony Paolitto.

He notes his company had a chance to test-drive Renishaw's AM 250 titanium additive manufacturing platform for the client. "Additive allows you to remove some of these

mechanical interfaces if you are clever with your designs. And some of this you can't do with conventional machining or casting."

Even Fritz acknowledges, "Prototype components can offer the designer valuable information that can affect the long-term cost of their design."

But, he adds, the 6000-year-old investment casting process still drives a global US\$12 billion market in raw castings and is an effective way to mass-produce parts.

I hope these stories help to reduce any agonizing you might be having over your manufacturing design decision-making process. **DPN**



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Printed in Canada ISSN 0319-8413

**Circulation:**

Nicole Cuerrier  
ncuerrier@annexweb.com  
Ph: 1-866-790-6070 Ext. 208 • Fax: 1-877-624-1940  
Mail: P.O. Box 530, Simcoe, ON N3Y 4N5

**Subscription Rates**

CANADA - 1 year \$30.00 + HST; U.S. - 1 year \$54.00  
US; FOREIGN - 1 year \$72.00 US (Airmail)

*Design Product News* is published six times a year for the specifiers of materials and components in product engineering (OEM); in-plant (systems); and design/production engineering (the crucial stage between finished blueprint/CAD drawing and routine mass production).

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**Javelin champions 3D printing for productivity**



Doug Angus-Lee of Javelin Technologies at RAPID Canada 2014 show talks about how 3D printing goes beyond just prototyping and into fixturing for more productivity gains.  
<http://bit.ly/1DAzBvB>

**Festo top executive Dr. Eberhardt Veit interviewed**



Dr. Eberhardt Veit, chairman of the management board of Festo AG, discusses recent investments the company has made, the economy and which markets he's seeing growth in.  
<http://bit.ly/ZNLfUT>

**Siemens PLM Software CEO Chuck Grindstaff up close**



Chuck Grindstaff, CEO & president of Siemens PLM Software, talks to DPN at its recent 2014 Analyst Event in Boston about his company's product lifecycle strategy and its philosophy of customer engagement.  
<http://bit.ly/1yYo0GI>

## SolidWorks 2015 launch marks 30 years of CAD Micro

TORONTO – The Hockey Hall of Fame played host to a couple of power plays with the launch of SolidWorks 2015 and the 30th anniversary celebration of CAD MicroSolutions, Inc.

CAD MicroSolutions managing director Chris Watkinson said the company began with one person in a home office. “It is heartening to see that some customers have been with the company the entire time “and to see the quality of the new ones that continue to select CAD MicroSolutions. It’s also great see the quality of staff that we’ve been able to attract –

it’s very humbling.

“Last year our customers asked us for a little more in-depth training on a day like today. The technical team did a great job in adding value for our customers. It’s always tough to take a day off of work and to justify that time spent away from the office, but I’m confident that every single person here today got a lot out of the day.”

Darren Gornall, president of CAD MicroSolutions said, “Today was about inspiring innovation and recognizing legends. A number of our customers are doing inspirational innovation now and

we want them to become legends in the very near future.

“I’m really proud of the relationship we have with SolidWorks. Recently I was in Paris at Dassault Systemes and seeing what they are doing with the 3D Experience platform is just phenomenal work.

“This will help the staff of CAD Micro make our customers more innovative.”

At the event addressing CAD Micro customers were Paul Adams, VP Worldwide Technical Sales at SolidWorks who presented the 3D Experience platform while SolidWorks Mechanical-Con-



Shoots, scores: The Great Hall with the Stanley Cup at the Hockey Hall of Fame provided the venue for the 30th anniversary of CAD MicroSolutions and its launch of SolidWorks 2015.

ceptual was presented by Michel Cloutier, SolidWorks senior territory technical manager.

[www.cadmico.com](http://www.cadmico.com)

## Turck acquires 50% interest in Chartwell Automation



Steve Boehmer, VP sales & marketing, Turck Chartwell Canada Inc.

Mark and Steve Boehmer, co-founders Chartwell Automation Inc. established April 1983, have announced that effective October 1, 2014, Turck has acquired a 50% interest in Chartwell Automation Inc.

The new company name is Turck Chartwell Canada Inc. Further, on October 1, 2017 Turck

will buy the remaining shares in the company at which point they will have 100% interest in a new subsidiary Turck Canada Inc. Mark and Steve Boehmer have signed long term management contracts and will continue in their respective roles.

“This is a very exciting event for both companies, for our employees, our distributor partners and customers,” the Chartwell founders said in a statement.

“Our greatest assets have always been our people and by joining forces with Turck we believe that it will allow us to provide a wider array of services with enhanced knowledge and expertise. Our partnership with Turck will create a more comprehensive in-

frastructure with faster response times and access to all of the resources available through the world wide network that Turck has established.”

**Partnership will create a more comprehensive infrastructure with faster response times**

Chartwell has been Turck’s exclusive partner in Canada since its start in business in 1983 having grown the Turck brand and name into one of the leading automation suppliers in Canada.

“We have similar corporate

cultures, values and philosophies on doing business. Turck Chartwell Canada Inc. will continue to provide outstanding application and technical support for the array of products in our core categories of sensing, field bus, interface and connectivity,” the Boehmers said.

“Though our name has changed, our distributor partners and customers can rely on the same personal working relationships that they have had in the past. They will still be dealing with the same people and they can depend on the same quality of work.

“Our line up of products from other world renowned suppliers will continue to be available through Turck Chartwell Canada Inc.

[www.turck.ca](http://www.turck.ca)

## Festo acquisition Lab-Volt wants to break into the European market

With its acquisition by Festo Didactic of Lab-Volt on June 20, the company now wants to reach the European education market.

Lab-Volt technology teaching equipment is intended solely for the post-secondary technical education, college and university. The company was founded in 1959 in Quebec City.

According to Philippe Ranger, director of training at the plant in Quebec City, this market has not been available so far for this company.

“Our acquisition by Festo Didactic will allow us to reach this market where we had no presence before,” said Ranger, who points out that Lab-Volt sells textbooks and manufactures technical tools for educational institutions in



Philippe Ranger is director of training at Festo Didactic in Quebec City, formerly Lab-Volt.

different teachings spread in 82 countries.

Festo Didactic, the educational division of

the German automation giant Festo AG, will preserve the Lab-Volt name through some product lines that have yet to be determined.

“If we are viewed in the context of pre-merger, Quebec accounted for about 3% of the market in terms Lab-Volt shipping educational products and Canada about 6%,” said Ranger.

Web-based learning from Lab-Volt includes courses on mobile hydraulics, PLCs, BLDC motors, diesel engines and pneumatics.

Other markets for Lab-Volt technology teaching tools include the U.S., the Middle East, Africa and Asia.

[www.labvolt.com](http://www.labvolt.com)  
[www.festo.ca](http://www.festo.ca)

# Investment casting faces additive technology challenge

*continued from Front Cover*

a decision about such an investment.”

Earlier this year, Anthony Paolitto and Valerio Valentini of Coronéo Inc. visited the Renishaw offices in Montreal for just such an opportunity. Coronéo ([www.coroneo.com](http://www.coroneo.com)) is a Montreal-based business that specializes in R&D and product commercialization of medical devices primarily for the field of cardiac surgery. Much of their work is focused on medical devices that assist in the development of cost-effective and less-invasive surgical procedures.

Coronéo’s decision to work with Renishaw, rather than its competitors was primarily due to the way in which oxygen is managed in the work chamber. “That is what drew us to Renishaw,” says Paolitto, president of Coronéo. “We had a titanium application, and we liked the way the machine draws the vacuum and manages the oxygen levels.”

There were other systems that seemed better for large production runs, or seemed close to what

## One advantage of additive is building a simple fixture for machining

they were looking for but didn’t offer the same level of support in Canada. But actually using the machine at Renishaw’s facility would help clarify for them what competitive advantage they might see from purchasing it.

Beyond Coronéo’s specialty work in cardiac surgery, they also do contract work for other medical specialists. For instance, the part they were there to produce on the Renishaw additive machine was a suction device for high volume suction in dental surgery.

A dentist had, with the help of an aerodynamicist, designed an implement with a bypass duct that reduced the turbulence in the device, thereby making it quieter. He came to Coronéo to create a prototype for him.

There are three main sections to the part that would normally have to be welded together were it to be made without using the additive process. While the central part looks simple from the outside, the interior is somewhat complex – therefore, a potentially ideal application for the additive process. “The client originally wanted to make the part out of investment castings in aluminum,” said Paolitto.

“However, to get a proof of concept, it would have required around \$30,000 or more in investments from day one, plus a lead time of two to three months at least, and typically longer. At that point, he’d have his first part and, if testing went well he would have another wait for production parts.

“Additive allowed us to make some parts that he can try. At this point he can decide whether he likes the functionality and performance of it. If, after he’s tested it, he wants to go with aluminum



Coronéo prototype of suction tool for dentistry created on the Renishaw additive manufacturing system. Inset: Computer rendering of the tool.

and make the whole thing solid, he can go the investment casting route. But if this is cost-effective using additive technology, he can look at options in stainless steel or titanium and have a higher price point instrument he can release. Hollowing it out using additive makes it that much lighter for use.”

Paolitto and Valentini, vice-president of Coronéo, also saw another advantage in using additive – building a simple fixture for machining the part afterwards. With the size of part they were looking at, this was potentially much simpler than building a custom fixture from a solid block.

They both learned a lot from being involved in the process of creating versions of the dentistry tool’s main body structure.

“You really have to be careful how you set up the part before you put it in the machine, making sure all of the surfaces are supported,” said Valentini. “We were lucky with this part, in the sense that we had the liberty that we could modify the design to make it easier to build using the additive process. This customer is very flexible. The challenge is that not every customer would be so accommodating.”

The part had to be configured in the machine a very particular way to ensure that all supports that would have to be removed after the build were on the outside. That sounds self-explanatory, but until you’ve sat with a part for some time and considered it in terms of the additive process, it was easy to see how a build could go wrong.

“In the interior of the part, we had some angles that were originally greater than 45 degrees,” said Valentini. “However, a 45 degree angle is generally the largest you can create in a structure without any support, so we redesigned it for that constraint. Anything flatter would have needed support. In our first version of the model that we built, there was a certain portion in one section that risked causing troubles because it was a longer horizontal without support. Although it didn’t cause trouble in the build, I still redesigned the support for safety’s sake.”

Paolitto believes that what they are learning through the use of the additive process will make them an ideal partner for many potential customers. “If we have a client that says they would like a certain part made using the additive process, they may not know how to maximize the



value of that technology,” Paolitto said.

“The part may be well designed but isn’t optimized for build times or productivity. Or it may be that it could be redesigned to reduce the weight of the tool. In the case of this suction tool, we drilled a little hole in the bottom of it to drain away left over powder trapped during the build. Little touches like that can significantly reduce the weight of, and improve the value of such a device. That is a value that we can offer clients.”

It doesn’t hurt that both Paolitto and Valentini are experienced designers, having worked for Pratt & Whitney, and having run Coronéo since 1997. Not only do they understand design, they also understand the bottlenecks in their own industry. “What we’ve noticed in our space is that there’s a drive to make surgeries less and less invasive,” Paolitto said. “Imagine you are developing a part for surgery and you are casting. If you find you have to optimize a part further, you don’t want to be changing castings all the time. So additive could allow development to go forward much more quickly.

“Secondly, when you are miniaturizing everything and you have moveable parts, you want to reduce the number of interfaces you are dealing with. Additive allows you to remove some of these mechanical interfaces if you are clever with your designs. And some of this you can’t do with conventional machining or casting.”

Another aspect of understanding how best to use the additive technology is how much to run in the machine at one time. As Valentini explains it, you want to design so that you run until the next day, when you want to do secondary operations on those parts.

As Kirby said, you aren’t necessarily driving for the lowest part cost. “It’s about being as agile as you can be,” he says. “It’s not just about what it can do, but how it can be done. And, of course, who the customers are going to be.” **DPN**



## Aspen Labs, Digi-Key launch PCBWeb Designer

Aspen Labs, in cooperation with Digi-Key, have launched PCBWeb Designer, a free schematic capture and layout EDA/CAD tool for design engineers. The software is available as a full-license application, with no limitations on number of parts, size or layer count, supporting a standard Gerber output. PCBWeb Designer is exclusively linked to Digi-Key's broad inventory of over four million searchable electronic components.

[www.pcbweb.com](http://www.pcbweb.com)

## ECAD/MCAD collaboration for PLM environments

Altium has announced a partnership with Aras to provide advanced PLM capabilities to ECAD design teams. Based on Altium's solutions for collaboration and ECAD design management and Aras' suite of PLM solutions, both companies work on a new approach to integrated MCAD-ECAD PLM workflows for companies with systems engineering requirements and complex mechatronic product development environments.

[www.altium.com](http://www.altium.com)



## NX 10 delivers up to 3x higher productivity

Version 10 of Siemens PLM Software's NX software includes new capabilities that deliver enhanced product development flexibility and up to 3x higher productivity, the company says. The 2D concept development solution makes it easier and faster to create designs, while enhancements to NX Realize Shape software, a fully integrated sub-division modeling environment, give designers more flexibility.

[www.siemens.com/nx](http://www.siemens.com/nx)

## NX 9 and JT converter for new and legacy data

Theorem Solutions has announced CADverter v17.2 for NX 9 from Siemens PLM Software, with translation capabilities for both new and legacy NX Data. With the ability to translate earlier versions of NX data, from 7.5 through to the latest NX 9, along with NX parts as far back as Version UGNX11.0, the new NX 9 CADverter ensures that both current and legacy data can be translated with just a single application.

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# SolidWorks challenges need for 2D drawings

Model Based Definition capability adds accuracy to the shop floor

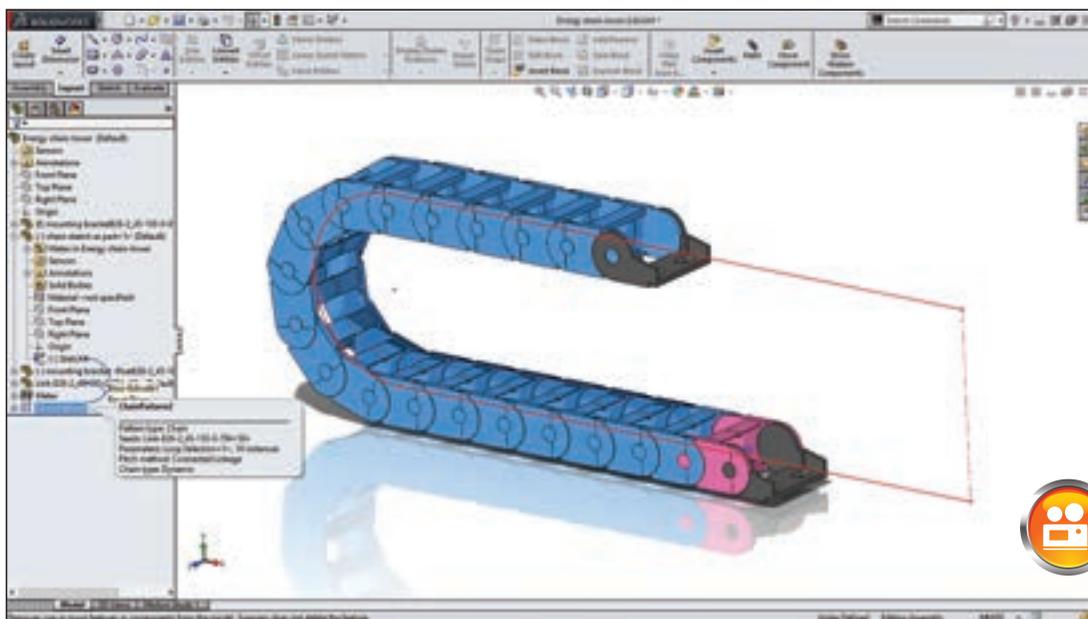
Having been involved in many different facets of the CAD industry for 15 years, I remember new releases in the past were all about the “wow” features meant to entice new customers. Often the focus was on bringing 2D users into one or another vendor’s new 3D products.

## Replacing all of the missing mate references is a great time saver in a large assembly

As a user in those years, it was frustrating to see so much R&D spent on new functionality when functionality that came in the last release was still buggy. This pattern seemed to be across the board with all of the 3D CAD products as software vendors raced to outdo each other to acquire new customers.

With SolidWorks 2015 – and the last several releases of SolidWorks – it’s clear that things have changed. With such a large user base, Dassault Systèmes SolidWorks ([www.solidworks.com](http://www.solidworks.com)) can now focus on its current customers. This is quite evident in this release by the emphasis on the end-user’s interaction with the product and with the addition of enhancements clearly targeted toward the experienced users.

SolidWorks 2015 has an overall improved performance as most operations are faster and file sizes are smaller. Experienced users will be impressed with the new functionality in 3D Splines, Variable Patterns, Asymmetric Fillet and Chain Patterns in Assembly. My favorite might seem insignificant to a casual user, but being able to replace all of the missing mate references in failed mates is a great time saver if you’ve modi-



One of numerous new features and capabilities announced by Dassault Systèmes for its SolidWorks 2015 product portfolio, the Chain Pattern feature lets users pattern components along an open or closed loop path to simulate roller chains, energy chains, and power transmission components.

fied a large assembly.

SolidWorks 2015 adds new functionality in Collaborative Sharing that is built on Dassault’s 3DEXPERIENCE Platform and allows users to store, access and share design data in the SolidWorks interface. Edrawing and DraftSight are now key components in the Collaborative Sharing environment for SolidWorks.

By granting a license of Collaborative Sharing, SolidWorks customers can give access to third-party users outside their organization. I see particular value in how Collaborative Sharing utilizes project communities to obtain feedback throughout the design process and enables non-

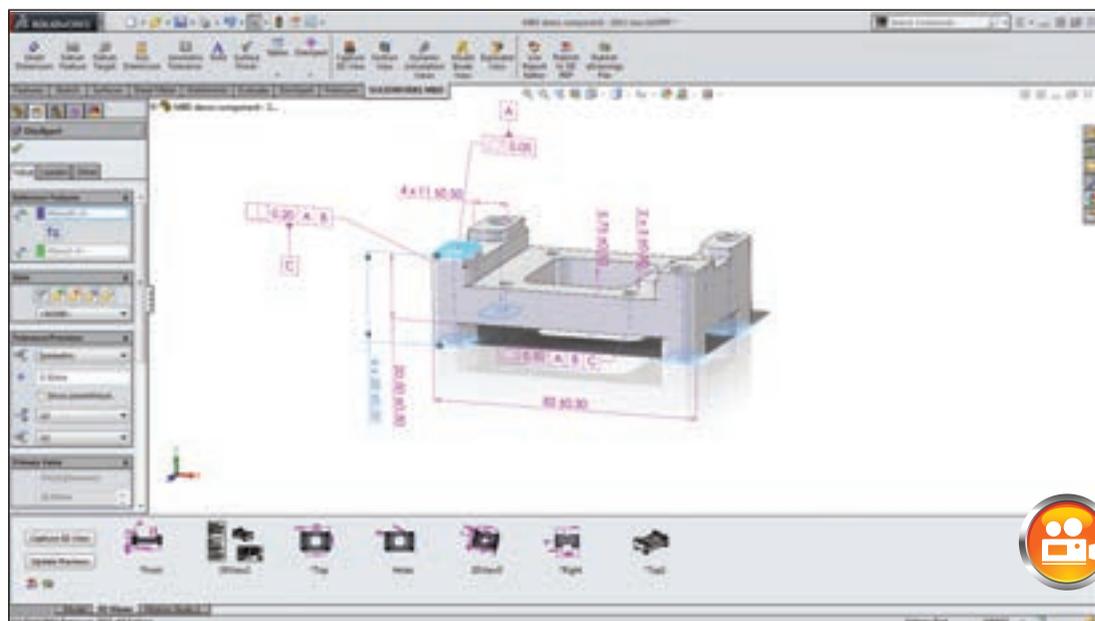
CAD users to be part of the design process.

If you’re looking for the future direction of R&D in the CAD industry and particularly in SolidWorks, in my opinion you’ll see it in their 2015 version with the launch of SolidWorks MBD (Model Based Definition). We’ve been using 2D drawings for centuries to communicate manufacturing intent and we’re still doing the same today. Regardless of how much time is spent creating 3D parts and assemblies in the end we finish with a 2D paper drawing that’s not much different than 100 years ago.

Giving a manufacturer a 3D model isn’t much better than handing them a sample part. Chances are if you gave them the part, the first step would be to create a 2D drawing. MBD may finally lead to the end of paper drawings. The goal of SolidWorks MBD is to have the required details needed for manufacturing contained within the 3D model. Having the PMI (Product and Manufacturing Information) integrated into the 3D CAD file eliminates the requirement for a 2D drawing and presents the required manufacturing information in a more concise manner.

SolidWorks MBD complies with industry standards and includes dimensions, geometric tolerances, surface finishes, welding symbols, bill of materials (BOM), callouts, tables, notes, meta properties and annotations. A user can export the 3D file with the MBD data to an edrawing or 3D PDF for easy sharing internally with other departments or externally with their client.

In summary, SolidWorks 2015 is a release clearly meant to please the user base and strives to help customers complete tasks more efficiently. **DPN**



SolidWorks MBD (Model Based Definition) MBD may finally lead to the end of paper drawings. The goal of MBD is to have the required details needed for manufacturing contained within the 3D model. Having the PMI (Product and Manufacturing Information) integrated into the 3D CAD file eliminates the requirement for a 2D drawing and presents the required manufacturing information in a more concise manner.

Neil Thomas ([neil@onecad.com](mailto:neil@onecad.com)) is the owner and founder of OneCAD Solutions ([www.onecad.com](http://www.onecad.com)), a professional engineering company created in 2004 and based in Markham, ON.

# Racing suspension systems undergo analysis

Manufacturer investigates solenoid hydraulic valve behavior with CFD

Headquartered in Sweden, Öhlins Racing AB is a very successful niche player in the global suspension system market. One of Öhlins' flagship products is semi-active suspension systems, which is based on its continuously controlled electronic suspension (CES) technology.

At the heart of Öhlins' semi-active suspensions is a solenoid hydraulic control valve that enables continuous control of the shock absorber fluid flow and damping performance. Smooth pressure-flow characteristics are achieved thanks to the unique hydraulic valve design. It is very difficult to fully understand the dynamic valve behavior given its small dimensions and high operating pressure and flow rates.

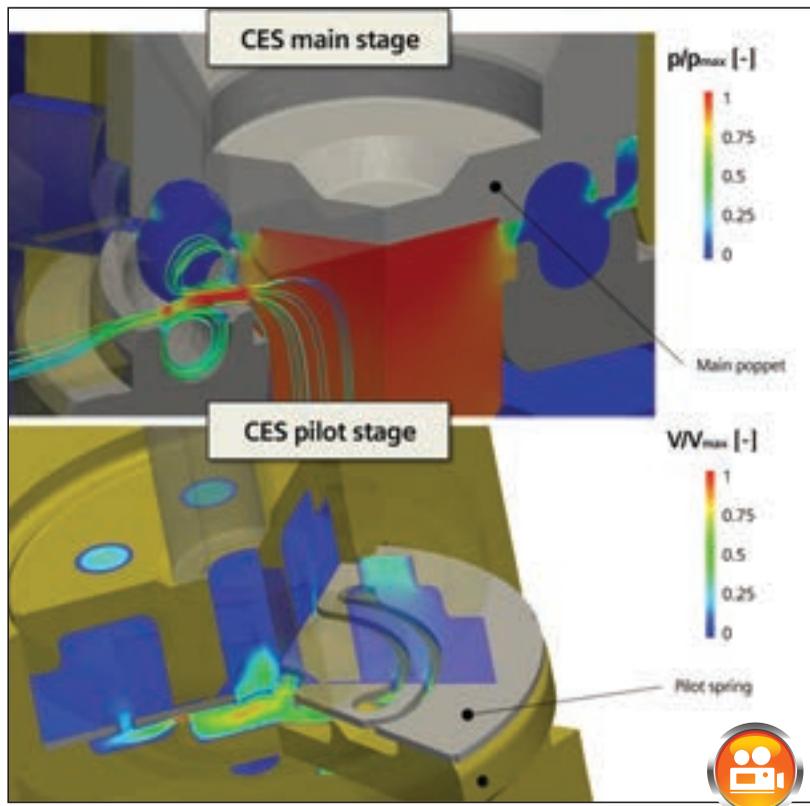
System simulation is the only way to analyze all the physical phenomena in the valve, predict its behavior and subsequently study different design options.

To extend its expertise and optimize current products, Öhlins has introduced numerical modeling into the standard engineering design process. After having considered several solutions from a number of vendors, Öhlins opted for LMS Imagine.Lab Amesim software (LMS Amesim), the mechatronic system simulation platform from Siemens PLM Software.

Design engineers found that the extensive LMS Amesim component libraries made it better suited for designing Öhlins' mechatronic products covering electric, mechanical and hydraulic domains. Using LMS Amesim has helped shift the focus from numerical development to physical modeling.

"We are not a company that specializes in modeling and simulation, and we don't want to make it our main business," said Urban Forssell, vice president of mechatronic systems at Öhlins Racing AB. "What Siemens PLM Software offered us corresponded perfectly with our requirements."

Under the CES technology development project, the use of numerical modeling was essential to understand the physical behavior of the CES valve. To increase predictability of the 1D CES valve model, Öhlins CES Technologies imported the results obtained from computa-



Delivering steady-state CFD analysis at the main and pilot stages of the CES valve.

tional fluid dynamics (CFD) simulation using LMS Amesim.

Design engineers carried out a CFD analysis and obtained critical

physical variables affecting valve behavior, such as flow coefficients and pressure distributions on moving elements. These data were cou-

pled with a detailed lumped parameter model of the CES valve. This 1D model enabled engineers to predict critical pressure/flow characteristics and the overall valve dynamic performance.

Finally, the numerical results obtained by the coupled 3D and 1D numerical modeling were validated both through measurements on specific areas of the valve and through testing of the complete CES valve.

Using LMS Amesim, Öhlins addressed several technical problems.

First, the company gained a deeper understanding of the influence of specific geometrical designs and manufacturing tolerances on the hydraulic valve's behavior. Second, LMS Amesim allowed the company's engineers to analyze the reasons behind unexpected hydraulic system behavior. Third, LMS Amesim helped the engineers predict the performance of physical product characteristics depending on different tuning combinations. **DPN**

This article was contributed by Siemens PLM Software.

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## Investment casting: achieving cost savings through part design origins

Technology has a proven 6000-year history

By Joseph Fritz

Finding its origins in ancient Egypt and China two millennia before the Xia Dynasty, investment casting is one of the oldest metal forming processes known to man.

The cost conscience design engineer strives to incorporate certain concepts

Yet, in spite of its 6000-year history, it is a relatively new manufacturing process, having its renaissance in the 1940s with the development of jet turbine engine technology.

Since that time, investment casting has found application in many of today's products, most of which are taken for granted. With more than 150 commercial foundries in the United States, plus numerous others around the world, today's global industry is estimated to produce \$12 billion in raw castings annually. A significant part of this wide-spread growth comes from the process's capability to displace costly forms of manufacture on traditional products.

Additionally, investment casting affords engineers greater versatility than other metal forming technologies when it comes to incorporating complex features



An example of lost wax casting at a foundry where molten metal is poured from a ladle into a mold. Investment casting has its origins in ancient Egypt and China two millennia before the Xia Dynasty.

into part geometry and specifying metallurgical processes to enhance component strength, thus improving component performance and longevity.

The investment casting process is comprised of several distinct steps, beginning with the injection of wax into a die, forming a wax pattern.

Patterns are assembled onto a wax tree or sprue with the final

assembly representing the cavity into which metal will ultimately be poured.

This wax assembly, often called a tree, is then affixed to a dipping handle to facilitate hand or robotic shell building. To build the shell, the tree is dipped into a ceramic slurry, backed up with stucco and allowed to dry in a controlled environment. This dipping process is successively repeated, laminating layers of ceramic material until the desired shell strength is achieved. (The ceramic shell serves as a one-time use mold, which will be destroyed later in the process.)

The wax is then melted and removed from the mold, typically in a steam dewax autoclave, tunnel kiln or both. The hollow shell is then inspected and prepared for the casting process. Typical preparations may include the application of insulation to the mold in select areas to control rate of alloy solidification, thus ensuring part fill.

The mold is then preheated to a temperature accommodating to the prescribed metal pour temperature.

Molten metal is then poured into the mold, filling the cavities and forming the parts. Though typically gravity poured, some foundries may employ the use of other casting technologies, such as vacuum, counter-gravity casting or even centrifugal casting.

The mold is then allowed to cool and the ceramic shell material, or investment, is then broken off and removed from the casting via a mechanical "knock off" process. The resulting parts are cut off the sprue, cleaned and finished. In some cases the customer may require additional metallurgical treatments be applied prior to final inspection and delivery.

The following are typical tolerances supported by the investment casting process:

**Linear:** 1 in.  $\pm$  .010 in.; add .005 in. for each additional inch

**Flatness:** depends on geometry and alloy

**Roundness:** typically, .015 in. on 1 in. diameter

**Radii, fillets:** commonly min .010 in.

**Surface roughness:** 125 RMS max

**Wall thickness:** depends on alloy



Figure 1: Investment Casting Process photo compliments of Richwood Investment Castings, photo copyright 2013.



Figure 2: Swirler for gas turbine engine is small part that replaced 27-piece fabrication.

selection

Capability will vary from caster to caster; it is highly recommended that designers consult with a foundry when specifying tolerances in their designs.

Depending on component requirements, investment casters may employ the use of special techniques to achieve desired results. Some of the factors that can drive the use of special techniques include component geometry, grain structure, volumes and time constraints.

## A 3D model of the component can be used to produce SLA patterns

Often, part geometries may call for internal passages or cavities. To produce these cavities, a foundry may employ the use of either ceramic or soluble coring in the wax injection process.

To create an internal cavity in a part, a core is inserted into the die and wax is injected around it, creating a cored pattern. Soluble cores are removed prior to shell building in an aqueous solution, while ceramic cores, which are typically used for intricate internal passages, are removed after casting in a caustic solution under extremes of temperature and pressure.

In applications where enhanced component strength is necessary, a design engineer may specify a specific grain structure to accommodate those needs.

An alternate approach to the basic process may also be required when there is a need for prototype parts or when volumes are too low to economically support wax die construction. In these cases, a 3D model of the component can be used to produce stereo lithographic array (SLA) patterns, machined wax patterns or printed wax patterns. These patterns

take the place of the injected wax pattern, and provide the designer with a cost effective solution to create small runs of parts in a timely fashion.

It is always beneficial to involve the foundry as early as possible in the component design process. Doing so will result in a shorter development times with a smoother transition to robust production. Additionally, seeking consultation from a foundry on component design is key to establishing a cost-effective approach.

Typically, many factors affecting manufacturing cost are controllable in the design phase. Conversely, cost increases with requirements. Dimensional tolerances, material selection, testing requirements and supporting documentation all play a role driving cost effectiveness.

For example, when considering part dimensional tolerances, the cost conscience design engineer strives to incorporate the following concepts whenever possible:

- Make thick-thin transitions gradual
- Use radii and fillets in corners
- Stagger intersections
- Account for machining stock

Consider post-cast processing such as straightening and surface finishing options.

Cost-effective part design is no accident. It takes planning and careful consideration of the more subtle cost drivers that can be overlooked. For example, a designer should refrain from placing datum targets on locations where gates will be located and never dimension a part from outside the part geometry.

A lack of clear requirements during the quotation process will also be a cost driver. It is important to be specific in the request for proposal process. Another thing to be considered is the economic benefit that can be derived from running prototype parts before finalizing all design requirements. Prototype

components can offer the designer valuable information that can affect the long-term cost of their design.

All of these factors, and numerous more, should be considered to affect a design suited for low-cost manufacturing. The best way to address these factors is to work with an experienced foundry before finalizing your design, if not at the start of it.

There are numerous metal forming processes in use today, and each of them has its place, but all too often, components currently in production are not being manufactured with the most cost effective process.

Investment casting can offer net-shape or near-net-shape solutions to components that are currently being machined from solids. These components can have higher manufacturing costs than castings due to the inefficient use of material and excessive machine time.

One such example would be that of an Inconel impeller that was formerly machined from solid stock. By resourcing this component as an investment casting, the original equipment manufacturer realized a 45% savings in unit cost as well as a 40% reduction in lead time.

Components made from fabrication or weldments can also afford manufacturers a cost savings when manufactured as a single-piece casting by eliminating labor, decreasing lead time and enhancing component life. One such example would be that of a swirler for a gas turbine engine that was previously manufactured as a 27-piece weldment. This is a very complex part, with .070 in. and .030 in. holes at critical angles being machined into the part.

The investment casting solution was to manufacture this as a one-piece casting, with the holes integrally cast into the product. This approach not only had a significant effect on component manufacturing cost and lead time, but it also extended the useful life of the part, significantly reducing operational costs for the end user.

The only way to answer the question "Is Investment Casting the Right Solution?" is to talk with a foundry that is suited to your needs. If you don't already have a relationship with an investment casting supplier, call the Investment Casting Institute. The institute receives inquiries on a regular

basis, and offers guidance to manufacturers in locating foundries well suited to their needs.

Contact the Institute at 201-573-9770 or email [ici@investment-casting.org](mailto:ici@investment-casting.org). **DPN**

Joseph Fritz is Executive Director, Investment Casting Institute. Reprinted with permission from INCAST magazine, August 2014.

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# How to properly pin a shaft and hub assembly

Coiled pins translate to lower total assembly costs

One of the primary benefits of using a coiled spring pin to affix a hub or gear to a shaft is the coiled pin's ability to prevent hole damage. Another benefit is that the coiled pin absorbs wider hole tolerances than any other press-fit pin. This translates to lower total manufacturing costs of the assembly.

**A cylindrical pin concentrates the compression force on only two circumference points**

There are a few design guidelines that must be adhered to in order to achieve the maximum strength of the pinned system and prevent damage to the assembly:

The design guidelines can be divided into two groups: 1) the shaft and hub, and 2) the pin.

When considering the shaft and hub, the hole in a shaft should not exceed 1/3 of the shaft diameter. For mild steel and nonferrous shafts, standard duty pins are recommended.

The extra strength of a heavy-duty pin is only beneficial if the hole is less than 1/4 the diameter of the shaft or if the shaft is hardened.

It is recommended that the hub be designed with a minimum wall thickness of 1.5 times the diameter of the pin. Otherwise, the strength of the hub will not match the shear strength of the pin (Figure 1). As the wall thickness of the hub increases, so does the area of material around the pin.

The diameter of the holes through both the shaft and hub should be precision matched to eliminate any movement of the pin within the holes.

It is recommended that the difference between the hole diameters in the hub and shaft not exceed 0.05 mm (.002 in.) to prevent movement of the parts relative to each other. Otherwise, the pin will

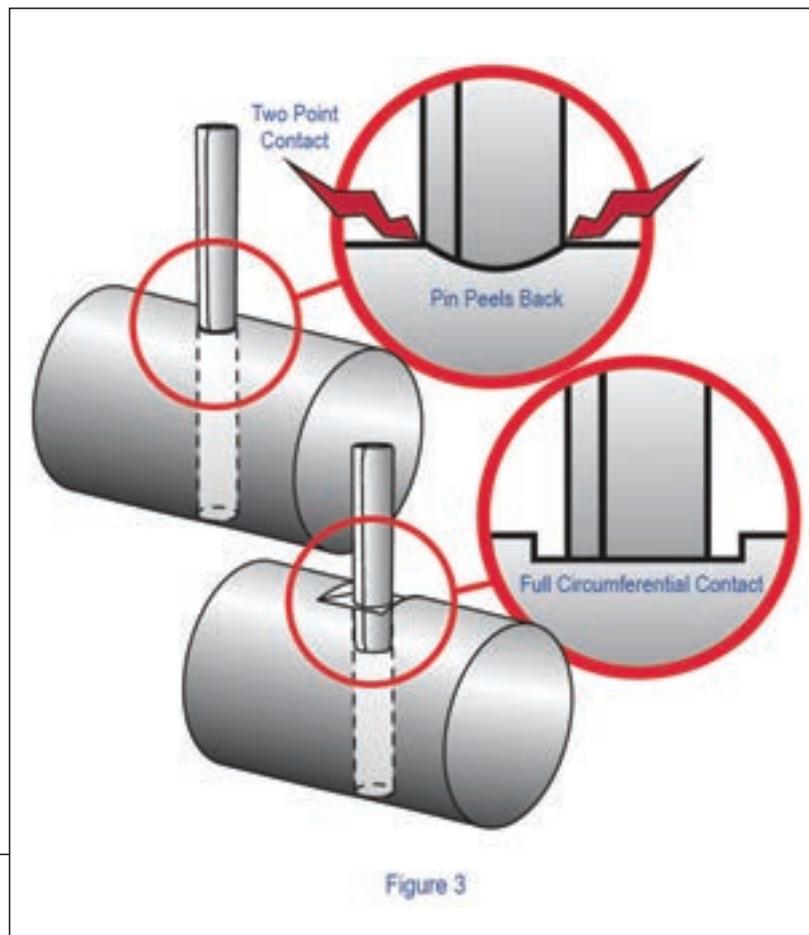
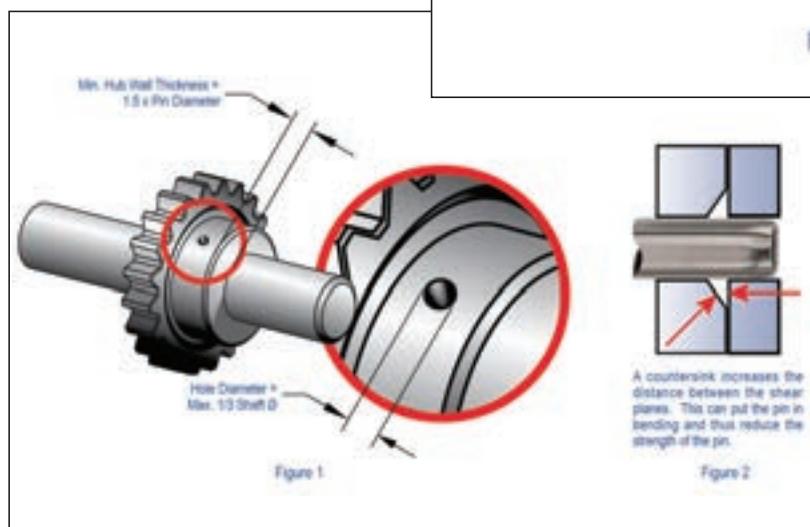
be subject to dynamic loading such that a very small change in velocity could equate to a significant change in force impacting the assembly.

The hole should be centred in both the shaft and hub to prevent stress concentration and ensure there is enough material around the pin to withstand the applied forces.

If the holes cannot be precision matched, dividing the tolerance between the shaft and hub is recommended.

The larger half of the tolerance should be applied to the component with the longest engagement length, and the smaller half should be applied to the other component.

Countersinks on the holes are not recommended. In addition, the outer diameter of the shaft (OD)



standard duty pins. Standard duty coiled pins have the optimum combination of strength and flexibility for use in nonferrous and mild steel components.

They are also recommended for use in hardened components as they have greater shock absorbing capabilities.

Heavy-duty pins should only be used in hardened materials where space or design limitations rule out a larger diameter standard duty coiled pin.

An exception to this rule is that austenitic (nickel) stainless steel pins should never be used in hardened components.

A light duty pin is recommended for soft, brittle or thin materials or where holes are close to an edge. In situations not subject to significant loads, light duty pins are often used because of the lower insertion forces required. **DPN**

Although this article, contributed by Spirol International, offers general design guidelines, it is recommended that application engineers who specialize in fastening and joining be consulted to ensure the optimum design is employed for each application. [www.spirol.com](http://www.spirol.com)

between the periphery of the hole and pin, and to ease installation, a flat should be placed on the exterior surface of the hole (Figure 3).

When considering coiled pins, it is important to start with the load to which the pin will be subjected. Then evaluate the material of the host to determine the duty of the coiled pin.

The pin diameter needed to transmit the load in the proper duty can then be determined from the shear strength tables located in the Spirol coiled spring pins design guide/product catalog taking into consideration these further guidelines.

Wherever space permits, use



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Henkel Corp. has introduced Loc-tite 4090, a versatile hybrid adhesive that combines the bond strength of a structural epoxy with the speed of an instant adhesive, the company says. This structural cyanoacrylate adhesive is said to offer rapid, high strength bonding to a range of substrates along with impact and moisture resistance, and temperature resistance to 300°F. The high viscosity gel adhesive fixtures in 3 to 5 min when used to fill gaps up to 0.2 in.

[www.henkelna.com/4090](http://www.henkelna.com/4090)

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[www.masterbond.com](http://www.masterbond.com)



## Large deflection wave springs

Crest-to-Crest wave springs from Smalley are pre-stacked in series, decreasing the spring rate proportionally to the number of turns. Uses are typically applications requiring low-medium spring rates and large deflections with low-medium forces. Among the major advantages, this design eliminates the need to keep the wave crests aligned. The need to use a key locating device is not necessary.

[www.rotoprecision.ca](http://www.rotoprecision.ca)

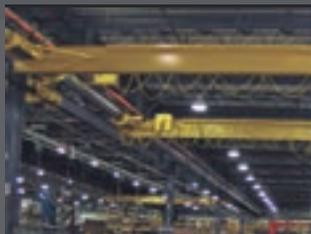
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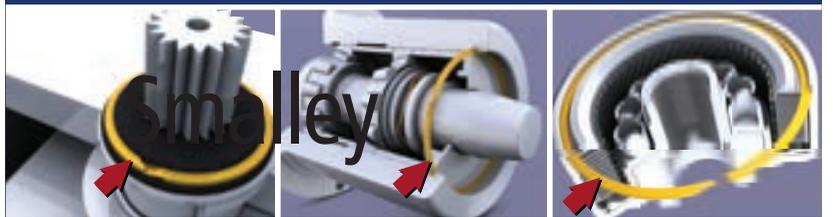
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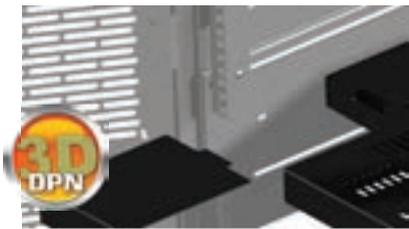
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The co-location rack cabinet system from Hammond features four different bay configurations and several roof options. The CLC series features one single frame that allows multiple bay configurations. Vented shelves include rear removable panels for vertical PDU installations. Front and rear perforated doors are designed for high airflow. Doors include 4-pin combination lock with key override. Vertical cable managers can be installed either top or bottom. Units are designed to accommodate sliding rail mount kit on servers.

[www.hammondmg.com](http://www.hammondmg.com)

## Battery-operated electronic locking system

Southco, Inc. has launched an integrated self-contained electronic locking system that incorporates an access control device, electronic lock, electrical override and power supply. The AA battery-operated model SC unit is available with keypad or RFID access, features a styled, drop in assembly and provides electronic locking functionality for a variety of applications. The system features a single component design that can be easily mounted into a 25 x 150 panel prep, the company says, simplifying the integration of an electronic access solution into a cabinet design, and eliminating the need for the wiring or connecting of separate components.

[www.southco.com](http://www.southco.com)



## Isolator door cover protects operators from live components

Rittal Systems has introduced the TS 8 isolator door cover. When deployed in tandem with the actuation mechanisms, adjacent door locking and interconnecting rods, the cover fulfills all requirements of the UL 508 A standard. Featuring multiple technical updates and design features, the 125-mm-wide isolator door covers prevent operators from opening the enclosure and touching live electrical components. The isolator door cover is mounted on the side of the enclosure to which an actuator lever or isolator switch, as the master switch, can be integrated.

[www.rittal.ca](http://www.rittal.ca)

## Electronic enclosures combine both plastic and aluminum construction

OKW has launched the SYNERGY electronic enclosures range – its first to feature both plastic and aluminum. The range of 36 individual enclosures is said to have a very high quality surface finish. Units feature OKW's new fast-connect system based around four internal assembly pillars that hold each enclosure together. The glass-reinforced polyamide pillars snap in to the recessed top panel, locate the assembly extrusion and are fixed to the bottom part with four stainless steel Torx T10 anti-tamper screws. Several pillars can be snapped together to create custom heights in 0.20 in. increments on request. The main body section of each case is extruded from AlMgSi 0.5 aluminum. PCBs can be mounted in the top and bottom for maximum versatility and efficient use of space. Top and base sections are manufactured from UV-resistant ASA+PC-FR (UL 94 V-0). They are black (RAL 9005) as standard but custom colors can be specified on demand.

[www.okwenclosures.com](http://www.okwenclosures.com)

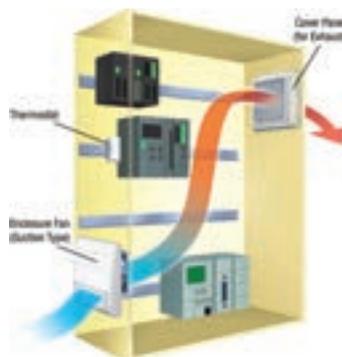


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## Enclosure fan modules offer IP protection

Oriental Motor has introduced enclosure fan modules that offer AC or DC input, greater IP protection, simple installation and one part number inclusive of all components, the company says. The fan modules are inclusive ventilation packages offering exhaust or suction airflow. Units are offered in 3 product classes and 5 outer frame dimensions. Enclosure modules without fans are also available. Installation and maintenance is simplified via utilizing a square mounting hole.

[www.orientalmotor.com/enclosure](http://www.orientalmotor.com/enclosure)

## Large enclosure vent for heat and moisture

Bud Industries has introduced its IPV series PC/PC wide opening external vent. Suitable for outdoor use, the enclosure vent is designed to allow circulation of a large volume of air while offering basic protection from rain-water and falling debris. It is equally useful indoors on larger cabinets where a large vent helps to protect electronics from heat and moisture. Typical applications for the new product include control boxes, WiFi and radio housing, power supply housing, access controls, high heat systems, corrosive environments and general factory environments. The RoHs compliant fibreglass enclosure is available in 2.91 x 2.91 x 1.1 in. and 3.95 x 3.95 x 1.25 in. sizes.

[www.budind.com/99](http://www.budind.com/99)



# Power Transmission PRODUCTS

## Bushed couplings complement different flange styles and offer greater bore capacity

Baldor Electric Company has introduced an addition to its Baldor-Dodge coupling product offering – the QD bushed Para-Flex coupling. The QD flange design complements the company's Taper-Lock and bored-to-size style flanges. The QD flanges are available from stock and accommodate Baldor-Dodge Para-Flex elements. The Baldor-Dodge Para-Flex QD (PXQD) product line is available in sizes PX50 through PX200, with torque ratings through 82,500 in. lb. Para-Flex QD flanges offer greater bore capacity, allowing customers to save money by downsizing their coupling selections, the company says.

[www.baldor.com](http://www.baldor.com)



## Right angle series of gearboxes

Wittenstein alpha has announced the SC+, SPC+, TPC+ product line for low ratio right angle applications. Providing a 2:1 ratio as line speed requirements continue to increase, an ability to run lower ratios becomes crucial, the company says. The SC+ uses a high-speed bevel design with reduced output friction to achieve speed increases of up to 30% for enhanced throughput. The gearboxes are intended to be a modular set to provide different ratios and output configurations. The SC+ contains the spiral gearset in a single stage design with output shaft configuration, and is available in 1:1 and 2:1 ratios. The SPC+ contains the spiral bevel gearset, but is also equipped with an SP+ shaft style planetary output stage, providing ratios to 20:1. The TPC+ contains the spiral bevel gearset, but it also equipped with a TP+ flange style planetary output stage, providing ratios to 20:1.

[www.wittenstein-us.com](http://www.wittenstein-us.com)

## Electronic fill & bleed pneumatic circuits

A fill and bleed circuit is a combination of pneumatic valve components used to inflate a volume or apparatus in one controllable function, and to release or vent pressure in a second controllable function. The circuits are commonly used in many applications where a particular pressure, firmness, or position can be controlled with the addition or venting of pressure. Circuits from Clippard feature: compact, robust design; fast response; long life; multiple flow and pressure options; variety of power and connection options; and, RoHS compliance.

[www.clippard.com](http://www.clippard.com)



## High torque stepper motors

Oriental Motor has announced the CVK series, compact standardized 24 Vdc input driver combined with performance driven, high torque stepper motors for the optimum application results. The CVK series replaces the CMK and CRK round shaft open frame packages and features 2 motor types with 3 basic step angles. Choices include 1.8°, 0.72° or a 0.36° step angle, each with specific performance advantages. The driver is matched to the motor type with maximum current setting flexibility.

[www.orientalmotor.com](http://www.orientalmotor.com)



## NFPA high-pressure hydraulic cylinders

Eaton Corp. has announced a line of NFPA small and medium bore tie rod hydraulic cylinders designed for a broad range of industrial applications. The Vickers NZ cylinder line has a solid base design featuring the Sure Seal sealing system, special rod and piston wear band, optional captured cushion, and an easy-to-service unitized rod cartridge, Eaton says. Units also feature hardened piston rods, high yield strength tubes and pistons, and steel heads/caps. The line has standard bore sizes from 1.5 to 8 in. and broad range of stroke lengths.

[www.hydraulics.eaton.com](http://www.hydraulics.eaton.com)  
[www.motioncanada.com](http://www.motioncanada.com)



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# Precision bearings provide rapid production rewards

Dampening noise is a priority of most new equipment

By Jeremy Gong

A factory, warehouse, or distribution center is inherently a noisy environment. Over the last few years, though, noise has become a big issue – simply increasing the speed of a few motion systems can increase the noise to a level where it is detrimental to communication and wellbeing in the workplace. As such, dampening noise is a priority of most new equipment.

The cost conscience design engineer strives to incorporate certain concepts

The proper bearing can greatly reduce the noise problem. By their nature bearings aren't silent components, but newer designs incorporate features that help lessen noise. Bearings that would fall into the precision category are also able to



Each Thomson Super Smart Ball Bushing Bearing utilizes precision ground balls manufactured to high quality standards for roundness and shape for maximum load capacity, travel life and performance.

run at high speed, typically from 1.5 to 3 m/s, and they tend to eliminate bearing binding or chatter.

Bearings manufactured more precisely usually have a coefficient of friction of 0.001 to 0.002. A low coefficient of friction also reduces stick-slip, which is another factor to consider when selecting precision-type bearings.

To help dampen noise, pre-

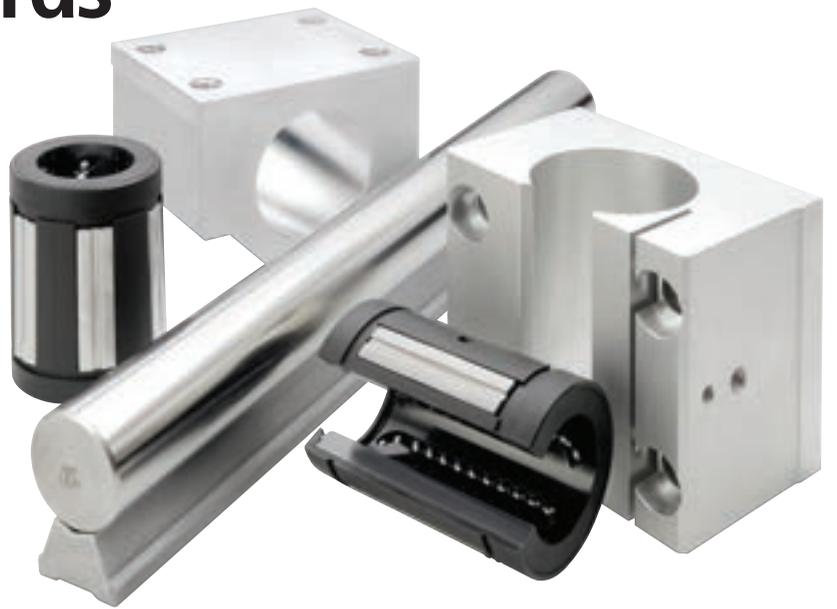
cision-type bearings generally have smaller ball elements. The smaller the balls, the less contact area is available among the balls and the less space there is between them, all of which helps reduce chatter and thus reduce noise levels. Plus, much of the steel that's not used for transfer of load is replaced with a polymer, such as Delrin (Polyoxymethylene).

The ball return portion of the bearing is one such area where polymers are used instead of steel because the balls aren't under load and polymers can help reduce noise. The main steel components of such bearings are usually the shaft, each ball, and the bearing plate.

In conveying equipment, not every roller needs to have a precision-type bearing to reduce noise or lengthen life. Conveyor manufacturers will often put rollers with precision bearings in about one-quarter to one-third of the conveyor rollers. This strategy can also be used on existing equipment, replacing old, worn rollers with ones using higher quality bearings.

For those applications where acceleration is important, precision-type bearings can handle higher acceleration requirements than standard bearings. Some precision bearings handle acceleration rates to 140 m/s<sup>2</sup>.

Bearings installed on equipment face tougher alignment challenges. Bearings often have to accommodate either dynamic or static misalignment, such as a warped roller shaft or a deflected head shaft on a loaded belt conveyor. Chatter is often an initial sign that there's misalignment in the system. Bearings such as spherical roller bearings can accommodate some "wobble" while carrying full system load. There are a lot of torsional alignment inaccuracies in the base carriage of many



Metric Super Ball Bushing Bearings from Thomson offer a coefficient of friction as low as 0,001. This allows the use of smaller less expensive motors, belts, gears and ball screws, when replacing high friction, plain bearings.

machines.

However, some bearing features handle such challenges well. Precision hardened rings enable a bearing to find its own proper position under load, which evens wear and thus, lengthens life.

Self-alignment enables a bearing to compensate for misalignment that results from imperfections in housing-bore roundness and parallelism, deviations in flatness of mounting surfaces, imperfect system assembly, or deflection at load.

Three particular types of misalignment are:

- Pitch, or shaft angular deflection or misaligned housing bore
- Roll, or distributed load on the ball tracks
- Yaw, or skewing between ball tracks and shaft.

Manufacturers can predict, with high accuracy, how long a bearing will last in a given application, which is a significant advantage for equipment manufacturers that offer extended life and warranties on their equipment.

While precision type bearings offer the advantage of longer wear, lubricating and reducing contamination are still parts of the equation. Most precision bearings have a lubrication port or pillow block for oil.

Contamination is also reduced by proper lubrication.

However, when an application can't be lubricated according to a schedule, grease should be used

because it allows a longer time between lubrications than oil.

Proper installation can keep maintenance needs low. Customers changing their own bearings should pay attention to maintaining tight mountings and alignment, and eliminating vibration. All bearing manufacturers have written procedures and recommendations that should be followed to ensure correct shaft seating, mounting tightness, and unit alignment.

Alternatively, the bearing manufacturer can be brought in at the beginning of equipment design. Bearing manufacturers typically look at load, speed, and life, along with other critical factors in the design of the system. Also they often can help with drive system selection as well as other system components.

In general, any application can benefit from precision-type bearings. Precision bearings are increasingly coming into medical and semiconductor applications, especially in pick and place equipment. As semiconductor chips get smaller, positional accuracy becomes more critical. And even in standard applications, OEMs are turning to precision bearings because they offer more extensive warranties or a way to differentiate themselves from the competition. **DPN**

Jeremy Gong is Global Product Line Manager Linear Bearings & Guides at Thomson Linear ([thomson@thomsonlinear.com](mailto:thomson@thomsonlinear.com)). [www.thomsonlinear.com](http://www.thomsonlinear.com)

## Lead screws automate hospital beds

Technology has advantages over hydraulic and pneumatic alternatives

There are more than a handful of key factors when designing a bed for the modern hospital. Safety, power, size, comfort, reliability, cleanability and maintainability are all significant considerations.

### Simplifying the design of safe, quiet, and reliable power-driven positioning

The FDA's Guidance Document, "Hospital Bed System Dimensional and Assessment Guidance to Reduce Entrapment," and IEC requirements standard 60601-2-38 are driving increasingly complex design geometries and safety features, meant to prevent pinch-points and areas of entrapment. Movable sectional rails and more points of articulation in the frame and new areas of bed movement will benefit from the kind of precise motion control and positional feedback that is available with linear actuators.

The more movable components that are included in a bed design, the more likely it is that areas of high strain or lifting moment will occur. And, with geometric size constraints in mind, more functionality must be achieved in the smallest possible footprint.

To achieve patient comfort and assist in therapy, there is a growing need for increased movement and articulation (with the concomitant need for linear actuators). Lift or sit assist and other solutions, designed to give better care with less demand on caregivers, require new design strategies.

Increased emphasis on prevention of hospital-based infection demands good cleanability of all touch surfaces, an ideal use for smooth-surfaced enclosures and guards. Small-footprint linear actuators help simplify enclosure design.

Designs must target the highest possible reliability and be maintainable. To meet the realities of demanding medical environments, components and mechanisms must be designed for quick return to full, safe usability.

Helping to solve all of these challenges, precision linear actuator systems simplify the design of safe,

quiet, and reliable power-driven positioning.

Linear actuators are a combination of an electric motor and an acme screw or a high efficiency ball screw. They are designed for easy installation directly into industrial or commercial applications, integrating easily with increasingly complex moving components and controls.

Linear actuator systems for automatic hospital beds can range from 2 in. stroke actuators to 24 in. stroke actuators with power to handle up to 6000 N loads.

Whatever the need – lowering, raising, repositioning, mobility, patient transfer linear actuators make small footprint design possible by combining high-efficiency motors with precision-formed metals and engineering resins.

Linear actuators contribute directly to smooth, precise and quiet movement that is designed to enhance patient comfort. With their quiet operation, highly-controllable motion and lock points, electric linear actuators continue to supplant other types of hydraulic or mechanical systems.

Precision manufacturing and materials engineering help ensure the reliability of linear actuators. Low-friction, precision-machined surfaces and dimensionally-accurate plastics molding which can utilize PTFE-infused or self-lubricating resins help reduce maintenance.

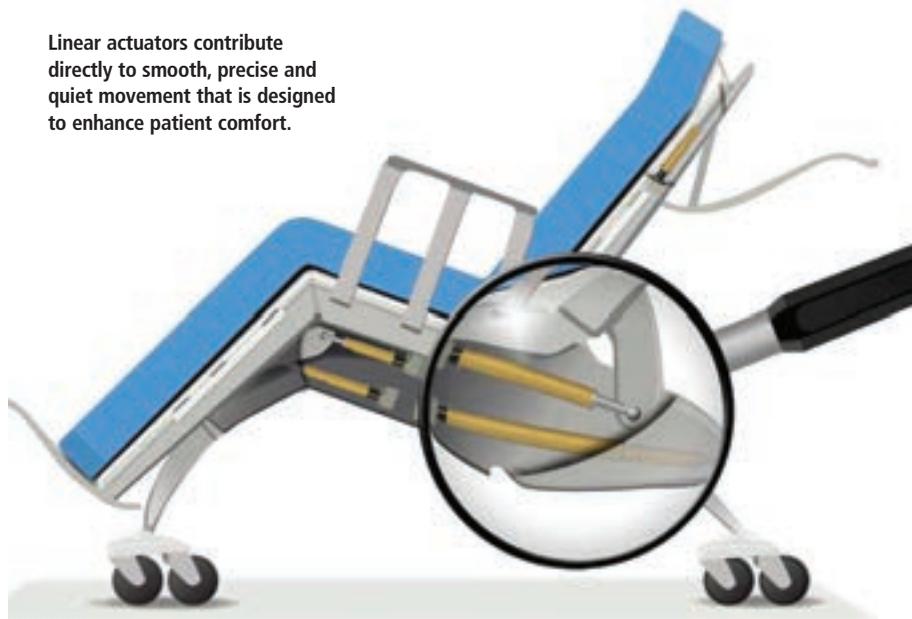
Enclosure design and other design features for cleaning are simplified with linear actuators, thanks to their small footprint and flexible design options.

Fully modular linear actuator design, plus a broad range of mounting options, work together in the creation of components that can be field-modified, repaired or swapped out quickly, reducing time constraints on medical bio-engineering and maintenance personnel.

Linear actuators are well-suited to a broad range of design objectives, including lifts and rotators, sit-to-stand lifts and mechanisms for patient transfer.

Simple installation is a hallmark of linear actuators – especially compared to hydraulic and pneumatic linear actuator systems – with the additional advantage of requiring

Linear actuators contribute directly to smooth, precise and quiet movement that is designed to enhance patient comfort.



space-demanding hoses or pumps.

Helix Linear Technologies offers a product line that includes rolled, milled, or ground screws and nuts, in standard and customizable sizes. The company provides the flexibility required to service the expanding and evolving customer-driven market for precision linear motion products with its Acme, Trapezoidal, or Speedy (high lead) threads with a precision

low-backlash nut, or a state-of-the-art anti-backlash design. **DPN**

This hospital bed case study was contributed by Helix Linear Technologies, a subsidiary of Nook Industries. Helix offers custom components and its design team will work with manufacturers to create linear actuators that meet their individual motion, NVH, power and footprint specifications. [www.helixlinear.com](http://www.helixlinear.com)

An advertisement for HARTING Canada. At the top right is the HARTING logo with the tagline "Pushing Performance". Below the logo is the text "Make a lasting connection with HARTING Canada". A horizontal chain graphic runs across the middle. Three circular callouts are attached to the chain: "Ethernet Connectivity" (showing network cables), "Communication Connectivity" (showing various communication cables), and "Industrial Connectivity" (showing industrial connectors). The background is a light blue gradient.

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# SAE Supermileage demonstrates Canadian engineering ingenuity

Our universities score 5 of 11 top finishes

Every year since 1980 the SAE (formerly Society of Automotive Engineers), the American automotive engineering regulatory and standards body, has held its Formula Supermileage competition. It flowed from heightened concern over automobile fuel economy following two “oil crises” of the 1970s.

Plastic must be able to withstand tight clamping pressures without buckling when hot

Supermileage challenges university engineering students (there was also high school division until 2009) to pit their ingenuity and technical skills against other schools in designing and constructing a vehicle that achieves the highest fuel economy under controlled conditions.

SAE sets the parameters and specifies the engine so all teams start from the same base, but there is still lots of room for engineering creativity.

Supermileage is part of SAE's Collegiate Design Series (CDS) that includes many other competitions like Formula SAE (race cars), Formula Electric (electric cars) and Baja SAE (off-roaders).

CDS gives students a break from classrooms and books, an opportunity to apply their knowledge and theories to a solid, practical hands-on project, spurred by the stimulus of competition.

And it's not just technical skills that are tested. Participants also make business cases, prepare written reports and deliver technical papers on their projects.

Supermileage cars have always been powered by a 3.5 hp air-cooled, four-stroke, Briggs & Stratton one-cylinder gasoline engine that's more at home mowing grass or rototilling gardens. It has served well, but after 35 years there is a move to progress to a B&S Junior 206 model competition engine.

Starting with the standard engine, students can experiment in areas like air/fuel induction, low friction oils, bearings and seals, and drivetrains.



The 2014 SAE Supermileage winner was Université Laval of Quebec City with 1145 mpgU.S.

They design and build their tiny one-passenger cars, often with carbon fibre bodies, to be as light and aerodynamic as possible. Low rolling resistance tires also help. Aluminum is a typical frame material and minimum driver weight is 59 kg, with ballast added for lighter ones.

The project culminates in a track competition in June at Eaton Corp.'s test facility in Marshall, MI. A Supermileage sponsor, Eaton is a highly diversified engineering and manufacturing company that supplies components to the automotive industry and other sectors.

Cars must complete six laps of the 2.6 km track, a total of 15.6 km at a minimum an average speed of 24 km/h, all under the watchful eye of competition manager Jim Gluys, an Eaton design engineer. Maximum velocity allowed is 40 km/h.

If you wonder how Canadian universities fare in Supermileage, the answer is very well.

The 2014 SAE Supermileage winner was Université Laval of Quebec City with 1145 mpgU.S., or 0.205

L/100 km – with bonus marks for its design report.

Under the guidance of Laval faculty advisor Professor Francois Mathieu-Potvin, team leader and software engineering student Lucas Brunet manages the operation and is the team's liaison officer.

The team members are mostly from mechanical engineering plus some from electronics, software and physics. To carry the Laval DNA forward there are some carryover members from the previous year.

Laval's car body is carbon fibre and the team strives to lower the weight every year. The 2014 car is a feathery 41.9 kg and whispers through the air with an ultra slippery 0.07 coefficient of aerodynamic drag, determined by computational fluid dynamics (CFD).

An important contributor to Laval's success is a student-built chassis dynamometer used mostly for engine and ECU (engine control unit) tuning, allowing the team to optimize performance of the engine and other components.

Second place went to Ecole de Technologie Superieure in Montréal with 1134 mpgU.S., or 0.207 L/100 km. Brigham Young University of Provo, Utah recorded the top 1,211 mpgU.S., but a lower report score gave it third place overall.

Five of the top 11 places went to Canadian universities. The others were Dalhousie (6th); Concordia (10th); and University of Moncton (11th). Nineteen teams competed.

SAE's Collegiate Design Series graduates are highly sought after by the auto industry for their keen automotive interest, analytical abilities, and the initiative and dedication to venture beyond the traditional curriculum.

During the past 10 years Canadian universities have won SAE Supermileage six times: four by Laval and twice by University of British Columbia. Canada's engineering education is in good hands. **DPN**

Bill Vance (bvance1@cogeco.ca) is an author and founding member of the Automotive Journalists Association of Canada.

## Midget fuse holders rated for Class 1 Division 2 and Zone 2 environments

DePro FMC Midget Fuse Modules from Emphatec are Class 1 Division 2 certified midget fuse holders. These include a single phase and a three-phase module. The single phase version has terminations for both line and neutral so this module is the equivalent of a midget fuse terminal block and a feed through terminal block. The status LED is between the line and neutral on the output so it provides fuse healthy indication – meaning no leakage current if the fuse blows. The three phase version has terminations for the 3 phases on the input and output sides (there is no neutral termination).

[www.emphatec.com](http://www.emphatec.com)



## Explosive area fuse and disconnect terminal blocks

Phoenix Contact has expanded its range of fuse and disconnects terminal blocks with screw connection to include a new variant for use in potentially explosive areas (Zone 2). The new terminals meet the requirements of the following ignition protection concepts. CSA: Ex nA IIC Gc; AEx nA IIC Gc; Class I zone 2; Class I, Div. 2, Groups A, B, C, D. IECEx: Ex nA IIC Gc. ATEX: X II 3 G Ex nA IIC Gc; Ex i. The new Class1Div2 fuse block is a plug-in element rated up to 6.3 A in explosive area. The terminals are characterized by their current-carrying capacity of up to 20 A.

[www.phoenixcontact.ca](http://www.phoenixcontact.ca)

## Three-wire, IP67-rated photoelectric sensors

AutomationDirect QM series 30 m range photoelectric sensors are IP67-rated and available in three-wire NPN or PNP styles and with visible red and infrared versions. The mini-rectangular photo eye sensors are made with plastic housings and have either an attached two-meter output cable or an M8 quick-disconnect connector. The series includes diffuse, diffuse with background suppression, retroreflective, retroreflective for transparent objects, and through-beam styles. Retroreflective models include one rectangular reflector; through-beams are an emitter and receiver pair.

[www.automationdirect.com/photoelectric](http://www.automationdirect.com/photoelectric)



## Analog interface for explosion-proof rotary encoders

POSITAL has added an optional analog electronic interface to its range of explosion-proof IXARC rotary encoders. The devices have been designed to comply with ATEX directives for Category 3 electrical products and are suitable for Zone 1 and Zone 21 conditions (i.e. potential exposure to hazardous levels of explosive gases and dust concentrations). Available housing materials include aluminum and Types 303 or 316 stainless steel. The housings are designed to contain any electrical sparking and to prevent dust from entering the devices.



[www.posital.com](http://www.posital.com)



## RFID-equipped versions of connectors

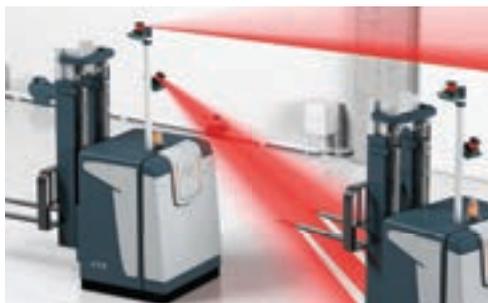
Harting has expanded its Han HPR heavy duty power connector line with passive UHF RFID-equipped housings that lets users track data they define about the unit, like part numbers for requisitioning or purchasing replacements. Accessing configuration and parts information via RFID is said to be a faster and easier way of tracking inventory and handling maintenance issues. The Han HPR RFID comes in sizes 6B, 10B, 16B and 24B. The integrated transponder has a read range of 1 m and provides the same IP68/69K protection as the locked Han HPR housing.

[www.harting.ca](http://www.harting.ca)

## Detection laser scanner has time-of-flight technology

Pepperl+Fuchs has introduced the R2000 Detection laser scanner. Smaller than most coffee mugs, the company says, the 2D laser scanners feature a 360° gapless measurement angle with angular resolution within 0.071°, scan frequency to 30 Hz and object detection down to 1 mm. An eye-safe visible red laser simplifies alignment and, because the light spot is up to 15x smaller than competitive technology, it enables precise detection of very small objects or reflectors, the company says. The IP65 rated scanners can also detect objects up to 10 m away and reflectors up to 30 m away, with measurement repeatability that is always within 12 mm of true distance value.

[www.pepperl-fuchs.us](http://www.pepperl-fuchs.us)



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Application example: Coiled Spring Pins as hinge pins in SUV rear window latch assembly

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# Extending the scope of smart phones

Endoscopy video capture simplified

**W**hSymbiosis is a word that properly belongs in the lexicon of biology. It refers to the cooperative, mutually beneficial relationship between two organisms – but it's meaning is especially apt when it describes a smartphone and an endoscope.

Easy image capture without video towers reduces patient trauma, especially in children

An endoscope (scope for short) is an instrument that enables a doctor to look inside a patient – it predates a smart phone by a couple of hundred years. In its primary function, an endoscope is used as a diagnostic (endoscopy) instrument to determine an effective therapy, namely whether surgery or a more conservative method should be applied (this is especially true in the early stages of cancer).

The first known endoscope for internal inspection was designed in 1805 by a German doctor who was attempting to examine the urinary tract but not until 1868 was an endoscope used to explore inside the stomach of a living person.

The earliest endoscopes were rigid and whatever could be seen through them was probably neither treatable nor, at the time, understood. The process of looking probably did more to satisfy the doctor's curiosity than contribute to the well being of the patient for whom the experience must have been fraught with excruciating pain.

The array of endoscopes for modern medicine is now vast and specific to almost every part of the body. Scopes generally have a long, thin flexible tube that the doctor can weave through a body passageway or opening through which to see inside an organ.

The first flexible scopes were introduced in the 1930s and about twenty years later the gastro-camera was invented. Harold Hopkins (a renowned British physicist) played a central role in the creation of a device called a "fibroscope." It consisted of a bundle of flexible glass fibres that, due to a more concentrated focus on the



Mari Teitelbaum, VP Products at Clearwater Clinical, demonstrates the ClearSCOPE smartphone video endoscopy system.

inspected areas, offered better image quality than its predecessors.

Today, with the combination of innovation and technology, the bar has been raised again on medical science by advancing the efficacy of endoscopy.

Clearwater Clinical ([www.clearwaterclinical.com](http://www.clearwaterclinical.com)) develops mobile medical solutions that target the endoscopy and audiology markets. Its mission is to accelerate and democratize access to medical solutions by delivering rapid deployment at a fraction of the cost of traditional approaches.

In 2013, Clearwater introduced the ClearSCOPE endoscope adaptor.

ClearSCOPE enables full high definition video recording with any smart phone attached to a generic endoscope interface. Following 14 months of field testing by more than 2000 doctors, Clearwater Clinical has now announced the general release of its ground breaking ClearSCOPE Endoscope Adaptor for smartphones.

"By taking advantage of the power of smartphones, we've been able to

produce a video capture solution at a fraction of the cost of traditional towers," said Dr. Matthew Bromwich, Otolaryngologist and Co-founder of Clearwater Clinical.

Today, capturing an image or a video during an endoscopic procedure requires a very expensive video tower. Video towers – aside from being very expensive – are large and cumbersome and have to be pushed between locations on carts. Due to their cost, hospitals don't usually have more than one or two video towers, often only available during surgery.

If a doctor or medical intern doesn't have access to a tower, images can't be captured during a procedure and this often means that a patient will need to be re-scoped later by a specialist. This frequent duplication of effort doubles the patient discomfort that, while a mere inconvenience to adults, makes the procedure twice as traumatic to children.

Endoscopy and smartphones also pair well for the future of remote medicine since many small clinics may never be able to afford an expensive

video tower yet still need to consult with specialists in cities – maybe even countries – far away.

In addition to the manifold benefits to the diagnostic process, the extent to which ClearSCOPE can graphically capture a procedure has powerful educational value for students and residents.

All these are the benefits that propelled the creation of the ClearSCOPE endoscope adaptor. Everyone has the power of HD video imaging in their pockets so by creating an adaptor that connects a smartphone to any standard endoscope, doctors and residents can now have easy and affordable access to HD video and still images for every procedure performed.

ClearSCOPE's unique design is brought to reality by L-D Tool and Die of Stittsville, ON, so the combination of a valuable product with quality manufacturing again exemplifies "a symbiosis." **DPN**

Mark Sunderland is President of Ottawa-based Biomedical Industry Group ([msunderland@biomedgroup.com](mailto:msunderland@biomedgroup.com)).



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## NEW! EVG High Flow Electronic Poppet Valves

Clippard's EGV series are small, electronically-piloted valves ideal for large flow, low leak applications. Available in 1/8" NPT and manifold mount, they utilize Clippard 10 mm or 15 mm valves, and offer numerous voltage and connection options. Available in 2-way and 3-way styles, each provide flows to 53 scfm.



## NEW! EFB Series Electronic Fill & Bleed Circuits

Clippard's compact fill and bleed circuits are a combination of Clippard pneumatic valve components used to inflate a volume or apparatus in one controllable function, and to release or vent pressure in a second controllable function. Fill and bleed circuits are commonly used in many applications where a particular pressure, firmness, or position can be controlled with the addition or venting of pressure.



## NEW! High Flow Poppet Valves Including Cartridge Styles!

Clippard's compact GV-GTV series valves offer a bubble tight design with high flow rates of 38 scfm @ 50 psig; 67 scfm @ 100 psig. These compact 2-way and 3-way valves are offered in 1/4" NPT and 3/8" push-quick ports along with a cartridge mounted version.

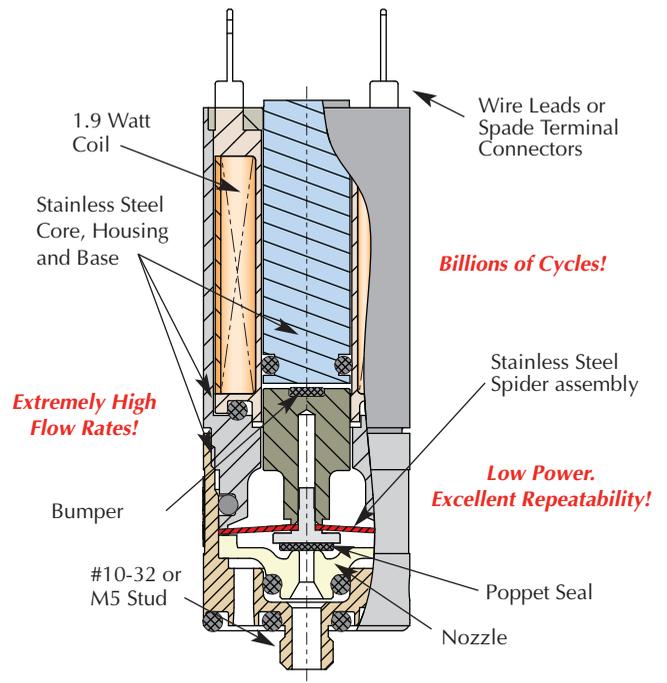
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- 2 "GV" Series High Flow Poppet Valves
- 3 Electronic Valves for Analytical Industries
- 4 "HV" Toggle & Stem Valves
- 5 "EGV" Electronic High Flow Poppet Valves
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