

Accelerate!

POTENTIAL UNLOCKED
HOW MANUFACTURERS CAN DO MORE WITH DATA

DETLEF ZÜHLKE ON
**REALISING
INDUSTRY
4.0**

**REWARDING
CHALLENGE**

AN INSIDER'S VIEW ON DEVELOPING
THE LATEST LASER TRACKER

DESIGN FOR LIFE

ENGINEERING LONGEVITY
INTO HARDWARE DESIGN



HEXAGON
MANUFACTURING INTELLIGENCE

IN FOCUS

BROADEN YOUR HORIZONS

BLAZE 600M blue light
measurement system



EDITORIAL

FULFILLING POTENTIAL



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Potential is a strangely unquantifiable thing. I suppose it's about our ability to develop in future – making it something both unknown and immeasurable, but also exciting. When you look at a young child, you have no idea what they might grow up to be. There may be some hints – academic intelligence, a gift for music, athletic prowess. Whatever 'it' may be, they have potential of some kind that you know, through learning and continuous improvement, they can fulfil.

Learning and continuous improvement are two things that we should never stop doing. It's particularly important in our world of manufacturing – every manufacturer knows that the mistakes that we don't learn from are the costliest kind! At Hexagon Manufacturing Intelligence, we take data from the real world, digitise it into a format that we can learn from, and use it to make improvements back in the real world. Whether through design simulation, process control or simple comparison to CAD, data has huge potential in helping manufacturers make continuous improvements. For me, 'manufacturing intelligence' is all about connecting and using the data we gather throughout the process to make smarter decisions.

In this issue of **Accelerate!**, our cover feature explores the potential of data throughout the lifecycle of a product and what 'data-driven manufacturing' means for our customers. I'm very pleased to welcome guest writer Professor Detlef Zühlke to the magazine as he reveals what needs to happen for manufacturers to capitalise on the potential of Industry 4.0. We also get an inside look at potential fulfilled in our feature on the development of the new Leica Absolute Tracker AT403 – the latest improvement to our entry-level laser tracker range.

So, what motivates us to improve? Well, our customers are the people who make the technologies that change the world. Cars, planes, smartphones, medical devices and all the components within – whatever you make, there are ways you can progress and work smarter to realise the next generation of these technologies – and even the disruptive technologies that will render what we know today obsolete. My hope is that Hexagon Manufacturing Intelligence has a role to play in your business unlocking its true potential.

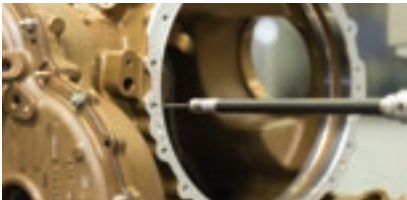
Happy reading

Norbert Hanke
President, Hexagon Manufacturing Intelligence

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HIGHLIGHTS

Catch up on the news, events and stories from Hexagon Manufacturing Intelligence.

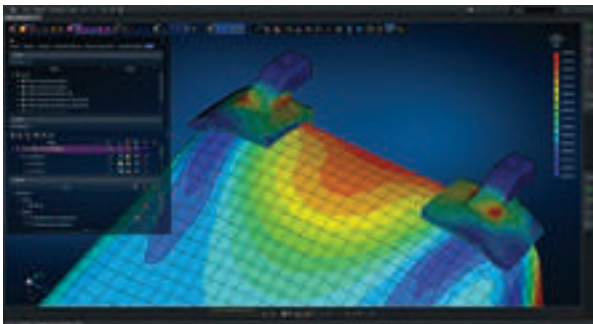
Hexagon Acquires MSC Software

Hexagon AB, a leading global provider of information technologies that drive productivity and quality across geospatial and industrial enterprise applications, has acquired MSC Software, a leading provider of computer-aided engineering (CAE) solutions, including simulation software for virtual product and manufacturing process development.

MSC's simulation analysis capabilities empower customers to optimise design for production, ensuring downstream productivity, product quality, and durability. The acquisition strengthens Hexagon's ability to connect the traditionally separate stages of design and production – integrating real-world data generated on the production floor with simulation data to further improve a customer's ability to reveal and correct design limitations and production problems prior to manufacturing.

"MSC represents a game changer in our mission to deliver actionable manufacturing intelligence, taking us another step closer to realising our smart connected factory vision in discrete manufacturing industries such as automotive and aerospace," said Hexagon President and CEO Ola Rollén. "We can now leverage the data our Manufacturing Intelligence division is generating to improve design choices and processes upstream in the workflow. The acquisition will also open up new markets and touchpoints for MSC via our PPM division."

Headquartered in Newport Beach, CA, United States, MSC has over 1 200 highly-skilled professionals in 20 countries. Its strong brand and reputation in industries such as automotive, aerospace and electronics spans more than 50 years.



Dedicated Composite Inspection System Launches

Hexagon Manufacturing Intelligence has launched a Composite Inspection System for the ROMER Absolute Arm with Integrated Scanner (SI). Based on Apodius 3D technology, it offers inspection and analysis of carbon-fibre components at an unprecedented level of speed and detail.

The system equips the arm with the HP-C-V3D Apodius Vision Sensor camera-based scanning hardware and the custom-built Apodius Explorer 3D real-time software package. Together, they deliver high-definition fibre orientation and geometry measurement, and complete 3D model creation and analysis.

"Until now, three-dimensional digitisation has required the sensor to be robot-mounted," said Alexander Leutner, Managing Director of Apodius. "The technology of the ROMER Absolute Arm enables portable hand-guided composite inspection for the first time, resulting in a much faster and more convenient process."

"We're really excited about this solution for composite component producers," said Stephan Amann, Business Director for Portable Measuring Arms at Hexagon Manufacturing Intelligence. "New applications for carbon fibre are emerging all the time. Technology like this is exactly what the sector needs to keep growing."



Hexagon Strengthens Calibration Capabilities

Hexagon AB has completed the transfer of assets from the metrology calibration services business of FEINMESS GmbH & Co. KG to Hexagon Manufacturing Intelligence.

Founded in 1992, FEINMESS provides independent services in the field of geometric measurement technology. Operating from its premises in Bottenhorn, Germany, the company has a team of experts dedicated to calibration activities. In 2003, the company was awarded Deutsche Akkreditierungsstelle GmbH (DAkkS) accreditation. The Bottenhorn site will continue to provide calibration services, with the FEINMESS staff joining the Hexagon team.

“Bringing the expertise of FEINMESS into our business is a demonstration of our commitment to dimensional metrology services,” said Norbert Hanke, President of Hexagon Manufacturing Intelligence. “The team at FEINMESS brings a wealth of experience, so we look forward to drawing on their knowledge to grow our own capabilities and offer new services for our customers.”

New System for Inspection, Tracking and Positioning

Hexagon Manufacturing Intelligence has released a new camera-based portable coordinate measuring machine (CMM) for highly precise shop-floor measurements. The AICON MoveInspect XR8 can simultaneously capture multiple points, making it capable of time- and cost-saving benefits in several applications.

The CMM consists of two high-resolution eight-megapixel cameras, which are equipped with invisible flashes that eliminate dependence on environmental lighting. Measurement with total freedom of movement is delivered by the AICON MI.Probe handheld probing device, while the MoveInspect software determines the 3D coordinates of object points or the six degrees of freedom (6DoF) data of solid bodies at any time.

“We believe the AICON MoveInspect XR8 is one of the most stable portable camera-based CMMs ever to enter the market,” explains Carl-Thomas Schneider, General Manager of AICON 3D Systems. “With this system, shop-floor recalibrations are reduced to a minimum, removing unnecessary delays from the measuring process.”



New Multisensor CMM Systems Launched

Hexagon Manufacturing Intelligence is expanding its vision range with the new Optiv Classic 8102 and Optiv Classic 12152. These wide CMMs have broad XY measurement ranges, enabling fast and automated inspection for palletised batches of small serial parts such as clutch discs, fine-blanked parts and sheet metal cut-outs for electric motor construction.



The CMMs are fitted with a world-class vision sensor system comprised of a high-resolution digital CMOS colour camera combined with a programmable 6.5x CNC motor zoom to enable fast, repeatable, and automatic point capture.

“We have added two broad measurement CMMs to our comprehensive Optiv Classic range to give manufacturers a choice of specialised solutions for large part and palletised applications,” said Wolfram Fröhlich, Business Unit Director PL sCMM (Vision Unit) at Hexagon Manufacturing Intelligence.

Partnership with Wichita State Innovation Campus

Hexagon Manufacturing Intelligence has announced a technology partnership with Wichita State University (WSU). The company will lease 3 000 square feet of space on WSU's Innovation Campus. The new commitment is an extension of a five-year partnership with WSU's National Institute for Aviation Research (NIAR).

“The aerospace market is driving engineering creativity and the search for more productivity,” states Angus Taylor, President and CEO of Hexagon Manufacturing Intelligence North America. “We intend to remain at the forefront of that trend by forging alliances with dedicated innovators like NIAR, who push the envelope with our solutions.”

Hexagon will employ staff at the campus to facilitate R&D and support their local customer base. The company will also introduce an internship program for the Midwestern states and students will have access to state-of-the-art industrial metrology software and systems. Hexagon is the third global partner to join the WSU's Innovation Campus, following Airbus and Dassault Systemes.



THE SHAPE OF PROGRESS.





THE SHAPE OF POTENTIAL.

With Hexagon Manufacturing Intelligence continuing its development of solutions that shape smart change in manufacturing, **Accelerate!** considers how much progress can be made, what shape it will take, and where the potential lies for customers in the world of manufacturing.

The difference between progress and potential is subtle, yet significant. 'Progress' is about moving forwards or developing towards a more advanced state. 'Potential' on the other hand, is more about future prospects and developing on inherent characteristics to make the best of them – it could be considered 'the state you are progressing towards'. Either way, businesses have a vested interest in both. A realistic estimate of potential provides a target to progress towards, whether that be in sales, in output, in quality or in revenue.

It's fair to say that manufacturing in every industry has shown significant progress over a number of years. The automotive industry has developed from the horseless carriages of the late 1800s to the mass-produced yet highly-customised vehicles of today. Progress in the aerospace industry turned international travel from the exclusive preserve of intrepid shipboard adventurers to the accessible, everyday affair that it has become. The electronics industry, born less than a hundred years ago, has progressed beyond belief and in turn has driven huge progress in other industries, where both manufacturing and product operation relies on digital technology.

Progress in these industries might be plain to see. However, potential – future-oriented as it is – is harder to define at an industry level. What might a car look like in twenty, thirty, forty years? Will we still need planes, or will the sci-fi staples of flying cars unite the two industries? Maybe we'll have reached the point of making teleportation devices, consigning automotive and aerospace as we know them to the past. With limitless potential, all things are possible!

However, if we come back to these 'realistic estimates' of potential, the possibilities do become more immediately tangible. If a manufacturing company is producing a certain number of parts per day with certain productivity-limiting factors in play, then removal of these factors might be enough to increase output to what might be considered the factory's 'full potential'. There are undoubtedly progresses to

be made that can remove at least some of the barriers to productivity and move manufacturers closer to realising their potential – however they quantify this.

Hexagon defines itself as a global provider of information technology solutions that drive productivity and quality across geospatial and industrial landscapes. The meaning is not ‘information technology’ in the traditional ‘IT’ sense, but ‘information technology’ meaning a provider of technologies which deal in information – providing insight and analytics through data and using them to inform decision making. Hexagon’s vision places information centrally as a key driver of progress, and the company sets out to develop technologies that enable companies to fulfil their potential.

So, where does Hexagon Manufacturing Intelligence see this potential? Well, for an organisation committed to research and development, there is always potential in the technology it produces. Whether it’s an iterative upgrade, a true next-generation product or an entirely new and innovative way to solve a customer problem, the R&D department is in the progress business.

But in recent years, the company has developed several new touchpoints within the manufacturing process – each with development potential of its own of course – but their coexistence in the same company’s portfolio opens new lines of enquiry for R&D and product managers. Where previously Hexagon Manufacturing Intelligence’s information technologies addressed data capture in the post-production, quality assurance phase of manufacturing, its skillset now ranges from design, costing, simulation and engineering, through to production phase CAD/CAM and statistical process control solutions, as well as metrology. Although these technologies are related, few companies have tried to assemble such a broad range of manufacturing information technologies under one roof – and the reason for this diversified skillset is the potential the company sees in leveraging such technologies to bring the traditionally separate phases of manufacturing closer together. This is the potential power of data.

Every manufacturer captures data daily. Whether the driving force behind it is stringent regulatory requirements or a simple internal report, data is being captured and stored. But how many businesses have time to truly interrogate this data and implement learnings from it? Everyone knows that they should – but there are so many obstacles to doing so that it almost seems unachievable. Data is typically captured in disparate systems and stored in different, often incompatible file formats.

As a result, data that costs money to record is sometimes accessed only in isolation when looking back at a fault, and even then, may not present a complete picture.

But what if every piece of information recorded in the manufacturing process, right from concept through to reality, could be integrated into a single system and interrogated as a complete set? What if information gathered at any phase of the product or component’s development could be used to inform every other phase of the product lifecycle? The potential of connecting data could have a huge impact on the way manufacturers design products and processes in future. If data could be constructively used to inform decision making, both upstream and downstream, then the resulting series of feedback loops enable continuous learning and improvement to become embedded in the process.

This learning could even transcend the factory and take service life data back into the iterative development of parts. Take the example of a compressor blade – a critical part of an aircraft engine. Its designer has carefully considered how the profile can be optimised to generate the pressure and temperature required of the inlet air. Materials have been selected. Its production has been simulated, a manufacturing process designed and implemented. The blade has been made and its quality checked, then it goes into service. What potential might there be in taking data from its service life – maintenance records, behaviour in different environmental conditions, failure analysis – back to the design team? What if the simulation could be compared directly to the real-world behaviours? Maybe next time around, the factory could give the maintenance team a more accurate estimate of the service life of that blade, enabling predictive rather than reactive maintenance. But it all relies on data flowing seamlessly between departments on demand – a joined up digital thread that breaks down traditional operating silos.

The interesting side effect of such connectivity is that it could start to challenge the shape of factories as we know them. Instead of production lines, factories of the future could become more modular in nature. If parts could then begin to carry their own data intelligently, we might see factories with production islands; allowing individually optimised processes for each one. Perhaps the factory of the future is an interconnected ‘ecosystem’ of independent, but inherently connected production phases that rely on each other’s data to optimise and make efficiency improvements. And then, manufacturers’ estimation of their own potential might be revised for the better. ■

IN YOUR WORDS

Hexagon Manufacturing Intelligence customers and partners share their views on the shape of progress and what it means to them.

“Progress means to us only one word; it's 'people'. We can only work with people, for people, through people.”

Jean-Charles Valet
Poncin Metal, France



“Progress means being updated with the latest technology.”

Ravi Gera
Ashtech Toolings, India

“Progress means for me, being a woman at Velan – working at this level.”

Mélanie Cestari
Velan, France



“Progress for me, being from Mexico, is getting access to the education which guarantees our wellbeing.”

Raul Moreno
VISI Series, Mexico

“Progress means for me always trying to achieve higher accuracy and better speed for our racecars, anything we can to evolve our processes, and just never settling for what we have and always trying to do better.”

Brandon Evans
Hendrick Motorsports, USA

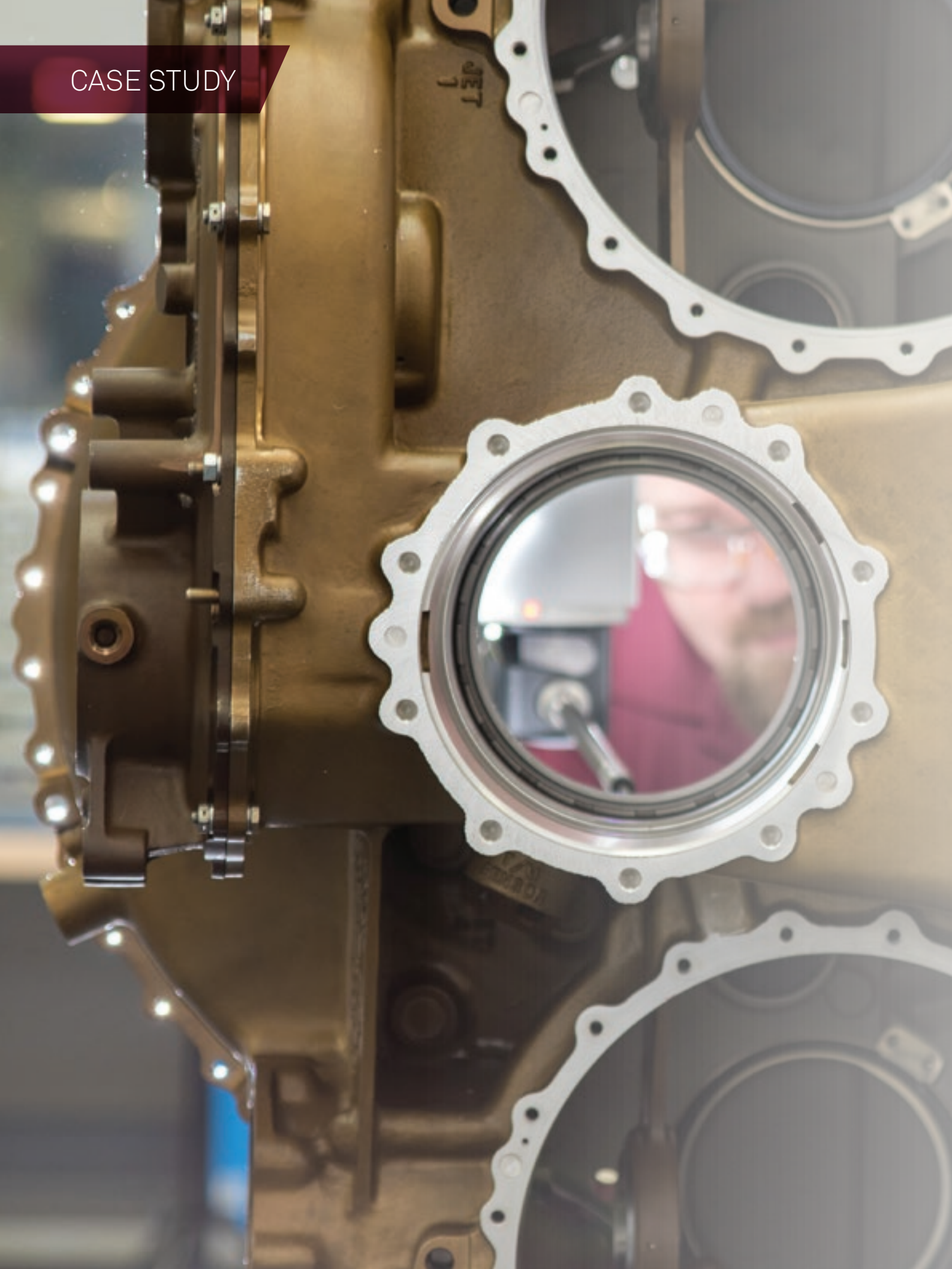


“Progress means change, change for the better. If change doesn't make you better, then it is not a progress.”

Chakrawut Anprueng
CCA Marketing Co. Ltd., Thailand



CASE STUDY



GEARED FOR SUCCESS

Gear manufacturing company saves 20-24 hours per assembly on helicopter gear casing inspection process.

Over the last 40 years, Michigan-based Triumph Gear has built a solid reputation for its expertise in machining precision gears. When the company diversified its offering to include parts like a large gear casing for the transmission of a helicopter rotor system, the need for a new coordinate measuring machine (CMM) became apparent. Due to size constraints on the existing CMM, the part had to be laid on one side, measured, then flipped 180 degrees about the Y-axis before the other side could be measured, causing a quality control bottleneck. The solution came in the form of a GLOBAL Advantage 15.30.10, which enabled the gear to be measured without being moved. Overall, Triumph Gear saved roughly 20-24 hours per assembly of this helicopter component, as well as gaining a more flexible measurement solution. ■

“In order for us to maintain credibility with our customers, we need accuracy and repeatability. Efficiency is important, but not if it jeopardises our quality. We are very confident in the accuracy of our programs and our overall ability to inspect parts.”

Robert Farr
CMM Manager, Triumph Gear

Company: Triumph Gear Systems-Macomb
Location: Macomb, Michigan, USA
Industry: General Manufacturing
Solution: GLOBAL Advantage 15.30.10
with PC-DMIS



Read the full case study to find out what other benefits Triumph Gear realised with its new CMM. <http://hxgn.biz/2pWKidV>

FEATURE



This March we launched the Leica Absolute Tracker AT403, the latest iteration of our entry-level line of laser trackers. Beginning with the AT401 in 2010 and followed up with the AT402 in early 2013, this product range has been very popular with users taken by the idea of ultra-large volume, highly portable measurement at an affordable price point. Launched later in the same year as the AT402 was the Leica B-Probe, which delivered one of the first productivity improving entry-level probing solutions to enter the market.

Managing the development of an AT403 which would carry on the success of this by now well-established product range while delivering improvements in key areas was a real challenge. But seeing the end result enter the market to a positive reception from measurement experts around the world has been equally rewarding.

slightly – changed since a project's first release, recontextualising the functionality and suitability of that product.

In 2014 we launched the Leica Absolute Tracker AT930 and AT960, the newest models of our flagship range of laser trackers. Their success was unprecedented, and raised vital questions about what exactly the market needed next. So it was with this background that in 2015 we sat down together to decide what to do with our more affordable tracker range. Did we need to update this line? Did the market still need it? If we did and it did, where could we make the significant improvements that would make a real, quantifiable difference to customers?

What Should a Product Be?

While we run within a highly organised structure when it comes

REWARDING CHALLENGE

Following Hexagon Manufacturing Intelligence's release of the Leica Absolute Tracker AT403, **Accelerate!** gets an inside look at launching a major new product from Portable Metrology Product Manager, **Matthias Saure**.

Beyond the AT402

This product range, and the AT402 in particular, opened the door to laser tracker measurement as an affordable solution for a huge range of customers, and these excellent little units have made their way into workshops and portable metrology toolkits all around the world over the last four years. However, we felt we could do better as we looked ahead at the future of the range.

There were a handful of places where we wished we could have had more success with the AT402; however much we want a product to be everything we wish it could be, sometimes compromises have to be made in the product development process. Maybe these are based on limitations of budget considering the planned price point of the final device, or maybe this is simply because the technological developments needed just haven't happened yet. Alternatively, perhaps the needs of the market have fundamentally – or even only

to product development at Hexagon, flexibility is vital throughout the process. Dozens of people played a direct role in bringing the AT403 to market, from the initial discussions about whether the time was right for a new addition to this range through to finalising the technology and design of the product that would go to market. Changes to our goals and expectations over the course of such a project are to be expected, even welcomed, and what we end up with is a development process that feels very organic but nevertheless benefits from structured objectives and milestones.

This was very much the case in the development of the AT403. As we researched exactly what we might be able to achieve technologically and how that synced with what the market needed, we gained a greater understanding of just how much better we could do, and how important the product at the end of the process could be to a wide range of customers.



FEATURE

We consulted a group of highly valued commercial colleagues within our division of Hexagon, who between them boast vast experience in the metrology sector and who we refer to as our market experts. We also consulted our sales teams more generally – the people who introduce our products to our customers directly have both their own highly informed opinions to report, and the thoughts shared with them by the customers who apply our devices every day in their work.

Such customer feedback led directly to new features implemented in the AT403, such as the increased operating temperature range of -15 to 45 °C, the acceleration of measurement process times or the ease-of-use improvements that became a primary goal for us at an early stage of the project. We already knew we could make improvements in this area, but hearing how key such improvements would be for customers made it one of our central objectives, both for the tracker as a whole and more specifically when it came to the measurement efficiency of the Leica B-Probe.

Accuracy Comes from Within

Other improvements that have become a part of the AT403 package were more internally driven. This was the case for instance with the system's new continuous measurement function, which is based on improvements to the technology of the Absolute Distance Meter (ADM) that is at the heart of this range of laser trackers. These improvements were being made as part of our efforts to improve the speed performance of the device, but a clever member of our research and development team noticed the potential of these improvements to enable the AT403 to measure dynamically.

The full dynamic measurement possibilities allowed for by an Absolute Interferometer (AIFM), as found in the AT960, remain beyond the capabilities of a product at this point of the market. However, a simplified version of this function, which we refer to as 'continuous measurement', would be possible with our newly redesigned ADM. And the simple sphere fit or circle fit reflector functions possible with this new continuous measurement mode throw up some interesting possibilities – a single point measurement taken with a reflector using a circle fit continuous measurement function is up to twice as accurate as a standard reflector measurement.

Managing the development of a new product at Hexagon Manufacturing Intelligence is both a challenging and rewarding experience, built on the hard work and creativity of a large group of professionals. The reputation we've built over the years means our customers expect a lot from us, and living up to those expectations is no simple task. But it's absolutely worth it when we do. ■



The WiFi Challenge

One of the most challenging aspects of managing the Leica Absolute Tracker AT403 from concept to reality was actually related to what I consider the most important single feature we added to the range with this latest iteration – full WiFi access point functionality.

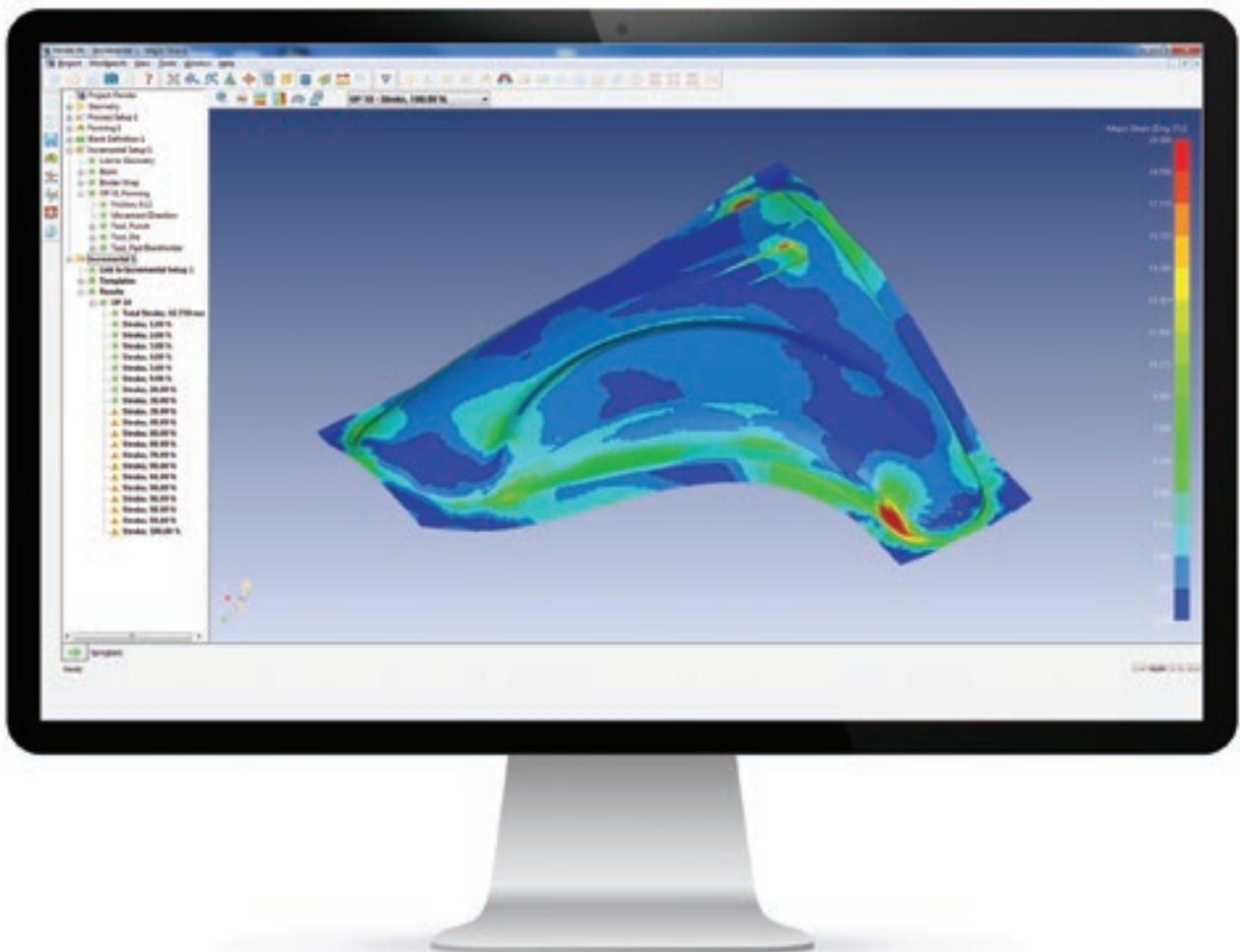
While WiFi functionality has been a feature of our laser tracker lines for some time, this hadn't been without its problems. Chief among these was caused by changes made within the Microsoft Windows operating system. Our customers' ability to easily connect their laser tracker to their base computer was suddenly removed with changes to the standard feature set of Windows as Microsoft moved from Windows XP and 7 to Windows 8 and subsequently 10. Suddenly a feature of our product that had previously been a boon to productivity was leaving our users messing around with external access points and configuring IP address settings, and just generally spending more effort than having wireless capabilities was really worth. We needed a solution.

That solution was the decision to build full access point functionality into the WiFi module within the AT403 controller. But this was also not without its difficulties. The international regulations surrounding WiFi transmission are a tricky and tangled web to navigate; delivering a solution that both worked and was acceptable and approved under standards in dozens of regulatory zones was a massive undertaking.

But navigate this tangled web we did, and the outcome was the delivery of our first ever tracker with this sort of true access point functionality baked in. We couldn't be more satisfied with the results – WiFi connectivity with the AT403 is more straightforward than it's ever been with a laser tracker. After being forced to take a small step back, we've responded with a great leap forward for measurement productivity.



FORMING NEW



In April 2016, Hexagon AB acquired the Canadian design and costing software specialist Forming Technologies Inc. (FTI). One year on, **Accelerate!** put some quick-fire questions to **Michael Gallagher**, President and CEO at FTI.

RELATIONSHIPS

“One thing that’s become really apparent is the combined strength of our companies together.”

Firstly, give us the overview of FTI.

Forming Technologies Inc., better known as FTI, was founded in 1989. Today we are the world’s leading provider of software solutions for the design, feasibility and costing of sheet metal components. FTI provides OEMs and suppliers in the automotive, aerospace, electronics and appliance industries with innovative solutions designed to reduce development time and material costs. Our leading-edge technology enables our customers to immediately improve their workflow and balance sheet by reducing material and labour costs.

And you are also a training provider, aren’t you?

Yes, FTI offers an extensive curriculum of hands-on metal stamping and welding training courses that are developed and delivered by industry experts. We also offer engineering services based on our software products and our experience in the sheet metal industry. Some of our professional services include training, engineering, consulting, product

feasibility, formability risk assessment, and green simulation. FormingSuite® Professional is our signature product for green simulation. Automotive OEMs around the world and their Tier 1 suppliers are now demanding green simulation to confirm the viability of their quotations for tool and die work while reducing their immediate impact on the environment.

Where does FTI fit into the Hexagon Manufacturing Intelligence vision then?

Since FTI was acquired by Hexagon, we have been getting to know the strength and reach of Hexagon’s brand as well as where FTI fits into the bigger picture. At HxGN LIVE 2016 in Anaheim, California, we truly saw how a combined effort within Hexagon could categorically solve many of the automotive industry’s issues and problems. Plans are now underway for new solutions pertaining to the die build process. There are currently several OEMs interested in our solution but one thing that’s become really apparent is the combined strength of our companies together.

We have a huge number of experts all working together to build these game changers for the industry. But there is a lot more we can do collectively and over the next few years so we will continue to work together to achieve impactful solutions for our customers.

What can you tell us about these synergy projects then – where do you see the potential?

Well, FTI has been involved with another Hexagon-owned company, Vero Software, for over 12 years. We supply technology that enhances the VISI CAD solution for sheet metal. Our common customers can look forward to additional transfers of technologies to Vero Software in the near future; things like springback compensation can be implemented almost immediately and in the long run, incremental analysis and die face design are also in the plans. FTI can also gain new ground by working with the Vero Software team to enhance our offerings to the automotive market; this too is ongoing and we are very excited about the future. ■

TAKING MEASUREMENT TO THE EXTREME

Spanish company tests Hexagon
Manufacturing Intelligence laser tracker
in the extreme conditions of Arctic Norway.

Asturfeito is a Spanish business whose global reputation in the fields of equipment commissioning, engineering, manufacturing and assembly led to its involvement in the complex installation of two radio telescopes in northern Norway. Working within the Arctic Circle, the company used its Leica Absolute Tracker AT402 laser tracker to verify the components of this complex installation, ensuring that each exactly met the required specifications and guaranteeing perfect adjustment during the later assembly. Once at the build site, the laser tracker proved essential as it was used to control the bearing pins that ensure the correct horizontal and vertical rotation of the telescopes. ■



Go online to read the full case study on how Asturfeito took precision metrology to the Arctic Circle. <http://hxgn.biz/2j2cckF>



Company: Asturfeito
Location: Asturias, Spain
Industry: Other Cool Stuff
Solution: Leica Absolute Tracker AT402

“ The two 13.5-metre diameter radio telescopes have a flatness tolerance in the azimuth and elevation axes bearing seats of less than 0.04 millimetres in a 1.2-metre diameter. The demands are very high, but the equipment worked seamlessly during intense use in a machine welding construction workshop, and also under really extreme environmental conditions in the Arctic. ”

Manuel Martínez Morilla
Quality Department Manager, Asturfeito



CLOSING THE MANUFACTURING LOOP

As Hexagon Manufacturing Intelligence expands its solution offering towards data-driven manufacturing systems, **Simon Lee**, Regional Director EMEA at Vero Software, shared his thoughts on the relationship between metrology and CAD/CAM in a podcast interview.

Accelerate! catches up with the conversation in this HxGN Radio Recap.

Let's start with you telling us a bit more about Vero Software and your role.

Vero Software has developed into the world's number one provider of CAM software over the recent past. Similar to Hexagon, it's been a serial acquirer, consolidating the CAM software market quite significantly. So, that put us in this number one position. We provide solutions for a wide range of applications for the machining of metal, whether that's milling, turning, mill-turn or sheet metal working, which is typically laser profiling, punching and CNC bending. We also provide solutions for machining stone, wood and composite materials.

It sounds like you have quite a lot of diversity in the marketplace as well.

We do. I think all our customers have one thing in common; they are machining, whether they're machining metal, stone or wood. So, it's an increasingly complex market. We have great coverage around the world through a network of resellers and industry partners, and we have built a very good reputation.

How do you see the union of metrology and CAM benefiting customers?

I think the acquisition of Vero Software by Hexagon raised eyebrows because it is a potential game changer for the

manufacturing industry. Metrology, as you are probably aware, is coming more out of the air-conditioned room on to the shop floor, which is where we exist. So, I think our customers are going to be very excited by the prospects of metrology and CAM coming together and closing this manufacturing loop where corrections can be made very early in the process, making the whole process a lot more efficient.

Hexagon's mantra is Shaping Smart Change, and that fits well in the context of smart manufacturing. How does Vero Software use intelligence in terms of CAD modelling to bring efficiency to the manufacturing process?

Vero Software's CAD modelling tools are specifically aimed at the mould and die industry. So, this is where you are moulding plastic components and stamping steel or metal components. There are ways to automate that design process. Of course, in a mould tool, for example, the core of the tool is based on the finished component. There is a cavity that mimics the form of the component. Apart from that, the tool is based around standard components. So, the design can be automated using these standard components. Also, based on the geometry of the component itself and the finished part, things like cooling channels and ejector pins can be placed in an automated and intelligent manner.

Could you talk a bit more about the optimisation of modern machine tool technologies and Vero Software's role in that sort of scene?

Yeah, as I mentioned earlier, machine tools are becoming more complex. Our customers are making more complex parts. Introducing computer technology gives designers greater freedom to express their wishes in terms of 3D freeform design shapes, which significantly impacts the manufacturing process. It makes it harder to make those parts. So, the complexity is achieved by high levels of complex machine tools. So, a machine tool, historically, would either be a milling machine or a turning machine. But now, with today's machine tool technology, it means that these technologies are converging, and the machines can be multi-functional, performing lots of different operations, which means there are more moving parts. Different parts of the machines have to be synchronised with each other to avoid collisions. And controlling those machine tools has become a very complicated affair, which our software team handles. So, it's a very powerful tool that customers must have.

What are some of the trends you are seeing in the CAD/CAM industry, and how is Vero Software addressing those?

I think the trends are similar to other markets and other circumstances. Globalisation, for example; the world is becoming a smaller place, and our customers who are based in various continents around the world are wanting to standardise their manufacturing processes so that they can make something anywhere – they can design it anywhere. And through the consistency that our products bring they can get the same result whether the part is made in the USA or in Europe. So, collaboration – our customers want to work with each other sharing data – the ability to use our products at the same time, or we call it 'follow the sun', so our software could be used in Europe in the morning and in the USA in the evening. Our licencing, for example, supports the sharing of our software between the facilities.

Simon, thank you for chatting with us today.

It's been my pleasure. Thanks. ■



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FEATURE

A man with white hair and glasses, wearing a blue button-down shirt, is smiling and interacting with an industrial control panel. He is holding a tablet in his left hand and a key with a yellow tag in his right hand, which is near a red emergency stop button. The background shows industrial machinery with labels like "Bosch Group" and "FESTO". A large green circle with a dashed line is overlaid on the image, containing the text "INDUSTRY 4.0".

INDUSTRY 4.0

FROM THEORY TO PRACTICE

The term 'Industry 4.0' was popularised in around 2011, although the concepts behind it came into existence several years before that. Described as the fourth revolution in industry and manufacturing, it is the concept of cyber-physical systems – how software interacts with objects within the physical world – and is already in practice in everyday life. You can now send a message to your kettle for example, to tell it to boil before you get home. You can even tell it what temperature to heat the water to.

This ability to talk to a machine from a completely different location is at the heart of Industry 4.0. We want to create a universal network on the Internet of Things (IoT) to automate manufacturing processes to improve production across all industries. But to do this, we need to work together to ensure a fair, safe and efficient system.

As with the birth of each revolution before it, progress within industry is reaching a point where something has got to give and an explosive change in the way we manufacture goods is required to meet the new demands of our markets.

Why We Are Here?

So, how have we got to this point? In this instance our markets are changing, as are our customer paradigms. There is a shift from the demand for mass-produced standard items to mass customisation and with this the manufacturing methods need to change to meet those needs.

Customers are no longer happy to wait for a product to be manufactured overseas and take weeks or even months to arrive for the sake of a lower price. Now, people want their products faster and are much happier to pay a higher price for the privilege, especially if it is customised or uniquely built to their needs. So as with every revolution before, market pressure is the driving force for change to progress our world and its industries.

As more companies aspire to deploy smart manufacturing principles, Industry 4.0 expert and **Accelerate!** guest writer **Detlef Zühlke**, Executive Chairman of SmartFactory^{KL}, explains the thought process behind the developing industry revolution and how cyber-physical systems are already helping to shape smart change across the globe.

Products will need to be manufactured closer to the customer markets to facilitate faster deliveries and so production is being reshored at smaller plants and mass production will likely begin to decline. International economic structures will be affected, particularly in countries that currently thrive on mass production methods. These countries need to move quickly – a reason, I believe, why China is putting the most investment into this area as it recognises that the markets are changing.

The internet is another major driver, especially with everything becoming more connected. Networks of machines in factories will replace the current pyramid-style control structures to create more dynamic systems. Remote maintenance is not new, yet it is based on the same principle. We have devices talking to the systems, which alert us to when there is a fault or maintenance requirement.

As we go forward, we will have more and more unplanned, non-engineered extensions of our systems, simply realised through standardised connections just as simple as plugging a printer into your computer. You will be able to plug in any device to your control systems and work with them straight away.



I like to compare it to a LEGO brick, a wonderful example as it is a building block from which many people have built inspiring creations. There are limitless possibilities with just this simple, standardised shape and I like to think there is the same potential when manufacturers will come together to connect with Industry 4.0. We will have a network that can access anything and bring data back and forth over the Internet of Things.

What's Next?

I anticipate that the evolution from today's world into the new world will be quite steady as the technology to implement Industry 4.0 will initially be available only to larger organisations who have the capital to fund the research and development of these systems. Then, over a few years, this will become more accessible to medium- and small-sized businesses. But before any of this can become a reality there are a few challenges we need to face.

The inherent need to open up our networks and connect on the Internet of Things comes with additional data security risks. There needs to be a sense of trust in crucial machine to machine (M2M) communication to avoid any IT problems that could lead to costly downtime and loss of throughput.

The current lack of skills for this new way of working needs to be addressed. Workers need to be retrained to take on the new requirements of the industry. Manufacturers need to safeguard their workers and provide this training as there is likely going to be a feeling of negativity among stakeholders as they anticipate that some job roles may be lost when processes become more automated.

So, what do we need to put in place to be able to meet these challenges?

1. First, we need worldwide standards. The Industry 4.0 concept works only because everything can be connected. But in order for everything to be connected, we need everyone to be using the same universal connection. This needs to be defined.
2. Secondly we need security solutions. With pretty much every major organisation in the world having been hacked already at one point or another, we need to ensure that when everyone is connected on the Internet of Things there are no loopholes or areas of risk for those involved. We need to trust the system, otherwise it will not be accepted in the industry – especially for those whose data privacy is of the upmost importance.
3. Next we need a legal framework to define liability for the systems and those connected to it. If we have a system setup, who is responsible for the 'LEGO bricks' provided by different manufacturers?
4. Lastly we need skilled people to set up these networks and maintain them. They will need training and requalifying to the new business framework.

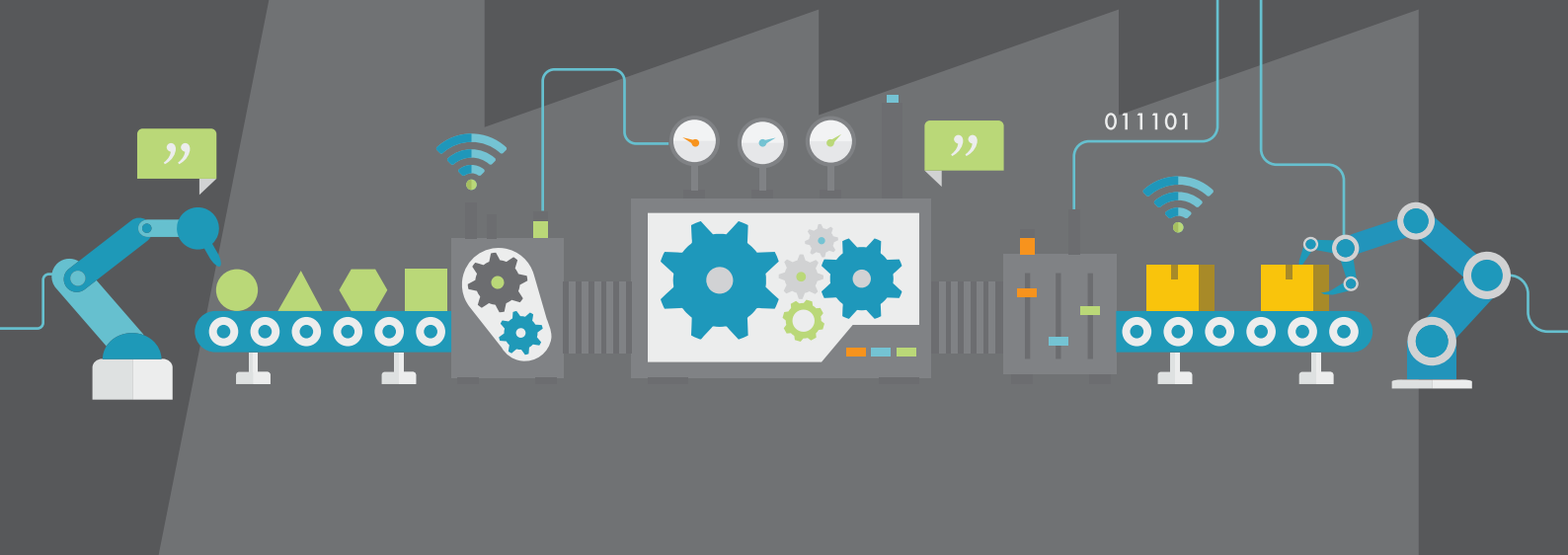
Despite these challenges, Industry 4.0 is the direction manufacturing is moving in. To ensure a successful transition into the new revolution, we need to work together to build better communications and enable ourselves to build systems which can contribute to a unified network on the Internet of Things. This can only be achieved if all these challenges are addressed. ■

DID YOU KNOW?

WHAT IS MANUFACTURING INTELLIGENCE

“ **Manufacturing intelligence** is the software to bring a corporation's manufacturing data together from many sources for reporting, analysis and communication between enterprise-level and plant-floor systems.

Its primary goal is to turn large amounts of **manufacturing data** into real knowledge, hence driving **business productivity**. ”



CALIBRATING TO PERFECTION

Accelerate! meets the Hexagon Manufacturing Intelligence Service Team in Telford, UK to find out why they rely on the TESA TWIN-T10 portable display for inductive probes when servicing coordinate measuring machines.

Hexagon Manufacturing Intelligence service departments worldwide are dedicated to providing outstanding levels of service on every installation and calibration task they come across. Having access to the right tools is a major factor in their ability to deliver such service, and Hexagon engineers are fortunate to have their choice of equipment from inside the company's own extensive portfolio of equipment, including the TESA range of handheld measurement equipment.

Like their counterparts around the globe, the Telford service team has clear objectives when installing or calibrating a coordinate measuring machine (CMM): accuracy, reliability and time savings. To make the geometric assessments required to complete the task, the service engineers need a mobile, compact and autonomous solution.

The TESA TWIN-T10 display together with the GT31 lever probe provide just such a system. They enable the team to check and adjust the CMM with sub-micron accuracy according to specifications during installation, calibration and maintenance.

The advantages of the TESA TWIN-T10 portable display coupled with GT31 lever probe for this application include portability, ease of setup, compact size, accuracy, repeatability and stability across various measuring ranges, which combine to speed up the measurements and give confidence in the accuracy of the results achieved.

The portable display has been carefully designed for efficiency and provides effortless reading thanks to the detailed segmentation and the numbering across the scale. The clear tactile feedback of the keypad prevents operating errors, while the TESA TWIN-T10 is also powered by standard AA batteries to offer complete autonomy in use.

TESA TWIN-T10 IN ACTION: THREE APPLICATIONS IN CMM CALIBRATION

Application 1: Checking Air Bearing Lift and Air Bearing Ways

"We have to measure within two microns when checking air bearing lift to avoid the risk of damage to the air bearing way," explains Gallon. "We use the TESA TWIN-T10 during all CMM installs, service and calibration and any service intervention relating to air bearing functionality. This instrument is ensuring that the accuracy of the CMMs complies with the manufacturer's accuracy statement so that the customer can have confidence in the reported results produced on their CMM."

Application 2: Aligning of Gantry CMM Beams and Bearing Ways

"As you can imagine, hoisting two heavy steel fabricated beams on top of fabricated legs which are two metres high and then aligning the beams parallel and true over five metres or more requires a capable and accurate instrument," says Gallon. "The time we used to take using a dial test indicator for this alignment has decreased and we can align CMMs with micron accuracy. The TESA TWIN-T10 gives us the ability to mount a GT31 probe on a CMM carriage and measure accurately along the full axis of travel, reducing alignment issues from hundreds of microns down to a few, which enables us to maintain our accuracy statement when installing large CMMs."

Application 3: Mechanical Alignment of Axis Squareness

The ZX, ZY and XY axes squareness is also checked with TESA TWIN-T10 and GT31 lever probe. This measurement is done by mounting the GT31 lever probe on the Z axis and traversing the probe in X, Y and Z axes along a granite square reference mounted both vertically and horizontally (depending on the plane to be adjusted) and perpendicular to the Z axis.



John Gallon, Service Team Leader in Telford, explains why the device is so useful for his team: "Prior to using the TESA TWIN-T10 we used long-range plunger dial test indicators and lever type dial test indicators with their inherent drawbacks. Now, rather than counting revolutions on the plunger dial test indicators and resetting position regularly, we can accurately read the display from a distance. This is very important as the GT31 probe is mounted on the CMM carriage at a significant height above your head, whereas the TESA TWIN-T10 remains within reach in such a way you can monitor the readings.

"Also, the adjustable lever of the GT31 enables measurement in hard to reach areas of the CMM where a straight pencil-type probe or a plunger of a traditional dial test indicator would not fit or reach," adds Mr. Gallon. "The time saved with this instrument is based mainly on ease of setup and not having to keep resetting or misreading a plunger style clock. We are very satisfied with TESA instruments and the quality of these products, which enable our Service Team to complete their work on time and to the high standards that are expected by our customers. No training from TESA was required as the TWIN-T10 display is so logical to use and handle." ■

FROM WEINHEIM TO THE WORLD



From a quiet town in the south-west of Germany to global installations and project management, **Accelerate!** caught up with the Q-DAS System Integration team to find out how a consultative approach shapes customer progress.

Weinheim, a quiet German town with about 44 000 residents, is home to the Hexagon-owned statistical process control specialist Q-DAS. Its software sets standards for quality assurance in industrial production, with 150 000 users all over the world trusting this high-performance toolset. From its impressive campus building, Q-DAS provides training and services for its statistical software and associated topics.

One of the key functions supported out of Weinheim is the System Integration (SI) team. This team consists of the skilled engineers who implement various projects for many different customers around the world. After an order is completed, the project engineer typically operates on site at the customer's location – in the case of Q-DAS this location could be in one of 55 countries worldwide!

Q-DAS develops various software products for computer-aided visualisation, monitoring and evaluation of product and process data in industrial production. The single programs can be combined in various ways to meet customer requirements and fulfil the respective tasks, even with the help of a third-party system.

The SI team is responsible for the customer-specific implementation and configuration of Q-DAS products and so facilitates the progress of our customers. The team members work consultatively with customers, analyse their tasks and find a solution meeting their requirements and needs. Once they are familiar with the customer situation and know their specific preferences and expectations, the project engineers work out a suitable individual solution ranging from single installations to the implementation of the entire 'CAMERA Concept'. This concept consists of six phases and the SI team implements the required tools on site.

During the first phase, Q-DAS products record measured values. Phases two and three assess the recorded and visualised data and store them in a central database. In the fourth phase, the user can access the database to perform the desired statistical



evaluations. The evaluation results may be illustrated in automatically generated reports in the fifth phase. Data archiving is the last phase, closing the loop.

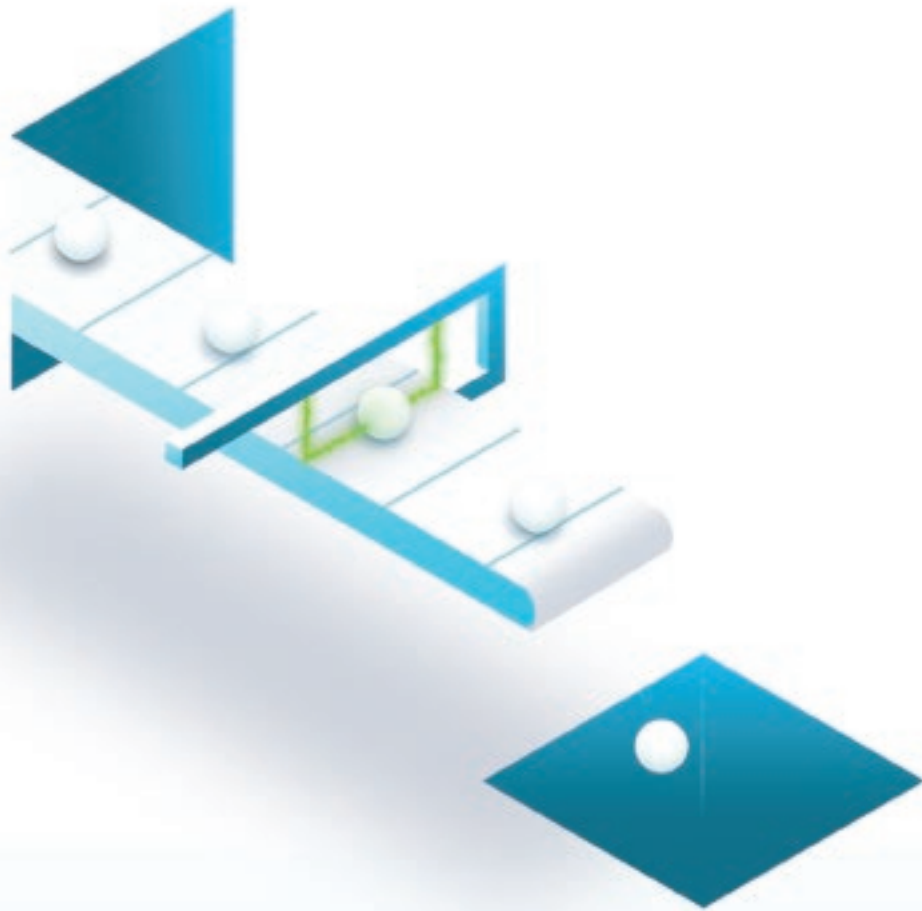
The final goal of the customer is to transfer their collected values into actionable information by using Q-DAS statistical software and the Q-DAS CAMERA Concept. This is the only way to use the full potential of their data, to raise quality in production and thus to save time and costs. A continuously increasing skillset and experience helps the system engineers to achieve this aim. They offer comprehensive technical support during the implementation of the project and install the software on site. In addition, their knowledge about the software and technical understanding helps them to configure the Q-DAS products to fulfil specific customer requirements. Each installation is different and every situation poses a new challenge that they must meet individually. The SI team does not avoid the

application of third-party systems; instead pragmatically combining and connecting different solutions to maximise value for the customer.

This is how Q-DAS shapes customer progress. However, this is not where the work of a project engineer ends. The team members remain a contact person, staying in touch with customers and supporting them in answering any project-related questions and in maintaining Q-DAS products in the long run. This variety of tasks gives the SI team a healthy balance between field work at customer sites and telephone support or remote maintenance. The customer and the Q-DAS employee often keep in contact for several years and the team members gain strong customer loyalty based on a cooperative partnership. The work of the SI team contributes to a successful application of Q-DAS software and shapes customer progress in a production environment. ■

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DESIGN FOR LIFE

Creating innovative new products is a design team's dream. However, managing those products throughout their lifecycle is a long-term process that begins with R&D. **Doriano Cometto**, Project Manager for Software and Application Services at Hexagon Manufacturing Intelligence, explains how planning for service life impacts upon product development.

CONTINUED ON P34 >>>

FUNDAMENTALS OF SERVICE REQUIREMENT FULFILMENT

Product Serviceability

The serviceability of a new product must be guaranteed and monitored throughout the life of the product defined during development; allowing quality service after shipping is a priority.

Training

Training for service and applications teams must be defined and scheduled prior to the product's commercial launch. Skilled technicians are a prerequisite for quality service.

Documentation

Service documentation and procedures must be released and distributed to field technicians prior to a product's commercial launch.

Service Tools

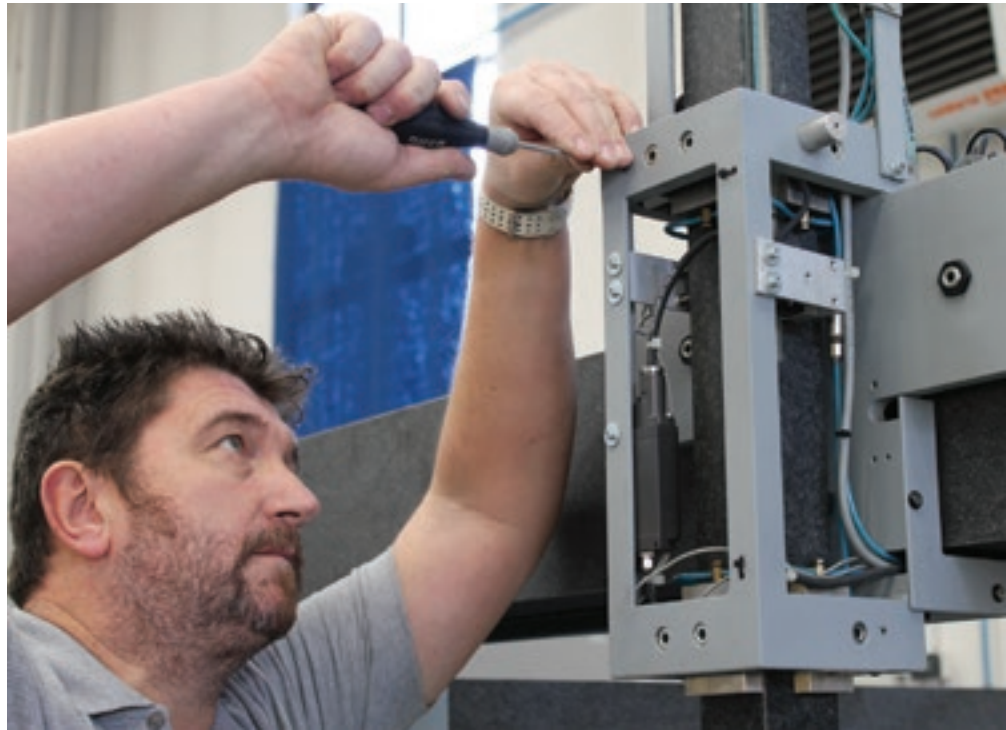
The tools required for servicing a product must be clearly defined and provided to service teams along with training prior to the commercial launch.

Spare Parts

Defined at bill of materials (BOM) level by the R&D team during the design phase, the spare parts list should be available at product launch with volume based on sales forecast.

Call Centres and Non-Conformity Management (Quality)

Teams must be established to support the service and applications teams in relation to product claims, technical clarifications and any non-conformity issues.



Design intent is a curious concept. Some products are designed to last just a few years – or even only a few months – while others are designed to last many more. The design intent of the Egyptian pyramids for example was completely different from the design intent of today's smartphones; and it's fairly safe to say that the pyramids will outlast any of the devices we are producing today.

A variety of factors determine exactly how long a product will be expected to endure, from whether the final customer is consumer or professional and if the technology used in manufacture is mechanical or electronic, all the way to differing social habits.

The general perception is that a product designed for professional use should last longer than a consumer product, though this is not a general rule, and does not apply for all professional products. While certainly a professional tool, a stick of dynamite has a very short life once ignited! But what the professional customer wants to know is exactly how long a product will last. They are also interested in the expected cost of ownership of the product, including everything from training costs and running costs through to downtime and disposal costs.

The more complex a product is, the more attention the manufacturer must pay during its design. The application of best practices in product design drives the success of any new product. Is it compliant with legal directives? Have environmental factors been carefully considered? Does it represent good value? Is the design supported by an element of common sense?



How Long Does a Product Live?

Hexagon Manufacturing Intelligence offers a broad range of products and solutions to the customer, from the simplest hand tools to the most complex customised and integrated solutions. The goal of these products is always to deliver actionable information that has the potential to improve customers' production processes and results.

In general, we can say that Hexagon's core hardware product range comprises automatic measuring devices that are considered 'machines' judged by the directives in force today. A machine should typically last ten years, based on these directives. But some additional considerations should be kept in mind. A machine such as a bridge coordinate measuring machine (CMM) can be considered in terms of its mechanics (the frame), its on-board electronics (the controller, motors, sensors etc.) and the computer and software that power it. As you can imagine, these three component categories do not share the same life span.

Software evolves extremely quickly, and after just a few years on the market can become obsolete, or at least outdated. The story of the computer is closely tied to software evolution, and it would be far from untrue to say that if something happens to your PC after five years, you may have to resort to a museum exhibit to find compatible replacement parts.

The story is better for electronics, with a ten-year lifespan not unreasonable to expect. The whole electronics system of a product therefore suffers far less from obsolescence than the software and computer components.

And yet for the mechanics of the product – often the most expensive part of the machine purchasing cost when it's broken down – it would not be unusual to see a lifetime of operation spanning decades.

Altogether this means that a CMM which has been on the market for ten years can be renewed with a service intervention aimed at upgrading only those parts and subsystems, such as the software, computing hardware and electronics, that have become obsolete. The result is not a machine with the cutting-edge performance a brand-new product, but a product completely renewed to the level of its original performance, or perhaps even better. The highest safety standards are restored; it is again a more productive tool and it again has a long lifetime of use to look forward to. And all this for a fraction of the cost of a new machine purchase.

Innovating with Process

When Hexagon brings a new product to market, the fact that this product must maintain a healthy condition during its entire expected lifecycle is a vital consideration of the design process. This means that how the product will be serviced must be considered from the outset. This is a key difference between an R&D prototype and an engineered product: both share the same specifications and functionalities, but only for the latter can it be guaranteed that it can be effectively maintained throughout a lifetime of use.

This requirement for good product serviceability is why the design process adopted to develop any new Hexagon product features a milestone to check that future service requirements have been fulfilled. Every development team has a service requirement manager, whose responsibility is to keep an overview throughout the entire project development process to ensure that all serviceability requisites are met. At every project review, the project manager checks that the defined service requirements are on track before allowing the project to pass to the next milestone.

From the moment that a product is offered for sale, Hexagon is ready to fulfil its service obligations as well. And that level of quality service, available whenever a customer needs it, is only possible because of the high value placed on integrating future service requirements into the product design process from the very beginning.

A design process with such an emphasis on serviceability is what allows Hexagon to guarantee customers a level of serviceability that respects their investment in our products. ■

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