

Accelerate!

SPEED AND CONFIDENCE

On track with
Infiniti Red Bull Racing

TO UPDATE OR NOT TO UPDATE?

Why software upgrades
make the difference

SURFACE DEEP

How fully-automatic quality
assurance takes surface
measurement to a
new dimension

Making Manufacturing Intelligence

SENSING. THINKING. ACTING.

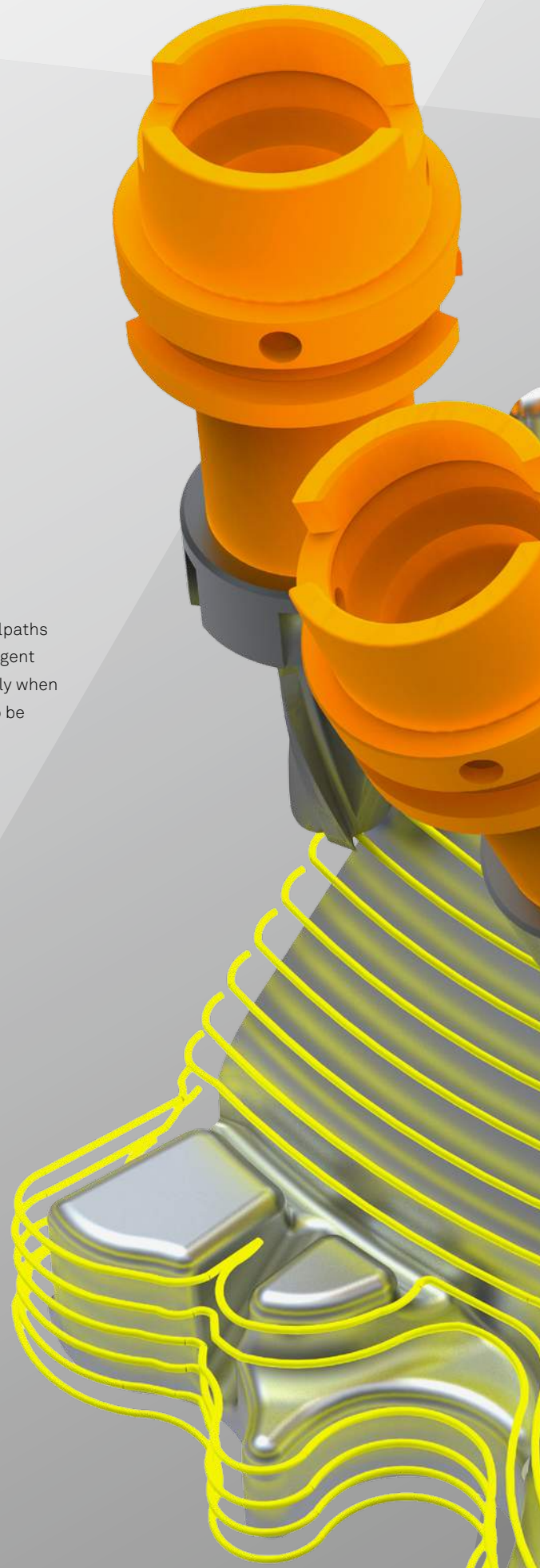


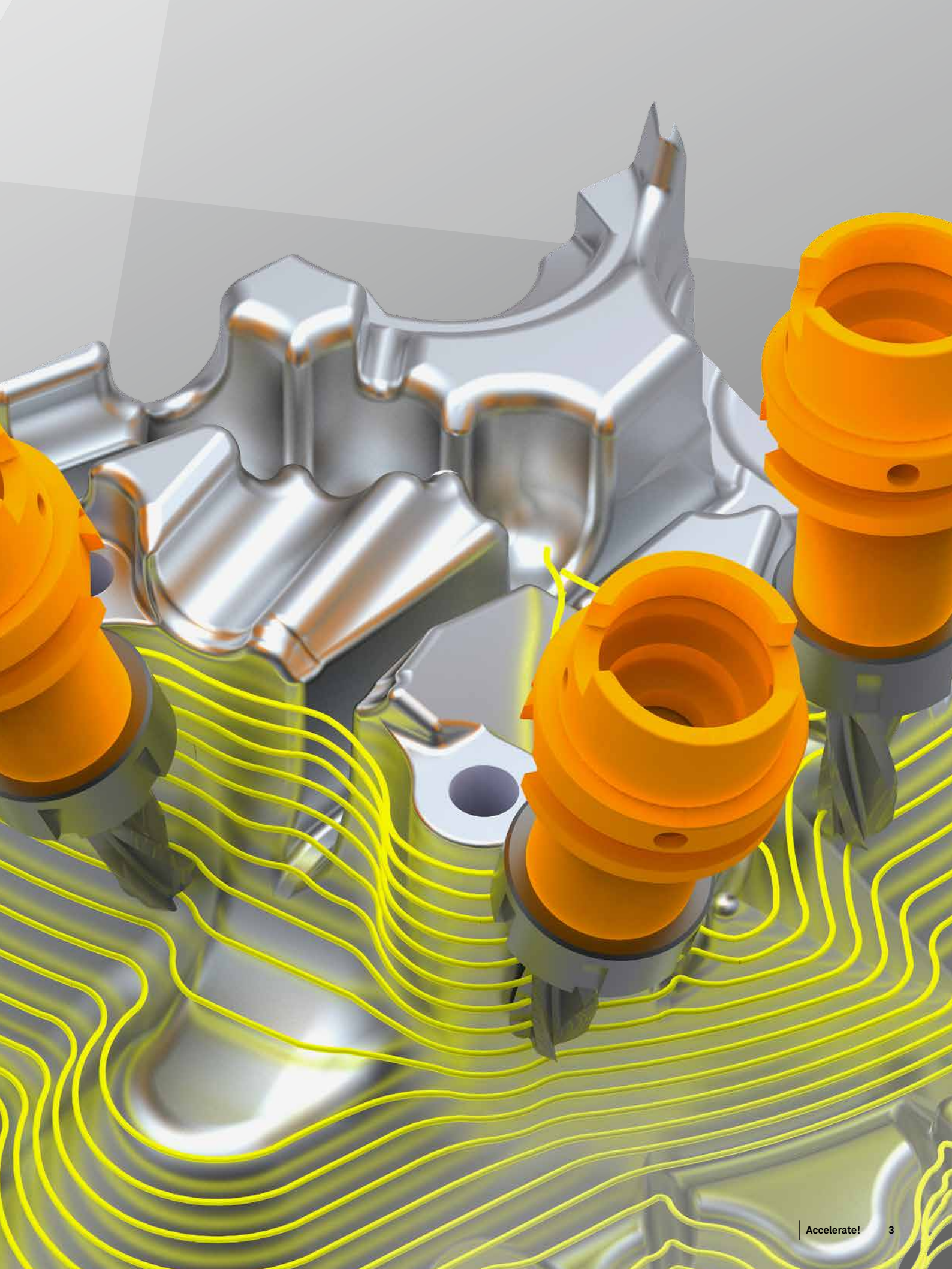
HEXAGON
MANUFACTURING INTELLIGENCE

AUTOMATIC **5-AXIS** MACHINING

From Vero Software

Automatic 5-axis machining allows users to automatically generate 5-axis toolpaths based on existing 3-axis toolpaths. The 3D to 5-axis conversion provides intelligent collision detection and will automatically tilt away from the piece geometry only when required. It enables the use of short, rigid cutters and allows more of the job to be machined using a reduced number of machine setups.







EDITORIAL

Change!



Follow me on Twitter
[@NorbertHanke](https://twitter.com/NorbertHanke)



An ancient philosopher once said that “everything changes and nothing stays the same”, and I think it’s a wise observation. Change is constant, and with focus, determination and hard work, we might even call it progress.

With these sentiments in mind, it is my great pleasure to welcome you to the very first issue of **Accelerate!**, the new magazine of Hexagon Manufacturing Intelligence.

Hexagon Manufacturing Intelligence is not just a new identity. It is a progression – the evolution of our brand. And this evolution didn’t happen overnight. Our new identity represents the culmination of a number of changes which have taken place over the last few years.

As a company, our core competence is dimensional metrology – using sensors to gather data. But in recent times our skillset has broadened with expertise in new areas like statistical process control and CAD/CAM software. This is a conscious strategy to improve our offering to customers – instead of simply sensing, we are developing the ability to sense, think and act to make a difference, and we look more deeply into these ideas in this issue’s cover story.

Although closely linked to metrology, these new capabilities take us beyond quality checking. They are about actively improving manufacturing and enabling customers to work in smarter ways. They are about driving productivity. They are about manufacturing intelligence.

So why ‘**Accelerate!**’? Well, as I’ve explained we are in a state of change, and acceleration is a constant change of speed – an increase of speed in fact. Of course, speed is also very important to our customers. Our solutions for manufacturers are enabling them to work at the speed they want with the confidence they need to be sure of their product quality. Our development goals are to help customers accelerate throughput, accelerate time to market, accelerate productivity, even accelerate their imagination and push the boundaries of progress even further.

I hope you enjoy the new magazine and find inspiration as you read on.

Happy reading

Norbert Hanke
President and CEO, Hexagon Manufacturing Intelligence
Quality drives productivity

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HIGHLIGHTS

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



Tube measurement has a new shape

Hexagon Manufacturing Intelligence has released its much-anticipated TubeShaper software, a brand new dedicated tube measurement package for use with the ROMER Absolute Arm. Developed in collaboration with some of the world's leading tube manufacturers, TubeShaper simplifies tube and pipe inspection, tube production, reverse engineering and tube gauging applications.

Designed for usability, TubeShaper features two operator profiles within its intuitive graphical user interface. Measurement plans can be created automatically or set up offline, making batch measurements faster. An advanced CAD engine enables the import and export of tube data as well as the inspection of complete tube assemblies. The software also has the ability to interface directly with CNC tube benders, enabling correctional

data to be calculated and applied within the process for streamlined operations and minimal scrap.

"With TubeShaper, the user experience is completely different to previous tube measurement software options," said Stephan Amann, Product Line Manager at Hexagon Manufacturing Intelligence. "We're really excited to bring a package like this to market."

Investing in youth at WorldSkills 2015

WorldSkills 2015 saw over a thousand competitors from around the world converge on the Anhembi Park Exhibition Centre in São Paulo for the biennial competition aimed at promoting vocational education and skills excellence.

2015 marked the first time that the event was held in Latin America, and Hexagon Manufacturing Intelligence reinforced its commitment to developing youth skills by participating as a gold sponsor for the event. Competitors in the industrial manufacturing categories used hardware and software supplied by the company to demonstrate their knowledge as they contested various challenges. Equipment in action included an Inspector BR coordinate measuring machine (CMM) and an

OPTIV Performance multisensor device as well as PC-DMIS metrology software. "Education is a key element in ensuring that the demands of industry all around the world are met," said Danilo Lapastini, Vice President Hexagon Manufacturing Intelligence South America. "We support events like this to support vocational learning and the challenge of a competition brings fun and excitement into the teaching of these much needed skills."

Edgecam supports m&h touch probes

Hexagon-owned CAD/CAM specialist Vero Software has unveiled new capabilities within Edgecam, the CAD neutral production CAM system for milling, turning and mill-turn machining. Users can now measure workpieces with Hexagon Manufacturing Intelligence's m&h





WorldSkills 2015

machine tool probes and simulate probe movements directly within the Edgecam software environment. Edgecam solutions combine the power of sophisticated toolpath generation with seamless CAD integration. Used globally within a multitude of industries, Edgecam consistently produces the best tool paths to improve productivity.

In the first direct technology collaboration between a Vero Software brand and a Hexagon Manufacturing Intelligence hardware, Edgecam now provides six measurement cycles: Probe Surface, Probe 4th Axis, Probe Feed, Probe Corner, Probe Bore/Boss and Probe Web/Pocket. Within each cycle, users can access eight functions to give a wider choice of measurement data in the process, minimising scrap by checking and correcting positional errors amongst other useful functions.

New Wetzlar facility hosts Automation Forum

Automotive industry professionals convened at the new Hexagon Manufacturing Intelligence Automation Centre in Wetzlar, Germany to celebrate its opening with a two-day technical event.

Focusing on inline and offline 3D measurement technology within body

shell manufacturing, the Automation Forum showcased how top vehicle manufacturers are driving productivity by moving quality assurance into the production process.



Highlights included a live demonstration of the Hexagon Manufacturing Intelligence 360° SIMS (Smart Inline Measurement Solutions) cell, while the event also featured presentations on current trends in the automotive world from top-class speakers. Industry 4.0, big data and collaborative robotics were among the hot topics, while headline presentations included Mark Fulthorpe from IHS Automotive speaking about how OEMs are adapting to the changing needs of the market to increase production flexibility, and a session on simulation and virtual offline programming from Dr Johan S. Carlson, Director of the Fraunhofer-Chalmers Centre.

Hexagon Manufacturing Intelligence forges links with academic institution

Hexagon Manufacturing Intelligence has signed a Memorandum of Understanding (MOU) with Republic Polytechnic (RP) in Singapore to collaborate on knowledge sharing and joint projects for manufacturing applications.

The cooperation will strengthen industry links through the provision of training and services, and create a joint laboratory aimed at providing a full suite of solutions in product realisation, from Computer-Aided Design (CAD), 3D prototyping, measurement and inspection and tooling design for mass production, to statistical process control.



The MOU was signed by Hexagon Manufacturing Intelligence's Asia Pacific President Lim Boon Choon, and Seto Lok Yin, RP's Deputy Principal (Industry Services), who said, "RP is honoured to be in partnership with Hexagon Manufacturing Intelligence, a technology leader providing solutions ►



for advanced manufacturing processes. We plan to set up a Joint Laboratory that enables our students to deepen their skills in metrology technology and manufacturing, and for both parties to explore technology projects in this area.”

HxGN LIVE competition winner announced

In the final issue of **MEASUREUP**, readers were asked to pick out their favourite new technology for the chance to win a trip to the Hexagon conference.

Congratulations to the competition winner, **Filip Cieslar** from the Czech Republic, who has been invited to



HxGN LIVE Hong Kong with flights and accommodation courtesy of Hexagon Manufacturing Intelligence.

Filip, who works at Hyundai Motor Manufacturing Czech, wrote about his enthusiasm for the Leica Absolute Tracker AT960:

“I’ve been using the AT901 laser tracker for more than 5 years, so definitely the AT960 is the biggest revelation for me. It was the best Christmas present I received! Batteries, integrated levelling, compact size, the warm-up speed – I love it! Also the new Leica T-Scan 5 is awesome; shiny dark surfaces are no problem anymore and the range is perfect!” ■



MMS PULSE

Monitoring the heartbeat of your CMM

Discover MMS PULSE, a monitoring system that offers real-time insights into external and environmental factors impacting upon operating environments.



TESTIMONIALS

“ From a qualitative point of view, the competitiveness of a company like ours is based on two key factors: the product quality and the process quality. In these terms our latest Hexagon product, the WLS400A robotic white light system, will enable us to keep close and uninterrupted control of product and process quality, and guarantee the earliest possible intervention to prevent the occurrence of errors and defects.”

Carlo Mandirola,
PMC Automotive, Italy



IN YOUR WORDS

The latest comments and feedback from Hexagon Manufacturing Intelligence customers in Europe.

“ The activities undertaken within a production company are increasingly shifting to various production locations. In order to keep up with this development and the constant demand to manufacture more efficiently, highly-flexible and portable measuring solutions with absolute accuracy are highly valued. Both the Leica T-Scan 5 and the Leica T-Probe are measuring devices that support our work and the objective of maximum precision.”

Dieter Hildesheim,
Volkswagen Sachsen, Germany



“ We have been working in partnership with Hexagon for more than 15 years. They have helped us to develop our measurement activities within the assembly workshops at Airbus Helicopters. Year on year, they offer us increasingly powerful measurement equipment – laser trackers. That is certainly the case with the new Leica Absolute Tracker AT960, which offers us improved portability and faster measurements. As a result, the services we provide are even more efficient.”

Laure Corneille Royer,
Airbus Helicopters, France



“ Hexagon is a trusted supplier whose equipment can be relied upon. It is a company that is not only extremely supportive of NPL objectives, but also shares our passion for assisting manufacturers in this region. We're delighted to have helped users either introduce or develop new and existing products and processes as well as improve measurement accuracy and change calibration or traceability.”

Andy Morris,
National Physical Laboratory, UK

CASE STUDY

ADDING A TOUCH OF CLAAS



Established in 2010, Uz CLAAS Agro LLC is a joint venture which produces CLAAS agricultural equipment for the Uzbek and wider Central Asian markets. The company has grown rapidly and now employs around 250 people. Its output of harvesters, balers and tractors has already made it the largest producer of agricultural machinery in the country.

While the Uz CLAAS Agro plant initially opened with no metrology equipment on site, the developing scale of operations led to a need for a versatile measurement system which could be used for the dimensional inspection tasks generated by the diverse equipment range.

Following a recommendation from colleagues in Hungary, the company purchased a ROMER Absolute Arm with the HP-L-20.8 external laser scanner. A portable system with a 4-metre measurement volume and the ability to switch seamlessly between highly-accurate touch probe readings for feature measurement and data-rich point cloud digitising, the arm is now an essential tool for the plant. ■



To find out more about how Uz CLAAS Agro use the ROMER Absolute Arm, go online to read the full case study.

<http://hex.ag/RYCpq>



Company: Uz CLAAS Agro

Location: Tashkent, Uzbekistan

Industry: Agricultural machinery

Solution: ROMER Absolute Arm and HP-L-20.8 Laser Scanner



IN DEVELOPMENT

In the technology-fuelled world we inhabit today, upgrades and updates are a regular occurrence. When we upgrade to a new phone, we expect to update the operating system periodically. But why do we need to make these continuous changes? **Doriano Cometto**, Project Manager for Software and Applications at Hexagon Manufacturing Intelligence investigates the never-ending story of software.



Doriano Cometto
Project Manager for Software
and Applications

Everyone knows about software updates. Software updates are the little badge on the home screen of your smartphone asking you to install updates or the requests to restart your PC because some new security package or version of a program has been installed. In fact, we've become so accepting of updates that most of us don't stop to ask why they are needed.

The rate of technological advancement has now reached the point that several changes can take place within a generation. We used to watch films and TV shows on video, until DVDs came along. Now we have Blu-ray and a wealth of digital download or streaming services to choose from. Yet in the consumer goods market, changes in software tend to be less noticeable than changes in hardware. Most people could probably look at a line-up of computers dating from 1980 to the present day and make a decent guess at which were the oldest and which were the newest, judging by characteristics like size, colour, whether they use tapes or disks or CDs. Perhaps they would struggle more to distinguish between software iterations over the same timeframe.

Rates of progression

In the world of metrology, customers tend to be more aware of physical wear on their equipment than of aging software. But hardware changes are probably not so pronounced as in consumer goods markets. A well-maintained coordinate measuring machine (CMM) frame can function effectively for well over a decade or longer. Even though the steady evolution of mechanics and electronics makes the newer products in the

marketplace more sophisticated than their predecessors, it isn't necessarily a reason to rush out and upgrade your CMM to the latest model. So if you can keep your machine functioning for another few years, why not just keep the version of the metrology software that came with it?

Hexagon Manufacturing Intelligence releases new versions of its software packages at least twice a year. These releases may add new features or tools, improve the performance and stability of the package and offer a better user experience overall. For newer metrology equipment, updated releases may ensure that operators can access the complete functionality of their technology. Critically for manufacturers these updates also enable developers to include the latest versions of standards, so by keeping software up to date they are also ensuring compliance.

Keeping up with the hardware

In theory there's always room for improvement, but in the unlikely event that a software developer was convinced that their program was perfect and could not be made any better, chances are that they would still need to update the package. Because computer hardware





improves so quickly, operating systems evolve with it as they are designed to optimise the performance of the latest technologies. Even if it is barely perceivable to the user, new software versions may have critical changes within the base code of the program to ensure compatibility with newer PCs. Any software that stands still will quickly become obsolete – developers have to follow the trends of other related sectors.

For example, early metrology software was purely text based – matching the capability of the computers it ran on. When more powerful graphics cards entered the marketplace, metrology software began the transition to the graphics-heavy CAD-based packages of today. This is just one of the reasons why a CMM with fifteen years of service behind it probably doesn't run the software that it came with – computer hardware and operating systems don't typically last this long. Even if they do, running outdated metrology software on an older PC is a risk. If that PC fails and needs replacing or the company moves to a newer operating system, the gap in system compatibility may cause the quality department to be without its software and in the worst cases, needing

to start all its part-programming again from scratch.

Small steps minimise risk

One of the best ways to minimise these risks is to move in small steps when it comes to software updates. When developers make changes in a program, they generally want to make the alterations as simple as possible from one version to the next. When you try to make bigger steps or miss out versions of the software between upgrades, it introduces a much greater element of uncertainty. Crucial conversion algorithms may be ineffective, resulting in anything from minor glitches to unsuccessful or incomplete upgrades – and potentially a costly repair job if you need support from metrology software technicians.

To ensure they are gaining the full benefit of the latest version of their software and to avoid the hassle caused by missing an update, many Hexagon Manufacturing Intelligence customers take out a software maintenance agreement (SMA). Businesses covered by an SMA receive all regular updates throughout the duration of the contract and also have access to the latest information about their software, helping to provide

a 'continuous learning' approach to employee training. Telephone or remote support is also included so that any problems can be solved professionally by experienced software developers.

Peace of mind

In one sense, SMAs are about peace of mind – knowing that you have the support you need for your software whatever the circumstance. But they can also help to safeguard businesses and futureproof them against potential changes and challenges. If for example a PC-DMIS user wants to configure their software for a new sensor or CAD format, or add a new module such as PC-DMIS Gear, they need to be on the latest version of the software. The same goes if an update is required to the controller firmware or hardware, or if an operating system update causes a compatibility issue. SMAs take the hassle out of staying on the latest version, and mitigate a lot of potential problems in the process.

The moral of the story is that software is never set in stone. It's a living thing; it evolves and should continue to change for the better. But living things need support to flourish and will always benefit from the help of specialists. ■

SENSING. THINKING. ACTING.

In November 2015, Hexagon Manufacturing Intelligence was unveiled as the new name for Hexagon Metrology. This issue, **Anne Willimann**, the company's Director of Global Marketing Communications and **Accelerate!** Editor-in-chief, goes behind the rebrand, delving into the company story and philosophy to find out where the business is going next.





HEXAGON

MANUFACTURING INTELLIGENCE



Anne Willmann
Director of Global Marketing
Communications

Living in our increasingly connected world, it's hard to switch off from information. With constant streams of media reaching us via ever-more portable devices, we are all becoming more informed and savvy consumers. And company image is important to consumers. Stories of positive, and indeed negative, brand associations spread quickly and have the potential to make or break a firm. As a result, businesses are increasingly 'brand aware'. But defining a brand – what makes it unique, identifiable, and attractive to customers – is not always straightforward. Put simply, what makes a brand?

It's easy to dismiss a brand as simply a name or a logo – but these alone mean very little. However, they are representations of something less tangible. A brand is a promise to customers. The name and logo can be mistaken for the brand easily enough, but this is because they provoke a

response in people – they look at a logo and think of the value that company brings them. Successful car brands are often said to stand for 'technology', 'quality', or 'performance', because they have a pedigree of delivering on this promise to customers. But of course, to successfully deliver on a promise, a brand has to accurately represent the company offering. And as markets change, technologies change, demands change and offerings change, so brands must change too.

Reassessing customer needs

Although they come from a hugely diverse range of industries – automotive, aerospace, electronics, medical, power generation and energy, and machining to name just a few – our customers share a common characteristic. Each and every company we serve is manufacturing a product of some kind, and has historically come to us for dimensional inspection technology to support quality control checks. The reasoning behind this might be very different across industries, ranging from aesthetic quality on a small consumer item to traceability and regulatory requirements on an aircraft or a medical device.

At one time, measuring output after production and giving go/no go decisions was enough for most manufacturers. Quality control was seen as something

of a necessary evil – a cost in time and money that had to be done but added no real value to production. But now our informed and savvy customers want more. They want to find smarter ways of working, and are looking for partners who can help them develop better products more efficiently and more cost-effectively. They need to get to market faster and be more competitive. They want expert support to achieve their productivity goals.

Speed and confidence

While specific industries have their own unique challenges and motivations, productivity is central to manufacturing success across the board. To balance the books, manufacturers must find the right levels of speed, efficiency, cost and quality for their product and ensure they remain productive at those levels. Sometimes there might be a payoff between factors – in the case of a luxury item where top quality is expected, the manufacturer might choose to work more slowly and therefore push the cost up. For a cheaper mass-market item with less tight tolerances, speed and throughput are essential and they may prioritise streamlined processes over product quality.

At Hexagon Manufacturing Intelligence, we believe that the key to success for our customers is the ability to work at



the speed they need while maintaining complete confidence in the reliability of their process and the quality of their products. And this is what we promise to our customers: speed and confidence in manufacturing transformation.

From the past to the future

The Hexagon Metrology brand was built around the message of quality coming together. It represented a broad portfolio of measurement equipment – from gauges, calipers and micrometers through portable measuring arms, laser trackers and white light systems, to bridge and gantry coordinate measuring machines and optical measuring systems – being shaped and developed to create more complete solutions for dimensional inspection. With each new acquisition, Hexagon Metrology gained new skills, new technologies, new expertise and experience which enabled it to be more collaborative with our customers and better understand their businesses. This growing knowledge, coupled with an ongoing commitment to and substantial investment in research and development, progressed its offering further to meet the needs of its customers.

The needs of customers are at the heart of any commercial business, and in recent years Hexagon Metrology

recognised in its capabilities the potential to meet a wider spectrum of needs for customers in the manufacturing industry. This began with advanced metrology software turning raw data into actionable information more quickly and simply than ever before. The acquisition of m&h Inprocess Messtechnik in 2008 marked the first movement towards supporting the manufacturing process itself, albeit still through dimensional inspection. However, the 2014 acquisition of CAD/CAM experts Vero Software, followed closely by the statistical process control specialist Q-DAS, accelerated this broadening of capabilities, and this is why the time is right for our brand to reflect this evolution.

Even as Hexagon Manufacturing Intelligence, metrology remains our core competency and is still central to our offering. But our new capabilities take us beyond the traditional quality control applications of our technologies. For the past few years, Hexagon Metrology was talking about the need to 'close the loop' in manufacturing: gathering data, producing actionable information and acting upon it to improve outcomes. Statistical process control offers new potential for analysing data and informing decision making. CAD/

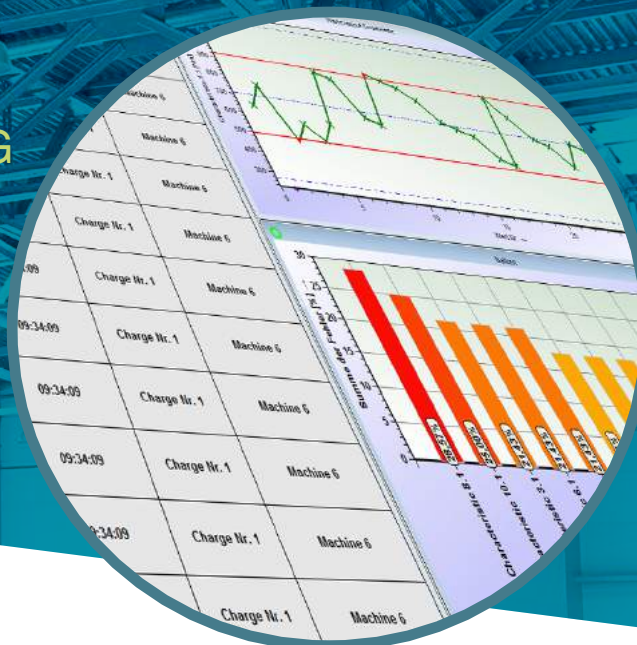
CAM software gives just one way of influencing outcomes at the point of production. As we continue to develop in these areas and others, we move closer to achieving this vision of smarter, data-driven manufacturing. It's not just about metrology anymore. It's about manufacturing intelligence.

Sensing, thinking and acting

The aim of Hexagon Manufacturing Intelligence is to combine technologies and ideas to enable this closed loop manufacturing – developing solutions that solve customer problems. In cognitive science, the human response to a problem can be described in three terms: sensing, thinking and acting. These are the terms we use to define our areas of expertise:

- **SENSING** represents our metrology heritage – using one or many sensors to gather data and gain insight into manufacturing processes
- **THINKING** is our analytical ability – processing and packaging raw data into actionable information to inform decision-making
- **ACTING** is the implementation phase – taking the knowledge acquired through measurement and analysis and using it to make improvements in the real world

THINKING



This ability to effect change is the key difference between the value proposition of Hexagon Metrology and the value proposition of Hexagon Manufacturing Intelligence. And much like when Hexagon Metrology gathered its broad portfolio of metrology equipment together, not every product will be right for every customer. We understand that some customers only need us to supply measurement equipment for quality checking, and we will continue to support them. But we also recognise that many of our customers need, and already use, products in all three of these areas. As Hexagon Manufacturing Intelligence,

we are uniquely positioned to offer connected, integrated solutions with the superior response times of a single vendor – and to place information at the heart of manufacturing.

Quality drives productivity

In the past, metrology could be viewed as something which presented manufacturers with problems rather than solutions. Quality assurance was a barrier to productivity. However, we believe that now, we have the potential to change this perception. Sensing, thinking and acting independently is just the first step. We are already beginning to connect the dots,

creating links between each phase of the manufacturing cycle. Tapping into the full potential of automated solutions, the Internet of Things and Industry 4.0 principles, we believe that sensing, thinking and acting can become an automated, closed-loop cycle, taking the theoretical knowledge gathered through metrology back into the physical world and making real improvements. In the vision of Hexagon Manufacturing Intelligence, instead of being a barrier to productivity, quality drives productivity. Now that's a brand shaping smart change. ■



ACTING

ONE VISION

From a small town in the west of Germany to the worldwide electronics and medical markets and beyond. **Accelerate!** visited Saarwellingen, home of Hexagon Manufacturing Intelligence's vision product line, for a factory tour.

With a population of just over 13 000, Saarwellingen is at first glance similar to other Saarland areas. Yet out of this inauspicious municipality comes state-of-the-art measuring equipment which is helping to support the ever-growing global demand for consumer electronics and cater for the needs of other industries producing small and intricate parts.



Saarwellingen is the headquarters and heart of Hexagon Manufacturing Intelligence's vision and multisensor technology division. Alongside the factory staff producing coordinate measuring machines (CMMs), it also houses research and development (R&D), operations and service teams. And like the multifaceted CMMs it makes, there is more to Saarwellingen than meets the eye.

Multitasking operations

On site, Hexagon Manufacturing Intelligence designs, develops and produces its three OPTIV range models of multisensor CMMs. Although typically associated with the image-processing vision sensor, these CMMs can be equipped with various tactile and non-contact sensors. In addition to the vision, traditional touch-trigger and analogue scanning options, the machines carry chromatic white light, laser point and laser scanning sensors – resulting in a large number of deliverable configurations. All of this means that the production and fulfilment operations at Saarwellingen must work in perfect harmony – so internal processes are a key priority.

Saarwellingen has pioneered several new and innovative approaches to process management. Product lifecycle management (PLM) software enables interactive real-time planning and control of the production. A tablet-based information and visualisation system links all production work centres so that every operator has access to the information they need to inform decisions and identify problems from supply chain through to product testing. PLM data can also be merged with information from other systems and connected with relevant product data such as CAD

models, designs and part lists. The result is that every machine that leaves the factory has a traceable history on file.

From research to reality

Multisensor CMMs are used for quality assurance of precision components in all areas of industry, but are most associated with the electronics, telecommunications, medical, microsystems technology, automotive and aerospace supply chain, tool and mould construction, and plastics industries. Each has rapidly changing needs, keeping the R&D teams on their toes.

As well as using the PLM to guide development operations, this department follows Hexagon Manufacturing Intelligence's internal innovation process to ensure R&D projects result in products which have a real impact on the market. Among Saarwellingen's many engineering achievements is the development of the DUAL Z CMM technology, which offers independent Z-axis movement for two sensors, simplifying programming and reducing the need for stylus changes, reclamping and referencing.

Customised to care

Also based in Saarwellingen are the sales and technical support teams for the multisensor product lines, including the dedicated customer care team.

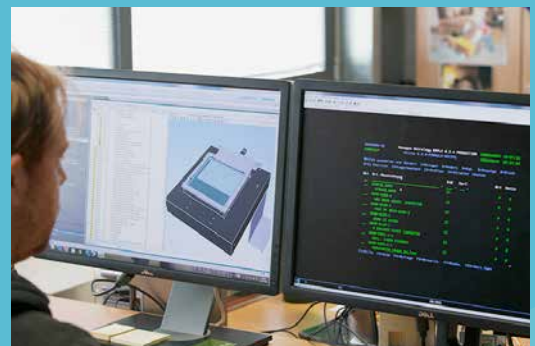


Unlike many organisations, the process-driven approach is just as noticeable in services as on the shop floor. All customer interactions are documented to help staff respond quickly and efficiently to problems, and to ensure that agile feedback is gathered and improvements are made when necessary.

As with R&D and production, the customer services department is linked to the rest of the site by processes and systems. For example, if a customer comes to their technical support contact with a request for a specialist fixture, sensor or accessory, defined channels enable that contact to direct enquiries to the relevant developer, product manager or technician to determine the feasibility of the request and act to deliver it.

Seeing clearly

Business success is often related to finding the right combination of people, processes and tools to work at speed and deliver quality – and this is particularly true for manufacturers. As a manufacturer itself, Hexagon Manufacturing Intelligence understands this better than most, and the customer-centric, process-oriented approach of Saarwellingen is a perfect example of working smart for success. ■



FROM ONE MACHINE TO ANOTHER

For a company that has always performed measurements manually using height gauges and micrometers, taking the step towards automated measuring technology is a pretty big deal. However, if like contract manufacturing company Köppel AG you have a clearly formulated job profile, the acquisition process becomes far easier.

Central to Köppel AG's requirements was that production should be able to continue during the measurement process and any necessary corrections be made once the measurement result becomes available. "Our priorities were easy-to-use hardware and software, and being able to use the machine in production," recalls managing director Marcel Köppel.



Köppel AG conducted intensive investigations into products from three leading providers of measuring machine. Ultimately, it was Hexagon Manufacturing Intelligence that offered the most appealing overall package in the form of the TIGO SF: "Its design for use in a workshop, flexibility, fast delivery, a great price-performance ratio and ease of operation clearly spoke in favour of the TIGO SF," says Köppel.

"The TIGO SF represents added value for our employees, our customers and our company thanks to increased productivity, minimised waste and a quick return on investment. The measuring machine from Hexagon has definitely met our expectations." ■



To find out more about the TIGO SF in production at Köppel AG, go online to read the full case study.
<http://hex.ag/RyCOo>



Company: Köppel AG
Location: Berneck, Switzerland
Industry: Precision industry
Solution: TIGO SF and PC-DMIS CAD with Operator Interface

MAKING MANUFACTURING INTELLIGENCE

Following Hexagon Metrology's change of identity, **Accelerate!** quizzed regional presidents **Zhou Liang** and **Angus Taylor** about the ongoing evolution of the company and what Hexagon Manufacturing Intelligence will mean for customers and employees.



You've been with Hexagon in its various forms for a number of years now. What have been the greatest changes you've seen in that time?

Zhou Liang: I've been with the company for nearly 12 years and the progression in that time is incredible. In terms of the business and its offering, I think the greatest change is the consolidation from what were originally very diverse fields into the more integrated dimensional metrology we see today. Measurement hardware and software are increasingly closely entwined and optimised for each other, and of course metrology is starting to connect more deeply with other areas of the manufacturing process. We've moved from being a standard machine business to a leader in solutions, and I think we'll continue to see more customisation in future.

Angus Taylor: The greatest changes I have seen are the organisational shifts in some of the smaller, privately-owned businesses that have become part of Hexagon. Where many of these previously operated regionally, they now maximise the benefits of our global footprint. They've expanded across the company's infrastructure, utilising the economies of scale this brings and benefitting from synergies in product development. The transition from multiple organisations to a single brand has created a sense of belonging for our employees and enhanced the strength of the company in the eyes of our customers – giving them greater confidence in our ability and offering.

There has been a lot of excitement around the change from Hexagon Metrology to Hexagon Manufacturing Intelligence. What opportunities will this give our customers in the manufacturing community?

ZL: In recent years we've grown our capabilities in the fields of data capture, information analysis and more recently active process improvement – sensing, thinking and acting. Of course, we still intend to innovate in all three areas, so we will



Zhou Liang
Executive President
Hexagon Manufacturing
Intelligence Greater China



Angus Taylor
President and CEO
Hexagon Manufacturing
Intelligence North America

continue to give customers new opportunities in this respect. But transitioning to Hexagon Manufacturing Intelligence is more about connectivity. We want to unite our leading hardware and software technologies and complete the loop for manufacturers, making quality control an enabler for our customers.

AT: The value metrology brings to manufacturing becomes substantially greater the closer we are to the production or assembly processes. Our customers need great quantities of data, not only to control their processes but also to enhance product reliability and performance through product lifecycle management. There will come a point where this demand for rapid access to data, facilitated by the Internet of Things, will not just be a nice to have. It is expected now, and will eventually be mandatory. As Hexagon Manufacturing Intelligence, we are committing to supporting this wider need and we will help customers drive decisions faster, increasing productivity and throughput in their operations.

When you look at its history, this is a company where change is almost a constant. How do you keep employees motivated in such an evolving environment?

ZL: We build the company culture in a way that is focused on customer demands and we base our success on our customers' success. If the environment is evolving we have to offer opportunities for our employees to evolve and better themselves too. There will always be room for improvement and their jobs will always be challenging, which is a great motivator in itself.

AT: Certainly in North America, and I suspect around the world, there are two main drivers that keep our employees motivated. The first is seeing the company achieve profitable growth, which enables us to invest in people. Profitable growth leads to the second, which is strengthening human capital. Training, education, personal development, travel –

none of this can happen without the stability of profitable growth. Both of these drivers are critical and one doesn't exist or thrive without the other. We need both to create a healthy environment that people want to belong to, with sufficient capital available to develop products and improve our internal processes with new technology investments.

With this new direction in mind, how do you see the business developing over the next few years?

ZL: As a trend, changes will go faster than ever before! The future business will have more crossovers with different aspects of the manufacturing process and we will have a broader field of opportunities, some of which never even entered our imagination a few years ago. Of course, we will face quite different challenges – a wider and more diverse customer base, different competition areas, perhaps the need for different knowledge and skill sets. But that's the exciting thing about a business like ours, we have the agility and scope to develop in this way and we're good at it.

AT: I also think there will be a need for additional external skills. Understanding our customers' manufacturing processes and workflows will become very important within Hexagon Manufacturing Intelligence. Many customers have found that technical skill levels have been lost in certain aspects of manufacturing, and it's the responsibility of a company like ours to help bridge this skills gap with both people and technology. There will be further developments in metrology automation and the collection of data, as well as real-time data processing and analysis. I think the introduction of the statistical process control expertise we've brought in with Q-DAS will be a really interesting driver in defining software strategy too. Ultimately, we must continue to add value in manufacturing environments that will constantly be in a state of change – so I anticipate more changes ahead for us as well! ■

GOING LIVE

Every year, Hexagon customers and partners come together to share stories on the Metrology/Manufacturing track at Hexagon's international user conference. **Accelerate!** checks out what's on offer at HxGN LIVE and why attendees keep coming back for more.

From inspiring keynotes to must-see technologies, HxGN LIVE has a proud reputation for showcasing the latest knowledge and progressive thinking. Gathering together several thousand users of Hexagon's industrial and geospatial technologies, the conference has gained a loyal following at its annual North American edition while HxGN LIVE 2015 Hong Kong launched the event in Asia. But what motivates people to take time out of their busy schedules to attend an event like HxGN LIVE?

Focus on customers

Through the work of its customers and global brand network, Hexagon has contributed to revolutionary projects that not only have great impact, but generate great stories worth telling. A user conference with user stories at its heart, HxGN LIVE is committed to sharing these stories and session presenters regularly include Hexagon Manufacturing Intelligence customers giving others the benefit of their experiences.

Focus on industries

Every industry has its own unique challenges, so HxGN LIVE's session content is organised to share knowledge in industry-specific tracks and subtracks. Hexagon Manufacturing Intelligence's industry emphasis enables attendees to identify their own needs and join the sessions most relevant to their drivers, from speed and productivity to validation and traceability across a complete range of tolerances.

Focus on technology

Designed to enable customers to better harness the power of Hexagon technologies, the conference features The Zone technology expo – a live and interactive demonstration centre showcasing all the use of Hexagon equipment across all kinds of industrial applications. Attendees have the chance to get hands-on with Hexagon Manufacturing Intelligence hardware and software under the guidance of technology experts and product specialists.

Focus on solutions

Progress and development brings with it new challenges to overcome. HxGN LIVE is about solving problems, today and tomorrow. By bringing together product specialists, industry experts, customers with individual requirements and a wealth of manufacturing technology, Hexagon uses the conference as a networking centre and ideas hub, producing new ways to apply expertise and develop solutions.

Focus on the future

HxGN LIVE looks forwards, with thought-provoking keynotes presenting visions of the future while prototype demonstrations and technology previews bring tomorrow a step closer to today. Hot topics for Hexagon Manufacturing Intelligence in recent years have included everything from automated solutions to collaborative robotics, addressing the skills gap, the Internet of Things and Industry 4.0. When there's a new trend in manufacturing, you can expect to hear about it at HxGN LIVE.



HxGN CHANNELS

CONTINUE THE **CONVERSATION YEAR-ROUND!**

Stay connected to Hexagon by visiting our HxGN channels, the digital platforms where great stories about our brands come together.

Join our growing community of innovators and thought leaders by tuning in to these outlets for announcements, previews and buzzworthy features!



MEET at HxGN LIVE

Join us at HxGN LIVE, our annual international conference that presents an exciting lineup of keynotes, evening events, a technology expo and hundreds of sessions centred on geospatial and industrial enterprise solutions.



WATCH HxGN TV

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MEGA ROBOTICS

In 2012, researchers began a project aimed at enabling large format manufacturing operations to be performed to the accuracies expected in small-part production. Three years later, and with the help of a Leica Absolute Tracker from Hexagon, MEGAROB was born.

Recognising manufacturing as a key driver for growth, the European Commission has made a long-term commitment to develop the industry through its Factories of the Future (FoF) programme. This programme outlines a vision of high added value manufacturing technologies that enable factories to be clean, high performing, environmental friendly and socially sustainable.

One project to benefit from FoF funding is MEGAROB, an ambitious scheme to develop new capabilities for the high-accuracy manufacturing of parts in excess of 10 m in length. The original scope for the €4.3 million project set out the development of a flexible automated platform enabling high-accuracy manufacturing operations for medium and large complex components using a spherical robot, a laser tracker and an overhead crane. The theory was that by mounting the multifunctional robot on the crane, it could be deployed for different tasks anywhere within the volume while the workshop floor would be left completely clear. Allowing a range of different operations including milling, drilling, deburring, grinding, polishing, riveting, screwing, welding, coating and painting, the system was also intended to reduce the need to invest in specialist machinery for all these tasks.

The project is coordinated by Spanish research institution AITIIP Technology Centre with the support of CSEM (Swiss Centre for Electronics and Microtechnology) and brings together leading research centres and technology providers from across

Europe in a public private partnership. The objective is to develop this innovative multifunctional manufacturing robot with positioning accuracy of $\pm 0.216 \text{ mm} + 0.5 \mu\text{m/m}$, which implies a tolerance of $\pm 0.4 \text{ mm}$ in a 100 m part. With such accuracies well outside the positioning capability of standard industrial robots, AITIIP turned to Hexagon Manufacturing Intelligence and its pioneering Leica T-Mac laser tracker machine control sensor.

Installation of the prototype MEGAROB system began at AITIIP's Zaragoza site early in 2015. Its overhead gantry enables the robot to work in a 20 x 6 x 5 m cell. The crane has three motional axes, while the robot operates in a spherical space. With a Leica T-Mac probe consisting of three individual faces mounted on it, the robot's movements can be monitored in six degrees of freedom by the Leica Absolute Tracker portable coordinate measuring machine.

Thanks to the Laser Tracker EtherCAT real-time interface, CSEM was able to implement a controller to correct the robot's end effector position and orientation up to a thousand times per second, ensuring that the robot operates accurately along the provided toolpath. Currently in its testing phase, the system is widely believed to be unique in its capabilities and early results suggest that this initiative could be a fixture for European manufacturers in years to come. ■



SPEED AND CONFIDENCE

No sport embodies speed and confidence more than the full throttle world of Formula One. **Accelerate!** visited Infiniti Red Bull Racing to see how speed and confidence in the factory equates to performance and reliability on the track.

As the dominant force in Formula One since scoring its maiden championships in 2010, Infiniti Red Bull Racing knows a thing or two about speed. The team also has a reputation in the paddock for working differently – placing complete confidence in the abilities of its people. From its policy of supporting emerging young drivers including four-time world champion Sebastian Vettel and the sport's youngest-ever driver Max Verstappen, to its unique 'CamoBull' test livery, this is a team that enjoys pushing the boundaries.

Formula One is a sport of the finest of margins. In the pursuit of race-day speed, a typical car has around 100 000 complex components working at the very top edge of their performance potential. With every car an evolving prototype, a team can complete as many as 30 000 design changes in a single season – all



while travelling the globe during the hectic nine-month racing schedule. Speed is not only a must for the driver on track, but also for the design and development teams back at the factory. Yet with strict regulations from the sport's governing body to adhere to, coupled with a firm focus on safety in this most intense form of single-seater racing, this speed must come with confidence in the quality of every part. This is why a top team like Infiniti Red Bull Racing looks for technical partners like Hexagon Manufacturing Intelligence.

Al Peasland, Head of Technical Partnerships at Infiniti Red Bull Racing, explains, "The whole business of Formula One is about measurement, analysis and then continuous improvement. So for us the speed and confidence we get from Hexagon really relates to our two drivers in the

business, which are performance and reliability – the reliability coming from quality."

Quality control is integrated into every aspect of the team's day-to-day operations. Every component used through the season is fully inspected using a range of equipment supplied by Hexagon Manufacturing Intelligence. In the factory where accuracy is the top priority, the team uses stationary coordinate measuring machines (CMMs) – many of which are customised to a specific task – to measure parts to the micron. Portable measuring arms are used for quick inspections of parts and setups, while 2015 saw measurement move trackside with the ultra-portable Leica Absolute Tracker AT960 laser tracker travelling the globe with the team, ensuring greater accuracy in car setup and configuration at the circuit, resulting in even faster development times. However, the key to

success for Infiniti Red Bull Racing has not been in the equipment itself, but in the wider gains of its partnership with Hexagon Manufacturing Intelligence. Together, experts from the two companies have found new ways to utilise quality data effectively to inform the manufacturing process and enable smarter decision making in the car design and development departments.

"We've been a partner with Hexagon since 2006 and it's been a hugely successful and beneficial partnership for both parties. During that time we've won 50 grand prix and eight world championships – four drivers' titles and four constructors' titles," says Team Principal Christian Horner. "Hexagon has played an important role behind the scenes in each of those successes, and hopefully in the future many more to come." ■



SPREADING OUR WINGS FOR CHARITY

How far could you run if the whole company was behind you? As Hexagon Manufacturing Intelligence employees found out in May 2015, quite a lot further than expected...

Alongside its business and brand evolution, 2015 saw Hexagon Manufacturing Intelligence take a new approach to corporate social responsibility. For the first time, employees from around the world came together to support a global charity – spinal cord research foundation **Wings for Life**.

The charity's flagship event is the Wings for Life World Run, a unique annual race taking place in 35 places simultaneously. Known as 'the race where the finish line catches you', all locations start at the same time whether it's day or night and half an hour later the 'Catcher Cars' set off in pursuit. These mobile finish lines mean that rather than a set distance,



competitors run as far as they individually can. With 100% of the World Run entrance fee going directly to Wings for Life, the race contributes hugely to its funding. On 3 May 2015, Hexagon employees were amongst over one-hundred thousand people who lined up to challenge themselves for charity – the company supporting each volunteer with an additional €50 contribution on top of their entry money. Hexagon also pledged a donation to the charity in place of its corporate Christmas cards.

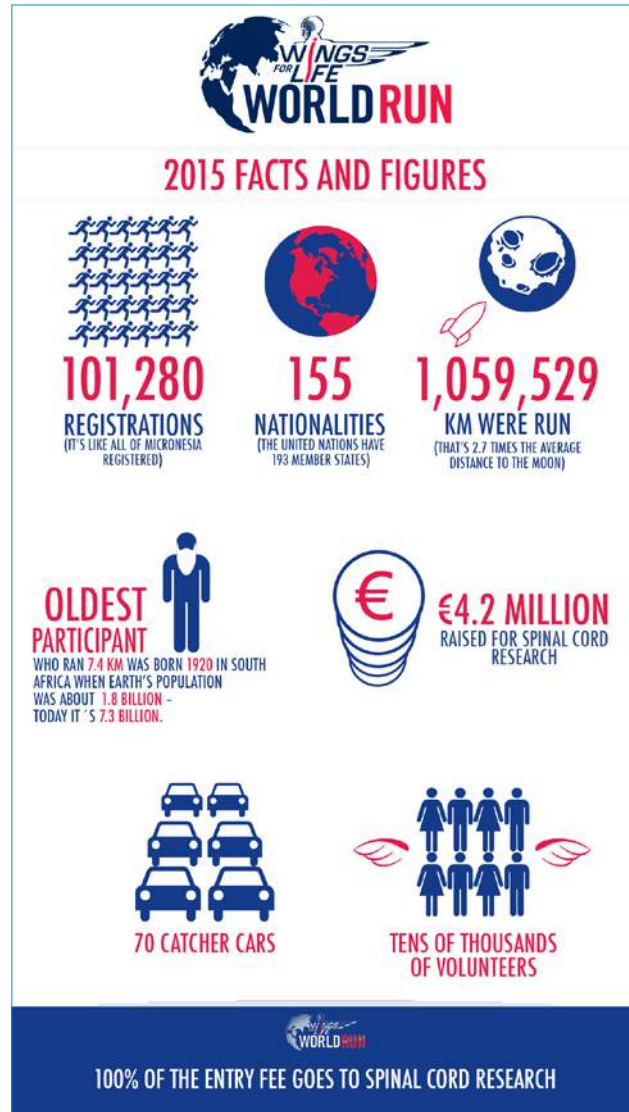
The driving forces behind Wings for Life are two-time motocross world champion Heinz Kinigadner and Red Bull founder Dietrich Mateschitz, who set up the not-for-profit organisation in 2004 following an accident which left Kinigadner's son tetraplegic. Realising that spinal cord research was underfunded, the pair committed to an ambitious mission – to make spinal cord injury curable.

"We first became aware of Wings for Life through our partnership with Infiniti Red Bull Racing," said Anne Willmann, Director of Global Marketing Communications at Hexagon Manufacturing Intelligence. "We supported charities at a local level before but for an international company like ours, it's a pleasure to get behind a cause like this globally. Our teams are spread across five continents and the World Run was an opportunity for them to come together and do something amazing."

Team Hexagon and the other runners covered over a million kilometres, raising more than €4.2 million. The men's race was won by Lemawork Ketema, who ran 79.9 km in St Polten, Austria, while the winning woman, Yuko Watanabe, completed 56.33 km in Takashima, Japan.

Mustapha El Bouchouafi, General Manager at Hexagon Manufacturing Intelligence Germany, who ran an impressive 20.74 km in Darmstadt said "The World Run is a completely different kind of race, so I jumped at the chance to run with my colleagues. The whole day was such good fun, everyone was supporting each other and I would definitely recommend it to anyone thinking of taking part next year!"

Planning is already underway for the next Wings for Life World Run on 8 May 2016. Team Hexagon will be there – to join them on the start line and see how far you can run with the whole world behind you, register online at www.wingsforlifeworldrun.com. ■



Mustapha El Bouchouafi
Commercial Operations Manager at Hexagon Manufacturing Intelligence Germany

#SOCIALMEDIA ONE MORE 'LIKE' TO SUCCESS



Hamish Eccles

In the past few years social networks have gone from being blocked on office networks to being an essential business tool. However, many companies are still struggling to find a way to make social media work for them. This issue, **Accelerate!** put your questions to **Hamish Eccles**, Digital Marketing manager at Hexagon Manufacturing Intelligence.

Q: Why is using social media good for a business?



A: We are living in the digital age and the way we communicate is continuously evolving. An ever-increasing part of business-to-business (B2B) communications is now achieved using social media tools. They enable businesses to spread their message and keep track of mentions within the millions of digital conversations that take place every day – gathering customer feedback almost instantly.

One of the prime benefits of using social media for your business is being able to increase awareness of your brand with little to no budget while also sharing current and trending content fast and easily with both existing customers and potential prospects. You have the ability to find new customers and help expand your audience while continuing to create meaningful relationships with your current customers and suppliers. Every company knows how valuable customer opinions are, and social media makes it very easy for people to voice their opinion. It also allows two-way conversation which can really help when handling complaints or criticism. Social media can also help to increase website traffic and search engine ranking, so there are a lot of positives to be found for businesses.

Q: What social media channels would you recommend for B2B use?

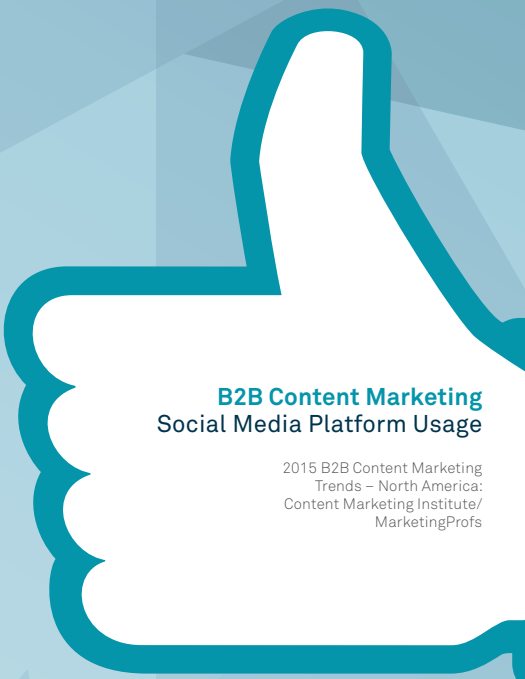


A: There are many channels to choose from. Recent research suggests that around 94% of businesses in North America are using LinkedIn, followed by 88% using Twitter and 84% on Facebook. But that's not to say that those are right for every business. It's a matter of finding out where your customers and prospects congregate on the internet. By identifying which channels your customers and industry leaders are using and cultivating the right image in those touchpoints, you can really make an impact on people. It is important to remember that all social media sites have their own unique functions, so you need to understand how your content fits within these functions to achieve the maximum levels of success.

Q: Keeping multiple social media channels active can take a lot of time, how can I manage these better?

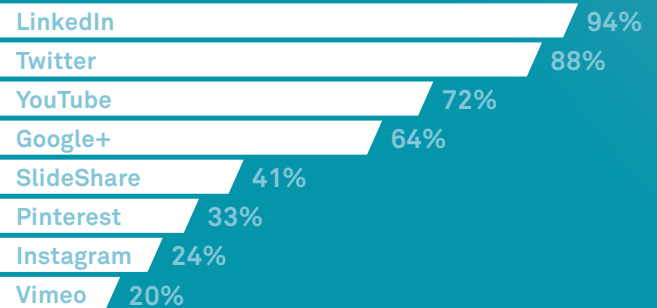


A: This is a good question. There are numerous tools available to manage the posting and monitoring of your channels, such as Hootsuite, Buffer, TweetDeck and Sprinklr. These offer both free and paid accounts depending on the complexity of your needs.



B2B Content Marketing Social Media Platform Usage

2015 B2B Content Marketing
Trends – North America:
Content Marketing Institute/
MarketingProfs



One advantage of these tools is the ability to pre-schedule social media content on a calendar. In some cases you can post to multiple channels simultaneously, which can free up a large portion of your time.

For almost any business, knowing what users are saying about you, your industry and your competition is important. Typically you are looking for things like customer support requests, positive or negative mentions of your company and others, mentions of your products or services. Using a social media management tool usually gives you the ability to monitor multiple streams for all of these things and in turn gives you the chance to respond to questions or join the conversation. It's also useful to know what your customers are talking about and what kind of content is getting them talking so that you can hone your offering too.

Q: Have you got any tips and tricks for staying ahead of the competition?



A: To stay ahead, you need to constantly monitor what your competition is saying. Try to be more active than your competition. Although it may be tempting sometimes, don't get involved in disagreements or even 'social banter'. It's important that you follow the conversation and don't get involved too early – see where the discussion goes first and then you can respond appropriately.

Q: What is the most important social media channel for you?



A: In my opinion LinkedIn is by far the most important tool for me – at least from the B2B connection point of view. You are able to connect with like-minded professionals in similar industries and share useful information. Although it's not perhaps as slick to operate as some other social networks, with the right content it can be a very powerful tool indeed. ■

LASTING RELATIONSHIPS

The name may be new, but for some dealers their relationship with the company is anything but that. **Accelerate!** asked two long-standing North American resellers about working with Hexagon Manufacturing Intelligence and its predecessors.



Productivity Quality

Productivity Quality started working with Brown & Sharpe in 1988 on coordinate measuring machine (CMM) sales. Its primary location is Plymouth, Minnesota, USA just west of Minneapolis. Today, it is a full-line Hexagon Manufacturing Intelligence partner for CMMs, portable measuring arms, laser trackers and scanning systems as well as TESA gauging products. In 2014, it was the TESA North American Distributor of the Year.



In 2001, a division was established to focus on contract inspection services. The Plymouth facility features Hexagon Manufacturing Intelligence equipment including a Leitz PMM-C in a climate-controlled laboratory offering sub-micron contract CMM measurement. Today, there are over 70 employees: 20 focused on inspection services, 15 on field support and calibration and 10 on CNC machine tool probing and metrology. The company has been ISO 17025 accredited for calibration and inspection since 2001.

“ Our partnership with Hexagon has never been stronger. As a distributor of many kinds of metrology systems, we work with several partners and Hexagon consistently leads the way with innovative products and a cooperative relationship that puts our customers first for service and support. The length of our relationship has resulted in over 1 000 systems being installed and supported in our territory. After 25 years, we not only have a great business relationship; but, also many lasting friendships with Hexagon people built through meals together or weekend retreats in the Northwoods as well as our regular work together. ”

Keith Summers



Exact Metrology

Exact Metrology has always been focused on growing the portable CMM market. Run by two principals, Dean Solberg and Steve Young, the business was formed from two separate resellers covering different but adjoining territories. In 2000, they joined forces and became Exact Metrology.

The company now sells portable CMMs and 3D scanning technologies as well as providing training and support services. In addition, they have a large team of application engineers who handle the contract services group, where they measure, inspect and reverse engineer parts onsite for customers. Just recently, they have started to offer computed tomography (CT) scanning. Currently, Exact Metrology has two US offices, one in Cincinnati, Ohio and another in Brookfield, Wisconsin.

“Exact Metrology has been a reseller for Hexagon ever since they purchased ROMER. We feel this product has changed how the manufacturing engineer gathers tooling data and understands process capabilities on the shop floor. Based on this we have always been one of the top resellers for Hexagon. Having Hexagon with its product depth is always an advantage – a customer can almost always use other Hexagon products to solve their measurement problems.”

Steve Young



AGENTS OF CHANGE

As Hexagon Manufacturing Intelligence continues its evolution, **Accelerate!** spoke to some of the company's longest-serving employees about the changes they've seen in the business. With 110 years of experience between them they truly represent the voice of experience.



Franca Gallo

Job: Project manager for exhibitions

Length of service: 39 years

We haven't always been Hexagon Manufacturing Intelligence, what was the company known as when you joined?

It was DEA – Digital Electronic Automation SpA.

What other roles have you held in your time at the company?

From 1976 to 1978, I worked in an internal office linked to the production planning of our machines. Since 1978, I've always been in the advertising department, so working on exhibitions and various marketing activities. Since 2007 my job has been part of the EMEA marketing team and my activities are mainly focused on exhibitions.

What is it about the company that has made you stay?

The stability of a big company is appealing of course, but I also like that the production of this company – as well as the marketing activity – is ever varied and exciting! Genuinely, I like this job, and although it can be heavy and tiring at times, I try to find a new side to the role every day. I like to develop new ideas and nobody has stopped me doing this at any time. I'm pleased to say I never get bored!

What has been your most memorable experience at work?

Meeting great people. It is because of them that I've been part of so many memorable experiences! But the most memorable I guess was my first phone call in English!

What have been some of the biggest changes in the company since you started?

Well, I've seen us go from DEA to Brown & Sharpe DEA and then to Hexagon Metrology and through the rebrand in 2012. More personally, the move from the Italian advertising department to the EMEA marketing team has been a big and challenging change.

If you could go back in time and give your younger self some advice, what would you say?

Sometimes I think it would have been better to change company every 5 years like some people do. But honestly, I think that I would like to repeat my experience exactly as it has been, with the same mistakes and the same successes!



USA



Douglas Tencer

Job: Senior software engineer
Length of service: 24 years

We haven't always been Hexagon Manufacturing Intelligence, what was the company known as when you joined?

I joined Cabinet Vision, which is now part of Vero Software.

What other roles have you held in your time at the company?

I've been in technical support and training, managed our support team and created documentation and help guides. I developed the link between our software and machine interfaces, and for a time was vice president of development.

What is it about the company that has made you stay?

The flexible environment allows plenty of creativity. I work with some great people and there is a mutual respect for our roles and value; opinions are encouraged. There is great satisfaction in knowing that doing my job right makes our customers' lives easier.

What has been your most memorable experience at work?

Linking our software to a CNC machine for the first time. I visited the IWFS show four days before it opened to see if any machinery companies were interested in attempting to link our software to their machine. The reception was mixed, but I found one that was willing to try and after days of adjustments we had success! It was thrilling to see the machine mill a part from our software. It's common now, but it wasn't always and to experience it for the first time was amazing.

What have been some of the biggest changes in the company since you started?

When I started at Cabinet Vision we had less than a dozen employees. Our program was not Windows compatible; it was DOS software distributed on two floppy disks. We have grown from helping a few cabinet shops to being a leader, steering an entire industry towards flexible machine automation.

If you could go back in time and give your younger self some advice, what would you say?

Buy stock in Apple, Microsoft and Hexagon! Everything you do has a lasting effect. If you do your job right the first time everyone around you will benefit for years to come.



SWITZERLAND



Hansrudolf Siegenthaler

Job: Software and SAP administration
Length of service: 47 years

We haven't always been Hexagon Manufacturing Intelligence, what was the company known as when you joined?

I started as an apprentice at Kern in Aarau, Switzerland.

What other roles have you held in your time at the company?

I've held lots of roles! After completing my apprenticeship in 1972, I took further education from 1973 until 1975 to become a service manager at Kern. Then I worked as a service manager for geodetic and photogrammetric instruments until 1980. From 1980 until 1992 I was in technical service at Kern, then Wild Leitz Kern and later Leica Geosystems. Then I spent three years in marketing before moving to administration. In 2005 I took on my current role in software and SAP administration.

What is it about the company that has made you stay?

It's a really good working environment. I have always had good cooperation with all my colleagues at Unterentfelden and also in other countries. There's always something new.

What has been your most memorable experience at work?

The five years when I was in Bogotá as service manager was the most memorable time in my life. Working in a foreign country with another culture and people with different temperament and language was the best experience I ever had.

What have been some of the biggest changes in the company since you started?

When I started printers, computers and mobile phones did not exist!

If you could go back in time and give your younger self some advice, what would you say?

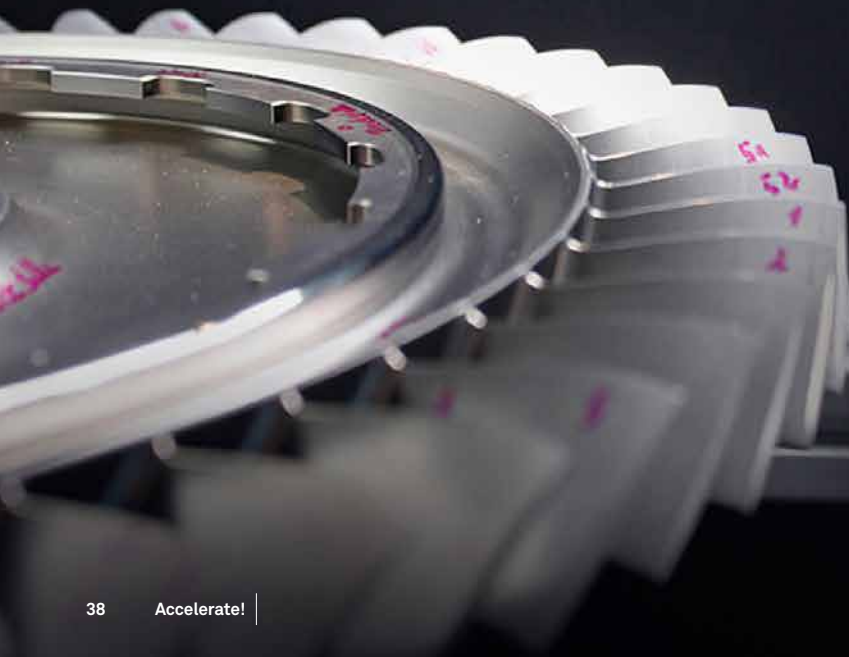
Keep cool and friendly in any situation.



MEASUREMENTS AND SURFACE INSPECTIONS

For fully-automatic quality assurance

As part of the European Clean Sky research programme, experts at the Fraunhofer Institute for Industrial Mathematics ITWM and Hexagon Manufacturing Intelligence have developed an integrated and fully-automatic solution for surface inspections and dimensional measurements of BLISKs (Blade Integrated Disks).





Dr. Henrike Stephani



Norbert Steffens



Stefan Fall

This article is excerpted from an interview originally featured in **inspect** magazine issue 2/2015 and is reprinted with the kind permission of the publication and the interviewees. **inspect** spoke with **Dr. Henrike Stephani**, Deputy Director of the image processing department at the Fraunhofer Institute for Industrial Mathematics ITWM, **Norbert Steffens**, R&D Division Manager UHA at Hexagon Manufacturing Intelligence and **Stefan Fall**, Project Manager at Hexagon Manufacturing Intelligence, about their experiences in a joint development project.

BLISKs are important components of turbines and jet engines. It is no surprise that they have to be measured and tested. But what was the motivation for Hexagon Manufacturing Intelligence and the Fraunhofer ITWM to become involved in this issue?

Steffens: The project involved developing a solution for the BLISKs extending beyond the geometry to measure additional features on the workpiece, for example a visual inspection or roughness measurement. The medium-term trend in the industry is towards integrating multiple measuring processes on one device. This reduces setup time, increases throughput and enhances the benefits overall. We wanted to stay ahead of these issues with collaborative work in this project.

Stephani: The motivation at the Fraunhofer ITWM was very much the same. A paramount trend in the aviation industry is that more and more components are being produced which require visual inspections by highly-qualified personnel. What is needed is support for the inspection process with automatic image processing that performs a 100% check, increases throughput and enhances transparency for the customer.

How did the collaboration come about?

Steffens: Hexagon's approach was to increase customer benefits by integrating new measurement

processes that cannot be derived from adequate conventional measurement technology. We looked around the market for partners with the necessary expertise, visiting various companies and institutes in the process. Finally we found the expertise we needed for the solution in visual inspection at the Fraunhofer ITWM in Kaiserslautern. They already had experience in the relevant areas of visual inspections that covered a good 80% of our requirements. We also wanted to avoid reinventing the wheel, using synergistic effects instead and adapting, optimising and integrating the potential for a solution already available on the market with little effort.

Is it fair to say the partnership involved a development goal that was not trivial to achieve?

Steffens: It is not at all trivial, as we are pursuing a challenging multi-stage approach. In the first step the geometry is measured. This is done in the conventional manner with a tactile scanning touch probe supplemented by an optical sensor system. This not only determines the geometry, but also the position of the part on the device, which serves as orientation in the second step for the automated visual inspection. The key here is to detect potential surface errors that are recorded with an automatically interchangeable camera system without changing the measuring device. In the next step, potential errors that were found are measured again with a highly-accurate optical sensor. In

addition, the roughness of the surface of the BLISK can be measured.

Stephani: The visual inspection of a BLISK also lasts for a relatively long time, especially because it has a very complicated geometry and many different types of errors can occur. The purpose of the automatic visual inspection is to provide support for the inspector by covering the entire BLISK visually, and 100% of the surface errors are found. In this way we identify the errors and then the measuring device measures how deep the errors are. We also provide a sort of protocol for the inspector.

What technical challenges did you face during the project?

Steffens: One significant challenge was to integrate new sensors into the overall system and calculate a common coordinate system required for this purpose. Suitable processes had to be developed so that different sensors could use a common coordinate system – once for the camera and once for the optical and tactile sensors. The sensor integrated into the process is a new element: a multi-camera system with lighting.

Stephani: From our point of view – image processing – the challenge was the geometry of the BLISKs and covering them completely with cameras. Looking inside gaps was especially difficult. To achieve this 100% coverage, we use three different types of lighting and two cameras. The first big milestone ►

for us was simply generating the images required for image processing. Coverage for a single BLISK results in approximately 30 different image types. And we had to find an algorithm for each image type that reliably detects the error. So there was also the task of transferring the space covered with 2D images and the errors that were detected to a 3D coordinate system and implementing a corresponding algorithm.

Fall: One general challenge consisted of coordinating communication between the existing partial systems, for example the measuring device and the image processing system. We succeeded in combining the two measuring methods on one platform, which was only possible on systems working separately before.

What surprises, unexpected progress or noteworthy breakthroughs occurred during the project?

Steffens: I'd like to tell you one right away. Over the course of the project, we benefited from being able to use an already integrated interferometric point sensor successfully. We couldn't use tactile sensors for this because in highly-efficient jet engines the BLISKs can also have reflective surfaces and tactile sensors could possibly leave scratches behind, which would in turn have to be classified. It turned out that this optical sensor with a diameter of just 6 mm fits very nicely into the gaps on the BLISKs, which had a positive effect on this measurement task.

Stephani: Covering such a complex geometry in the visual inspection and stable error detection represented noteworthy progress for us in the project. One of the milestones we did not see in advance is the added value resulting from the ray tracing process. To be able to communicate with the Hexagon sensor, we have to convert our errors in the 2D images to 3D coordinates. In ray tracing we use the previously measured CAD model and the positions of the camera and lighting. Virtual light beams equivalent to the lighting/camera position are sent in the direction of the object. Where they intersect in our CAD model is the error region in the coordinate system. In addition to simply transmitting the coordinates, this process also delivered many excellent possibilities for visualisation. This was more than was initially required, so naturally it is a gratifying success.

Fall: ITWM makes use of a priori knowledge for this, such as positions and orientation of the camera and CAD data to estimate the depth information with ray tracing algorithms.

To what extent is this project also an example of the special potential of technologies described as multisensor systems for solving problems?

Steffens: Of course 'multisensor systems' is a broad concept. It became apparent very quickly in our project that especially on this complex part, the measurement tasks would be difficult to solve with a single sensor. So we

tried to find an optimum solution for the measurement problem by selecting and combining suitable sensors. Conventional coordinate measurement technology, especially tactile measuring, was expanded with new processes such as the interferometric distance sensor system. But roughness sensors are also used.

Fall: I think this is a good example of using a multisensor system. You could go one step further and even call it sensor automation, because sensors are changed fully-automatically without recalibration. Full automation is a crucial factor, because that is how we achieve an extreme increase in throughput in comparison to today's inspection processes.

What potential for solving problems does a project of this kind offer compared to research and development exclusively in a single company?

Steffens: The special expertise the Fraunhofer Institute brought to the project was not available in our company. If we had had to develop this expertise ourselves over an extended period of time, the scope of the project would have been greatly expanded. Both sides contributed different and complementary know-how to find the optimum solution. It was a very creative process on both sides, which contributed greatly to different areas of expertise ultimately achieving success. ■

DID YOU KNOW?



MIND MATTERS

Hexagon Manufacturing Intelligence is not the first to define its world in terms of sensing, thinking and acting. In this issue, **Accelerate!** looks at the background of the sense-think-act cycle.

1 Connecting mind and body

Linking perceptual inputs with behavioural outputs, the sense-think-act cycle is widely used in cognitive science to model human behaviour patterns such as responses to problems.

2 Five senses

People have five connected yet distinct senses: sight, hearing, touch, taste and smell. These mechanisms – either individually or in combination – shape our perception of the world.

3 Thinking big

The human brain is regarded as having limitless potential for imagination and advanced thought, so many people are surprised to learn that it typically weighs less than 1.5 kilograms and around 73% of that weight is water!

4 Taking action

Actions tend to be associated with physical motion, but in cognitive terms acting can describe any kind of behavioural output, from a bodily movement to an outburst of emotion or change of mood.

5 Active thought or basic instinct

In human terms, the thinking phase can be split in two: conscious thought and reasoning, and the more instinctive reflexes that help us react quickly to situations, particularly in response to danger.

6 Defining artificial intelligence

Some cyberneticists consider sense-think-act to be a robotic paradigm – a mental model of how a robot operates. However, some argue that robots are currently only able to sense-plan-act, and that a robot with the ability to think would represent true artificial intelligence.

REPUTATION FOR QUALITY



Manufacturing over ten thousand different designs of workpiece every year is no easy task. Ensuring that all these parts are up to the rigorous safety standards required in the aerospace industry is even more of a challenge. Yet for Öznur Defense and Aviation, such challenges are just a part of daily business.

“Our corporate culture places great importance on quality. We are especially proud of our ability to measure a wide array of products in all different sizes using 3D CMMs,” says Meric Ekiciler, who works in the production engineering department. “We purchased our first CMM in 2005. Hexagon was recommended to us as a supplier by several of our customers who also use Hexagon measuring equipment.”



Since 2005, Öznur Defense and Aviation has significantly developed its dimensional inspection capabilities with the addition of some DEA GLOBAL Performance range CMMs. However, the purchase of new milling equipment prompted the need for a larger-volume measuring machine, and the team opted to install a DEA ALPHA 20.50.15 gantry-type machine. This solved the problems associated with the inspection of large components while fitting seamlessly into the quality control ecosystem already established around the other Hexagon Manufacturing Intelligence CMMs. ■



To find out more about Öznur Defense and Aviation's metrology environment, go online to read the full case study.
<http://hex.ag/RYDad>



Company: Öznur Defense and Aviation
Location: Ankara, Turkey
Industry: Aerospace
Solution: DEA GLOBAL Performance and DEA ALPHA

VITAL STATISTICS



Edgar Dietrich
Founder and President Q-DAS

Could you give us a brief introduction to Q-DAS and how you founded the company?

When I started Q-DAS, I was a professor at the University in Mannheim, and statistics was just a little part of my life. I started the company with a friend of mine and we focused on training in statistics, developing software to work with. And we found that this was what the visitors and participants of the training courses liked – they wanted to buy our software because it made understanding the statistics easy. Today, our products take statistical information from manufacturers around the world and give them visibility into their processes. You know, Winston Churchill said that you shouldn't trust any kind of statistics – unless you prepared them on your own! This was the starting point of Q-DAS and we've come a long way from there, especially in the automotive industry where our software is the de facto standard.



With Hexagon's acquisition of Q-DAS in March 2015, Hexagon Manufacturing Intelligence gained a wealth of knowledge and experience in the field of statistical process control (SPC) and data analysis. At HxGN LIVE 2015 in Las Vegas, **Accelerate!** spoke to Q-DAS Founder and President **Edgar Dietrich** about his company and what the acquisition means for customers.

As a leader in SPC solutions, can you tell us about some of the most exciting projects you've been involved with?

The most interesting was probably a Bosch project. Worldwide, the Bosch company has 200 or more plants producing parts. At the beginning, they had in the region of 20 to 40 plants using our software. But three years ago, we got an order to support all the plants, rolling out the first 100 sites in just six months. It was a big task, but we made it work by using a terminal server installation. In effect, the software is only installed in two places: Singapore and Germany. From these two places, all the plants are able to use our software and the data is stored in the central cloud-based area. It was very exciting to fulfil all these requirements and see the user benefit of our software grow.

You recently became part of Hexagon, how do you see this benefitting your business and your customers?

Well, for sure a company of this size can help us with business development, and the natural synergies between our product offering and those of Hexagon mean we can offer a more complete service to customers. We are already starting to train Hexagon Manufacturing Intelligence engineers on our software, because in fact it works with all of the measurement equipment they provide. We made the decision very early in our discussions that by the end of 2015, all Hexagon sensors should be able to directly connect with Q-DAS software. It may sound obvious but this is a big benefit for the customer. Without this connection, they have to use data converters – and converters always create trouble. It's all about ease of use for our customers.

The team at Q-DAS are reputed to receive very advanced training. What can you tell us about how you coach them to success?

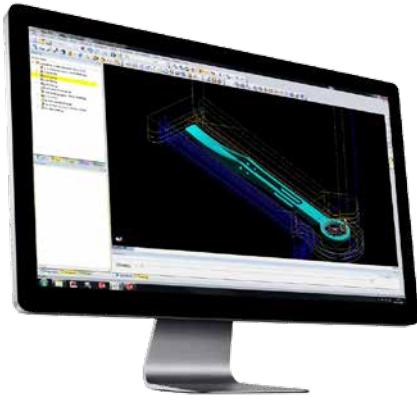
As I mentioned before, I started out in the training area and I will certainly go back into the training area. For example, I give lessons in the University of Aachen and I've written several books. So this is my first profession and my passion. I think it's important to take every chance you have to train people. If they see some success, they become really motivated to learn more. In the area of statistics, where it can be difficult to understand, many people have negative experiences. But we really are able to make it easy for everybody. We say that with the statistics black box, the only things you have to understand are what kind of functions you have to use and how to interpret results.

You've been running Q-DAS for over 25 years. How would you describe your leadership philosophy?

Honestly? From the beginning I have said that we have to follow customer needs. I'll give you an example. The Q-DAS hotline has always been free of charge. Everybody can call us from around the world. When your customers know they have this kind of support, they give you a lot of input about their needs and how we can improve things. If you get a good information flow, a good relationship with customers, this is the most valuable feedback we can get and it drives us in the right direction. And we've been really successful, so why should I change this direction? ■

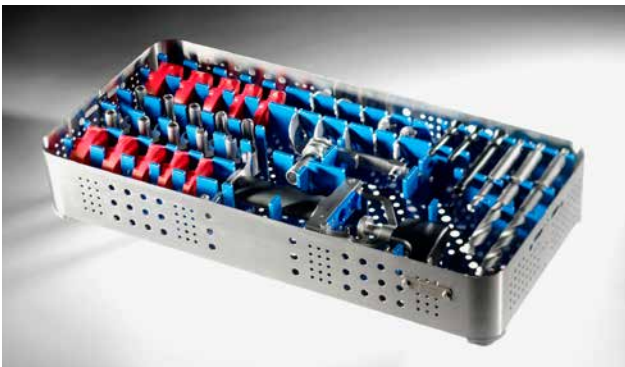


JUST WHAT **THE DOCTOR** ORDERED



Whether it is one specific instrument or a complete set of everything a surgeon needs to carry out a joint replacement operations, Sheffield Precision Medical say they could not have physically produced many of last year's 50 000 piece parts without Edgecam. According to manufacturing director Steve Lambell, their products are so complex that it would be impossible to write CNC programs for them manually.

"There would be thousands of lines of code. We just couldn't do it. Many of our Edgecam programs are for milling 3D surfaces on Bridgeport and Haas 3-, 4- and 5-axis machines. We carry out all our positional work with 5-axes – previously we'd need to make fixtures to hold the parts in the right orientation... but Edgecam creates perfect tool paths for 5-axis machining, saving us around 60% on setting up time."



Sheffield Precision Medical's range runs to several hundred different products, including drills, reamers, rasps, guides and cutters, in varying sizes. "We'll get the programs right for one size, and then Edgecam quickly produces toolpaths for the other sizes. This is vital for getting full machine utilisation and optimum floor-to-floor time." ■



To find out more about how Edgecam helps Sheffield Precision Medical achieve the impossible, go online to read the full case study.
<http://hex.ag/RyDzD>



Company: Sheffield Precision Medical
Location: Sheffield, UK
Industry: Medical
Solution: Edgecam CNC software



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KEYNOTES

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