

Klartext

HEIDENHAIN

RELIABLE PROCESSES

Strategies from experience



Editorial

Dear Reader,

Don't be surprised if you think you're seeing double while reading this edition of Klartext. It contains a number of "twins," although they may differ from each other in significant details.

The companies WB mechanics and Endutec, for example, are both headquartered in Upper Bavaria and have been using StateMonitor to optimize their processes with great success. But what they actually do is quite different.

Our report about Endutec also contains certain parallels to our article about the Keck Observatory in Hawaii. Both involve outer space. The Endutec story is "just" about the moon, while the Keck Observatory article covers infinite expanses.

Doppelmayr (Italy) and Sermec (Portugal) are our southern European "twins." Both companies machine large parts and employ full-surface machining with the TNC 640 to reliably attain their manufacturing goals. While the Italian company's combination of choice is milling-turning, the Portuguese firm is a big fan of milling and hobbing on a single machine.

By the way, this edition of Klartext even includes a digital twin. With this new offering from the HEIDENHAIN Service department, a nearly perfect virtual copy of the machine comes straight from the shop floor to your design office.

So take a close look, and discover new ways to keep on improving! Happy reading!

IMTS Spark 2020: discover process reliability and innovations

✚ In this edition of Klartext, starting on Page 16

✚ Already online: imts.heidenhain.com



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Publisher

DR. JOHANNES HEIDENHAIN GmbH
Postfach 1260
83292 Traunreut, Germany
Tel: +49 8669 31-0
HEIDENHAIN on the Internet:
www.heidenhain.de

Editors

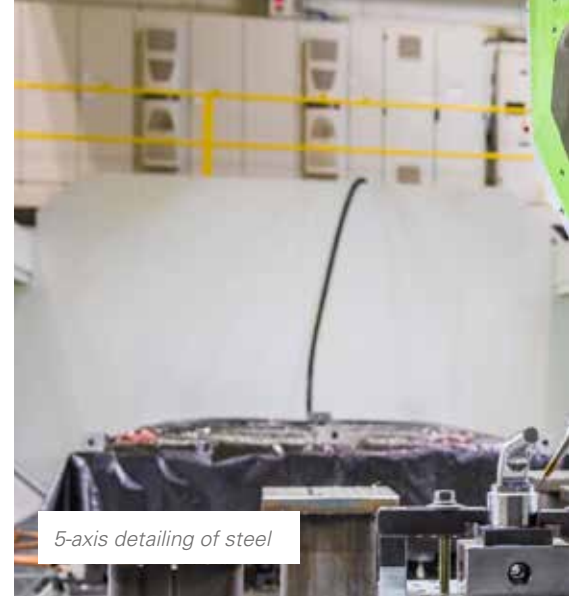
Ulrich Poestgens (responsible),
Judith Beck
E-mail: info@heidenhain.de
Klartext on the Internet:
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5-axis detailing of steel



Endutec made the impossible possible—with support from StateMonitor.



Sermec manufactures large parts by milling and hobbing in a single setup.



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USER REPORT

Consistently better

WB mechanics in Putzbrunn near Munich, Germany, relies on state-of-the-art machines and StateMonitor for process optimization

Bernd Rossmair always dreamed of setting up his own precision machining company. After completing his vocational training and certification as a master tradesman, Rossmair initially worked in two positions before the opportunity arose to turn his dream into a reality. Werner Berndt, whose initials adorn the company name to this day, was looking for a successor to take over his one-man operation at the beginning of the 2000s. Rossmair took the helm of the precision machining toolmaking business and tenaciously developed it into an exemplary company with 12 employees and a machine shop where none of the 12 machine tools are more than five years old.

Rossmair sums up the philosophy behind his business success in simple terms: "We concentrate wholeheartedly on our strengths. What we do, we want to do correctly, efficiently, and to the highest level of technology." That's why the tidy production shop at WB mechanics is equipped entirely with milling machines and lathes. "We deliberately forgo other processes such as electrical discharge machining or grinding."



The production floor at WB mechanics: six milling machines with HEIDENHAIN controls, along with six lathes, are all connected to StateMonitor.

Always at the forefront of technology

"As a precision machining service provider, we primarily produce single parts and small series. Runs of 1000 parts are a real exception," says Rossmair, describing his business. These jobs mainly include prototypes and pre-production samples with stringent quality and accuracy requirements. WB mechanics is able to meet these requirements thanks to its qualified personnel and state-of-the-art machines. "All of our workers are specialists for 5-axis milling machines and EMCO turning centers, and none of our machines are more than five years old. This allows us to take the next technological step forward every time a machine is replaced," explains the successful business owner with a touch of pride.

For Rossmair, the efficiency of his processes is at the forefront of his business decisions and investments. At the moment, he is primarily focused on two strategies. "In view of our relentless fo-

cus on 5-axis machining for milling, I'd now like to implement full-surface machining on all machines, including for turning," he says, explaining his investment in a new EMCO HYPERTURN 65. "I'd also like to consistently minimize time lost during production."

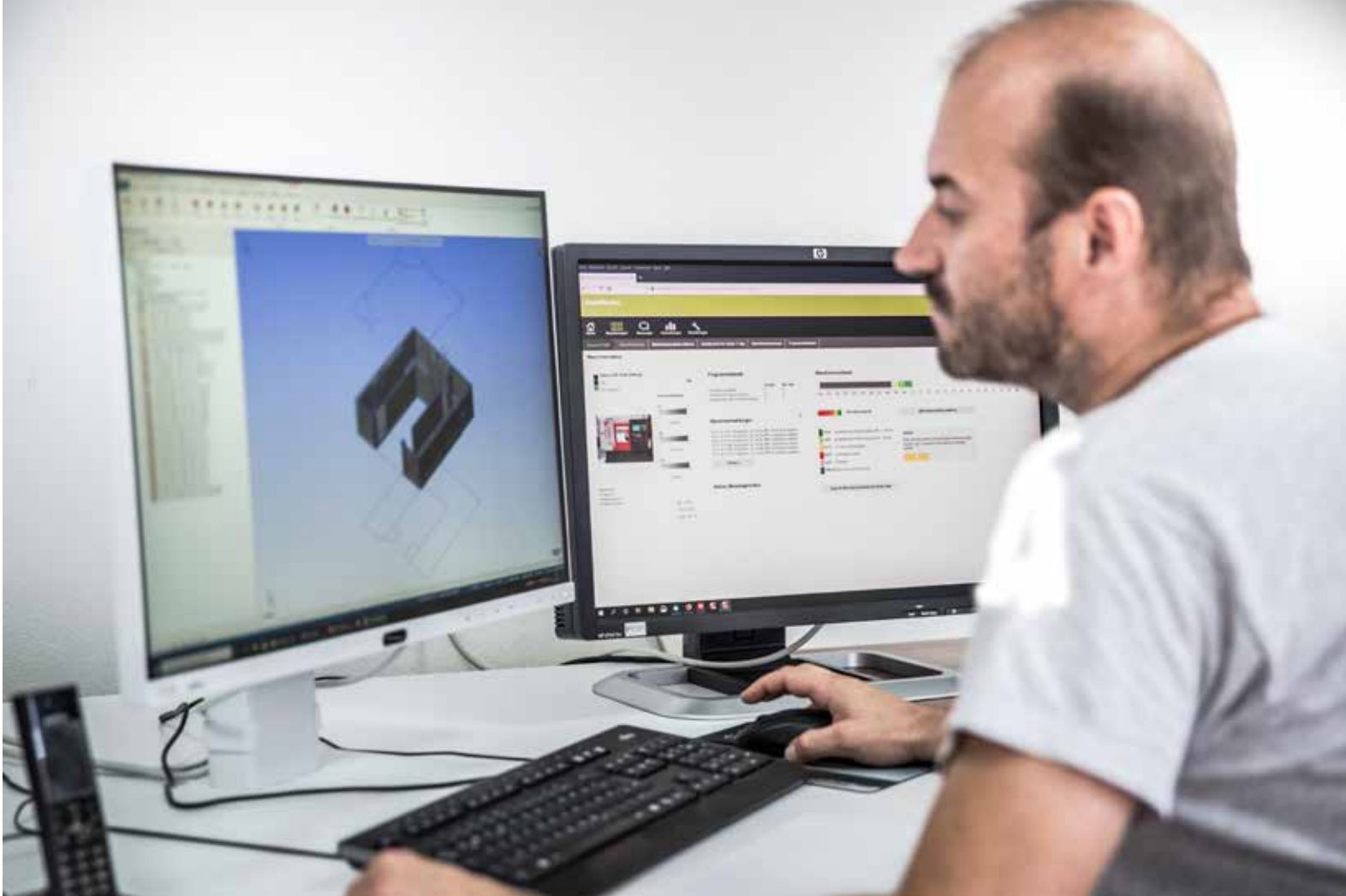
StateMonitor for all machines

WB mechanics has been deploying StateMonitor for precisely this purpose since the beginning of 2019. In search of a solution for monitoring his machine tools, Rossmair came across the StateMonitor internet sites. "It was exactly the solution I was looking for because it promised to connect machines regardless of their manufacturer." Since WB mechanics was already very familiar with HEIDENHAIN as a control manufacturer, Rossmair didn't hesitate for long. "When I purchased a new Alzmetall GS machine, I ordered StateMonitor along with it."



"We're always open to new technologies. We look at them and then pick out the things that'll take us a step forward—like StateMonitor."

Bernd Rossmair



In the office, Joachim Schmidt can program the next part uninterrupted while using StateMonitor to keep an eye on his running machine.

After just over six months, his assessment is positive: "Connecting the milling machines with HEIDENHAIN controls was no problem at all. The EMCO machines were connected via OPC UA. However, a few things had to be adapted due to the different server versions on the various machines, for example. But HEIDENHAIN and EMCO quickly resolved those matters." Rossmair is enthusiastic about the support. "Our queries and requests were always taken seriously and dealt with quickly." For example, he was initially dissatisfied with the depth of data that StateMonitor could retrieve over the OPC UA interface. "But I think I was kicking at open doors with my request. The response and necessary modifications came immediately," he says.

How does WB mechanics benefit from StateMonitor in its daily routine?

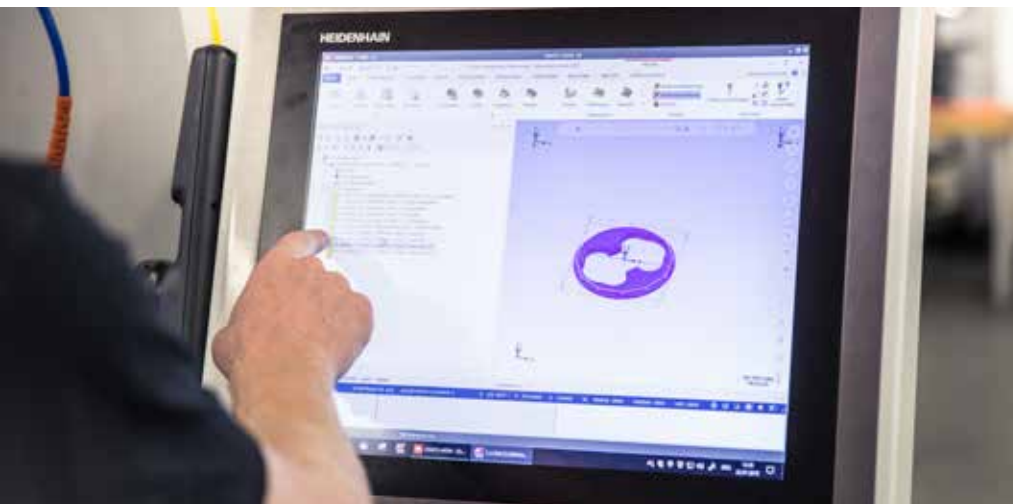
The employees are happy about having a lot less legwork. Now they can use StateMonitor to keep an eye on their running machines while they're in the office editing programs for the next jobs or setting up another machine tool. "We did write programs in the office before StateMonitor, but the staff had to run out to the machine every 30 minutes or every hour to see if things were still running. Most of the time it went well, but sometimes the machine stood idle for quite a while, and valuable time was lost," notes Bernd Rossmair about the difference to now. "They can now monitor

everything from the office and work on their programs in peace. This prevents unnoticed downtime and also helps them concentrate."

The staff also has complete access to all information and processes. Not all of the credit goes to StateMonitor, though. For complete networking of the shop floor with the production planning department, WB mechanics also uses Remote Desktop Manager on its HEIDENHAIN controls. "We have a basic membership in the TNC Club and chose Remote Desktop Manager as our free sign-up software option. This enables us to access the CAM system directly from the controls and update data from the shop," says Rossmair, visibly pleased with his efficiently digitalized operation.



*WB mechanics also uses StateMonitor on its shopfloor machine controls.
For Markus Hollerieth, the software makes it easier to operate multiple machines.*



Need to make a change? Remote Desktop Manager brings the CAM program to the control.

Looking ahead to the next steps

What is the enterprising business owner planning next? "The Batch Process Manager software for HEIDENHAIN controls is intriguing, and I'd like to take a closer look at it," says Rossmair. "I'm also considering a premium membership in the TNC Club. The on-site user day is certainly appealing as well. While State-Monitor was being installed, I kept noticing how much we benefited from having experts come into the company bringing new perspectives and ideas."



+ How StateMonitor takes you forward:
www.heidenhain.com/statemonitor

+ A service provider for precision machining:
www.wbmechanics.de



Canadian Shop tracks growth using Zimmermann milling machines with HEIDENHAIN controls

Service Mold + Aerospace Inc.
brings improved solutions to many

Laser Tracker Operator scanning rough machined Steel Bond Tool, readying it for final machining

Founded in 1987 in Windsor, Ontario, Canada, Service Mold + Aerospace is not your typical mold shop. Their core competence remains the design, engineering and building of molds for the automotive industry. However, the company has emerged as a contract, build-to-spec supplier of parts for many throughout North America and Europe, including for aerospace and medical customers.

The early years at Service Mold began with steady growth from the production of molds for automotive and consumer goods. Always committed to using the latest technologies for CAD, CAM programming Service Mold established a reputation early on for quality work. Then the demand for highly accurate parts made more quickly arrived and industry needs changed.

As Service Mold president Martin Schuurman explains, "In 2006, we purchased our first 5-axis machine to meet these new needs, a Zimmermann machine tool with a HEIDENHAIN iTNC 530. The path control and contour fidelity of the HEIDENHAIN controls are superb and masterfully addressed the conflict

between fast, smooth and accurate. This acquisition gave us the capability to enter the aerospace market for the first time. After a number of calls and quotations, we scored a small order from a major Tier 1." Sales then began to grow, some years by more than 25%, Schuurman says proudly. By 2013, there were four additional Zimmermann machines on the floor and the existing facility had nearly filled to capacity.

The company acquired property adjacent to the current facility in Windsor and erected a new building in 2016, giving the company a capacity of 64,000 square feet. They purchased three new Zimmermann / HEIDENHAIN milling machines with larger workspaces, open-



ing up more opportunities in the aerospace market. In something of a perfect storm, the emergence of composites in the aerospace industry enabled Service Mold to pursue the huge layup mandrel market to a much greater degree.

The high accuracy of the Zimmermann machines used in aerospace inspired the company to venture into medical device machining. Since medical parts are usually high mix, the ability to easily adjust programs after they are post-processed from CAM through the HEIDENHAIN control comes in handy. "We're currently working with an orthopedic surgeon, producing joining plates for humerus and femur sections, something we'd never have considered a few years ago. With the programming speed

and high degree of flexibility in our production work now, it's not only become possible, but also profitable," Schuurman muses.

Still, the home base, with over 70% of the sales for the company, remains the aerospace market, including a favorite project for Schuurman, one he describes with great excitement. "We have been involved in manufacturing parts for servicing the International Space Station." As happens with most workpieces in this market, there is an extremely high degree of material removal involved in the production of this workpiece and Schuurman notes the Zimmermann machine rigidity and high precision moving milling head make the job much easier to accomplish and repeat.

"The support from HEIDENHAIN has been great both on the application and service side."

Martin Schuurman, president of Service Mold + Aerospace



5-axis machining on FZ37 of Aerospace Steel Bond Tool

Schuurman notes “We’ve worked very hard over the years to carve out some unique niches for our shop and we have a very solid reputation in various industries. That’s given us great pride and, on a practical note, greater stability and protection from the economic volatility in certain vertical markets.”

Key Machining Tools

Schuurman points out that a key to the flexible nature of his company is the fully programmable capabilities of the Zimmermann machines and HEIDENHAIN controls. Especially useful is the new TNC 640 control which has color-coded NC code, the Smart Select option and a comprehensive Help menu to make

programming easier. The graphics in the simulation mode have been enhanced and can now show the tool path with code numbers and in different colors for different machining steps. A new on-board cutting data calculator lets the operator do the most basic feed rate (per teeth, contour feed rate) calculations right at the machine.

Also, Service Mold runs various CAD programs, including Catia and NX CAD, post-processing in-house to run the HEIDENHAIN CNC on each of the Zimmermann machines here. HEIDENHAIN’s contour tolerance cycle called Cycle 32 is outputted with every NC code and is easy to adjust afterwards if deemed necessary. It easily allows the user to define the width of the tolerance

band, the high-speed cutting mode and an angle tolerance for the rotary axes. Weekly certification of the machines onsite, with volumetric compensation calculation is done with the help of KinematicsComp, a HEIDENHAIN control option. Compensation of the rotary axes for thermal and static errors can also be performed before or during jobs with a canned cycle available on the control.

Cornelius Kiesel, president of Zimmermann for North America, with its headquarters located across the river from Windsor in the greater Detroit area (Wixom, Michigan) adds, “We have forged a solid, good faith working relationship with Service Mold since that first sale in 2006. Today, Service Mold is one of our largest customers in the world, and



5-axis machining on FZ37 of Aerospace Steel Bond Tool

we are pleased that our machines were a perfect fit for their requirements." He also noted that the HEIDENHAIN TNC controls offered some added advantages such as Dynamic Efficiency and Dynamic Precision packages that have helped Service Mold move into other markets and types of jobs over the years. HEIDENHAIN "Dynamics" packages comprise functions that compensate for oscillations and chatter which commonly lead to blemishes on the workpiece finish. Without such compensation, chatter would reduce tool life and increase the wear on machine components like ball screws, guideways and the spindle, which subsequently increase the total cost of ownership.

Schuurman adds, "Our partnership with Zimmermann has brought about many expectations over the years and Cornelius and his team have delivered for us." He adds, "at the same time, the support from HEIDENHAIN has been great both on the application and service side. HEIDENHAIN has ramped up its support team and now provides the same high-level assistance we are used to in our home market."

Machining time at Service Mold now stands at approximately 15,000 hours annually on the seven Zimmermann/HEIDENHAIN machines alone. As the company currently runs round-the-clock operations, it would appear the investments are paying off.



5-axis detailing of steel

+ Service Mold + Aerospace Inc.:
www.service-mold.com

+ Zimmermann Inc.:
www.zimmermann-inc.com

+ Video link, Zimmermann FZ37
at Service Mold + Aerospace Inc.:
www.youtube.com/watch?v=OIOa72HIKc



USER REPORT

Night flight to the moon

Endutec monitors the automated nighttime production of lunar vehicle parts using the StateMonitor machine data acquisition software (MDA)



How many parts manufacturers can claim that their workpieces will fly to the moon? Endutec, a twelve-man operation based near Lake Chiemsee in Germany, decided to reach for the stars. They milled 30 parts that were initially said to be unmillable. These components are now an integral part of the "Mission to the Moon," the first German lunar mission.

It's the year 2104. The spaceship Covenant is on its trajectory to a distant planet. Upon landing, the crew believes itself to have arrived on a habitable paradise. Maggie Faris sets out to explore unknown territory with the Audi lunar quattro. However, the crew soon realizes that it is trapped on a sinister world.

While most science fiction vehicles originate from the creative pen of Hollywood, the movie "Alien: Covenant" is an exception. The Audi lunar quattro moon

rover is very much a reality and is set to play a key role in an actual mission to the moon. Half a century has passed since Neil Armstrong walked on the moon. Now, the German new-space startup PTScientists from Berlin aims to return to the Apollo 17 landing site in the Taurus-Littrow valley. Together with its partners, the company has developed the ALINA lunar lander and the Audi lunar quattro moon rover.

The mission

For manufacturing the moon rover components, the team of developers initially approached established manufacturers in the aerospace industry, who declared the parts to be unproducibile. It wasn't until talking with Endutec near Lake Chiemsee that PTScientists found willing ears. The custom machine manufacturer normally produces high-precision manipulators for the semiconductor in-

dustry and has built up a further mainstay with its own automation concept.

"It quickly became clear to us that this was a unique opportunity, and we simply had to say yes," says Andreas Flieher, managing director of Endutec. He set about implementing the project together with his partner Michael Hascher and a team of design engineers and milling machine operators. They faced three major challenges.

The obstacles

The concerns expressed by the aerospace companies proved to be true—the design had to be modified to make the components millable at all. "All of the walls are very thin, because in the aerospace sector every gram counts," explains Flieher. One need only consider the current lunar freight costs, which start at 800,000 euros per kilogram.

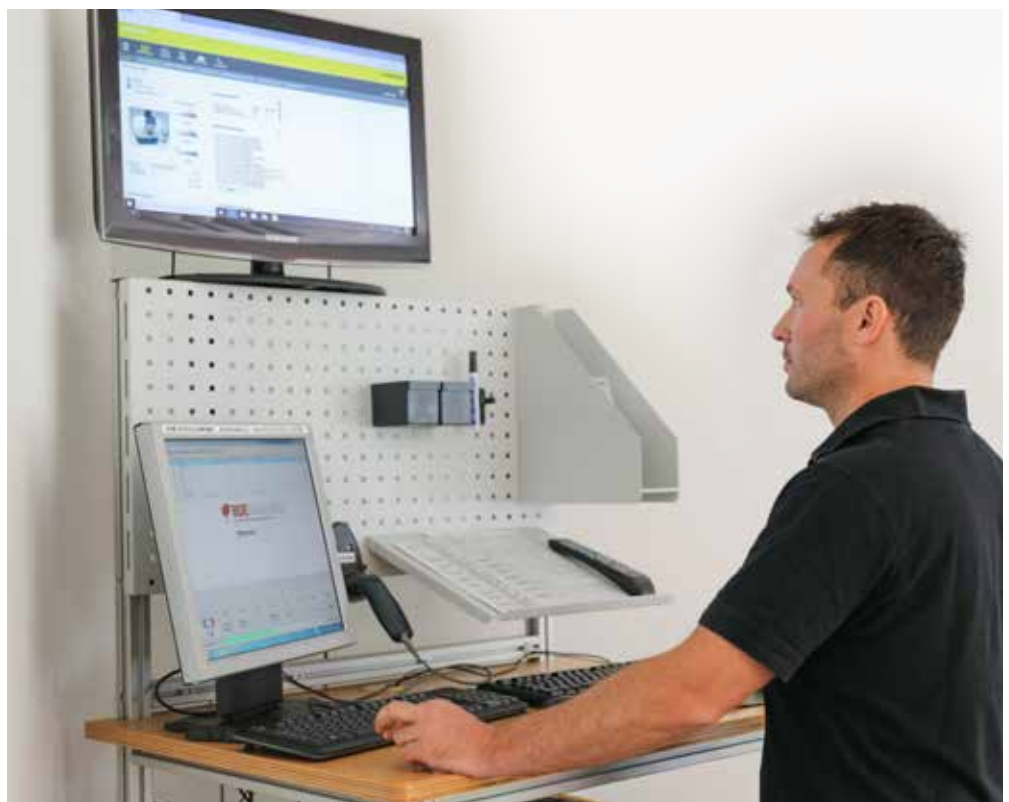


Andreas Flieher and Michael Hascher with parts of the moon rover.

Secondly, the deadline of just under two months was extremely tight. This is nothing new in the lunar mission business; NASA also faced enormous deadline pressure after John F. Kennedy announced his intention to put a man on the moon by the end of the 1960s.

Thirdly, the extremely long production times of up to 14 hours had to be implemented with existing capacities and despite full order books. "The only way was to exploit nights and weekends using our own automation technology," says Flieher. "This included our assembly robot in combination with StateMonitor from HEIDENHAIN, which actively informs us about the statuses of our machines."

Preparing new jobs and monitoring them is no problem with StateMonitor.



“To achieve anything, you have to know exactly what you want, think the steps through, and then finally get going.”

Andreas Flieher, Endutec

The strategy

Endutec set a clear goal for itself and scheduled the lunar project accordingly. “To achieve anything, you have to know exactly what you want, think the steps through, and then finally get going. The danger is turning back halfway when difficulties arise,” says Flieher. But turning back is out of the question for this managing director. He’s too ambitious for that. “As a business owner, you strive to make the best of any situation. I like to tackle challenges and achieve something.”

Implementation phase

By the time the lunar vehicle parts entered production, the team at Endutec had a clear plan. During the day, the staff worked on orders from existing customers. As evening approached, they clamped the blanks for the moon rover parts into the automation system, particularly those parts requiring long run times. The robot would then load the parts at night and on the weekend.

“Of course, unattended operation doesn't always go smoothly,” says Flieher. “I remember a situation when the machine reached its coolant minimum on the weekend. Without State-Monitor’s push notification, we would have lost two production days.” The active notification provided by the MDA software significantly eases the workload. Flieher explains, “In the past, we used to have a webcam installed in the machine. So, to check the machine status, I had to actively dial in. This meant I was constantly under stress in the evenings and on weekends.”



Ready for the night shift: workpiece blanks in the pallet changer.



The automation technology

From the very beginning of Endutec, Flieher and Hascher gave a lot of thought to the automation and digitalization of processes. They started out as an engineering firm in 2009 after the company they had previously worked for shut its doors during the financial crisis. Three years later, they set up their own production plant, including their own recipe for automation, which they now sell to other companies.

"We use a combination of technologies; that is, automated machine loading with our robot system and the monitoring capability provided by StateMonitor. That makes us efficient," says Flieher, who is convinced of the positive effects that automation has on the work of his employees. They can do their jobs in a much more relaxed manner because they can concentrate on more qualitative tasks or even sometimes leave work earlier.



Unattended shifts were the only way to meet the tight deadlines.

Thin walls, complex structures, and extreme time constraints: Endutec manufactured parts that other manufacturers had declared unproducible.



The potential

Endutec has discovered how to take advantage of the digital revolution. This is because the best way to get a return after investing in machines is by fully utilizing available capacities. "In this area as well, we used StateMonitor to identify hidden potential and increase machine utilization," says Flieher. It's how a twelve-man company manages to achieve something extraordinary alongside their everyday tasks. "This project really motivated every one of our employees. After all, how many people can claim to have made workpieces that will fly to the moon?"



Andreas Flieher knows where he wants to go and what he needs to get there—for example, an automated Alzmetall milling machine.



+ Find out everything about StateMonitor at:
www.heidenhain.com/statemonitor

+ Everything about Endutec:
www.endutec.de



DIGITAL EVENT

Discover process reliability



Would you like to mill and turn with high process reliability, accuracy, and productivity even with lot size one? And would you like your production machines to be fully digitally integrated into your process chain? Then a visit with HEIDENHAIN during IMTS Spark digital platform will be well worth your while. At IMTS Spark, we'll be discussing the TNC 640 with a 24-inch widescreen and Extended Workspace Compact.

Reliable mastery of all production-related processes creates a clear competitive advantage. During the IMTS Spark digital event, HEIDENHAIN will be showcasing new solutions for this mastery.

OCM: the next generation in trochoidal milling

You're already familiar with trochoidal milling from the Dynamic Efficiency package of functions for the TNC controls. The new Optimized Contour Milling (OCM) function will give you an expanded option, allowing you to program trochoidal milling operations for any pocket and island directly on the control in the shop. All you have to do is enter the contours. The control then automatically calculates the best trochoidal strategy. This allows you to harness highly efficient trochoidal milling processes for a much wider range of workpieces, thereby increasing productivity and reducing tool wear.



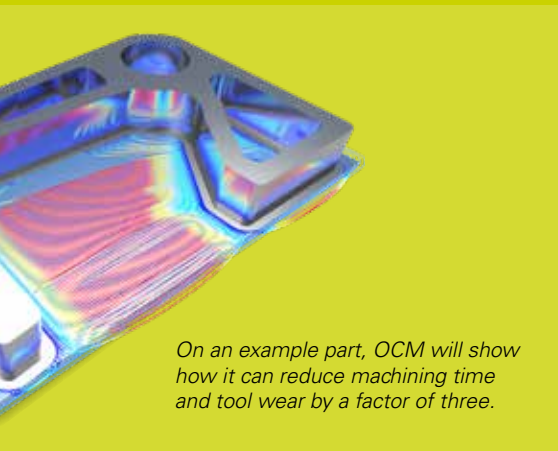
Control technology that moves intelligently

During IMTS Spark, HEIDENHAIN will also be discussing its new Gen 3 drives for the first time. This generation of drives is a perfectly harmonized, self-contained system based on particularly innovative and future-oriented technologies. You benefit from high surface quality and short production times thanks to:

- Improved performance data for optimum results
- The newest interfaces for intelligent transmission technology
- Powerful diagnostics for high availability
- Simple mounting and connection technology

Monitoring spindles and feed axes

The new Component Monitoring feature of the TNC controls keeps a close eye on machines in order to protect them from malfunctions arising from overloading and wear. The continuous monitoring of the spindle bearing load prevents defined limit values from being exceeded, thus hindering damage to the spindle. Cyclic monitoring of the feed axes provides insight into ball-screw wear and anticipates pending failure. The Component Monitoring feature of the TNC increases process reliability, productivity, and machine service life while also reducing unplanned machine downtime and its consequent high costs.



On an example part, OCM will show how it can reduce machining time and tool wear by a factor of three.



Milling, turning, and grinding in a single setup

How would it be if, in addition to milling and turning, you could soon use your machining center with a TNC 640 to also jig grind, and all of this in a single setup? This option allows you to jig grind any contour, and it is programmed in a manner similar to the already existing machining operations. Optimized tool management supports you with every single process, including dressing, so that you can give your parts a perfect surface finish.

How important is measurement technology for process reliability?

In addition to the new features of its controls, HEIDENHAIN will once again focus on the importance of measurement technology for process reliability. Even though linear and angle encoders do their work behind the scenes, the choice of the right encoder is a decisive factor in attaining reliable processes and highly accurate production results.



For more information: imts.heidenhain.com

Full utilization

Doppelmayr Italia actually needed a large lathe. Instead, it bought a 5-axis milling machine that can also turn.

“Wow” is the first thought that comes to a visitor’s mind when he stands in front of the new FPT Dinomax at Doppelmayr Italia in Lana, South Tyrol. The machine’s production repertoire includes cable sheaves for cable car systems, which nowadays carry passengers not only up high mountains but also between airport terminals, for example. To manufacture such products, this South Tyrolean company employs innovative technology on a massive scale. Thanks to a TNC 640 on the FPT Dinomax, the company can mill and turn workpieces up to 4.2 meters in diameter and weighing up to 15 metric tons—all in a single set-up. That’s not something you see every day.

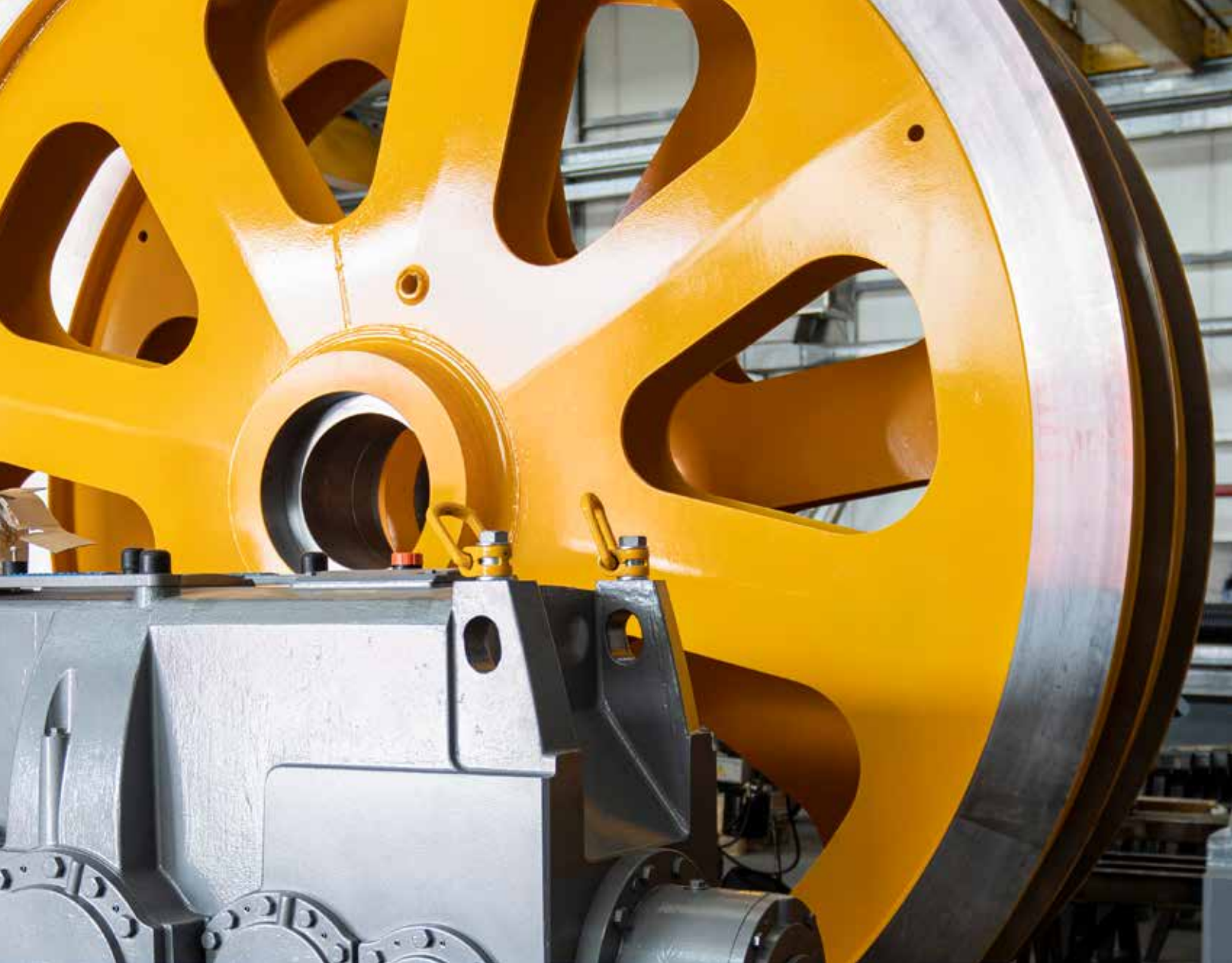
It was clear to everyone involved at Doppelmayr that the company’s old facing lathe needed to be replaced. But what machine would fit the bill? Lorenzo Benvenuti, head of production and procurement at Doppelmayr Italia, describes the situation at the time: “In years past, large cable sheaves were made entirely by our parent company in Austria. But now, we in Lana were expected to re-launch production whenever single parts and special solutions were needed. We weren’t anticipating the high quantities that would fully utilize a dedicated lathe.”

Choosing a control: (not) a hard decision

Against this backdrop, the machine manufacturer FPT provided the decisive tip: a Dinomax milling machine with a rotary table for vertical turning. Between turning jobs, the machine could still be fully utilized for milling work. But which control should the machine have? A lathe control that can also mill? Or a milling control that can also turn? “Milling is by far the more complex process, and we wanted to have reliable mastery over it. So we went with the HEIDENHAIN TNC 640. When it comes to milling, HEIDENHAIN is our go-to product,” explains Benvenuti.



Christof Karlegger (left), Ing. Peter Plattner (middle), and Franz Frei (right) during setup of the massive cable sheave for London Luton Airport gives a good idea of how much room the machine offers for large projects.



Impressive dimensions: the cable sheaves, each 3.6 meters in diameter, and their drive system for London Luton Airport.



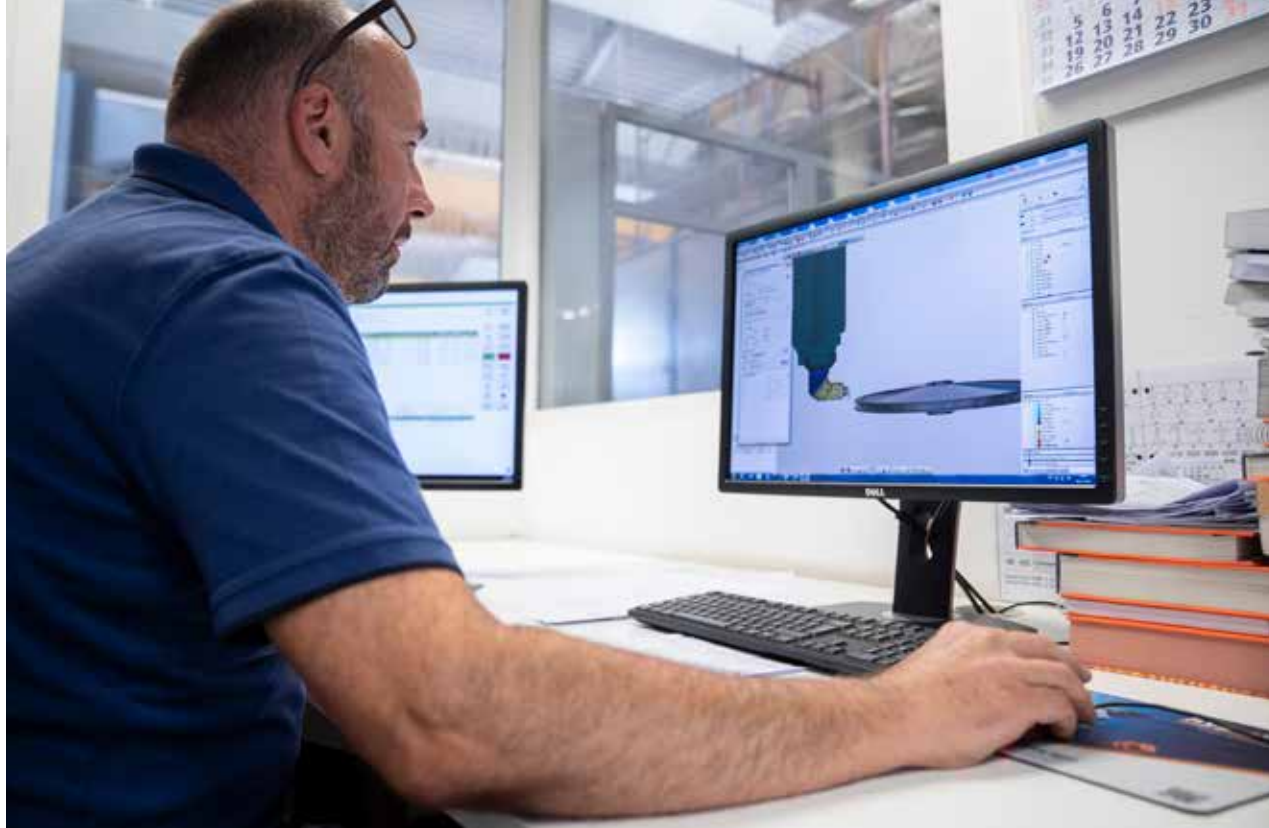
When deciding on a control, Lorenzo Benvenuti carefully weighed the facts and, together with his team, ultimately chose the HEIDENHAIN TNC 640.

The machine has been in operation for about a year now. "You can have a plan for everything, but the world always ends up turning in the opposite direction," laughs Benvenuti, recalling the 20 large cable sheaves that have already been run on the machine this year alone. Among them were the heaviest sheaves that Doppelmayr Italia has ever made. Prior to machining, the workpiece blanks of these huge, yellow-painted wheels, each featuring two cable guides, weighed roughly eight metric tons. Now they are waiting to be shipped to London Luton Airport, where they will soon be shuttling airport guests from terminal to terminal in speed, comfort, and safety.

Accuracy is key

Comfort and safety are key requirements in this kind of cable car project, and accuracy is a decisive factor in attaining them. For their 3.6-meter outer diameters, the giant cable sheaves for London Luton Airport must meet tolerances down to a tenth of a millimeter. Tolerances for the bearing seats and brake surfaces are even as low as the famed hundredth of a millimeter. Such accuracies ensure the long service life, reliable functioning, and jerk- and vibration-free operation that make for a pleasant ride.

Due to the machine's unexpectedly high



Franz Frei at the CAD/CAM workstation: within sight of the production floor, staff members write the programs for their own machines.

utilization rate, absolutely everything on it must work as intended. Franz Frei, head of production and therefore the machine's "boss," is satisfied on the whole. "Of course, there were some teething problems in machining the large cable sheaves. At these dimensions, turning becomes a complex process with its own unique set of pitfalls," notes Frei. When you stand next to the machine and feel the forces at work while a roughly two-meter wide sheave is being machined (what Frei calls "a small sheave"), you can just imagine what the machine has to withstand when working on an eight-ton specimen.

The machine assists with many tasks

"And when everything is new—the machine, control, and CAD/CAM program—something will inevitably go wrong somewhere," remarks Frei, who holds a very pragmatic view of the initial phase. But now everything works well. The machine manufacturer FPT, the CAD/CAM supplier HyperMill, and HEIDENHAIN were always on-site when adjustments were needed. Some turning cycles still had to be optimized, for example, and programming improvements were made

for turning processes in the CAD/CAM system. "The machine provides optimal support and relieves us of many tasks," Frei is now pleased to report. For example, the machine is equipped with three heads for the various machining operations:

- A spindle extension for machining workpieces with deep, narrow pockets and other elements
- A universal head with a mechanical gear system and freely selectable angles for inclined machining
- A head for heavy turning

The head for heavy turning can be indexed automatically. This facilitates the use of short tools that enable faster machining and higher accuracy. "If the NC program requires a change of heads, then the machine automatically switches to the correct mode," says Frei. "During milling, the table is then either stationary or freely rotatable, whereas during turning, it can spin at up to 180 rpm."

"With programs from the CAD/CAM system, milling and turning are no problem at all. For milling, we program smaller jobs and modifications directly on the machine's control," confirms TNC user Christof Karlegger, one of the two

tradesmen who operates the Dinomax. His previous role at Doppelmayr Italia involved working with a HEIDENHAIN iTNC 530 on one of the company's travelling column milling machines. "For turning, I personally work entirely with CAM data from the design department," he says. "I'm not yet that familiar with how to write turning programs on the control." A special training course from a HEIDENHAIN end-user consultant will soon remedy that.

Process reliability from the get-go

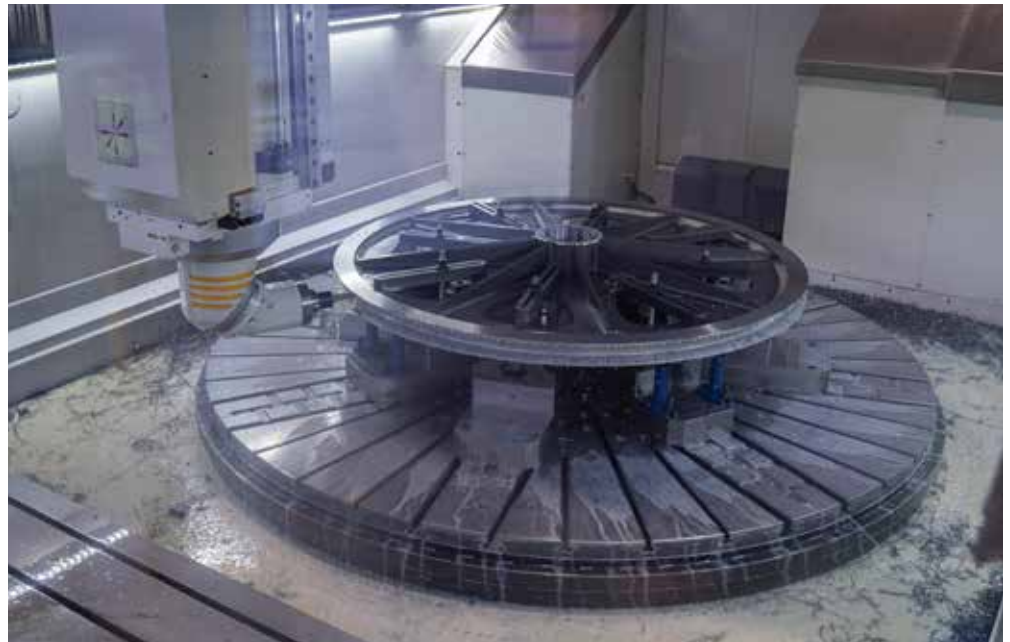
For the creation of its NC programs, Doppelmayr Italia relies entirely on the expertise of its skilled tradesmen at the machine. "Only those workers who know and master the machine are qualified to program in the CAD/CAM system," insists Frei. "If there's a mistake in the CAD/CAM program, then that sends us all the way back to square one. It's definitely better to know, for example, what needs to be considered with regard to workholding." That's why every program is first simulated in HyperMill before going to the machine.



“ With the 3-D simulation function of the TNC 640, I can immediately determine whether a machining operation will really work. ”

Christof Karlegger, TNC user

The TNC user then takes another look at particularly critical sub-processes in the 3-D graphical simulation of the TNC 640. “In the normal view, I often can’t discern the sheave contours or the tool with adequate precision,” says Christof Karlegger. “I can’t really see the exact infeed point of the tool, for example. But in the 3-D simulation, I can verify all of that very carefully and ensure that the machining operation really will run without a glitch.” For Doppelmayr Italia, this long-range verification of cycles is a very important criterion for process reliability. Nobody here can or wants to risk several tons of scrap and potentially many hours of lost time.



The “small” two-meter sheaves look almost tiny inside the machine room of the FPT Dinomax.



- + Turning and milling with the TNC 640:
www.klartext-portal.com/en/cnc-controls/tnc-640/multi-operation-machining
- + Innovative transportation systems:
www.doppelmayr.com
- + Milling machines and more from FPT:
www.fptindustrie.com/en/index.php



Online knowledge

The Internet is an endless source of knowledge. Knowing where to look for the information you need can seem like a daunting task. For TNC control users, the Klartext Portal is the place to go.

The Klartext Portal is the go-to site for user support related to HEIDENHAIN controls. To keep you from getting lost in the sheer mass of information available on this site, we have collected the most important online resources for you.



+ www.klartext-portal.com

Other links that may interest you:

+ www.heidenhain.de/de_EN/software



Free HEIDENHAIN software for a PC, such as programming stations for the TNC and CNC PILOT controls, the TNCremo data transmission software, and much more.

+ www.heidenhain.us/service/support



Complete information about servicing, such as replacement parts and exchange devices.

+ www.heidenhain.de/automation-partners



Together with qualified partners, we provide individually tailored automation solutions.

+ www.heidenhain.us/contact-us



Complete contact data of the contact partner near you.

+ de.industryarena.com/heidenhain

The HEIDENHAIN forum is a great place for users to get fast help from other end users. After all, among our 6200 followers, there is bound to be a TNC expert who can help with your questions.

Klartext



CNC Controls

Tips

PC So

Programming examples

The NC Solutions are a treasure trove of example programs for a plethora of different applications, ranging from simple programs for apprentice training to complex 5-axis programs for inclined machining operations. Use the filter function to quickly find the sample solutions relevant to your task. Videos show many of the programs in action.

Answers

Under NC Solutions, you'll find more than just sample programs. You can also find answers to frequently asked questions. The practical filter function will quickly guide you to the solution you are looking for.



Klartext – The Information Site for HEIDENHAIN Controls

Training Portal

The HEIDENHAIN training program covers the entire gamut of control-related knowledge. After all, we want to help you get the most out of your control, whatever your application may be.

Self-learning with HIT



Less is more? Certainly not when it comes to knowledge and expertise! That's why we created HIT 3.0, a multimedia learning platform for NC programming, so that you can teach yourself new skills as an NC user, including on mobile devices. We also have very attractive offerings for teachers and trainers.

Webinars

Thoroughly and clearly explained: trainers from the HEIDENHAIN training center explain various functions of the TNC and CNC PILOT controls in 60 minutes.

What else is in our media library?

- Klartext reports with extra information about the articles in the printed magazine
- Product videos about our controls and their functions
- User's manuals for current and older control models
- Brochures about our controls

HEIDENHAIN helplines

With our free helplines, you receive immediate and direct support from specialists in various fields.



The rotary table enables the horizontal machining of parts weighing up to five metric tons.

Big and accurate


Sermec Group, based in Portugal, machines large parts in a single setup using HEIDENHAIN controls on machines from Soraluce.

Sermec Group counts wind turbine builders, steel mills, cement factories, and refineries among its customers. The company from Folgosa near Porto supplies them with high-precision parts, usually in low quantities or even in lot size 1. That's why the company selects machines with the perfect combination of flexibility, productivity, and accuracy. With its FS 10000 traveling-column milling-turning

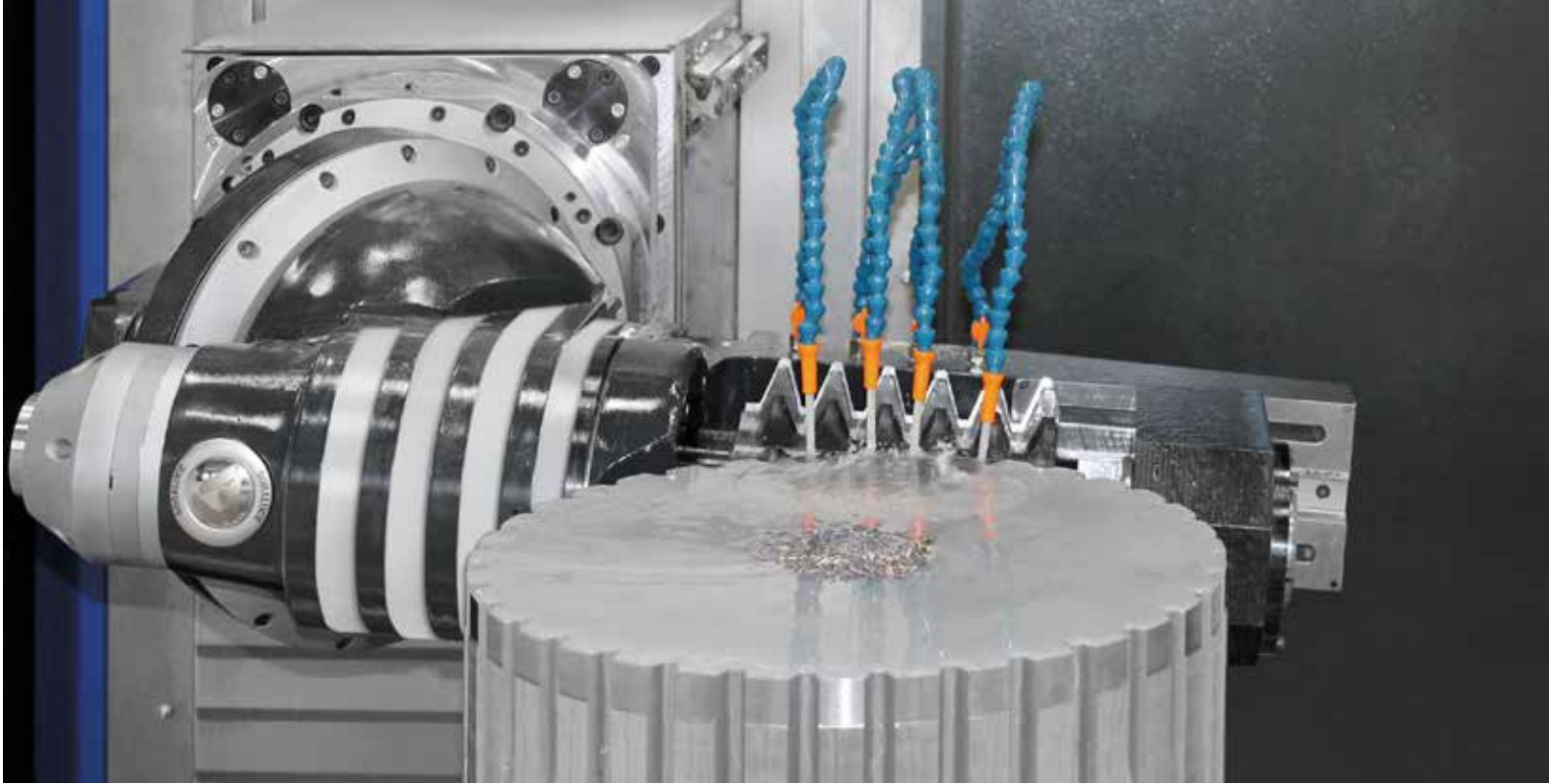
center from Soraluce and a HEIDENHAIN TNC 640, Sermec can manufacture gears and axes for wind turbines with full-surface machining—including difficult gear teeth.

Sermec wanted to perform milling, boring, turning, and hobbing operations in a single setup on a single machine featuring enough room to accommodate various types of large parts. This would

significantly boost the company's productivity and manufacturing accuracy, giving it a clear edge in the competition for production jobs and in meeting the rigorous standards of high-tech customers. So, Carlos Pereira, technical director at Sermec, started looking for a solution to meet this remarkable requirements profile. His search came to an end at Soraluce.



Despite the machine's impressive size, the user can monitor and control all of the processes from inside his cabin thanks to the TNC 640.



The Soraluce FS 10000 features a special milling head for the hobbing of large gear teeth.

High productivity through multitasking

With traversing paths of 10,000 mm x 3600 mm x 1600 mm across a worktable that is 11,000 mm long and 2500 mm wide, the Soraluce machine provides Sermec with sufficient room for the workpieces it typically produces. Added to the mix is a rotary table with a diameter of 2000 mm that is well-suited for both vertical and horizontal machining. The machining center therefore allows 4-axis machining and is optimally equipped for all production jobs. A variety of milling heads—a steplessly tiltable universal milling head, a fixed horizontal milling head, and a boring and face-turning head—along with a tool change system featuring 60 pockets, ensure that the best tool for the upcoming machining operation is always inserted in the machine.

Control of the myriad possible operations is performed by a TNC 640. “Hobbing capability is particularly important to us,” explains Pereira. “It opens up completely new opportunities in the large-part machining market.” Intuitive operation of the cycles makes the production of, say, large gear parts and axes for wind turbines not only easy but also productive and therefore lucrative. This is particularly true because Soraluce has developed a milling head specifically for hobs. “The hobbing cycle from HEIDENHAIN synchronizes the movements of the rotary and linear machine axes with perfect choreography for the hobs,” says Pereira, describing the shop’s new production abilities.

The control isn’t the only thing from HEIDENHAIN

Soraluce doesn’t rely on HEIDENHAIN just for its controls; inside the FS 10000, other HEIDENHAIN solutions are also busy at work behind the scenes. Its motors and encoders come from the HEIDENHAIN production facilities in Traunreut: servomotors, linear encoders, and angle encoders provide accuracy and dynamic performance for the positioning of the machine table, rotary table, and spindle drive system. And, just like the TNC 640, these components share the typical characteristics of Soraluce machines: high accuracy, great dynamic performance, high stability during machining, and maximum availability.



+ Hobbing and skiving with the TNC 640:
www.klartext-portal.com/en/tips/programming/skiving-and-hobbing-operations

+ The machines from Soraluce:
www.bimatec-soraluce.com/machines

+ The Sermec Group: www.sermecgroup.pt/en



“ A key advantage is the simple, truly intuitive operation of the HEIDENHAIN cycles. ”

Carlos Pereira



Accurate for a lifetime

NH Watches manufactures high-precision micro parts for its timepieces using a Pyramid Nano from KERN paired with an iTNC 530 from HEIDENHAIN.

Exclusive watches “made in Australia”? Nicholas Hacko makes it possible. The watchmaker runs a small but remarkable production facility in Sydney. In order to be flexible and competitive, the entrepreneur invested in a 5-axis machining center with which he reliably produces tiny parts to micron-level accuracy.

Originally from Europe, the Hacko family has a long tradition of watchmaking. When Nicholas Hacko emigrated to Australia in 1992, he was his family's third generation of watchmakers. He initially limited himself to repairing all types of timepieces, just like his ancestors. But he wanted more. “I knew early on that I wanted to use my creativity and make my own watches.” In 2011, he took his first step toward this goal when he founded “Nicholas Hacko Watchmaker,” often simply referred to as NH Watches. Five years later, he created his first entirely self-designed and developed watch.

Producing tiny parts to micron-level accuracy

Along with creativity and entrepreneurial spirit, two additional factors are crucial to the success of NH Watches—on the one hand, the company's seven employees, and on the other, the KERN Pyramid Nano high-precision 5-axis machining center with an iTNC 530 control from HEIDENHAIN. It never ceases to thrill Hacko: “This machine mills very small gears, bridges, pallets, mainplates, and other micro parts to greater accuracy than is actually required.” To put this



NH Watches has been designing and producing its own watches since 2016: they really are “made in Australia.”

into numbers, Hacko typically requires a production accuracy of between 6 μm and 10 μm in order to ensure that his watches keep perfect time for a lifetime. In exceptional cases, some mainplates even require hole separations of just $\pm 2 \mu\text{m}$. The Pyramid Nano reliably attains a machining accuracy of better than 1 μm throughout its service life.

A used machine with flawless precision

These extraordinary characteristics are the reason why the Australian watchmaker long had his eye on a machine from KERN. At the AMB trade show in 2016, he saw one in action for the first time, which only confirmed his opinion: “I was convinced that a machining cen-

ter of this type would be ideal for my needs.” When the possibility of purchasing a used machine came around, Hacko quickly made up his mind to buy it. According to KERN, the machine's performance and machining accuracy remain unchanged throughout its service life. “That's just like with my watches,” says Hacko. After a year of experience with his 5-axis milling center, Hacko is also very satisfied with its ease of operation. The easy-to-understand programming language, the straightforward operating design, and the many possibilities offered by the control leave nothing to be desired. As Hacko says, “The machine produces each part exactly as we programmed it. It simply doesn't make mistakes.”



Thanks to an iTNC 530 control from HEIDENHAIN and the Klartext programming language, NH Watches can manufacture its parts to even greater accuracy than is actually required.

“The machine produces each part exactly as we programmed it. It simply doesn't make mistakes.”

Nicholas Hacko

Contract manufacturing as an additional source of income

Recently, NH Watches has started using its Pyramid Nano not only for its own watch production but also to manufacture micro-precision parts on a contract basis for the medical technology and mold-making industries. With no significant competition for this type of service in Australia, Nicholas Hacko is confident about the future, “It’s a great feeling to be the only business owner in Australia with a high-precision machining center of this type. I’m sure this will give us a lot of growth potential, and I’m looking forward to being able to buy more KERN machines in the future.”



Highly precise micro parts like this mainplate ensure that timepieces from NH Watches keep time correctly for the duration of their service life.



+ TNC functions for lifelong accuracy:
www.klartext-portal.com/en/tips/functions/dynamic-precision

+ Machines for microtechnology:
www.kern-microtechnik.com

+ Watches from Australia: nicholashacko.com.au



The machine in your office



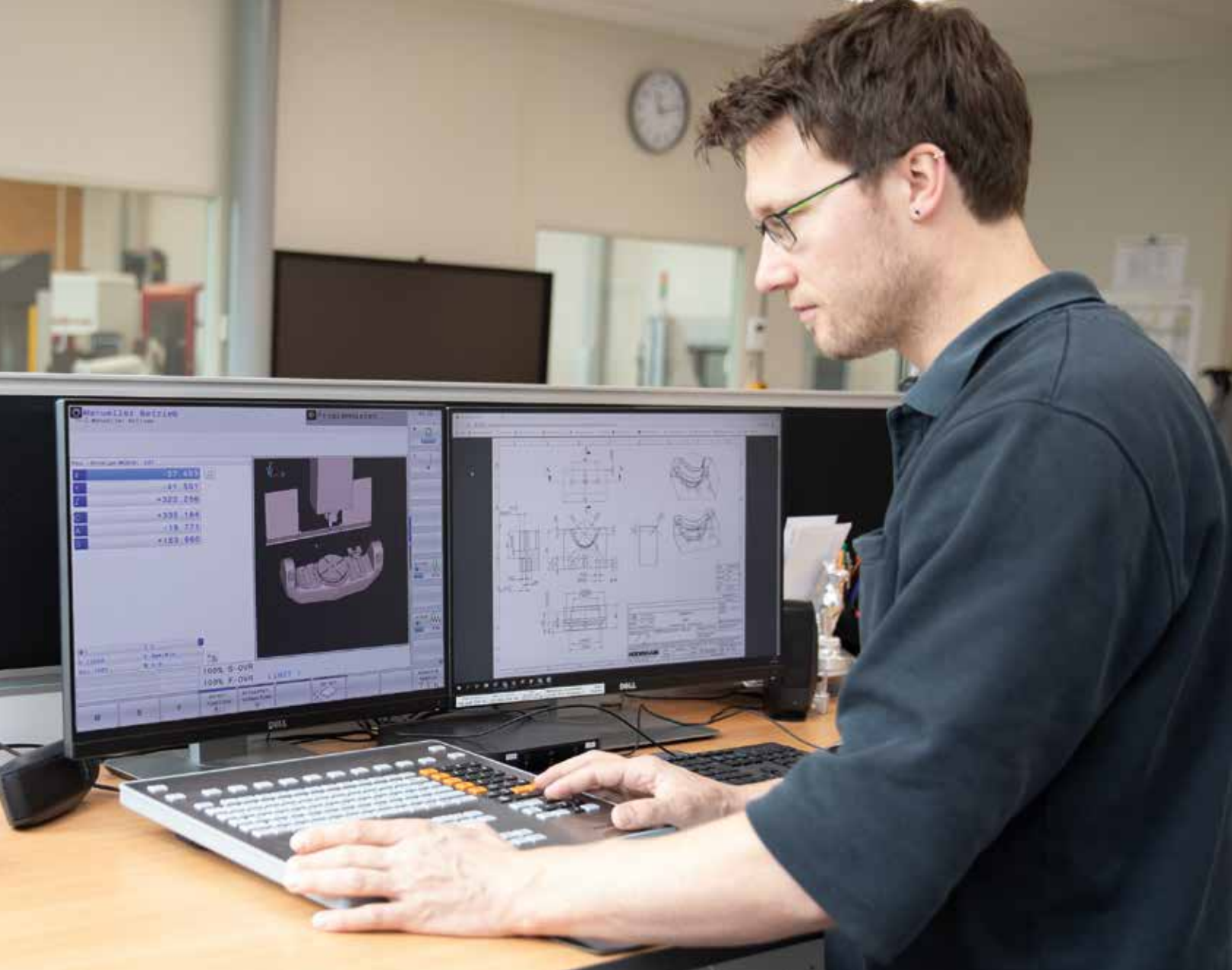
The original on the shop floor: a 5-axis machining center with a TNC 640.

With the digital twin, the programming station in the design office has a nearly perfect copy of the machine on the shop floor.

A programming station from HEIDENHAIN is an exact copy of a control, but it doesn't duplicate the machine itself. Now the HEIDENHAIN Service department is changing all of this by offering a digital twin.

Hans-Peter Wimmer normally works as a CAM programmer for HEIDENHAIN encoder prototypes. But in recent weeks, he has also been involved in the development of a new offering from the HEIDENHAIN Service department—he has been a beta tester of the new digital twin. “As it is, the programming station is pretty nifty,” Wimmer says while describing the project. “After all, it's an exact copy of the control. But until now, it could provide only a simplified model of the machine.”

This meant that programs coming from the design office—especially very difficult machining operations—always had to be simulated directly on the machine, just to be sure (e.g., with a simulation run). “That always cost us lots of valuable time at the machine,” says Wimmer, highlighting the main disadvantage. Or one had to invest in an equally expensive virtual machine. “With the digital twin on the programming station, I now have a true copy of the machine kinematics in my office, allowing me to run verifica-



The digital twin in the design office.

tion tests as if I were on the shop floor," he says. "That gives me much greater confidence that the program will run correctly when I'm at the machine." This reduces setup and simulation time as well as reprogramming work on the shop floor. It also improves process reliability, thereby increasing overall productivity.

“The digital twin brings the machine right into my office, allowing me to account for its particular configuration during CAM programming and start production sooner.”

Hans-Peter Wimmer



+ Your direct number to the NC Programming Helpline: 847-490-0351, select option 2, or email tnccapplications@heidenhain.com

ASTRONOMY

Perfectly pointed

After a thorough upgrade, the Keck Observatory telescopes in Hawaii can now see with even greater precision.

In many observatories around the world, HEIDENHAIN measurement technology ensures the accurate pointing of telescopes into the night sky. The Keck Observatory in Hawaii is no exception. Over the course of roughly thirty years, astronomers and astrophysicists have made a number of sensational discoveries here. Now, after renovation of the drive system and measurement technology, these telescopes can view the heavens with even greater resolution and accuracy.

Atop Mauna Kea, roughly 4200 meters above sea level, the 30-meter high domes of the twin Keck telescopes tower into the clear, dry air over Hawaii. Their 10-meter wide mirrors permit exceptional views of the night sky and are able to collect light from both the visible and infrared spectrums. For enhanced performance, they can also be used in concert to act as one massive, adaptive optical system.



Nine years of renovations under challenging conditions

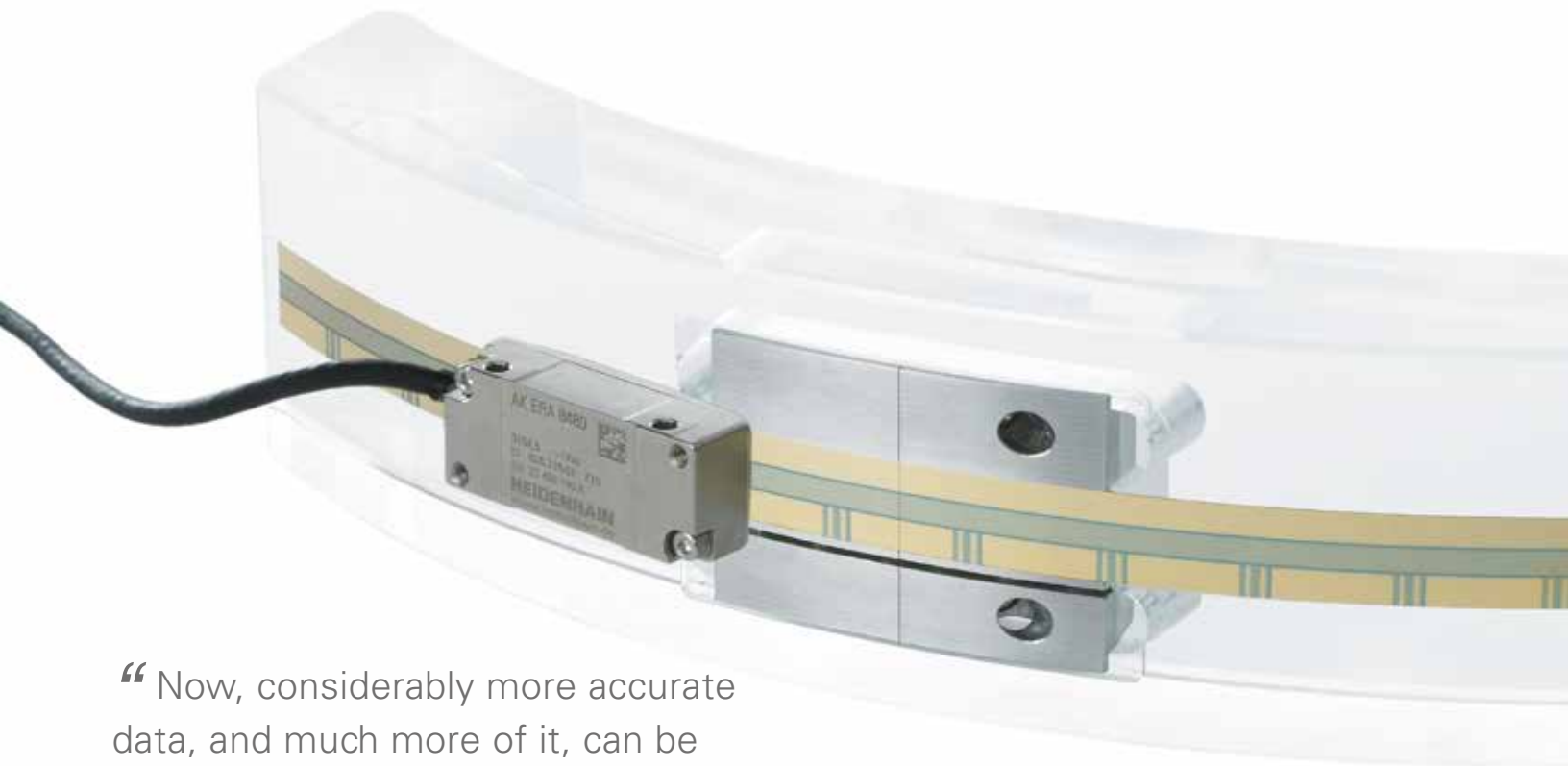
What these massive optical systems are ultimately able to see depends to a large extent on how accurately their mirrors can be pointed at the night sky. The greater the positioning accuracy, the more accurately astronomers are able to target, track, and observe a given region of the universe. This applies both to the azimuth, the horizontal orientation along the points of the compass, and to elevation, the vertical orientation relative to the zenith. For these reasons, the entire drive system technology of the telescopes was renewed and optimized.

Astronomy deals with notions of space and time very different from those of everyday life, and this was also evident in the renovations made to the Keck telescopes. Taking nine years to complete, the project was planned and executed under extraordinary conditions:

- During the renovation period, the astronomers at the Keck Observatory were supposed to enjoy full use of both telescopes. The renovation work, which was carried out during daylight hours, had to be planned such that the telescopes were ready for use again by nightfall.

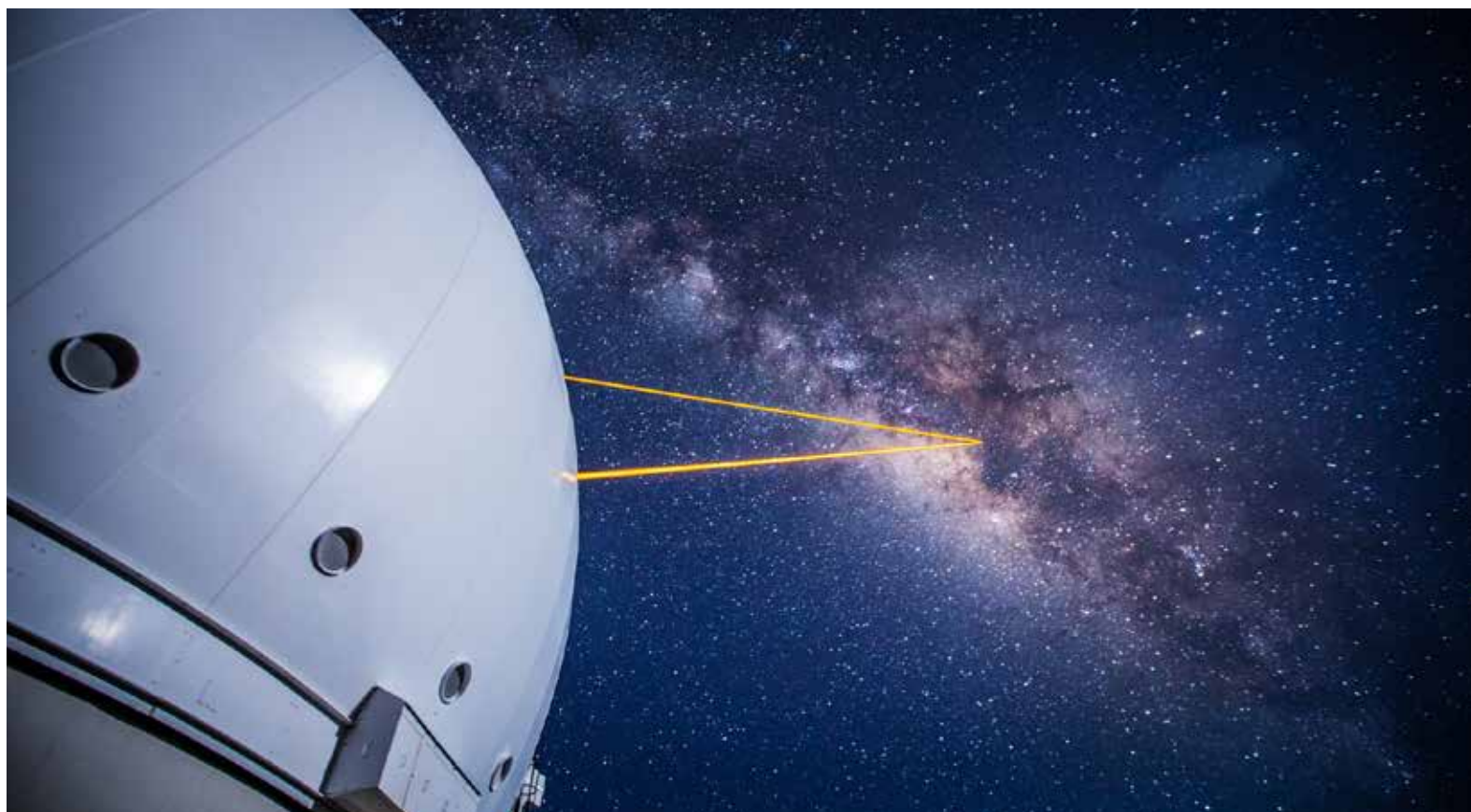
- The telescopes are located 4200 meters above sea level. Due to the lower air pressure and oxygen levels at this altitude, people ascending to the telescopes require breaks in order to acclimatize. In order to work properly, technical systems must also be adapted to the surrounding conditions.

*Clear air without turbulence and pollution:
high over Hawaii on Mauna Kea, the twin
Keck telescopes observe the night sky.*



“ Now, considerably more accurate data, and much more of it, can be made available to astronomers and astrophysicists around the globe. ”

Tomas Krasuski, lead electronics engineer

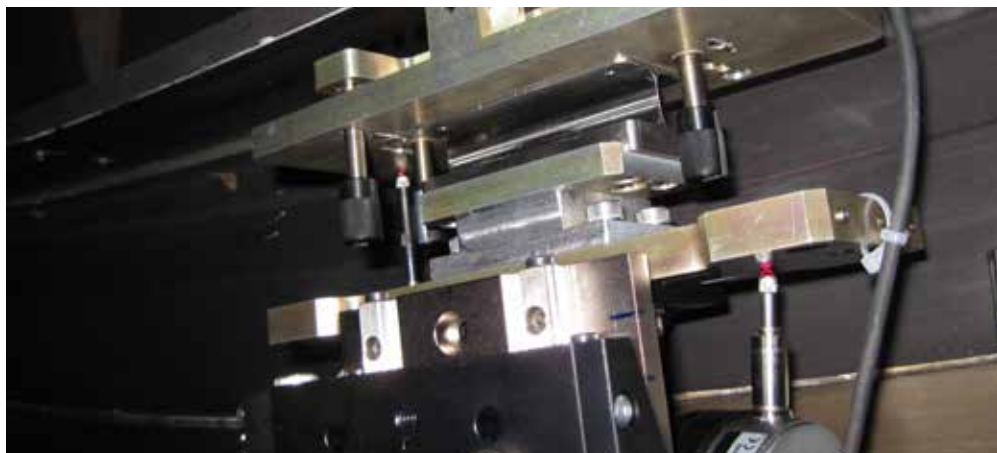


The new measurement technology allows the telescopes to be pointed at a star with greater speed and accuracy, as well as track its movement over an extended period.

For nearly absolute position measurement, the new angle encoders in the Keck telescopes feature markings on a separate scanning track in addition to the incremental track.



Mounting configuration of the ERA 8400 angle encoders on the telescope drive system for azimuth positioning



The ERA 8400 angle encoders on the drive system for elevation positioning of the Keck telescope

Well worth the trouble

But all of the work and waiting ultimately paid off, says Tomas Krasuski, the lead electronics engineer at the Keck Observatory: "We can now point the telescopes at any star within Keck's observable area with an accuracy of one arc second. We were also able to increase performance. Not only can we collect data with greater accuracy but we can also process these data faster—and we now have greater dynamic control of the telescope." The latter point is particularly important when researchers want to observe celestial objects over an extended period, requiring them to continually reposition the telescope. The newly installed HEIDENHAIN encoders contribute to this accuracy.

Measurement technology not unlike that of a machine tool

The position measurement of azimuth and elevation is now performed by ERA 8400 modular angle encoders from HEIDENHAIN. These encoders could be called the big brothers within the ERA family. Their smaller siblings, such as the ERA 4000, perform their service on the rotary tables and swivel heads of numerous machine tools. The graduation lines of the ERA 8400 encoders are spaced along the scale tapes at 40-micrometer intervals and are read by four scanning heads for azimuth readings and two for elevation. In conjunction with the EIB 749 evaluation electronics, the measured values can be interpolated down to a measuring step of 10 nanometers.

This translates into attainable telescope positioning accuracies of four milliarcseconds horizontally and one milliarcsecond vertically. "We can now target, track, and observe an individual star, even within a dense star cluster. That gives us entirely new insights and delivers considerably more data than the previous technology could," says Krasuski, taking initial stock after completion of the overhaul. "It's amazing that we can now move such massive technology like our 10-meter telescopes in measuring steps of just 10 nanometers."



**+ Take a look behind the scenes:
www.heidenhain.us/keck**

**+ The Keck Observatory in Hawaii:
www.keckobservatory.org**





The TNC 640 and Extended Workspace Compact
Keeping digital job management in view

