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# UpLoad

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The magazine for customers and friends of mobile and crawler cranes  
1 | 2022

**LIEBHERR**

**LIEBHERR**

A close-up, low-angle shot of a blue and yellow Liebherr crane. The crane's body is painted in a vibrant blue with a prominent yellow diagonal stripe. The word 'LIEBHERR' is printed in large, bold, yellow letters on the blue surface. The background shows a dramatic sky with dark, heavy clouds and a bright, glowing light source, possibly the sun, breaking through the clouds. The overall mood is industrial and powerful.

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We use male pronouns simply to make our articles easier to read.  
However, the content of the articles applies to all genders.

The photos in this edition were taken in compliance with all covid regulations.  
Everybody was vaccinated, recovered or tested.

# Dear Readers,

## Welcome to 2022.

A year that I personally am really looking forward to. Firstly, because we will be unveiling some pioneering products and technologies. Secondly, because we will be opening some important new buildings in Ehingen which will make our production and service procedures significantly easier. And finally, because I am confident that I will be able to welcome you at the Bauma in October 2022.

Unfortunately, towards the end of 2021, we again saw the introduction of more restrictions and challenges than we had all hoped. But we even managed to get these under control by working together. With you, with our partners and, of course, with our personnel around the world. For example, we have expanded our range of digital training courses right up to the digital crane handover. See page 80 for more details. And our digital products, such as Crane Planner 2.0, have also enjoyed a massive response – more details on page 82.

The subject of sustainability is one that is not only occupying us. What can we do today to leave our children and grandchildren a clean, fully functional world? We have already taken several steps in this respect – the use of HVO fuel instead of fossil diesel enables us to reduce our CO<sub>2</sub> footprint in Ehingen by 6,500 tonnes every year. In addition, our plant will be supplied exclusively with green electricity from wind power as from 1 January 2022. Find out on page 66, how we approach the subject to sus-

tainability before we design a crane. And on page 74 you can find out how our mobile and crawler cranes are helping to drive the process to reverse climate change and establish the energy mix of the future.

At the turn of the year we unveiled two new all-terrain cranes – a 300 tonne machine with a 90 meter telescopic boom, which can be transported in full with a 12 tonne axle load. And the LTM 1110-5.2, the first crane to feature the new generation of our crane control system, LICCON3. Coupled with a modern crane design, which will feature on all future LICCON3 cranes, and a new gearbox module for zero wear manoeuvring. See pages 26 and 46 for more details.

And finally we have another real treat for you – come with us behind the scenes, visit a crane operator and one of our employees and find out about their fantastic hobbies and characters on page 88. We are delighted to have such great customers, partners and employees who provide us with these insights.

2021 will go down in the history books as another year of the pandemic. The pandemic itself has shown us very clearly that we are stronger together than by ourselves. And I am convinced that together we have achieved a great deal of good over



the last year. I would therefore like to express my sincere thanks for our working relationship, our partnership and the trust that you have shown in us.

Finally, let me wish you all a great start to 2022, and I look forward to seeing you in person, at the latest in October in Munich.

**Daniel Pitzer**  
Managing Director Finance,  
Liebherr-Werk Ehingen GmbH

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to read, look at and download.

[www.liebherr.com/upload](http://www.liebherr.com/upload)



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# Moments

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## **Mother Nature's might**

Mountains, fjords and cranes. BMS are using an LG 1750 in Norway to install a new turbine at the Haramsfjellet wind farm on the Island of Haramsøya on the west coast between Bergen and Molde. Wind power is currently the fastest growing method of generating electricity in Norway.



## **O'er all the hill-tops...**

... is quiet now. This is one of Goethe's most famous poems dating from 1780. Optically at least, it is no longer true everywhere as our photograph from the Austrian Alps shows impressively. At about the height of the tree line, four rope access technicians wait for the next component. They are installing a massive overhead cable mast for a new power line. And they are supported by an LTM 1160-5.2 from crane contractor Prangl, who has sent a total of three Liebherr mobile cranes to work on this large infrastructure project in the mountains.







## High precision in minimum space

Two LTM 1500-8.1 cranes and two LTM 1400-7.1 models installed two nitrogen tanks and two liquid storage tanks at a solar farm in the United Arab Emirates in just ten hours.





ALFARIS 2200TANCR 3700

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## The largest wind farm in Russia

The Kochubeyevskaya wind farm in the Stavropol Krai region in southern Russia has a total of 84 wind turbines. It is the largest wind farm in the country and has been on the grid since 2021. Many of the turbines were erected using an LR 1500 from crane contractor Avtokran-Tyumen. The 500 tonne crane was set up for this purpose with an SL4DFB boom configuration, consisting of a 102 meter main boom and a 12 meter fixed jib.





## Building bridges – right from the start

AS Manutention used a brand new LTM 1750-9.1 to hoist a pedestrian bridge over the River Somme in Amiens, France. There was very little space available for setting up the large crane which meant that the planning and coordination processes on site were immensely important. With 154 tonnes of counterweight and a 13 meter fixed jib, the 9-axle crane was set up with the help of an LTR 1060. The job was successfully completed in just two days.





## Historic old town of Dresden

The historic old town on the left bank of the River Elbe is a Mecca for those interested in architecture and art. Dominated by imposing, magnificent buildings like the Frauenkirche, the Semperoper and the Zwinger, which were completely destroyed during the air raids in 1945, the old town has managed to regain its splendour after a long period of reconstruction. It is an area which is absolutely ideal for a mobile construction crane due to its narrow, winding alleys.









## Modern Dutch architecture

An LTM 1450-8.1 played a major role in the construction of the new railway station in Utrecht in May 2018. The station will handle around 1,500 trains every day.





## **The ultimate salt barrel**

Schweizer Salinen produce up to 600,000 tonnes of salt every year. In addition to table salt and salt types for industry, agriculture and pharmacy, the Alpine state also requires a great deal of winter salt. Enormous warehouses such as the Saldome2 at Saline Riburg in the Canton of Aargau are used to store enormous stocks of this important material. A Liebherr mobile crane was involved in the construction of the wooden cupola..



HARING

# Made with Liebherr

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**Renowned old towns and spectacular buildings, important communication infrastructure or just places for sport and leisure – Liebherr cranes are very much in demand for construction, modification and refurbishment work. So we can certainly also say: Made with Liebherr.**

## **Noiseless in Dresden old town**

Radeberg-based contractor Krandienst Kunze e.K. sent its Liebherr MK 88 Plus mobile construction crane to Dresden old town to replace glass elements in a shopping arcade. The conditions in the area around the Frauenkirche include narrow streets, requiring sensitive hoists from the atrium over a line of buildings thirty meters high and a high density of local residents. So it was an absolutely ideal job for an MK 88 Plus operating in electric mode. Hardly had the hydraulic outriggers been extended and the vehicle levelled, something happened which was extremely unusual for a crane job – complete silence. The diesel engine had been shut down and from then everything was carried out using site electricity, even the remainder of the set-up process for the MK. The heavy current cable carried

on the crane was connected to the power distributor box on the site and the elegant extension mechanism for the tower and boom were started using the remote control. 15 minutes later, the compact MK was fully erected with its boom at an angle of 30 degrees. Only for the first few hoists was the MK 88 Plus controlled from the infinitely height-adjustable elevating cab to keep a close eye on the building topography. After that, everything was done by remote control so that the operator was with the installation team on the roof, close to the removal and installation location for every one of the 800 kilogram glass elements. That made communication and a view of the load much easier. And it also meant that the job in the old town could be completed successfully with maximum safety and with pretty much no noise.





kilometers west of Basel. Its storage capacity was expanded around ten years ago with a large new facility after an extremely snowy winter and problems with the supply of winter salt. A Liebherr LTM 1055-3.1 mobile crane took care of the panelling of the massive cupola structure. Around

### Wooden cupola becomes new salt storage facility

In Switzerland, there is a statutory supply order for salt. Schweizer Salinen AG, owned by all the Canton's and the Principality of Liechtenstein, produces almost all the country's requirement of salt of all types at its three sites. One of them is Saline Riburg near Rheinfelden, around ten

1,300 cubic meters of timber were required to build the dome which has a diameter of 120 meters and a height of 32 meters. The wooden structure, which at the time was the largest wooden cupola in Europe, can hold over 100,000 tonnes of salt.

### 8-axle crane at the new station

Utrecht station is the largest railway station in the Netherlands. It handles around 195,000 passengers and 1,500 trains every day. First opened in 1843, it has been extended and refurbished several times. The station itself was recently reopened in 2016 after extensive building work and the area around the station has been completely restructured, with the work finishing in 2020. One striking feature is the new roof on the station square – which is where an LTM 1450-8.1 from crane contractor Heijkoop was in action in May 2018. The constricted site conditions on what is now the station square posed a minor challenge. A 1000 EC-H tower crane was dismantled whilst site operations continued. Fitted with a luffing jib and 134 tonnes of ballast, the components of the tower crane were hoisted out of the new roof of the station square. The slewing ring with the crane jib, weighing in at around 27 tonnes, was the heaviest load for the 450 tonne crane.



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# Mobile and crawler cranes

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**Night shift**

The new LTM 1230-5.1 from Quinlan Cranes PTY Ltd. replaces the air conditioning systems at the Water Gardens leisure and shopping centre in Melbourne, Australia.





# Tinkering on the crane of the future

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## In the crane workshop – LTM 1110-5.2 with LICCON3 control system

How does the future look? Will there ever be flying cars? Perhaps flying cranes? Who knows... but one thing is certain – the Liebherr crane of the immediate future looks pretty sleek – it is powerful, efficient, comfortable and straightforward. Marc-André Bader has known all about our crane of the future for more than a year now. Nobody has spent more time with the prototype than he. So we took the opportunity to take a look at the new crane in the company of Marc-André – the LTM 1110-5.2 with the LICCON3 control system.

Up close and personal – Marc-André Bader collected the first prototype of the brand new LTM 1110-5.2 featuring the new control system from the final assembly hall in summer

2020. “That was a very special feeling for me when I climbed into the first ever version of this crane. Quite simply because it is the crane of the future and it has been completely

redesigned”, he remembers. “At first, everything was unfamiliar, of course, as the new controls look different. Due to its really simple, intuitive design, which our colleagues from the



Enthusiastic about the crane of the future:  
Marc-André Bader, Department Technical Trial

# ***“There are worlds of difference between a dry clutch and the new wet starting clutch!”***

**Josef Schick**

Head of Technical Trial Department

control system and general design departments created, however, it quickly becomes very familiar. There are a lot of similarities between it and the LICCON2.”

## **Engineered for the future, built on experience!**

Marc-André then drove his new hobby horse onto the Technical Trial Department test site. This is where he has been spending his working days since 2017 – successfully completing a very exciting job. He continues: “In the Trial Department, you’re always one of the first to get hold of new developments. That makes for a very varied working day and you have loads of opportunities to bring in your own ideas and help to design the cranes.”

The first few days working with the new LTM 1110-5.2 were all about getting the basic functions to work. “The basics initially included powering up the control system and completing the initial crane movements in emergency mode”, says Marc-André, thinking back to his first days with his charge. “Then we moved onto standard mode. The switch to the new controls was absolutely no problem.” Marc-André and his colleagues from the Technical Trial Department work very closely with the development departments. There are regular meetings and consultations about topics which have to be revised. The man from the Trial Department continues: “In urgent cases, I just get in touch with the programmers when I

need some help quickly. The mutual collaboration works very well and is reliable.” The basic functions of the control system have now been ironed out in the prototype – with a large number of finishing touches and features now being implemented after they proved their worth on LICCON2.

## **Feel-good cab for everybody**

“A crane operator will not notice any major differences in the functions for operating the crane”, says Marc-André. Liebherr decided to develop the new LICCON3 control system to make it suitable for the demands of the future with a faster data bus, significantly more storage space and greater computer power. The third generation of the LICCON (Liebherr Computed Controlling) control system uses the same control procedures and overall has a number of familiar features. A new large display with a touchscreen function in the superstructure cab now makes it even easier and more comfortable to operate the crane. “The large screen makes it possible to operate the crane without moving the seat position. That is much more comfortable. The control and display units also provide more information, which is displayed in a very clear and self-explanatory

way using icons. The brackets and the USB chargers for smartphones and tablets are also really practical,” says Marc-André, describing his first hand experience with the new crane.

The team from the Technical Trial Department works outdoor or in the crane operator’s cab in both summer and winter whatever the weather. “It was very pleasant being able to try out the new drinks coolbox in the driver’s cab in temperatures of 35° Celsius during the summer. We also had to make a few improvements to the new automatic climate control system. This creates a pleasant climate in the cab at the touch of a button. You just set the temperature – and the system does everything else,” adds Marc-André. And during the current dark winter months in Germany, the optional LED lighting has shown exactly how good it is. “The lighting is really good. The crane and the surrounding area is very well illuminated during darkness, which is a major plus for site safety,” says Marc-André enthusiastically. “The central locking is another great addition. Opening and locking by remote is very convenient. The integral access lights also make accessing the superstructure much safer!”



### Smart technology in the chassis

Liebherr continued to follow its development plan with the chassis as well – familiar but ready for the future. The LTM 1110-5.2 is based on the LTM 1110-5.1 with LICCON2 control system, which was first unveiled in 2019. That model was also developed and built to be pioneering. VarioBase®Plus, ECOMode and ECOdrive, a quick-change system for ballast slabs and load charts for different wind speeds are just some of the features of this innovative crane concept.

“The main innovation in the drivetrain on the LTM 1110-5.2 is the first ever use of the TraXon gearbox with the new DynamicPerform clutch module,” explains Martin Dony, an engineer in the Design and Development of Crane Chassis Department. “The wet

starting clutch transfers the engine power using integral discs which are cooled by an oil system. This means that multiple starting procedures, even on gradients, and permanent, zero wear manoeuvring is possible without the clutch overheating or suffering wear.” On page 85 in the section entitled “Simply explained”, Martin Dony tells us more about the background to the wet starting clutch for the TraXon DynamicPerform gearbox system and how it works. Josef Schick, Trial Department Manager, continues delightedly: “All the development challenges were overcome. We can safely say that there are worlds of difference between a dry clutch and the new wet starting clutch! The close collaboration with ZF and intense testing means that the gearbox version is now ready for widespread use.” And there is a minor

addition to the drivetrain – the emissions treatment system on the diesel engine with SCR catalytic converter and particulate filter has now been certified for both Europe and the USA. This is a major advantage, particularly for international crane contractors.

Our engineers have also added a new feature to the active rear axle steering – the signal transfer to the sensors has been significantly improved. This reduces the number of failures and increases the level of availability. A plus point for greater economy – the hydraulic switching of the active rear axle steering has been improved so that it reduces fuel consumption.



# Award-winning design

Our engineers Reiner Keller and André Glanzer created the design for the driver's cab working with the Design Tech design agency based in Ammerbuch (Germany). "The challenge with developing a new driver's cab was the combination of design, functionality and comfort," says Reiner Keller. "A good design stands out through its clear forms, practical control concept and the use of appropriate materials. The result is an ergonomic workplace perfectly tailored to the crane driver." This was also confirmed by a large number of crane drivers at Bauma 2019. This is where the prototype of this new driver's cab design was first unveiled. In addition, a number of suggested improvements and ideas were adopted for the series cab.

The new driver's cab was rewarded with the renowned American GOOD DESIGN® Award 2020 in the "Transportation" category. The GOOD DESIGN® Awards were started in 1950 and are awarded to the most innovative and modern industry, product and graphic designs from all over the world.



The Liebherr development engineers in the newly designed driver's cab: Reiner Keller (right) and André Glanzer.



**LICCON3**

Crane control

**Honoured**

Good Design  
Award

**TraXon**

DynamicPerform



Find out more about LICCON3 here:  
[www.liebherr.com/liccon3](http://www.liebherr.com/liccon3)

**Simply superb!**

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## **„Small enough and a good capacity“**

We have added something new to our well-stocked, wide-ranging crane portfolio here at the Liebherr Plant in Ehingen. The recent addition to our range is the brand new LR 1700-1.0 crawler crane. Our new model, which features every single recent innovation in crawler crane technology, is off and running. The first machines have been on trial with our partners for the last few months. And what we are hearing from them tells us that we have satisfied all the demands of the market with this advanced 700 tonne machine. Which also means that we have also satisfied our own demand of being the technical benchmark for cranes. Globally.

With the drivetrain on its hook, the LR 1700-1.0 operated by Spanish heavy haulage group Eurogruas is shown here with a gross load of 89 tonnes. The gondola is three tonnes heavier. The design of the twelve meter boom tip enables large components to be manoeuvred easily just below the pulley head.

***„I think, Liebherr has done a good job.“***

**José Miguel Vázquez Sánchez**  
Supervisor, Eurogruas 2000



The brand new LR 1700-1.0 has been leaving our production halls since summer last year. After around thirteen years, it is replacing the LR 1600/2 crawler crane, more than 220 of which have been built. It was mainly the pioneering new developments by our engineers in crawler crane technology that paved the way for this advanced crane. We have completely redesigned the basic machine and made it more powerful, albeit invisibly. Although the new crane has similar dimensions as its predecessor, the performance parameters of the LR 1700-1.0 in part extend into the domain of its big brother, the LR 1750/2. And in some cases, they even exceed it.

The energy revolution is accelerating. More and more countries are choosing wind power as part of their renewable energy sources. This means that this sector is growing rapidly whilst the heights and dimensions of new wind turbines are increasing all the time. We are ready and waiting for it to happen! We have once again reacted to this development with our new crawler crane and tailored

the LR 1700-1.0 to meet these rising requirements. During its very first job at a wind farm, the new crane was able to demonstrate all its features in full. This particular crane – operated by crane contractor Hofmann, based in Paderborn – was set up with the maximum main boom length of 165 meters, together with a twelve meter fixed jib. This enabled the crawler crane to erect a 4.5 megawatt wind turbine made by Nordex with a hub height of 164 meters. To do so, it had to hoist gross loads of up to 75 tonnes to the top of the tower. This proved no problem to the power pack finished in the company's blue livery. In fact, in this set-up, the crane can hoist load cases of around 100 tonnes.

#### **„I like the machine“**

During its first year in action, Hofmann's LR 1700-1.0 has already erected five "windmills". The new crawler crane is awash with modern features which means it has several major time-saving tools on board. "The detachable Vario-Tray derrick ballast and the V-Frame mean that we no longer have any time-consuming ballasting work to do", says a happy Christoph Bergmaier, who shares the operator cab with his colleague, Stephan Dickel. His brief summary: "Powerful crane and really user-friendly."

Our new crane is also up and running with great success on sites in the USA and several European countries. Spanish group Eurogruas is another of our first business partners who have decided to buy the LR 1700-1.0. The machine was handed over to this crane and heavy haulage group, which is also active in Africa and South America, during November. However, the 57 trucks carrying the equipment started from Ebingen and went north rather than south. In fact, the crane components were transported to the northern edge of the Ruhr region and assembled near Recklinghausen. In the middle of a large wooded area, it was awaited by two wind turbines with hub heights of 161 meters and an impressive rotor diameter of 158 meters, which had to be erected. For this job, too, the





The systems send all the parameters for the crane status and hoisting process to the operator's cab of the R 1700-1.0. The right-hand display shows a current load case of 86 tonnes.

LR 1700-1.0 was set up with its maximum boom and the twelve meter jib. The loads were rather higher than at the Hofmann site at up to 92 tonnes.

José Miguel Vázquez Sánchez, Eurogruas' Site Supervisor seemed very pleased with his new machine after the first turbine had been erected very smoothly. In terms of its dimensions, explained the Spaniard, this powerful machine reminds me more of a 600 tonne crawler crane: "Small enough and a good capacity. I like the machine." In fact, during the design work for the LR 1700-1.0, we focused on giving it high lifting capacity values whilst keeping its dimensions compact. Not least to enable its individual components to be transported as efficiently as possible, and therefore economically.

### Wasel uses luffing jib from the LR 1600/2

Major crane and heavy haulage contractor Wasel, based in Bergheim near Cologne, also ordered one of the 700 tonne crawler cranes. This machine has also now erected several wind turbines. However, Wasel GmbH does not just intend to use its new all-rounder for this type of work. Jobs in the petrochemicals sector as well as infrastructure and industry jobs will also be tackled by its crawler crane in its blue and white livery. "For its first job at a power plant, we set up our LR 1700-1.0 with a 42 meter luffing jib", says Martin Bender, the Crawler Crane Dispatcher at Wasel. A 100 tonne load had to be positioned at a hook height of 85 meters using a radius of 27 meters. "The fact that the crane is suitable for universal use was the main factor behind our purchase decision". Just like Bender, Wasel's Technical Director Julian Schmidt is also extremely satisfied with this latest addition to the crawler crane fleet: "A brilliant successor to the LR 1600/2, which has been very reliable to date. In addition to its impressive lifting capacity values and the superb V-Frame concept, one of the main benefits is that we can use lots of components from our LR 1600/2. Including the complete luffing jib."

During the development of the new crane, our engineers here in Ehingen always had an eye on the wide range of possible uses for the LR 1700-1.0 and its economy, in addition to tailoring it for jobs in the wind power sector. That is why we ensured it had a wide range of set-up versions. From the 198 meter boom, consisting of the main boom and luffing jib, to a modular ballast wagon, which, by the way, can also be used on the LR 1800-1.0 and LR 11000. This so-called "M-Wagon" rounds off the highly efficient derrick system of the new crawler crane perfectly in addition to the "VarioTray" detachable ballast system and the "V-Frame" folding frame.



Which means that we were almost tempted to agree secretly with him when José Miguel Vázquez Sánchez, the Project Manager at Eurogruas, said with some satisfaction: "I think, Liebherr has done a good job."

### Space and time-savers:

The basic machine of the LR 1700-1.0, completely redesigned by Liebherr, here during slewing with the reduced VarioTray derrick ballast on the retracted V-frame.



# Top performance

## How do modern fixed jibs on crawler cranes satisfy current market requirements?

Lattice boom crawler cranes are used when other cranes reach their limits. They are used to hoist particularly heavy loads. And they are required when particularly great hoist heights or radii are necessary. The requirements for crawler crane performance are high and continue to grow. All the components must therefore be analysed and improved on an ongoing basis. Roland Bohnacker, Crawler Crane Development Manager, explains how the fixed jibs on our latest crawler crane models deliver top performance in every sense.

Main boom or luffing jib configurations are the norm for heavy load or industrial jobs. Fixed jibs are more of a rarity in these cases. However, they are certainly useful for some jobs and are popular if an interfering edge requires an angled lattice jib, but you want to save the cost of the more expensive installation of a luffing jib. Optimisation of the fixed jib was by no means a priority in the past. But the developments in wind power – ever higher and heavier – has resulted in an increase in the significance

of fixed jibs on lattice boom cranes. In this area, they have now become essential equipment because not only do they generate the space required to the main boom, but they also deliver greater hoist height and lifting capacity.

Today, we can offer a jib for the LR 11000 which can hoist 253 tonnes – a value which was inconceivable just a few years ago. This is the positive result of close cooperation with our customers. We have even managed to go beyond their high requirements. And we have learned a great deal. For example, we have managed to transfer the concept of the F2 fixed jib from the LR 11000 to our new LR 1800-1.0 and LR 1700-1.0 crawler cranes.

### Common features

The main point is designing the fixed jib for maximum lifting capacity. The fixed jib on the LR 1700-1.0 can manage 170 tonnes, whilst the one on the LR 1800-1.0 achieves 185 tonnes. Other common features include the 3 meters section length of fixed lattice jibs – in addition to the 12 and 6 meter intermediate sections, we also have 3 meter sections. These improve the lifting capacities over the entire hoisting height range.

To cover a wide range of jobs, the fixed jibs can be installed at three different angles. The smallest angle delivers sufficient space for wind power erection work. The larger angles are used for industrial jobs which often have to overcome interfering edges using longer jibs.





***“Intensive discussions with our customers have enabled us to improve crane components so that they meet the rising demands of everyday practice.”***

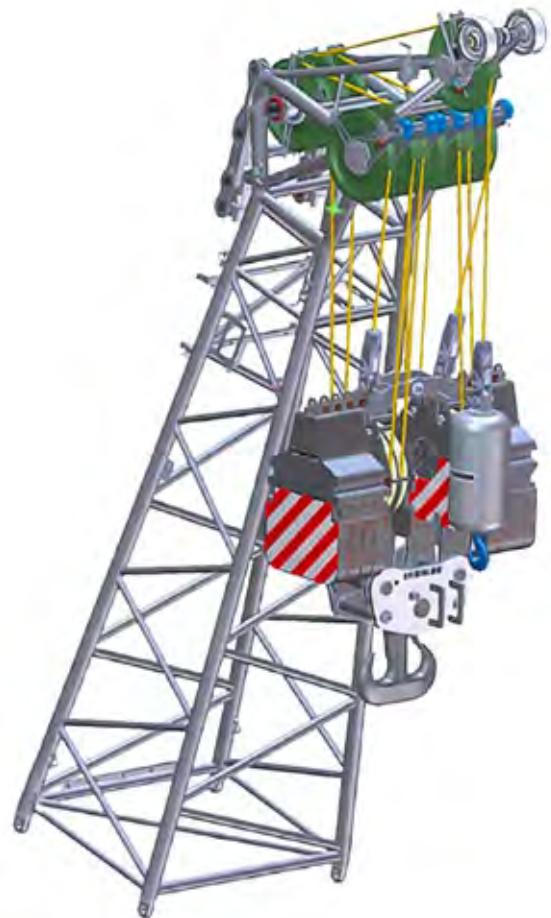
**Roland Bohnacker**  
Head of Crawler Crane Development

One very important point is that the jibs must be light-weight to enable great system lengths to be raised. This is why the guy rods in the form of stationary aramid fibre guying ropes have now become standard at Liebherr for fixed jibs. The prerequisites for satisfying customer requirements include fine-grain structural steel with a high yield point and, of course, weight improvements at the areas at which force is applied.

The new fixed jibs are designed for both single and parallel use. Limited rope length is then no longer a problem as two winches can work at the same time over the jib. In parallel mode, a particularly wide hook block prevents the block twisting. A tilt sensor ensures that both winches automatically operate synchronously.

And finally, the whip line is already integrated on the end section of the fixed jibs to reduce weight. It has its own load measuring system to increase safety in 2-hook mode.

The fixed jibs on our new lattice boom cranes have set a standard which takes into account the rising requirements of the market. Top performance, in other words.



Integral whip line and wide hook block for parallel mode

# Smart and stable with Y

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## Into the future with Terminal 3

It is the largest privately financed infrastructure project in Europe – the new Terminal 3 is currently being built at the southern side of Frankfurt Airport. Airport operator Fraport is investing around 4 billion euros in the future of Frankfurt Airport. Also involved in the project are the Schick Group and its Liebherr mobile cranes – and 86 Y-shaped supports, which are delivering stability and elegance. Really chic.

“When we started the construction work in 2018, this was all green fields,” says Carina Wehner. The 27 year old construction engineer is the Project Manager for Prefabricated Concrete Components at Anton Schick GmbH + Co. KG. Together with two other project managers, Aileen Kempf

and Michael Metz, she is responsible for the complete process from planning and production, to transport and installation on site. Michael Metz has been with Schick for 20 years: “The airport expansion is the largest construction project in the history of our group.”

The Schick Group is building the new tower with an impressive height of 70 meters and the two main passenger gates for the new Terminal 3. Pier J, with its three levels, a length of 600 meters and an area of 27,000 m<sup>2</sup> will provide space for 14 aircraft positions. There will be 12 positions at Pier H, which has two levels, a length of 400 meters and an area of 16,000 m<sup>2</sup>. Thousands of heavy prefabricated concrete components are required for the structures. The vast majority of them are manufactured at one of the Schick Group’s own prefabricated concrete plants in Bad Kissingen around 150 kilometers away.

### Y-shaped supports deliver stability and flair

Many of the concrete components will be visible once the piers have been completed. So they therefore have to be designed and produced accordingly. Almost all the prefabricated concrete components have been manufactured using a specially coloured granulate. The 86 Y-shaped supports, which fit on both sides along Pier J, are particularly striking. “The Y-shaped supports have both a load-bearing and architectural purpose. In load-bearing terms they dissipate the load of the projecting floor above them through level E02 into the ground. Their architectural feature is their unique geometry. They only have sharp edges which run at angles to each other,” says Wehner, explaining their twin function. “For our customer, they are essentially important and must comply with the architects’ plans exactly,” adds Metz.



An LTM 1090-4.2 installs coloured concrete façade elements on Pier H.



Aileen Kempf discusses the next crane jobs for installing concrete façade elements on site.

There is a total of five different types of Y-shaped support, depending on their structural role. There are also double Y-shaped supports, which provide extra stability at the two ends of the piers. Most of the supports weigh 22.5 tonnes, the heaviest weighs in at 44 tonnes. Metz explains the special installation procedure: “They are installed using two mobile cranes, an LTM 1230-5.1 and, depending on their availability, an LTM 1090-4.2 or 1160-5.2. The 230 tonne crane hoists the support and holds it in the right position for installation. The smaller crane provides hoisting support until the required angle has been reached by turning the component in the air. After the component has been installed, it then installs the angled supports which the Y-shaped supports require from the front to fill and harden the sleeve foundations.”



86 Y-shaped supports dissipate the load of the projecting floor above them through level E02 into the ground. An LTM 1230-5.1 installing prefabricated components on the roof of Pier J.

Wehner continues: “The installation work is particularly challenging because the angle of seven degrees to the front must be maintained precisely. Because this is difficult to check, surveying technicians check with specially manufactured gauges whether the position of the Y-shaped support is within tolerance.”

### All from a single source

The process, consisting of planning, production, transport, installation on site and embedding in the carcass structure is supported and completed in full by the Schick Group. It has its own vehicles, its own mobile cranes, its own personnel, planning and site managers – everything from a single source. Aileen Kempf, who has been with the Schick Group for almost ten years, believes that this delivers great benefits: “We have very good communication between each other, which enables us to react flexibly and quickly. As soon as the crane is available, it is used for other work.”

Michael Metz appreciates the fact that he can talk direct to the crane operators: “We planned the crane jobs at the office using the Liebherr LICCON work planner. That enables us to check which crane model is required for a specific job. We then define the crane configuration and the location. And sometimes that is a real challenge because the area for the crane and for setting up the crane is limited. We then discuss our plans on site with the crane operators because they have the practical experience. Their feedback is very valuable. We simulate particularly complex jobs on the actual site.”

“We often have to take projecting edges into account. There is also the fact that the maximum crane height at Fraport is limited to 60 meters because of flight activity. If the slewing range of a mobile crane projects into that of a construction crane, the latter has to be turned off. Industrial safety is absolutely paramount here on the site,” adds Kempf.



**Experts for the complete prefabricated component process** – Carina Wehner and Michael Metz. In the background you can also see the new tower for Terminal 3, which has also been built by the Schick Group.

With up to five mobile cranes moving around the site at any one time, the quality of the cranes and service work for them must be absolutely perfect. As far as Metz is concerned, this is the case: “We have a direct line to the Liebherr service team. The Liebherr customer service people complete maintenance work on Fridays and Saturdays so that the cranes are available again during the week. We have also suffered very few crane failures. There was one, however, that I remember very well. We had a problem in the afternoon. The Liebherr fitter arrived at five the next morning and by seven the crane was up and running again. That really impressed me.”

Terminal 3 is scheduled to start operating in 2026. It will enable an additional 19 million passengers a year to pass through the airport. The final extension will actually allow for 25 million passengers per year. The Schick Group is scheduled to complete its site work in 2022. In addition to the production and installation of the structural components of the external façade in prefabricated concrete, elements of the interior are also included. For example benches made of super-smooth, coloured concrete. Really chic.



## Frankfurt Airport

- Terminal 1 opened in **1972**
- Terminal 2 opened in **1994**
- 70 million passengers in **2019**
- **81,000** employees from **88** nations
- Daily (2019)
  - 190,000** passengers
  - 1,400** take-offs and landings
  - 6,000** tonnes of cargo

## Terminal 3

- Scheduled to open in **2026**
- Construction work started in **2015**
- Investment volume **€4 billion**
- **176,000 m<sup>2</sup>** of floor space, corresponding to 25 football pitches
- **403,000 m<sup>2</sup>** total area on all storeys
- **112,000 tonnes** of steel, the amount required to build 15 Eiffel Towers
- **19 million** passengers, when fully complete up to 25 million passengers

# So close to the sky

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## World champion in telescopic boom construction

**A new crane makes its debut and is already the world champion! 90 meter telescopic boom can be carried on 6 axles – the first ever crane to do so. The longest boom in the world, which can be carried on the crane with an axle load of 12 tonnes. The new LTM 1300-6.3 adds a versatile, economical fast-erecting crane with an unbeatable telescopic boom length to the Liebherr crane portfolio. Unrivalled as the new benchmark in the 300 tonne class.**

We continue to push the envelope in terms of the accepted limits of what is technically possible. For the first time in the crane industry, engineers at Liebherr have managed to design a mobile crane which can carry an immensely long telescopic boom of 90 meters on the road. And at the same time, Liebherr has not spared anything – the 6-axle, powerful fast-erecting crane has a full range of technical features.

“The boom has been designed using the time-tested concept. A whole host of detailed improvements has enabled us to save weight all over the crane,” explains Franz Ölberger. He is the Head of Telescopic Boom Design, and continues: “We managed to fit a complete additional telescopic section to the 300 tonne crane to enable us to reach a length of 90 meters.” This means that the new LTM 1300-6.3 has a total of 7 telescopic sections. That is one section more than on the LTM 1300-6.2, for example, which is also part of the Liebherr product portfolio.

### **Off to new heights**

The chassis of the LTM 1300-6.3 is particularly lightweight, which means that load-bearing parts could be reinforced and the boom extended. “This extremely lightweight design is the result of many years of experience and new developments in construction, structural engineering and our suppliers’ structural steel production methods. A whole host of factors play a role,” adds Franz Ölberger. The weight reductions on the chassis include, for example, the single-stage front outriggers, yet the crane



still delivers a wide range of possible support configuration due to its VarioBase®Plus system. A different axle design and mounting make the vehicle frame more rigid. Additional improvements were also made using modern structural engineering calculation methods. “Another point is that our suppliers can now produce the components even more precisely. This has enabled us to improve the way in which the telescopic sections retract into their storage position and the gaps between the sections are



***“Every single gram on the LTM 1300-6.3 is in the right place.”***

**Franz Ölberger**  
Head of Telescopic Boom Design

smaller,” continues Franz Ölberger. “That means that the internal sections have a larger cross-section, making the boom more rigid and giving it a greater lifting capacity.”

“Suppliers continue to make improvements alongside us. The structural steelwork is very good,” confirms Ludwig Förder, Telescopic Boom Assembly Manager in Ehingen, and adds: “That is the only way we could complete the assembly work on such a long boom satisfactorily. A long boom creates several challenges for us”. The individual sections must be aligned to each other in both the longitudinal direction and in slewing with absolute precision. “We can rely on our specialists in the Assembly Department. Our colleagues have a great deal of experience, expertise and sensitivity. They managed to achieve a tolerance of just 20 millimeters with a boom length of 90 meters. With seven sections, that is really an art form”, says Ludwig Förder in praise of the specialists in his department. The end result is always the clean, smooth extension and retraction of the boom.

One of the factors behind this is that Liebherr has improved the production process over the last few years. Peter Munding, Telescopic Boom Assembly Production Foreman, explains: “The boom sections have already their final coating when they arrive here in the assembly hall. The adjustment work is carried out on the painted, hardened telescopic sections which can therefore be adjusted perfectly. Furthermore, all the sliding surfaces are perfectly lubricated”. The enormous space requirement for the 90 meter boom for the new LTM 1300-6.3 means that the personnel face some big challenges. Including the pivot section and cylinder, the boom requires over 125 meters in the hall before it is assembled. Then we also require a few more meters for transport and working routes. So it is a good thing that Liebherr also has some smaller cranes in its portfolio.

Find out more about the LTM 1300-6.3 here:  
<https://go.liebherr.com/yx4rck>





Ludwig Förder (left) and Peter Munding ensure that the boom is erected smoothly.

**Fast and flexible –  
new benchmark in the 300 tonne class**

To sum up – the crane concept is excellent – the LTM 1300-6.3 is a new benchmark in the 6-axle class. It features superb equipment and all the new features – VarioBase®Plus, VarioBallast®, AutoBallast and the single-engine concept. Furthermore, the various load charts for different wind speeds are available for all operating modes. It is a crane for maximum versatility, performance and safety.

***“Our assembly specialists adjust every single boom with all their expertise and sensitivity to achieve the best possible quality.”***

**Ludwig Förder**  
Telescopic Boom Assembly Manager

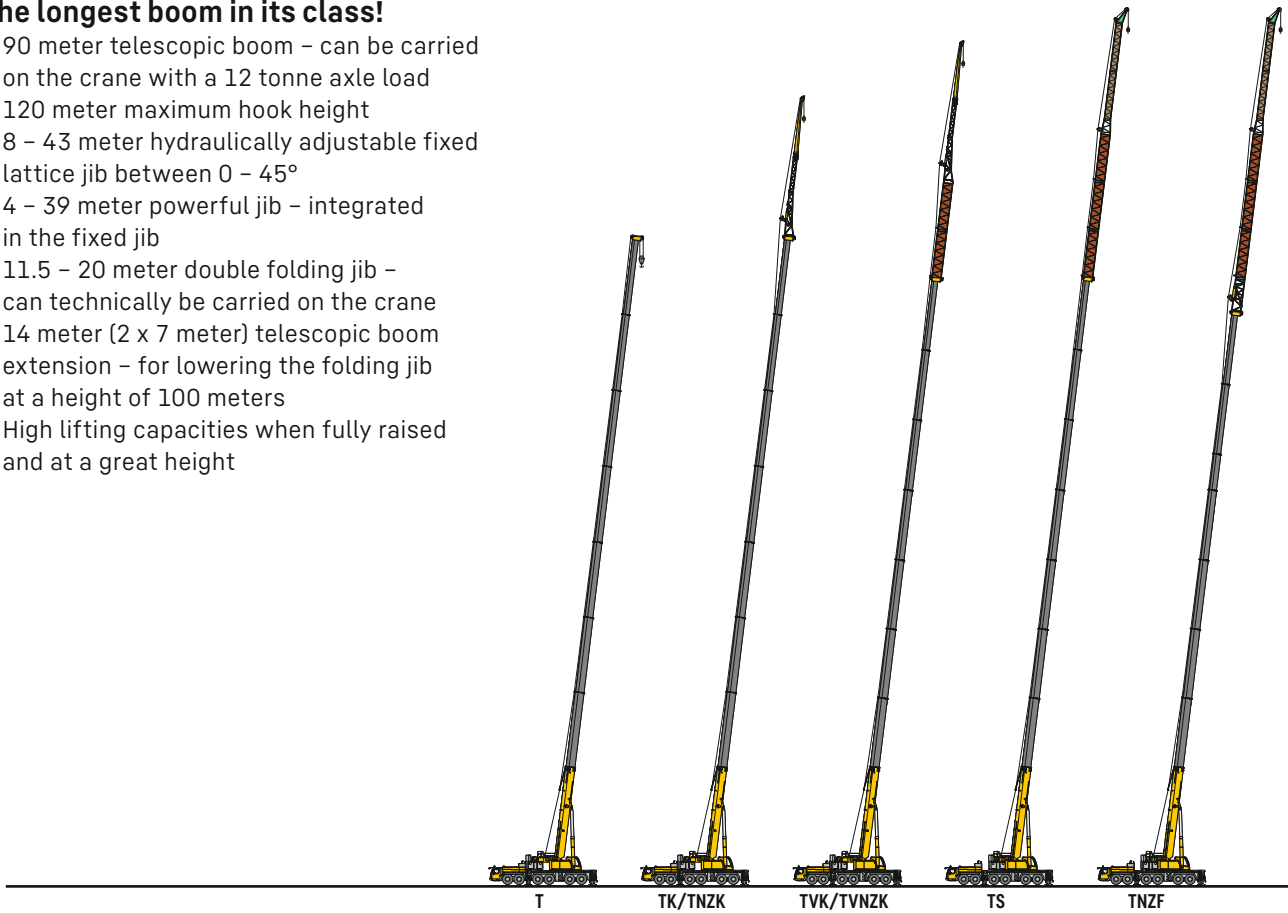
As a bonus, Liebherr has ensured that the new crane delivers the highest possible compatibility with other Liebherr crane models. For example, parts of the ballast, the detachable hook block and various lattice sections can be interchanged easily with other crane models.

The feature about this LICCON2 crane is the optional central lubrication system for the king pin bearings on the chassis which greases 24 lube points on the 6-axle crane automatically. Another highlight – a total of six LED rear lights are available to order, which illuminate the working area perfectly with bright light. That is something to behold!



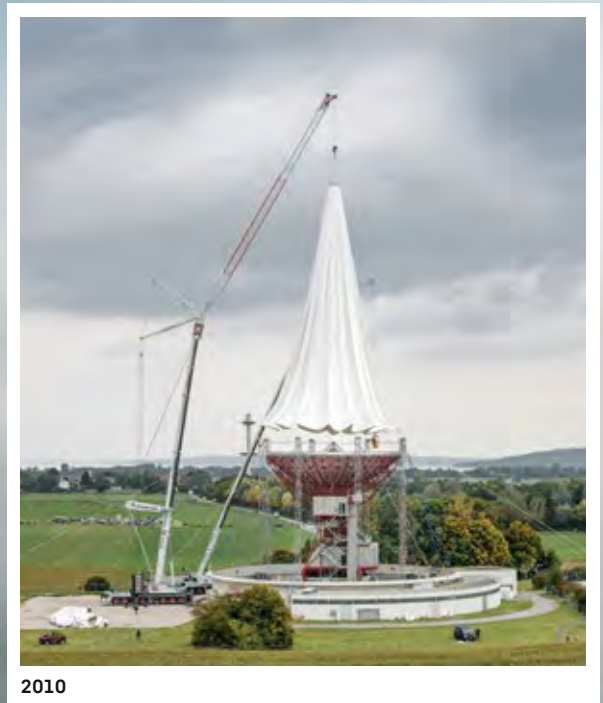
## The longest boom in its class!

- 90 meter telescopic boom - can be carried on the crane with a 12 tonne axle load
- 120 meter maximum hook height
- 8 - 43 meter hydraulically adjustable fixed lattice jib between 0 - 45°
- 4 - 39 meter powerful jib - integrated in the fixed jib
- 11.5 - 20 meter double folding jib - can technically be carried on the crane
- 14 meter (2 x 7 meter) telescopic boom extension - for lowering the folding jib at a height of 100 meters
- High lifting capacities when fully raised and at a great height





# Déjà-vu at Ammersee



2010

## Installing a cover on a massive parabolic antenna using Liebherr mobile cranes

Wind, wind, wind. Everybody involved with cranes or jobs with them knows very well that wind is a massive topic when we want a crane to work. If the wind speeds are excessive, sensitive crane assembly work may be delayed for weeks rendering detailed plans absolutely useless. Waiting for days to assemble wind turbines, for example, is hardly a rarity. To stay with this example, crane work at wind farms must be stopped if the wind reaches a speed of more than six to nine meters per second depending on the hoist height and type of load. Here at Liebherr, we calculate these limits for tricky hoisting work for our partners precisely. Last autumn an assembly job took place in southern Germany, which was extremely susceptible to wind and for which the limit was actually reduced to just two meters per second.

To recap briefly, a deep storm low with the pretty name of “Bianca” passed over large parts of southern Germany in February 2020. In some places, weather stations recorded wind speeds of over 160 kilometers per hour. The region to the south of Lake Ammer in Bavaria did not escape the ravages of the storm. Since 1963, the spherical protective cover on “Antenna 1” at Raisting Earth Station has projected up into the sky like a giant puffball, visible for miles around. This industrial monument

is known by the name “Radome”, an abbreviation of the words “radar” and “dome”. Its white air dome, a three-quarter sphere with a surface area of 5,300 square meters, held in shape permanently by a fan generating a low pressure in it, fell victim to the winter storm. Since then the luminous red directional antenna has been exposed to the elements. Recording the damage, issuing a tender, planning and production of a new spherical membrane – all this takes time.

### More powerful crane – greater stability

“We have been planning this job for well over a year”, says Johann Würz. Würz headed up this challenging job in the Bavarian foothills of the Alps on behalf of crane contractor BKL Baukran Logistik GmbH. Just eleven years ago, a Liebherr LTM 1400-7.1 mobile crane from the same contractor was used to replace the membrane, which at the time was almost 50 years old and had become porous. On this occasion, Würz initially wanted to use an LTM 1500-8.1 crane. “Then the plan was changed and a decision was made that the cover should be stretched out at its seams and snap-fitted over the radome. Naturally, that gave the wind a larger area to attack. That is why we decided instead to take our new LTM 1650-8.1”, the most powerful mobile crane in the company’s large fleet. “It was important to include an adequate safety factor and have plenty in reserve. It also means that we were ideally prepared for any surprises,” continues the experienced professional.

Johann Würz also sent an LTM 1230-5.1 to Raisting as a second crane for working with a personnel cage and for setting up the larger crane. This

**Origami? Not really. But certainly the art of folding. The giant cover with a total surface area of 5,300 square meters is spread out. The process would have been impossible without the help of the mobile crane. More parabolic antennas at the Raisting Ground Station can be seen in the background.**





#### Thick tube

Massive hoses filled with air pressure are used. They also protect the technical system and the membrane when snap-fitting it over the directional antenna.

modern five-axle model arrived at the site a few days earlier. It helped to hoist the membrane, which had been manufactured in Turkey, off the truck, unpack it and unfold it on a prepared surface. The new cover weighed a good ten tonnes and without the powerful boom on the mobile crane, it would not have been possible to move it. Before the new cover could be hoisted into position, an air hose, a tube with a diameter of one meter had to be installed along its opening. The idea behind this was that when it was hoisted over the parabolic antenna, it would be possible to push the opening on the underside apart. Additional hoses filled with air pressure were

installed all around the antenna by rope access technicians and the crane. To protect both the fabric cover and the technical systems on the industrial monument.

During the process to unfold the plastic, gentle gusts of wind could be felt, with the massive surface area of the membrane susceptible even to a light breeze. The fitters on the ground had their hands full in keeping the cover under control whilst it was suspended from the crane's hook. It quickly became plain that installing the cover on the antenna would be virtually impossible in anything beyond a slight breath of wind in the air.



**5,300**  
square  
meters

**2 m/s**  
max. wind  
speed

**10**  
tonnes



#### A light breeze

Even during the preparations, a little wind made the cover difficult to handle. The 5,300 square meter plastic cover acted like an enormous sail.



#### Veto by crane driver

It was in fact the gusty weather that then blew the site schedule completely out of the window. On the day scheduled for the installation work, the anemometer on the luffing jib of the LTM 1650-8.1 showed in the crane operator's cab that the wind speeds were permanently too high. Everything and everyone was ready when, as the breeze increased, the crane operator finally issued his considered but determined decision to call a halt to work for the day after discussing the situation with everybody concerned. They decided to try again the next morning. The meteorologists had forecast the prospect of a brief period of no wind. They decided to start work well before sunrise.

#### All in the green sector

BKL crane operator Steffen looks relaxed as he views the night-time scenery. The weather forecast and anemometer on the crane jib report almost zero wind. Perfect conditions for hoisting the new radome cover.

There was a dense fog over the site when the area for suddenly filled with life again shortly after five in the morning. The forecasts from the previous day proved to be accurate – there was not a breath of wind and the job could finally be started. Still before the sun had risen, the “hook up” instruction was heard and the giant white membrane slowly rose out of the fog. When BKL crane operator Steffen had hoisted the load to a hook height of around one hundred meters, the teams on the retaining ropes started to use winches and muscle power to spread the opening of the now skirt-shaped cover more and more. As if in slow motion, the luminous red of the parabolic antenna disappeared behind the gigantic white curtain. The rest went very



quickly. By the evening, the cover had been connected to the round plinth on the system to make it airtight and the giant ball was filled with a low pressure. After eighteen months, the radome finally had its protective cover back in place.

In Raisting, or more accurately, at Radom Raisting GmbH, a company fully owned by the Rural District of Weilheim-Schongau, they now hope that the radome is well protected for the future. "We had the hybrid cover, which is made up of around one hundred individual parts, made

in such a way that the diagonal strips of fabric are aligned to the direction of the forces on it so that they can withstand them whilst having more in reserve," says René Jakob, the long-standing Managing Director of Radom Raisting GmbH. "And we are delighted that in the end, everything went so well."

#### **From moon landing to "Cold War"**

Until it was decommissioned in 1985, the satellite ground station played an important role in radio and telecommunications systems on a global level. The most important use of the

radome was certainly the transmission of the first moon landing by the Apollo 11 mission in June 1969. The television signal was transmitted from the NASA Centre in Houston, Texas by satellite to the parabolic antenna in Raisting, from where it was broadcast to large parts of Europe. The Summer Olympic Games in 1972 held in Munich were also broadcast around the world by the radome. Furthermore, the American forces stationed in West Germany used the ground station to acquire a particularly secure connection to the USA during the Cold War.



# High tech from the Kaiser's time

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## Liebherr cranes reinstall repaired Rendsburg suspension ferry

On the morning of 8 January 2016, as on every other school day, a host of children on their bicycles headed towards the suspension ferry on the edge of the town of Rendsburg. The shortest route to the schools in the northern German town was over the Kiel Canal. Suspended on long steel cables under a high railway bridge, the ferry, a nostalgic vehicle dating from the 1910s, carries cars, pedestrians and cyclists over this very busy waterway. The two minutes or so that the crossing takes is always a welcome break for the children. On that January morning, however, the route to school initially ended at the boarding point. The ferry hung in the air, badly damaged and immobile over the middle of the canal. Salvage vessels were just arriving. It was a great spectacle for the children. In the early morning, the gondola of the suspension ferry had collided with a freighter in the dark.

The damage to both the vessel and ferry at the time was massive. Two people suffered injuries on the gondola, which was fortunately not busy due to the early hour. The historic ferry suspended under the railway bridge dating from the time of the German Kaiser was irreparable. Together with its travel gear at a height of around 40 meters, it was completely dismantled over the following months. Last autumn, the completely newly manufactured components for the ferry system were then reinstalled. Several of our cranes played leading roles in the repair project.

The high railway bridge in Rendsburg is one of the outstanding engineering monuments in Germany. It was built between 1911 and 1913 and is part of the railway track to Denmark. The clearance height for vessels on the canal travelling between the North Sea and Baltic Sea is 42 meters. The gradient for trains to achieve this height starts several kilometers before they reach the canal. What makes this steel bridge held together with millions of rivets very special is the ferry gondola suspended on from its underside, which provides free passage over the waterway "floating" a good three meters over the surface of the water. There are only eight of these suspension ferries still in operation around the world. However, the damaged vehicle in Rendsburg is the only one of them which is suspended from a railway bridge.



### Steel, steel, steel

Large rivet heads dominate the surfaces of the steel bridge structure. The impressive construction is held together by over three million rivets.

### More than twice as much steel as the Eiffel Tower

The whole thing is absolutely massive. The construction of the steel bridge and ramp structure measuring almost 2,500 meters in length required a total of 17,300 tonnes of steel. Well over twice the volume required for the erection of the Eiffel Tower in Paris. The whole structure has a length of 7.5 kilometers and at the time was completed in a construction period of just less than three years. That is an amazing fact when we consider that well over 100 years later, it took a full six years simply to replace the

suspension ferry. Bureaucracy, placing orders and technical challenges such as the installation of safety equipment all took an enormous amount of time. In addition, the pandemic put paid to the plan of the Waterways & Shipping Department to repair the system as quickly as possible. The timetable was corrected multiple times, and the restarting of commuter traffic over the canal was postponed time and again. But last summer, at last everything was finished – the new ferry had been completed and could be installed.



### Technical aesthetics or aesthetic technology

The bridge structure today is a monument and was celebrated around 110 years ago as a masterpiece of engineering.





Photograph: Ines Krisch / Rohwer Stahl- & Metallbau GmbH

#### Teamwork –

Stefan Heldt, Managing Director of Wille & Dulies Krane GmbH (right) planned the crane work at the high bridge in Rendsburg along with Ralf Rohwer from the metal and steel construction contractor of the same name.

#### Pulley heads extremely close to the bridge structure

During September, mobile cranes from Wille & Dulies Krane GmbH based in Harrislee near Flensburg, provided support for Wille-Krane in Kiel, travelling to Rendsburg on several occasions. At the site on the southern bank of the canal, the first stage was to install the drive section at a height of over 40 meters using two cranes directly under the bridge level. In addition to a modern 250 tonne mobile crane, the most powerful vehicle in the Wille crane fleet, an LTM 1450-8.1, also took up its position on the bank.

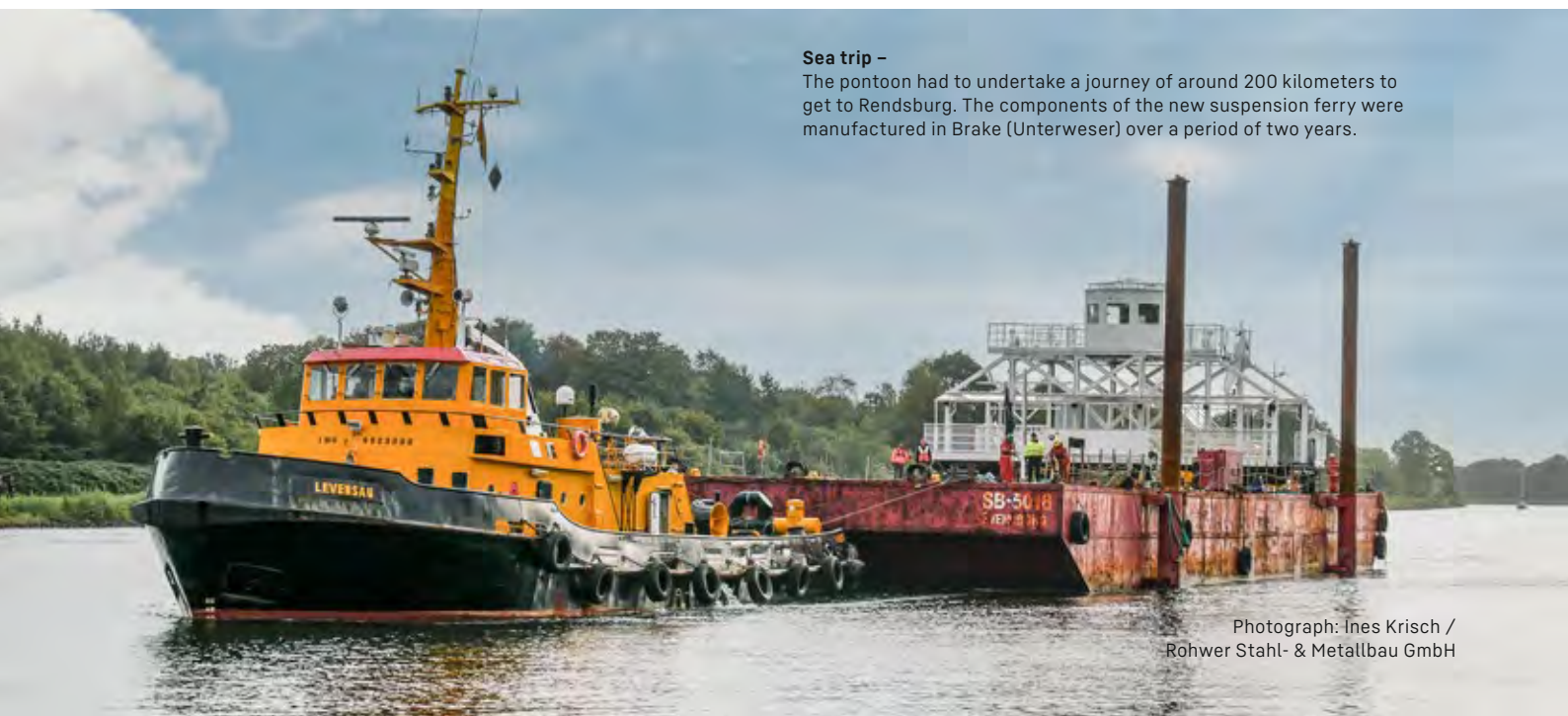
A fairly complicated job awaited the two crane operators, Florian Clausen and René Nestler. They had erected their Liebherr cranes either side of the massive truss pillars to tackle the tandem hoist. “Because the gondola is narrower than the bridge structure itself and the tips of the telescopic booms therefore had to be moved extremely close to the bridge, the installation process was certainly rather fiddly”, is how Ralf Rohwer explained the challenges on site. Rohwer and his company, which specialises in steel and metal construction work, completed the installation of the new ferry system on the monument. “At times, we had a gap of less than 50 centimeters between the bridge and

pulley heads during the complex process to get the drive unit rollers of the wagon up onto the rails.”

The precision balancing of the load on the crane hooks, and the complicated installation on the underside of the bridge took a great deal of time. Finally, the larger crane had to be moved to install the drive unit on one side of the gondola – another very tricky process requiring centimeter precision at a great altitude and therefore once again something of a challenge for everybody concerned. “Ultimately, everything worked really well,” says Rohwer very satisfied with a job well done.

#### Space for four cars and 100 people

The hoisting of the actual ferry, known as the ferry platform, one week later was rather routine, on the other hand. This job was tackled by two LTM 1450-8.1 cranes and was comparatively straightforward. The mobile cranes hoisted the 44 tonne gondola off the pontoon which had been towed to the bridge in the morning. The load was aligned and positioned precisely on wooden supports under the bridge. The white ferry gondola was then attached to the ferry vehicle in this position.



#### Sea trip –

The pontoon had to undertake a journey of around 200 kilometers to get to Rendsburg. The components of the new suspension ferry were manufactured in Brake (Unterweser) over a period of two years.

Photograph: Ines Krisch / Rohwer Stahl- & Metallbau GmbH



Photograph: Ines Krisch / Rohwer Stahl- & Metallbau GmbH

**Soon to be suspended again –**

Two Liebherr mobile cranes move the new 44 tonne gondola from the pontoon onto land. The ferry will be able to carry one hundred people and four cars.

The Rendsburg suspension ferry will now be able to carry up to four cars and one hundred people in its transport gondola. The new structure, which looks very similar to the original, was manufactured over a period of two years in Brake near Bremen and towed to Brunsbüttel on waterways via the River Weser, North Sea and Elbe Estuary and from there on the Kiel Canal to Rendsburg.

Commuters and tourists now hope that after the winter months, the test phase and trial period for the new ferry system will be completed and normal operations will be restarted. However, above all, the children who for many years have had to take the longer route to school will be delighted. And they can once again take a welcome break on the suspension ferry dating from the time of the German Kaiser.

**Unique –**

the suspension ferry in Rendsburg is the only one in the world to be suspended from a railway bridge. The gondola takes around two minutes to complete the 140 meter crossing. This photograph shows the ferry before the accident.



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# In focus

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**CO<sub>2</sub> emissions down**

Maximum reduction in CO<sub>2</sub> emissions for crane operations – a success for Cadman Cranes Ltd by converting to HVO fuel in Great Britain.



Contract Hire & Leasing



# From cradle to grave

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In the last edition of UpLoad, we started a series of articles under the heading “Sustainable”. In this edition, we report on an interesting study carried out in collaboration with economics consultancy, Frontier Economics. It analyses how emissions of greenhouse gases from mobile and crawler cranes can be reduced by using alternative power units. The background and results of the study are explained by Technical Director Dr Ulrich Hamme and Crane Vehicle Department Manager Phillip Federle. They also provide some insight into things that have already been done.

## Why did Liebherr ask an economic consultancy to analyse sustainable power units?

**Dr. Hamme:** Our economy must be restructured to achieve climate protection targets and comply with the greenhouse gas limits. Mobile cranes are a vital component for the process of change to establish a decarbonised economy, for example for erecting wind turbines and modifying infrastructure. However, mobile cranes also emit greenhouse gases. To ensure that the remaining greenhouse gas budget can be used efficiently, mobile cranes are one of the things that must be subjected to holistic life cycle analyses.

Liebherr's motivation and objective was to conduct a comprehensive greenhouse gas life cycle analysis of Liebherr construction machines, particularly of its mobile cranes.

The technical expertise and product competence required for this process is provided by Liebherr. The economic competence and expertise of comprehensive energy considerations and assessments for life cycle analyses comes from renowned, experienced economics consultancy Frontier Economics.

**Federle:** Liebherr and Frontier Economics have conducted an analysis for mobile cranes to determine what quantities of greenhouse gases they cause over their entire life cycle. Because although they are a driving force in the decarbonisation process and are essential for expanding renewable energy types such as wind power, they are also an emitter. The analyses by Frontier Economics are restricted to a scientific calculation of greenhouse gas emissions by various drive technology types, but do not reflect whether these approaches are technically feasible and effective.



***“The entire life cycle must be analysed to enable alternative power units for mobile cranes from an ecological perspective.”***

**Dr. Ulrich Hamme**  
Managing Director Design and Development



## What does a life cycle analysis actually comprise?

**Federle:** The emissions which are directly emitted by a vehicle can be calculated relatively easily from the volume of fuel inserted into the vehicle. Using the example of electric vehicles, the initial analysis shows zero CO<sub>2</sub>. However, if we operate electric vehicles using electricity generated with coal, we have simply shifted the emissions to a different zone and have not reduced them – a fact that is often ignored, whether that is deliberate or otherwise.

Energy generation and supply must not be ignored as does not matter to the environment when and why emissions are produced. That is why a holistic approach is required. However, it is not possible to produce a holistic picture unless you include the production process. During this process, CO<sub>2</sub> are generated, for example for steel, by ore extraction and at the steel rolling mill, taking recycled material into account, to the point at which the material is cut to be fitted onto the crane. And that applies to all materials, whether they be rubber, copper, electronic components, textiles or aluminium. The subject of waste disposal for components is the final aspect. Only now do we really know that emissions do not simply disappear. So there is no point saying pretty words to try and conceal that fact. That means that everything has to be covered – from cradle to grave as we say in the industry.

**Dr. Hamme:** Despite the fact that mobile cranes have a major role to play in converting the economy, they are nevertheless also greenhouse gas emitters, and therefore part of the problem. They also have to be operated and manufactured on an increasingly carbon-neutral basis. An informative greenhouse gas analysis must therefore consider emissions throughout their life cycle. Life cycles of mobile applications such as the mobile crane involve at least the following five stages:

- Production (cradle-to-gate)
- Energy production (well-to-tank)
- Infrastructure expansion
- Mobile crane use (tank-to-wheel)
- Scrapping or recycling (end-of-life)

## What did the studies show?

**Dr. Hamme:** The study of the mobile crane, for which we used an LTM 1160-5.2 as a typical example, showed us when it generated emissions and what volumes were generated. We also saw how these emissions were generated and how different materials or usage scenarios contribute to CO<sub>2</sub> emissions. Naturally, we cannot simply remove components from a crane to reduce emissions. And the same goes for functions which the customer requires. But it shows us where we should direct our focus.

***“As of now, we can reduce CO<sub>2</sub> emissions by around 75 % over the entire life cycle with HVO.”***

**Phillip Federle**

Head of Crane Vehicle Design Department



**Federle:** What is more, in the study, we not only calculated the current crane with all its components, but also calculated it with alternative power units so that we could compare them. We only studied those alternatives which appear to be practical at the current time. There are certainly other, technically very interesting approaches in the market which are also being discussed. However, we are not currently expecting that these will come into the reckoning with the relevant infrastructure over the next 10 to 15 years.

#### **But what contribution can these alternative power units make?**

**Federle:** We use the current crane with a diesel engine generating 100 % emissions as a reference. The results show that with our current knowledge and technology, the greatest CO<sub>2</sub> reduction can be achieved with hydrogenated vegetable oil. The use of hydrogenated vegetable oil, known as HVO, enables us to achieve CO<sub>2</sub> reductions of around 75 % over the entire life cycle. E-fuels, which constitute an equivalent technology for the crane, enables reductions of over 60 % of emissions to be achieved.

**Dr. Hamme:** A hydrogen internal combustion engine would actually increase emissions if it uses the hydrogen we produce today as it is normally produced using natural gas. That makes it senseless from an ecological point of view. For this reason, we decided to consider this technology with a future scenario using green, imported hydrogen. That would enable us to reduce well over half the emissions. A fuel cell results in the same tendency as a result of the fact that it uses hydrogen as the fuel, but this scenario highlights the better efficiency level of this technology.

A battery-electric power unit can also not contribute to reducing emissions using our current electricity mix. We therefore conducted another calculation in which we assumed that we could use 100 % green electricity. This produced CO<sub>2</sub> reductions of over 40 %. This clearly shows that the battery production process accounts for a very large proportion of the emissions.

#### **Why do green electricity and green hydrogen still produce emissions if they are green by name and by nature?**

**Dr. Hamme:** This is where unfortunately the holistic approach is simply ignored. If you erect a wind turbine today, the vast majority of the foundation and tower is made of concrete and steel. However, these raw materials cannot (yet) be produced on a CO<sub>2</sub>-neutral basis. This means that on day one, a wind turbine has a CO<sub>2</sub> rucksack which, of course, must be applied to the kilowatt hours it generates over its service life. This approach also applies to solar cells.

In addition, overhead cables and transformer stations also have to be considered. This means that a whole host of things are included in the final account. Unfortunately, we have to get away from the idea that the things that are currently described as “CO<sub>2</sub>-neutral” or “green” actually produce zero CO<sub>2</sub>. It is the same in practice as alcohol-free beer. It still contains small quantities of alcohol. With this in mind, I am looking forward to finding out how the first cities want to become CO<sub>2</sub>-neutral by 2030 as local CO<sub>2</sub> neutrality actually does nothing for our ecology. As long as a cement plant remains the same although it is not in the town, the environment has gained nothing.

## Why does fuelling cranes with HVO do even better than the version involving e-fuels?

**Federle:** That is definitely to do with the HVO that we use here in Ehingen. It was absolutely plain to us at the start that we must not use HVO produced using palm oil or palm oil residues. For this reason, we at Liebherr only buy HVO which is certified as being produced from waste – in actual fact from vegetable oils. That means that the waste at the current time involve no CO<sub>2</sub> rucksack. Emissions only have to be added for our crane from its conversion into fuel, its transportation and storage. If we were to plant sunflower oil specially for this purpose, the potential savings would be a little lower. With e-fuels, on the other hand, you always first have the emissions from the construction of the wind turbine or solar plant which means that this type of fuel will always generate slightly higher emissions.

## What hurdles or limits are there to HVO?

**Dr. Hamme:** The main limit for this fuel is definitely its limited availability. The volume of waste is obviously limited and this means that as far as we can see, it will never be possible to produce HVO in the quantity we would require to replace the diesel we currently consume. Values could certainly be increased a little by planting sunflowers or rape but it must be ensured that we never go so far that we find ourselves cutting down the rainforest to plant palm oil simply to protect the environment! This limit will certainly be the cause of more discussion among politicians and in general society.

**Some truck manufacturers have decided to go for hydrogen-powered fuel cell power units and are investing millions of euros in their development. Large amounts are also being invested in expanding the production of green hydrogen. How do you view this technology in the medium and long term for mobile and crawler cranes?**

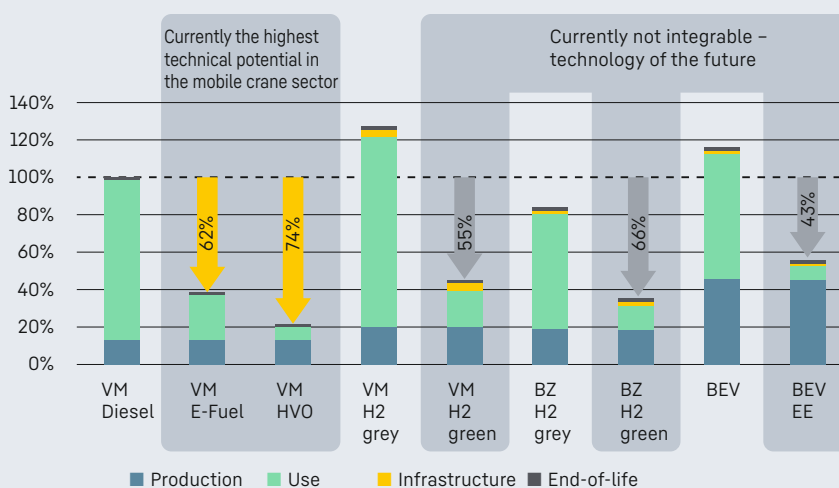
**Dr. Hamme:** We are, of course, monitoring the developments in hydrogen engines and fuel cells for all applications, for example in commercial vehicles and construction machines, very closely. At our engine plant in Switzerland, we are currently commissioning the first prototypes of a hydrogen engine on a test bench. This is where we have housed the hydrogen expertise available within the Liebherr Group. In a similar way to battery-electric power unit, there is no hydrogen technology that is available for immediate use in mobile cranes.

**Federle:** Fuel cell power units are not really suitable for mobile cranes which experience very uneven stresses and high load collectives. Hydrogen engines may therefore be more interesting. The lack of clarity overall is still so great that it is not currently possible to define any realistic targets. One of the core problems is storing the energy on a crane. There is not enough weight or volume available for hydrogen in gaseous form or for liquid hydrogen which has to be cooled to very low temperatures.

**Dr. Hamme:** There are still a great many questions to be answered in terms of storage technology, refuelling logistics and supply infrastructure. We must wait and see and watch closely what development routes are taken in the near and distant future, particularly for commercial vehicles and construction machines.

## Are the different approaches involving hydrogen and batteries the wrong technical development routes from this ecological point of view?

**Dr. Hamme:** Definitely not! There is still considerable development potential for these technologies which cannot be fully assessed at the current time. We are only talking about a review based on the current situation. What is more, we are only talking about an extract from the study, and the statements only refer to a mobile crane. The same process showed that significant benefits were possible for installing an electric motor in a mixer truck or a small wheel loader, for example.



Comparison of CO<sub>2</sub> emissions by various types of power unit (using the LTM 1160-5.2 as an example) (VM=Internal combustion engine, BZ=Fuel cell and electric motor), BEV=Battery and electric motor, EE=Electricity from renewable sources)

**Why is there such a difference if the same procedure is used?**

**Federle:** That is because of the extremely different ways in which the machines are used. As far as the crane is concerned, it was important for us to compare machines with identical functions. In other words, the machine must be capable of completing the same work as a current crane. This also includes the flexibility to work autonomously. A mixer truck, on the other hand, returns to base every night where it can be charged. And whilst it is being loaded with concrete, it can also be charged with electricity as it would be possible to provide the appropriate charging infrastructure.

**Dr. Hamme:** In addition, the mixer truck travels very limited distances compared to the crane and has to deliver a comparatively low level of performance. The load cycle of a mixer truck cannot be compared to that of a crane. If you can reduce the volume of stored energy as a result these marginal conditions, the battery can be reduced in size, thus significantly reducing the emissions from the production process.

**Why is Liebherr in Ehingen not currently pursuing battery-electric power units? Has this technology any potential for mobile and crawler cranes in the medium term? We read about developments which can significantly increase the capacity of batteries and drastically reduce charging times.**

**Dr. Hamme:** Battery-electric power units are not a realistic power option today for any mobile cranes, both all-terrain and lattice boom types, due to a large number of aspects

which cannot be realised with any sort of priority. In terms of climate protection and economy, this technology is not the first choice for our type of machines, quite apart from the fact that technically mature, sustainable solutions are not currently available for our cranes.

**Federle:** The amount of energy in lithium-ion batteries is very low relative to their size and weight. To deliver the familiar flexibility and performance of a mobile crane using a battery-electric power unit, for example, around 20 tonnes of batteries with a volume of more than 15 cubic meters would have to be fitted on the 5-axle LTM 1160-5.2 crane studied by Frontier Economics. That is completely unrealistic and shows that the current technology has no potential for universal installation in a fully electric mobile or crawler crane.

External battery packs for cable power supply as an alternative to mains power are also conceivable for use on small mobile cranes. It may be possible to meet the demand for “local zero emissions” on larger cranes using buffer battery storage devices.

**Dr. Hamme:** Other conditions such as safety, thermal stability, charging speed, charging logistics, service life and ultimately also economy will not make it any easier to use battery-electric power units in mobile cranes. There are no signs of any revolutionary developments of this technology which could vastly improve the above criteria.

The continued development of battery power units is focusing more on their mass use in cars and is subject to totally different requirements than those for using them in large, heavy cranes.



**Hydrogenated vegetable oils**  
The filling station at the Liebherr Plant in Ehingen has been converted to HVO fuel.

We are naturally monitoring the development of battery-electric power units very closely by adopting an “openness to technology” approach. We have bundled the technological competence for this within the Liebherr Group at a “Battery Competence Centre”. This will ensure that we stay on the ball and do not miss any developments.

**Mobile construction cranes in the MK series can be operated with site power as an alternative to an internal combustion engine. Could the technology behind this also be a reasonable alternative for telescopic mobile cranes?**

**Federle:** It is, of course, conceivable that this technology could be an alternative power unit for small mobile cranes as well. But as I say, that is an alternative. In other words, in addition to the HVO diesel engine for road travel and crane operation, it would require an additional electric motor to be installed for the superstructure. That would involve a great deal of volume, weight and money.

**Dr. Hamme:** The answers to a series of technical, application-related and economic questions must be sought for every single application and every crane model. It should be possible to operate a telescopic mobile crane supplied with site power in the same way as a crane with an internal combustion engine. The electric power unit must be designed so that site power can deliver almost the full performance of the crane, as well as the speeds of crane movements and the dynamic of a crane. That becomes more difficult, of course, as the crane gets bigger. The strength of the external power source, for example site power from a mains supply, is also limited.

An approach of this type is certainly conceivable for individual small telescopic mobile crane models for which “local zero emissions” play a role because they are frequently operated within enclosed areas.

**Liebherr has developed a battery-electric 250 tonne crawler crane at Nenzing. Can this technology also be used in smaller crawler cranes from Ehingen?**

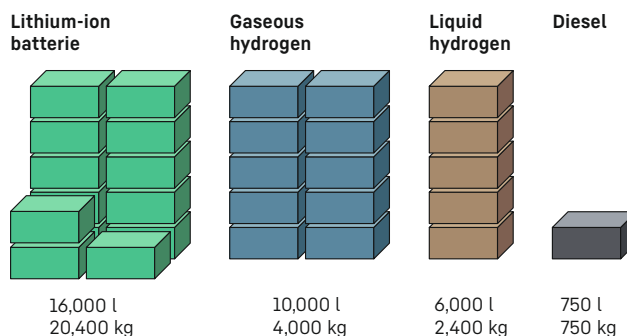
**Dr. Hamme:** The “smaller” crawler cranes in Ehingen start with a nominal lifting capacity of 500 tonnes and are designed to act purely as heavy duty assembly cranes. In other words, they are at least twice as powerful and twice as heavy as the electric 250 tonne machine from Nenzing. The battery-electric approach cannot be scaled up on a linear basis for these crane sizes.

The approach taken by our colleagues at Nenzing of building a crawler crane which is also a mobile crane with only an electric power unit is very courageous and an exciting development. The universal range of uses, the way in which the crane is used, the flexibility and the

performance of the electric crane compared to a conventional crane with a diesel engine are all subject to change.

The battery capacity installed in the LR 1250.1 unplugged must be combined with a cable connection to manage an average working day and the site must also provide a charging facility for the crane’s batteries. The approach for the 250 tonne crawler crane cannot be reasonably be used for the large heavy duty crawler cranes we make in Ehingen taking into account all the relevant aspects – and there are many of them.

**Federle:** Operating our cranes with the very latest emissions treatment technology which complies with Stage 5 and the use of synthetic fuels is a much more practical method and is already available on a widespread basis. This is also shown by the results of the Frontier Economics study we discussed earlier. Naturally, this “clean” crane still has some residual exhaust emissions.



Volume requirement and weight of medium including tank for various type of power unit using the LTM 1160-5.2 as an example

**Liebherr has already stated that there will be an electrically powered version of a compact Liebherr mobile crane at the next Bauma. Can you tell us any more about this?**

**Dr. Hamme:** We have plans to launch the LTC 1050-3.1, our 3-axle, single cab compact crane in the 50 tonne class, with an additional, optional electric power unit for all crane functions before the end of the year. In other words, the crane will be fitted with the conventional diesel engine fuelled with HVO for road driving and crane operations, but as an alternative will also be able to carry out crane operations with an electric motor so that it complies with the “local zero emissions” requirement. That means that all the familiar usage properties of the crane will be retained, regardless of whether it is operated using its zero emissions power unit or its internal combustion engine.

The power for the electric motor will come from the local power supply using a cable connection. A heavy current 125 ampere connection is required to be able to use the crane's full performance. The maximum working speeds may be reduced with a 63 ampere connection.

With this approach we ensure that the hybrid LTC 1050-3.1 can continue to be used economically as a flexible "global crane" at all sites. Customer benefits, everyday practice and economy go hand-in-hand with global and local environmental protection.

**The future therefore has lots of interesting things in store on the theme of sustainable power units to reduce CO<sub>2</sub>. But let's look at the present. What is Liebherr actually putting in place in Ehingen?**

**Federle:** Since September 2021, we have been fuelling our mobile and crawler cranes at the Liebherr plant in Ehingen exclusively with pure HVO. This is used for the crane trial procedure and test drives as well as the first tank of fuel before delivery. Over the last few months, we have been working on preparing the entire range of mobile and crawler cranes for use with HVO. The diesel engines were first checked, certified and approved by the manufacturers for this purpose. The cranes have also undergone extensive testing and trials with pure HVO by customers and in our own trial department.

**Dr. Hamme:** We have analysed all the vehicles that drive around our plant at our Ehingen site. With a very few exceptions, they can also be fuelled using HVO. As a result, we will be able to save 2.5 million liters of fossil diesel per year by switching to HVO fuel. This will result in an annual reduction of around 6,500 tonnes of CO<sub>2</sub> at our plant.

And another thing – we have been exclusively purchasing green electricity for our Ehingen plant since 1 January 2022. So we are supplying the complete plant with certified electricity from European wind power sources. That is just another milestone towards CO<sub>2</sub> neutrality.

**What do you think about power units, alternatives and climate protection? We look forward to reading your views. Please send you mails to [upload@liebherr.com](mailto:upload@liebherr.com). Perhaps we can use your question or view in one of our articles in our next magazine. Let's get talking!**



**1** **As one of the first crane rental companies worldwide, you've announced in July to adopt using HVO for your mobile crane fleet. Why did you take this step?**

We have monitored our environmental impact for several years now and we were very aware that our consumption of fossil fuels was unsustainable in the long term. Though our crane replacement strategy has certainly made a difference with some great advances in crane technology and efficiency over the last few years we are still a mobile crane hire company and we need to move hundreds of tonnes of metal many thousands of kilometers every year. We knew battery power was not going to be an option for a long time so we started looking at the fuel itself. We were alerted to HVO early this year and the environmental gains did look incredible. After several months of discussions with crane and engine manufacturers and a series of trials we could not find a valid reason not make the switch.

We know there are some risks being the first to do this and we know that there will be some who are monitoring our progress before making any decisions. But we want to lead the way and we hope that our actions may be a catalyst for the rest of the industry. But it is not wholly altruistic, we know there are customers, projects and industries that will be fully supportive of more sustainable crane movements and we also know that, as an industry, big changes are coming – by choice or by regulation – and we think being in the lead is the best place to tackle these challenges.



3 Questions to:

# Matt Waddingham

Managing Director, Cadman Cranes Ltd, UK

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Having HVO in use now for roughly half a year, what are your experiences with it, how do your customers react on it?

Our experiences have been wholly positive so far. We have seen no negative effects on the cranes itself and our customers have been very supportive and keen to understand it better. It is more expensive but we feel the gains are worth the extra costs. My only concern is the resilience of supply, we have had no problem getting it so far, even through the recent fuel supply dramas in the UK but we are aware that we don't have the infrastructure in this country to produce it yet. It will be interesting to see what happens should there be a substantial uptake in its use. Now we have made this move we certainly don't want to be going back.

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With this step, it's a first move on the path towards net zero carbon. What else do you have in mind or already started with to take on this journey?

We are looking at everything and have a strong understanding of every aspect of our impact. But 70% of our carbon output is the crane movement and operation so this is where we have concentrated our efforts so far. We are part of the Milbank Group – a diverse group of companies with interests in agriculture, construction, manufacturing, information technology and retail – and our chairman is committed to nurturing successful businesses that make a positive impact on our communities. Soon we will have Sustainability Manager on board and we are looking forward to working with an industry expert to really shake things up and help plot our route to net zero carbon. But we understand it doesn't end with us, or a small handful of companies, our customers and supply chain are just as important so it is great to see Liebherr's commitment as well. It's obviously going to be a challenging few years ahead but it is also exciting to see what innovation and ingenuity our industry can contribute.

**Cadman Cranes Ltd.** is one of the leading crane rental companies in East Anglia, United Kingdom, with over 50 years of history in the crane rental business. Since the beginning the company has made its great importance to being more than just another crane rental company. Quality, reliability and safety are the core values of Cadman Cranes, which are always geared towards customers and employees. Full-service solutions are offered that go well beyond crane rental. Matt Waddingham has been appointed Managing Director of Cadman Cranes Ltd. in 2019.



**“There is fantastic  
wind blowing here.”**

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## Offshore simulation for massive turbines

For once, readers, we will not be starting this story with our cranes for a change. They appear to be fairly well covered in this UpLoad magazine anyway. So let's start this short report about an exciting site in northern Denmark instead with a person who we can safely describe as a "grey-haired superstar" on this case. A man who appears to have construction site blood running through his arteries – Crane Supervisor Espen Andersen. Andersen, a Danish giant who, at the age of 66, is still extremely dynamic and normally very cheerful, is the jack of all trades in Østerild, a rambling test site for offshore wind turbines. When you leave the metalled road turn off to get to the test site, a barrier stops you going any further. "No problem", says Espen Andersen: "Just call me. I open."

Even as a gate keeper, Espen, who is called by his first name by everybody here, is not too bad. In his main job, the likeable Dane, who somehow looks after everything and everyone on the sprawling test site, however, is an absolute professional. Or to be more precise, he is a seasoned expert in all Liebherr crawler cranes, which are regular visitors to Østerild. For decades, he sat in the operator cabs of an enormous number of crane models. He is very familiar with almost all Liebherr mobile cranes from the hundred tonne versions to the LTM 1750-9.1. He has also spent plenty of time with our lattice boom mobile cranes and, of course, Liebherr's crawler cranes right up to the LR 11350. He first climbed into a crane at the age of 22.

So it will hardly come as a surprise that Espen is the person on the research site who could be described as the crane man. In the role of Crane Supervisor, he coordinates all the hoisting work in Østerild. Since 2015, he has been working for Danish crane contractor BMS Heavy Cranes A/S at this isolated site. This is the place, almost at the northern tip of the Danish mainland, just a few kilometers from the coast at the Skagerrak Strait, the bay in the North Sea which covers Norway, Sweden and Denmark, where manufacturers of wind turbines test their latest developments for generating electricity at sea. Offshore windmills, in other words, as they are called in the vernacular. Danish manufacturer Vestas and Siemens Gamesa Renewable Energy are present at the site. Nine test fields are currently filled with various different systems. Every one of them is a rather impressive size. Because it is significantly easier to test new turbines on land than at sea, there is high demand for this site. In fact, it has even been extended recently. The operators sought out one of the windiest sites in Denmark at Østerild.

### Generator load case

"At the moment we and our cranes are on field number seven, where we are erecting a large wind turbine with a rating of fourteen megawatts and a tower height of 155 meters for Siemens Gamesa", says Espen. To install what is to date the largest turbine at Østerild, he also ordered the most powerful crawler cranes to come to his site: "We are currently working with two Liebherr LR 11350 cranes, which we have set up for a hook height of 185 meters. Each crane is equipped with the double "PowerBoom" and 380 tonnes of ballast. That enables us to hoist gross loads of up to 350 tonnes up to the 155 meter tower."



### Next generation

The preparations for the tandem hoist of the enormous gondola are continuing apace.



**Heavy!**

This special yoke is used for hoisting the heaviest loads with two cranes. An impressive 800 tonnes can be attached to the mega hook.

The individual components of the test system look like a major challenge to onlookers. The giant gondola looks enormous, particularly when people are working on it or there is a vehicle standing next to it. The component measures ten meters in height and has a gigantic volume of 800 cubic meters. The largest load case among the components for the colossal turbine for the two powerful hoisting machines from Liebherr, however, is by far the massive generator. “Including the hook block, special yoke and fastening equipment, each crane has a gross load of 176 tonnes”, adds Espen. “With a radius of 32 meters, it means that we are using almost all of the lifting capacity of the two crawler cranes.”

This newly developed turbine with its fourteen megawatts is one of the most powerful that Siemens Gamesa plans to manufacture over the next few years. One hundred of these turbines have been earmarked for a wind farm in the English North Sea. As from 2024, there are plans to install these turbines with a rotor diameter of 222 meters there. First of all, however, the prototype of this impressive windmill still has to turn countless trial rotations at the site in Østerild.



**Know how**

Espen Andersen has been responsible for crane operations at the test site for almost seven years of behalf of BMS Heavy Cranes.

### **In action around the world for wind power**

For this job at the test site, BMS Heavy Cranes went for the most powerful hoisting machines in its gigantic fleet in the form of the LR 11350 crawler cranes. The BMS Group, based in Aalborg, Denmark, is a global player with a workforce of around 1,100 people and a total of around 640 cranes. The majority of them are Liebherr cranes. In 2021 alone, BMS ordered 23 cranes from us with a total capacity of over 7,000 tonnes. Not least because the enterprising company is expanding rapidly. In addition to its normal crane business with outlets throughout Scandinavia, BMS has continued to expand its wind turbine assembly activities throughout the world.



The Danes are active in more than a dozen countries. Including Russia, Australia and the USA. Liebherr LR 11350 cranes are currently working for BMS Heavy Cranes on major wind power projects in Vietnam and Taiwan.

### **Wind – a curse and a blessing alike**

“We already had two of our LR 11350 cranes in action here a few years ago”, says Espen. At that time, however, the cranes were dismantling the turbines on their own.” This tandem job by two powerful crawler cranes was an exciting premiere at Østerild.

And in the final assessment, it went like a dream. Everything worked perfectly. Although, the windy weather and its frequent strong gusts proved to be a real challenge both for the installation team and for the team from BMS Heavy Cranes. All too often the wind speed was above nine meters per second, the upper limit for completing hoisting work on the new turbine. “We obviously had a lot of waiting time because of the weather. But,” continues Espen placidly, “the weather conditions here, after all, are the reason why we direct the test turbines here in Østerild in the first place. There is fantastic wind blowing here.”

### **Sunshine and dark clouds**

The weather can change quickly near the coast. Sometimes, only short periods are available for crane operations due to the vagaries of the weather.



... a virtual trip around the world

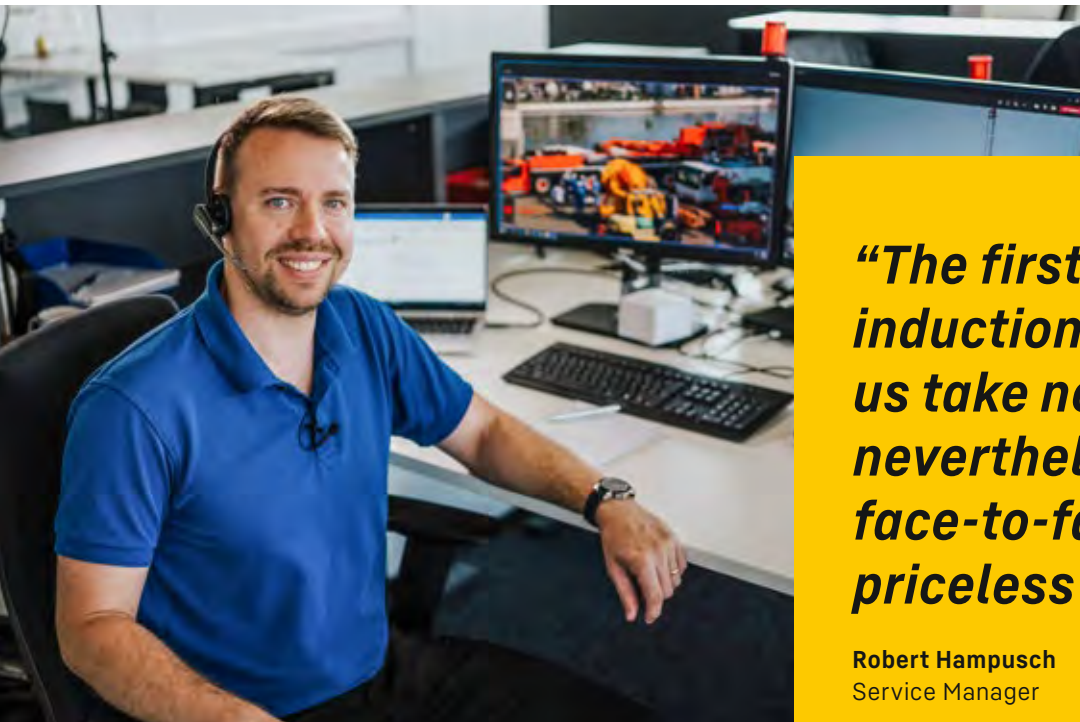
# Problem solver digitalisation

Virtual reality. Digitalisation. Remote. Words which are more and more common in our daily lives. Digitalisation is also becoming increasingly important for crane manufacturers. But the main question remains – what do our customers gain from it? This is our focus for digital products and developments. Digitalisation should make life easier and make the impossible possible. The coronavirus has also had a part to play in this respect. A few months ago, for example, nobody would have thought that crane induction training could have been carried out in full digitally. In fact, there was no demand or even requests to do so. But then ...

In the past, it was a matter of course that when a new machine model was launched, the service fitters from our global branch outlets around the world would come to us in EHINGEN. They received training here and were given the knowledge they required, not only to maintain the cranes in their markets, but also to train customers locally and show them how to use the new machines. This often included active support from our service technicians in EHINGEN. For large, complex cranes, customers from all over the world also came to us at the manufacturing plant for intensive training because we have perfect training conditions here.

This process had been established, tested and successful over many years. But then, along came the coronavirus. A time of restrictions. It was no longer possible to travel across borders and back freely as we had been able to do in the past. In some cases, it was only possible to do so by complying with significantly harsher regulations, sometimes involving up to 20 days of quarantine. However, our customers still had to be shown how to use new cranes by trained personnel.

We had to act – and quickly! It was clear what we had to do. Therefore, right at the beginning of the pandemic, our Training Department switched to online training courses. This meant that the transfer of theoretical knowledge



***“The first digital crane induction training saw us take new routes, but nevertheless personal face-to-face induction is priceless for everybody.”***

**Robert Hampusch**  
Service Manager





### Live and kicking

Video goggles and microphones transmit sound and pictures to Ehingen from Japan 10,000 kilometers away.

could continue thanks to digitalisation. Check, move on! Nevertheless, we still had a question – how could we continue to provide local support for our customers? The solution was simple – put crane induction training online as well! It sounds like a challenge, but it worked. Naturally, after we had had the idea we had to face a series of additional questions: How do we want it to work? What technical equipment is required? How can we ensure a fast, stable internet connection all over the world? How can we handle the time differences?

### Teamwork leads to success

However, we had no time for lengthy reviews, preparations and tests as the cranes had to be delivered to the customers. So we used what we already had – the technical expertise and equipment that was already available to us. It all started with induction training for an LTM 1650-8.1 – in Japan. To enable us to be there live and maintain a good overview of the whole area, we set up several cameras on the surrounding buildings. They enabled us to visualise the conditions at the site. This, in turn, enabled us to deal with the questions and requests from the customer and react accordingly, while still being live at the site.

Our Japanese colleagues at the site were equipped with video goggles which were able to send both pictures and sounds to Ehingen. That meant that we could see exactly what the people on site could see. And hear what they could hear. The foundation for a live transmission between our fitter on site in Japan and us here in Ehingen was in place. The digital crane induction training could now take

place live despite us being more than 10,000 kilometers away and the time difference of eight hours along with some rather unfamiliar equipment. And induction training for an LTM 1650-8.1 is definitely not child's play. So yes – check!

Thanks to the fantastic expertise of our Japanese service team, our good relationship with the customer and mutual understanding for the complex situation, we all quickly got used to the whole thing. The Germany-Japan team grew together virtually. It all meant that the first digital crane induction training was completed with flying colours.

But virtual induction training on a crane will not be the standard in the future. We always have to consider the overall situation for each specific case: Is the site suitable? Is the internet connection good enough? Or is filming actually prohibited at the site?

Furthermore, close personal relationships with our customers remain very important to us. Working together face-to-face and partnership are important aspects and should be retained. They simply cannot be replaced by the digital world. Nevertheless, digitalisation and remote working will continue to be used as support measures in the future to keep our machines in action for our customers as well as possible even in difficult times. It was a great experience for our joint team in Ehingen and Japan, together with our customer and in keeping with the slogan – You and us together.

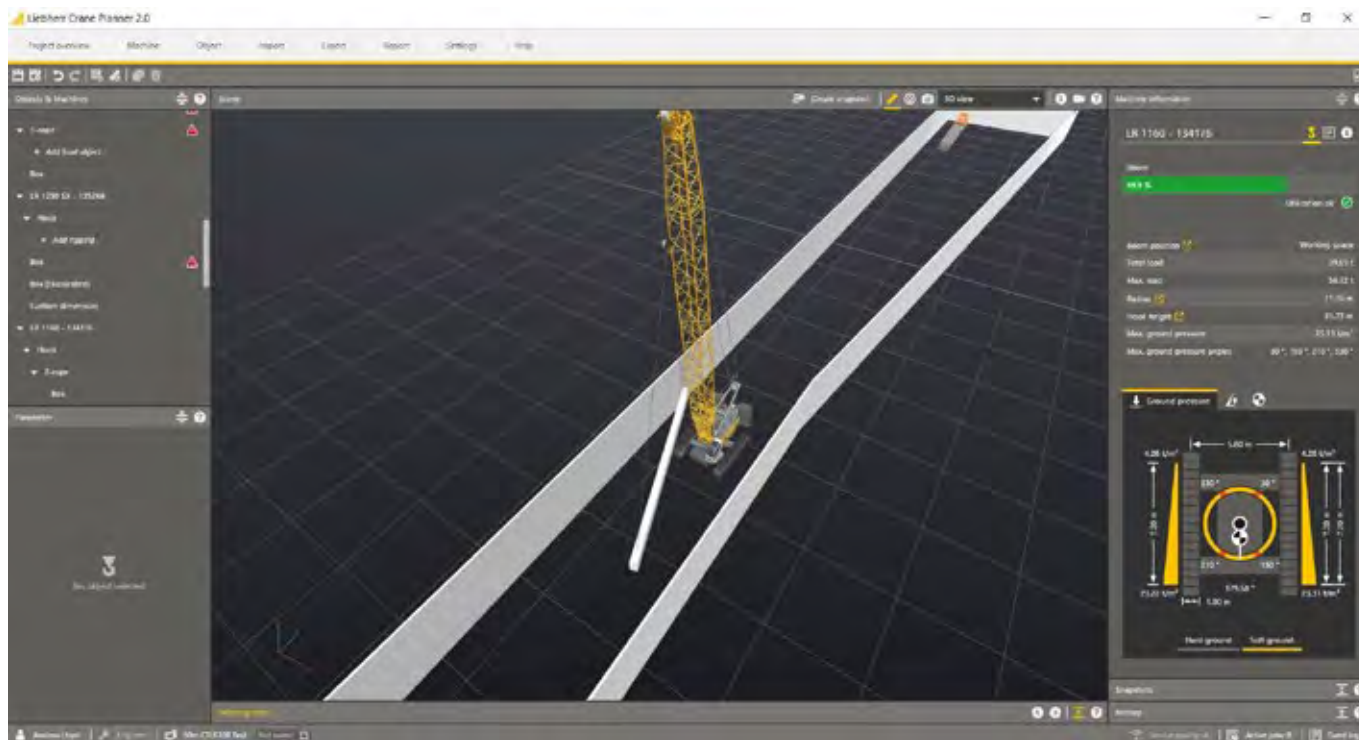
# Playing with cranes to achieve perfect planning

Andrew Lloyd is the Senior Project Engineer at Select Plant Hire Co Ltd. in Cambridgeshire, Great Britain. His everyday work is to plan crane jobs of all types. He uses the Crane Planner 2.0 tool from Liebherr a great deal for his work. In the Engineering Matters podcast entitled “#131 - Cranes: How to Plan a Lift”, he explains why Crane Planner 2.0 has become so important to his work. The hosts of Engineering Matters also speak to Wolfgang Boos, a Product Manager with us, and Christoph Mai, a Product Manager at Liebherr in Nenzing. Give it a listen.

“It is always possible to plan a large crane for a job, which will complete the lift easily. The challenge in the planning process, one which is always my objective and motivation, is to make the job as simple and efficient as possible”, says Andrew passionately as he explains his intention: “I want to make jobs economical, sustainable and safe. However, that is often rather complicated.” He pleads for engineers to involve job planners like him in the design of their structures. Minor modifications to individual components or procedures can make the process significantly more straightforward and result in massive savings in the installation work.

## Crane Planner 2.0 includes all relevant factors

Liebherr developed Crane Planner 2.0 to cover all this – professional hoist planning with all the relevant crane data and which can be completed easily. Andrew is delighted with the tool and uses it almost every day: “All the information I need is in the system. To plan the job, I first have to enter the available information. For example, buildings, roads, obstacles or a pre-defined crane model. If there are 3D models of the site, I can include these very easily as well. If there are only simple drawings, I have to create the relevant environment myself.” One of the main points about Crane Planner 2.0 is that it requires neither particularly high performance hardware nor any knowledge of



Through the eye of the needle – positioning the load has been very precisely planned to ensure it can be completed safely in practice.



***“Crane Planner 2.0 is a fantastic tool for excellent job planning.”***

**Andrew Lloyd**

Lifting Engineer at Select Plant Hire Co Ltd.

CAD programs. At the same time, our engineers and software developers are constantly working on new functions and the integration of additional crane models.

“The great thing is that I can play with the site situation and the crane, in other words I can simply try out different positions, configurations and procedures. Crane Planner calculates the correct lifting capacities after every change – I could never evaluate that volume of data manually, not to mention the enormous time savings”, says Andrew enthusiastically. Andrew’s experiences with Crane Planner 2.0 mainly involved crawler cranes from Liebherr-Werk Nenzing GmbH, which were the first to be included in the software package. He believes that the application potential for mobile cranes from Echingen is massive, as more and more of them are included in the system. He continues: “Particularly mobile cranes, such as the LTM 1750-9.1 with systems like VarioBase® and VarioBallast®

are now so complex that there is no chance of finding the correct lifting capacity for every position in a single table as there are so many possible configurations.”

### **Three-dimensional for better understanding and clarity**

For a simple two-dimensional planning process, there are so many factors that it is very difficult to draw them all. “When I find a solution, I must be able to explain it to the management team so that they are certain to understand it. You also have to look at multiple 2D drawings simultaneously to create a 3D world and plan the processes in your head. That is incredibly complicated”, Andrew continues. “I can simply display all the processes in the 3D world in Crane Planner. The processes are clear and comprehensible. And the relevant data are reliable and complete.” As the precise machine data are calculated using the same methods as the live data for mobile and crawler cranes, they are absolutely reliable. That also includes the weight of the hook and rope, for example, as well as the ground pressures. Crane Planner also produces a professional report, including processes for perfect communication with the customer, at the touch of a button.

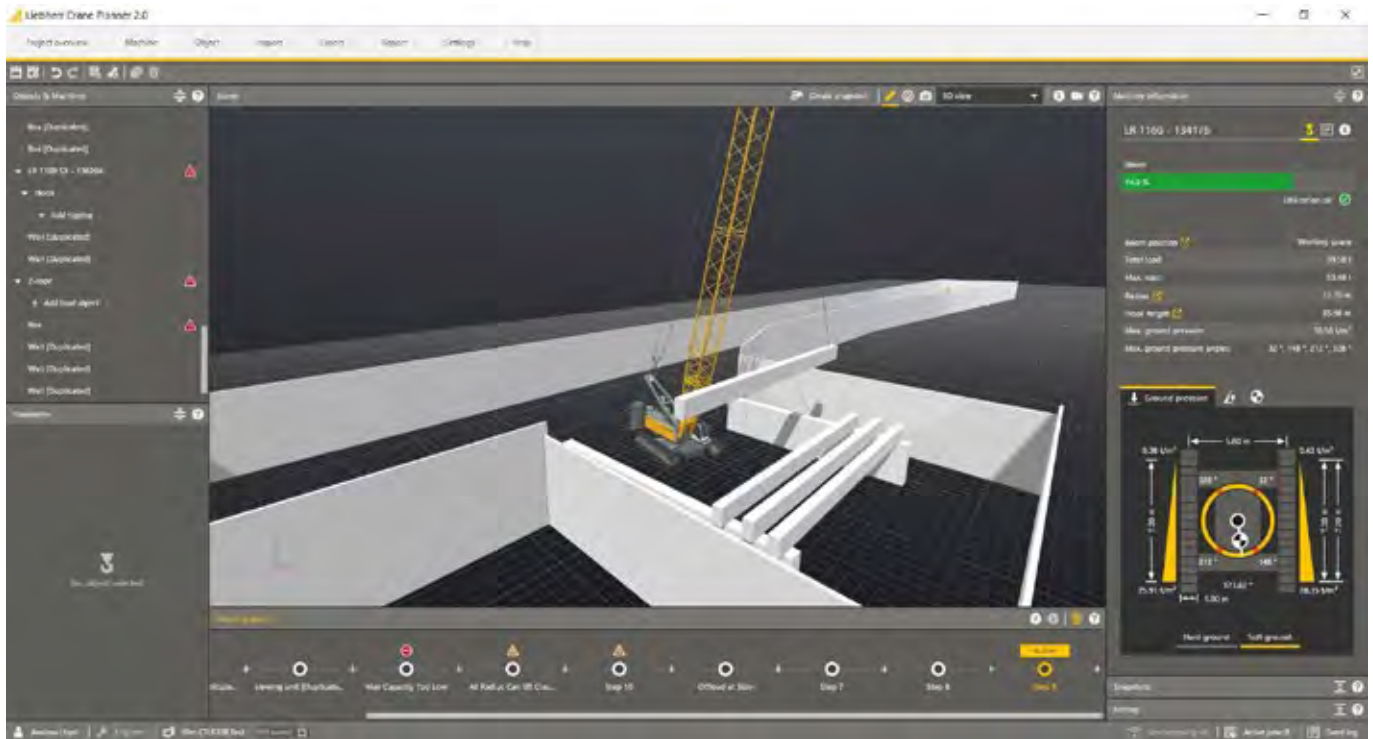
### **Select Plant Hire Co Ltd.**

With over 30 years’ experience, Select Plant Hire, has built an excellent reputation as a large and diverse partner to the construction industry. The company provides technically advanced cranes and hoist equipment, as services in the UK and Australia. Great emphasis is placed by Select on logistics, engineering, safety and efficiency.



**Link to podcast!**

<https://engineeringmatters.reby.media/2021/10/21/131-cranes-how-to-plan-a-lift/>



**Clear and comprehensible:** space requirements, slewing radii, working range limits, edges and ground pressures can be taken into consideration easily in Crane Planner 2.0. The processes can be planned superbly.

### Think outside the box to create new solutions

In the podcast, Andrew shows an example of a job which he was able to plan much more easily and efficiently using Crane Planner. It involves a bridge building job in London with lots of individual components in a restricted environment and a great many obstacles. “Originally, the job was to be completed using a large crawler crane hoisting the components from outside the site into position with a large radius and lots of crane equipment. The job would have lasted a very long time due to the massive number of individual components and would have been very expensive using this heavy duty crane,” says Andrew and explains his alternative solution: “There was already a LR 1160 on the site and I wanted to do the job using this small crawler crane. To manage it, the 160 tonne crane had to unload from truck and manoeuvre it through a long, narrow area with the girders on the hook. It was very narrow, but I was certain that it would work. However, I also had to persuade the decision-makers at the site of this.”

Andrew went through the scenario with Crane Planner 2.0, convincing himself completely that the idea was feasible and when it was 100 percent certain, he demonstrated the processes to his customer. Every step, obstacle and solution was clearly shown in the simulated 3D world –

the positioning of the truck and the crane, all the movements of the crane, the positioning of the bridge components and the movement routes through the eye of the needle. The customer was persuaded by Andrew’s professional solution, completed the job as proposed and managed to save a great deal of time, money and effort.

### Crane Planner 2.0 Version 1.7

Since the release of the latest version, now in addition to the LTM 1750-9.1 the mobile cranes LTM 1650-8.1, LTM 1450-8.1, LTM 1300-6.2, LTM 1250-5.1 and LTM 1230-5.1 are also available for planning work. Additional telescopic mobile cranes will be added to the Crane Planner 2.0 at regular intervals. The LTM 1350-6.1 will be the first of these. Users of the previous version will enjoy the benefit of the new crane models and functions automatically and free of charge after the update. These also include the new distance tool which enables objects such as machines and buildings to be positioned relative to each other with centimeter precision.



Find out more about Crane Planner 2.0 here:  
[www.liebherr.com/craneplanner](http://www.liebherr.com/craneplanner)

# TraXon DynamicPerform

**Simply explained**

At Bauma 2019, we announced a new gearbox to make starting and manoeuvring mobile cranes possible with zero wear – TraXon DynamicPerform. Since then the new gearbox has undergone a period of intense testing and advanced development. Now it is ready for widespread use. First of all, it will be installed in the new LTM 1110-5.2, after which we will start to install it gradually in our mobile cranes with between three and five axles, starting with other 5-axle models. Martin Dony, an engineer in our Crane Chassis Development and Design Department, explains exactly what DynamicPerform is and what benefits the new gearbox delivers in practice.

DynamicPerform is not actually a new gearbox at all, it is the new clutch module for ZF's TraXon gearbox. The main benefit in short is that it delivers zero wear for starting and manoeuvring with centimeter accuracy and with no overheating.

Before I tell you exactly how it works, I would like to go back a little in the history of gearboxes in Liebherr mobile cranes. Until around 20 years ago, we had automatic transmissions in all our mobile cranes, in different sizes depending on the weight of the vehicle. Thanks to the integral torque converter, using the clutch generated zero wear. However, the downsides to these gearboxes included

their great weight and high price as well as high fuel consumption and low speeds due to the low number of gears.

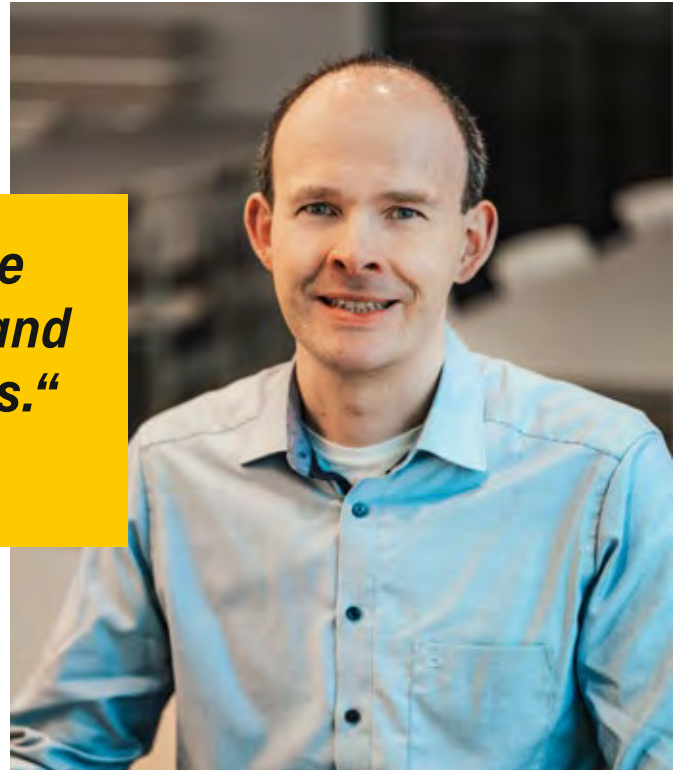
In 1999, we launched the first automated manual gearbox for Liebherr mobile cranes in the LTM 1100/2, which at the time was part of ZF's new AS-Tronic gearbox family. The electronic gearbox control system enabled automatic clutch and gearshift operations to take place without the driver having to do anything. Twelve or sixteen gears delivered better gearshift quality to improve the operation of the diesel engine within its optimum engine speed range and led to more economical driving with lower fuel consumption.



**DynamicPerform**  
Zero wear starting on gradients

***“DynamicPerform takes the strain off the crane driver and reduces maintenance costs.”***

**Martin Dony**  
Crane Chassis Development and Design Department



However, many crane drivers first had to get used to the much more challenging gearshifts with the dry clutch. The increased friction during starting and manoeuvring meant that the clutch lining could suffer wear and the clutch could overheat. This was the reason that the vehicles were fitted with a two-stage distributor gear. Whilst the second stage is normally used to increase the torque and therefore to enhance gradeability, the lower gear ratios in a crane vehicle are generally used to reduce travel speed. This enables the clutch's friction to be reduced during manoeuvring, thus minimising the wear on the friction lining.

In 2017, the AS-Tronic gearbox was replaced by the modular TraXon gearbox system. This completely newly developed gearbox series delivered improvements in terms of the transferred torque and efficiency, whilst also significantly reducing noise emissions. At the same time, new functions such as Hill Start Aid and the "ECODrive" program, a gearbox setting to improve fuel consumption, were introduced.

But even with this new gearbox system, there was no zero wear starting and gearshift clutch for more lightweight vehicles. As the torque converter for the TC Tronic HD and TraXon Torque gearbox, which we use all our 6-axle cranes and above, is too heavy and too expensive for smaller

mobile cranes, we have been looking for an alternative for some considerable time. When ZF had examined the possibility of developing an oil-cooled multi-disc starting clutch in the course of its initial development, the "wet starting clutch" project for mobile cranes and special vehicles was started and Liebherr became involved in the ZF development in the role of lead customer.

#### **„Wet starting clutch“**

The main function of the clutch between a diesel engine and gearbox is to balance the speed between the drive and output sides. At the beginning of the starting process, the diesel engine initially turns at slightly higher than idling speed. The section of the drivetrain downstream of it (gearbox, gear shafts, distributor gear, axles and wheels) remains at a standstill. If the clutch is now slowly closed, the friction forces between the clutch surfaces transfer the speed of the diesel engine to the output side and cause the downstream drivetrain to start moving. As the output side is not yet turning at the same speed as the drive side, a large proportion of the drive energy is converted into heat energy due to friction. The speed of the output side gradually increases and the speed of the vehicle continues to rise. The friction heat is generated up to what is known as the bite point after which the speed of the output side is identical to that of the drive side.

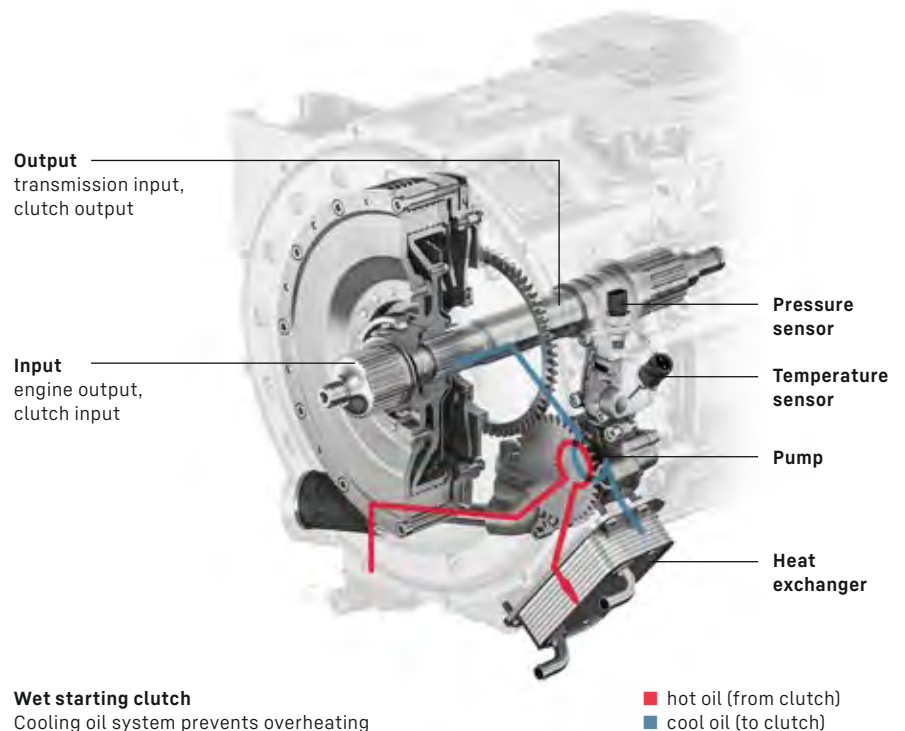
When using a dry clutch, the heat energy is absorbed by the pressure plate (steel compound) and the clutch lining. The pressure plate only cools slowly due to the low level of heat transfer between steel and air. If the lining disc is exposed to great heat frequently, it will wear more quickly. However, DynamicPerform is based on the principle of a wet multi-disc clutch whose typical feature is the parallel arrangement of multiple friction linings. This enables the multi-discs to absorb more heat energy. Cooling the discs with a flow of oil enables the heat to be dissipated quickly. The oil in the clutch transfers the energy in an oil-water heat exchanger to the diesel engine's coolant circuit which then dissipates in the cooling system.

The new clutch module has an integral control unit for the oil cooling system. ZF has developed special temperature models for the particular requirements of a mobile crane in its software and tested them exhaustively together with Liebherr. Pressure and temperature sensors enable the condition of the clutch to be monitored so that protective functions can be activated in critical situations. Tests in a refrigeration chamber at temperatures as low as minus 40 degrees have confirmed that DynamicPerform works reliably even in extremely low temperatures.

### Clear advantages

So what are the benefits of the clutch for everyday use? All starting manoeuvres generate zero wear, which means that none of the clutch's components suffer any wear at all. Even hard starts, such as starting on gradients, can be carried out multiple times in short intervals. Finally, for manoeuvring with centimeter precision, for which only a fraction of the engine speed is transferred by the clutch to the drivetrain, the friction on the clutch also creates zero wear as a result of the oil cooling system. The dissipation of the heat prevents the clutch overheating and increases the availability of the vehicle.

Crane drivers can now concentrate fully on the manoeuvres without having to think about the stress on the clutch. Crane contracting companies benefit from the long service life and the easy maintenance of the clutch. The oil can be changed using the same service interval as other jobs, thus reducing downtimes to a minimum. This therefore saves costs on maintenance work. The whole thing means that innovative technology has made mobile cranes just a bit better.



# An ode to the crane

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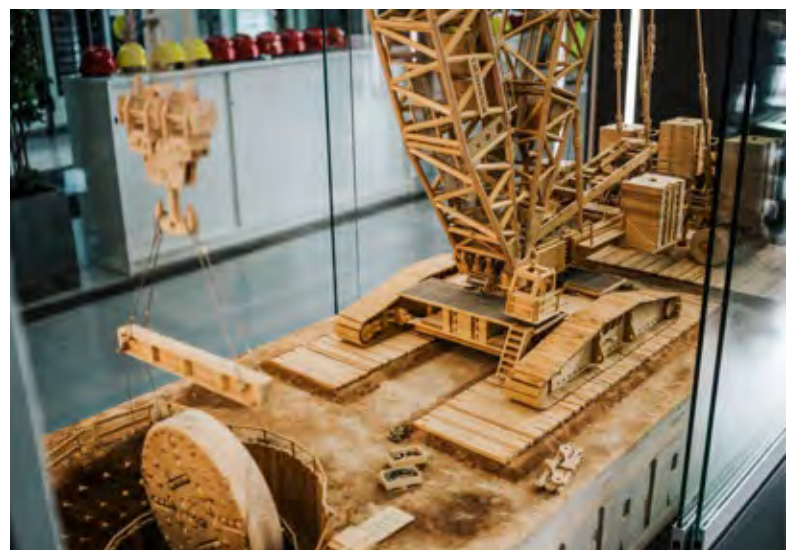
**What do Liebherr customers and personnel actually do in their spare time? Some of them have crane interests. For example, building an LR 1750 out of wood. Or keeping over 1000 collectors items in the attic. All this is by no means just a hobby, it is a passion born of their professionalism and precision. Let us show you behind the scenes at the homes of Torsten Schwarz and Oliver Thum.**



Torsten Schwarz, a specialist in spare parts and wooden models

When the journalist's phone call arrives, Torsten Schwarz is in the spare parts warehouse at Ehingen. As the Control Stand Shift Leader, he has over 100,000 parts which Liebherr customers need for their mobile and crawler cranes. "I've held every one of them in my hand at one time or another. After 26 years, I know exactly what the products look like and where they are fitted." And we could add that Torsten Schwarz can look at all these parts from very close and can also handle them and turn them over, as long as they are not too heavy.

And he has certainly done that with some of them in the project he started in 2018 to create a complete replica. In spring of that year, he took the first step to create one of the 7,805 individual components which, three and a half years later, would form the LR 1750. During that time, his workshop became his living room. "If I don't switch the television on for three months, I don't have a problem. But my jigsaw? That's got to be on!" says the trained plastic mechanic, laughing. When you meet the man, you quickly notice that he is a man of action – and a cheerful one. The wooden model took him a total of 785 hours to complete. It also brought him a great deal of knowledge, a dream come true – and tinkering about on the edge of despair. "In spring I was really down and close to throwing the model into the fire. You can make wheels very easily out of wood, but crawler travel gear and chains? Almost impossible!" Four attempts failed, rubber covers were broken by UV light, the wire rope could not be tensioned. Then on the fifth attempt, the whole thing worked. "And I was absolutely euphoric!" It is really impressive when Torsten Schwarz tells you how he has also made other vehicles, pushed the envelope and designed them to be ever closer to reality and accurate.







**785**  
hours

**7,805**  
parts

### Challenges? Overcome them!

And that of course is the greatest challenge in this project – design. A crane made of wood is something unique. “The difference between steel and wood is simple – it is possible to suspend the weight of many tonnes on a steel boom. However, building something out of wood that can hold loads is difficult!” Particularly when everything has to be made to scale. Torsten Schwarz chose a scale of 1:20. That means that parts in a real crane that measure 4 cm instead measure just 2 mm in the model. The parts are

made of pine and beech with some of them also being oak. “Beech is hard, pine is soft. This means that pine can be easily filed and abraded, but is less strong!” The result is a scale model with a surface area of 60 x 60 cm, 220 cm high, a plinth which weighs 100 kg and a crane which weighs 8 kg. Schwarz actually decided to make this crane model, the 700 tonne LR 1750 with a 42 m boom totally by chance: At the time, there happened to be one standing in the yard. That meant that I could study the details closely and take photographs which you would never guess from our design plans.”

### A supportive environment

His conversations with colleagues in the training centre were also helpful, particularly those involving tricky questions. “At what angle are the lattice sections installed? What is the reeving sequence using the rope pulleys? What load case is suitable for this crane configuration?” According to Schwarz, he now understands many of the products better. “When you’re building a model you realise that our designers had all sorts of thoughts relating to every detail!” It is these colleagues who are now giving admiring looks to the glass-fronted cabinet at the Meeting Point in the training centre. Crane fan Schwarz was delighted to put his masterpiece on display there. “It’s the perfect place because the people who will look at it there are the ones who operate and understand these machines. To be honest, I am also happy to have a bit more space in my workshop again!” The relocation to “home” was

straightforward as the crane, like its big brothers, can be dismantled into individual components for transport. Naturally, the chains move, the boom can be raised, lowered and slewed.

So what next? Now it’s winter, the workshop is cold and the television is working. But there is no chance of him suffering spring fatigue: “On my next project as well, I’ll be in the workshop sometimes at half three in the morning. When I get going on something, I simply can’t stop!”



Oliver Thum, crane expert and model collector

over  
**1,000**  
models

**80 m<sup>2</sup>**  
of floor space

### **Give up? Not an option!**

Another person who cannot or will not stop is Oliver Thum. That applies both to his job, in which he plays a leading role in Austria's crane and construction industry, and to his collection activities. The trained crane builder is responsible for External Technical Service at Prangl in Tyrol and coordinates some interesting sites for the renowned crane and lifting platform rental company. During his career, he has given a helping hand in the development of several crane prototypes. "When I was 25, I was able to drive what at the time was Liebherr's largest telescopic crane at Schmidbauer in Munich. On this 800 tonne crane, you sat at the bottom end of the vehicle which had a maximum height of 150 m, from where you could hoist enormous loads around the place which required nerves of steel." He worked on the biggest sites in Europe for 20 years. He was even involved in the underground construction of CERN in Geneva – he was one of two crane operators who lowered components weighing 350 tonnes to a depth of 50 m for the world's largest particle accelerator.

### **A life with the crane**

Training as a crane builder and operator essentially saw Oliver Thum continue along the route that had started when he was a child. At the time, he accompanied his father, the owner of a crane contracting firm, to many sites such as the construction of the Brenner motorway. "Sometimes I travelled back at night by taxi because my father had to stay." When you talk to the man approaching his 60th birthday, his clear voice and precise wording quickly show you that a life full of sites must be wonderful, challenging, educational and simply fantastic. And the whole thing continues in his attic.

An attic approaching bursting point. With model cranes. Crane models. The first one he received from his father for his 2nd birthday has been joined by well over 1,000 more. "The rather gloomy 80 square meters contains all types and sizes including a few construction machines and heavy haulage vehicles. The collection also contains a few publicity models in the original paintwork which you get either direct from the crane contractor or from model makers." Whether it takes luck, or contacts – the main thing is getting the crane. For example, he received a gift of a telescopic crane he had helped to develop to celebrate its 30th anniversary from Taiwanese model maker YCC in original Schmidbauer livery. "It is the number 1 of 200. With a certificate number!" Oliver Thum's pride shines out clearly on the telephone. His pride is driven by passion, a passion which often leads him to opening his doors at his home town of Rum near Innsbruck. "Come round if you're in the neighbourhood!" Many people have taken up this invitation. In addition to acquaintances and customers, they include all the leading model manufacturers such as Conrad, YCC and WSI. "Even Liebherr personnel have visited my attic!"

### **To Liebherr, with Liebherr**

Tyrol-born Thum came to Liebherr in Ehingen as an apprentice in the German autumn of 1977, a time dominated by terrorist attacks by the Red Army Faction. He was just 15 years of age, travelling alone on the train with wanted notices in every railway station. "I trained as a machine fitter, became fully involved straight away and even after I had finished my apprenticeship, I worked for two years in the Repair Department." Almost half a lifetime has passed between then and now, involving many generations of

cranes. When Thum talks, it sounds more like a revolution than evolution. "1977 and now – they are worlds apart. At the time, the 110 tonne model was Liebherr's largest telescopic crane with a 45 m boom length and we were simply unable to imagine a lifting capacity of 800 or even 1,200 tonnes for a telescopic crane. We all thought it was phenomenal when a lifting capacity of first 160 and then 200 tonnes became possible in 1980. The boom length was 55 m, a 100 m boom like today was inconceivable!"

Painting models in company liveries, was pretty standard even then. Because there are so many models which do not have the original paintwork, Oliver Thum regularly works as a crane builder in his attic. "I dismantle the standard model in yellow, modify it, refine it, pickle it and then paint it." Naturally, none of this involves guesswork or inaccuracy, it is all done with absolute crane precision. "Collectors only use the original RAL colour, and then the signwriting is made precisely to scale and affixed."

#### **Very well known among crane operators:**

##### **Tight space conditions**

He used to make lots of models with Lego, but now he continually checks his vast to ensure everything moves correctly. There is less and less space available, although

he has plenty of scope in his house. This may change, however, if he starts looking longingly at his daughter's room when she moves out shortly. "I think I would have to do a lot of work to really convince my wife," says the crane fanatic laughing

Until then, he will continue to collect, paint and drive to the annual get-together in the Netherlands. That event sees a gathering of passionate collectors from all over the world to swap models and show off others they have built themselves. One good thing for Thum is that when there is no model in sight or the attic is too warm, he can sort things out himself. Recently, he even manoeuvred a crane again and during our phone call he was travelling to his current project, a major site near Salzburg. Just before he arrived, Thum shared a story of bright pink crane romanticism involving large crane contractor Franz Bracht, based in northern Germany, whose owner Dirk Bracht is himself a collector of models and genuine vintage cranes, giving his daughter an original pink crane to celebrate her birth. Thum also has a pink crane in his glass-fronted cabinet – of course he has. What he does not yet have, however, is the blue one that Bracht gave as a present to his second-born. So a new crane is likely to be added to the collection at any time!



# Shift the centre of gravity

Our LTR telescopic crawler cranes combine the benefits of telescopic and crawler cranes – the excellent manoeuvrability of the crawler travel gear means that they can be used on almost any terrain. Thanks to its crawler travel gear, the LTR can also be moved with a full load on the hook. And if things get particularly tight, our LTR cranes can also operate on a narrow crawler track width – with the added safety of the LICCON overload system. Markus Kolb is Design Group Leader and, among other things, is responsible for telescopic crawler cranes. He explains how you can adjust the track width whilst being very gentle on the crane.

When the crawler carriers are adjusted on our heavy LTR cranes with lifting capacities of 100 tonnes and over, the process generates some very high forces. My tip will help to reduce the stress on the components and make the track adjustment easier even on surfaces with high friction.

***“Shift the centre of gravity of the crane so as to take the load off the crawler carriers you wish to adjust”***

**Markus Kolb**  
Head of Slewing Platform Design Group



**Pressure differences**  
The ground pressure of the crawler carriers on the surface are displayed on the LICCON display.

# My Tip

The basic idea is to shift the centre of gravity of the crane so that as much weight as possible is on the crawler carriers which are going to remain stationary so as to take the load off the carriers you wish to adjust. This can be achieved easily with two crane movements. First of all, turn the superstructure so that the ballast is positioned over the stationary crawler carriers. The telescopic boom will then point towards the crawler carrier you wish to adjust. The further you luff up the boom, the greater the load will be removed from the track.

To adjust the other crawler carrier, simply turn the superstructure through 180 degrees. Then the main weight of the crane will be on the crawler carrier you have already adjusted. There is one very important thing to remember for this process – the correct load chart must be selected for the slewing process, the 360 degree chart for the smaller track width taking into account the counterweight and site gradient involved. Additional important information can be found in the operating manual, in the section entitled “Adjusting the track width”.

Unfortunately, however, there are also sites which are so narrow that you cannot slew the superstructure. That means you cannot take the load off the crawler carriers using the method described above. In this case, you should at least ensure that the chain has uniform ground pressure over its entire length. This can be achieved by luffing up the boom without a load until the centre of gravity is in the centre. This is actually indicated on the LICCON display.

This action helps you prevent the crawler carrier at the front, for example, being easier to adjust than at the rear. Having them at an angle would result in increased friction in the cross members. This would make adjusting the track width more difficult.

### Shift the centre of gravity

Less weight on the crawler carriers you wish to adjust makes it easier to move them.



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# The world with Liebherr

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**Active everywhere**

Liebherr products are in action all over the world.  
On building sites, on roads, on the water and on land.  
Day and night.



# On the move – without barriers

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**Freedom from barriers makes life easier for us all. Electrohydraulic actuators from Liebherr elevate railway vehicles to a whole new level of comfort and safety. These technologies benefit passengers of all abilities, allowing them to easily board and exit trains, for example.**

## **Rolling along through life**

It doesn't happen too often. But this is one situation in which Patrick Berger prefers to take the lift. Taking the legendary staircase leading up to the Albertina, the famous art museum in Vienna's First District, is simply not an option. Since the age of 11, Patrick Berger has had to use a wheelchair due to the effects of myelitis. This means that large staircases with many narrow steps are of no use to him.

However, Patrick doesn't think in terms of limitations and barriers. At an early age, he topped the rankings in various sports, where he competed in both the European and World Championships. That was until the curvature of his spine caused him to give up competitive sports.

Patrick is always up for an adventure. That's why barrier-free accessibility is such an important topic for him in his everyday life. He knows that not every person with a disability is able to maneuver over obstacles. And to achieve this, barrier-free access to transportation is an absolute necessity. "It's not just about people with disabilities. It's also about making life easier for others. We're all in the same boat when it comes to accessibility," Patrick emphasizes.

## **High-tech, high-comfort rail travel**

The team at Liebherr-Transportation Systems GmbH & Co KG in Korneuburg (Austria) are working to develop technical solutions that enable people to board and exit trains without barriers. Paul Hofbauer is an industrial engineer specializing in mechanical engineering and heads product management in the field of hydraulic systems. "Hydraulic leveling systems are an important focal point due to boarding and exiting trains without barriers," explains Paul. "Our hydraulics program ranges from complete leveling systems to passive undercarriage control systems, and all the way to electrohydraulic actuators for tilting technologies used in railway vehicles."

Leveling systems have long been in use in North America, where it is required that the height difference between a train and the platform should be no greater than 16 millimeters during boarding and exiting. "Our sensor-controlled electrohydraulics enable us to raise or lower a train at the platform by as much as 80 millimeters. Train operators in many North American regions are already using our leveling systems with excellent results," says Paul.



***“We live in a mobile society. By getting rid of barriers, we make sure that everyone can take part.”***

**Patrick Berger**  
Wheelchair user and sportsman



# ***“Hydraulic leveling systems are an important focal point due to boarding and exiting trains without barriers.”***

**Paul Hofbauer**

Product Manager Hydraulics

Liebherr-Transportation Systems GmbH & Co. KG



## **All aboard! Barrier-free rail travel in Europe**

Successful testing has already been carried out in Hanover (Germany). “We already have the solution,” Paul continues. “But before we see large-scale investment in barrier-free railway access in Europe, we’re probably going to need new laws and regulations at EU level.” And it appears that the cornerstone has already been laid. For example, in an EU regulation it says: “Railway undertakings and station managers shall, through compliance with the technical specifications for interoperability (TSI) for persons with reduced mobility, ensure that the station, platforms, rolling stock, and other facilities are accessible to disabled persons and persons with reduced mobility.”

## **Insights from the aerospace field coming into play**

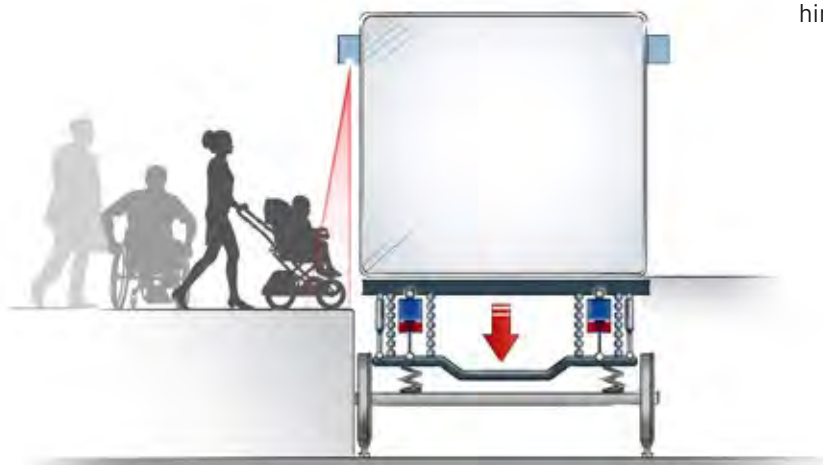
Greater travel comfort and barrier-free mobility are just one aspect of the work being carried out by Liebherr-Transportation Systems developers in Korneuburg (Austria). They are equally concerned with travel safety and making sure the technologies are completely reliable.

That includes scenarios in which hydraulic actuators are connected with power electronics to provide active radius steering, lateral positioning, and yaw damping. The result is hydraulic leveling that is noticeably smooth and produces little noise, even at high speeds, as well as reduced wheel wear and lower risk of rail damage.

## **Quality comes first**

To develop these comprehensive solutions, Paul and his team are working closely together with their colleagues at Liebherr-Aerospace in Lindenberg (Germany) and other Liebherr development centers. “It takes a team effort to achieve technological advances today,” says Paul.

He firmly believes that the key to success lies in the quality of technically sophisticated products. As an engineer and product manager, Paul takes some inspiration from legendary football trainer Dettmar Cramer, who once rallied his team before an international title match by telling them, “As long as better is possible, good isn’t good enough.” Patrick Berger could not have put it better himself.



Read the whole story here:  
[www.liebherr.com/leveling-systems](http://www.liebherr.com/leveling-systems)

# Looping the cosmic loop

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One of the world's largest research facilities for physics research is being constructed at the Helmholtz Center for Heavy Ion Research (GSI) in Darmstadt. When construction work is completed on the new Facility for Antiproton and Ion Research—or FAIR—scientists from all over the world will work on uncovering the mysteries of the universe from the Big Bang to the present day. The centerpiece of the facility will be a particle accelerator that is 1,100 meters in circumference. In this structure of cosmic proportions, ions and antiprotons will be accelerated at almost the speed of light for a variety of research projects.

The universe, the origin of matter, the stars and the preconditions of all existence are the subject of the work of legions of scientists, philosophers and engineers worldwide. One center of universe exploration is located in Darmstadt: the GSI Helmholtz Center for Heavy Ion Research. The facility is considered to be a supernova in

the field of scientific research, not least because it houses a completely unique accelerator for heavy ions. Among the centre's most important achievements is its discovery of new chemical elements and the development of a new cancer therapy.

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### The universe in a laboratory

And it is precisely there at GSI in Darmstadt that one of the largest research projects worldwide is currently being built: the international accelerator center FAIR - Facility for Antiproton and Ion Research in Europe. Nine countries (Germany, Finland, France, India, Poland, Romania, Russia, Sweden and Slovenia) signed an international agreement in 2010 and are now investing more than three billion euros in the project until it becomes operational. Hopes are resting heavily on the centrepiece of the new facility—the new SIS100 ring accelerator, which will enhance the existing accelerator facilities. Here matter will be exposed to extremely high temperatures, pressure and densities to mimic the conditions that exist on large planets, stars and supernovae. Jörg Blaurock, Technical Director of the GSI and FAIR explains how the accelerator enables scientists to create cosmic matter in a laboratory. Particles are “shot” at small samples of material where matter is created for a short moment at the nanoscopic point of impact. Several thousand researchers from all over the world will use the facility to gain new insights into the structure of matter and the evolution of the universe from the Big Bang to the present day.

### Accelerating ions at near light speed

“The SIS100 runs through an underground tunnel located 17 meters below the surface. It has a circumference of 1,100 meters and can accelerate ions of all the naturally occurring elements in the periodic table up to 99 percent of the speed of light,” Jörg explains. “The magnets that hold the ions in their orbit are superconducting and cooled with liquid helium to  $-269^{\circ}\text{C}$ . It’s an absolute feat of engineering.” The construction of the buildings that house the facilities also requires a considerable amount of ingenuity.

And this is where the experts from Liebherr Tower Crane Solutions come into play. Eric Konijn from the Netherlands is the go-to project engineer for unusual construction projects. He has worked closely with construction company Porr Deutschland and heavy-duty logistics company Wasel to develop a crane concept that would effectively support the construction of the circular accelerator tunnel. The solution needed to ensure that multiple cranes could operate simultaneously without crossing paths. They also needed to safely clear the surrounding treetops and pivot by  $360^{\circ}$ . Eric knew he needed to find a flexible solution, so he designed a rail system that could be constructed inside the tunnel site. “It’s often necessary to move cranes about on tunnel construction sites. And this can be very costly





**2 mio. m<sup>3</sup> earth**  
are moved – as much as for  
5,000 single-family homes



**1,000**  
construction vehicles  
are in use



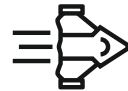
**65,000 t steel**  
are used – this equals  
nine Eiffel Towers



**1,100 meters**  
circumference



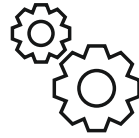
**600,000 m<sup>3</sup> concrete**  
are used – eight times as much as  
for the football stadium in Frankfurt



Ion acceleration to **99 %**  
of the speed of light



Liebherr cranes were moved around  
**1,100 meters**  
on relocatable rail systems



Experiments:  
NUSTAR, CBM, PANDA, APPA





and time-consuming. Installing the tracks provided much more flexibility and avoided the need to continually assemble and disassemble the group of cranes. This soon proved to be a very good solution, especially during the extensive concreting work.”

Safety is always a top priority for the planning engineers at Liebherr Tower Crane Solutions. “Collisions between cranes must be avoided at all costs. It’s also necessary to strike a balance between mobility and the high static requirements. This is especially important in stormy conditions,” Eric continues. With a tunnel depth of 17 meters, the cranes, each with 100 tons of ballast on the tower base, were to reach a height of 40 to 60 meters in order to be able to turn over each other above the neighboring trees with their jibs.

### **The joy of problem solving**

As a trained mechanical engineer, Eric relishes the chance to pit his wits against tricky engineering puzzles. He is so devoted to his profession, he even spends his free time touring construction sites and building model cranes. As he explains, “I love it when I get the chance to combine creativity and top-notch engineering capabilities.” Luckily, Eric had the chance to apply both these skills during the FAIR project. Excellent time management skills also became a key requirement due to the tight project schedule. “There were only three months between the first request and the launch,” Eric explains. This was the first time he had used a rail system to choreograph the movements of multiple Liebherr cranes. “This was new territory for everyone involved in many ways, but it has proven to be 100 percent successful.”

Eric has recently moved into a new role in Singapore but is closely following progress on the site in Darmstadt. The cranes completed all the work a while ago. As Jörg Blaurock explains, “In total, more than 65,000 tonnes of reinforcing steel and 600,000 cubic meters of concrete were used at the FAIR facility. Two million cubic meters of earth had to be moved around for this purpose. Everything happens on a massive scale at FAIR. What’s more, everything has to be completed without interrupting the scientific work at the existing facility.” The heavy ion research programme is still continuing to run at full throttle at the GSI site while the new facility is being built.

So, whilst experiments that will lead to a deeper understanding of matter and the universe continue unabated, 25 new buildings are popping up on the 150,000-square-meter site next door. “This is an amazing thing to see,” explains Jörg, “But the ongoing research activities place very high constraints on the construction efforts.” The construction team is glad they can rely each day on a cohesive construction schedule that meets the demands of this highly complex large-scale project. All the structural and civil engineering work is carefully coordinated alongside the work that is being carried out on the accelerator and the other scientific work. “The goal of revealing to humanity the secrets of the universe, planets, stars and supernovae as well as the origin of all cosmic matter is now coming into closer view. It’s great to be involved in creating such a marvellous research facility for the Einsteins of today, tomorrow and the day after that!”

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