LIEBHERR

UP LOAD

The magazine for customers and friends of mobile and crawler cranes

2| 2019

Dear Readers,

We are coming towards the end of an eventful 2019. In April we unveiled two completely new mobile cranes at the Bauma. In July we celebrated our 50th anniversary at our Ehingen site – a great party which we at Upload wanted to share with you. And today, towards the end of the year, we have another highlight to tell you about – a massive increase in lifting capacity for the LTM 1750-9.1. You can read all about it on page 24.

At the same time, after enjoying a successful 2018, we are delighted to report that this year has once again seen plenty of positive development. Although our annual financial statement, the 2019 is not yet finished, we have already set a new record for deliveries of mobile cranes. We would like to take this opportunity to expressly thank you for the confidence you have shown in us. And you can rest assured – we will continue to work every day to ensure that we deserve to keep your confidence. For example, we are currently expanding our worldwide service organisation to provide you with competent assistance on site at any time – and we don't just mean physically at your site, but also using modern technology. One example of this is our remote diagnostic facility for mobile cranes which you can read more about in our Expert Tip on page 70.

Another highlight last August was the delivery of the 100th LTM 1450-8.1. The fact that such a large number of these cranes is now in the market within just 21 months from its launch confirms our concept of the fast-erecting crane on eight axles. How we work with you during the development of our crane concepts is shown clearly on page 40 by the first job tackled by the LR 11000 with the V-frame in Switzerland. The fact that our cranes are suitable for global use in very harsh conditions was confirmed recently in the permafrost of the Antarctic – you can find out more about this on page 32.

But 2019, was not just an eventful year for us – it was for the global economy as well. The subject of Brexit has been in the headlines in Europe for months and both customs duties and economic sanctions have been dominating the global news. Despite all this, we managed to get mobile cranes and hundreds of spare parts consignments to you every day in well over 80 countries. We take a closer look at these challenges in an interview on page 66.

Best wishes from Ehingen and a good start to 2020.

Mario Trunzer

CFO Liebherr-Werk Ehingen GmbH

Mobile and crawler cranes

Title
An LTM 1450-8.1 dismantling a Liebherr tower crane at the new railway station in Utrecht, Netherlands.

Also available online:
UpLoad is also available at liebherr.com to read, look at and download.

Find out more:
www.liebherr.com/upload

Moments

A picture is worth a thousand words: in the following we have captured some extraordinary crane moments for you (and posterity).

Rows and rows
Snowtown 2 Wind Farm:
An LTM 11200-9.1 erects wind turbines in Barunga Gap in southern Australia.

Power pack
The LR 13000 is the most powerful conventional crawler crane in the world. At the Mexican port of Tampico, it loaded oil platforms onto barges which were then towed to the south of the Gulf of Mexico. Read all about it on page 54.


ESE ASA

Black Beauty
The new LTM 1110-5.1 in its black Bauma livery caused a real stir on the factory site in Ehingen.

108 decibels – pure emotion
The “Yellow Wall” supports the home matches of Borussia Dortmund by generating a volume of up to 108 dB at Signal Iduna Park, which has a capacity of 81,360, making it one of the largest football stadiums in Europe. An LG 1550 played a major role in its construction.

The second largest church in the world
Nossa Senhora de Aparecida Cathedral in São Paulo, Brazil, is the largest Catholic church in the world after Saint Peter's in Rome and can accommodate 45,000 people. Two Liebherr mobile cranes were in action erecting the metal structure for the bell tower.


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A giant on land
The port of Rostock has invested heavily in the heavy load handling sector by purchasing the new TCC 78000. With a height of 164 metres and a lifting capacity of 1600 tonnes, the crane has been dominating the skyline at the port of Rostock since summer 2019.

Made with Liebherr

In the past they have been a great help, today they are absolutely essential – Liebherr mobile and crawler cranes are in action all over the world. Whether they are used for renovation and refurbishment work, spectacular or just everyday hoists – these cranes are helping to change the world.

Tandem hoist on bell tower

Two Liebherr mobile cranes were in action installing a metal structure for the bell tower at national treasure Nossa Senhora Aparecida, Our Lady of Aparecida, in São Paulo, Brazil. The project was completed by Brazilian crane contractor Guindastes Tatuapé. The erection work was part of the preparations for the 300th anniversary of the apparition of Mary in the form of a statue found in the Paraíba do Sul River. This anniversary was celebrated in 2017. An LTM 1750-9.1 and an LTM 1500-8.1 completed a tandem hoist for a metal structure measuring 36 metres and weighing 97 tonnes. The LTM 1750-9.1 had 114 tonnes of ballast and its telescopic boom was extended to 52 metres. The LTM 1500-8.1 was set up with 90 tonnes of ballast and a 61.9 metre boom. 13 bells were hung in the new bell tower. Twelve of them are dedicated to each of the apostles. The 13th and largest is in honour of the Virgin of Aparecida.

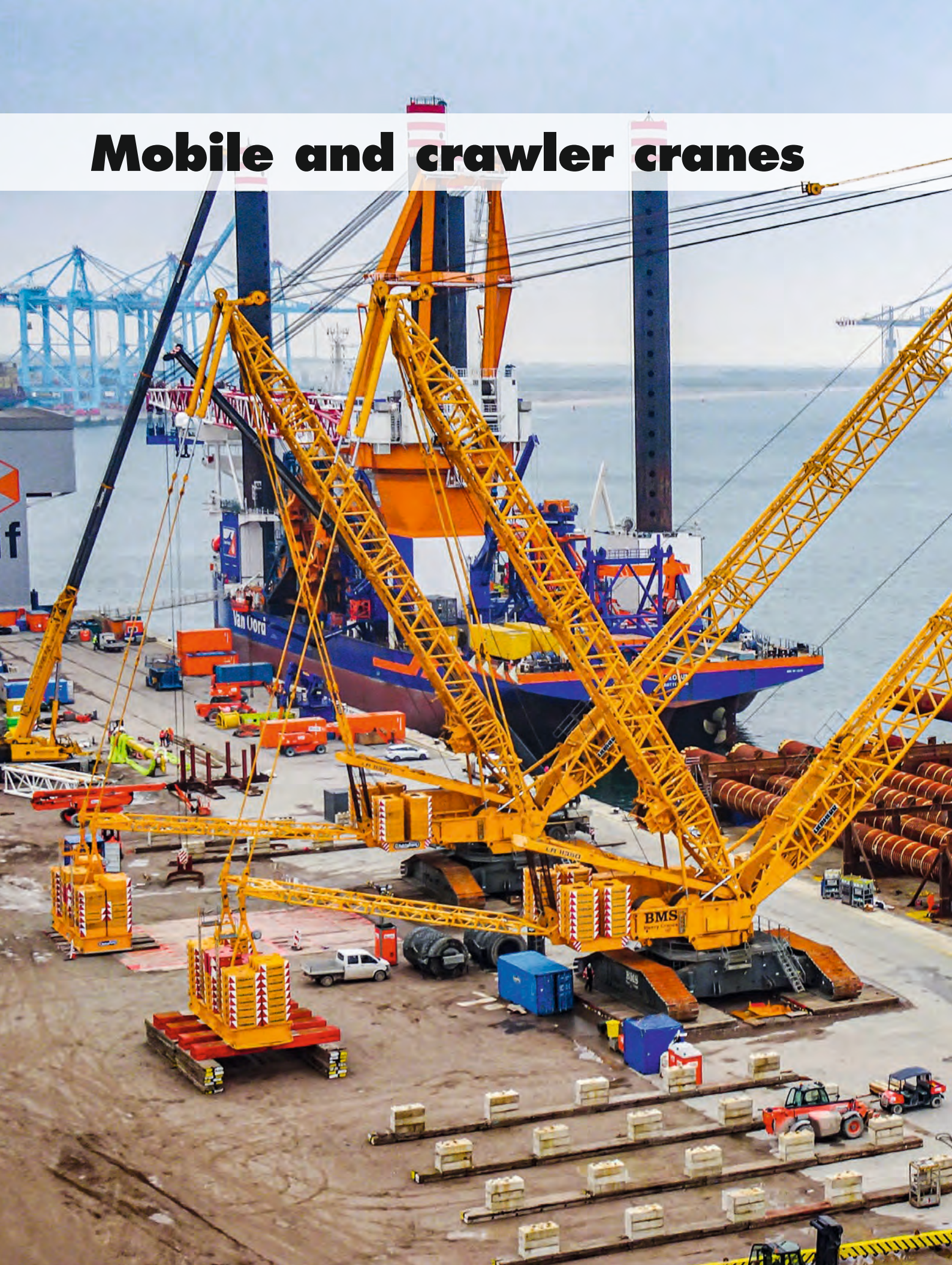
LG 1550 provide support for extension

The foundations for the original Westfalenstadion were laid in 1971. Built to host the World Cup in Germany in 1974, the stadium became the home of Borussia Dortmund after the tournament had ended. During the major refurbishment work carried out between 1995 and 1999, an LG 1550 was responsible for installing the steel girders to support the roof on the stands. Each roof girder weighs around 300 tonnes and measures 110 metres long and around 16 metres high. These girders were installed over all four stands. The LG 1550 from Fricke-Schmidbauer was in action there for several weeks at the time. The capacity of what today is known as the Signal Iduna Park was increased to 81,360 spectators during a total of three expansion phases – the “Yellow Wall”, as the south stand is known, can hold 25,000 spectators with a gradient of 37 degrees and is now the heart and soul of the stadium.

LTM 11200-9.1 and LG 1750 together on the quayside

The TCC 78000 was unveiled in August 2019 to great ceremony. TCC stands for Travelling Cargo Crane. It is a rail-mounted heavy duty crane which moves on a gantry between the Liebherr factory plant in Rostock and the edge of the neighbouring quayside. Its maximum lifting capacity of 1600 tonnes and total height of 164 metres with its boom projecting into the sky means that the TCC 78000 will not only dominate the skyline of the port of Rostock in the future, but will also help expand heavy load handling operations in Rostock. Fitted with a double chassis and a track gauge of 30 metres, it is designed to handle large goods of all types. An LTM 11200-9.1 from Megalift and an LG 1750 from Mammoet were both used to install the crane, including positioning the top section of the boom at a height of around 100 metres. Read the full story on page 86.

Mobile and crawler cranes



A special model on the harsh Atlantic coast

Just 21 months after the start of deliveries, the one hundredth LTM 1450-8.1 was handed over to its new owner in July. It went to the Atlantic coast, specifically to Niort in western France, where the 450-tonne machine upgraded crane contractor Bezombes' fleet. It saw its first action on the actual coast, in La Rochelle's marina.

From left to right: Guy Bellec, Francis Ebert (both from Liebherr Grues Mobiles SAS), Benoît Bezombes (Bezombes Niort), Christoph Kleiner, Georg Reinbold (both from Liebherr-Werk Ehingen GmbH).

"We had to replace our LTM 1250-6.1 after 13 years of good, reliable service because our customers are now demanding greater lifting capacity, more hoisting height and larger radii. That is why we invested in a crane in a higher performance class," explains Benoît Bezombes, Managing Director of Bezombes Niort. "The LTM 1450-8.1 is a member of the latest generation of cranes. It is safe, easy to use, quickly ready to start work and also energy-efficient as it is a single-engine crane."

The LTM 1450-8.1 was unveiled at the Bauma in 2016, featuring a completely new concept for 8-axle mobile cranes, with great economy and simple set-up on site being the main priorities. This means that this 8-axle crane is capable of travelling on public roads with a 12-tonne axle load including its complete 85-metre telescopic boom and all supports. This enables it to be prepared for use quickly once it reaches the site.

> “When I bought my first 250-tonne crane at the age of 25, Liebherr trusted and supported me. We have been working with the same people for over 15 years.”
>
> Benoît Bezombes,
> Managing Director of Bezombes Niort

The 85 metre telescopic boom was an important factor in the purchasing decision for Bezombes. “It enables us to erect tower cranes in record time. What is more, with its luffing jib, the crane delivers extraordinary lifting capacity values. VarioBase® and VarioBallast® makes us extremely flexible on constricted sites,” adds Bezombes. The company boss tested the crane personally at the Liebherr acceptance site and was delighted with the sensitivity and precision of the crane movements.

The benefits of the 8-axle crane played a major role in its first jobs on the Atlantic – a 35-tonne yacht had to be hoisted out of the cleaning dock onto a transporter in constricted conditions. As a result of the tight conditions, both VarioBallast® and the VarioBase® support base were used in full. The yacht was hoisted around 20 metres and then slewed through a row of trees and shrubs and on to the transport trailer using a radius of around 20 metres. The crane was set up with 44 tonnes of ballast for this job. The whole job, including driving to the site, setting up the crane and the actual hoist took less than four hours. This is where the concept of the fast-erecting crane on eight axles pays dividends. “The crane can be erected incredibly quickly and flexibly. What is more, the crane is really safe, particularly during the set-up, with all its railings and safety equipment. The LTM 1450-8.1 is simply a fantastic piece of equipment – it’s really fun to work with”, reports Bezombes.

The LTM 1450-8.1 is now the largest crane in the company’s fleet and will be used for jobs in industry, construction and civil engineering, wind power and for hoisting boats in and out of the water in Atlantic ports near the company’s headquarters. The crane and heavy haulage contractor has 14 personnel and 8 mobile cranes, almost all of which were supplied by Liebherr. “When I bought my first 250-tonne crane at the age of just 25, Liebherr trusted and supported me. We have a very close partnership with Liebherr. We have been working with the same people for over 15 years,” says Bezombes, emphasising the long term partnership with Liebherr.

Now even more powerful – the LTM 1750-9.1 gets an 800t upgrade

The nine-axle LTM 1750-9.1 mobile crane can now hoist even heavier loads. The use of refined static calculation methods means that lifting capacity values have been increased across almost the entire working range. This has converted the crane into an 800-tonne machine. The model name LTM 1750-9.1 will stay the same. A new luffing jib configuration has been prepared using existing elements to provide additional capacity increases for wind power applications. Cranes which have already been delivered can be retrofitted with the new system.

The wide-ranging experience that the design engineers and structural engineers have with thin-walled boom sections has enabled the popular calculation models and approaches of the finite element method to be further refined. Supported by high performance computers, the real load-bearing structure of the crane is simulated even better in the static calculation model. This makes new findings and methods possible which can be used in the development of new cranes. For example, for the LTM 1650-8.1, which was unveiled for the first time at the Bauma event. However, these new findings can also be transferred to existing cranes such as the LTM 1750-9.1. The most recent calculation standards have also been taken into consideration. As a result, the lifting capacities of the 750-tonne crane are significantly higher in most working ranges than those that were calculated at the market launch of the crane in 2012.

The new lifting capacity tables also contain a table with the nominal maximum lifting capacity of 800 tonnes. Owners of the LTM 1750-9.1 can now update the crane software with the new tables and, if necessary, add any additional equipment required.

There is also the fact that the LTM 1750-9.1 has broken into a higher lifting capacity class due to the new luffing jib configuration used for wind power work. So, for example, more than 10 tonnes of additional lifting capacity can be generated for erecting wind turbines on 90 and 100 metre towers. The LTM 1750-9.1 is also significantly more powerful for heavy duty hoists. One example of this is loading transformers into ships with normal working radii of 12 to 16 metres. The additional lifting capacity in these cases exceeds seven tonnes.

Furthermore, lifting capacity tables for three wind speeds are now available for this crane and for all the latest new developments. This delivers significant additional support for customers, both during job planning and in operation.

"We have completely recalculated the crane. The latest findings for calculating lifting capacity in compliance with all current standards have been taken into consideration – we have simply made the crane more powerful."

Holger Schilke, Structural Engineer, Liebherr-Werk Ehingen GmbH


Find out more:
www.liebherr.com/800t-upgrade

The finite element method

Simply explained

It is one of life's challenges – we are confronted with jargon whenever we read magazines, literature or even during conversations. In our new "Simply explained" column, we want to provide a simple definition to various pieces of industry jargon so that even non-specialists can understand what they actually mean. Tobias Haller, a structural engineer at the Liebherr Plant in Ehingen, explains the term "finite element method (FEM)".

"The FEM is extraordinarily important to us. If we did not have it, the lightweight construction that we use for our cranes would be inconceivable. We would not be able to supply our customers with cranes which have high lifting capacities on the one hand whilst being economical to drive on roads on the other.

Our daily bread in structural engineering is the question as to how much the material is stressed by external forces. The stresses on geometrically simple forms, such as a bar or cuboid, can be calculated using well-known physical formulae. But how can more complex forms be calculated if there are no formulae for them? And this is precisely where the finite element method comes in.

The body you wish to calculate is broken down into a finite number of parts with a simple form. In other words, for example, into lots of small cuboids or tetrahedrons. These are the "finite elements". The physical properties of each individual small element, such as the relationship between force and deformation or between heat and temperature, can be described by mathematical equations. This means that complicated forms can be calculated using lots of small bodies. Although this results in a large number of linear equations, fortunately they can be solved efficiently using modern computers.

"The FEM enables us to evaluate lots of different design ideas without having to physically build them. This, in turn, enables us to develop new solutions more quickly and bring them to the market."

Tobias Haller, Structural Engineer, Liebherr-Werk Ehingen GmbH

Let's take a look at a simple example (see Figure 1): A long narrow body is divided into nine finite elements. This results in 40 junction points which join the elements. Each junction point may be deformed by stresses in three spatial directions, x, y and z. This means that we have a total of 40 x 3 = 120 unknown deformations. To solve this, we require 120 linear equations. Figure 2 shows the deformations resulting after solving the equation system, whilst Figure 3 shows the stresses derived from the deformations in the body. The rule of thumb for both diagrams is that the redder the colour, the greater the stress. When we complete the calculations for our cranes, we obviously have significantly more finite elements to contend with, and therefore millions of equations. The more elements we have, the more precise the result will be. Nevertheless, FEM is still only an approximation method. Figure 4 shows the FEM evaluation relating to the deformation slewing platform on a vehicle frame.

FEM enables us to evaluate lots of different design ideas without having to physically build them. This, in turn, enables us to develop new solutions more quickly and bring them to the market."

Figure 1

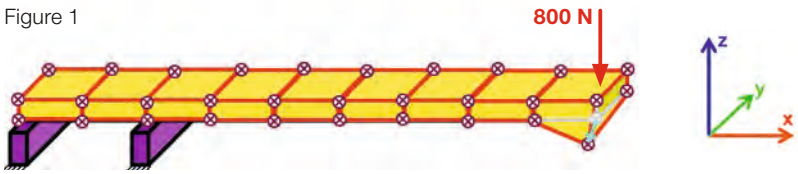


Figure 2

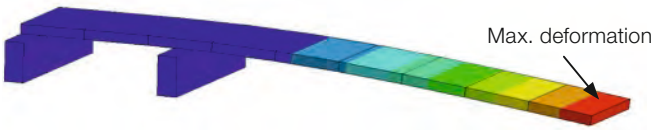
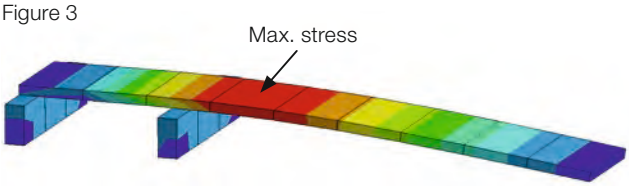


Figure 3



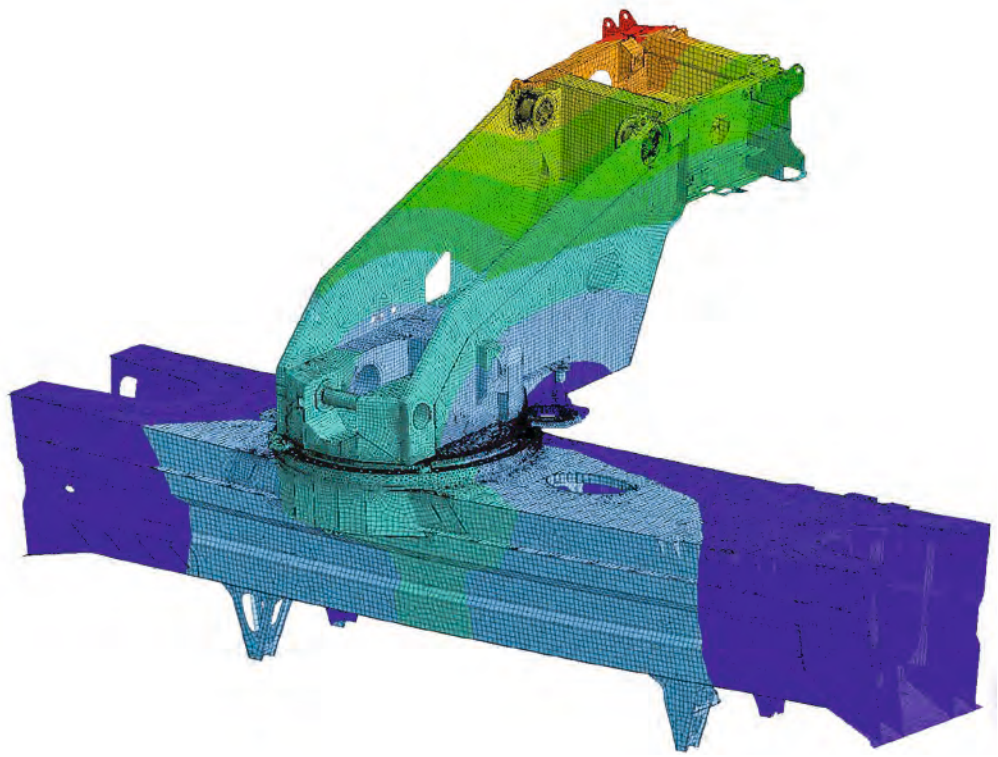


Figure 4

In the land of the ibex, chamois and marmot

A massive project is currently underway in the Swiss Alps. A new arched dam wall is to be built on the Grimselsee reservoir in the Bernese Mountains at an altitude of 1900 metres over the next six years. A container village has now been established for the workers and specialists who will build the new dam wall at the high altitude site.

“Spitallamm” dam wall on Grimselsee:

- Type: Double curved arched dam wall
- Construction period: 2019-2025
- Height: 113 metres
- Coping length: 212 metres
- Concrete volume: 220,000 cubic metres
- Cost: 125 million Swiss francs

A large crack, which covers almost the entire area of the old “Spitallamm” dam wall and splits the structure vertically into two segments resulted in the project for the new dam wall being created. Completed in 1932, at one time the Spitallamm was the highest dam wall in Switzerland at 114 metres from its foot to its coping. Concerns that the old wall would be unable to withstand the water pressure from the reservoir at Grimsel Pass if there was a powerful earthquake, led the developer, Kraftwerke Oberhasli AG, to start this ambitious project, with the new dam scheduled to be completed by 2025.

Swiss construction group Frutiger AG based in Thun is the lead contractor for the project, heading a consortium involving several companies. Liebherr mobile cranes and MK mobile construction cranes from the company’s fleet are frequent visitors to the Alpine site. An LTM 1130-5.1 worked its way up from Aare valley near Meiringen, around tight hairpin bends to the reservoir to build a container village on a rocky plateau between the two barrages on the glacial reservoir. The modern mobile crane was commissioned by Frutiger at the start of the year, replacing a nine-year-old LTM 1100-5.1. The Vario-Base® variable support system on the new crane was extremely useful for this high altitude job because the very small set-up area for the vehicle meant that it was not possible to extend all the outriggers in full.

A total of 60 residential containers were positioned precisely by crane operator Heinz Wittwer and his mobile crane in just three days. Radii of up to 47 metres were required for this purpose. 40 workers will move into their temporary accommodation after the winter break (no work will be carried out on the site during the snowy season).

The scheduled six-year construction period will be one year shorter than was required to construct the original massive dam wall at Grimsel Pass. Instead of around 600 people who worked on the old dam, the new project will require only around 100 specialists. As an aside, one advantage of building a new dam rather than refurbishing the old one is that the reservoir does not have to be drained at any time during the construction work, which means that power generation will not have to be stopped. Grimsel reservoir is supplied by glaciers and holds a volume of around 100 million cubic metres of water.

The VarioBase® variable support base makes it possible to use the crane.

Journey into the eternal ice

14,400 kilometres, 53 days and 4 different ships: it took a few strokes of logistical genius to transport a mobile crane to its destination on Earth's southernmost continent. This is how it all began.

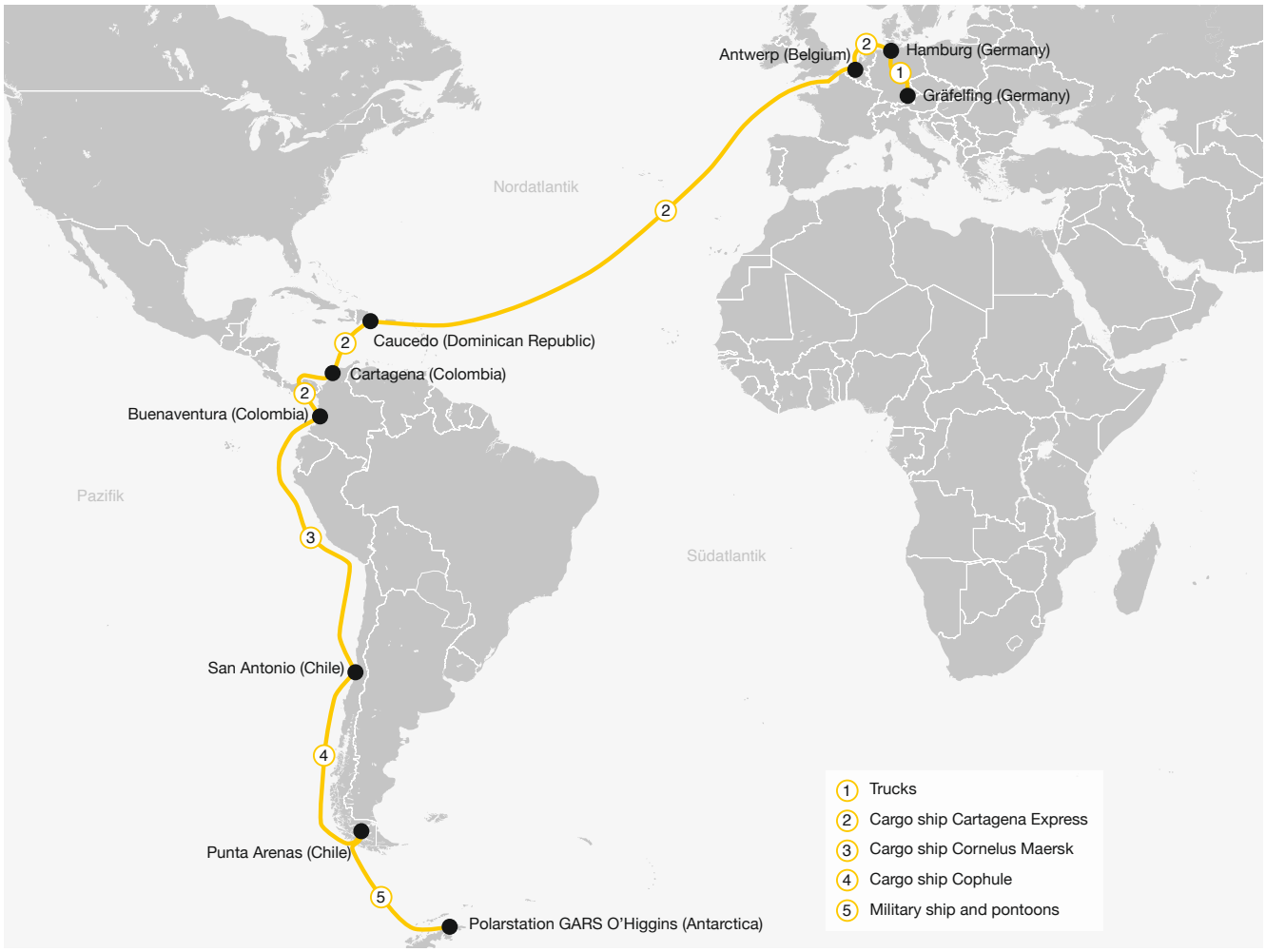
After 53 days of travel, the mobile crane reached its site: the polar research station GARS O'Higgins.

It's December, 21st 2017. Three days before the Christmas holiday, Schmidbauer, a system service provider of crane technologies, receives an order approval from the German Aerospace Centre (DLR): one Liebherr LTM 1040-2.1 mobile crane is to be transported to Antarctica to help redevelop a polar research station. "After that, it was a race against time', recalls Minka St. James, who managed the Antarctica project at Schmidbauer. "The crane needed to be shipped within just two weeks, or else we would have lost a whole year.' Options for transporting equipment to Antarctica are extremely limited. The last stage from the southern tip of Chile to the research station is only possible through a joint effort by the German Aerospace Centre and the Chilean military.

Another challenge came in the form of strict environmental regulations. Ships are not permitted to dock directly at the pier next to the research station to avoid disturbing the penguin population that lives on the island. Instead, they must offload their cargo onto pontoons, around two kilometres off the coast. However, these shallow floats, similar to rafts, can only carry loads of up to eight tonnes. So within the span of two weeks, Schmidbauer must not only deal with the challenge of transporting the crane to Antarctica, but also dismantle it into individual parts and then plan how to reassemble it on site once it arrives.

Securely packed, the crane's individual parts are loaded onto trucks for the journey to the Port of Hamburg, where they are then transferred to the container ship the "Cartagena Express".

"Despite the difficult conditions, it was clear to us that a delay was not an option', explains Minka St. James. By the beginning of January, the crane's individual parts were shipped out from Schmidbauer's headquarters in Gräfelfing near Munich.



The first stop on the cranes route was the Port of Hamburg. From there, the cargo passed through multiple legs on a journey across the North Atlantic, then along the western coast of South America, before reaching Antarctica. The crane even crossed the Panama Canal.

Within three days, the LTM 1040-2.1 mobile crane was disassembled into individual parts for transport. Each part could not exceed the weight limit of eight tonnes.

On board the military ship Oscar Viel, the crane is returning the last leg of its journey.

An interview with three crane experts

Preparation is everything, especially during a mission to Antarctica. This fell onto the shoulders of workshop supervisor Michael Paul and his assistant Charlie Zöllner from Schmidbauer, who worked on the crane from when it was disassembled in Gräfelfing until it was reassembled in Antarctica. During the disassembly process in Germany, they were supported by Tobias Hunger, a customer service representative from the Liebherr plant in Ehingen.

Mr Paul and Mr Zöllner, do you often find yourself working on a job like this?
Michael Paul: No, this was a brand-new experience for me. When a colleague first told me that we would be assembling the crane in Antarctica ourselves, I thought he was joking at first. A job in Antarctica is completely out of the ordinary and it takes a lot of preparation.

Charlie Zöllner: I doubt I will ever work on another job like that again in my lifetime. In 2017, I hadn't even been working at Schmidbauer that long, and this was my first job abroad. That was definitely quite extraordinary.

Charlie Zöllner and Michael Paul (from left to right)

You received the order just before Christmas in 2017 and the crane left the warehouse on 2 January 2018, all within the space of less than two weeks. Can you tell us about the preparations you made on the shop floor?
Michael Paul: There was a lot of pressure to do things quickly because disassembling the crane wasn't the only thing we had to do. We also had to prepare and pack all the spare parts and tools we would need for the installation on site. Things also became quite stressful when we needed to have individual crane parts packed by a specialist company and when we had to receive a large delivery of spare parts from Liebherr. Because of the tight schedule, everyone had to work at maximum capacity.

How did you go about disassembling the crane?
Michael Paul: Disassembling a crane is by no means standard procedure. Plus, the individual parts all had to weigh under eight tonnes and had to fit within specific dimensions. So we worked very closely with Liebherr customer service whilst we were disassembling the crane.

Tobias Hunger

Tobias Hunger: It's our job to solve our customer's problems while also working to a tight schedule. But even for us, this was an unusual challenge. We studied the crane's technical drawings and developed a disassembly plan. We had to improvise certain things during the disassembly process; for example, we had to prepare a new, smaller diesel tank for the engine in the crane's undercarriage. Normally, the diesel tank for the undercarriage is located in the superstructure, but that had to be removed to keep within the weight limits. It was imperative that the engine would function correctly whilst the crane was being assembled on site. As we were disassembling the crane, it was also important to consider how it would be reassembled in Antarctica. We wanted to make sure that we would be able to reassemble it in as few steps as possible under the harsh weather conditions there.

The crane was shipped out at the beginning of January. You flew to Punta Arenas (Chile) in March where you were reunited with the crane and then you escorted it on the final leg of the journey to the research station. How was that part of the trip for you?
Michael Paul: We very quickly learned a local saying: 'In Antarctica, the only certain thing is that nothing is certain.' So for example, it took longer than expected to transfer the crane's parts onto the pontoons because of all the ice floes floating off the coast of the island. Even just positioning the outrigger on the pontoon was very stressful because of its size. We had to guide the lifting work from a small motorboat. But to get down to the boat, we had to climb down a metal ladder on the side of the military vessel. It was a long drop, looking down the side of the ship. That was a pretty scary sight.

How different is it assembling a crane in Antarctica compared with assembling it back at the factory?
Michael Paul: We have specialised tools at our disposal in Gräfelfing and we can always order any spare parts we need at short notice. In Antarctica, it usually takes several weeks for a shipment to arrive. That made the planning stage in Germany even more important. There were plenty of sleepless nights for me. But in the end, everything worked out. Even though the crane parts were unloaded and reloaded multiple times, in the end, we were only missing four bolts, which the Chilean colleagues have kindly provided to us.

Charlie Zöllner: The conditions on site in Antarctica are like nothing else we'd ever experienced. Instead of working in an enclosed shop floor, we had to assemble the crane outdoors. Although we were actually pretty lucky with the weather, with temperatures around the freezing point, it's a good thing we had our protective clothing with us because of the powerful Antarctic winds. We also fully appreciated the kindness of our fellow men when working on the island. For example, the Chilean military let us use a smaller crane during the assembly.

How does it feel to look back on all your hard work when you see that the crane is finally fully installed?
Charlie Zöllner: You just pray that after all the work, the crane will actually start up. You can imagine how relieved I was the moment I turned the key in the ignition and the crane started up immediately.

Michael Paul: Me too. I mean that shows that all our planning had really paid off. Looking back on it, I was especially impressed by how well everyone worked together, from the support we received from the German Aerospace Centre, to the expertise shared by Liebherr during the disassembly phase and then the help we received on site from the Chilean military. If it hadn't been for that level of teamwork, a project like this would never have been feasible!

German research at the South Pole

The German Aerospace Centre has been operating a polar research station on a small island around 30 kilometres off the northern tip of the Antarctic peninsula since 1991. The German Antarctic Receiving Station (GARS) O'Higgins receives satellite signals and Earth observation data via an antenna that was specially designed for operation in Antarctica. This data is analysed as part of multiple research projects and is fed into national and international databases. The data provides researchers with significant insights into how Antarctica is changing. This can also be used to help researchers learn more about the way the climate is changing worldwide.

Since 2010, the station has been operated by a team of four researchers all year round. For around two to three months each year, the researchers here must endure temperatures between -20°C and +8°C and wind forces of up to 200 kilometres per hour. The research station is divided into two units: one building houses the research facilities and the other contains the additional technical infrastructure. This infrastructure is essential because the station is operated autonomously and runs off its own power supply from diesel generators. There is also an osmosis installation for water treatment and a biological purification system. The infrastructure building

needed an overhaul, so plans were made to renovate and extend it by 2022.

A confined construction site at the end of the Earth

One of the challenges for the construction work is the lack of space on the island, which is only 300 x 200 metres in size. The German research station is also directly adjacent to the Base General Bernardo O'Higgins, Chilean Antarctic Military Base. “It was absolutely critical for the German Aerospace Centre that the crane could be manoeuvred in these cramped conditions and that the construction site could be fully covered from a single location”, explains Minka St. James, who directed the project for Schmidbauer.

Customer service is also extremely important, even in Antarctica. It is crucial to use the short summer period as efficiently as possible because that is the only time of year in which construction work can be carried out and the transport routes are navigable. There is no time to waste. “That’s why we chose a Liebherr crane because, in the event of an emergency, an engineer can be sent to the research station from the Liebherr customer service centre in Chile”, Minka continues.

Once the crane was assembled, it was immediately shored up for the winter. All the test runs were successfully completed during the following Southern Hemisphere summer (December to March of 2019). The construction work to extend the research station kicked off officially in November 2019 and is expected to be completed in 2022.

Find out more:
www.liebherr.com/antarctic-crane

Jobs with the folding frame work perfectly


EMIL EGGER
SOUTH ROCK
THOMY

V-frame proves itself in practice

Our LR 11000 has successfully completed its first jobs using the innovative, highly flexible “V-frame” ballasting system. The 1000-tonne crane operated by Swiss crane logistics contractor Emil Egger AG completed a spectacular bridge hoist near Lausanne and also removed an old lightship from the River Rhine in Basel. If the V-frame had not been used, these two crane jobs would only have been possible at significantly higher cost.

Almost there – the two large hydraulic cylinders extended the derrick ballast to a radius of 28.5 metres for positioning the railway bridge. The maximum possible radius is 30 metres.

The bridge site is Moudon in western Switzerland was a real challenge – extremely restricted space, protected trees and a heavy bridge which had to be positioned over a river with a 180 degree slewing process by the crane with a large radius and therefore also a large suspended ballast radius. The demanding requirements on site therefore created perfect conditions for a stiff practical test for the first use of the new V-frame on the LR 11000. “Without the hydraulically adjustable ballast radius, hoisting the bridge would have been significantly more expensive,” is how Managing Director and crane enthusiast Michael Egger explains the solution he provided for this job. “Firstly, it would have required much more expensive work on the embankment to get closer to the abutments with a crawler crane. And then we would also have required a much longer crane track to complete the bridge immediately in front of the abutment.”

Right at the heart of things – Managing director Michael Egger securing the attachment equipment.

The benefit of the VarioTray – with the central section of the ballast disconnected from the derrick boom, the crawler crane can position its suspended ballast pallet itself.

Variable ballast radius from 13 to 30 metres creates flexibility

However, the V-frame made this expensive additional work superfluous on this site. The new development from the Liebherr Plant in Ehingen made it possible to reduce the radius of the suspended ballast to just 13 metres once the 380 tonne load had been hoisted. As a result of this small radius, the ballast pallet could be carefully guided past a small row of protected trees during the slewing process. When the railway bridge was placed on its abutments at a radius of 38 metres, the hydraulic ballasting device pressed the 440 tonne derrick pallet at a distance of 28.5 metres. “Another benefit of using the V-frame for jobs,” continues Egger, “is that the derrick ballast pallet has a maximum ground pressure of 150 kilonewtons per square metre thanks to the integral load distributor plates. The ground pressure from a ballast trailer is at least three times higher and therefore often requires expensive work to prepare the ground.”

Michael Egger has long been convinced by the benefits of a hydraulically adjustable folding frame for the suspended ballast. That is why he discussed this solution when he ordered his LR 11000 with Liebherr at the start of 2017. The design of the V-frame for the LR 1800-1.0 was in full flow at that time and Liebherr unveiled it at the Customer Days in 2018.

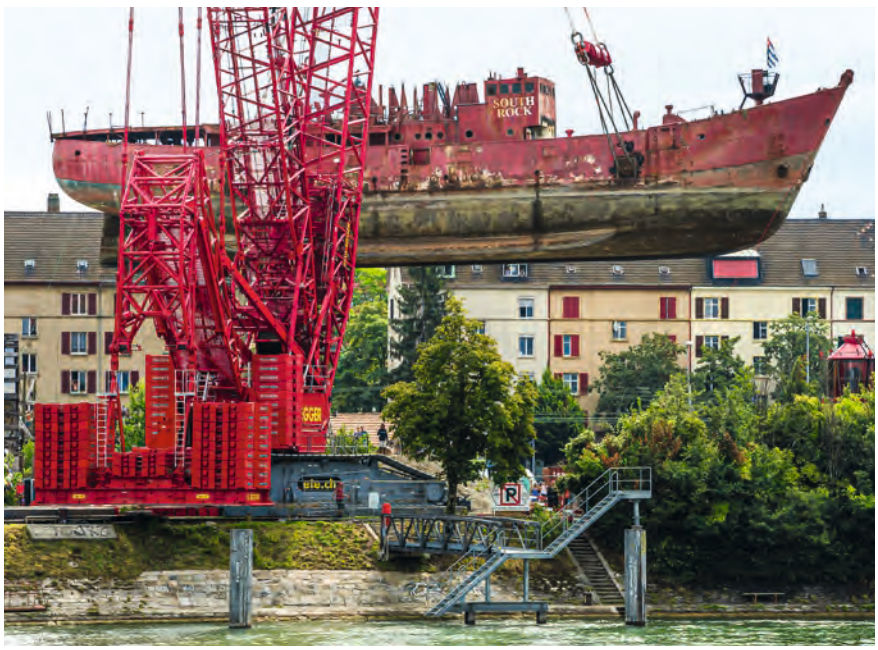
> “The V-frame on the LR 11000 has two joints to achieve the enormous adjustment range from 13 to 30 metres.”
>
> Clemens Norz, Designer, Liebherr-Werk Ehingen GmbH

As a result of Egger’s request, the decision was made to design a similar system for the 1000-tonne crane. Clemens Norz, Designer in the Crawler Cranes department at Liebherr, remembers it well: “Mr Egger had a very clear idea of what he wanted and we were then able to make even the details into reality. The important things for him were a large adjustment range for the ballast radius and the ability to retrofit it to his LR 11000, in other words, a crane we have had in our range for several years. That was a challenge for us. The suspended ballast radius had to be significantly reduced to hold the ballasted pallet without a load on the hook in the air. On the other hand, the maximum ballast radius of 30 metres had to be achieved so that the entire lifting capacity of the crane can be used. The V-frame on the LR 11000 has two joints to achieve this enormous adjustment range from 13 to 30 metres.”

The design and the structural calculation of the V-frame saw Liebherr enter a whole new world. Norz explains: “We had to recalculate the complete erection concept and the new loads for the crane. Another important point was that the LICCON crane control system enables the V-frame to be adjusted automatically during crane operation so that the crane operator can concentrate on the load. We also came up with a few snazzy details. For example, the available oil volume for the extension cylinders is limited by the capacity of the oil tank. To counter this, we use an extraordinary cylinder design in which the rod volume of the cylinder is used as an additional tank.”

VarioTray makes auxiliary crane for ballasting superfluous

Another clever feature on Egger’s crawler crane ensured that the job on the bridge site in Moudon was completed quickly – the VarioTray detachable ballast system. The facility to simply unbolt the central section of the suspended ballast means that there is no need for a mobile crane to stack and destack the ballast slabs. “Because of the situation on the site, we would have needed a large crane for this job – we would have lost an enormous amount of time and required a great deal of space,” says Egger. “In most cases, our LR 11000 can position the derrick ballast pallet, or at least the outer section, itself since the central section of the ballast remains on the crane and therefore only around 300 to 350 tonnes have to be moved.”



The adjustable ballast allowed the load to be slewed past buildings and obstacles.

Lightship becomes event location

Just a few weeks later, the V-frame was able to show its strengths yet again when it hoisted a 550 tonne ship onto the banks of the River Rhine in Basel on the same crawler crane. The adjustable ballast system was used for this job because there were buildings and obstacles in the way of the derrick ballast during the slewing process.

"Gannet", a 42 metre lightship will be used as an event location for up to 300 people in an event and culture park in the port district of Basel. Before its decommissioning in 2010 it showed seafarers the way for around 70 years near South Rock in Ireland. In spring it was towed over the English Channel to the River Rhine via Rotterdam. The light tower had to be dismantled so that it would pass under bridges. Once it arrived at its new location, the light tower was reinstalled on the ship to be used as a radio transmitter.

The light tower will be used as a radio transmitter.

Support from the manufacturer

Liebherr monitored and supervised the first use of the innovative V-frame technology closely from the very outset. During the hoist on site, three members of the team from the Ehingen crane factory where present to provide support, just in case. A service technician, a machine tester and the programmer of the software for the hydraulically adjustable folding frame were involved in the whole process from setting up the crane to positioning the bridge in Moudon. But that's not all: “First of all, we used an identical crane on our test site in Ehingen with the same set-up configuration, the parameters from the Swiss site and of course a load of the same weight to simulate this hoist”, says Dominik Gemeinder, who works at the acceptance testing site for crawler cranes in Ehingen.

Crane operator Michael Egger is a person who appreciates this service and customer proximity from Liebherr. “We had never worked with the V-frame before and it was really great that Ehingen offered us this superb support for its first job. Perfect.”

Customer proximity literally – Software Developer Matthias Ströbele, Service Technician Albert Götz and Machine Tester Dominik Gemeinder (from left to right) monitored the first job completed by the V-frame closely.

Find out more:
www.liebherr.com/vframe

The birth of an ocean giant

Visiting giants

The boom in cruising has been going on for years. Demand for new ships is therefore enormous. And because the demand is not just for more, but ever larger ocean-going giants which can provide accommodation and pleasure for as many as 6000 passengers, some shipyards are slowly coming towards the limits of their capacities. This means that shipbuilders are becoming increasingly reliant on mobile cranes. A shipyard report from Emsland.

The little town of Papenburg is right up in the north of Germany, just a few kilometres from the Dutch border. This is where, 50 kilometres from the coast and only linked to the North Sea by a river and a wide bay, you will find the massive buildings of the traditional Meyer Werft, which can be seen from miles around in the flat landscape. The shipbuilding business was founded in 1795, launched its first cruise ship 35 years ago and is now one of the global players in this booming segment. And although the eager shipbuilders in Emsland have the largest covered construction dock in the world, the business appears to be bursting at the seams. Because the building, which measures over 500 metres in length and 75 metres in height, is often too low for the ocean-going giants, the high components such as funnel casings and antenna systems are increasingly having to be installed in the open air. Furthermore, the time pressure in the construction docks is so great that the floating sections, which are up to 140 metres long and are later assembled to produce the luxury liners, are often guided out of the docks and completed outdoors. This is where large mobile cranes come into play. For many years, crane service providers Gertzen and Ulferts, based in Lower Saxony, and their mobile cranes have been providing support to the Papenburg-based shipbuilder with the construction of their “floating towns”.

The finishing touch – three Liebherr mobile cranes from Ulferts GmbH hoist material on board a completed Meyer Werft luxury liner in the harbour at Emden.

Urgent work in the construction dock – when time is at a premium and the gantry cranes are working on other things, an LTM 1130-5.1 has sometimes had to install the enormous ship's screw.

"Nowadays we take our large cranes to the Papenburg shipyard around three times a year", says Managing Director Wolfgang Gertzen, whose company provides crane and heavy haulage logistics services from its headquarters in Kluse, 20 kilometres away. Ulferts cranes are also frequent visitors to the shipyard site. Generally, several mobile cranes are in action at the same time, working on the final phases of a finished luxury liner, shortly before it is handed over to the customer. For the first time this summer, an LG 1750 lattice boom crane, operated by Nolte-Autokran based in Hanover, made its way through the Papenburg works gates. A large glass domed roof measuring around 1000 square metres had to be installed over the pool on the sundeck in one of the centre sections of a vessel. This job was certainly not an everyday event and proved to be extremely complicated.

All a matter of routine: "The difficulty with this job was actually to spread the load evenly over the twenty suspension points", says Jürgen Peters in an interview. He is responsible for large crane jobs at Nolte.

Find out more:
www.liebherr.com/
cranes-ocean-giants

To prevent damaging the filigree dome structure, which is made up of 340 separate panes of insulated glass, its weight had to be spread evenly over 20 fastening points. It took hours before the curved, oval glass roof was finally suspended on the lifting tackle and levelled using the special cross beam. Hoisting the domed roof with a gross load of 138 tonnes was almost simple by comparison. The hoisting process took less than half an hour before the installation workers could secure the free-standing glass dome on its supports on the ship section.

In action for decades

The frequency of jobs for mobile cranes at the Meyer Werft site is rising steadily. The shipbuilder's plans for the future include handing over three finished ocean-going giants per year to its customers in Papenburg. During the 1990s, only around one cruise ship per year was actually launched there. This high ship output is made possible by a highly complex logistics system with a sophisticated build strategy, 3500 works personnel and hordes of workers from external service providers. And, of course, the frequent use of our modern cranes on the works site.

For decades, Liebherr mobile cranes have been hoisting heavy or large elements onto cruise ships shortly before their completion. If the strict timetable of the shipbuilders so demands, the crane operators and their teams will even work in darkness. Four years ago, two LTM 1750-9.1 cranes had to position the funnel casing on the "Anthem of the Seas" during the night, as the delivery date for the ship, which can accommodate almost 5000 passengers, was imminent. And even in the construction docks, Ulferts or Gertzen mobile cranes are very welcome helpers, taking the strain when the shipyard's own gantry cranes simply cannot keep up with all the work. By Papenburg standards they are small, but important assistants in the logistical masterpiece of building cruise liners in Emsland.

The general fitting out team required space parallel to the set-up areas for the cranes.

Total precision at night – the two cranes (Thömen and Gertzen) carefully guide the funnel casing between their two luffing jibs.

Why is the LG 1750 lattice boom mobile crane so successful?

Background

Liebherr will deliver the hundredth LG 1750 in mid-2020. Although there is a large number of crawler cranes in this lifting capacity class, crane contractors continue to choose the LG 1750 lattice boom mobile crane. We asked Klaus Huberle, General Manager Crawler Cranes at Liebherr, why is this crane concept so successful?

"Our customers are generally always looking for the most economical crane concept – maximum lifting capacity, as few transport vehicles as possible and very short set-up times. Telescopic mobile cranes are best at meeting these requirements but the telescopic boom soon reaches its limits in terms of lifting capacity. Where the telescopic crane has to give up in performance terms, the LG concept comes into its own as the lattice boom delivers significantly higher lifting capacities due to its design. It can also be supplemented with a derrick system, which enables it to reach lifting capacities which are a multiple of those that a telescopic crane can achieve.

This has always been the case. For example, at the start of the 80s we built telescopic mobile cranes such as the LT 1300 with a lifting capacity of up to 300 tonnes on 8-axle chassis and lattice boom cranes that could lift up to 500 tonnes on the same chassis. Let's just look at the 8-axle LG 1550, which is still popular today, and was launched a few years later. It shared its chassis with the LTM 1800.

The higher lifting capacity of the lattice boom crane comes at the price of greater transport volume and a longer set-up time for the boom, but the benefit of the chassis with tyres of the LG crane remains. If, for example, we compare the LG 1750 with its counterpart, the LR 1750 crawler crane, the crawler crane chassis requires three transport units for the two crawler tracks and the centre section plus 95 tonnes of central ballast. The LG chassis, on the other hand, can be driven fully equipped to the site and requires very little set-up time.

The LG concept also delivers other benefits. In contrast to the crawler crane, the lattice boom mobile crane does not necessarily need a flat surface as it can be levelled using its four outriggers. The ground pressure from the supported crane is precisely defined and is generally lower than that of a comparable crawler crane. These are benefits on all sites, whether the crane is on a wind farm or performing heavy duty single hoists.

The special success of the LG 1750 is certainly also due to the fact that we did something new with this crane. We did not use an existing chassis from a telescopic crane, as we had done in the past, but designed a very specific new undercarriage. The focus of this process was to enable the crane to travel between sites with some of its equipment at low cost. That is why it has particularly strong crane axles and tyres. This means that the LG 1750 can carry up to 40 tonnes per axle.

We must also mention the main benefit of a crawler crane at this point, however. It is very flexible to use as it can move with a full load on its hook. However, this requires a solid surface and the track must be adequately wide. These conditions are often not satisfied, however, particularly in wind farms. This is where the LG 1750 can show its strengths with its narrow chassis as the complete basic crane can be moved around the site. Its concept and its lifting capacity are unique. That is why, in addition to crawler cranes, Liebherr will continue to build LG cranes as a result of the benefits they offer.

All the crane types mentioned above have their own advantages. The good news for you is that we can always offer you the right crane with the perfect concept for your needs."

Steel colossus on the hook


CREST
BAZAN 1

LR 13000 saves time and money

Just three hours rather than the normal 18 and no need to close the waterway – all made possible by the most powerful conventional crawler crane in the world. Mexican crane and heavy haulage contractor ESEASA used its Liebherr LR 13000 crawler crane for the first time to load oil platforms onto barges at the port city of Tampico.

Tampico is on the Gulf of Mexico and is a major industrial centre with its own port. A large number of industrial companies have made their homes on the banks of the Rio Pánuco, to enable them to ship their freight down the river to the sea. ESEASA also has a company site directly on the banks of the waterway. The company is currently manufacturing seven oil platforms there for state oil group PEMEX. These were hoisted onto barges in component form by the LR 13000 before being transported to the south of the Gulf of Mexico.

ESEASA is currently manufacturing seven oil platforms for state oil group PEMEX.

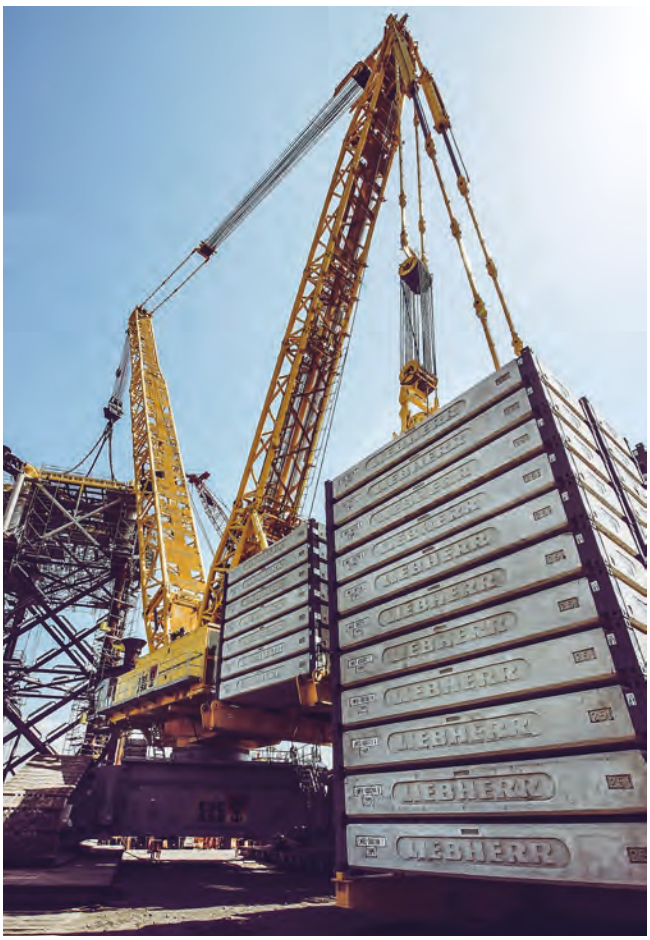
Liebherr developed the extremely powerful slewing ring on the LR 13000 in-house.

Santos appreciates having a direct line to Liebherr and its reliable service around the clock. “We require competent service and fast solutions for our projects. We cannot accept delays, we need solutions on the day,” explains Santos. “Liebherr provides us with excellent support and also ensures that well trained technicians are normally available. We also appreciate the high quality of Liebherr cranes.” The main areas of work for ESEASA are in the energy sector, such as petrochemicals and wind power.

The loads for hoisting were gigantic. Up to 1200 tonnes had to be positioned on the barges using a radius of up to 38 metres. Our 3000-tonne crawler crane is ideal for this work and delivers significant benefits compared to the previous method for loading oil platforms. Normally the heavy components are loaded onto SPMTs (self-propelled modular transporters) using jack-up systems and then driven onto the barge on them. This takes around 18 hours. To be loaded in this way, the barge must be positioned front-in at a 90 degree angle to the quay and held in place by several tugs. In this position, the barge extends so far into the waterway that it has to be closed for a significant period, costing an enormous amount of money.

Loading the enormous steel structures using the LR 13000 took just three hours and the barge could be secured alongside the quay. Tugs were required for significantly less time which saved a great deal of money and the canal could be left open for shipping. Since no heavy SPMTs had to drive onto the barge with the steel components, smaller barges could be used, therefore also reducing costs. Aldo Santos, who owns ESEASA along with his four brothers, was delighted: “Loading the massive components using the Liebherr LR 13000 worked perfectly and is significantly more economical than our previous procedure. The extremely short time required is extraordinary.”

Heavy haulage and crane contractor ESEASA based in Mexico City, has three LTR 11200 cranes, three LTM 11200-9.1 machines and one LR 11350 as well as an LR 13000. Aldo



For low cost transport, the ballast slabs for the LR 13000 have precisely the same dimensions as a 20 foot container and can be loaded with a spreader.


ADW MOBILKRANE
LCY-101
LCY-102
ADW
C06109/50111-0

Cleaning job in a chemical plant

Cleanness in chemical plant – Mobile construction crane makes sanitisation of chemical plant possible

From setting up the site at the reactor to lifting in environmental service employees, to the (dis)assembly of diverse scaffolding, the MK 140 Plus mobile construction crane has been in constant operation at a chemical plant. In the German city of Stade, a reactor was shut down, cleaned, serviced and overhauled.

Assigned diverse tasks, the MK 140 was in almost daily demand for around 10 hours per day, over a nine-week period at the wastewater treatment reactor of the American chemical company Dow. Its 58.5-metre maximum radius in trolley mode meant the crane was able to cover the area of the reactor with ease. “We had already achieved positive results with an MK 110 for work on a previous reactor. However, it was already pushed to its limits back then. As the new reactor is higher still, and we had to hoist significant loads again, we decided on a MK 140 this time round – purely because it offers the necessary hoisting height,” says Alexander Kehrbach, Work Coordinator at Dow.

Let there be light

The construction site needed optimal lighting from the outset as some of the work was carried out well into the night. For this purpose, the MK 140 lifted the necessary material, including site lighting, into the reactor. Supplemented by the light of the LED floodlights positioned on the MK 140’s jib, the reactor and its environment were brightly lit, early and late each day.

For especially heavy loads, such as the scraper bridges, the mobile construction crane MK 140 was temporarily supported by a Liebherr LTM 1500-8.1 mobile crane.

Lifting to the limit

The heaviest part to be lifted by the MK 140 was a reactor cover weighing 2,800 kilogrammes. This was at a reach of 33.5 metres and the cover had to be lifted out into the open from inside the reactor. “The radio remote control was perfect for this: I was able to move freely and always had the load firmly in sight,” says Crane Operator Stephan Achenbach. He was impressed time and time again by the precise control of the MK, even with such heavy loads on its hook. The reactor cover was set down outside of the reactor and later sandblasted before being put back in its place once the sanitisation process was complete. For even heavier loads, the MK had the temporary support of an LTM 1500-8.1 Liebherr mobile crane, which has been a successful part of the crane services company Hüffermann for many years. This crane, for example, lifted the 12-tonne scraper bridges out of the secondary sedimentation tanks and then positioned them again after repairs.

Within four days and three night shifts, the MK 140 lifted a total of 125 tonnes of scaffolding material.

Playing it safe

For the precision sanitising of the secondary sedimentation tanks, the MK 140 lifted several employees of a sanitisation company into the reactor in a specially authorised passenger transport cage.

Well equipped for scaffolding

In order to apply a completely new coating to the reactor after its sanitation, a large scaffold was erected inside. This meant that the MK 140 had to lift a total of 125 tonnes of scaffolding material within four days and three night shifts. In addition, the MK 140 also lifted the mobile scaffolding for the sedimentation tanks as well as various other materials and further perforated sheet metal covers into and out of the reactor.

> “The remote control fits perfect for this case: I was free to move and always had the load firmly in view.”
>
> Stephan Achenbach, crane driver, Krandienst Hüffermann

Crane operator Stephan Achenbach had everything in sight at all times thanks to the trolley camera.

Additional safety, especially for this phase of operation, was ensured by the presence of a redundant power supply and the trolley camera, which enabled crane operator Stephan Achenbach to have everything in sight at all times. Two weeks before the start of this phase, the commissioned crane service provider Hüffermann ensured that the passenger cage was officially authorised for use. Good to know: For faster handling of projects of this type, Liebherr offers specific additional equipment for the MK 140 for passenger transport. In Germany, a mobile construction crane with this equipment is automatically compliant with the passenger transport regulations from the authorities (BG Verkehr).

Crane Operator Stephan Achenbach was completely satisfied, “It was a job with lots of different aspects and tasks – sometimes involving radio remote control, sometimes the height-adjustable cab. Plus the team work of those involved was great. Overall, it was good fun,” says Achenbach.

In focus

50th anniversary of the Liebherr Plant in Ehingen – a reason for celebration

The anniversary party for our personnel took place in July on the factory site in Ehingen in superb weather. After being welcomed by the management team and watching a film presentation about 50 years of Liebherr in Ehingen, they enjoyed a relaxed atmosphere with live music, food trucks and drinks. And as promised in the last edition of Upload, we are delighted to provide you with a few photographs of our 50th anniversary celebration.

To the ends of the Earth

In 2014, Liebherr-Werk Ehingen GmbH celebrated the delivery of its 30,000th mobile crane. Since then, an average of 1700 new cranes have been added to the number per year which means that we will reach the 40,000 mark in 2020. The new cranes and more than 200 used cranes as well as over 70,000 shipments of spare parts are supplied every year to the far ends of the Earth. Commercial laws, customs duties, licensing procedures and transport restrictions are not the only problems we face every single day, we also have to deal with trade disputes and embargoes. We talked to our CFO Mario Trunzer, our Dispatch Manager Benjamin Buchmüller and our Customs / Import Manager Michael Schuster about the challenge of getting cranes and crane components to precisely where our customers need them.

How are our cranes shipped to customers in Germany, Europe and overseas?
Benjamin Buchmüller: Our German customers mostly collect their cranes in person from the manufacturing plant. We deliver cranes to other European countries and overseas straight to the customer on site or to the destination port or our local branch companies. The basic units for the mobile cranes are primarily transported on their own wheels. If possible and sensible, we also use waterways. For example, we transport machines for our customers in the Netherlands on barges from Mannheim to Rotterdam. In addition to transport by truck, we also use railways to transport crane accessories. For example, last year we transported 160 wagon loads of crane accessories from Ehingen to sea ports, from where they were shipped to our customers.

Loading the pivot section of the LR 11350 in Bangladesh

Overseas deliveries generally use so-called RoRo (roll-on, roll-off) vessels. These are essentially floating car parks which were initially created for transporting cars. In addition to space for around 6500 cars, they have heavy duty decks for transporting construction machinery, tractors or, of course, mobile cranes.

Mario Trunzer: As we are a company with direct sales and a high proportion of exports, it has always been a massive challenge to send cranes to exotic corners of the world. That is why we established an efficient shipment department very early on and why export procedures and controls have been normal practice for us for a long time.

Furthermore, we work with a reliable network of logistics services partners from haulage companies and forwarders to port authorities and shipping companies.

What are the actual challenges involved?
Benjamin Buchmüller: One of our greatest challenges over the last few years, and one which will certainly remain in the future, is the infrastructure with the resulting steady increase in regulations for transporting our cranes. Bridge weight limits, driving time restrictions and escort vehicles required from private companies or the police are just some of the things we have to deal. Then there is also the lengthy processing time to obtain transport licenses from authorities, which is an ongoing topic. But it is not just us, it is also our customers who are confronted by these challenges.

Mario Trunzer, CFO, Liebherr-Werk Ehingen GmbH

Mario Trunzer: As the infrastructure requires urgent building work, for example, we can no longer drive directly to the seaports we use, such as Hamburg or Bremerhaven. The additional cost for taking the diversions amounts to one million euros per year. And unfortunately, there is no improvement in sight.

Logistics plays an ever more important role in the development of new crane models, which means we always have to ask the question: How do I transport a crane from A to B? This is a question of weights, dimensions and axle loads. The fact that our newly developed cranes, the LTM 1090-4.2 and LTM 1110-5.1, can be driven with an axle load of 10 tonnes besides 12 tonnes is a massive benefit for both us and our customers.

What has been your most challenging shipment to date?

Benjamin Buchmüller: That was the delivery of an LR 11350 to Bangladesh for a Russian customer last year, involving special transport services in Germany and elsewhere and the initial erection process on the site. Planning the transport took several months. We had to investigate the route, which included 52 bridges, field tracks and roads which had been washed away by a monsoon. The water in the inland port nearby was too shallow for a normal ship. That meant we had to find a special vessel with a low draught. In addition to various departments here at the plant, Liebherr companies in Russia and India and our transport partners were all involved in planning the transport services. We supplied the crane to the site and our colleagues from Russia and India erected it and handed it over to the customer and also provided induction training.

Benjamin Buchmüller, Dispatch Manager

Mario Trunzer: Mr Buchmüller personally inspected every pothole on the route in Bangladesh.

Benjamin Buchmüller (laughs): That journey not only left an impression on me professionally but also personally. I will remember it for the rest of my life.

Customs and duties always play a major role in transporting goods over international borders. What are the main aspects of this?

Mario Trunzer: As a company, we bear full responsibility for doing everything properly. That means that we have to complete all the procedures correctly.

Lattice sections for the LR 13000 ready for shipment in Ehingen

Michael Schuster: In fact, that means we have to do a great deal of checking. We have to obtain all the foreign trade details and documents in advance. That means, for example, certificates of origin and customs tariff numbers, extending to embargo regulations and export licences. All this information is then sent together in customs applications to the German customs authority. After being reviewed by the authority, we obtain final approval and they provide us with the export documentation. The goods can only leave Germany with this documentation.

Overall, more and more responsibility is being transferred to companies. That means additional checks, audits and bureaucracy. There have also been sanction lists relating to individual companies and people since 11 September 2001. We are responsible for making the appropriate checks.

Where possible, we obviously use standard procedures on our own. Our working relationship with the customs authorities and the Federal Office for Economic Affairs and Export Control (BAFA) is very close and extremely professional. We use a certified software package and an automated customs clearance system. We also use “simplified procedures” approved by the customs authorities (customs approvals). The work required for the Customs Department is almost the same whether we are exporting an LR 13000 or a small screw. For example, we only have a single customs tariff number for a crane, whereas there

Loading the slewing platform of the LR 11350 in Bangladesh

are lots of different numbers for a spare parts order due to the number of parts involved. The country of origin must be identified and specified even for small parts. If we make an error during the customs procedure, the entire shipment could be stopped.

Benjamin Buchmüller: Some of the challenges in this respect for the spare parts business are actually greater than those for shipping a crane. No two days are the same, orders are very difficult to plan and we are often under time pressure. That is when close collaboration with all the departments involved is essential. Together with our colleagues from Purchasing, Logistics, Customer Service, Customs and the national companies, we achieve an outstanding daily delivery rate in the high 90s in percentage terms.

This topic obviously raises the question as to what affects a hard Brexit would have.

Mario Trunzer: We would be very much affected as we buy parts from English suppliers and sell cranes to England. Our turnover there is around 60 to 70 million euros per annum. The complexity of the procedure is completely unclear – how difficult

Michael Schuster, Customs/Import Manager

and time-consuming will it be? But additional procedures do not scare us as we can manage every single procedure. We have already made advance purchases and have a little extra in reserve so that we do not have any difficulties in sourcing components from English suppliers.

Michael Schuster: It is possible that customers in England will have to wait a little longer. But we have the expertise. Whether we deliver goods to Norway, Switzerland or England – it would then simply be a standard third-country transaction. The one question we must wait to answer is whether duties will be imposed on our products in England.

Benjamin Buchmüller: However, the initial or transition period after Brexit will certainly pose problems. The Port of Dover alone handles around 10,000 trucks, which currently pass through the port every day without any border controls. The introduction of border controls which take just 2 minutes per truck have led the port company in Dover to forecast traffic jams around 30 kilometres every day.

Mario Trunzer: This shows once again that regardless of where on the planet our customers are, nothing is possible without the professional work of the Shipment and Customs Department.

Road preparation for crane shipment

Mobile cranes ready for shipment in Bremerhaven.

Shipments and customs in figures (2018)

- 2050 cranes (new and used)
  - 1820 transported on their own wheels
  - 230 on low loaders
  - 900 requests to complete heavy haulage journeys
  - 5200 trucks (crawler cranes and crane equipment)
- 160 railway wagons from Ehingen
- 50 cranes on barges from Mannheim
- 920 cranes on ocean-going vessels, 670 of which go to overseas destinations
- Spare parts shipments:
  - 141,000 delivery notes
  - 3100 air freight shipments, 1028 tonnes
  - 58,900 shipments by courier, express and parcel services, 1002 tonnes
  - 13,900 general freight shipments, 21,480 tonnes
- 19,000 customs applications involving a total of 152,000 items
- 50,000 items with countries of origin
- 58,000 items with customs tariff numbers
- Transport documents managed for around 55,000 sales orders

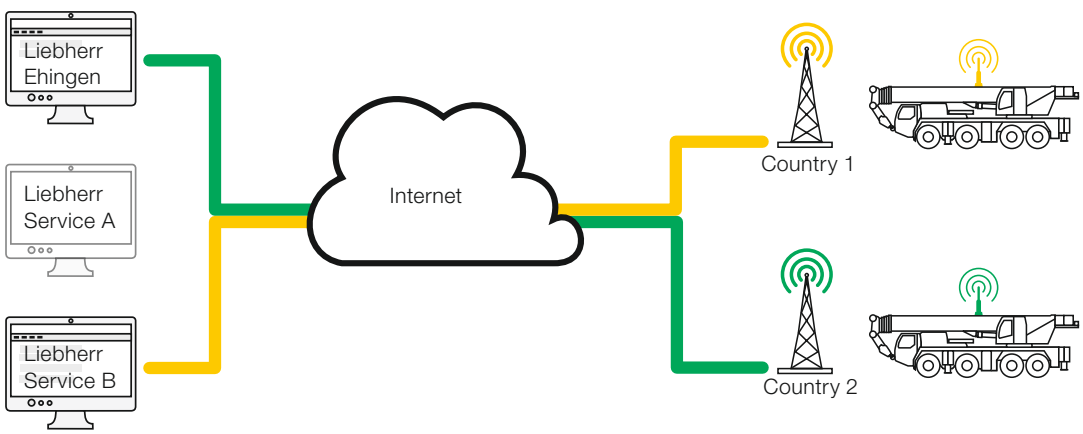
Save with Liebherr remote diagnostics

My Tip

Christian Gumper, a member of the Customer Service team at Liebherr in Ehingen, has been looking at the subject of remote diagnostics for cranes for many years. He knows how crane contractors can save money – if they allow Liebherr Customer Services "to look at their cards".

"Sometimes it is just something minor, but the crane cannot operate. At that point, the contractor wants to find the faults as quickly as possible. Our local service outlet or my colleagues in After Sales can dispatch a service fitter immediately, but that costs both time and money. Remote crane diagnostics is faster and easier. The service personnel uses mobile phone technology to connect to the crane's controller without leaving the office. He can see exactly what he would see if he were on site. Even our older cranes with the LICCON1 control system have a test system which enables faults to be localised quickly and displayed on the screen. This screen displays error codes and descriptions and visualises functions as well as the assignments of sensors and actors. The more recent LICCON2 control system features even better diagnostic tools.

What do you get from this? In many cases, simply a tip from the service expert to the crane operator is enough to enable minor faults to be rectified immediately on site. If a spare part is required, the correct part can be dispatched immediately. A service fitter may have to make his way to the site anyway if the problem is a little more serious. But at least he will already be aware of what the problem actually is. He can make the appropriate preparations and bring any spare parts required with him. In exceptional cases, problems may occur which mean that the local service outlet requires support from the manufacturer's experts in Ehingen. But even then, the remote diagnostic tool delivers benefits because much less time is required to identify and rectify the fault.



For many years we used GSM technology for remote diagnostic purposes as it was state of the art. However, in many countries it performed poorly or not at all. We therefore decided to improve the system. Data transfer is now possible throughout the world using an encrypted 3G connection. The new system is already fitted on many models in the current crane range.

What must you do to enjoy the benefits of remote diagnostics?

On more recent crane models with the 3G modem, your crane operator simply has to press a button in the driver's cabin to establish a connection to a Liebherr server for 10 hours. We have developed retrofit kits for older crane models, including those with a LICCON1 control system. Ask your local service partner for a quotation. Installation is worthwhile because the costs for retrofitting the equipment will pay for itself very quickly."

What benefits does remote diagnostics deliver?

- Reduction in downtimes in the event of a fault as support can be provided by the global Liebherr service department more quickly and with greater focus.
- Reduction in deployments of service fitters by providing support to the customer for troubleshooting work.
- Support for local service fitters for trouble acting from specialists at Liebherr-Werk Ehingen GmbH.
- Data are transferred using an encrypted 3G connection.

Emissions tests in real-world driving – mobile crane compared to a modern truck

A series of tests conducted with TÜV NORD and engineering partner IAV recently proved that even large vehicles, such as our 5-axle LTM 1160-5.2 with a road weight of 60 tonnes meet the high onroad requirements of the Euro VI c standard. Dr. Ulrich Hamme, Technical Director at Liebherr in Ehingen, Daniel Rössner, Development Engineer at Liebherr, Daniel Lüderitz from IAV and Dr. Martin Goschütz from TÜV NORD produced this report on the so-called PEMS tests in Ehingen. PEMS stands for Portable Emission Measurement System.

The testers from TÜV NORD and the engineering partner IAV were recently in Ehingen to carry out a comprehensive series of tests. Why were they there?
Dr. Hamme: Mobile cranes are used in very limited quantities around the world compared to trucks and only cover around 10,000 kilometres per vehicle per year. Despite the very low levels of pollution they cause due to this relatively low use, modern, sophisticated exhaust emissions technology is used to clean the emissions. We conducted this PEMS test to demonstrate the that we do not have anything to hide compared to conventional long distance trucks. We wanted to show the following: Our cranes are clean. Our environment is not just protected safely and reliably in theory but also in practice.

Dr. Ulrich Hamme (Liebherr), Daniel Lüderitz (IAV) and Daniel Rössner (Liebherr) planning the PEMS test series

The emissions scandal in the car industry has seen a great deal of criticism directed at the tests. How can you guarantee that this PEMS test will tell the whole truth and nothing but the truth?
Daniel Lüderitz: Let's get the most important thing out of the way first: These PEMS tests are measurements taken during real-world driving. In other words, we measure the exhaust emissions in real, everyday traffic conditions, not on a test bed. The measurements are taken in normal traffic whilst driving on defined routes. The routes must contain a certain proportion of urban, rural and motorway sections, as defined by the legislator. For the Euro VI c measurement, which we are interested in, this means 20 percent urban roads, 25 percent rural roads and 55 percent driving on motorways.

Dr. Goschütz: The route was defined on the basis of measurements carried out in advance by Liebherr. We rechecked the route and carried out a test drive on it. The result was a route around Ehingen and Ulm covering a distance of 105 kilometres. This included around 15 kilometres in the town, 25 kilometres cross-country and 75 kilometres on the motorway. At TÜV NORD, we carried out a comparison measurement between a LTM 1160-5.2 mobile crane with offroad emissions stage V and a Mercedes Actros 1842 long distance truck which complies with the onroad Euro VI c standard. We ensure that the measurement equipment is calibrated, the

The convoy of the mobile crane and long distance truck on the route between Ulm and Ehingen.

measurements are carried out correctly and we document the results in an independent report.

Daniel Rössner: We installed the PEMS system together on the crane. It essentially comprises equipment to measure the exhaust emissions at the actual tailpipe. We deliberately brought our colleagues from IAV on board to take the measurements on the truck which was driven over the same route as the crane to provide a basis for comparison. They have a great deal of experience with measuring long distance trucks and were therefore the perfect partners.

That sounds like a lot of work for an in-house project. Is it really worth it?

Dr. Hamme: We are convinced that it is. We have been conducting research for over 20 years and a significant part of our development budget is spent on reducing emissions. During this time we have managed to reduce nitrogen oxides and particulates, in other words fine dust, in several stages by around 97 percent. Before our fleet was converted to emissions stage V, we started a field test lasting several months with crane hire company ESB based in Biberach to monitor and improve the diesel particulate filter and urea dosage system in real-world conditions during use by customers (Editor's note: Upload edition 2 / 2018). Now we can prove with these independent measurements that our cranes are truly clean. The results of these measurements are a pioneering milestone in the development of gearboxes and engines for our mobile cranes.

Daniel Rössner: We do not believe that there will be an alternative drive technology in the near future, which can replace the diesel engine in full. The complex requirements for a mobile crane, in other words, the combination of road travel and site operations, quite simply mean that it is impossible. With this in mind, we both wanted and felt an obligation to ensure that the engines we use in our mobile cranes are state of the art in technological terms. Modern mobile cranes with the single-engine concept only have a single engine for both road travel and site operations. All diesel engines built in 2019 onwards, which are installed in mobile cranes and licensed in EU countries, Switzerland or Norway, must satisfy the Euro V emissions standard. The requirements are similar to those for the onroad Euro VI c standard. That is why this comparison measurement was essential for us.

What factors were particularly important during the tests, which were difficult to assess and what did you have to change about the process once it had started?

Daniel Lüderitz: A test is never straightforward. We drove in convoy. The mobile crane was in front since it was the main vehicle due to its limited speed. It was followed by the truck, which in turn was followed by an escort vehicle. If they ran into a traffic jam, the time for the various route sections would no longer be correct, rendering the whole measurement invalid. If that happened, we had to abort the measurement and start all over again.

We also had to ensure that the results were clearly comparable. That meant that we had to complete two different comparisons. In the first comparison, the truck was tested as specified by the regulations of Euro VI c. This test requires the truck to carry a load between 50 and 60 percent of the maximum payload. The second test requires the 40-tonne truck to carry its maximum payload so as to be more comparable with the mobile crane which has a 12 t axle load, which corresponds to a total weight of 60 t. And what's more, the recording process starts when the engines of both vehicles are cold and continue for the entire duration of the measurement.

Dr. Martin Goschütz (TÜV NORD) and Daniel Rössner installing the equipment on the LTM.

Daniel Rössner: Fortunately, we had to change very little during the tests. In fact, the planning we conducted in advance proved to have been very valuable in this respect. And we were also fairly lucky as we did not encounter any unforeseeable events such as traffic jams or accidents en route.

So now we come to the exciting bit – what were the actual test results the end?

Daniel Lüderitz: Our measurements show that the mobile crane is in the same sort of range as the truck in terms of nitrogen oxide emissions. In terms of carbon monoxide, they also produced similar measurements and for hydrocarbons, you can see that the

The measuring equipment on the LTM 1160-5.2

LTM is actually significantly lower than the comparison truck.

Dr. Goschütz: The mobile measurements were designed to provide the best possible comparison to the Euro VI c requirements and all the measurements were within the limit values.

Dr. Hamme: Now that we have completed the project, we are delighted that we conducted these comprehensive PEMS tests on our cranes with TÜV NORD and IAV, comparing them to the modern emissions technology for trucks. We were able to demonstrate that our cranes comply with all the required limit values specified by Euro VI c for commercial vehicles. Our cranes really have nothing to fear from a comparison with a fully laden long distance truck, thousands of which can be seen on every road in the world. Our cranes are clean.

In other words, your PEMS tests demonstrated that in practice Liebherr cranes meet all the emissions limit values set out in the onroad Euro VI c standard for trucks. Even though the vehicles cannot be compared in terms of power, distance travelled and quantities. So what was the technical breakthrough that enabled you to achieve this massive reduction in emissions?

Dr. Hamme: We have always tried to set pioneering, forward-thinking standards in terms of cleanliness and environmental protection with our latest Liebherr engines and our modern mobile cranes. The main focus, of course, is on the engines themselves. They are manufactured in Switzerland at our sister plant in Bulle – whilst we conduct the development work jointly. And that is the main point. There is probably no other manufacturer in the world producing engines on such a small scale that can claim to have the same level of influence over the development work. And that applies to both the hardware and the software.

I would like to express my sincere thanks to everybody concerned for this achievement – in Ehingen, at the Liebherr-Components Division plants and also our partners. The results of these tests show that we are moving in the right direction. And they provide some impressive evidence of this.

Dr. Ulrich Hamme, Technical Director

Emissions stage V:
Emissions legislation for mobile machines and equipment in the EU takes the form of Regulation (EU) 2016/1628. This regulation contains engine categories, emissions limits, introduction dates, durability requirements and a series of administrative guidelines for the current EU emissions stage V for mobile machines and equipment not designed for road traffic.

EU standard VI c:
Euro VI c is the limit value level for truck exhaust emissions in a directive issued by the European Union based on the European Parliament's regulations for commercial vehicles. One of the main components of the directive is that measurements must be taken whilst the vehicle is driving in real-world conditions.

PEMS test:
The PEMS (portable emission measurement system) equipment is a mobile emissions measuring device for real-world driving. The in-service conformity method (emissions during use) is also used to measure emissions using PEMS on public roads. To conduct the ISC test, vehicles are fitted with the PEMS device for mobile emissions measurement and tested in real road traffic situations to find the limit values of nitrogen oxide (NOx), carbon monoxide (CO) and hydrocarbons (HC).

Cranes on tour


INTERNATIONAL CARGO
TRANSPORTER
ANTONOV 124-100M-150

Above all – safe!

On 27 June 2017, we received an order from the Federal Office of Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) to deliver a total of 71 armoured mobile and recovery cranes worth around 150 million euros.

The order comprises the delivery of 33 armoured recovery cranes with the model name G-BKF and 38 G-LTM mobile cranes, which feature armoured drivers' cabs and crane cabs. We delivered the first of these machines in February. The deliveries are scheduled to be completed by the end of 2021.

High personnel protection requirements

The focus when the order was placed was on the protection of personnel in the cranes. We are working with Rheinmetall, the leading European supplier of military equipment, on the armoured driver's cabs and armoured crane cabs to ensure that the high requirements for them can be met in full. The drivers' cabs protect the crew from ballistic and mine threats and also feature an NBC ventilation system. The superstructure cabs protect the crane operators from ballistic threats during crane operations. The two cabs are identical for the G-LTM and G-BKF vehicles.

G-BKF recovery crane

The G-BKF from Liebherr is an armoured recovery crane on a standard four-axle mobile crane chassis. Its two recovery winches and a towing hitch at the rear enable it to rescue and tow a wide range of different vehicles such as the new generation of armoured control and command vehicles (GFF), armoured transport vehicles (GTF), MULTI FSA (swap body vehicles) and wheeled vehicles which are already in use. The G-BKF can be used flexibly and economically since it is equipped both to recover vehicles and to hoist loads. Its 20.9 metre telescopic boom enables the G-BKF to handle loads of up to 20 tonnes quickly and precisely.

G-LTM mobile crane

The G-LTM ordered by the Bundeswehr is a standard four-axle mobile crane. Its all-terrain chassis features the latest chassis and drive technology, which ensures excellent handling, even on difficult terrain. It has a 35.7 metre telescopic boom and a recovery winch at the rear. The order from the Bundeswehr comprises 17 G-LTM cranes with 8.4 tonnes of counterweights known as "heavy duty mobile cranes" and 21 units of the same model with 22.5 tonnes of counterweights with the designation "very heavy duty mobile cranes".

Bundeswehr tests everything

Even before the order was placed for the 71 cranes, the Bundeswehr tested a prototype of the G-BKF over period of many months. We developed it on behalf of the Bundeswehr based on its specifications. The tests have continued even after the delivery of the first serial machines. As part of the tactical deployment tests, August saw the transportation capacity of the Liebherr military cranes tested in an Antonov AN-124. The Antonov AN-124 is one of the largest freight aircrafts in the world.

These tests were monitored by Armin Bucher from the Crane Carrier Design Department and Arno Bücheler from the Testing Department. “The entire loading concept for air transport was checked during the tests. These tests included checking the dimensions, driving onto the access ramp and securing the chains to the lashing points”, explains Armin Bucher.

“The Bundeswehr tests the various capabilities very intensively and exhaustively. Each test takes the vehicles into their limit ranges.”

Arno Bücheler, Group Leader Testing,
Liebherr-Werk Ehingen GmbH

"Each crane is secured in the Antonov by 36 chains. The number of lashing points was significantly increased compared to those on our standard cranes. Acceleration forces of up to 2.3 g (g = 9.81 m/s^2) were used during the design phase. Arno Bücheler was also impressed by the scope and intensity of testing by the German Army: "I monitored the prototype tests on the G-BKF – and now the tactical deployment tests as well. Since the cranes will be used in harsh conditions, this type of testing is absolutely essential." The Bundeswehr and Liebherr have been working very closely together during the tests. "The project is extremely important to the Bundeswehr. We have weekly telephone conferences with the BAAINBw", says Armin Bucher. "This enables us to assess complaints and requests for modifications as quickly as possible and take any required action. The Bundeswehr is very satisfied with the machines and with the straightforward collaboration with Liebherr."

> "Each crane is secured in the Antonov by 36 chains. Acceleration forces of up to 2.3 g were required in the design"
>
> Armin Bucher, Group Leader Crane Carrier Design, Liebherr-Werk Ehingen GmbH

As part of the tests, the vehicles were loaded using a ramp at the front of the aircraft. Containers for crane accessories and counterweights are hoisted into the Antonov by the aircraft's own crane system at the rear. The results were extremely positive – the transport aircraft must be loaded with a total of over 100 tonnes to transport the G-LTM. In addition to the crane weighing 48 tonnes, a MAN Multi with a ballast flat (20-foot swap body) and other accessories were loaded. The G-BKF recovery crane is a little lighter – in addition to the vehicle weight of 44 tonnes, there is another 1.6 tonnes for a 10-foot flat.

Into the aircraft

The tests were conducted at the Leipzig/Halle Airport site. Two Antonov AN-124 aircraft operated by Ukrainian airline Antonov Airlines are permanently stationed at this major freight hub and

Tight – there is not a lot of space for the G-LTM.

Made it. But there is not a lot of room to manoeuvre.

The first are already attached – each crane is secured in the Antonov by 36 chains.

are also available to NATO and the EU as part of the SALIS (Strategic Airlift Interim Solution) programme. The transport orders are coordinated by the Bundeswehr's logistics centre in Wilhelmshaven, which also provided the aircraft for the tests.

A total of 56 AN-124 aircraft were built between 1984 and 2004, 28 of which are still operating. The giant transport aircraft is now mainly used for charter freight flights and now holds a monopoly position within this segment. The aircraft weighs 173 tonnes and can transport 120 tonnes in the civilian version or up to 150 tonnes in the military version. It is 69.1 metres long, 20.8 metres high and has a wingspan of 73.3 metres. It lifts off the ground with a gross weight of up to 400 tonnes and cruises at a speed of over 800 km/h.

Almost swallowed – the G-BKF measuring almost 4 metres high disappears into the mouth of the giant aircraft.

Crane accessories are loaded by the Antonov's own crane system at the rear.

The dream of the international crane operators licence

Book a car online before travelling, collect it at the airport, show your driving licence, get in and drive off. That is how cars are hired in every country in the world, even those where the cars drive on the other side of the road. Although an official international driving licence is required in some countries, obtaining it is generally just a formality if you already hold a national driving licence. However, as far as a crane operators licence is concerned, we are still a very long way from an internationally accepted testing process.

In some countries, including Germany, there are absolutely no statutory regulations for crane operators. Although other countries do have regulations, but the differences between them are enormous. Training periods range from a few days to up to three years. The European Crane Operators Licence ECOL should be a step in the right direction in this respect. We talked to Christoph Behmüller about the background, what has been achieved and visions for the future. He is Manager of the Liebherr Training Centre in Ehingen and also chairs the relevant working group at FEM (European Materials Handling Federation), in which capacity he has been monitoring the European crane operators licence for years.

Mr Behmüller, why is a European Crane Operators Licence required?

Christoph Behmüller: Safety is absolutely paramount. We want to avoid damage and in particular personal injuries. Not only does that require safe cranes, but also good training for crane operators. Public institutions, crane contractors and we, the manufacturers, have been providing this for many years in the form of training courses. But we really need standard statutory regulations. An internationally accepted crane operators licence will increase the safety of crane operations and enable our customers and crane operators to extend their activities internationally.

How did the European Crane Operators Licence ECOL come about?

Christoph Behmüller: ESTA, the European Association for Abnormal Road Transport and Mobile Cranes, took the initiative for a crane operators licence, which would be accepted throughout Europe, in 2013. ESTA then approached the European Materials Handling Federation (FEM) in Brussels and asked for its support. The cranes and lifting equipment product group is part of the FEM. Working groups were then formed, including crane operators, groups of professional specialists and manufacturers. The main working group is part of ESTA, whilst

there is a sub-group at FEM. They defined the contents of the operator's licence and defined uniform standards not just in terms of content, but also for training methods and outline conditions. The VDMA monitored the project to ensure it complies with competition rules.

What is the current status?

Christoph Behmüller: The European Crane Operators Licence ECOL is now ready and is already accepted in many countries as a licence for crane operators. Although we do not yet have any statutory regulations in Germany, the relevant associations have welcomed the ECOL. We will be able to provide a course for the licence at the training centre from spring 2020. We are currently undergoing the certification procedure with ESTA.

This checks whether we can provide the training required for the licence. Even the training centre itself is being checked. ESTA has subcontracted the checking procedure to certification companies Aboma and Lloyd.

The chamber of industry and commerce in Dortmund has already completed a course. Other crane manufacturers are also coming on board. One interesting point is that the "British Columbia Association for Crane Safety" in Canada, is the first non-European country to acknowledge the ECOL.

Is there anything similar to the ECOL on other continents?

Christoph Behmüller: There is the NCCCO in the USA and the CICA in Australia, which provided the template for ECOL. But there is a great deal of work needed there as well. For example, NCCCO is not accepted in all US states. There is still a struggle over there with different regulations in different states. We have not heard of anything similar in South America, Africa or Asia.

What are your hopes for the future?

Christoph Behmüller: I hope that the European Crane Operators Licence will be accepted by every country in Europe and training for it can also be provided in every country. The industry will demand this. An international crane operators licence would be a dream, of course. But that will take a little more time.

The main point is to ensure safety when operating cranes. Despite all the technology, we must not forget about the person operating it. We all bear a great deal of responsibility, both manufacturers and contractors. Good crane operating training must be regarded as very valuable.

The world with Liebherr

The birth of a colossus

The skyline of the industrial port of Rostock has had a new landmark since the summer – one of the most powerful land-based gantry cranes in the world is now located on the Liebherr-MCCtec Rostock GmbH site in the form of the TCC 78000. With its boom fully luffed, the colossus reaches a height of 164 metres. The crane can hoist loads weighing up to 1600 tonnes – with a radius of 36 metres. A high lifting capacity and hook height were required to position the massive top section of the boom. That called for large mobile cranes.

Absolutely everything about this new power pack at Liebherr's heavy load port in Rostock is enormous and imposing – its dimensions, lifting capacity values, foundations and also the rail system on which the TCC 78000 will be able to move through the site with a load on its hook. The abbreviation TCC stands for the "Travelling Cargo Cranes" series, a combination of slewing crane and bespoke rail-bound gantry. The massive dimensions of this enormous crane set completely new standards, and not just in a technical sense, but also optically. Next to the enormous crane, the two largest mobile crane models from the Ehingen Plant, which helped to erect the new giant, look positively filigree and petite.

Team Cool – the crane team from Mammoet Deutschland with the colleagues from Megalift Andy Lemke, Nico Zerfowsky, Joos Bremmer, Kai Schweigel and Heiko Bischoff (from left to right).

Mammoet Deutschland, entrusted by Liebherr with planning and completing the heavy hoists for this imposing, large project, had to visit the site several times with its LG 1750 in its SDB set-up version with full suspended ballast. The powerful lattice boom crane installed the 460-tonne cross member on the massive gantry together with two LHM 800 mobile harbour cranes in a three-way crane hoist with the larger crane having to manage half of the load. The gantry column and machinery house on the TCC 78000 were installed in a tandem hoist with one of the mobile dock cranes. However, the maximum hoisting height of the plant's own cranes was not capable of installing the top section of the boom weighing 160 tonnes. That meant that an

Truly heavy – giant shackles and steel ropes as thick as an arm are used to secure the top section of the boom.

LTM 11200-9.1 mobile crane was hired from Megalift in Bremen for this job, which also took the form of a tandem hoist. Both mobile cranes were set up with a hook height of 106 metres. The derrick boom on the LG 1750 and the Y-guying on the 1,200-tonne mobile crane, together with hundreds of tonnes of ballast, provided the stability required for this extraordinary job on the quayside.

Maximum demands on crane technology

"This erection of the TCC 78000 had to be completed in compliance with stringent tolerance, adjustment and crane technology requirements", is how Gernot Öder explains the extraordinary challenges posed by the project. Öder is Manager of Crane and Transport Projects at Mammoet Deutschland GmbH who planned and took responsibility for the heavy hoists required to erect the giant Rostock crane. "Our plan also had to have sufficient flexibility to implement deviations caused by production tolerances quickly, for example changing the slinging points."

Despite a tight deadline and downtimes often caused by the weather, the assembly of the new heavy duty gantry crane was completed on time. A great deal of praise was handed out for the professionalism and sheer brilliance of the work, and not just by the customer. In fact, Mammoet Deutschland also received the "BSK Award for the best crane work of 2019" for this job. Congratulations from us!

The TCC 78000 has now officially been in action since August and in the future its work will include hoisting, assembling and loading large cranes and very heavy components manufactured by various companies, including Liebherr, of course. The crane will also be available to other companies for heavy duty handling work at the port of Rostock. At the end of 2019, the crane is due to complete its first major work, hoisting an HLC (heavy lift crane) 295000 on to a jack-up vessel. This offshore crane has a lifting capacity of 5000 tonnes with a radius of 30 metres, making it the most powerful crane ever built by Liebherr.

The undercarriage of the LTM 11200-9.1 looks positively filigree beside the massive 30-metre wide gantry on the heavy-duty crane.

Find out more:
www.liebherr.com/
colossus-quayside

In the future the gantry crane will move on two pairs of the largest available standard rails on a curved section between the northern factory site and the neighbouring quayside – even with loads on the hook. The entire quay had to be rebuilt, including inserting over 600 piles to transfer the immense forces into the foundations.


Make 500 into 1
LIEBHERR
LIEBHERR

New giant will save thousands of kilometres

A new record-breaker has been on site since the summer in the industrial port of Neuf-Brisach, a French town not far from Colmar – the LR 11000 is the most powerful crawler crane in France. The 1,000-tonne heavy duty crane will be used to handle industrial goods such as gas turbines and mining excavators on the Franco-German border between Basel and Strasbourg – saving several thousand kilometres of road transport.

A gas turbine can weigh up to 450 t – which is why the LR 11000 has been permanently installed at the port.

The green, white and red LR 11000 has been an impressive sight on the quayside at Neuf-Brisach for several months. The new power pack operated by transport and heavy haulage logistics contractor Scales was officially commissioned in September. A festive ceremony was held at which Colmar Chamber of Trade started its activity with “heavy goods” at the Colmar / Neuf-Brisach Rhine port. Sophie Albrecht, family shareholder at Liebherr-International AG, also attended the celebrations.

LR 11000 enables the River Rhine to be used

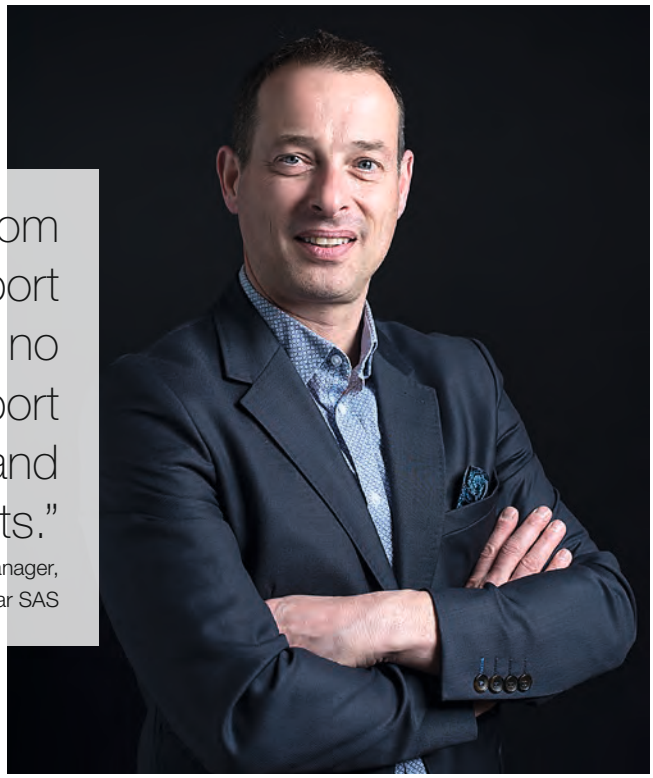
The location of the Rhine port means that the new crawler crane can handle large gas turbines manufactured at the General Electric (GE) plant in Belfort, France. In future, the enormous gas turbines, which weigh up to 450 tonnes, will be loaded here for onward transportation on barges. To date, Scales’ special trailer for transporting the enormous turbines, which is over 100 metres in length, is towed by two tractor units and has a total of 28 axles, has had to travel almost twice the distance to Strasbourg. Although there is a gantry crane there with an impressive lifting capacity of 460 tonnes, it actually consists of two equal hoist units. If, as with the most recently loaded turbine, a component with a gross load of 450 tonnes and an extremely decentralised centre of gravity has to be handled, one of the hoist units in Strasbourg would actually be overloaded.

However, these gigantic turbines pose no problems at all to the new Liebherr crawler crane in Neuf-Brisach. Asymmetric loads can be lowered into the required position in the barge’s hold using lifting tackle of different lengths. The LR 11000 will now be stationed permanently at the Rhine Canal with a 66 metre main boom and a derrick boom for loading particularly heavy piece goods. The new crawler crane will be supported by an existing LHM 280. This mobile harbour crane, with a maximum radius of 40 metres and a capacity of 84 tonnes, is used at many inland ports as a cargo handling crane for vessels up to the Handymax class.

New transport option for Liebherr in Colmar

In the future, components for wind turbines will also be handled by the new Scales crawler crane, as will heavy machine components for mining equipment and hydraulic excavators from the Liebherr plants in Colmar, Alsace. Since June 2019,

> "The route using the Rhine from Colmar will reduce the transport distance by 500 kilometres - we no longer have the road transport through France, Germany and Belgium to the Atlantic ports."
>
> Marc Lagarde, External Logistics Manager, Liebherr-Mining Equipment Colmar SAS



Liebherr-Mining Equipment Colmar SAS alone has shipped loads weighing more than 6,000 tonnes, which corresponds to 34 machines on 11 ships using this new transport option. The Mining Division in Colmar manufactures large hydraulic excavators with an operating weight of up to 800 tonnes and small trucks with a gross weight of around 180 tonnes.

Some components of these mining machines are up to 19 m long, 5 m wide and over 4 m high – and can weigh up to 100 t. These machines are pre-assembled in parts and shipped by Colmar via European deep sea ports to large mining operations in Australia, Africa and Asia. The machines then undergo final assembly on site.

The effects on the environment are massively positive. Using the River Rhine has already enabled Liebherr in Colmar to save around 100,000 kilometres by road and up to 160 tonnes of CO_2. The vessels use less energy than road transport and their CO_2 emissions are on average four times lower than travelling by road. What is more, the river has an accident rate of almost zero, making it an extremely safe transport route.

Components of an R 9800 mining excavator en route from Colmar to Zeebrugge.

Electric aviation launches

Better energy supplies, lighter weights and more efficient aircraft all round: Liebherr has started conducting major research into electric systems at three different sites which could revolutionise the field of aviation in the near future.

“Ready for take-off!” Working in the cockpit requires the utmost concentration. The aircraft accelerates and lifts off. At the push of a button, the landing gear retracts right in front of the pilots’ eyes. That’s because the nose landing gear is located directly in front of the cockpit window. The pilots are engineers, controlling a flight simulator at the Liebherr Aerospace E-Wing Research Centre in Lindenberg, Germany.

They are part of a team of engineers and developers working alongside two other project teams in Lindau and in Toulouse, France. The teams are steering a course that leads towards the next generation of aviation: the More Electric Aircraft (MEA).

The goal of MEA is to make aviation of the future lighter, more efficient and better for the environment. That also means significantly fewer ducts, shafts and cables.

The teams are particularly focusing on the role of actuators. These are devices that convert centrally generated hydraulic energy into mechanical motion. The Liebherr developers in Lindenberg are working hard to find out how these kinds of hydraulic systems can be replaced by electro-mechanical or electro-hydrostatic systems in the future, which for example will be supplied with power by a central, electro-hydraulic, heavy-current-based Powerpac (540 V direct current).

"The More Electric Aircraft is based on the idea of cutting down to a single energy source: electricity. This results in a simpler aircraft construction that cuts energy consumption and reduces the weight of on-board installations."

Stefan Pufe, Director Research & Technology,
Liebherr-Aerospace Lindenberg GmbH

Research in progress

"At E-Wing, we're using five test benches to test and monitor various options for controlling actuators, such as conventional hydraulic, electro-hydraulic and electro-mechanical", explains Stefan Pufe, Director of Research & Technology of Liebherr-Aerospace in Lindenberg. The various designs are connected to one another as demonstrators and the engineers can simulate how they would actually operate in real life. This is clear to see in the model of an aircraft wing. Here, all three types of hydraulic systems work side by side. The motions of the spoiler flaps are controlled from the cockpit simulator, demonstrating how they slow the aircraft after landing.

“In the More Electric Aircraft, power electronics must become even more flexible. Our goal is to capture excess energy that used to be wasted and feed it back into the system.”

Alfred Engler, Head of Development Technologies, Liebherr-Elektronik GmbH.

Golden Power Pack

Lake Constance has historically been a favourite location for aviation pioneers. This is where the first Zeppelins took to the skies in the early 20th century, as well as the first all-metal aeroplanes and airships. Nearly 100 years later, an 80-strong team from Liebherr-Elektronik GmbH in Lindau (Germany) is working on new aviation innovations. Electrical engineers, software developers, machine engineers and testing engineers focus on an essential component of the More Electric Aircraft: power electronics.

This includes a golden "Power Pack". "The inverter is designed for power-optimised electrical aviation," explains Dr.-Ing. Alfred Engler, Head of Development Technologies at Liebherr-Elektronik GmbH. The inverter ensures that high-voltage direct current (540 V) is supplied to the actuators in aerofoils and control units, while also opening up entirely new possibilities for the aircraft’s climate control systems. Conventional aircraft use 115-volt, 400-Hz alternating current as standard.

In the labs, the researchers are testing whether the new heavy-current-based equipment will perform as intended under any possible flight conditions. The power inverter is exposed to all kinds of adverse conditions, from intensive rattling and shaking, to powerful blasts of air and freezing temperatures, all while being carefully monitored. Safety is the top priority.

A unique testing environment

Toulouse, here, Nathalie Duquesne, Director of Research & Technology at Liebherr Aerospace Toulouse SAS is heading up the GETI project (Dynamic Electrical and Thermal Management). The Liebherr team is optimizing two main electrical systems for the environmental control system and the wing ice protection of aircraft leading edge. The goal is also to reduce the weight and fuel consumption of the More Electric Aircraft to achieve significant reductions in CO_2 and nitrogen oxide emissions.

To achieve this, Nathalie Duquesne and her team have developed a unique testing platform called “GETI”, which is based on the global vision of the more electrical aircraft and its non propulsive energy. “In GETI, we can identify the main electrical consumers for the more electrical aircraft of the future,” explains Duquesne. The focus of the platform has also been on the models, which were developed to reproduce the electrical and thermal behaviors of the different systems.

“In parallel, flight test campaigns operated on both ATR72 and A320 flying test beds in 2016, which were focused on electrical environmental control systems, have proven a competitive

solution for this more electrical vision", says Nathalie Duquesne. Both intensive internal tests and flight tests validated fully the robustness and the stability of the pressurization and air conditioning systems.

"We've designed a promising electrical environmental control and ice protection architectures for the More Electric Aircraft. The result is fully satisfying. Now, it's time to optimise the individual components even further and bring the system to maturity for future proposal. The future of aviation has begun", says Nathalie. "We at Liebherr are a part of that."

"There's no doubt about it: the More Electric Aircraft is coming. We will be ready for it. We're already well on our way at Liebherr Aerospace."

Nathalie Duquesne, Director of Research & Technology, Liebherr Aerospace Toulouse SAS

Find out more:
www.liebherr.com/moreelectricaircraft

It's oh so quiet

E-bikes and e-scooters are all the rage nowadays because they are so much fun and easy to ride. Modern versions have done away with noticeable judder and annoying extraneous noise thanks to compact high-precision gear technology.

Compact precision engineering

Norbert Ambros rarely lets anything throw him off course. This is also true when he sees the bemused faces of his colleagues as he whizzes across the factory floor at Liebherr-Verzahntechnik GmbH in Kempten on a futuristic electric vehicle that looks like a cross between a scooter and a bike. "This scooter has been designed to be used at trade fairs where Liebherr staff continually have to make their way across the large exhibition halls," explains the seasoned e-bike enthusiast. "The gear technology in the motor determines how comfortable the journey will be – it should ideally facilitate powerful acceleration with as little noise from the motor as possible."

Gear hobbing and gear grinding machines produced by Liebherr for customers all over the world make all this possible. Norbert describes the plant's machinery as, "Cutting-edge technology at its best, providing high-precision gear mechanics for applications where space is a premium". In his role as senior mechanical engineer, he coordinates machine acceptance tests, test runs and any fine tuning that needs to be carried out before the machines are delivered for use in various production processes.

Microgeometry is critical

But does this mean that e-mobility is redefining drivetrain technology and increasingly making gear wheels redundant? "Lower volumes are needed to fulfil e-mobility requirements," says Norbert Ambros. "As it's becoming increasingly important for the gears to function more cleanly and quietly, the gear wheels need to be of an exceptional quality."

Ambros emphasises that this is why it is even more important to use innovative machinery which can deliver an excellent surface finish and maximum precision. The machines should also run exceptionally smoothly and ensure the geometry of the tooth flanks is absolutely perfect. It is especially important to get the microgeometry right to ensure that the teeth engage correctly under stress. And this is particularly critical since the gear wheels are specially designed in accordance with the natural frequencies of the drivetrain and to dampen drivetrain vibration.

The moment of truth at Eschacher Lake

Norbert Ambros is a passionate cyclist and nature lover. He is also a tech freak. Norbert switched to riding e-bikes years ago so that he could embark on as many varied and long cycling trips with his wife as possible. The fruitful partnership between Liebherr and Morat Swoboda Motion may also benefit him in the future.

The 58-year-old senior mechanical engineer has worked at Liebherr-Verzahntechnik GmbH for 43 years. He loves the fact he can experience the benefits of a technology he has worked with his entire working life during his leisure time. “I am reminded every day how important our work is.” Ascending the mountainous terrain above Eschacher Lake is a good example. He describes the way the small high-tech gear wheels come into their own here and deliver such strong torque. He also notes how the noise of the motor is only perceptible from its very quiet hum.

“I don’t want to hear any annoying noises from the motor and transmission when I’m off on my bike in the great outdoors.”

Norbert Ambros

Better to be on the road than in the bicycle repair shop

“When I am out enjoying nature, I just want to enjoy the scenery, feel the wind in my face and hear the birds singing. Nothing else,” he says emphatically. “Drive wheels that have been ground with microscopic precision are a critical factor. They make the vehicles reliable, durable and comfortable to ride. I would rather avoid trips to the bicycle repair shop or having to continually carry out maintenance on my bike.”

From his experience as a senior mechanical engineer and keen cyclist Norbert Ambros is certain: “I can see so much potential in e-mobility and not just for e-bikes and e-scooters. I want to be among the pioneers through my role at Liebherr. The fact that these kinds of innovations allow me to have so much fun outdoors in the beautiful Allgäu countryside is a good enough reason alone.”

Find out more:
www.liebherr.com/e-bike

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