The new Liebherr Mobile and Crawler-track Cranes – Top Technology in Crane Construction

Talk by Dr.-Ing. Ulrich Hamme,
General Manager of Liebherr-Werk Ehingen GmbH,
to representatives of the European specialist press
during the Information Tour in Ehingen on May 10, 2001

Ladies and Gentlemen,

Before a mobile or crawler-track crane can be marketed successfully a large amount of conceptual, preliminary development and experimental work is needed to ensure that the customer can be offered state-of-the-art technology.

The new crane has to be correctly positioned within the company's product programme and the required basic performance data, the choice of technologies and of course the customer benefits that it is intended to provide must be carefully coordinated so that the expectations of the market are satisfied.

A major element in our company's overall strategy is therefore long-term product development planning, four aspects of which I would like to discuss here. They are:

- Willingness to innovate and speed of development
- Crane concepts and technology
- The product programme and performance data
- Economy and customer benefits

1. Willingness to innovate and speed of development

Between 1990 and 2000 Liebherr either developed or extensively revised 29 crane models. Today our sales programme consists of 13 all-terrain cranes and 5 crawler-track cranes, but these only represent about half of the development work we undertook in the past ten years. The list also has to take into account special projects as sunshields for Saudi Arabia,

winches for the Kurushima Bridge in Japan and multi-purpose carriers for the United Arab Emirates.

At the moment our LR 1600/1 and LR 1300/1 crawler-track cranes and the LTM 1045/1, LTM 1055/1, LTM 1150/1, LTM 1200/1 and LTM 1250/1 all-terrain cranes are all in a more or less advanced stage of new development.

Last year 70 percent of our new crane turnover was achieved with models that have only been on the market since 1997. The figure is a clear indication that without unceasing development work and innovation, including careful assessment of the risks involved and an intensive trial phase, it would be impossible to secure a market for leading-edge technology.

2. Crane concepts and technology

If top technology is to be accepted by the market, the overall crane concepts must be correct. This calls for intensive study of market conditions and above all permanent contact with customers – crane hire companies, assembly firms, operation managers and senior management. The industries that operate our cranes – for example the power supply undertakings, those responsible for transport infrastructure and technical plant constructors.

From this work, various crane concepts gradually emerge, and our task is to interpret them as high-performance products. Regardless of the crane type, this means that we must have developed and mastered various basic technologies.

Some of the significant technological developments in recent years that have contributed greatly to the success of our LTM cranes are:

- Boom and telescoping action (Telematic)
- Data bus technology (the Liebherr System Bus)
- The use of very high-strength fine-grain structural steels up to S 1100 QL quality
- Driveline technology, including the AS-Tronic transmission (LI-AS Drive)

Early in 1996 the LTM 1160/2 was the first crane to feature the new "Telematic" boom technology. Some of its main new elements are:

- a developed version of the oval boom cross-section,
- the single-ram telescoping system with locking head, and
- automated telescoping action with LICCON control.

At the end of 1997 Liebherr's system bus technology, developed by its own staff, reached the market on the LTM 1030/2 crane, another new development. This modular-structure data bus principle, developed specially for LTM and LR cranes, boosted their economy and made them even more reliable.

Just over two years ago it became evident that demands for maximum mobile crane load capacity would make it necessary to adopt fine-grain structural steel grades with a very high strength rating if the tare weight of the cranes was to be maintained at the existing level. This decision involved taking a large number of peripheral factors into account, such as reliable machining and processing, the material's mechanical properties and its long-term strength. Ultra-high strength fine-grain structural steel of grade S 1100 QL was used for the first time on the LTM 1060/2 for the lower boom shell, and extensive testing was carried out to determine its suitability for other welded structures.

At the end of 2000 the LTM 1100/2 was introduced with the new LI-AS Drive vehicle driveline, consisting of a Liebherr diesel engine combined with an automated-shift gearbox from ZF. The adoption of this form of transmission led to a distinct improvement in economy, environmental acceptability and driver convenience. The electronics for the engine, transmission, ABV, Intarder and eddy-current brake are networked together by bus systems to permit an operating strategy specially suited to crane operation.

The four steps forward in crane technology that I have quoted as examples have either proved successful already or are well on the way to doing so. In the meantime they are not only to be found on our LTM and LR cranes, but in slightly modified form on competitors' products too – in other words they have become state-of-the-art features of modern crane technology.

Apart from these major technological breakthroughs, a great many smaller but none the less unique design features are to be found on our LTM and LR machines. Here, without any claim to completeness, is a list of some of the more important ones:

- On the larger models all crane movements are actuated by closed hydraulic circuits which save energy and can be controlled with great accuracy
- The crane can be levelled when lowering its supports by pressing a single button
- There are more than 3,000 programmed fault codes to permit rapid onboard diagnosis of all the electronically controlled and monitored travel and crane operating functions
- All crane engines comply with the EURO 3 exhaust emission standard (from 10/2001 onwards)
- Even when the engine is running at idle speed, up to four crane movements can be superimposed without any risk of stalling the engine and causing uncontrolled movements
- There is continuous load interpolation for lattice-boom cranes in all operating-equipment modes with a luffing fly jib in use, and the main boom and fly jib can be moved simultaneously under load
- Variable (telescopic) ballast truck or suspended ballast repositioning increases the crane's load capacity and reduces its rear-end slewing radius
- Electro-hydraulic platform repositioning for the crane operator's cab makes the work more convenient and enables movements to be carried out more reliably.

3. Product programme and performance data

Liebherr-Werk Ehingen GmbH sells LTM cranes in a very broad range of sizes, with two to eight axles. The mobile crane load-capacity range extends from 30 to 800 metric tons, and the telescopic booms can be between 30 and 84 metres long at maximum outreach.

At the moment there are 13 models that represent an almost uninterrupted product range (though this is subject to continuous revision). These 13 crane types compete with some 25 to 30 cranes from rival companies.

The maximum lifting heights of LTM cranes are between 42 and 146 metres, equivalent to maximum load moments between 105 and 4,356 tm.

If the LR 1300/1 model currently under development is included, we will in future be able to offer five crawler-track crane models with load capacities between 300 and 1,200 metric tons. Their maximum lifting heights are between 163 and 226 metres and they can operate at maximum working radii from 120 to 164 metres. The maximum load capacity expressed as the load moment, is between 5,080 and 20,904 metric tons.

With these models, Liebherr caters for the entire all-terrain and crawler-track markets – everything from the mobile 'taxi crane' with all-in concept to the heavy-duty vehicle crane for assembly tasks, complete with various attachments.

With this comprehensive programme of cranes, Liebherr's share of the international market in 2000 was approximately 36 percent.

4. Economy and customer benefits

In the final analysis, customer satisfaction is the key to the success or failure of a mobile or crawler-track crane.

There are several factors that contribute to customer satisfaction:

- Economy
- Environmental acceptability
- Operating reliability
- Safety (including reliable operation of the controls)
- Flexibility in use
- Logistics
- Comfort and convenience

A mobile crane's economy can be calculated from 'life-cycle cost' data, in other words manufacturing cost (or the purchase price) and running costs on the one hand, compared with earnings and resale value on the other.

A reduction in energy consumption when on the road or during actual crane operation not only improves the economics of crane ownership but

also makes a useful contribution towards reducing the environmental burden.

Compared with conventional drivelines, new technologies such as the LI-AS Drive system already mentioned help to reduce fuel consumption when the crane is being driven.

By October 2001 all Liebherr diesel engines used in LTM and LR cranes will comply with the EURO 3 or Euromot Stage 2 exhaust emission legislation. Thanks to this significant reduction in exhaust emissions, they will easily outperform the statutory limits.

Considerable work has also been done on optimising components that act as a source of noise, for example the diesel engines, hydraulic motors, fans and hydraulic pumps, and also on secondary noise-insulating measures. As a result, noise emissions have been lowered still further in both the road-travel and crane operating modes.

Fully tested and proven components manufactured in volume and intensive quality assurance measures during the entire design and construction stages for our mobile cranes ensure that they perform to high standards of reliability. Integral on-board diagnostic systems make it easier to localise and rectify any operating faults or functional defects that could occur.

Ease of maintenance is designed into these LTM and LR cranes as a means of ensuring top standards of operating reliability.

Their versatility and operating logistics are important factors in relation to the size of the crane and the conditions in which it is expected to operate. In the case of large cranes in particular, the proportion of the total cost and time represented by the actual load lifting operation on site is often quite low. To obtain the full benefit from this, it is vital for other important aspects such as the transport dimensions and weights and the speed of setting up the crane at the operating point to be taken into account at a very early stage in crane design. These precautions have been taken in the case of both LTM and LR models.
Although increasingly high performance is demanded of our LTM and LR cranes, it remains essential for no risk to be involved when they are driven or operated. Safe working in all possible conditions is and remains our top

priority. Safety requirements have to take precedence over the crane concept, never the other way around.

A further customer-benefit factor is reliable operation of the controls. Since the controls in all our models are standardised, the crane operator rapidly becomes familiar with every LTM and LR crane and remains in full command at all times. The equipment and work-area ergonomics in the crane operator's and driver's cabs also play a part in this process that should not be underestimated. An adequate standard of comfort is essential if the crane is to be operated safely for lengthy periods. The standard equipment specification offered on our LTM and LR models takes this requirement fully into account.

There will be certainly be ongoing changes to the technical design of mobile cranes Our aim must be to apply new and developed technologies in the most suitable proportions and at the correct moment to cranes that have been conceived in every detail for efficient performance of the tasks for which they are intended – and to keep a watchful eye at all times on the cost-benefit ratio that our cranes offer their users.

Since the technical situation is constantly becoming more complex, it is clearly important for the exchange of know-how between the development engineer and the crane user to be intensified wherever possible.

Thank you for your kind attention.