A longer life for your port cranes

Crane upgrades are an increasingly viable and attractive option for container terminals of all sizes. But what is really involved, and when is upgrading older equipment the right choice?

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Get more value out of your crane with a well-planned upgrade

As container throughput and vessel sizes continue to grow, and as terminals face continuous pressure to reduce the cost per container move, operators need to be ready to go faster and higher with their port cranes. However, this has to be done while keeping costs under control if they are to stay afloat in an increasingly competitive market.

Serving larger vessels may mean heightening ship-to-shore (STS) cranes and extending the boom reach, while addressing rising fuel costs and stricter environmental regulations means seeking out alternative ways to power rubber-tyred gantry (RTG) cranes. Coping with increased container throughput may also require heightening RTGs and other yard equipment to enable vertical expansion through higher stacking.

CHOOSING A SUPPLIER

Regardless of the type of upgrade project, there are several factors to consider before any kind of work can begin. The starting point is scoping the work involved and its technical implications, which will help develop a clear idea of the costs in collaboration with potential providers. Crane upgrade timeframes can vary immensely between projects and terminals. Based on the scope of work, a terminal may decide to use its own maintenance staff, but due to the sporadic nature of the needed resources, the most common approach is to put the project out to tender and select a preferred supplier to handle the entire process.

For terminal operators, the key factors to look for in a potential supplier are transparency, trustworthiness – including financial stability – and a strong track record. Working with a supplier who can provide comprehensive assistance right from the early stages of the decision-making process will ensure the best possible outcome. Operators should look for proactive support during the scoping stage, a deep understanding of their needs and requirements, and a shared vision of the goals they want to achieve.

GEARING UP FOR THE DEMANDS OF A RAPIDLY CHANGING INDUSTRY

Port cranes can be upgraded for several reasons. Equipment may suffer from reliability problems due to age or poor maintenance. Wear and tear is a natural process that any terminal operator has to deal with throughout the equipment lifetime, with specific components requiring one-off replacement to maintain safe and efficient operation. Technical advances may enable new features that can be installed on

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existing cranes or components. Spare parts may no longer be available for obsolete electrical drives and control units. A crane may require thorough repair or refurbishment due to damage, for example after a vessel collision. Furthermore, operators are driven to reduce their fuel costs and comply with tightening environmental regulations by improving energy efficiency.

KEEPING THE TERMINAL MOVING IS CRITICAL

Improved reliability is by far the biggest benefit of upgrading, because a terminal that is not moving is not making money. When serving vessels and moving containers, the implications of a breakdown can be significant and costly. For a terminal serving a large vessel with three STS cranes, a breakdown of just one crane may mean a few hours' delay in ship turnaround time, but this can have a huge compounding effect. The vessel may miss the tide and be unable to sail for the following 12 or even 20 hours, meaning it is unlikely to fulfil its tight schedule and may have to skip a planned port of call entirely. These delays may even result in financial penalties for the operator.

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UPGRADING VS. REPLACEMENT

When should a terminal replace an older crane instead of upgrading it? Due to the highly variable nature of terminal operations, there is no single right answer to this question. However, a viable upgrade project should always be more cost-efficient than replacing a crane. Direct costs are easy to calculate, but indirect benefits or disadvantages as well as unknown risk factors are more challenging to quantify. Structurally, a crane may be in good shape and not require any significant attention, but other components may be old or poorly maintained, with spare parts being hard to source. For example, drives and electric motors may suffer from poor or irregular maintenance procedures and may not be performing at full capacity, while an outdated, uncomfortable operator cabin can reduce productivity.

If the condition of a crane is such that it requires major refurbishment, perhaps involving structural upgrades, the decision can be a close call, with the total cost of upgrading perhaps being significant compared to that of purchasing new equipment. However, even in these cases, upgrading does offer a big advantage over replacement in speed of deployment. Aside from the significant capital investment, the lead time for purchasing a new port crane is typically 12 to 24 months. With upgrades, operators can start addressing the issue within a much shorter timeframe.

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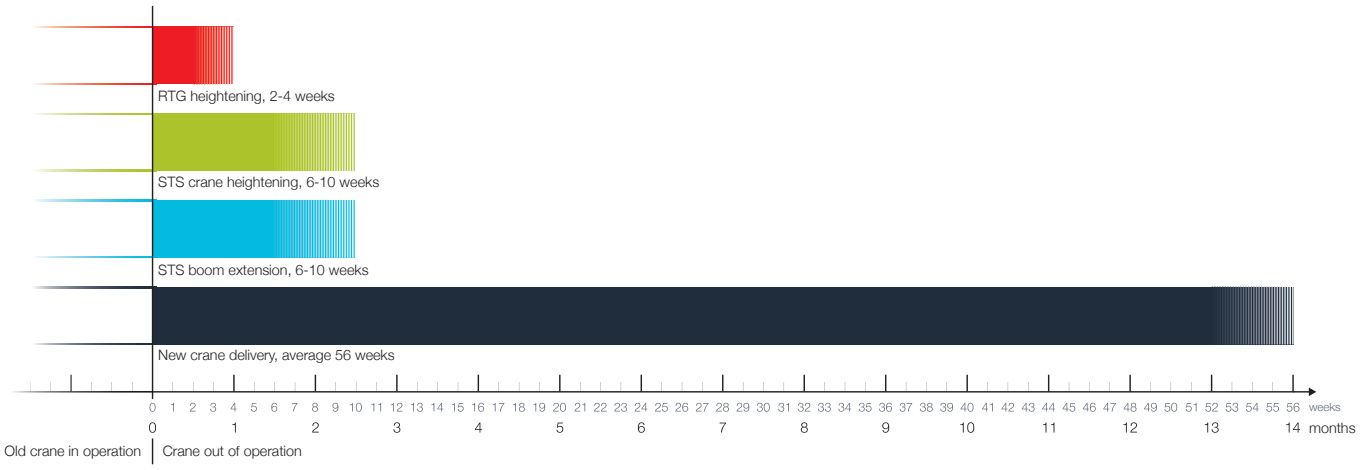

AN EXPANDING MARKET

The global market for crane upgrades is expanding rapidly, driven by the factors discussed above. For large terminals located within or close to cities, there may be little or no possibility for expansion. In this case, the only way to meet new operational demands is to increase productivity by boosting the efficiency of terminal equipment.

Upgrading is very much a case of smart asset management. Upgrade planning is an chance for forward-thinking terminals to get the most from their equipment and take every opportunity to maximise their return on investment. Often even a relatively modest investment can pay huge dividends in terms of productivity and, therefore, profitability.

FUTURE-PROOFING STS CRANES

With STS crane heightening and boom extension being inextricably linked to the maximum size of vessel that can be served, the investment decision becomes a strategic choice – a terminal can either serve larger vessels or it cannot. It is not simply a case of weighing the return on investment; rather, a decision to upgrade STS cranes in this way immediately sets the course for the future of the terminal and the customers it can attract.

Some terminal operators have taken an early gamble and have undertaken crane heightening and extension without first securing customers with vessels to serve. If the gamble pays off, it gives them a competitive edge over neighbouring terminals because they are already set up to handle these larger vessels. Alternatively, they may choose to serve a different customer segment altogether, making heightening and extensions unnecessary.

For heightening, a critical consideration from an engineering point of view is the load tolerance of the quay below the crane. This will determine what kind of jacking system can be used to lift the crane during heightening – a choice that also has cost and time implications. The options open to the terminal will be covered during the detailed engineering study undertaken by the chosen partner. During heightening, the portal structure is strengthened to maintain stiffness and reinforce the structure for increased loads. Cables, drums and hoists are also modified according to the new height. Furthermore, the boom may be lengthened to allow the crane to serve wider vessels.

> Moving an STS crane is a highly demanding undertaking.

BENEFITS FOR BOTH NEW AND OLD EQUIPMENT

Older cranes are not automatically prime candidates for upgrading. Even relatively new STS cranes may already be too small to handle the larger types of vessels that some shipping lines are now operating.

Heightened cranes are typically between 5 and 15 years old, with the average lifetime of an STS crane being about 25 years, depending on the number of moves. For newer equipment this kind of upgrade essentially means changing the physical dimensions of the crane; for older equipment other upgrades will probably need to be undertaken at the same time. These can include, for example, the addition of modern crane monitoring systems and a new operator cabin.

COST AND DOWNTIME

The cost of heightening an STS crane varies greatly depending on the equipment in question and the chosen heavy-lifting solution, but as a rule of thumb it can be somewhere in the region of 1.2 million euros per crane. In terms of crane downtime, the timeframe can vary from six to ten weeks, but a longer period of extensive engineering calculations and

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detailed planning has to be undertaken before this. A jacking system that lifts the crane from the ground can take longer to set up, but once it is ready the heightening work can be repeated much more quickly in multi-crane projects than if the crane were to be lifted from the sillbeams with the weight on the railspan. The latter is a safe choice when the limits for maximum ground pressure would otherwise be exceeded, or are not known for certain.

RELOCATING STS CRANES

Moving an STS crane is a highly demanding undertaking. There are three reasons why a port operator might relocate a crane: major repairs, the crane no longer being in use, or transferral of port operations. For global terminal operators, the last of these is a common driver behind relocation, i.e. transferring equipment between their own terminals to address changing needs.

The complex, potentially risky process can easily result in economic loss or human injury if undertaken without expert knowledge of crane stability and the abnormal stresses that transportation places on crane structures. Water transport is generally more complicated than short-distance moves on land. With numerous environmental parameters to take into account – including seawater depth, tides, swell and wind – engineering a crane move by water can easily take several weeks.

RTG ELECTRIFICATION AND HEIGHTENING

With most RTGs still running on increasingly expensive diesel fuel and with emissions and noise regulations becoming ever stricter, electrification is fast becoming a question of ”when” rather than ”if”. In addition to fuel savings and reduced environmental impact, electrified cranes also experience less downtime and are simpler and cheaper to maintain.

The two common ways to electrify RTGs are the bus bar and cable-reel systems. When it comes to selecting the best approach for the terminal, the layout, operation type and number of cranes all need to be considered. A preliminary site inspection by the supplier will help to prevent any potential problems and achieve the best possible outcome.

CABLE-REEL VS. BUS BAR

With the bus bar system, a conductor bar assembly is installed along the stacking area and power is fed to the RTGs via a collector trolley on the bus bar or arm-collector assembly attached to the crane.

A cable-reel system involves the installation of a power transformer onto the crane to reduce mains power to the RTG motor supply voltage, with the power feed point either at the end or centre of the container block. As automation technology advances and terminals look to take advantage of the cost and efficiency benefits it offers, the cable-reel system may become the most popular choice in the future. With this system, fitting the optical data link required for data transfer between automated cranes and a monitoring station is relatively simple. Electrification is considered a prerequisite for automating some RTG functions or entire RTG operations in the future.

Diesel electric RTG

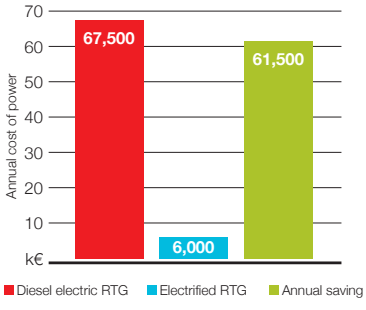
54,000 litres/year
3,000 h/yr, 18 l/h

67,500 €/year
1.25 €/l

Electrified RTG

120 MWh/year
3,000 h/yr, 40 kW/h

6,000 €/year
0.05 €/kWh



Approximate annual saving per RTG
€61,500 = $66,000

Annual saving for a terminal with 20 RTGs
€1,230,000 = $1,300,000

Currency rate 4/2015

ROI expectation:
2–4 years depending on project scope and local fuel price

> The financial benefits of RTG electrification are easy to calculate.

FINANCIAL BENEFITS OF RTG ELECTRIFICATION

The financial benefits of RTG electrification are easy to calculate. As an example, an RTG may consume 18 litres of fuel per hour and have a typical operation time of 3,000 hours per year. At a fuel price of €1.25 per litre, this results in an annual fuel cost of €67,000 per crane. After electrification, factoring in the cost of power at about 10% of the price of diesel fuel, the saving can be something in the region of €60,000 per year per crane. For a medium-size terminal operating 20 RTGs, this adds up to significant savings. If the average cost of the electrification upgrade is €150,000 to €200,000 per crane, the payback time of the investment is only approximately three years.

RTG HEIGHTENING

Similarly to STS cranes, RTGs can also be heightened, with the cost being close to that of electrification. Heightening involves adding leg inserts to extend the height and the main hoist, and modifying the cables and ropes to enable longer lifts. New braces are also installed to maintain structural stiffness. Increasing stacking height, for example from four to five containers high, enables a 25% increase in terminal capacity that can deliver a rapid return on investment.

These kinds of upgrade operations can be compared to fixing an airplane while flying. With most terminals running at full capacity year round, mitigating the impact on operations requires careful planning from the start.

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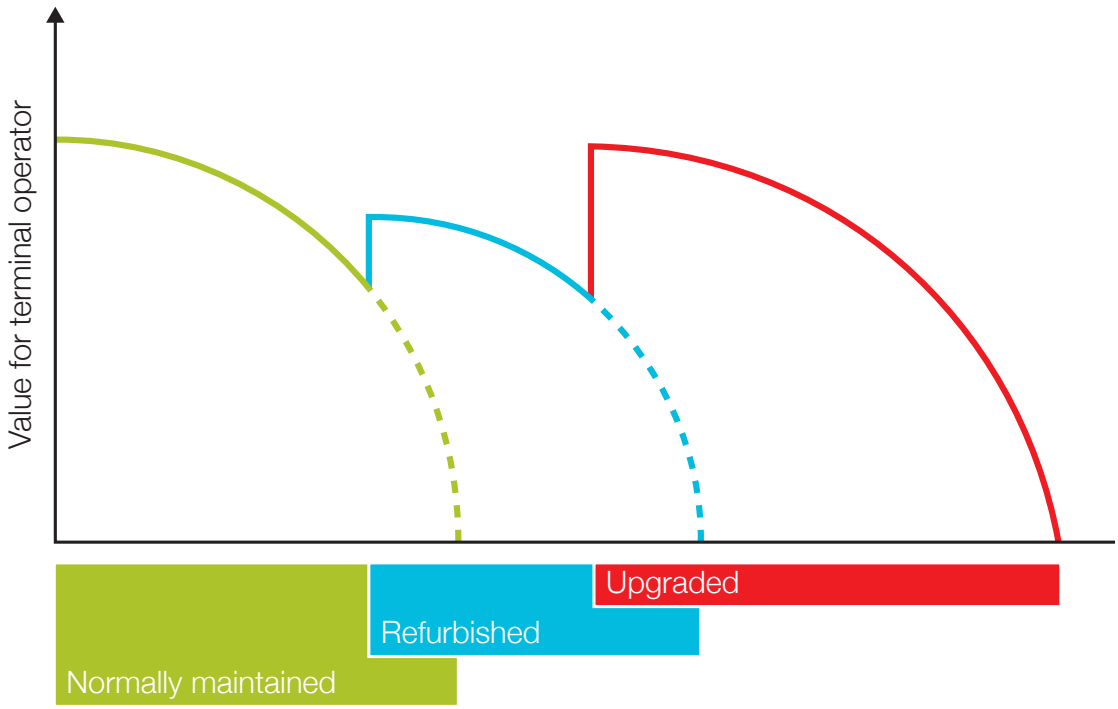
> Crane upgrades open up a world of possibilities to get more value out of existing assets.

SMARTER ASSET MANAGEMENT

With container volumes and vessel sizes growing continuously, and terminal operators looking for cost-efficient ways to go higher, faster, and greener, crane upgrades open up a world of possibilities to get more value out of existing assets. With a careful choice of supplier and a solid strategy in place for the future needs and direction of the terminal, operators can take a giant leap forward by enhancing their existing cranes and extending their lifespan as a cost-effective alternative to purchasing new equipment.



Refurbishments and upgrades can extend the crane lifetime

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Vice President Crane Upgrades, Kalmar, is a container industry professional with more than 25 years experience in the business. Mikko has a broad background within Kalmar; he started his career in product business management with main focus on terminal tractors. Mikko has been leading sales and service operations, been responsible for business development and led mergers and acquisitions. Mikko is currently responsible for the Kalmar Crane Upgrades business on a global level.

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Director Crane Upgrades EMEA North, Kalmar, has strong experience in the crane upgrades business. Jelle started his career as a sales engineer and has worked with crane upgrades since 2008. He has led several projects related to crane upgrades and refurbishments.

ABOUT THE COMPANY

Kalmar, part of Cargotec, offers the widest range of cargo handling solutions and services to ports, terminals, distribution centres and to heavy industry. Kalmar is the industry forerunner in terminal automation and in energy efficient container handling, with one in four container movements around the globe being handled by a Kalmar solution. Through its extensive product portfolio, global service network and ability to enable a seamless integration of different terminal processes, Kalmar improves the efficiency of every move.

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