

Moving crane operations to the control room - What can we learn from process industries?

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Moving crane operations to the control room

Stacking crane operations have been handled from a control room for some time now. As we begin to see ship-to-shore (STS) crane operators moving down from cranes to control rooms, the question arises: what does this mean for container terminals? One way to identify both opportunities and possible pitfalls is to look into what, for instance, process industries have done to improve the ergonomics and thus productivity by developing concepts for control rooms and the primary operator working environment.

The recent orders awarded to ABB show that remote control of STS cranes has made its breakthrough on the market. Driven by the need for higher cranes with lifting heights over 50 metres and higher productivity requirements, we expect the demand for this technology to increase.

Benefits of control room operations

Crane operations from the control room improve operators' working environment and reduce fatigue, stress on the neck and back, and so on. Operators supervise the crane motion via views from on board cameras, which are often more comprehensive than the views available from inside the crane cabin. With no operator on board, the crane can run faster and ramp times can be shorter. This enables shorter cycle times to unload an entire ship of cargo.

The fact that cranes will be operated from an office environment alone creates opportunities for improved operator performance, this also enables improved productivity. Moving

crane operators to an office environment already improves working ergonomics but the ergonomics can be enhanced further by looking into how the control room and the operator workstation should be designed. Investing in modern, well-functioning working environments pays returns by reducing sickness absenteeism, and encouraging more motivated and better performing operators.

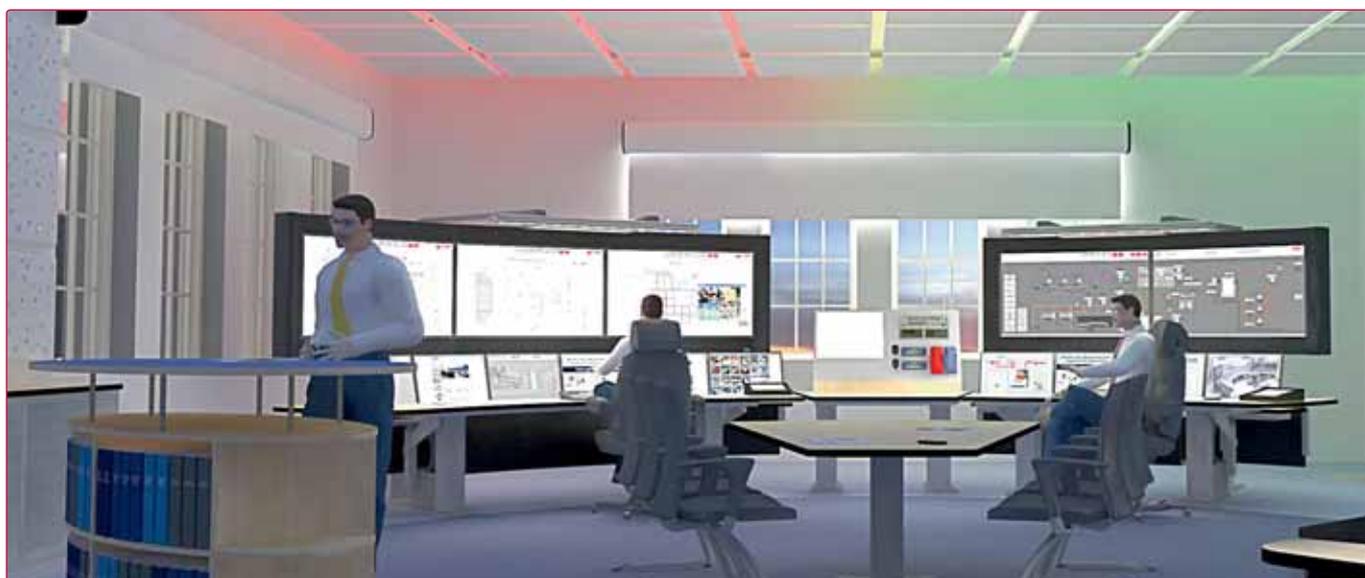
This article presents some valuable findings from other industries that have already taken steps within this area and have improved operator performance and productivity. For several years, ABB has conducted research and development to create a concept for the intelligent control room with a modern working environment for operators, from the perspective of both ergonomics and productivity. The concept includes understanding of the operator's role and how operator performance affects a plant's key performance indicators (KPI).

Important lessons from process industries

The trend in process industries is a consolidation of small isolated and dedicated local control rooms into one control centre. This enables the operators responsible for supervising different parts of the process to work together more effectively. A shared physical working environment creates a feeling of belonging to a team and makes the sharing of information between different functional groups easier and a natural part of working. The layout of the control centre facilities plays an important role in how well this target will be achieved. In fact, from the recent study conducted by ABB, consolidation of systems in centralised control rooms was the single most



Crane operators new working environment: modern control room where operations and maintenance personnel can also collaborate to improve terminal operations



Lighting can be used to support operator in critical operational situations. In this example from process industries, the surrounding lighting is tuned down to increase operator's concentration on the screens. Lights in different colours are used to communicate to others in the room that the operator is handling a critical situation (red light), so is reminded not to disturb the operator.

important factor in promoting collaboration between operators and other groups, including maintenance management.

A common mistake when making this change is that the operators and monitors from local control rooms are moved to the control centre in keeping with traditional operational principles, which also determine how the control room is built and designed. This often results in building a bigger control room than necessary. The communication and collaboration needs and patterns are not taken into consideration, which hinders operators benefiting from a shared location in various operational conditions and situations.

As a consequence, companies that merely move existing control environments to a new central one will miss the opportunity to think about operating and operator strategies and visions to optimise the operator performance and achieve maximum productivity improvements. In the ABB survey mentioned previously, the respondents confirmed that operator performance has an impact on a plant's key performance indicators, such as plant availability and utilisation, as well as equipment damage and personnel safety. There are also studies indicating that a significant share of unscheduled production disruptions are related to human errors.

The conclusion from this survey is that it pays off to invest in the operators' working environment and systems that support operators' decision making. Dialogue with companies in process industries also confirms that a modern operating environment attracts competent personnel when recruiting new operators. In some industries and countries, this has already become a prerequisite for ensuring that highly skilled personnel remain with the company.

ABB philosophy: operator in focus

ABB's philosophy for the modern operator's working environment is based on the fact that the control room and control centre should support the company's operating strategy.

One example of a company's operating strategy could be that the operator should concentrate fully on his or her core responsibilities as an operator and make sure that the production-related processes are running smoothly. Another example of what might be included in a company's operating strategy is that information is made intuitively available and that this is available

exactly where the user is, ie. in the operator's workstation or in the mobile devices of maintenance personnel.

Furthermore, the operator should be the central focus when designing a modern operation environment. This means considering every aspect of the operator as a human being as well as the environment itself. The objective should be to create an overall pleasant and effective working environment that promotes operator alertness and proactivity. The following list contains a number of important aspects to consider according to ABB's philosophy. Some of them are directly related to the operator's workstation itself and some discuss the design of the control room from a wider perspective.

Information presentation

Traditional solutions for control systems in process industries present huge amounts of data to the operator. This requires many monitors. Positioning a large number of monitors in a way that the operator can view them and work efficiently and comfortably is difficult. By using modern technology, ABB can offer possibilities to present information quickly and easily in context when needed. The monitors should be placed so that sight angle recommendations (EN 894) are met.

The operator's key role in monitoring the process can be made easier and more comfortable by optimising the information presentation. This allows the operator to concentrate better on the task at hand. It also reduces the number of monitors needed.

Considerations for consoles and chairs

All consoles and chairs in the control room need to be easily adjustable to meet individual needs. This may sound simple, yet it is too often ignored and when adjusting the furniture is complicated, people do not make use of it.

Placement of the operator workstations in the control room

Placing operators too close to one other creates a disturbing environment. Placing them too far away from one other increases the cost of the control room space. It also makes it hard for operators to collaborate and communicate with each other. It is therefore important to consider early in the planning



An example of a crane operations control room layout based on experiences from process industries. In addition to the operator workstations the layout takes into consideration the positioning of adjacent areas such as meeting rooms, locker rooms, and dining areas.

phase the actual number of operators that will be working in the control room. The future needs with regard to number of operators should also be anticipated at early stage so that a cost-effective, sustainable control room solution can be designed from the very outset.

Lighting and noise

Correct lighting and low noise levels are important factors. Windows provide natural light and give operators a reference to time (day/night), making it easier to stay alert and focused. Flooring, noise absorption solutions as well as communication tools (eg. walkie talkies rather than mobile phones) play an important role in achieving a desired noise level. The importance of these factors grows along with the number of people working in the control room.

Adjacent areas

Meeting rooms, kitchen/dining tables, locker rooms and other similar facilities should preferably be located close to the control room. However, they should be separated in order to keep noise, smells, rubbish and dirt out of the control room. When these facilities are available in conjunction with the control room, the personnel can, for instance, enjoy their coffee and lunch outside the control room without disturbing the operators on duty. Paying attention also to the adjacent areas, not only the control room itself, allows the creation of a comfortable and effective overall working environment.

Planning the people flow

When designing a control room, it is important to take into consideration how personnel can move between different areas. Major pathways should be placed so that personnel can move between the process areas without entering the control room and in a way that ensures the control room does not become a shortcut when moving between the process areas. The same goes for planning how visits to the control room should be handled. Visitors are often welcomed to the control room during normal operational conditions. However, sometimes visitors might be in the way when operators need to take care of some kind of disturbance or alarm situation, and in such situations visitors should have an alternative way of viewing the control room. A large monitor outside the control room displaying the current production status provides a good solution. If there is a window to the control room, it should be placed in such a way that the operators do not notice if someone is looking at them.

Location of the control room/centre

Whenever possible, the control room/centre should be placed apart from the actual process, for instance in a separate office building. This enables a more pleasant, safe and ergonomic environment as well as reducing noise, vibration, pollution etc.

Focus on ergonomics on an early stage

Ergonomics and designing well-functioning working environments for operators requires expertise. To avoid mistakes

that are difficult to correct later, it is advisable to consider ergonomics and the control room layout early in the process. A successful concept considers the operator's primary working environment i.e. the operator's workstation, and the secondary environment i.e. the overall control room design as one entity.

Implications for crane operations

In many ports of the world, new container terminals are being built and will be built during the coming years. The technology is already in place for moving ship to shore crane control operations to a central control room instead of local control rooms i.e. cabins located in the cranes. Since new infrastructure will be built, observations made in process industries provide valuable insights and inputs for terminal operators. ABB has created a concept for the intelligent control room with a modern working environment for the operators from the perspective of both ergonomics and productivity. Several control rooms applying this concept have already been implemented by many companies within process industries.

In conclusion

We have seen the positive impact of well-designed control rooms on productivity in our customer organisations within process industries. The trend is also clear: an increasing number of companies have realised the importance of the operators' working environment. While terminal operators have many aspects to consider when they start to apply new technologies and new ways of working, such as remote control of cranes, they can anticipate a positive impact on productivity and operator performance as a result of investing in modern and well-designed control rooms.

ABOUT THE AUTHORS



Clara Holmgren joined ABB in 2001 and has a long and versatile experience in crane automation. In her role as product manager she has been deeply involved in the development of ABB's remote control solutions and in applying the company's control room design knowledge to container terminals. Clara studied automation engineering at the Chalmers University of Technology, Gothenburg, Sweden.



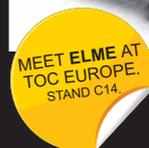
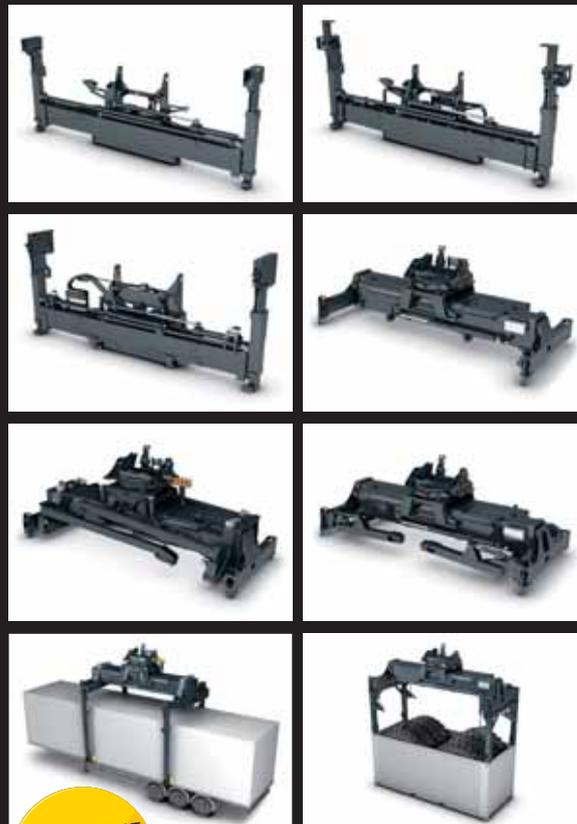
Lena Nyberg started at ABB in 1985 with much of her career focusing on control systems within process industries. In recent years she has specialised in operator working environments. Before joining ABB, Lena studied economics and finance at the University of Mälardalen, Västerås, Sweden.

ABOUT THE COMPANY

ABB Crane and Harbor serves customers in container and bulk cargo handling. Based on its in-depth experience on terminal operator's processes and operations the unit provides complete automation and electrification systems for new installations, upgrades as well as modernization of existing systems. ABB's automation and electrification solutions increase the terminals' productivity allowing short turnaround times for even for the biggest vessels.

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