A global integrated oil major relies on Yokogawa for seamless technology obsolescence management at key offshore fields, all while achieving uninterrupted production.

When you operate offshore platforms that produce over 100,000 barrels of oil and more than 20 million cubic feet of natural gas per day, some of them in deep water fields in excess of 5000 feet, maintaining safe operation with no lost production is vital. A lost production event will have a significant bottom line impact and could potentially stress a production asset.

Any time operators of such installations consider making modifications to their control systems, it takes multiple drivers to balance against the risks. End user operations teams realized they could considerably reduce OPEX by rationalizing commercial personal computer (PC) platforms and the accompanying software licensing. They could also greatly extend the system lifecycle with new PC and server platforms—a critical consideration given that the expected service lives of the offshore production facilities exceed 30 years.

They also realized that they could benefit from the myriad new technologies that have recently arrived on the scene.

Not only are IT and OT technologies merging, both are in the midst of unprecedented disruption. While they all fit neatly within categories that use the latest buzz-terms—advanced analytics, artificial intelligence, augmented reality, Cloud, digital twin, Edge, Internet of Things, machine learning, virtualization—benefits must be proven before the technology is put into practice. Proof-of-concept testing told them to expect gains in productivity, energy efficiency, safety, and working capital employed.

Looming large in terms of risk management was compliance with corporate IT technology standards in order to address cyber security threats and obsolescence of commercial PC operating systems.

Yokogawa recently worked with the oil major on a number of successful control system upgrade projects at installations around the world. Since the systems were commissioned, the end user expected requirements would only become more demanding. A key requirement was that the control system continue to enable deployment of new technologies, ultimately supporting a complete digital transformation.
In order to manage risk, the end user determined that staying current is critical. Finite lifespans of Windows operating systems are always prominent in risk assessments. Internal technical compliance audits are intolerant of software applications or operating systems that do not allow updates to address cyber security vulnerabilities. Standard risk management practices strive to keep operations technologies well ahead of impending ends-of-services lives.

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On the opportunities side, newer versions of Windows and Windows Server operating systems support emerging technologies in which the end user has been interested—as do recent versions of the control system applications. Keeping software versions current also enables long-term lifecycle planning with reduced risks in terms of support.

The operations teams saw opportunities to reduce the computer hardware footprint and rationalize software licenses. The original project called for more “seats” than the evolving staff required. There was underutilized computer hardware as well as unused software applications that continued to consume computing resources.

Operations teams were also eager to take advantage of newer PC platform technologies, which offered many benefits such as increased reliability and service lifespans compared to the commercial, off-the-shelf platforms currently in use. For example, virtualized platforms could replace multiple servers with more robust, secure technology. Yokogawa had recently completed testing of all their control system applications on virtualized platforms.

In addition, Yokogawa had announced updates to their “Global PCs,” which are standardized PC and server platforms that are fully pre-tested with control system applications. Among the numerous supply chain benefits is the fact that end user customers can rapidly commission the platforms with no configuration, software installation or proof testing.

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Dell supplies the platforms globally and optimizes the hardware, BIOS, drivers, and operating system settings for industrial automation applications. An embedded operating system minimizes the dependency on Windows and, in fact, isolates it from the control network. Extended lifecycle models enable a stable supply anywhere in the world.

A staff engineer stated that, "staying well ahead of hardware obsolescence is critical. New platforms could enable many years of very low risk system operation going forward."

A system software technology refresh was also in order. It was after the control systems were commissioned, that the afore-mentioned, disruptive technologies began to prove themselves. While the control systems were not originally designed to support IoT era technologies, newer releases are up to date in that regard. With full intentions of exploiting new opportunities such as digital transformation, the teams felt that updating was critical.

Management also kept in mind that in such a large-scale operation, the projects were much more than simple footprint reductions or version updates. There were numerous requirements with major impacts on productivity, OPEX, cyber security, risk management, compliance and lifecycle management. For any projects affecting operations, stakeholders span across the entire company and beyond.

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**Project Goals, Objectives and Approach**

The technology refresh projects focused on hardware rationalization, software license optimization and software/firmware version updates. Primary goals for all projects were OPEX reductions and meeting IT compliance requirements for cyber security, risk management, reliability, and lifecycle management.

A complete replacement of all PC and server platforms comprised the hardware rationalization. Updating to Windows 10 and Windows Server 2016 were key drivers on the software side. The project also called for updates to the latest versions of all control system applications for engineering stations, operator interface stations, asset management, historian, modular procedure automation, OPC servers and operator training simulators.

Control system version updates included firmware downloads to all distributed controllers and safety instrumented system logic solvers.

Topping off the list of project constraints were requirements that there would be no operation shutdown and no safety incidents. For a major upgrade project, including all top-end replacements and updates to all controllers, meeting those requirements was no small task.

Project teams needed to work around production schedules, which allowed very limited time slots for hardware replacements, firmware updates and commissioning of new software applications. In one case, over the course of the entire project, the end user allocated only a six-hour window during which production would undergo a planned shutdown. Any work that did require a shutdown would have to be meticulously planned and executed.
For all projects, Yokogawa was the main automation contractor, working in conjunction with end user program teams in a collaborative manner. Ultimately, collaboration and cooperation as a single, integrated team proved valuable. Brainstorming allowed the joint teams to devise innovative solutions that expedited project schedules and provided additional cost savings.

Skillset requirements emphasized strong program management and IT expertise. Upgrade projects on such a large scale incur numerous risks. Detailed planning, scheduling and management of change capabilities were critical. While IT skills took priority over OT skills such as upstream process knowledge, there were always team members with OT subject-matter expertise. An understanding of the complexity and impact associated with the integration of the critical operational systems into the process control and automation system to ensure uninterrupted service is paramount.

It was also very important for team members to possess an intimate knowledge of all Yokogawa applications and their behavior on new computer platforms. In addition, Yokogawa's main automation contractor experience and agile project execution methodologies allowed the teams to meet aggressive schedules.

In order to minimize travel, particularly including expensive trips to deepwater facilities, the teams conducted acceptance testing off-site with many members participating from other locations.

Going forward, end user operations are able to budget considerably lower OPEX due to software license optimization and reductions in the hardware footprint.

Project Execution

Projects began with two-week front-end engineering design (FEED) studies, on site, for complete audits focusing on software licensing. Those consisted of interviews with end-user operators and monitoring, to determine which applications were being used and which were unused.

The resulting license optimization yielded substantial OPEX reductions in annual software maintenance. There were other benefits, as well. Deployment of fewer applications simplifies compliance audits, increases reliability and reduces risks. The end user was able to decrease license costs and compliance auditing even further by deploying thin clients as operator workstations, a recent update from Yokogawa.

Virtualization enabled consolidation of software such as operator training simulators. By replacing multiple servers, a virtualized server can substantially reduce CAPEX and OPEX. In one case, consolidating more than 20 simulators on a single virtualized platform provided a considerable cost saving.

Meeting the schedule required the project team to conduct multiple hardware and software updates in parallel. Each of these “sub projects” used agile execution and involved detailed design, procurement, proof-of-concept testing and implementation. Project engineers conducted proof-of-concept testing in a virtualized simulation environment to perfect procedures for which on-site commissioning time slots were limited.

Team collaboration proved to be a key factor when it came to resolving differences in technical controls between the Yokogawa Global PC and end user IT requirements. Identifying details and taking action very early in the project enabled success. In a number of cases, Yokogawa defined new, standard platform configurations that adopted the end user’s controls.

A recently released control system capability allows end user operations to download new firmware versions and applications, “on the fly” with no requirement for the process to shut down. Ironically, updating the original firmware did necessitate a shutdown. Of course, the end user required the team to conduct the entire project with no lost production—but there was that six-hour window.

Success required detailed planning and coordination. The team downloaded new firmware to dozens of controllers and logic solvers within the six-hour timeframe and ultimately completed the entire project with no lost production.

Finally, in each project, a small number of distributed controllers required new hardware. The teams devised a backplane design that allowed replacement of controller hardware while the production process continued operating. In all cases, the teams accomplished the on-site hardware turnarounds on schedule.

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Conclusion

Despite very limited time constraints, the teams executed all projects on time and on budget. Production operations experienced no loss of functionality. There were also no reliability impacts, no safety incidents and no compliance violations.

Keys to success were effective project management and execution. While selecting team members with optimal skillsets was crucial, collaborative project engineering was very effective, particularly when it came to addressing differences in technical controls and cyber security requirements. Early resolution of those issues and incorporation of the controls in standard platforms were major factors leading to an on-schedule project.

It was also noted that Yokogawa’s experience as a main automation contractor in such time sensitive projects was critical. Detailed planning and simulation testing prior to time-sensitive technology updates on-site were critical. Focusing purely on technology refresh, rationalization and upgrades, while avoiding additional scope, also reduced risks to the schedule.

Going forward, end user operations are able to budget considerably lower OPEX due to software license optimization and reductions in the hardware footprint. Enabled by hardware rationalization, virtualization and thin client technologies, the simplified configuration not only expedites compliance audits, it increases reliability and reduces risks.

Updating the entire system also allows many additional years of low-risk operation. The updates offer new control capabilities and improvements in cyber security and lifecycle management. In the controllers, future updates to firmware versions and changes to applications programs can be made “on the fly” with no requirement for process downtime. The latest versions across the board enable new technology deployment and digital transformation, which will bring numerous additional benefits.

Replacing commercial, off-the-shelf PCs with global standard, system supplier-supported platforms increases reliability, reduces risks and removes costs associated with future compliance requirements. In case of system expansions, operations teams can rapidly commission the platforms with no configuration, software installation or proof testing required.

The control system technology refresh project also yielded an unexpected benefit. In response to the COVID-19 pandemic, the up-to-date, functionally stable system with secure remote access has helped streamline operations with minimal staffing on-site.

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