Coordinating a complex automation project

Installing an integrated control system in support of a major refinery upgrade meant coordinating the work of multiple EPC contractors

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To meet the latest European fuel specifications, INA has upgraded its Rijeka refinery, including building a new hydrocracking/hydrodesulphurisation unit, hydrogen generation unit and sulphur recovery unit. Critical to the project's success was the careful coordination of a complex automation project by Emerson Process Management, which helped ensure on-time start-up and efficient operations.

INA d.d. is an oil and gas company with exploration and production activities in the Adriatic Sea, Angola and Egypt, and refineries producing fuels in the Croatian cities of Rijeka and Sisak. The Rijeka refinery, located next to the Adriatic Sea, has a nominal crude oil distillation capacity of 4.5 million t/y. Production is centred on white products such as naphtha, gasoline and kerosene, but with a significant amount of fuel oils produced.

In 2007, INA began the process of upgrading the Rijeka refinery — including installation of a new hydrocracking complex — to enable production of Euro V grade products and meet the latest EU environmental legislation. The complex consists of a new hydrocracking/hydrodesulphurisation unit, hydrogen generation unit and sulphur recovery unit. A new centralised control facility for all three units was also part of the upgrade.

Because of the significant size of the overall project, the construction of each process unit was contracted out to a different engineering, procurement and construction (EPC) company. The lack of available EPCs in Croatia at the time of the start of the project led INA to turn to companies from outside the country. The hydrocracker processing unit was constructed by an EPC from the Czech Republic, the sulphur recovery unit by a Hungarian company and the hydrogen generation unit by an Italian group.

The modernisation project was split into two phases. Phase one, which finished in mid-2010, aimed solely to enable Rijeka to produce Euro V quality gasoline and diesel fuels in compliance with EU environmental standards. Phase two will be a residual upgrade project, which looks to improve yield and profitability from the new units.

Integrated control and safety system

In 2009, during construction of the new hydrocracker complex, INA approached Emerson Process Management to provide an integrated control system and safety solution for all three of the process units in the hydrocracking complex. Operated from a central control room, the integrated system had to offer a common user interface for operators of all three units. This would streamline training and enable the refinery's operators to move from one unit to another. It was also important that operators could view both the process data and the safety system data within the same user interface. This would improve the efficiency of operators and help to improve plant safety.

Digital plant architecture

With the three processing units having different contractors and completion dates, the integrated control and safety system project represented a considerable challenge. Critical to the success of this significant project was Emerson's ability to coordinate activities between the EPCs. Emerson provided a single point of contact for them, took sole responsibility for the automation systems, and coordinated the engineering approach. This coordinated approach ensured that fixed scopes, time schedules, budgets and warranties for each project were not adversely affected by the others.

INA selected Emerson to be the main automation contractor (MAC) for the sulphur recovery unit, responsible for front-end engineering and design (FEED) for the integrated control and safety system, and providing services that included automation engineering, installation, acceptance testing, commissioning, configuration, and start-up support for all three units.

The integrated solution for the hydrocracking complex is based on Emerson's PlantWeb digital plant architecture including the DeltaV automation system, DeltaV SIS safety instrumented system and AMS Suite predictive maintenance software. As an integrated control and safety system, DeltaV and DeltaV SIS systems provide the refiner with an integrated engineering, maintenance and operations environment, enabling the new units to operate safely and at optimum levels to maximise profitability.

INA found that all safety-related information is easily accessible through familiar and intuitive

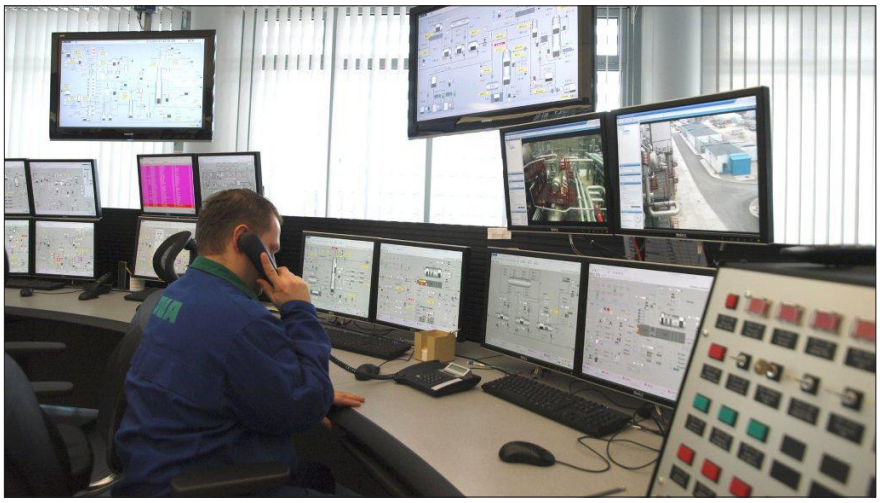

Figure 1 The centralised system is operated from one control room

applications. The integrated but separate architecture complies with standards for physical separation and independence of safety and control, delivering the benefits of total integration and total separation without the trade-offs associated with the two extremes.

The refiner also required an integrated gas detection system within the new safety instrumented system. Emerson's fully integrated gas detection system simplified the implementation, requiring only an additional separate cabinet to be connected to the DeltaV SIS. The integrated system requires less engineering, offers faster alarming and visualisation, and creates a single point of responsibility for upgrades and maintenance.

In addition to the integrated control and safety system, Emerson provided the majority of the field instrumentation, tank gauging and control valves. Now installed, this huge system incorporates nearly 50 process controllers, 180 logic solvers and approximately 5000 process and safety I/O devices.

Maintenance improvements

INA is using Emerson's AMS Suite predictive maintenance software to support improved maintenance procedures at the plant. By using predictive intelligence about the performance and condition of valves and instruments, we are now able to improve the availability and performance of these key assets.

The central control room is located approximately 1.5km from the process units. A video surveillance system with remotely operated cameras and a radio system were installed as a foundation for remotely operated systems.

A secure write mechanism within the DeltaV SIS enables maintenance overrides to be authorised for specific areas of the plant or group of equipment. This is performed via a key switch that is accessible by authorised operators using an HMI in the control room. This simplifies our override procedures, which would normally require a trip into the field and activation of a hard-wired override key switch located within the ESD system cabinet.

Project implementation success

The approach taken by Emerson to the project and the implemented solution was successful. An automation project of this size requires capabilities not only to implement the supplier's own equipment but also to manage multiple EPCs from different countries with different standards, specifications and schedules. A critical element to the success of the project was the ability to deploy locally based resources to coordinate these activities and ensure that the integrated system offered a common user interface for all three units.

During the course of this project Emerson helped to solve any issues INA had and provided on-going service and support. It took sole responsibility for the automation systems and coordinated the engineering approach, and the result was that there were no delays for any of the unit projects. Having installed the most advanced equipment and systems, Emerson's technical experts are now helping the refiner to maximise performance, ensuring the plant becomes one of the most efficient facilities of its type.

The supplier's project management services helped bring the plant on stream quickly and smoothly. Prior to start-up, INA's operators were trained off-line using Emerson's OTS simulator. This enabled them to understand the capability of the new system and how best to respond to process changes and unusual situations whilst in a no-risk environment prior to actual plant operation.

Integrated advantages

The integrated process control and safety system has created a number of opportunities for procedural improvements. The centralised system operated from one control room (see **Figure 1**) has enabled INA to optimise the number of operators and improve communication between individual unit operators. The entire operating team now works very much as a single team.

Because all subsystems are visible through one common user interface, with an overview schematic graphic on a central screen, it is much easier to use than the old system. United graphics on the dashboards make things easy to find and work with. Identification of process errors is subsequently faster and training operators is now much quicker. Because of the success of this project, INA will now standardise on a centralised control room and an integrated process control and safety system for all future expansion projects and upgrades to existing facilities.

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