"The future of automation will go hand in hand with the IT industry"

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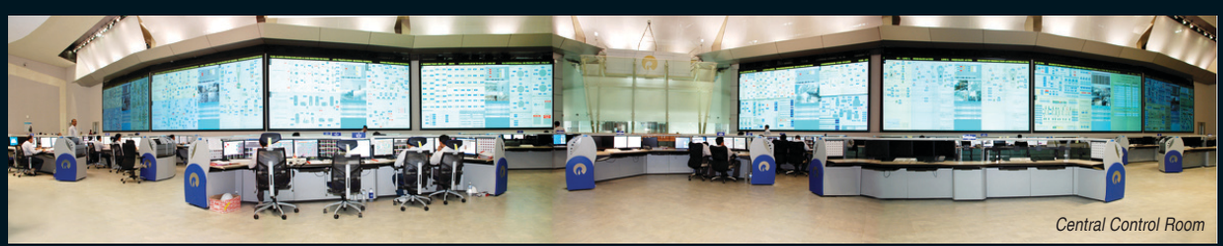

Central Control Room

You have led the implementation of fieldbus technology for Jamnagar Export Refinery Project (JERP), what was the objective to automate the entire facility?
With more than a decade of existence of state-of-the-art world class Jamnagar Refinery, Reliance management decided to build new refinery (JERP) in Jamnagar, with unique configurations, technologies, flexibilities and with the aim of automation technology to create next-generation control system using rich intelligence property of the refining process and the latest in technology to achieve operational excellence which will have no parallel in the world. Mission of automation in refinery was to achieve operational excellence in monitoring and managing process and business; optimum level of integration between process control, operation support and business support systems and showcase corporate image of Reliance Industries providing next-generation control systems. By implementation of Foundation Fieldbus (FF) technology, we have been able to achieve various objectives which include inter-operatable products and systems, elimination of proprietary protocols, device diagnostic, enable innovation by manufacturers through technology, lower installation cost, get more information from the valves and receive multiple inputs from single device. Additionally, it is much easier to add new instrumentation later and there has been significant reduction in wiring, terminations and commissioning time.

At JERP, various process units which have been integrated using FF technology include – crude distillation unit, vacuum distillation unit, saturated gas concentration units, Vacuum Gas Oil Hydrotreating Unit (VGOHT), fluidised catalyst cracking unit, polypropylene recovery unit, heavy naphtha hydrotreater, CCR platformer, delayed coker unit and gas plant, saturated LPG merox, sulphur recovery unit, diesel hydrodesulphurisation unit, Light Cycle Oil (LCO) hydrocracker unit, scan-finer unit, C4 alkylation unit, butamer unit, polypropylene unit, depentaniser and extractive merichem unit, tail gas treatment unit, refinery tank farm, marine tank farm, offsite and utilities and cogeneration captive power plant.

What are the various complexities of operations and their integration in mega scale process plants?
At times different vendors are used for implementing the overall control system plan to harness the core competency of different solution providers. Open control system architecture plays a major role in tightly integrating the different modules of control system, and makes them work in unison.

It is never an easy task to fulfil all requirements of process control and safety. Seamless integration of Distributed Control System (DCS) and Emergency Shutdown System (ESD) and integration of various systems with DCS like machine condition monitoring, compressor control systems, analyser management, fiscal and allocation metering systems, automatic tank gauging systems, PLCs for large mechanical packages is always a challenging task. To design and implement safety instrumented systems and mitigation layer system like Fire and Gas (F&G) system is also very critical in nature. In refinery we have various process systems like advance process control, tank farm management system, ESD system, F&G system, Oil movement system and blending and optimisation system, terminal automation system etc. which work in tandem and perfect synchronisation.

What homework did the company have to do before freezing on fieldbus automation?
We looked at three major aspects in selection of technology which included the future of process automation, proven technology and openness. We looked at the life cycle benefits that come during the lifecycle of project which typically included engineering, construction, commissioning and start up and operation and maintenance.

We ensured that the infrastructure was neutral, standards based, provided end-users with a common framework to implement and manage the strategies; and it improved continuously. Our experts visited various sites like Shell plant in CNOOC, Nanhai in China and SECCO plant in Shanghai, and also had various references from Shell Dear Park Refinery etc to look at technology advancement. Based on the feedback from our visits and references as well as others' experiences, we were confident that technology was proven. Additionally, through our continuous involvement with our vendors we learnt that the FF technology is non-proprietary, open and interopratable. We also considered

List of few advance technologies integrated in the JERP

- DCS with FF for major control and monitoring using Field Device Tool (FDT)/Device Type Manager (DTM) Technology. It involves 15,000 field instruments, 1200 temperature multiplexers and about 3600 FF Segments.
- ESD system with Latest Safety Standards (SIL) introduced for all the new technology plants.
- Alarm management following Engineering Equipment and Material User's Association (EEMUA) 191 guideline and robust asset management to provide predictive maintenance.
- State-of-art control room with visitor gallery catering to all process and utilities units, which has 110 operator stations and 40 engineering station. The gigantic eight video wall installed for collaborative management handling, start up scenario, shut down scenario, steady state scenario and Abnormal Situation Management (ASM), which itself is new concept in control. Each video wall comprises eight by four modules, each of size 8 metre wide and 4 metre high.
- Redundant single mode fibres connecting 40 Process Interface Building (PIB) runs about 700 Kms.
- F&G uses state-of-art detection device like triple Infrared (IR) flame detectors, multi-sensor smoke detectors and connect to central control room.
- CCTV network streaming live data to central control room which can pan tilt and zoom on the gigantic video on demand.
- Vibration monitor uses latest system to optimise the operation of plant.
- State-of-art online analyser and laboratory to ensure the fine control of the quality of the products and safety of plant and personnel. It also has 25 analyser house and 560 analysers spread across the entire JERP site. All are centrally connected using fibre to the central control room.

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the facts on market availability of the devices and products, compliance and if the technology will be supported in Indian market in the due course; interoperability to know how easy it is to activate devices on the systems and interchangability.

What were the main challenges in integrating and automating the entire complex prior to implementation of fieldbus automation?

FF requires different skill set and experience which was not available in all the offices and hence we had to struggle a lot to make it happen as we had very large work volume being implemented at the same time. Challenges were many since FF technology was relatively new to India as well as with the detailed engineering contractors. Learning curve was a must since many engineers in the detailed engineering contractor's offices too were unaware of the technology.

We ensured involvement of all parties including operation and maintenance teams from very early stage. Reliance had dedicated specifications for FF implementation to ensure consistency across entire JERP, minimise design effort at various design centers and simplify the overall field bus implementation process across various engineering contractors and engineering centers. These efforts were undertaken to minimise testing and problems related with commissioning and to get project common FF hardware components like FF junction boxes, power supplies and field barriers etc.

The teams for system and device selection and evaluation worked closely with the engineering device in their development laboratory in the USA and FF system training at Invensys India for pilot testing dedicated to JERP project implementation. FF template was developed on the IA system and each device was tested.

Our team also carried out FAT of devices along with the system by connecting all available devices on a segment and loading of segments to its full capacity. Training was another challenge, since this was the biggest kind of FF project in India and worldwide. Right from the conceptualisation till commissioning of the project training was imparted to entire team comprising of people who were involved in project i.e., design engineers, operation engineer, maintenance engineer, instrument technicians, and commissioning engineers. Different kind of training was given to different people at different time. This helped for successful implementation of FF without major issues.

FF experts from Bechtel Houston conducted regular audits at various stages during engineering, installation and commissioning, the key features of the FF implementation programme; which helped us to take care of rectifications during the initial stages of the project implementation thus reducing the commissioning time. We developed better installation methods, comprehensive testing methods and guidelines etc. during the implementation phase of the project.

What were the major challenges during the stage of project implementation?

Given the size of the project, coordination with all the engineering contractors and standardisation of automation design practices across JERP was a mammoth task in itself. It was a challenge to minimise number of Process Interface Buildings (PIB) where all automation was located, to fit automation cabinets inside limited space of PIB - marshalling, system, network and power distribution, etc and to design and implement fiber optic networks. More than 600 km of fiber optic cable was designed and laid in diversified redundant network to avoid single point failure. However, there was increase in actual cable length than engineered cable length. We had to address the practical problems in interoperability test of various FF field instruments with DCS.

There were differences between devices revision tested and actually supplied by the device vendor. Moreover, host of templates had to be created for each type of device.

How has implementation of fieldbus automation eased out the operations of the entire facility and if there are challenges that JERP needs to address?

Involvement of the expert team from projects, operation and maintenance from the early days of projects and effective interaction with selected vendors and other end-users had made the automation technology of refinery 'Future Proof'. We have immensely benefited after implementation of FF technology. His has enabled us to prioritise various process and system alarms as per the latest automation standard and trends in the process industry.

Device monitoring and information during the service fault and other diagnostic information has helped in predictive maintenance. Real-time Plant Asset Management (PAM) has given us access to assess plant health field devices and automation system; and ability to add new devices with reduced time, wiring and termination. Technology has built-in standard safety function such as device failure, function check and maintenance request with single operator display. Since display is digital, it eliminates conversion such as analog to digital which has improved accuracy and reliability. We can integrate certified products from different suppliers to selected system uniformly with standard features which will allow for interchangability.

In India most of the manufacturers are yet move away from conventional modes of automation to advanced automation technologies, what would be your advice to them?

There are five major identified forces most likely to impact industrial automation businesses which include transition from transactional to real time environment, transition from process to product management, transition from labour workers to performance management, transition form an island to holistic business perspective

and transition from rigid to agile operations. Industry is in for challenging times as these five driving forces impact operations in ways. The companies that best survive and thrive will be those that deal with the impact of the driving forces in the most effective manner. This will require a holistic, real time business model that will help drive profitability, and agility across industrial plants and entire industrial enterprises.

Any automation manufacturer to remain leader in market has to come-up with Innovation, latest technology, cost effective solutions. Also in place of standard offerings they should offer value added solutions to end-user. If a manufacturer does not follow the trends, it will be difficult for them self to sustain the business and leadership.

Many of the manufacturers today compromise on environmental and health aspect and thereby harm the community at large. They use obsolete technology to produce the product with the just acceptable quality but not meeting the other standards of production which calls for efficiency and lesser environmental impact. To subjugate this problem, various manufacturing forums as well as government statutory bodies should effectively help legislate and implement laws that would address not only product quality issues but also production quality issues without jeopardising the profits. This will trigger new wave of automation within the automation sector. Manufactures should work as a stake holder of the society rather than working in their own silos. Advanced automation technologies can certainly add more value in this process of reform in the chemical industry within India.

May we have your comments on the next generation automation?

Automation Industry has been evolving very fast with the advent of microprocessor technology that offered us flexibility of implementing our process control strategy. There have always been spill overs from consumer technology within the automation world. For example, advancement in IT and telecommunication technology has widely influenced the automation industry. There is a definite shift from the age old proprietary hardware and software systems towards more open universal hardware and software systems, which offers better interchangability of automation products. What differentiate much are the application layer and the hardware at the I/O level, with better availability and Mean Time Between Failures (MTBF) figures.

The future of automation will be going hand in hand with the IT industry such as the concept of virtualisation. Now a days, automation systems vendors are heading towards virtualisation of operator system interface; with running multiple operating system, on single physical machine by dividing system recourses between virtual machines; Isolating fault and security at hardware level with advance recourse control preserve performance; migrating any virtual machine to any similar or different physical service, which gives hardware independence; optimum utilisation of servers through recourse utilisation.

Through virtualisation, high cost related to maintenance, network, disaster recovery plan can be reduced and in turn also have low infrastructure needs such as low floor space, low cooling requirement, low power consumption etc. Another concept getting popular in process automation is Remote Operated Management (ROM). Due to rising operating cost, the plant operations are becoming more geographically dispersed. The traditional approach now days do not work with dynamically changing supply and demand; tighter production specification and environmental norms; challenge in identify skilled and qualified human recourses. In order to counter act such difficulties in present scenario, concept of ROM get as solution.

ROM can be used by conventional method of collecting datas from systems and analysis the datas as per the end-user requirement. Another ROM concept which is not popular in process industry, but used for the smaller size automation application, is CLOUD based ROM. In CLOUD based ROM, the datas are collected and stored in remote server through various communication gateways such as serial communication, Modbus RTU, or GPS; this stored datas are access through secured network such as Ethernet IP, GSM or GPRS for end-user through customised online display.

Recent development on ROM concept is being thought of by integrating Wired infrastructure, remote I/O's and ISA Wireless infrastructure, into FF infrastructure data management. This will enable real time operation management through more effective use of various data structure, data quality, in turn increase reliability and availability with predictive maintenance strategy. Control has already shifted to field with the maturing of the fieldbus technology.

Technologies like the CHARMS have used the windows like approach of plug and play that has helped in modernising certain Brownfield projects. There is innovation in terms of DART technology that helps us deliver more power to the instruments compared to the conventional intrinsic safe technology. The future lies in more processor power to execute complex control strategies in a real time 'control in the field' environment. Today there is a limitation on the number of devices that could be put on a segment on a fieldbus or a wireless segment. Further innovation in communication and microprocessor technology will help reduce the scan time of loop and the overall response time.

The bottleneck in technology advancement shuttles between hardware and software periodically and is being continuously addressed by the automation world. A radical change coming from the fundamental research in Physics can bring in a disruptive change in the automation world, just as it came after the advent of semiconductor technology. ■