



A Rockwell Automation Company

Tri Ocean Engineering Ltd./Lasmo Nova Scotia Ltd. Cohasset/Panuke Offshore Oil Production - Control & Safety Systems

The Client:

Lasmo Nova Scotia Ltd. is a wholly owned subsidiary of Lasmo PLC., one of the largest independent producers of oil in the world, with major reserves in Indonesia and the North Sea. The Cohasset Field, offshore Nova Scotia, is the first offshore field to be developed in Canada.

Tri-Ocean Engineering is a Calgary based independent engineering company with extensive experience in the design and specification of offshore drilling units, used in the production of oil, offshore.

The Requirement:

Tri-Ocean Engineering, acting on behalf of Lasmo Nova Scotia, contracted HinZ to design the control system for a 60,000 bpd. offshore oil production facility to be installed 260 km Southeast of Halifax, Nova Scotia. The control system was to be installed on the jack-up rig RGIII, located in the field. It was to be designed to control production from a remote platform, Panuke, and from a local platform, Cohasset. The system was to regulate the flow of condensate through the separation train, control the flaring of gas, re-injection of produced water, and monitor the transfer of oil via pipeline to the field located storage tanker (F.S.O.).

The system was also to be capable of monitoring and controlling the power generation on the facility, detecting, alarming, and initiating responses to fire and gas leaks, initiating emergency shut-down (E.S.D.) procedures on detection of faults in the process or equipment failure, and monitoring the communication systems between the RGIII and the Panuke platforms.

The Design Solution:

It was decided the prime element of the control system would be a Bailey INFI 90 D.C.S. system.

Off shore production facilities have to be designed and constructed with two major constraints pre-eminent; space is limited and all equipment located external to the safe area must be suitable for hazardous area, Class 1, operation. The D.C.S. system offers major advantages in both areas. All processing, I/O, and power supply units are housed in one cabinet that can be conveniently located in a safe area. All communication is via low voltage twisted pair and is redundant. Separate routing of communication links greatly improves system integrity during catastrophic failures. Expansion of the system does not involve costly I/O housing and supports being installed in hazardous locations. The new sensors can be wired back to the safe area and any I/O or processor additions can be carried out using standard practice.

The physical separation of the Panuke and Cohasset platforms, 10 km, dictated that two processor/I/O cabinets be utilized. The Panuke unit would act as a slave to the Cohasset master until such time as communication was lost between the units. At that time the Panuke P.C.U. becomes independent and would initiate a controlled shut-down of the platform producing wells.

The process itself was designed by Tri Ocean staff in close cooperation with HinZ control engineering staff. Control logic diagrams and I/O assignments were produced by HinZ personnel using AutoCAD to minimize error and speed-up the process. Motor control schematics were similarly produced and forwarded to the M.C.C. manufacturer for incorporation in the M.C.C. This pre-wiring significantly reduced installation time and allowed for an element of pre-commissioning.

The control system was designed to be fail-safe with 3 levels of shutdown control. Level 1 (E.S.D.I) would shutdown one specific (faulted) area of the process. E.S.D.II would shutdown the whole process, but leave all life support systems, including power generation, active. E.S.D.III produces a "Dead Rig" and is essentially intended only for use when "Abandon Ship" is sounded. E.S.D.I and E.S.D.II are controlled by the D.C.S. which receives input from various sensors via the E.S.D. panel and acts accordingly. However, the regulatory bodies dictate that there also be an independent stand alone fail-safe E.S.D. system installed on offshore production facilities. To satisfy this requirement a Pepperl Fuchs relay based E.S.D. system was installed. This unit is hard-wired to initiate the necessary shutdowns. All sensors are also repeated to the D.C.S. system, along with the E.S.D. commands, consequently failure of the E.S.D. system itself will initiate an E.S.D. via the D.C.S.

The Fire and Gas (F/G) detection system is connected to the D.C.S. and E.S.D. systems. The F/G panel is a Seiger GDACS microprocessor controlled unit with supervised sensors. Detection of fire or gas on one sensor only will initiate an alarm in the D.C.S., detection on two sensors, a "voted alarm", and will initiate an E.S.D.II.

As stated, Panuke is 10 km. away from Cohasset and, being offshore, normal communication methods are subject to the weather. It was therefore decided to incorporate a 4 fiber, fiber optic bundle into the sub-sea power cable run between the platforms. Optical communications provide reliability, integrity, and accuracy, especially in under water applications. The length of the run would have necessitated the use of repeaters in a wire system and a minor sea water leak would destroy the whole cable. As back-up for the fiber system, a microwave link with separate transmit and receive antennas was installed. The normal method of communication is via the fiber. The signals carried by the fiber include process commands and status, voice communications from the P.A./internal phone system, F/G status and alarms, and video from C.C.T.V. cameras mounted at strategic locations on Panuke. The microwave link does not carry the P.A. or video signals. Upon failure of a fiber optic component an alarm is initiated, control is then via the microwave system and the process continues uninterrupted. Upon subsequent failure of the microwave, an E.S.D.II is initiated on both platforms.

A central control room in the "safe" accommodation area of the RGIII houses the main control console and various ancillary displays and controllers. The control console comprises 4 displays with two keyboards for operator adjustment of control variables and alarm acceptance. One display is normally assigned to a Panuke process overview, one to a Cohasset overview, the third to alarm monitoring, and the fourth allows detailed examination of any part of the process for fine tuning/maintenance.

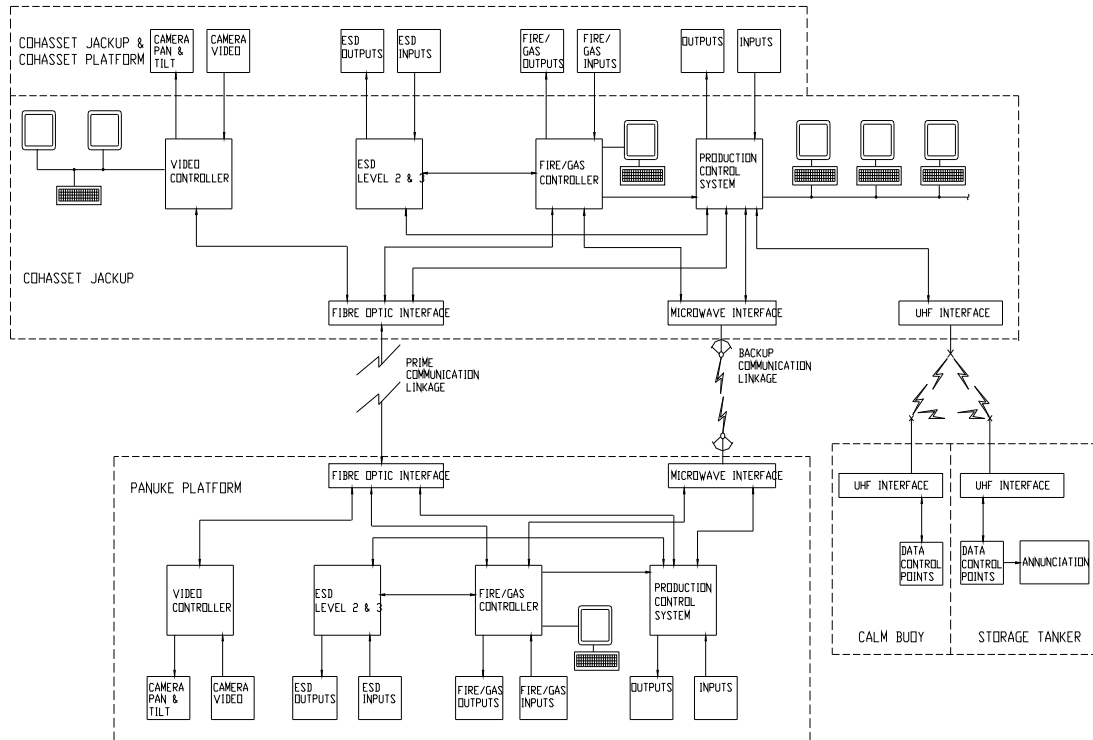
A fire/gas monitor screen is also mounted on the main console as is the C.C.T.V. monitor and switcher.

One major feature of the control system is load management. Available power offshore is definitely a finite resource and, if generator failure were to occur during full production, there is a real possibility the complete system would trip with all the related complications. To minimize this risk the D.C.S. system monitors the number of generators on line (Total Available kVA) and the Actual kVA. When actual exceeds available the D.C.S. starts selectively shedding load to reduce the actual to tolerable levels. The look-up table the D.C.S. accesses to determine order of shedding is operator settable, but certain loads (e.g. fire pumps) cannot be shed.



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System Specifications:

- Bailey INFI 90 D.C.S. 2 Units
- Bailey O/S 20 Control Stations 4 units
- Sieger G.D.A.C.S. Fire and Gas Monitor 2 units
- Sieger I.R. Gas Detectors 25 units
- Pepperl Fuchs E.S.D. System
- 2,000 D.C.S. I/O Points comprising;
 - 1,800 Digital
 - 200 Analog
 - 25 P.I.D. Loops
 - 150 E.S.D. I/O Points
- 350 I/O between intelligent devices e.g. Fire/Gas System, P.A. System.
- C.C.T.V. system utilizing Panasonic cameras - 14 units
- Microprocessors controlled P.A. system / Intercom
- Maritime Communications system comprising;
 - Optical Tx/Rx
 - U.H.F. Tx/Rx
 - Video
 - Telephone

For further information or to contact a Hinz office near you, please check our website at:

www.hinz.com