Fuel Facility Monitoring and Automation

The fuel storage facility at Salt Lake City (SLC) International Airport is managed and operated by Aircraft Service International Group (ASIG). This includes the day-to-day operation of the fuel facility and associated hydrant system that is used to distribute fuel to the ramp. In 2009, ASIG commissioned an independent operational feasibility study of the fuel facility. The resulting report identified the existing inventory management and control system was reaching the end of it's service life and was not in line with current industry standards.

Our Client

Over it's 60 year history, ASIG has grown to one of the industry's largest independent providers of commercial aviation services. The company's operational, management, quality, safety and training programs are recognized by the airlines they serve, as well as the Federal Aviation Administration (FAA) and other regulatory agencies. ASIG consistently blends experience, technology and innovation to safely deliver consistent and reliable services that offer real quality and value.

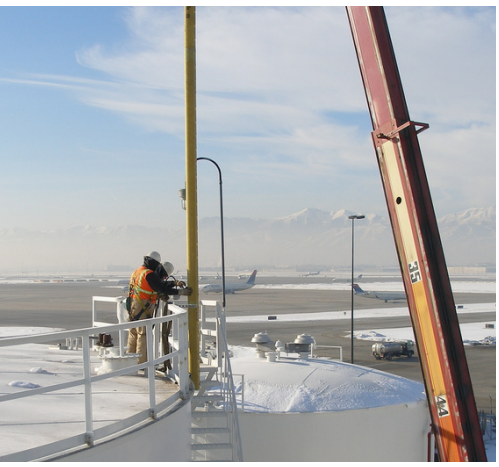
Fuel Facility Systems

The aging system utilized relays and custom software to control pumps, valves and emergency shut-off stations. The critical industrial logic running directly from the operations computer was an inefficient method of implementing control logic when compared to current Programmable Logic Controllers (PLCs). If the system crashed, the entire site would need to be manually operated until the operations computer could be re-booted and the logic re-loaded - a situation that would be considered dangerous by today's control and automation standards. Also, the logic programming did not allow the most efficient methods of controlling pump sequencing and cycling, which in turn caused excessive wear on the facility's fuel pumps and spikes in power requirements.

An outdated CiTech® inventory tank gauging system was used to monitor six jet fuel bulk storage tanks and one mogas tank. It automatically collected level measurements from float and tape tank gauges via a terminal unit. Temperature measurements were obtained by manually recording the value from an analog temperature probe mounted in the base of each tank. This lack of integrated, accurate temperature measurement did not easily facilitate reconciling and reporting net fuel volumes on a daily or monthly basis.

To ensure a steady fuel flow to all gates, hydrant line pressure is maintained by automatically controlling fuel pumps via a first-on/first-off system. This balances pump starts/stops and also optimizes power management.

Varec's 8130 Remote Terminal Unit provides system connectivity to the servo tank gauging system and expandable functionality for future facility automation and integration.



The 6005 STG's high accuracy and multi-measurement capabilities are ideally suited for jet fuel applications. In order to take advantage of the high accuracy multi-measurement capability and operate to API standards, a fiberglass stilling well was fitted to each tank.

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The Solution

Based on the recommendations presented in the independent feasibility study, as well as meetings with the Fuel Facility Consortium Chairperson and the ASIG Facility Manager, it was clear that the existing system needed to be replaced with an industry standard solution that could provide the following.

- Replace the existing Opto-22 Control System with a system that provides automatic pump sequencing and cycling that would limit pump starts/stops and balance pump run times, thereby improving power management and reducing equipment maintenance. The existing Emergency Fuel Shut Off (EFSO) system located at the concourse gates and throughout the fuel facility, as well as the pump control board would need to be maintained to allow for manual control in emergency situations.
- Replace the existing tank gauging system with instrumentation and system software that can provide complete inventory management with specific functionality to measure, display and report net volumes automatically, without the need for facility personnel to perform on-tank activities. The system would also provide redundancy, automatic validation of product receipts from the pipeline and the ability to generate a report (as required) that supplies close-out inventory values for the previous day.

Varec's competitive solution proposal was accepted with the following integrated elements.

- Supply, program, install and commission an industry standard Allen-Bradely® (SLC 500) PLC with several discrete input, analog input and discrete output modules that replace the Opto-22 Control System.
- Supply, configure and commission Varec's FuelsManager® Oil and Gas v7.4 professional edition software with the optional Product Movement Tracking System and workstation to replace the CiTech® inventory management system.
- Supply and commission Varec's 6005 Servo Tank Gauge (STG) with a calibration chamber and a 4532 Average Temperature Convertor (ATC) for each of the seven storage tanks at the facility.
- Supply, configure and commission a Varec 8130 Remote Terminal Unit to replace the existing L&J Technologies® MCG 3600 Remote Terminal Unit.

Implementation

The project was performed in three distinct phases. During phase one, Varec system engineers pre-configured, tested and validated the FuelsManager and PLC systems at the headquarters and manufacturing facility in Atlanta, Georgia. During this time, ASIG managed all on-site tank preparation and instrument installation. The on-site commissioning of the new tank gauging system, including FuelsManager, tank gauges and the 8130 RTU was performed during phase two. Phase three transferred all monitoring and control to the new PLC system. Within each phase, the facility maintained operations without affecting aircraft fueling operations. The teamwork, commitment and organizational skills of all involved allowed the project, which was originally planned to be completed over a 6 month period, to be completed in just three months. Upon completion, the Varec solution fulfilled all customer requirements and provided other benefits not initially requested in the scope.

► *In addition to level measurement with an accuracy of +/- 0.7 mm, the 6005 STG provides complete measurement of jet fuel, including interface level measurements of up to three liquids, density and tank bottom. In conjunction with the 4532 ATC, the 6005 STG provides complete and accurate fuel measurements throughout the tank.*

► *Operators can easily monitor the entire fuel facility from a single workstation with dual monitors to catch potential problems before they become a serious issue.*

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System Benefits

- FuelsManager® interfaces with the 8130 RTU to obtain inventory data from the field instruments and interfaces to the PLC to provide SCADA functionality - enhanced inventory management and automation with discrete and supervisory control over pumps, valves and associated alarms from a single user interface.
- FuelsManager provides clear visual and audible indication of alarm situations to the operator. These soft alarms include high-high, high, and low levels on each tank. The PLC system monitors level alarms via an independent hard-wired connection to Magnetrol® level switches installed at critical points in each tank. In the event of an alarm, the PLC is programmed to control specific pumps and valves based on the type of alarm. This combination provides an independent hard-wired primary overfill protection system with secondary software alarms.
- The PLC and FuelsManager's archiving system maintain historical records of operational data, such as pump run times. This allows the system to automatically balance the operational load across all pumps on a daily basis, service interval basis and lifetime operation basis. Balancing the operational load across all pumps reduces strain on any one pump and overall equipment maintenance and facility downtime. Operators are also able to utilize the historical data to create trends and reports that allow improved management and planning of facility equipment, resources and fuel stocks.
- Manual EFSO controls at the fuel facility and concourse gates continue to operate independently and allow manual control. However, EFSO status is also displayed in FuelsManager for daily monitoring. Operators can command the PLC and FuelsManager to override specific EFSO controls in order to perform monthly EFSO testing and maintenance, without interrupting ramp operations.
- The 6005 STGs on each tank follow the fuel level at all times except for a few minutes each day when an operator is requested by the tower to run an automatic density measurement. The density measurement is then used for accurate inventory accounting and reconciliation.
- The existing float and tape tank gauges were disconnected from the system, but left operational; with minimal yearly maintenance they can now be used as a manual backup to the servo tank gauge system.
- The optional FuelsManager Movement Tracking System uses accurate inventory data collected from the 6005 STGs to track all pipeline receipts, tank to tank transfers and outgoing fuel disbursements to the ramp in real-time. Operators can easily create reports or print a ticket when the fuel movement is complete. The accurate fuel tracking data can then be used to analyze fuel usage and validate receipts from the oil pipeline companies.
- The FuelsManager system provides redundancy through a cold backup server on a daily basis. Operators can quickly restore the system and maintain inventory data in the event of a failure on the primary FuelsManager workstation.

Corporate Headquarters
5834 Peachtree Corners East
Norcross (Atlanta), GA 30092
USA
Tel: +1 (770) 447-9202
Toll Free: +1 (866) 698-2732
Fax: +1 (770) 662-8939
www.varec.com

Houston
5151 San Felipe
Sage Plaza, Suite 1100
Houston, Texas 77056
USA
Tel: (281) 498-9202
Fax: (281) 498-0183
www.varec.com

Asia Pacific
Level 8, 91 William St.
Melbourne
Victoria 3000
Australia
Tel: +61 3 8623 6400
Fax: +61 3 8623 6401
www.varec.com.au

Europe
Suite 120, 94 London Road
Headington, Oxford
Oxfordshire, OX3 9FN
United Kingdom
Tel: 0800 044 5704
Fax: 0844 544 1874
www.varec.co.uk