

A New Era of Supply Chain Management: Gulf of Mexico Case Study

Scott M. Shemwell, D.B.A., Chief Operating Officer, Gary Crouse, VP Business Development, and Jim Johnson, Director of Technology, Wescorp Energy, Inc,

Many readers are familiar the small plastic tags attached to expensive retail goods such as clothing and electronics. Generally, if not deactivated at the cash register, an alarm will sound when the shopper passes through the *passive reader* at the store's exit. These plastic tags are RFID (Radio Frequency Identification) inventory control devices which first appeared in the 1980s. Many of the large retailers use this technology extensively to track inventory throughout their supply chain, deter theft, and optimize logistics processes.

RFID tags are now available in a variety of formats, for a multitude of uses in a wide range of industry sectors and working environments. However, the basic technology is the same—the tag itself, composed of an electronic integrated circuit and an antenna, emit radio waves whose signals are received by a receiver or reader. Moreover, the price point for an individual tag continues to fall rapidly, making them cost effective for many applications.

Major aerospace manufacturers are using RFID tags to track critical, high cost material and components throughout the global manufacturing process. Not only does this technology enable manufacturers to track parts assuring their arrival in a timely manner, but it enables them to tie critical information such as compliance reports, quality control, supplier information, etc. to the individual part, store and make that information available to authorized parties for the life of the aircraft. Additionally, maintenance history and other life cycle information can be tied to the tag number in much the same way that an automobile Vehicle Identification Number (VIN) enables car dealers and owners to have access to the complete repair history of an individual automobile.

The Marine Service Challenge

The difficulties of operating in the oceans of the world have often been compared to those associated with space travel. Like the aerospace industry, the oil and gas industry has routinely developed and implemented new technologies and processes to more effectively find, extract and produce global petroleum resources.

Increasingly, the marine service industry requires faster access to and more complete information about the project status, equipment, material, and personnel tasked to perform a variety of offshore services. Whether it is the number of gas cylinders necessary for welding and human diving, the compliance status of diving equipment and subsea remotely operated vehicles (ROV), or the information about a specific section of pipe about to be laid in deep water, management (including supply chain partners) need this and other critical information in process appropriate real time and must have assurances that the information is correct.

There is one major difference between the supply chain process of the aerospace manufacturing environment and the hostile oceanic environment in which much of the global petroleum exploration and production processes take place. The sea itself!

The Solution

In the fall and winter of 2007, the requirement for an RFID tag that would function in the ocean's depth and in real world oilfield operations was identified as a result of discussions with senior executives at a number of the oil and gas marine service providers. Subsequently, waterproof tags were designed, and manufactured that would withstand 8,000 pounds of pressure per square inch for extended periods and still be readable when returned to the surface.

Following bench tests, these EPC Gen 2 RFID tags were field tested in approximately 4,000 meters of water in the Gulf of Mexico for about 4 months. The tags were attached to several subsea transponders. These transponders are components of an ocean floor inertial navigation system designed to provide ROVs with a very sophisticated navigation capability. This equipment often spends several months in hostile environments before retrieval and retrofit for the next job.



Source: Kongsberg

At the end of this test period, the transponders were retrieved and the RFID tags were intact, attached, and readable. To the authors' knowledge, this was the first time RFID tags had been tested to this depth and hostile environment successfully.

The RFID Technology Used

The RFID tags developed met EPC Gen 2 standards. EPC Gen 2 is the acronym for Electronic Product Code Class-1 Generation-2 UHF RFID Protocol. The specification was developed by EPCglobal, for the second generation RFID air interface protocol. It is a standard for passive RFID tag protocol typically used in retail and industrial supply chain applications. EPCglobal is a subsidiary of the not-for-profit standards organization GS1 that supports standards for visibility of information throughout the supply chain.

Tag construction consists of a Mylar substrate encapsulated in epoxy. Permanent installation on subsea equipment will use bolts for durability and longevity. For this test, the tags were wire tied to the transponders.

The tags were read using the hand held reader manufactured by Symbol Tech Inc, (Motorola) Model MC9090-RS, Handheld Mobile Computer. This device, designed for rugged environments captures a comprehensive range of data including RFID, bar code and digital images.

This suite of RFID technologies was selected to enable field operations with fit-for-purpose sensors and readers designed to meet the marine services requirements. The tags were read at the surface before deployment to the ocean floor and then again at the surface upon their retrieval—specifically identifying each individual transponder.

While this was a most challenging use of RFID, additional projects undertaken include the use of this technology to track material and equipment movement in staging yards both for offshore and onshore operations—very harsh RF environments. In these cases, the sheer volume of heavy equipment requires an engineering assessment of passive antenna placement to minimize radio signal degradation as well as work process change management associated with the deployment of a new way of doing business.

Many of the large retail firms work closely with their supply chain partners to attain best practices for the use of RFID as a fundamental component of the supply chain process. This learning curve is being mirrored in the petroleum industry today.

Other projects involve the use of RFID “smart” pickup truck beds that can read tags on individual tools and material. This assures that personnel leave for the job site with everything necessary to perform the tasks and minimizes hot shot runs. A similar capability is available for marine vessels where the cost of hot shot is much higher than on land.

Just the Beginning

The RFID tag is simply an identifier. The transponders discussed are piece of equipment with a bill of materials, maintenance history, etc. The RFID tag does not hold all of the information necessary to manage this gear; it simply identifies the specific transponder as one of many. Additional back end operations and

maintenance (O&M) information is required. For example, operators, service companies, and engineering contractors are demanding:

- Web-based, collaborative solutions for managing the maintenance lifecycle of geographically dispersed assets to accelerate and streamline their ongoing operation and maintenance activities significantly increasing their return on investment.
- Automated workflows that notify specific individuals of project deliverables and tasks with task completion verification that ensures accountability and the capture of true completion dates for mobilization/demobilization accounting.
- Project status reports that empower management of third party vendors.
- Sarbanes-Oxley driven asset management techniques using a traceable (auditable) construct.
- Integrity management throughout the lifecycle of the asset.
- Concurrent document management that eliminates time delays associated with document retrieval, delivery and approval.

The RFID tag is the front end of the full operations and maintenance support process across the supply chain and throughout the asset lifecycle. It is an enabling technology for the *digital oilfield*.

Value Proposition

Across all industries the adoption of EPC standard RFID is expected to grow at 40 percent CAGR through 2011. This solution is proving viable as the first signs of maturation are emerging, both technically and commercially. As the results of tests and prototype solutions such as discussed herein, end users perceive and recognize the value to their operations. Finally RFID is seen as the enabler for a larger O&M solution. The status of these Key Performance Indicators (KPI) suggests this technology is commercially successful.

In the petroleum sector there are four major areas where value can be realized; tracking assets and small tools, logistics, HSE and inventory management. The value proposition is somewhat different for each area; however, generally most results point to benefits in operational efficiency as the highest value. For example, reduced downtime waiting on parts and personnel, reduced rework and fewer hot shot runs resulting in higher asset performance are key.

Increasingly, operators are almost completely dependent on their supply partners for just-in-time, concurrent process performance. Likewise their strategic partners depend on supply chain visibility to meet their commercial obligations. This results in a need for a greater level of granularity as a Critical Success Factor (CSF) for operations and maintenance processes.

Lessons Learned

In the summer of 2007, it was not clear that RFID technology was a viable method for tracking subsea equipment deployed into deepwater service applications. Today, we not only know that the technology is fit-for-purpose in that harsh environment, but that it may be the best way to enable project accounting processes.

Moreover, given the current global financial market's demand for better transparency, field operations are increasingly under scrutiny. One oilfield equipment rental firm is using RFID tags to manage their fleet of thousands of down hole motors. Their management believes that this is the best way to address Sarbanes Oxley derived reporting requirements. Other executives have noted that the use of RFID to manage equipment, material, and information about personnel (including the extensive sub contractor talent pool) can add direct and immediate value to the bottom line.

The petroleum industry has often expressed concerns regarding the value to be derived from information technology initiatives. In the past, in some instances those concerns were justified. Today, however, two fundamental drivers are changing that equation.

When properly deployed in a production environment, the impact from new technology is immediate. There are no long lead times necessary to find illusive productivity gains.

If technology makes field operations easier, safer, or more efficient, the results are instantly visible. Additionally, the incoming workforce is demanding technology driven solutions that build on those they take for granted and routinely use, comfortably.

Deploying enabling technologies as small prototypes with definable metrics over a short period of time in a manner that does not materially impact normal operations is a cost effective way to gauge the value of technology to specific operational processes. Using this method, a new proven method for managing field assets has been developed and deployed. RFID has proven to be a smart solution for optimizing oil and gas operations.