

Using Software for Full Field Automation and Analysis

Louis I. Ray, Case Services, Inc.

Introduction

In most fields today, operators are asked to do more with less. The common theme is “Keep production up and expenses down.” This paper describes the results experienced in several fields in the United States that are using Case Services’ csLIFT software suite for production field automation. The combination of the right personnel and the right software has provided an environment where production costs were reduced and total production was maintained or increased. Efficiently monitoring well and facility operations, analyzing well performance, and accurately predicting problems with csLIFT has resulted in significantly decreased failure rates and stabilized or increased production per well.

Field Automation Systems

Driving the Problem Home – Why Have Such Systems?

Without data gathering devices such as RTUs and RPCs in place, oil and gas wells cannot be brought into a central location to be monitored and analyzed as individuals or as a group of selected wells or items. In-person or on location monitoring typically involves driving excessive miles and spending hundreds of non-productive hours for field personnel each year. This can mean that a company pays its employees or contract personnel to sit in a vehicle while driving from one producing well to another or from one production facility to the next, and then pays for the time needed to gather the required data at each location.

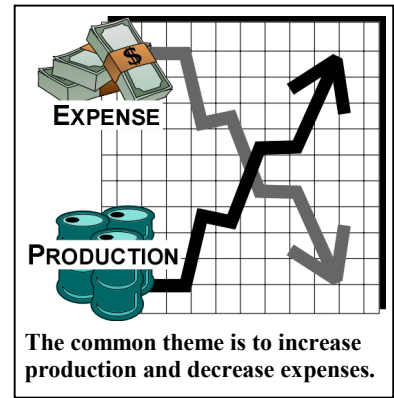
In addition to the cost of inefficient time use, in-person inspections of well sites and related equipment allow the opportunity for extensive undetected downtime. If a well or compressor fails shortly after an inspection is completed, it could be literally days before the next opportunity for intervention. This prolonged downtime can cost producers thousands of dollars in postponed revenue.

Manual Reporting: A Number of Concerns

Collecting and transferring inspection readings manually from in-person site visits creates a new list of difficulties, starting again with excessive time requirements. Hours spent copying numbers from one piece of paper to another make it impossible to quickly respond to changing conditions. It can be days before the necessary numbers are in place for a report to be run. Furthermore, the copying by hand or dictated numbers over the telephone may result in inaccuracies. This can cause problems with predictive reports such as gas volume nominations, which can put a company in jeopardy of having to pay costly penalties to pipelines or other customers.

Field Automation Puts Status, Control, and Analysis Information On-Screen In the Office

Automation systems rely on remote reporting devices such as rod pumped controllers (RPCs) and remote terminal units (RTUs) that use some form of communication (radio, direct link, cellular phone, satellite) to transmit information back to a central site. With csLIFT, all these remote devices can be monitored from one central location and information received is automatically entered into the reporting software. This allows the operator to see immediately which wells or facilities might be down. Based on this information, operating and maintenance personnel can be sent only where they are needed and as soon as a problem is detected, thus eliminating likely long periods of downtime. One production supervisor reports



reducing his trips to the field from once a week to once a month after his company installed field automation hardware and the csLIFT software suite.

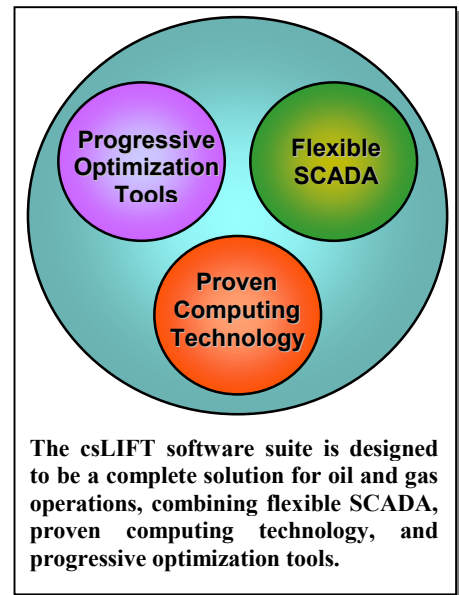
The csLIFT software, in conjunction with remote reporting devices, can be set to page “on-call” personnel any time a well or production facility begins to move outside of pre-set operating parameters, further reducing the potential for downtime, spills, and other problems.

The trending functions inherent in the csLIFT suite allow operators to track multiple aspects of producing wells and their production over time. A trend showing declining production from a well testing facility can be used in combination with runtime and load trends gathered from RPCs to indicate the need for preventive maintenance to fix a potential problem before the result is lost production, lost revenue, or other more costly repairs. In addition, because csBeamAnalysis uses the “wave equation,” it can generate downhole pump cards from the surface load and position data gathered from RPCs for quick recognition and accurate analysis of suspected problems.

Reports generated by the csLIFT suite are faster, more accurate, and more complete than those created manually by the operator. Oil and gas production tracking becomes much easier with a number of reports automatically generated based on complete data gathered in real time, thus allowing the producer to quickly take action if production is trending outside expected parameters. This has the very real economic benefit of avoiding activation of penalty clauses in gas delivery contracts.

Criteria for Selecting csLIFT For Field Automation

The csLIFT software suite is designed to be a complete solution for oil and gas operations, combining progressive optimization tools, SCADA, and proven computing technology. The functionality added by the combination of these three things gives numerous advantages over the typical automation system. Each one holds distinct benefits when added individually. When added as a group they transform the typical automation system into a complete solution to optimize production.



I. Optimization and Analysis

The typical automation system generally includes the ability to scan and control wells or facilities and then bring the information into a database. The term SCADA (Surveillance, Control, and Data Acquisition) aptly describes what many oil and gas fields use to operate their field. A basic SCADA system is suitable for the basic operations of an oil and gas field. However, if well and field optimization is the primary goal, analysis of the field operational data must be included. Commonly, companies will use a set of applications located at the corporate office or a central site to accomplish data analysis. This creates a multitude of problems, such as those listed below:

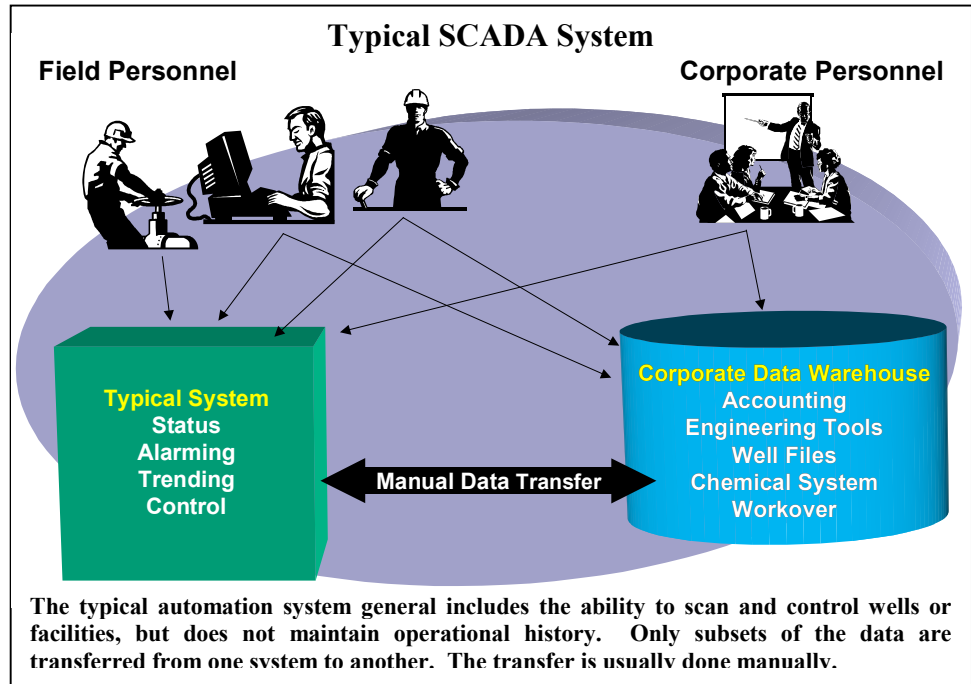
- Field personnel must access several systems or tools to get the data needed for core work.
- These tools typically have poor performance.
- There is often a time lag in transferring data to and from the corporate database.
- Data is typically manually moved from one system to another for analysis or presentation.
- Corporate tools are typically built for non-field needs.
- No operational history is included.
- Only a subset of data is moved between systems.
- Corporate personnel lack access to tools used by the field.

Usually, field personnel receive analytical data from the corporate office that is not easily understood and is no longer current. Typical corporate applications are set up for corporate needs and lack the necessary requirements for field operations. For instance, corporate databases generally do not keep any operations history, resulting in the field operators

receiving information that commonly lacks the detail and the time comparisons needed for proper analysis and efficient field optimization.

II. SCADA Versus The csLIFT Solution

There is certainly some benefit in simply automating current manual procedures with a SCADA system. Producers know immediately of any system failure, they receive an abundance of data, and they can perform some control functions remotely. These functions alone create savings in time and productivity. However, stopping there would rob the company of the things that computer software does best - perform trending and analytical functions by comparing current



information with historical data. In addition, the availability of built-in analysis may be where csLIFT software's long-term benefits shine the most. Downhole analysis for beam wells, complete system analysis, design for submersible wells, and AGA calculations for gas wells are some examples of what is easily available through the csLIFT automation software. By reporting historical trends of this data and alarming the user with analytical results, the producer can make early identification of oncoming problems and then take action preventing the potential loss of production or equipment failure.

A typical SCADA system performs the following four primary functions:

- Basic status. Displays status of devices, wells, and tanks.
- Alarming. Displays an alarm or pages an operator when an alarm is detected.
- Trending. Provides the capability to trend measured analog or discrete points.
- Control. The system has the capability to shut down wells.

A SCADA system may also provide an HMI interface for users to see a basic diagram of the field and the current status of the wells or facilities.

There are several differences between a SCADA system and the csLIFT automation software system. The major difference is that csLIFT software is designed to be a complete solution for oil and gas operations. It has the logic, a large set of tools, and the functionality designed to efficiently operate a complete field. A good analogy to accurately describe these differences is the difference between a spreadsheet application and a corporate financial system. The spreadsheet could be programmed to become the corporate financial system and deliver all the functionality needed by a corporate financial system. However, all the functionality that is required would have to be programmed manually by the user, where as the corporate financial system is functionally complete at installation.

The primary benefits of the csLIFT automation software system over the typical SCADA system are as follows:

The csLIFT software suite is designed for field personnel to do most of the day to day maintenance of the system on the fly. For example, if a well is going to be down for a period of time, field personnel merely put the well out of service. This

action automatically stops the well from being scanned on a regular basis. There is no need to edit custom scripts or no reason for corporate IT personnel to dial into the system to take care of the needed changes.

csLIFT has several thousand man-hours invested in it to deliver the functionality required for oil and gas operations, thus reducing the initial costs. Building or integrating that same functionality using a traditional SCADA system approach would require a large investment of money and time.

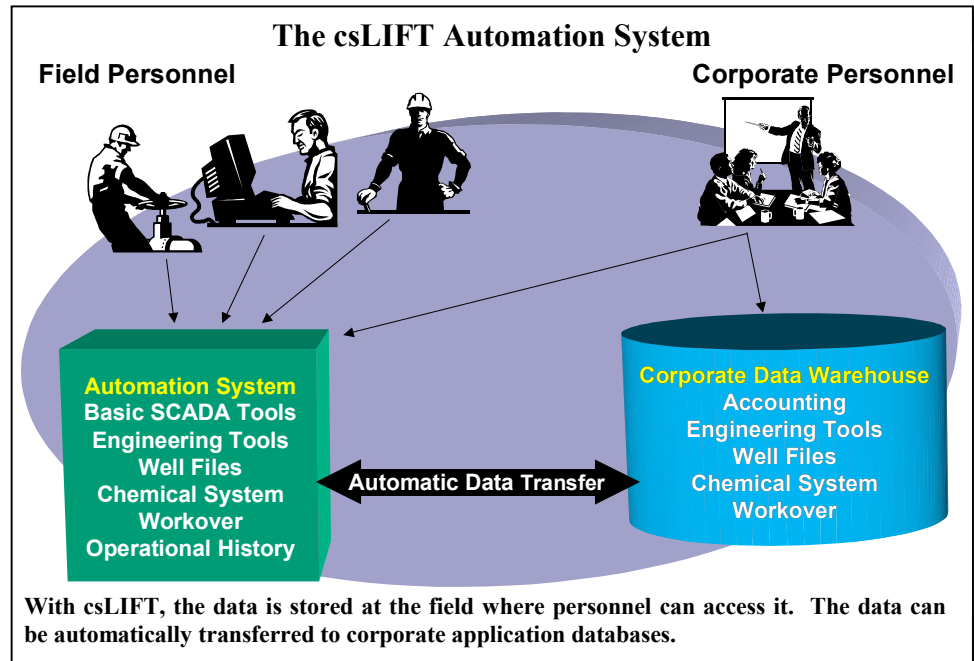
Long-term costs are also reduced with the csLIFT automation software system. Most SCADA systems involve a large amount of customization. Once the SCADA system is in place, a considerably higher maintenance cost is required to perform the required maintenance. Also, expanding the system requires additional customization work. With an integrated automation software package, every new release includes significant new features at no additional cost to the user.

As an example, "Company A" has run well tests on a regular basis over the last year and has stored test results in Case Services' software. csLIFT can now compare today's well test results against stored well test information established during the past year. If today's test is outside of the parameters set by the operator, the csLIFT software alerts the operator that this well merits further attention. The operator may then discover anything from a potential problem with

the individual well to a larger issue concerning injection, the most recent chemical treatment, or any other possible cause. Therefore, he no longer is simply aware of what is currently out of service or up and running in some fashion, but now he knows of potential problems that can be dealt with before they become a costly failure.

Analysis does not only anticipate the negative. Trending can be used to test a new well treatment chemical, a different treatment schedule, or other parameter changes that could lead to increased production or reduced expenses. By incorporating operational logic into csLIFT software, the user of the system can run nearly all aspects of the field rather than merely monitoring and responding to alarms. Well testing is an example of an operational task that can achieve better results through the integrated logic included in csLIFT automation software suite. With integrated well test logic, the sequence of wells tested can be changed so that critical wells are tested more often than non-critical wells. When a well test is completed, csLIFT can evaluate the well test based on historical data from that well. Of course, the user could override the software evaluation, if needed.

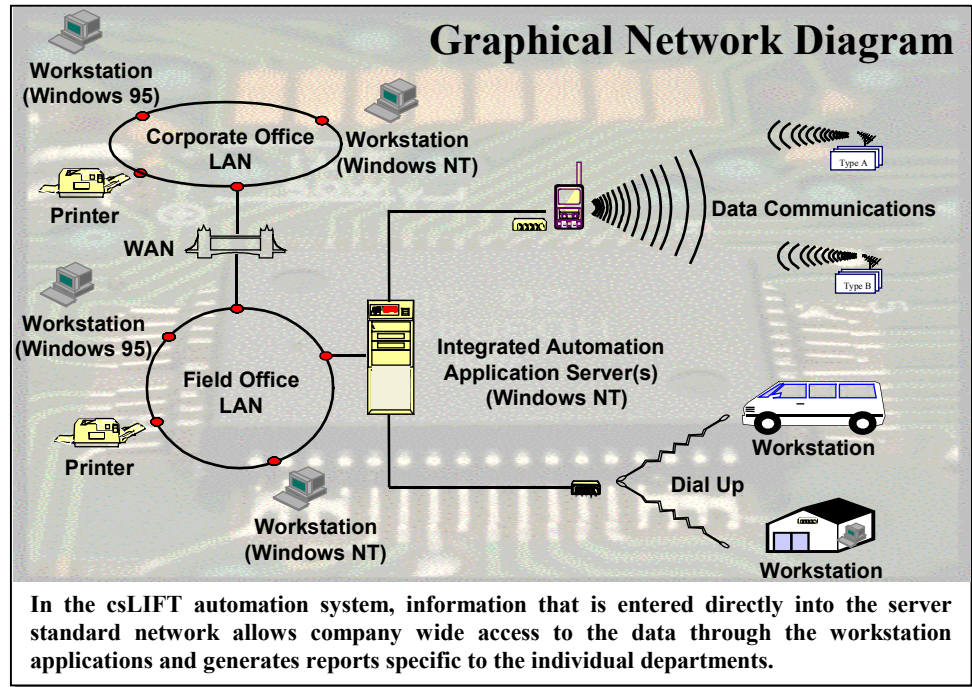
Another example of operational logic that is included in the csLIFT software suite is the ability to calculate production accounting statistics. This is beneficial for both oil and gas fields. Production summary reports for oil processing facilities give the user reports designed to replace manually derived or spreadsheet generated reports. This obviously increases manpower efficiency, but also can help identify produced fluid volume shrinkage. Gas fields gain more utility since they can use production accounting numbers to more accurately do nomination volumes for the proper regulatory agencies. For the field at large, providing integrated material balancing, control functions, such as the ability to shut down producing wells when high tank levels are detected at a fluid handling facility, are available in the csLIFT automation software suite.



III. Computing Technology

Networked or stand alone systems?

The ability to quickly gather and share data and information drives the world's economy today. The oil and gas industry is no exception. Stand alone automation software systems limit the ability of users to distribute information to all interested parties. Distribution is confined to user access to a single location where the data is gathered and processed. On the other hand, networked distribution systems, through LANs, WANs, or intranets, make it possible for all local users, as well as anyone with access to the



network, to see and use real time data gathered from the csLIFT automation software system. Engineers and corporate management, like the field personnel, have access to well status and production data at their fingertips.

What makes this possible?

A network can be as simple as attaching two computers together in the same office or as complex as multiple servers linked to thousands of workstations across the world. The communication links in a network are the key to providing the ability to share real time data. Information that is needed by multiple people within an organization can be downloaded to a common server. Once the information is saved it becomes available to all of the different workstations. The computer communicates to the server what information is needed and the server pulls the information and sends it to the linked computer. The server is capable of communicating with more than one workstation simultaneously. This allows more than one employee to gain access to the same information at the same time.

UNIX or Windows NT?

Today's two main network system choices are UNIX and Windows 95/98 or Windows NT. While UNIX is flexible, it is extremely complex, making changes difficult to effect. UNIX is an operating system that requires programmers with special training, which drive up its cost of operation. Workstations also typically cost \$10,000 to \$20,000 each, making adding a single workstation a major economic decision. Windows 95/98 and NT, which is the operating system used for csLIFT, are graphically based and much more user-friendly, especially with the plug and play capability of integrated automation software. Adding workstations is as simple as buying a properly equipped PC at a cost around \$2,000 to \$3,000. Adding or changing peripherals such as printers and modems becomes very simple and cost-effective.

The single csLIFT system or multiple systems?

Multiple systems create challenges like the following:

No unified reporting. While multiple systems collect some data, they do not present it in a single usable format, especially when several fields are involved. Reporting functions are back to being based on the time-consuming and error-prone system of manual copying creating an inefficient corporate system.

Training. People trained on one system may not know how to operate another when the two must be meshed, or when someone leaves on vacation. This creates more opportunity for confusion and mistakes.

Information access. Personnel in accounting, production, and other departments will not have immediate access to the numbers they need for reports. Manually disseminated numbers is slower and less accurate, creating costly delays and reporting errors.

The single networked csLIFT system provides the following:

1. Reports and data numbers are quickly available to anyone on a network. One United States operator benefited greatly by changing to the csLIFT system. Not only were their reports available more quickly and accurately, but personnel in their home office could retrieve reports instantly, when they needed them most. Previously, information needed was quickly dictated over the phone by field personnel, which creating delays in handling field problems.
2. Training. Since everyone uses csLIFT on the network, training is simplified and cross training is almost automatic.
3. Information is automatically placed in the reports. There is no need to manual copy or transfer data into the csLIFT system. This also means all reports come from one screen. A producer in Texas used a system that required getting in and out of multiple screens to check data and run reports. Changing to the unified Windows-based csLIFT software saved that company a great amount of time by allowing multiple screens to be open at once.

IV. Building the System versus Buying the System

The first question to answer once the decision has been made to install an automation software is whether to build your own system or to buy software that is already written, commonly referred to as off-the-shelf or plug-and-play software. Building software from scratch brings with it a number of challenges, including these listed.

Time. It can take months or years to create software from the ground up. A Supervisory Control and Data Acquisition (SCADA) system, on which typical automation software is based, is a general-use system. This means it takes a large amount of adaptation before the system becomes useful in the field. Adding wells and facilities or making other changes becomes very time-consuming even after the system is operating, and usually requires specially trained personnel to execute changes.

Cost. By taking months to create, SCADA systems involve extensive man-hours of configuration that obviously must be paid for. Additionally, each day that goes by without the software in place is another day of operating less efficiently and extended undetected downtime for wells and facilities. Each time a change is made, adding or deleting wells, facilities, or functionality on a SCADA system, a programmer must be paid to do the work. This creates an ongoing cost factor.

Personnel Issues. More time must be dedicated to training personnel to simply operate the typical system, which often consists of several separate and unique software packages, rather than identifying and solving field problems.

On the other hand, buying the csLIFT automation software package offers some immediate advantages.

Major components already in place. The csLIFT software system has been constructed and enhanced through years of input and trial by multiple users. The user does not have to allow time to work out every possible bug in the software before realizing the benefits. csLIFT makes it possible to begin saving operating costs right away. In the csLIFT suite, a wide range of functionality specifically suited to oil and gas producing operations is already in place, such as gas volume nomination tracking, material balancing, production and analysis trending, and downhole cards. While there may be certain reports or possible user interface formats that might still need customizing, the csLIFT automation software is ready to be used upon installation.

Configuration. csLIFT software suite anticipates the need to add or delete wells, compressors, facilities, etc., and makes it very simple to do. There is no need to consider the cost of special programming or personnel to make changes when needed. Configuration alterations can typically be made in a matter of minutes by the users of this software.

Training. Employees, especially those familiar with Windows, can learn the csLIFT software very quickly. There is no need to train personnel on the use of several types of software. Windows-based software is intuitive and graphically based.

A simple point and click of the mouse can access most of the csLIFT software functions and reports. Pull down help menus provide reminders for seldom-run procedures and make even a written manual practically unnecessary.

Benefits

People and Organization - Allow the Software to Empower Personnel

Choosing the right personnel structure involves determining the needs of the system and coupling that with the available people. Fields that have put an emphasis on well analysis have shown great strides in well failure reduction, which by itself stabilizes or increases field production. Proper automation choices allow producers to concentrate on operations efficiency, eliminating much of the need for solving problems on an emergency basis. With extensive data and control functions in place, all that remains is to decide how best to organize people to make the most efficient use of all the data. One company with extensive production near Denver City, Texas, organized field operations into teams responsible for a group of wells and facilities. Each team includes a well analyst, an injection flood analyst, a lease operator, a rig supervisor, and a technician.

Each analyst is responsible for the optimization of more than 220 wells. They spend most of their time monitoring and optimizing the parameters of rod pump controllers with the csLIFT software. The analysts work directly with production operators with a set group of wells. The injection flood analysts (IFAs) spend two to three hours with the software each day checking for exceptions. They pass these on to the rig supervisor, who handles repairs, and to the well technician, who is responsible for well testing. The greater level of communication in this team concept provides a number of benefits. Rather than blindly passing work orders from department to department, team members consider the activities, work habits, and schedules of their teammates in order to prioritize requests. Each member of the team has a sense of ownership in the wells and facilities under their control. This allows them to set a goal of achieving optimal production and a sense of a job well done as the production curve rises.

Hard numbers bear out their success. In January of 1996, before making these changes and installing csLIFT, there were thirty-six beam pump failures. In May of 1997, after the changes were made, failures dropped to fifteen. This alone represents huge savings in continued production and repair costs. A savings in operating cost is evident by reducing the number of repair rigs from thirty to thirteen.

Conclusion

Combining the csLIFT automation software suite and the optimal use of this software allow producers to move from a reactive mode to a proactive mode. Wells become more stable, and analysts can spend more time fine tuning operations for maximum production rather than searching for problems and fixing emergencies. In short, the networked csLIFT automation software system with specific operations functions calls on computers and other devices to handle the manual and repetitive work of monitoring wells and facilities, as well as collecting and crunching numbers. It frees personnel to create solutions and make judgments that squeeze more profit out of every dollar spent on oil and gas production.

As the leading provider of oil and gas production automation systems, Case Services, based in Houston, Texas, pioneered the market for a single-source automation software for producing oil and gas fields. This software is used by major oil and gas companies to run over 15,000 wells around the world.

Case Services, Inc.

738 Highway 6 South
Suite 800
Houston, TX 77079

Phone: 281-497-0242
Fax: 281-497-0683
Email: info@caseservices.com
Web Site: www.caseservices.com