USING INTEGRATED SOFTWARE FOR FULL FIELD AUTOMATION AND ANALYSIS

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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 Texas that are using an integrated software tool for production field automation.

The combination of the right personnel and the right software has provided an environment where production costs are reduced and total production is increased. Efficiently monitoring well and facility operations, analyzing well performance, and accurately predicting problems has resulted in significantly decreased failure rates and increased production per well.

Choosing the right software involves several decisions:

1. Building versus buying the system;
2. A single integrated system versus multiple systems;
3. UNIX or Windows-based system;
4. Built-in analysis or a separate analytical program;
5. Simply automating existing procedures or providing analysis that improves operations.

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 increases field production. Proper automation allows producers to concentrate on operations efficiency, eliminating much of the need for solving problems on an emergency basis.

Driving the Problem Home

Since oil and gas wells cannot be brought into a central location and monitored and analyzed as a group, in-person monitoring typically involves thousands of miles and hundreds of non-productive hours for personnel during a year's time. That means a company pays people to sit in a vehicle driving from well to well or facility.

Besides their cost in inefficient time use, in-person inspections allow opportunity for extensive undetected downtime. If a well or compressor were to fail shortly after an inspection, it could be days before its next opportunity for intervention, costing the producer thousands in postponed revenue.

Manual Reporting: A Number of Concerns

Collecting and transferring readings manually from in-person inspections creates a new list of difficulties, starting again with time. 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 numbers are in place for a report to be run. And, the accuracy of numbers copied by hand or dictated over the telephone may be in doubt. This can cause problems with predictive reports such as gas nominations, which can put a company in jeopardy of having to pay costly penalties to pipelines or other customers.

Field Automation Puts Information and Control Onscreen

Automation relies on remote reporting devices such as pump off controllers (POCs), remote terminal units (RTUs) and others to radio information back to a central site so that all these devices can be monitored from one station. Reporting numbers then are automatically entered into reporting software. This allows the operator to see immediately which well or facility is down and to send personnel only where they are needed--and he can send them as soon as a problem is detected, thus

eliminating 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 turned to field automation.

Computers and remote devices can be set to page on-call personnel any time a well or facility begins to get outside operating parameters, further reducing potential downtime.

Reporting functions also allows operators to trend production over time. A gradual slowing of production may indicate the need for preventive maintenance to fix a potential problem before it results in lost production, lost revenue and more costly repairs.

Reports generated by automation software are faster, more accurate and more complete than manually created ones. Nomination tracking becomes much easier with reports based on complete data in real time, 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 delivery contracts.

Build versus Buy

Making the decision to convert to field automation is the first step. Deciding how to go about the automation process is just as critical. The first question is whether to build your own system or to buy software that is already written.

Building from scratch brings with it a number of challenges:

1. 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 software is based, is a general-use program. That means it takes a huge amount of adaptation before it becomes useful in the oil 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.

2. Cost. By taking months to create, SCADA systems involve intensive man-hours which must be paid for. Also, every day that goes by without the software in place is another day of operating less efficiently, of possible extended downtime for wells and facilities. Each time a change is made (adding or deleting facilities) on a SCADA system, a programmer must be paid to do the work, creating an ongoing cost factor.

3. Personnel Issues. More time must be dedicated to training and to simply operating the typical system, rather than identifying and solving field problems.

Buying existing software, on the other hand, offers some immediate advantages:

1. The major components are already in place. An oil field software system such as the product from Case Services has been constructed over years of input and trial by multiple users. The user does not have to work out every possible bug before realizing benefits; it can begin saving operations costs right away. A wide range of reporting functions, specifically suited to the oil field, are already there, such as nomination tracking, material balancing, downhole cards and many more. While there may be certain reports or formats that still need customizing, the majority of the work has already been done.

2. Ease of making changes. Existing oil field software anticipates the need to add or delete wells, compressors, facilities, etc., making it very simple and easy to do. There is no need for the cost of special programming or personnel to make changes. Alterations can typically be made in a matter of minutes by the producer's own employees.

3. Training. Employees, especially those familiar with Windows, usually learn this software quickly. Windows-based software is intuitive and graphically based. Many changes and reports can be run by pointing and clicking. Pull down help menus provide reminders for seldom-run procedures and make even a manual practically unnecessary.

The build-versus-buy question is summed up by the following example. You could figure your income taxes by using either a spreadsheet such as Excel, or you could buy TurboTax. Using Excel, it would be necessary to build all the tables, including various percentages and complex tax laws, and to link the appropriate ones together. It would take months, and you would

have to personally test each stage for bugs. With TurboTax, or other pre-written software, all you do is plug in your numbers and write your check.

Multiple systems vs. a single integrated system

Multiple systems create challenges such as the following:

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

2. 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.

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

A single unified system provides the following:

1. Reporting numbers are quickly available to anyone on the network. A South Texas operator benefited greatly by changing to a unified system. Not only were their reports available more quickly and accurately, personnel in their home office of Houston could retrieve reports instantly, when needed. Previously, information needed quickly had to be dictated over the phone by field personnel, creating delays in handling field problems.

2. Training. Since everyone uses the same system, training is simplified and cross training is almost automatic.

3. Information is automatically placed in whatever reports needed it. There is no manual copying or transferring of data. This also means all reports come from one screen. A producer in the Denver City area had used a system that necessitated getting in and out of multiple screens to check data and run reports. Changing to unified software has saved his company a great amount of time by allowing multiple screens to be open at once.

A UNIX-based system or Windows 95/NT

Today's two main network system choices are UNIX and Windows 95/NT.

While UNIX is flexible, it is extremely complex, making changes difficult to effect. This is another system that requires programmers with special training, driving up its cost of operation. Workstations also typically cost $10,000 to $20,000 each--this makes adding a single workstation a major economic decision.

Windows 95 and NT are graphically based and much more user-friendly, especially with the plug and play. Adding workstations is a simple as buying a PC at a cost of $2,000 to $3,000 or slightly more. Adding or changing peripherals such as printers and modems becomes very simple and cost-effective.

Built-in Analysis or a Separate Analytical Program

The availability of built-in analysis may be where integrated software's long-term benefits shine the most. Downhole analysis for beam wells, current and amperage analysis for submersible wells, AGA calculations for gas wells--these are some examples of what is only easily available through integrated software. By reporting these trends over time, the producer can make early identification of oncoming problems, then take action preventing the potential loss of huge amounts of production.

For the field at large, it provides integrated material balancing and control functions such as the ability to shut down producing wells when high tank levels are detected in a battery. Collecting and transferring enough data into a separate analytical program would be a nightmare in time and accuracy, making it practically impossible.

Simple Automation or Advanced Analysis

There is certainly some benefit in simply automating current procedures with a SCADA system. Producers know immediately of any system failure, they receive an abundance of data, you can perform some control functions remotely. These functions alone create savings in time and productivity.

But stopping there would rob the company of one thing computer software does best: perform trending and analytical functions by comparing current information with historical data.

For example, Company A has run well tests on a regular basis over the last year and has stored test results in the computer. An integrated software package can compare today's well test against the parameters established over a year's time. If today's test is outside those parameters the software alerts the operator that this well merits further attention.

The operator then may 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. Thus, no longer is he simply aware of what is currently out of service or up and running in some fashion--potential problems can be headed off before they become a costly failure.

Analysis does not only anticipate the negative. Trending can be used to try 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 the 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 with integrated logic included in the software.

With integrated well test logic, the sequence of wells tested can be weighted so that critical wells are tested more often non critical wells. Then when tests are completed, the software can evaluate the test based on historical data from that well. Of course, the user could override the software when needed.

Another example of operational logic that can be included in the software is the ability to calculate production accounting numbers. This is beneficial for both oil and gas fields, but gas fields gain more utility since they can use the production accounting numbers to more accurately do nominations.

Letting Software Empower Personnel

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, has 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 pump off controllers with integrated 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 of 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, there were 36 beam pump failures. In May of 1997, after the changes were made, failures dropped to 15. This alone represents a huge savings in continued production and repair costs.

Conclusion

Combining integrated software and optimal use of software allows producers to move from reactive mode to proactive mode. Wells become more stable, and analysts can spend time fine tuning operations for maximum production rather than searching for problems and fixing emergencies.

In short, a well-written, networked integrated 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 wring more profit out of every dollar spent on production.