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Evolution of Decision Environments: Lessons Learned From Global Implementations and Future Direction of Decision Environments

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Abstract

Chevron and Science Applications International Corporation (SAIC) are working together to implement Asset Decision Environments (ADEs) across business units as part of the Chevron *i-field*™[1] initiative. This paper describes lessons learned from the program to date, covering types of ADE, challenges faced, solutions delivered and benefit realized. It goes on to discuss the future development of the ADE concept.

Chevron has explored ADE value and usage through the implementation of different types of environments targeted at different problems, and this paper will outline the logic behind this multi-strand approach, and the benefits delivered. Examples will include Decision Support Centers, collaboration environments, and training environments. As the initial implementations deliver success and collaborative working becomes more widespread, questions are being asked about how far we can go with collaborative working and decision-making. The paper will provide some insight into the vision for the ADE in the future.

This paper will set out practical lessons learned on how to design an ADE to address current problems, deliver value and still remain flexible to developments in the future. It will describe challenges and solutions for many aspects of ADE design and implementation, highlighting issues, solutions and benefits delivered. The paper will share a vision for a multi-functional and multi-asset operational ADE of the future, including key challenges that still need to be resolved.

Decision and collaboration environments are being deployed by companies to address challenges associated with response to real-time data, scarcity of experienced resources, and integration and collaboration between disciplines and locations. This paper provides a Chevron and SAIC perspective on the questions: How can decision environments deliver value, and how might they evolve in the future to deliver more integration and collaboration?

Introduction

Over the past three years, Chevron has been working with Science Applications International Corporation (SAIC) on the design and implementation of various types of Asset Decision Environments (ADEs) across multiple business units. An ADE is Chevron's term for a collaboration environment or decision environment. This paper sets out some of the key features of the ADE program, the design approach, lessons learned and results, and provides some insight into the future direction of the ADE.

The Chevron ADE Program

Background and History

Chevron's *i-field*™ program is a Digital Oilfield initiative, which was launched in late 2002, with a vision to transform the way assets are managed and operated through integration of new technologies, work processes and new ways of working. Unneland and Hauser[1] provide a comprehensive overview of the origins and purpose of the *i-field* program at Chevron, laying out the vision, the perceived benefits and the initial projects that were included in the early program scope.

[1] *i-field* is a trademark of Chevron U.S.A. Inc. in the United States and/or other countries.

i-field, or the integrated field, is an operational transformational philosophy that drives enhanced and optimized operating processes, with common attributes:

- Manage by exception (focus on highest value)
- Improve collaboration across distance and function
- Remove people from harm's way
- Standardize and centralize analysis and decision-making
- Use real- or right-time data in decision-making

The *i-field* team has developed an assessment process to engage assets and business units. The process identifies an asset's key issues and makes recommendations on how *i-field* could help to resolve those issues and add value to an asset. Early assessments carried out in 2003 and 2004 recognized some common issues associated with different groups not being able to access the same data at the same time, the need to collaborate across disciplines and locations, and how to make best use of scarce expert resources. The concept of the ADE was developed in 2004 in response to these requirements to share information and expertise, and collaborate more effectively.

A joint venture project was set up between Chevron and SAIC to guide the design and implementation of ADEs within Chevron. SAIC was already working on the *i-field* program, and had expertise in developing similar collaboration centers in other industries. A small project team was formed to work on the ADE approach, and an ADE community was set up as business units began ADE projects. This community participated in a regular call to share experience and lessons learned, and discuss issues with one another and the central team. The experience was leveraged by the central project team to help to develop a standard approach to ADE design and accelerate ADE deployment across Chevron.

Chevron also participated in a Joint Industry Project (JIP) from 2004–2007 that was focused on research into the use of Operation Centers in the upstream industry. Other participants in the JIP were Shell, Hydro, SAIC, and Epsis, with additional funding provided by the University of Bergen. During its lifetime, the JIP has carried out research into specific aspects of Operation Center activities and technologies, including collaborative decision-making processes[2], bandwidth requirements and limitations, and the measurement of success via metrics and key performance indicators. JIP work has fed into ADE activities at Chevron.

ADEs at Chevron

The definition of an ADE is intentionally general, allowing a number of different types of decision environments to be included under the ADE umbrella. An ADE is a real-time operating environment where people can manage and execute business processes via collaborative decision-making across part or all of an asset or business unit. Figure 1 shows an illustration of how an ADE, or collaborative environment, spans office and field, and may include experts from other locations, or other organizations. It may be a physical operation room, a virtual environment or a hybrid of both. An ADE is not defined by its physical properties; rather, it is thought of in terms of the activities and processes that it enables and facilitates. An ADE:

- Can connect multiple locations virtually, allowing individuals in different locations to share the same information and collaborate on analysis and problem solving
- Can be the process environment (setting) in which other *i-field* solutions are delivered (new software tools, new technologies, new processes)
- May incorporate real-time or near-real-time data ("right-time" data), audio and visual communications and advanced visualization
- Allows decision making and routine meetings to be transformed
- Allows efficient use of limited expertise

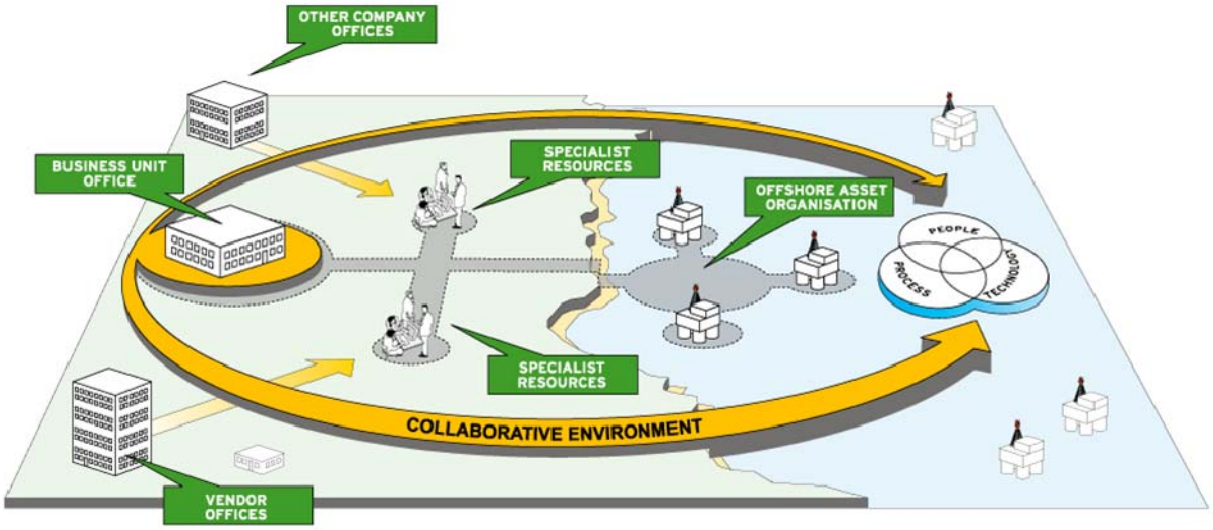


Figure 1: Illustration of the Collaboration Environment, or ADE at Chevron

There are two main types of ADE at Chevron:

- **Continuously Staffed.** One or more individuals work in the ADE full time, i.e. it is their place of work, and they do not have a desk elsewhere in the building. This type of ADE may be staffed during the working day, seven days a week or even 24 x 7. Examples include the Decision Support Centers (DSCs) implemented in the San Joaquin Valley Strategic Business Unit (SJV SBU). Here, a process specialist monitors and analyzes data from across the business in respect to a particular process such as steam generation optimization or compressor optimization (see Figure 2). Oran, Brink and Ouimette[4] provide a more complete description of *i-field* activities at SJV, including the DSC program and implementation results.
- **Event Driven**. This type of ADE is not continuously staffed but rather is used for scheduled or opportunistic events. These can include regularly scheduled activities such as a daily morning meeting or a well pattern review, ad-hoc events, or meetings held in response to a particular problem or issue. Examples include the decision environments implemented offshore and onshore for asset teams in the Europe SBU to help with specific meetings and ad-hoc collaboration between the onshore and offshore teams (see Figure 3)

Current Status

To date, over 20 ADEs have been implemented at Chevron, including:

- Collaboration Rooms in San Ardo, Kern River and Lost Hills, SJV SBU, California
- Decision Support Centers, SJV SBU, California
- Tahiti / Deepwater Training and Operation Center, Gulf of Mexico (GOM) SBU
- *i-field* Control Center, Carthage, Mid-Continent/Alaska (MCA) SBU
- Suite of 13 Integrated Decision Environments at Aberdeen, Europe SBU

Decision Support Center (DSC)

- New DSC lead role works full time in the DSC (example of continuously staffed ADE)
- Standardizes key processes
- Optimizes performance of like facilities across a single SBU and even across multiple SBUs
- Key activities:
  - Continuous optimization
  - Collaboration with field operators
  - Application of lessons learned

Early Benefits: Efficiencies through identification of early problems and process standardization. Capex and Opex savings

Implementation: SJV (2005 onwards), GOM (2007 onwards), MCA (planned)

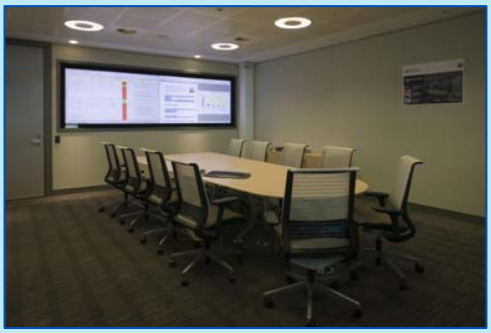
Figure 2: Example of a Continuously Staffed ADE

Another 30+ ADEs are in development, scheduled to be implemented during 2008:

- Expansion of DSCs at SJV SBU
- Implementation of DSCs at GOM SBU and MCA SBU
- Suite of 20+ ADEs in the new NorthPark office building in Louisiana for the GOM team
- Onshore and offshore ADEs as part of Agbami project, Nigeria and Mid-Africa (NMA) SBU
- Several work team ADEs in downtown Houston (including *i-field*, Base Business & Reservoir Management HQ, and for MCA SBU)

Additional ADEs are likely to be scheduled and developed as part of emerging *i-field* projects in locations such as Canada, Angola, Kazakhstan and Australia.

Collaboration Center



- Dedicated environments for event-driven collaboration
- Structured “use cases” for key collaboration events and processes
- Optimizes information sharing, analysis and decision-making between groups and locations
- Key activities:
  - Regular meetings and reviews
  - Ad-hoc collaboration for problem-solving
  - Sharing of information onshore and offshore

Early Benefits: Improved understanding, more effective analysis, more rapid decision-making. Higher productivity

Implementation: SJV (2006 onwards), Chevron Upstream Europe (CUE) (2007 onwards), MCA (planned), GOM (planned)

Figure 3: Example of an Event Driven ADE

ADEs can be used at all stages of the upstream life cycle and may evolve in use during the lifetime of an asset. At Chevron, ADEs are being used in Major Capital Projects to help with collaboration during hook-up and commissions, and for training of operators before the facility is in place. A training simulator has been installed in an ADE and is being used for operator training. This provides a venue for realistic and effective training before the facilities come on-stream, and it will continue to be used after start-up, both in terms of training and for simulation of daily operations. An adjacent collaboration space provides an environment for collaboration during commissioning and hook-up, and once production has started, an ADE will be used as an operation center, monitoring and analyzing data from the platform. This evolution of ADE use during the lifetime of a project and asset illustrates the need for flexibility in ADE design, which is a key component of Chevron's approach.

The ADE is very much part of the vision for the future across many Chevron business units. It has moved from being one of many potential components of an *i-field* project to a key integrator. All assessment reports now include some level of recommendation on collaboration and ADEs, and the ADE is seen as a foundation for *i-field* success. An ADE will enable multiple key activities within an *i-field*, including:

- Major process monitoring, analysis and optimization
- Multi-discipline, live decision-making, including optimization across disciplines and processes
- Connection of disperse locations within a business unit and of experts outside a business unit (including third parties)
- Remote operations

Overview of Approach

There are a number of different approaches to take for ADE design and implementation. To assess suitability for application within Chevron, the team looked at examples and lessons learned from other industries and investigated a number of different approaches. Two types of approach were identified; one focused on the physical design of the environments themselves, and the other focused on process design for use in the environments:

- Focus on physical design ("Build it and they will come"). This approach focuses on building the physical environments, with the assumption that once they are up and running, people will use them. While this can be a successful approach in the right environment, there are significant risks and challenges associated with the assumption that "they will come." Without the right level of attention to process redesign and user training, there is a high level of risk that the rooms will not get used or will just be used as standard meeting rooms, without users taking advantage of the advanced collaboration facilities. We took the view that this approach can work in a business environment where people are used to collaboration, e.g. when adding new ADEs to an area which already has established ADEs working successfully, but it is too risky an approach to take in a business unit or asset that has never experienced a collaboration environment before. For the initial implementations, this approach was not used.
- Focus on process design. This approach involves a high level of user involvement up front. A detailed process design and reengineering exercise is carried out that designs new processes to run in the collaboration environment and is used to drive physical and technical requirements for the new environment. The users are heavily involved throughout, and are taken through intensive training to educate them on the new processes and use of the technology. We believe that this approach can be successful in an environment where there is a high level of management support, but it can be a lengthy process. There is a risk that user enthusiasm and management support will dwindle during the months it can take to go through the process design and implementation. It may not a good process for demonstrating results quickly. Although there are some situations (e.g. new green field) where this approach would be appropriate, it was not used for the early Chevron implementations.

The Chevron-SAIC team) felt that although both approaches had some advantages, neither was well suited to the Chevron environment. The ADE concept was very new, and taking a long drawn-out process-based approach would not help to deliver value quickly, or to get people (and management teams) onboard with the ADE idea. Conversely, building rooms and expecting people to use them also felt like a risky approach – one that had delivered mixed success elsewhere in the industry.

We designed a "middle way," trying to combine some of the advantages of the two approaches outlined above. We aimed to build the rooms quickly to provide facilities that could be used to deliver some value, but at the same time, carry out some focused process and training work to ensure that the user communities felt comfortable with using the ADE. We avoided prolonged, detailed process design before initial implementation. Lessons from other industries and other oil companies had shown that when users started using ADEs, it opened their eyes to possibilities that were not obvious before they had worked in one. We decided to focus on getting some processes operational in the ADE while putting in place the right levels of support to allow users to develop and expand the use of ADEs once they had become familiar with ADE operation. The basics of the approach are as follows:

- Identify and understand the key areas where there are business-driven opportunities. Some of this initial identification could come from the assessment process, but further analysis may be necessary in order to target where to make an impact
- Identify a small number of key processes that will be implemented in the ADE, and start with those
- Start where there is initial leadership support and a willingness to try something new
- Allow flexibility. Assume that some things are going to change once the ADE becomes operational
- Focus on getting started quickly and cheaply, identifying the initial learnings and then building on them
- Provide the right level of support mechanisms for the user community post-implementation. In cases where Chevron is implementing a suite of ADEs in a single business unit, a full-time role called the "ADE coach" has been created. The ADE coach will be in place for six months to one year after initial implementation. This individual is responsible for providing initial support to users in their ADE and helping with the development and implementation of further processes in ADEs as driven by the users

The process design work takes place in parallel with physical design and build-out, and users are trained in the new processes and use of the collaboration technology. We believed that this approach provided the right combination of process, technology and people activities, and would be able to deliver results more quickly. Our results have shown this to be the case. Once users start working in an ADE, a "pull" is created to implement further processes and use the ADE more extensively. The ADE coach and local *i-field* project team can respond to that pull and help users create new use cases for ADE implementation.

This approach has delivered success in that many of our early implementations are demonstrating benefits that were not envisioned in the original design. These benefits become apparent as users become familiar with ADE operations and identify new ways of working. The user communities are responding with suggestions of new processes and increased collaboration post-initial implementation.

The approach works for both event-driven ADEs and continuously manned ADEs. For event driven ADEs, a small number of events can be chosen for initial implementation. These may be meetings (e.g. the daily morning meeting) or regular review activities (e.g. periodic well pattern reviews). Use cases can be built to identify the steps in the process, the information required at each stage, the individuals and expertise that need to be involved, the decisions taken and subsequent actions expected. The information from these use cases can be used to drive the technology requirements for the ADE, which may include new visualization and analysis tools. In the case of a continuously manned ADE, a basic set of processes is identified and designed that covers the core of the role(s) carried out in the new ADE. This may involve the creation of a new role, in which case, a job description needs to be generated and the responsibilities and deliverables from the role documented. Again, the focus is on a "light touch" before implementation – enough work and documentation to describe the role, but not too much time spent on details that may change post-implementation.

A number of business units in Chevron have taken an experimental approach, building out an "ADE lab" that can be used to test software, processes and user experience (comfort, levels of acceptance, usability and so on). This environment is put together quickly during the early stages of the project and then used during design and implementation for familiarization, training and experimentation. This approach allows users to be more involved in design and to create an environment where they are encouraged to raise (and test) their own ideas on how to improve collaboration.

Implementation teams must pay close attention to change management. Working in an ADE involves considerable change for the users impacted, and they need to be kept engaged. It takes time to develop trust in new technology, new environments and new ways of working, and any successful project team will anticipate this and include the appropriate change management activities to ensure that this trust is built and the new ADE implemented successfully. Ratcliffe-Smith and McMillan[3] provide a detailed look at practical change management for Digital Oilfield projects, and the approach outlined in their paper has been used successfully at Chevron.

Key Challenges Faced

The challenges faced by Chevron will not be unique; to a large extent, all oil companies (and perhaps other industries) will need to address similar challenges. We consider these in the familiar categories of people, process and technology.

People

Typical people-related challenges include countering such statements as:

- The technology is too difficult to use
- I'm happy working at my desk, thanks
- We already tried viz rooms
- I don't want anyone looking over my shoulder

- I don't understand what we are going to do differently from we are already doing
- Isn't this just a posh meeting room?

Actions that Chevron has taken to address these issues include:

- User involvement. Getting users involved in the early stages helps to build buy-in, ensures credible process design and subsequent implementation success. However, the challenge here is that users are generally very busy and have limited time to devote to ADE work. Our approach of building a small number of use cases for specific processes that will deliver benefits early helps to reduce the impact on users' time
- Identifying champions within the user community. This is part of the change management activity. Local champions are more persuasive and have a higher degree of credibility than those from outside. In the case of new roles such as the DSC lead, selecting an experienced resource who already has high credibility within the business unit will contribute significantly to the delivery of early success
- Securing management support. Actively communicate with the management team to ensure that they are behind the ADE project and are communicating positive messages to their teams
- Emphasizing the positive. ADEs are not there to watch or monitor individual performance ("someone looking over my shoulder"), and this message needs to be reinforced
- Using other successes. We have observed that attitudes change after individuals have visited an ADE. Once a couple of early ADEs had been delivered in Chevron, members of other asset teams were encouraged to visit and talk to people working there. The messages from those individuals were very positive and helped to change attitudes across the business
- Training. Some of the technology will be new, and if it's not easy to use, people will not use it. The importance of an effective training program is critical. Scenario-based training tends to be more effective than function-based training. Offering training through a variety of channels can also be helpful, e.g. making online refresher training available on demand after class-based training has taken place
- Considering an ADE coach when implementing a large number of ADEs. The coach can support users with teething issues, encourage collaborative behaviors and provide a resource to help to develop new ways of utilizing the ADE. This helps the change to "stick" and provides a contact point for any ADE-related issues

Process

Typical process-related issues include:

- How to avoid getting caught in the "current process modeling" trap
- Designing new collaborative processes versus transferring today's inefficient processes into a new environment
- Understanding what better collaboration can do to a process
- Focusing on the critical few, higher value processes across a business unit
- Getting contributions and ownership from the eventual users

Actions that Chevron has taken to address these issues include:

- A light touch with respect to process design. Identify a small number of key processes that can add value, develop detailed use cases for them, implement and start to deliver early results. This will create momentum from the users for further implementations
- Be very selective in the amount of current process mapping undertaken. Spending a lot of time mapping today's processes can restrict thinking. Today's processes have evolved to meet today's approach and technologies, and we are trying to deliver a new way of working. Our approach has been to get users thinking about what they are trying to achieve (the purpose of the process) and how they could get there versus painstakingly mapping the steps that are followed today
- Allow the users to generate their own ideas. The approach of implementing a few key processes initially exposes users to the possibilities that are created by working in an ADE. This generates ideas that do not surface in early design sessions before users have real ADE experience. Limiting early implementations to a small number of processes allows these ideas to feed into the next wave of processes that are implemented, generating further transformation, and moving further towards a new way of working

Technology

Typical technology-related issues include:

- Making technology choices in a rapidly-moving environment that do not lock you in to an outdated solution
- Selection of appropriate and robust collaboration technology
- Integrating the technology together
- Providing for remote collaboration – bandwidth, bandwidth, bandwidth
- Building many one-off, unique environments

- Finding office space for a re-design

Actions that Chevron has taken to overcome these issues include:

- Paying attention to usability. This is linked to the people issue associated with "the technology is too hard to use". It doesn't matter how good a piece of technology is, if it's too difficult to learn how to use, then the vast majority of users will not adopt it. You may get one or two experts who spend the time to learn how to use something effectively, but this does not bring significant asset-wide change
- Thinking carefully before adopting anything that is "release 1," or still in development. The collaboration environment technology picture is evolving quickly, with new products being developed and released regularly. However, some of these new products may not be tried and tested robustly in a commercial environment. Any project team should think very carefully about whether to adopt a significant new piece of technology at the same time as an ADE go-live. It's not impossible to do this successfully, but it is easy to underestimate the amount of effort involved, and it can add risk to the project
- Ensuring that the bandwidth limitations are properly understood. Some collaboration solutions (e.g. video conferencing) offer very limited advantage in low-bandwidth environments
- Having a central team, even if it's just a few part-time people, who are responsible for collecting the knowledge gained in the implementing business units and transferring this to other areas. This drives consistency between implementations and avoids duplication of effort
- Using the central team to drive pilots of new software, moving the risk and effort from the business unit to a central team. Once the concept has been proved, it can be implemented in a business location at less risk
- Leveraging any new office build or office move. The ADE project has benefited greatly from linking ADE activities to office builds and office moves in a number of locations. New buildings in Aberdeen and Louisiana have provided the opportunity to design new suites of ADEs into the office environments

Results and Lessons Learned

The ADE program has been very successful at Chevron. The first Chevron ADE was delivered at the end of 2005, and less than two years later, there are over 50 either implemented or due to be implemented during the first half of 2008 across locations in Bakersfield, Houston, New Orleans, Aberdeen, and Nigeria. ADEs continue to be a central part of *i-field*, and further projects and implementations will be launched during 2008.

There is a challenge associated with measurement of results. At Chevron, the approach is not to try to build a business case for the ADE alone. ADEs are usually implemented as part of an integrated *i-field* project that includes other elements such as new hardware and instrumentation, software tools, analysis and visualization tools and improved processes. Trying to identify which element is responsible for observed benefits is very difficult and not particularly useful, as any assignation of benefit is always open to question. At Chevron, business cases are developed at the *i-field* level where possible, with "hard" benefits (increased production, reduced costs) measured at the project level. However, at a lower level, metrics can be put in place to capture "softer" benefits, such as:

- Availability (Is the ADE available? Does everything in it work?)
- Use (How often is the ADE in use against expected usage from the design phase? Is the ADE in use often or left standing empty for much of the day? How do the users find working in an ADE? Is it easy to operate?)
- Effect (What difference is the ADE making?)

Metrics associated with availability and use may be captured and monitored quite easily. Metrics related to user experience and ADE effect are more difficult to capture but can be done through a variety of methods. At Chevron, user surveys have been conducted to measure levels of satisfaction with the ADE, perceived ease of use and so on, and to capture anecdotal evidence on benefits. User interviews have also been carried out, and the ADE coach (where one is in place) can log incidents of users commenting how much easier or more quickly a problem was solved because of the collaboration facilities. Typical results from ADE implementations include:

- Working faster. Observed increases in the amount of work covered during a meeting or a review (e.g. number of well patterns reviewed increased by 40 percent)
- Faster decision-making. Ability to access and analyze data during a meeting meant that users were able to come to a decision during that meeting. Previously, they had tended to go away with actions to collect and analyze data, then meet again to make the decision
- Improved collaboration. Having the right people participate (whether locally or remotely) means that the right expertise is present, and groups are able to understand the issue more completely. Communication between different functions is improved, and understanding of decisions increased

- Improved visualization leading to greater understanding. The ability to simultaneously view information from different sources and view that information on large, high resolution screens can improve understanding and lead to better decisions due to the higher quality of information available
- Making better use of experts. The DSC allows one process specialist to support many or all of the assets across a business unit (or even across multiple business units). Creating the DSC lead role has led to immediate benefits, as the specialist is able to identify performance issues and make recommendations for improvements. This can help to deliver increased efficiencies and reductions in operating costs
- Reduced misinformation. Having everyone look at the same data in the same format, using the same tools significantly reduces confusion and misinterpretation of data
- Helping to embed overall *i-field* changes. An ADE brings together many different elements within an overall *i-field* project and can be the catalyst to deliver sustainable change

User Experiences in Decision Environments

We previously discussed operations with the team crowded round a desk. But with the scale and resolution of the screens available to us, the clarity is so good that you physically feel drawn in. We can now visualize, describe and interpret structures with ease. As a result, we subsequently captured maximum reserves by positioning our well in the optimum location. *Operational Geologist, Aberdeen*

More people are showing up to my meetings. The tools in [the] Collaboration Solutions Room have allowed us to collaborate better. *Production Engineer, California*

The Control Room Environment has changed the way we do our business because of collaboration … we can see what's going on in the field, and we can help them respond to problems … being able to work in a group has really improved things. *Artificial Lift and Corrosion Specialist, Texas*

Figure 4: Quotes from Users on Their Experiences in ADEs Across Chevron

In terms of lessons learned, there are many lessons spread across all areas, some of which have been mentioned above. Our key lessons learned include:

1. Strike the right balance between early delivery and process design
2. Pay attention to the technical and usability issues. If it's too hard to use, the users will not engage
3. Involve the user community from the start, but be sensitive to the time commitments that they need to make to the project
4. Remember that the opportunities are significant – don't just take people doing their current jobs and move them into an ADE. The DSC lead is a good example of a new role created, something being done differently, with measurable benefits
5. As the ADEs implement, users will generate new ideas to transform the way we work
6. Change management (not just training) is very important
7. Post-implementation support is important if the changes are to stick. For suites of ADEs implemented simultaneously, consider a full-time ADE coach role
8. Leverage success – once one ADE has been implemented successfully, use it as a showcase to demonstrate its value. Peers make great influencers
9. Don't try to develop a business case for an ADE in isolation, but do develop and capture success metrics for the ADE. Success metrics can be a mixture of availability and usability statistics, user surveys and anecdotal evidence

And finally:

10. This is just the beginning. At Chevron, we believe that the ADE implementations to date are only a small step on the collaboration and transformation road. Our approach is to manage the scope of an implementation to allow benefit to be delivered early, but at the same time, to remain flexible as to where the work could go in the longer term.

Future Direction of ADEs

How far can we go with collaborative working and decision-making? We believe we have only "scratched the surface" of the potential of ADEs in a production operations world that has been transformed. As we continue to progress toward more advanced digital oilfields, there will be opportunities to set the bar higher and higher in defining the transformed state of how we operate our assets. (See Figure 5 for Chevron's vision of the advanced *i-field*). Our limitation will most likely be how comfortable we will feel changing work processes and how much behavioral change we will be willing to absorb.

Figure 5: Chevron's Vision for the *i-field*

Already, we are seeing ADEs becoming increasingly accepted as integral to how we work in the SBUs. Every new deployment of *i-field* contains a theme of decision environments that builds on the last deployment and takes things further. The more mature *i-field* SBUs are moving toward entire offices re-thinking their collaborative space. Chevron's Aberdeen office for the Europe SBU has been completed and is in full use. The new GOM office will become operational in 2008. Both of these new buildings leveraged the *i-field* ADE program to design a transformed mode of working within the office teams, as well as interfacing with field operations. The MCA SBU will be moving into new space in Houston over the next couple of years, utilizing the ADE learnings to design their space. More and more ADEs will contain employees that permanently work in them, instead of in individual offices. "Open space" and "collaborative space" will be redefined into areas that are highly rewarding for our teams. Geography will no longer matter as virtual connections improve.

As we move into 2008 and 2009, new learnings will be applied to initial deployments in centralized headquarters groups, and to new projects in Canada, Angola, Nigeria and Australia. As this critical mass develops, even more learnings and new ways of thinking about how we work will unfold. The stage is set to target an even more aggressive vision of where *i-field* and the ADE journey can take us.

Imagine what a "nerve center" for a group of assets might look like. Picture a centrally managed environment where all aspects of operating decisions and the consequences of those decisions are instantly known. Similar to the human body in relationship to the brain, we will be able to understand the impact of both action and inaction on the entire operational system. Cambridge Energy Research Associates (CERA), in their Digital Oilfield of the Future descriptions, calls this "total asset awareness." While it may begin with the scope of a single asset, eventually all assets under the management jurisdiction of an organization will come together in an interactive environment. Some of the aspects of this environment may include:

- Continuous live connections to remote sites
- Push-button access to third parties
- Immersive interaction with team members, from wherever they are in the world
- Voice-activated access to internal systems and people
- Automatic solution generation of decisions, similar to what has historically been experienced
- Multiple options offered, along with the relative impacts of the associated decision
- Rapid-response think tanks to address situations that have never occurred before
- The capability of modeling decisions prior to making them, knowing the consequences and dramatically lowering risk and uncertainty
- Experiential training of personnel in an immersive, virtual reality atmosphere based on real situations
- "Condition-based" leadership to maintain healthy, accurate and current strategic plans that can be modified "on the fly" in order the navigate the ever-changing dynamics of our industry

- A complete re-invention of competencies, roles and positions required to operate this new world into future generations

Of course, it will take a phased-approach to successfully make this journey into uncharted territory. Today, we are matching the scope of transformational change with what our limited resources can effectively manage. Fortunately, as more and more segments of our business operations move into these new decision-making environments, subsequent learnings and new enhancements will be applied in faster and faster cycles.

Technology developments will also drive advancement in ADE operation. Advanced visualization, availability of bandwidth, remote collaboration and Web 2.0 tools will offer additional opportunities to collaborate and transform. Social networking, wikis and instant messaging are all tools that are regularly used by many but have not yet been widely adopted in the workplace. The *i-field* program is starting pilots using some of these tools, and we believe that these may offer another step-change in the way work and knowledge can be managed. As with the original ADE implementations, we do not know exactly what will be possible once they are implemented, but the scoped pilot activity will help us better understand their potential use, value and impact. The next generation of technology will drive further changes and capabilities within the integrated field.

All of the above aspirations will depend upon the business drivers of the appropriate scope of operations. Some scenarios of this envisioned state could be:

- Single large assets, with long lives
- Multiple like assets, with many common operational processes
- Multiple non-strategic assets that, when managed as a whole with minimal resources, become collectively viable
- Regional strategic plays that require alignment as part of a whole
- Entire operating areas that are managed from a "central command" at headquarters; remote operations; humans dispatched based on need only

As ADE implementations continue, it becomes easier to outline an ambitious vision for ADEs in the future, but challenges remain if we are going to progress from the current status of the ADE, including:

- Not being restricted by the current state. Ensuring that the next wave of ADEs builds on the success of the current wave versus simply reproducing the current functionality
- Technology availability. The ADE is one area where there are some technology restrictions. Bandwidth availability to remote locations, easy-to-use remote collaboration tools and advanced remote visualization are all areas where technology improvements could enable ADE advancement
- Appetite for guided workflow. The tools exist to allow users to be guided through processes, but do we want to make that type of change in working practices?
- Ability to demonstrate value. There is strong anecdotal evidence that ADEs are delivering value across the industry, but defining and delivering precise metrics remains a challenge

Subsequent ADE implementations will need to address some of these challenges to deliver the next step in collaboration. The next generation of ADEs will

- Complete the implementation of truly managing a major process across an entire business unit
- Solidify the culture of "two teams working as one" between the field and the office
    - The field team is responsible for day-to-day operational decisions
    - The office team looks after key decisions that are more long-term to impact the current year's performance, and beyond
    - And…**both** teams help each other in their decisions via the collaboration
- Network with other ADEs, across location and across organization (i.e. bring in external experts)
- Increase the scope and degree of processes managed (e.g. from compression to rotating equipment)
- Provide a venue where we understand and put into practice more guided workflows
- Continue to offer an exciting and attractive environment for the next generation to work
- Provide the venue for managing the increasing volumes of data, with analysis and artificial intelligent tools, enabling us to focus on the key activities and to manage by exception
- Measurably reduce travel and increase safety performance (keeping people out of harm's way)
- Serve as natural command centers for incident management and disaster recovery
- More often become the place where new solutions are built

- Understand the full benefit of fiber-enabled collaboration and communication as the first systems are put in place
- Deliver new ideas on how collaboration can be enhanced with the next generation of technology

With the planned implementations over this next year, even more learnings will be generated. These learnings will provide the information needed to determine how aggressive we should be in our quest for the future state as described above.

Conclusion

Decision environments are being implemented across the upstream industry. Chevron, working with SAIC, has developed its own ADE program, which has delivered various types of ADE across multiple locations. The approach developed was to build the environments quickly, model a small number of processes, and get users in the door, providing the right levels of change management and support to ensure the changes stick, and that users are supported and encouraged in development of further ADE use.

The program has been very successful, with over 50 ADEs implemented or due to be implemented by mid-2008. Early results show a very positive reaction to the environments, with observed benefits in increased understanding and communication, improved analysis and more rapid resolution of issues.

We believe that the ADE work carried out to date is just the start of a collaboration journey. Further developments in technology, coupled with increased acceptance of collaborative working, and a better realization of what really might be possible will lead to significant developments in ADE implementation and operation over the next few years. Chevron's ADE program continues to accelerate and will remain a key integrator in the overall *i-field* program.

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