Delivering value from insight to execution.

Halliburton Consulting and Project Management is one of the few organizations in the world with enough breadth and depth to help you assess, plan, build, and manage entire oil and gas assets.

**HALLIBURTON CONSULTS IN FIVE MAIN AREAS:**

- Mature Fields
- Unconventional Reservoirs
- Field Development Planning
- Well Planning and Design
- Business Performance Improvement

**HALLIBURTON ALSO MANAGES PROJECTS, SUCH AS:**

- Well Construction and Completions
- Workovers
- Plugging and Abandonment
- Gas Storage and Geothermal

**EXTENSIVE EDUCATION AND EXPERIENCE**

Halliburton employs more than 1,000 consultants and project managers with extensive oilfield experience in geology, geophysics, petrophysics, geomechanics, chemistry, evaluation, modeling, drilling, monitoring, logistics, change management and more. More than a third of our consultants have PhD's. Virtually all of our project managers have decades of field experience.

Clients choose Halliburton for our collaborative style, integrity, and thoroughness. They appreciate the sense of certainty Halliburton brings to projects as well as the results Halliburton produces.

**LET US HELP YOU:**

- Design the optimal development plan for new assets
- Optimize production from existing assets
- Extend the producing life of a field
- Exploit unconventional assets
- Design and deliver wells on a turnkey basis
- Diagnose and resolve production issues
- Improve processes that affect asset performance
- Take advantage of real-time and new technologies
- Coordinate and manage oilfield projects
- Expand your capabilities and train your staff
- Accelerate the development of an asset
Increasing production, adding reserves and reducing costs

As a field’s lifecycle plays out and production declines, the question becomes, “How can we keep this field profitable?” Our Mature Field consultants address this question by rapidly applying global best practices and new technologies that will work best in your specific field.

Immediate P&L impact

Most of Halliburton’s mature-field engagements are designed to have immediate impact through some type of intervention. After reviewing well data and prioritizing needs, Halliburton recommends and implements solutions that fix underperforming wells, address artificial lift challenges or address operational issues.

Reservoir rediscovery

Halliburton also reevaluates well logs and seismic data using new tools and techniques designed to pinpoint pockets of bypassed pay. The goals: identify remaining reserves, develop infill-drilling programs, and pinpoint opportunities for enhanced recovery.

Cost-effective well abandonment

When economics finally turn against operators, the best way to make money is to stop losing it. When a well or field is no longer covering its operating costs and there is no hope of turning it around, prudence calls for devising the most cost-effective, yet environmentally responsible, well abandonment strategies possible. This represents another one of Halliburton’s areas of expertise.

SUCCESS STORY

Reducing P&A Costs

A U.K. client had 201 subsea wells in 15 fields that were expected to cease producing in less than 10 years. They commissioned Halliburton to review 89 of the wells, develop a P&A strategy, and provide cost estimates for each well. Halliburton ranked each well based on type, expected duration of production, and plugging and abandonment costs. Halliburton also developed proposed wellbore schematics and identified new technologies for each well type. This approach achieved all client objectives. Additionally, categorizing wells by type allowed the client to extrapolate costs beyond the wells studied. Halliburton also showed them how they could reduce costs by “campaigned mobilization” – addressing groups of wells at one time to eliminate redundant mobilization costs.

SUCCESS STORY

Increasing ROI by More Than 15% in Three Fields

A client with an underperforming asset asked us to reinterpret existing data and prioritize wells for intervention based on risk level and potential production increase. Collaborating closely with the client, Halliburton integrated surface and subsurface studies of three fields. After screening all data, Halliburton then recommended detailed workflows, plans and specific technologies for addressing each well.

Overall, the plan increased ROI more than 15%. Compared to original expectations, one well exceeded its production target by 667%, thanks in part to the integration of insight from Halliburton Consulting and execution from other parts of Halliburton. Another well exceeded its original target by 422%.

SUCCESS STORY

Increasing NPV 300%

Halliburton specializes in applying secondary, improved and enhanced oil recovery techniques to extend and, for a period of time, reverse the decline curve. In one field, a client had 80 percent of the hydrocarbon resource still in place, but pressure had dropped to one-third of its original level. The client asked Halliburton to evaluate waterflooding to increase production and extend reservoir life. The customer was prepared to spend approximately $100 million USD on the project. Using numerical algorithms and stochastic analysis, Halliburton determined that the original waterflooding plan was not the optimal solution. An alternative chemical enhanced-oil-recovery plan could increase NPV approximately 300% compared to the base case.
Halliburton Consulting has been instrumental in the early development of most North American shale plays – including the Bakken, Eagle Ford, Monterey and Marcellus – and is bringing this knowledge to new developments around the world.

All of these plays have resulted in sustainable successes due to a combination of factors: Halliburton's application of the "right" technology; our understanding of the differences between shales and what makes them productive; and clients with the ability to profitably manage lower margin projects.

No two shales are alike

Halliburton Consulting has developed evaluation tools, processes and modeling workflows that have enabled us to better understand shale disparities. Shale lithology, characteristics and production profiles vary significantly both within and between shale plays. Economic success requires optimizing well, completion and hydraulic design locally.

Halliburton uses a fast-loop, fully integrated, continuously refined Asset Model to help you assess and develop unconventional resources including shale and tight gas. The model integrates all reservoir properties to improve well placement, completion design, and well and field performance. Locating all this information in a single environment, accessible by all engineers and geoscientists, facilitates quick collaboration and continuous learning.

Optimizing for variations in rock mechanics

Shale can differ in many ways. Perhaps the most important is brittleness. Brittle shale fractures easily. Ductile shale may not fracture at all; if it does, the fractures may close as soon as pressure is released. Attempting to fracture ductile rock with the same program as brittle rock wastes time and money without returning profit.

At every point between those two extremes, optimal fracturing may require different combinations of pressure, fluid and proppant size.

Benefits of working with Halliburton for your unconventional field

Clients report that Halliburton consultants have helped them:

- Identify technologies and techniques that make fields profitable
- Increase total reserves
- Enhance production rates
- Reduce the total cost of operations
- Make marginal fields profitable
- Increase ROI and NPV
- Rapidly identify optimal well placement, well design, stimulation and development scenarios
- Predict economics of fields under consideration for leasing
- Reduce development risk

Get to full production faster

Shale often involves marginal economics. The faster you can find optimal well and stimulation plans for a reservoir, the more profitable you become. Halliburton Consulting fully understands shale complexity and the cutting-edge technologies that can quickly exploit it.

40% production increase in tight-gas field

A Latin American national oil company requested the development of an integrated exploitation plan for a tight-gas asset. Our Front-End-Loading (FEL) methodology pointed to a new subsurface strategy and recommended increasing surface facility capacities to reduce bottlenecks.

A multi-disciplinary consulting team identified exploration opportunities; evaluated uncertainties; delivered design recommendations for lateral and surface facilities; and recommended a pilot project that incorporated the new wellbore architecture and new stimulation technology. The exploitation plan was fully adopted and funded. Result: a 40% increase in production.
For any type of company

Our FEL/DMS process also works for any type of company. Whether you are a giant national oil company or a small independent, Halliburton can rank scenarios based on your objectives. The result: plans customized for your capital process.

The complete tool set

Of course, the value of any plan depends on the competence of the team compiling recommendations. The Halliburton field development planning team has hundreds of consultants, most with post-graduate degrees and decades of field experience. Halliburton has the entire spectrum of specialists needed for effective field planning – from geology and geophysics to reservoir engineering and production modeling. Halliburton professionals also understand field development costs better than most other consulting organizations. They bring an understanding of new game-changing technologies to every engagement.

Multi-domain scenario analysis and optimization

Traditionally, companies plan field development sequentially. One group of experts completes its work and hands it off to the next. In Halliburton’s process, all specialists work together up front to define a wide range of high-level development scenarios. Simulators then estimate costs, impacts and returns of each scenario. Identifying and ranking the most promising scenarios early in a project enables planners to thoroughly evaluate their risks and rewards, and rapidly identify the optimal plan with a high degree of confidence. This technique often identifies scenarios that may be counter-intuitive but which have higher-than-expected rates of return. It also helps avoid investing years of effort in development scenarios that may be less optimal or even damaging.

For any size or type of field

This unique approach works for any field:
- Large or small
- Gas or oil
- Conventional or unconventional
- Green or mature
- Onshore or off

Rapidly identifying the optimal plan for any size or type of field

Halliburton is recognized for pioneering the use of Front-End-Loading (FEL) principles in field development planning. Widely used in many types of engineering, FEL has rapidly proven its worth in upstream oil and gas. Compared to traditional sequential field development planning, the FEL approach evaluates a wider range of development scenarios in much less time. By utilizing Landmark Decision Management System™ (DMS™) software, Halliburton can efficiently analyze hundreds of field-development scenarios in days or weeks instead of a small number of scenarios in months or years.

Success Story

Doubling production in four years

A Latin American national oil company requested an exploitation plan for 17 on- and offshore fields. They ranged from newly found to developed, and from deep water to unconventional. Client objectives: maximize reserves while minimizing capital expenditures.

Using our Front-End-Loading (FEL) methodology, Halliburton ranked multiple development scenarios for each field based on client objectives. For the top-ranked scenarios, Halliburton also delivered engineering designs for everything from well architecture and new facilities to new stimulation technology. The client adopted the recommendations and, staying within budget, doubled production in four years. Production increased by 100,000 BOPD.

Success Story

Halting a production decline in six assets

A large South American national oil company facing declining reserves hired us to develop a 5-10 year exploitation plan for six principle assets. They hoped to find the most cost-effective way to slow or halt the production decline.

A multi-disciplinary team of senior Halliburton consultants analyzed assets, opportunities, alternative strategies and business drivers using FEL visualization techniques. The country’s Secretary of Energy used the study to justify budget requests for his country’s national oil company (NOC). Budget was approved in a timely manner. The NOC then implemented multiple improved and enhanced oil recovery projects, restructured the corporation, reallocated budgets, and improved knowledge management – all recommendations of the study. To date, they have halted the production decline on the six assets.
Global design-to-delivery capability

Halliburton Consulting offers Well Planning and Design services worldwide. Halliburton can take responsibility for the total well design consult on specific issues. Three main objectives:

- Optimizing the number of workbehres for best reservoir drainage
- Optimizing workbehre designs for safety, speed and cost
- Designing wells to help eliminate incidents and lost time

To achieve these objectives, Halliburton integrates world-class capabilities in well planning, tubular design, geomechanics and real-time.

Maximizing drainage with fewest wells

The least expensive well is the one you don’t have to drill. Our Collaborative Well Planning service enables engineers and geoscientists to maximize reservoir drainage with the fewest wells possible by understanding each other’s constraints. As a result, our recommended targets and well paths also avoid collisions and subsurface hazards that cause NPT or HSE issues.

Reducing drilling costs by almost two-thirds

A large fault, depleted sand, and weak rock zones concerned a client drilling a high-inclination (>65º), high-stress, deepwater appraisal well in the Gulf of Mexico. The well’s objective: to understand the volume of oil and gas in the reservoir by finding the point of oil/water contact.

Wellbore instability caused an unusually high number of stuck pipe incidents for a Middle East operator. When the operator raised mud weight, it overreacted and caused differential sticking – and a call to Halliburton Consulting.

After analysis, Halliburton recommended a mud weight that would allow a small amount of pressure buildup. This reduced the risk of kicks, stuck pipe, lost circulation and blowouts.

Benefits include:

- Accurate forecasts of pore pressure, fracture gradient and overburden gradients
- A better understanding of how the geologic section will react to drilling
- Increasing ROP
- Hitting the most productive targets quickly
- Optimizing well paths, casing and mud programs
- Reducing casing-related costs and contingency casing design
- Increasing safety
- Reducing risk of kicks, stuck pipe, lost circulation and blowouts
- Optimizing hole sizes for maximum protection and production
- Minimizing nonproductive time and capital expenditures
- Boosting production rates
- Increasing recovery rates

SUCCESS STORY

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Through meticulous geomechanical analysis and planning, the well was drilled without wellbore instability or fluid loss despite encountering the predicted hazards. While drilling, real-time pore-pressure readings indicated an opportunity to omit the intermediate casing string. Drilling the 15,000-foot well took only 14 days. As a result of this and other efficiencies, the client reduced costs by almost two-thirds and saved $15.9 million USD in reduced rig time, mud additives and casing costs.

SUCCESS STORY

Optimizing wellbore stability for safety, speed, cost

If not understood, pore-pressure and wellbore-stability issues can lead to costly equipment failures and nonproductive time. Risks include stuck pipe, lost circulation, wellbore collapse, blowouts, safety, environmental consequences and production loss.

To help avoid such problems, Halliburton geomechanics specialists predict how your target will respond to drilling with Landmark Drillworks® software. It provides an integrated pore pressure and geomechanical solution that helps achieve higher levels of risk reduction, cost savings and improved drilling performance.

Safe, reliable design for extreme environments

Halliburton Consulting routinely designs systems that keep oil and gas flowing even in extreme environments using Landmark WELLCAT™ Casing and Tubing Design Analysis software. Its advanced capabilities help Halliburton:

- Simulate fluid and heat transfer during completion, production, stimulation, testing, and well-servicing operations
- Analyze tubing loads and movements, buckling behavior, and design integrity
- Predict pressure and volume changes due to annular pressure buildup.

Next-generation real-time capabilities

Halliburton also takes well design into execution with real-time operating centers. Our integrated workflows help optimize drilling operations by connecting multiple capabilities. From bit and bottom-hole-assembly design to fluids, geomechanics and directional drilling, Halliburton can help you monitor and optimize operations more efficiently and reliably than ever. As always, Halliburton strives to help ensure safe, efficient drilling and well construction operations.

SUCCESS STORY

10X return on real-time operation center in first year

Wellbore instability caused an unusually high number of stuck pipe incidents for a Middle East operator. When the operator raised mud weight, it overreacted and caused differential sticking – and a call to Halliburton Consulting.

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These changes reduced stuck pipe incidents 75% during a 12-month drilling campaign that included five rigs and 40 wells. The reduction in nonproductive time saved the operator $40 million USD and paid for the $4 million USD real-time operations center in less than six weeks.
Customers come to us primarily with technical challenges. To maximize performance, Halliburton also helps with business process challenges.

Managing change
When improving productivity involves people, processes and technology, getting to the next level can be challenging. A Middle East oil company wanted to improve field productivity and reservoir management efficiency. To do that, the company knew it would have to adopt new workflows and roles enabled by new technology. (See Digital Oilfield on page 20.) Halliburton Consulting designed a pilot program around 50 wells in an existing field. Halliburton re-engineered workflows, built a real-time center, installed Landmark DecisionSpace® Production software, and deployed Pinnacle instrumentation for well monitoring and WellDynamics® technology for well control.

Instead of managing change via an external communication program, Halliburton used an internal “Do and Change” approach based on collaboration and technical coaching. This accelerated buy-ins and hand-overs of the new workflows. Among other things, the ability to monitor and optimize production in real time helped the company increase production by 7%. Its recovery factor also increased 4X. Well downtime was cut by 30% and the water cut dropped from 56% to 20%.

Improving business processes
When technical progress and business results are hindered by inefficient process or organizational barriers, Halliburton can help. Our consultants work with you to improve processes, your organization, and execution strategies—all while addressing core technical challenges.

Halliburton worked with a Latin American NOC to accelerate development of its assets by making its processes more efficient. After auditing the company’s processes, Halliburton found clients spent excessive time in meetings without the information they needed to make key decisions. After simple process and information management changes, they now make and execute decisions faster. Cash flow has improved as a result.

Developing new capabilities
Oil companies moving into new plays or needing to accelerate capabilities work with Halliburton Consulting to develop new capabilities and staff competencies. Halliburton has assisted clients in multiple areas including Unconventional, Field Development Planning and Offshore.

For a Middle East oil company seeking to expand into unconventional resources, Halliburton Consulting screened their staff for competencies and selected 18 high potential candidates. Halliburton then managed an intensive 22 month, office- and field-based program where they learned every aspect of unconventional asset development.

For other clients in the Middle East, Latin America and Asia, Halliburton has designed and managed programs combining coaching, project-based learning, field experience and classroom training. Halliburton has also assisted organizational capability development by providing standard process designs, organization and technology strategies.

Success Story
Cutting the time from discovery to production in half
A large European oil company with assets in the North Sea had more drilling opportunities than it had staff to take advantage of them. They needed to find a way to work more efficiently. Their goals: reduce the time from discovery to production from five years to 2.5, and increase the wells drilled per rig per year from three to five.

The company approached Halliburton for help in identifying and implementing performance improvements. After thorough analysis, development of key performance indicators, and process changes, the company is on track to achieve both objectives. Improvements have come from the ability to track job performance better, a reduction in hand-off time between groups through better project management, and planning wells and fields simultaneously. The company has hired Halliburton to help deploy their new practices to operations in nine other countries.

Success Story
Developing skills needed to grow in new areas
A large South American national oil company wanted to double production in 10 years. It acquired deepwater assets even though it had no experience offshore. The company hired Halliburton to develop workforce competencies and deepwater processes.

After creating a process model for deepwater exploration, development and production that included real-time capabilities, Halliburton developed a deepwater curriculum. Students spent four months receiving intensive instruction from Halliburton’s deepwater experts. At the end of the course, they created a deepwater field development plan used in the real world. Today, the company is successfully developing several offshore assets, continues to consult with Halliburton, and uses many other Halliburton services.
Choose the style best for you. Halliburton offers project management services on a time-and-expense or lump-sum basis – with or without rigs.

Whether you just want help coordinating projects, a full turnkey solution, or something between the two, Halliburton can help.

**Professional coordination**
Some clients want to make all financial and operational decisions themselves, but want the efficiencies that expert project management provides. For these clients, Halliburton offers Integrated Services (IS) on a time-and-expense basis.

**Turnkey accountability**
Other clients want a turnkey solution. They want to outsource construction of entire wells from drilling to completions. For these clients, Halliburton offers Integrated Project Management (IPM). In IPM projects, Halliburton assumes all financial and operational responsibility to deliver a finished well at an agreed-upon price. From start to finish, Halliburton collaborates with you to ensure that wells meet your specifications.

**Fast-track solutions**
Sometimes clients want to retain control over financial and operational decisions, but need help designing and constructing the well. For them, Halliburton offers Fast-Track services in which our consulting and project management groups work together under the supervision of the client to deliver the well.

A **single point of contact**
Regardless of how you want to work together, Halliburton Project Managers provide a single point of contact responsible for coordinating logistics, scheduling and daily reporting. Halliburton can also provide more advanced services, such as drilling and completions planning, contingency planning, financial tracking, performance optimization and HSE management. Halliburton can even catalog lessons learned to help ensure that your next well costs less than your last.

Additionally, as part of IPM services, Halliburton can manage third-party services, such as wellbore and civil engineering; regulatory approvals and compliance; procurement; rig contracting; and wellsites services such as security and living quarters.

**Fast-track development makes more fields economical**
A large national oil company that traditionally hired multiple vendors to provide a series of discrete services was frustrated by the time it was taking to plan, drill and complete wells. They awarded Halliburton a contract to provide directional drilling and logging-while-drilling services, surface data logging, drill bits, hole enlargement and coring services, cementing and pumping services, drilling and completion fluids, completion services, multilateral junctions, SmartWell® completion systems and VersaFlex® expandable liner hangers.

The operator also hired Halliburton Project Management IS to coordinate all these services. Through increased efficiency, IS reduced the time from sanction to production. The company also found that lower overall project costs allowed it to develop marginal oil discoveries that would have been uneconomical using traditional contracting models.

**Benefits**
- Ensure different disciplines interface with each other
- Keep vendors focused on team goals, not just their own individual goals
- Eliminate the cost of poor quality through comprehensive planning
- Improve communication, logistics and service quality
- Increase operational efficiency and safety
- Reduce nonproductive time and well construction costs
- Drill and deliver wells faster and more safely
- Improve net recovery
- Mitigate financial and execution risk
- Make budgets more predictable
- Reduce scope creep
- Accelerate asset development
- Mitigate financial and execution risk
- Get wells into production sooner
- Make budgets more predictable
- Scale drilling programs up or down without adding staff
- Take advantage of Halliburton efficiencies, processes, technology and experience

**Unlocking one of the world’s largest gas fields in remote deep water**
When our client discovered an estimated 17-30 trillion ft³ of natural gas offshore Mozambique, the country had no oilfield infrastructure. Validating the discovery proved to be a logistical challenge. There is only one deepwater port capable of supply operations in the entire country and it is eight hours from the discovery by supply vessel. Complicating matters, there was only one berth at the port for cargo ships. The best available staging area was crosstown and the roads were not built to handle heavy oilfield equipment.

After extensive planning, Halliburton IS brought in crews, bulk and portable repair facilities, drilling fluids, completion fluids, cement, plugs, lab facilities, cleanup tools and more to support the drilling of eight wells. All the planning paid off; there were no significant delays for equipment or supplies during the program and the client proved it had one of the world’s largest natural gas fields.
Halliburton Project Management delivers hundreds of wells each year throughout the world by solving complex challenges with step-and-repeat processes.

Good project management requires far more than managing logistics. To produce exceptional results, it also requires a thorough understanding of geology, well engineering, industry best practices and oilfield technologies.

Efficiently integrating resources
Our project managers work closely with every part of Halliburton. As leaders of a highly qualified team with global experience, our project managers understand how the many pieces of your project are connected. They also understand which resources to marshal for any given challenge and how to coordinate them for your maximum benefit.

Applying breakthrough technologies
Halliburton consistently ranks as an industry leader in terms of patents awarded each year. That means our project managers are in a unique position to see when new technologies could benefit your project.

Drilling and completing wells faster
By maintaining a core group on your project, Halliburton can apply lessons learned on one well to the next well. In a south Mexico HP/HT reservoir with severely depleted zones, we can apply lessons learned on one well to the next well. In a south Mexico HP/HT reservoir with severely depleted zones, they reduced average drilling time from 165 days per well to 68, and average completion time from 35 days to seven. (See SPE 102228.)

How Halliburton Does It
The keys to these improvements include:
- Multi-disciplinary teams with experience from different parts of the world
- Aligning drilling crew incentives to project goals
- Retaining crews and supervisors throughout an entire project to take advantage of lessons learned
- Maintaining good community relations to reduce slowdowns
- Eliminating nonproductive time and waste
- Drilling multiple wells from one pad
- Focusing on “quick hits” and tie-ins to nearby, existing facilities
- Enhancing communication
- Standardizing on best practices, processes and equipment
- Performing simultaneous operations

SUCCESS STORY
Reversing declining production by accelerating drilling with IPM
Since 2008, Halliburton has collaborated with a large Latin American national oil company on a 58-well, $683 million USD project. The contract calls for Halliburton to drill and complete each well for a lump-sum using rigs supplied by the operator.

The well conditions are challenging. They include depressurized and HP/HT formations, complex geologies and tremendous depths. The wells range from 5,000 to 7,000 meters and require underbalanced or managed pressure drilling. Despite the challenges, Halliburton IPM has delivered the targeted number of wells each year – on time, on budget. As a result, the operator has expanded the contracts scope by increasing the number of rigs allocated to us from 7 to 12. Contributing to the success: excellent collaboration with the client, integrated project management and a Halliburton-managed real-time operations center that optimizes work on all rigs simultaneously.

SUCCESS STORY
Accelerating development of one of world’s largest oil fields
In the Middle East, the operator of one of the world’s largest oil fields hired Halliburton to drill and complete up to 185 oil production, water injection and evaluation wells on a lump-sum, turnkey basis.

Halliburton started the project with three rigs and delivered more wells each year than the contract stipulated. As a result, the operator expanded the scope before the first phase of the contract had been completed. Halliburton provides drilling rigs, directional and horizontal drilling, logging while drilling, cementing, mud engineering, wireline logging, completion, perforating, and other well construction activities, including engineering and management of all drilling operations. Halliburton has provided services to the operator for nearly 70 years.

Several hundred MBOE at recovery costs between $30 and $50/barrel
A European national oil company (NOC) wanted to reverse declining production by shortening the time from discovery to production. They contracted with Halliburton to provide integrated project management, consulting, drilling, completions, cementing, and fluid services.

Working closely together, the client and Halliburton Project Management have reduced costs by standardizing equipment and work processes, and focusing on reservoirs that are easy to tie in to existing host platforms.

Under this fast-track contract, Halliburton is now helping the client deliver wells ahead of schedule and on or below budget. So far, this approach has been responsible for the discovery of hundreds of millions of barrels of oil at remarkably low recovery costs. “The focus on fast-track development has been a complete success,” says the client. “Normally, these fields would not have been profitable. Yet, now we have incredibly profitable production. Some of the fields will break even at only $30 a barrel!” The client now aims to deliver five new fast-track projects per year.

Reducing NPT and drilling costs
leads to 5 day payback on new wells
A Middle East NOC hired Halliburton to drill and complete 145 wells in five years on a lump-sum turnkey basis. The NOC previously used a variety of vendors on each well. By providing integrated services, Halliburton was able to keep crews together, enhance communication, and follow established processes.

Halliburton cut NPT by approximately 50% and has not had one recordable safety incident during the first four years of the contract (from day one to the date of this writing) – while honoring a mandate to use 40% local content.

The client is saving 20% on drilling costs. Even more impressive: the average well pays for itself in only four to five days due to high production rates.

SAVED 20%
5-DAY PAYBACK

Benefits
Clients report that Halliburton Project Management has helped them:
- Accelerate development of new fields
- Reduce drilling and completion costs
- Focus on their core business of managing reserves and production
- Eliminate nonproductive time and waste
- Reduce financial risk
- Enhance drill-site safety

FROM 7 RIGS TO 12

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Trinidad Drilling and Halliburton have established a joint venture, Trinidad Drilling International, to take high-performance drilling to the next level on Halliburton-managed projects.

**New level of integration between rig and service providers**

Trinidad Drilling is a major, vertically-integrated, drilling company headquartered in Calgary. Trinidad’s advanced manufacturing facilities and high-performance drilling services combined with Halliburton’s leading-edge technology and project management capabilities will provide a new level of integration and performance rarely seen on land rigs.

**Exclusively top-tier rigs**

Thirty to 35% of drilling costs are related to rigs. Improving rig capabilities can substantially reduce drilling costs and reduce risks, resulting in more predictable well costs. Drilling operations in North America have proven that new-generation drilling equipment can drill faster and with better results. Halliburton Project Management will utilize top-tier rigs from the Trinidad Drilling International joint venture to deliver performance gains for our customers. Unlike other companies, the joint-venture’s fleet will consist primarily of top-tier rigs that feature service-provider integration typically found only offshore.

Halliburton and Trinidad, through the joint venture, will further integrate Halliburton services into the rig design. It will enhance crew collaboration, expedite rig transport, improve drilling performance and increase rig reliability.

**High-end features deliver wells faster**

These rigs will deliver wells faster and enhance crew safety. All rigs feature high-horsepower mud pumps, AC electric variable frequency drive power, high-torque top drives, and fast moving capabilities. Additionally, they will be outfitted with ancillary equipment like iron roughnecks, hydraulic catwalks, BOP handling systems and pipe-handling machines.

**Unconventional and mature fields**

Trinidad Drilling International rigs will be rated principally from 1500 to 2000 horsepower. They have been designed specifically for horizontal drilling generally found in mature and unconventional plays. Halliburton and Trinidad’s initial focus will be on Middle Eastern and Latin American markets.

**Benefits**

- **Expedited rig transportation and mobility**
- **Improved crew safety**
- **More predictable results**
- **Reduced well-construction costs**
- **More predictable well costs**
- **Enhanced crew collaboration**
- **Improved well-delivery performance**

**Outsourcing a business process**

Mitigating risk requires thorough analysis and contingency planning. Halliburton manages large workover portfolios on a multi-year basis – from field operations to the entire business process. Halliburton Project Management, as an example, has earned a reputation for workover efficiency in the Middle East, where clients have some of the world’s largest workover needs.

**With or without rigs**

In new wells and old, Halliburton can help you stimulate and complete wells, manage interventions and wellhead maintenance, install electric submersible pumps, reduce water cut, ensure well integrity, deepen wells, develop sidetracks and much more.

**SUCCESS STORY**

**IPM improves efficiencies, saves $500,000 USD per well**

To improve its drilling efficiency, reduce its nonproductive time and improve cost controls, a large Latin American IOO outsourced construction and completion of several wells. Halliburton used real-time operations to improve teamwork, new bits to increase meters drilled per hour, managed-pressure drilling to penetrate highly depleted formations, ultra-light cement to eliminate squeeze jobs, and specialized BHA systems to eliminate extra wiper trips. Halliburton also established benchmarks for efficiency, introduced new cost-tracking programs, thoroughly integrated all suppliers, and retained the same team throughout the campaign. Compared to wells that Halliburton previously drilled in the same area, Halliburton project management further reduced drilling and nonproductive time to 10 to 15% and total costs per well 5 to 10%. That saved the client an average of $500,000 USD per well.

**SAVED $500K PER WELL**

**SUCCESS STORY**

**Ready resources save IOO $10-$15 million on P&A project**

A large IOO was pulling out of a North African country, and needed to plug and abandon several wells. However, they didn’t have the expertise in-country to do the job themselves. Because Halliburton had all the necessary resources nearby, they hired us to do the job. Through thorough risk analysis, flawless execution, and ready access to a vast array of resources, Halliburton saved the client an estimated $10 to $15 million USD compared to what it would have cost them to mobilize resources and do the job themselves.

**SAVED $10-$15 MILLION**
Simultaneously minimizing cost and risk in an uncertain environment

Experience Halliburton P&A specialists can minimize potential liabilities and costs—even when there are many unknowns.

By the time most wells are ready to abandon, they could be 30 to 50 years old—or more. Often, clients lack information about how wells were constructed, i.e., what steel was used, where the cement is, or what fluids are in the annulus. Current conditions inside the well may also be unknown.

**Cost and risk without reward: The P&A dilemma**

These uncertainties increase financial and technical risk. They also make cost control difficult at a time when operations have no current economic value. Complicating matters: Plugging and Abandonment (P&A) regulations can vary dramatically from country to country.

Poorly plugged wells create potential conduits for fluids to migrate between formations, into fresh water aquifers or the environment. Poorly plugged wells can create potential conduits for fluids to migrate between formations, into fresh water aquifers or the environment. Poorly plugged wells can create potential conduits for fluids to migrate between formations, into fresh water aquifers or the environment.

**More experience than any other P&A team in the world**

Halliburton Project Management has successfully managed P&A projects around the world. As P&A activity increases, it’s important to make sure experienced people who can handle any contingency are handling your job in a way that meets or exceeds local regulations.

**A complete and innovative tool-box**

A group within Halliburton Project Management specializes in P&A and has developed a disciplined, three-pronged strategy for mitigating uncertainty, risk and unexpected costs. Halliburton develops an inventory of all possible risks, characterizes it qualitatively through a third—without pulling the inner strings.

Having ready access to Halliburton’s entire toolbox prepares us for any contingency. Plus, innovative new Halliburton materials and tools help increase plugging quality while mitigating risk. For instance, the Xaminer® Electromagnetic Casing Tool can quantify corrosion (both radially and longitudinally) through two concentric rings of tubulars and characterize it qualitatively through a third—without pulling the inner strings.

**Economical P&A service**

Constraining well failure and removing the potential for future liabilities caused by environmental damage and non-compliance with legislation.

**Constructing geothermal wells and gas storage facilities requires special skills. Halliburton has deep experience with both.**

**Biggest geothermal provider in world’s biggest geothermal market**

Halliburton has developed special techniques for drilling and completing wells in such formations. In Indonesia, which has 40% of the world’s geothermal reserves, Halliburton drills and completes more geothermal wells than any other service provider, and has more than 60% market share.

**Gas storage challenges**

Gas can be withdrawn from salt caverns faster than other types of storage. This makes them useful for unexpected demand surges. However, unlike depleted reservoirs (also used for gas storage), salt caverns must be constructed, completed and tested.

**Geothermal challenges**

Compared to oil and gas formations, geothermal formations are hot, hard, abrasive, highly fractured, under-pressured and boiling with corrosive fluids. These conditions make drilling and completing wells difficult. Stuck pipe is common. Lost circulation is frequent and severe. Bit life is short. Cementing is difficult. Gases such as carbon dioxide and hydrogen sulfide limit casing choices and increase safety risks. Casing corrosion and scaling create the need for frequent workovers. All of these factors increase costs and make expert project management paramount.

**Geothermal drilling performance advantage**

To power its economy with clean, sustainable energy, Indonesia has stepped up production of geothermal power. Today, the country could not meet its electricity needs without geothermal. Special drilling, cementing, completion and project management techniques that Halliburton developed enable us to drill more than 20 geothermal wells in Indonesia each year. Because Halliburton has learned how to radically reduce borehole instability issues such as stuck pipe incidents, Halliburton drills geothermal wells 20-40% faster than competitors. As a result of superior performance, Halliburton recently won a 34 geothermal well project—the largest in Indonesia, which is the largest geothermal market in the world.

**Sixteen well P&A project comes in 30% under budget**

A large IOC operating in the North Sea hired Halliburton to plug and abandon 16 wells. Many technical challenges were evident, including an instance of tubing collapse, making it impossible to pass a mechanical plug through the restricted zone. Working in close collaboration, Halliburton and the client decided to use innovative, new Halliburton plugging materials that could be pumped and spotted using coiled tubing. Innovative Halliburton logging tools were also able to show that the shale formation behind the casing had completely sealed off the annulus, saving the client a costly and technically challenging remedial cement job. As a result of innovation, preparation and close collaboration, the project came in 30% under budget.
Halliburton can help you improve production in the short term and ultimate recovery in the long term with new completion technologies and workflows.

Optimize field development and production in real time

Real-time production surveillance systems, SmartWell®, technologies, remotely operated chokes and valves, and intelligent workflows. These are the tools of the Digital Oilfield (DOF). They enable you to process the steady streams of information flowing into control centers and act on what you see before production suffers.

Visualize, analyze, monetize

A good example of how all these technologies can work together is in a large Middle Eastern oil field. To help visualize production for the operator, Halliburton installed:

- Multi-phase flow metering
- Water cut metering
- Liquid rate metering
- Surface choke settings, control, pressure
- ESP monitoring and Variable Speed Drives
- Gas-lift measurement and manifold control
- Water injection flow rate metering
- Smart wells
- Distributed temperature sensing
- Remote terminal units
- SCADA systems

State-of-the-art

To analyze the flow of data, Halliburton designed and built a state-of-the-art real-time center and installed automated workflows that:

- Monitor key production parameters
- Allocate production
- Provide production surveillance
- Analyze production losses
- Distribute reports
- Visualize and analyze the reservoir
- Optimize gas lift
- Optimize water sweeps
- Evaluate well and reservoir performance
- Monitor and diagnose pumps

New production workflows lead to 7% daily production increase

A typical day in the life of a production engineer working in the digital oilfield above begins with a review of each well’s production in the last 24 hours. Automated alarms in the real-time center have improved daily production in this field by more than 7% on a sustainable basis. A happy client calls this “the future of oil production.”

Getting the most from your field development plan

The ability to visualize and analyze issues, coupled with real-time controls, gives your production and reservoir engineers the ability to alter pump rates, gas injection, water flooding and more to optimize production and increase ultimate recovery.

In addition to providing raw production data in real time, the systems also help diagnose problems and suggest the most profitable courses of action.

Increased production from the field paid for the state-of-the-art real-time center in less than two years. The field is expected to produce for another 50 years.

Future-proofing the oilfield

When designing digital oil fields, Halliburton simulates different scenarios to predict what the most likely needs will be in the future. For instance, will surface systems suffice if you get better-than-expected production? Halliburton can then build flexibility and scalability into the field development plan to support likely scenarios.

Field development planning should also encompass the life-cycle of an asset. As an industry leader in SmartWell®, real-time and other oilfield technologies, Halliburton knows where technology is heading. Halliburton can help you develop field plans aligned with technologies which may not even be commercialized yet.

SUCCESS STORY

Reservoir workflows add another 6% to recoverable reserves

In the same digital oilfield (see story on left), reservoir engineers begin their days much like production engineers. However, reservoir engineers use other workflows that optimize the entire reservoir, not just individual wells. These workflows help them closely monitor water injection, and changes in the field’s production and reservoir pressure.

They enable engineers to quickly recommend changes in reservoir management to help improve sweep efficiency and overcome problems related to water channeling. The goal: identify “stranded” pockets of oil and develop strategies to mobilize this oil toward producing wells. Evidence to date indicates that automated reservoir management will add at least 6% to recoverable reserves. Higher production has already paid for the real-time center and workflow development in less than two years.

DOF Benefits:

- Better field development plan execution
- Flexibility and scalability for future
- Faster reaction time when production issues arise
- Improved staff productivity
- Real-time optimization
- Improved field economics
- Enhanced ultimate recovery

SUCCESS STORY

Enhanced ultimate recovery

Improvement in daily production

7% IMPROVEMENT IN DAILY PRODUCTION

Improvement in reserves

6% IMPROVEMENT IN RESERVES
Halliburton real-time technology does more than let people see what’s happening at a rig site; it’s an essential tool that enables performance improvement in virtually every aspect of oilfield operations.

Real-time optimization of oilfield operations
Halliburton real-time technology enhances data collection, communication, collaboration and control. As data flows in, our technology enables companies to simultaneously monitor, visualize, analyze and optimize most oilfield operations. This real-time capability can reduce the cost and improve the quality of field development planning, drilling, logging, sampling, cementing, completions, interventions, fracturing, production and more.

By integrating information in ways that would be difficult on site, you can make better decisions faster in every step of well construction or production supervision.

The right information at the right time
Halliburton makes sure that the right people get the right information at the right time in the right place and in the right format to make the best decisions possible.

For instance, when drilling, Halliburton can create a high-resolution picture of the area around the bit and update earth models in real time to help you stay in the sweet spot. When fracturing, Halliburton enables clients to monitor variables, such as pumping rates, pressure readings, and proppant volumes, in real time. Clients can also see frac planes propagate as each job progresses. This helps ensure that fracturing stays in the reservoir and away from water-producing zones. Clients can see the extent, direction and density of frac networks in 4D. Halliburton’s digital oilfield technologies (see page 20) enhance customers’ abilities to increase production and reduce operating expenses.

Customized for your needs
Halliburton can tailor your real-time experience to meet your exact needs and budget. Halliburton offers far more than simple remote connectivity. Halliburton offers:

- The ability to integrate and analyze wellsite data using software from Landmark, Spercy, Pinnacle and others
- Complete integrated workflows that help drill wells faster and more safely
- Knowledgeable consultants who can help you operate systems and interpret information on the fly

Tight integration with other Halliburton services
Compared to other companies that offer simple connectivity, Halliburton offers a wealth of oilfield experience with our real-time technology.

In deep water, that expertise can help prevent simple problems from turning into very costly problems. In high pressure and high temperature situations, Halliburton can help you stay safely in control.

In unconventional, Halliburton can drive down supervisory costs for factory-drilling operations.

New real-time center helps cut time and risk
A client with operations in the North Sea, North Africa and Middle East needed to monitor its operations around the clock. Halliburton connected their experts in the U.K. to drilling teams on all of their drilling rigs around the world.

Their real-time center incorporated numerous Halliburton predictive modeling and monitoring technologies, such as InSite®, Drillworks®, WELLPLAN™ and StressCheck, along with an on-site consulting team that helps predict and observe the onset of drilling problems. This helps the client intervene early and prevent escalation of any problems that might develop.

The center updates engineering and geomechanics models in real time based on data flowing in. It also rapidly reduces the response time of the team so it can offer better field support. The customer is now able to get reliable, 24/7 monitoring that ensures nothing gets overlooked. The center has saved time and money, and significantly reduced risk.
More than 4X increase in heavy oil production

A developing, extra-heavy oil field of a North American client was producing 30,000 BOPD. Individual wells averaged a baseline of 240 BOPD. The company asked Halliburton Consulting to evaluate different ways to improve production. After thorough examination, Halliburton recommended a pilot project that alternated steam injection (three to five cycles). Average production per well increased from 240 to 1,170 BOPD – a 387% increase. Thirty to 40 barrels of oil were recovered for each ton of steam injected. After obtaining these results, Halliburton created a field development plan that the client is now implementing.

100X production increase in complex reservoir

An Integrated Field Lab helped a North American operator increase production from a complex reservoir plagued by low recovery since its discovery. Issues included low permeability, poor porosity, poor continuity, and high temperatures and pressures. The average well produced only 40 BOPD and had a life span of just one year. Halliburton’s Integrated Field Lab led to a new conceptual design for development wells. In a field test, the first well initially produced 4,300 barrels of oil per day (BOPD) – 100X more than previous wells. Sustained production was 25X greater. The well produced 270,000 barrels in just seven months, paying for itself in that time. The operator extended Halliburton’s drilling contract and gave Halliburton six more rigs in less than a year.

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Benefits of Integrated Field Labs

Clients have used our Integrated Field Lab methodology to:
- Rapidly identify and verify optimal development plans
- Maximize production and recovery rates
- Shift the decline curve in mature fields
- Improve production from complex, unconventional reservoirs where previous drilling has not led to commercial success
- Evaluate numerous scenarios for well, completion and stimulation designs in the shortest time possible
- Improve access to reserves
- Increase recovery factors and replace production

ENABLING TECHNOLOGIES | INTEGRATED FIELD LABS

Finding and verifying the optimum plan in the least time and at the lowest cost

Halliburton Integrated Field Labs begin with detailed subsurface analysis and modeling. Field trials follow in a small, representative area to help identify the optimum combination of technologies, processes and strategies before full-scale development.

Ideal for low-producing and complex reservoirs

Integrated Field Labs reduce field development costs and risks by optimizing field strategy in a small area before rolling it out field wide. This approach to learning is ideal for:
- Low-producing conventional reservoirs
- Unconventional reservoirs
- Wherever production has not met expectations
- Fields with low recovery
- Fields that are candidates for secondary and tertiary recovery

Rapidly identify best approach and technology to optimize production

Integrated teams facilitate quick collaboration across disciplines. These teams use an iterative, scientific approach. They thoroughly review all existing data. Then they acquire new information, if needed, to fill gaps. After developing a hypothesis, they experiment, refine their plans, experiment more, compare results, and make final recommendations.

This approach rapidly identifies the optimum combination of technologies, processes and field management strategies for any given area – before spending hundreds of millions of dollars.

Typical applications include complex, mature and unconventional reservoirs, as well as secondary or tertiary developments. This methodology works almost anywhere except deep water. There, the economics of testing iterations simply become too expensive.

100X production increase in complex reservoir

An integrated field lab is not a first step; it is best used after collecting basic data. It can be especially beneficial prior to a large capital expenditure. It helps ensure that the least number of iterations are required to achieve the desired results. It also helps ensure that the best suite of tools for any given job is deployed.

Unique combination of expertise

As part of Halliburton, our consultants have deep experience with a uniquely broad range of tools and technologies. In a field lab, these consultants also work side by side with our project managers who have extensive client-side experience and the ability to ensure plans are implemented properly. Together our consulting and project management groups comprise one of the few teams in the industry with the expertise to manage entire fields.

SUCCESS STORY

More than 4X increase in heavy oil production

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Accurately predicting how formations will react to drilling, completions and stimulation is necessary to maximize safety and recovery while minimizing NPT. Halliburton Consulting provides experts with hundreds of years of combined experience in geomechanics.

Halliburton consultants build reliable geomechanical models that help you improve the drilling and completion of wells, the management of reservoirs, and ultimate recovery.

**Reducing Drilling Hazards and Costs**

The more challenging the environment, the more important accurate predictions become. Bad geomechanical assumptions cause almost half of the drilling-related nonproductive time in HP/HT and deepwater environments. Stress, rock strength and fault analyses influence well location, trajectories, stimulation design, and safety mitigation. Wellbore stability and pore pressure analysis determine the mud weights and fluid types needed to safely drill without kicks, stuck pipe, other costly delays and safety incidents.

**Completions that maximize recovery**

Geomechanics also affect completions. Understanding pore pressures, flow rates, rock strengths and weak zones helps planners manage sand production and place perforations to maximize oil or gas production. Knowing stresses, stress directions and mineralogy helps them understand how fractures will propagate so they can maximize reservoir drainage.

**Optimizing reservoirs**

Porosities and fractures affect well spacing and layout during field development planning. Later in the life of an oil or gas field, fluid depletion can induce compaction, cause subsidence, change permeability, and reactivate faults. Without proper planning and mitigation, these changes could cause casing collapse, choke off production, fracture cap rocks, affect the operation of surface facilities and strand large deposits of hydrocarbons.

**Geomechanics Benefits:**

- Produce higher quality wellsbores
- Improve drilling and operational safety
- Lower drilling costs by reducing nonproductive time
- Mitigate kicks and blowouts
- Evaluate pore pressure compartments
- Reduce uncertainty
- Determine whether a prospect is drillable before investing in it
- Optimize the trajectory of horizontal wells
- Evaluate factors impacting hydraulic fracturing
- Reduce sanding and intervention costs
- Extend reservoir life
- Maximize ultimate recovery

**Developing an oil and gas asset can be one of the most capital-intensive endeavors in modern business. Front-end loading reduces risk.**

The difficulty of modeling all components of a production system together throughout their lifecycle creates a major financial risk. To reduce this risk, traditionally companies have each technical domain within E&P departments evaluate assets sequentially from their own unique perspectives. This progressively narrows the number of scenarios that the next group can evaluate. The last group has much less input than the first. In practice, this artificially limits a field’s potential.

**Identifying optimal scenarios earlier and faster**

Halliburton uses a different methodology. It’s called Front-End Loading (FEL). Halliburton starts by gathering a multi-disciplinary team. Together, the members consider as many scenarios as possible up front – where strategic decisions have the greatest opportunity to affect a field’s profitability.

**Hundreds of alternatives considered in days or weeks**

Halliburton’s goal at this first stage: to understand all probable outcomes under conditions of uncertainty. Using Landmark’s Decision Management System, Halliburton then simulates each development scenario. Finally, Halliburton ranks outcomes to identify those that best meet your business goals. Traditional linear development considers a handful of scenarios in months or years. FEL can consider hundreds in days or weeks.

**Maximizing NPV, ROI or other key metrics**

The FEL system often uncovers scenarios that have higher potential than those developed by traditional methodologies. Time and again, FEL has proven its ability to maximize value.

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**SUCCESS STORY**

**Saving a casing string without a safety incident**

An independent operator drilling offshore Africa requested a pore pressure model for a complex geological environment. A multi-disciplinary consulting team constructed and calibrated a regional 3D geopressure model from offset well data and seismic interval velocity data. Real-time monitoring while drilling enabled continuous updating of the model. As a result of the study and real-time monitoring, the client drilled each well successfully in less than 10 days – without one drilling problem. The client was also able to safely eliminate a planned casing string, reducing costs by several million dollars.

**SUCCESS STORY**

**Gas-flooding scenario improves NPV by $6 billion**

A large North American operator asked Halliburton to utilize its FEL approach to optimize the production of a major asset. Halliburton identified 15 likely scenarios. Integrated production models with stochastic simulators produced probabilistic forecasts that took into account reservoir conditions, productivity of the wells and conditions at the surface. The greatest uncertainties of field development were related to the volume of original oil in place, and the prices of oil and gas. A gas-flooding scenario produced NPV $_P$ that was $6$ billion USD greater than the base case.

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**ENABLING TECHNOLOGIES | GEOMECHANICS**

Providing the insights needed to optimize drilling, completions and reservoirs

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**ENABLING TECHNOLOGIES | FRONT-END LOADING**

Improving asset valuation, development and decision making
What makes us different?

On the preceding pages, you have seen examples of what Halliburton does, how Halliburton does it and the results Halliburton achieves. But there are many good consulting and project management organizations in the world. They all have success stories.

What makes Halliburton better?
- Global support, global insights and global best practices
- Broader, deeper experience than smaller competitors
- A refreshingly collaborative experience compared to large competitors

Halliburton Consulting and Project Management listens, learns and delivers results that meet your needs. We also offer the resources of one of the world’s greatest oilfield service companies. Halliburton professionals can help you:
- Understand new technologies that alter production possibilities
- Understand development costs for reliable economic projections
- Deliver what we recommend
Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.