

Meeting the challenges of today's oil and gas exploration and production industry.

Leveraging innovative technology to improve production and lower costs



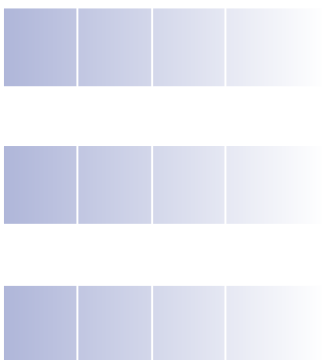
Executive Brief

Executive overview

The deep waters of the Gulf of Mexico, the frigid regions of Russia, and the hot, dusty, undeveloped deserts of the Middle East are merely the geographic challenges facing today's oil and gas exploration and production industry. But other challenges — just as serious and as threatening — face the industry as well. Global geopolitical forces are creating a highly volatile, rapidly fluctuating crude oil and gas market. Global competition for depleting resources continues to drive the need to lower operating costs and increase finding and recovery rates. The number of skilled resources continues to decline. Shareholders are pressuring companies for a return on their investments that is commensurate with other long-term investment strategies. And while advanced technology, such as 3D and 4D seismic downhole sensors, and bandwidth can provide vast amounts of near realtime information that can help companies be more successful in exploration and production, there is often too much complex information to assimilate and understand in the time needed to make quick, accurate decisions.

This convergence of forces, threats and technology is creating a perfect environment for the emergence of the intelligent oil field. New, innovative technologies can help companies remotely and automatically monitor wells and fields, and consequently take preventative measures to help avoid production downtime. The anticipated result is value creation in the billions of dollars each year through better finding and recovery rates, reduced lifting, production and overhead costs, and increased production.

The latest information technology (IT) innovation has made the intelligent oil field possible. Massive amounts of sensor data can now be stored and searched using advanced visualization technology — allowing data to remain at the source and avoiding transmissions of massive data stores. Complex data patterns can be detected automatically, such as for sanding or carbonite, so the right person can be alerted (or the designated individual can be alerted — and a response can be initiated before a production problem occurs. Visualization, modeling and analytics are making it easier for decision makers to understand the wealth of complex information, leading to improved reservoir management. The technology groundwork has been laid for the intelligent oil field to become a reality.



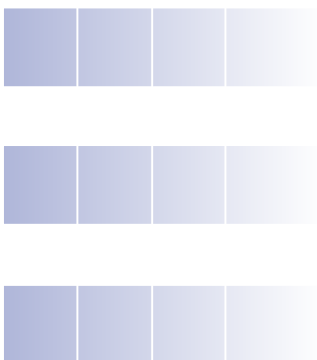
IBM solutions for intelligent oil fields are creating realtime global asset awareness by enabling proactive asset management. Early warnings and alerts, along with suggested treatments, are sent to the designated individuals through the detection of complex data patterns from sensors. Oil and gas companies can access the wealth of data generated from and pertaining to assets, such as realtime sensors and trend histories, which can help them make more informed, predictive decisions about their business. Wells and fields can be managed remotely, helping to save time and money, extend the leverage of skilled resources and increase recoverables. The anticipated result is that these companies can improve production and recovery rates with fewer people onsite and on-platform — all while significantly reducing risk and potentially lowering costs.

Key challenges facing the oil and gas industry

There may be no other industry today that demands a more diverse set of human, political, mechanical and technological capabilities than the oil and gas exploration and production industry. Competition for natural resources has driven companies to explore and produce in harsh, remote and even hostile locations, where even the simplest of logistical tasks can be difficult and costly. And, as the environment grows more diverse and unforgiving and the challenges more complex, skilled human resources are aging and growing scarce.

Intelligent surveillance, utilizing downhole sensors to monitor wells, is key to moving the industry forward. But to be effective, new processes, roles and responsibilities must be determined, and personnel must be trained. Today, many field workers operate independently in remote oil and gas fields. Centralized monitoring of wells will require oversight and procedural changes that may be difficult to institute.

Gathering and analyzing data quickly and effectively in a controlled laboratory environment can be difficult; in an environment such as the North Sea or Sub-Saharan Africa, this can be a monumental task. And while new technology has shown the promise of great things to come, integrating this innovative technology with existing systems, new tools and a global network of diverse business partners can be arduous. Much of the potentially useful data captured today is not typically stored, nor is it distributed to the people who can use it the most. Complex production problems — such as sanding, wherein solids, sand in particular, intrude and plug wells and adversely affect production — require an understanding of the issues and the tools to critically analyze data and determine historical patterns. Turning this data into useful, relevant information that will help make business-critical decisions is one of the main challenges the industry faces today.



On demand solutions to add value to the oil and gas industry

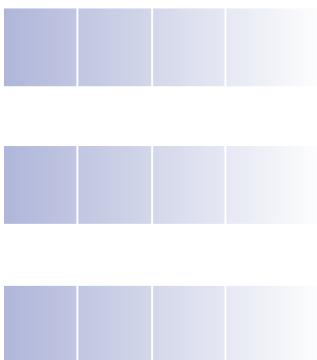
Recent studies in the oil and gas industry show that a significant increase in asset value can be attained by managing those assets on demand, in realtime. Today's on demand gas and oil companies have integrated their business processes end-to-end across the company and with key partners, distributors and suppliers. With an on demand business strategy, these companies are designed to have the ability to respond quickly to change, whether to customer demand, a market opportunity or an external threat. By optimizing their value net — their set of customers and vendors — these companies are reducing complexity and cutting operational costs. By increasing their flexibility, they are able to manage market volatility and unpredictability and to extract better value from the data they generate. They are optimizing their IT investments and tearing down silos within their infrastructures that are difficult and costly to manage. They have streamlined processes to improve employee productivity and increase efficiency.

On demand oil and gas businesses are gaining greater management oversight and bringing flexibility to staffing to help meet the personnel challenges of their industry. Realtime smart surveillance and early warning capabilities are enabling these businesses to support meaningful decisions and timely and accurate actions. Remote monitoring and management allow them to act more predictively to better manage the complex economic, political and environmental challenges of running an oil field today. Adopting an on demand business model is helping companies to more productively and profitably manage wells and fields worldwide from centralized locations, such as Houston or London.

Turning data into intelligence for improved asset productivity

The capabilities of recent monitoring technologies can cause a single field to generate more than a terabyte of data per day; an on demand approach to data access and analysis is required. From pump performance and fluid composition to temperature and pressure change, the data is complex and voluminous. Moving the data across unconnected, disparate architectures can slow interdepartmental communication. An on demand approach can deliver business value by enabling companies to turn that raw data into information that can be directed to the right person, in the right format, at the right time through remote visualization.

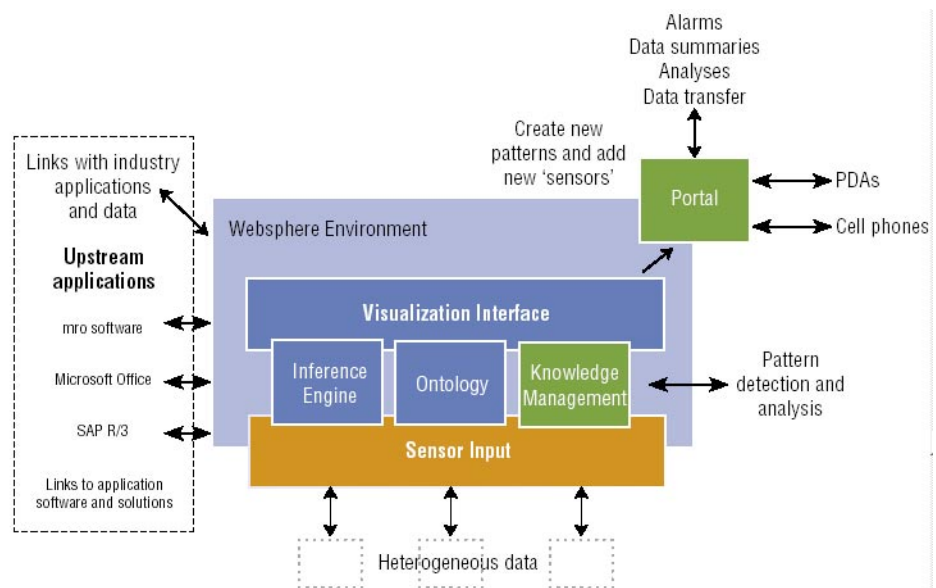
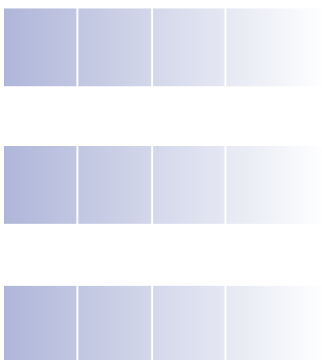
In the intelligent, on demand oil field, data is not just collected and stored. It's scrubbed, normalized and calibrated. Data remains at the source; meta-data is transmitted across the infrastructure. Information is fused and analyzed with multiple data streams around the clock, in near real time, helping enable companies to more accurately prevent costly occurrences such as pump failure. By analyzing their data against multiple historical references, on demand oil and gas companies can more



accurately predict future performance and proactively solve problems. Anomalous patterns are detected and sent to the appropriate person for investigation — and then reprogrammed to help improve future accuracy. Autonomic data analysis — analysis that is self-configured and self-adaptive — runs unaided, providing early warnings of critical issues, such as sand breakthrough, fluid composition changes or gas and water breakthrough. Spatiotemporal archiving — archiving that organizes data streams efficiently based on space, time, types of measurement and relationship to detection targets — provides critical historical information for data analysis. Anomalous and failure pattern archiving — archiving that stores manually annotated and automatically detected patterns — enriches the progressive learning and improvement of detection accuracy over time. Hierarchical analysis of the wealth of data generated by a field helps create a learning machine that enables analysts to more accurately predict occurrences and stage interventions based on the historical data that has been captured, analyzed and archived. Reservoir analysis can ultimately occur at any time based on the streams of data, meaning that analysts need not wait for major milestones. And finally, integration with existing internal and external systems, such as workflow and finance, provides an enterprisewide view of data that dramatically affects long-term strategic planning and performance.

IBM solutions for intelligent oil fields — a successful combination of technology and integration

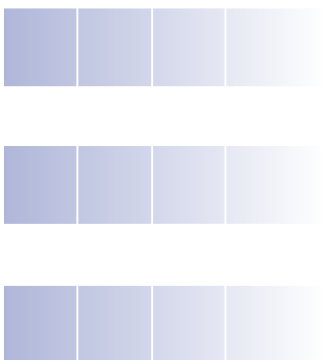
End-to-end technology and service capabilities — together with deep industry experience, world-class hardware and software and a global presence — make IBM highly qualified to deliver solutions that are designed to enable oil and gas companies to evaluate and execute drill programs to facilitate better reservoir management, optimize profits from producing assets and better leverage their existing workforce.



IBM solutions for intelligent oil fields include a federated early-warning system that is designed to provide near realtime data cleansing, calibration and normalization, pattern detection and ontology management. An ontology describes sensor data relationships for each well. IBM's solutions for the intelligent oil field effectively prepare and route incoming downhole data for analysis and event recognition based on ontological definitions. Innovative new data analysis tools mine the stream of data, creating new and adaptive algorithms to assess reservoir, production and operating performance. False positives are corrected to verify the accuracy of predictions. An open IBM technology architecture allows intelligent oil field solutions, including the algorithms, to be integrated with in-house and third-party applications to create a more unified, enterprisewide view of the information. A combination of innovative technology and integration services, IBM solutions for intelligent oil fields are built on a robust, scalable, open and security-rich IBM architecture that facilitates enterprisewide integration with existing systems and standard oil and gas industry applications. IBM solutions for intelligent oil fields are based on new and existing IBM technologies, including IBM WebSphere®, IBM DB2® information management and IBM Tivoli® software, and IBM SnoBase and IBM ABLE technology — many of which have been proven and deployed by IBM in various industries. Full support for both wired and wireless access means virtually anywhere, anytime access.

From the industry experts at IBM Business Consulting Services to the professionals at IBM Research, from world-class hardware solutions to industry-proven innovative software applications, IBM offers a comprehensive solution that is real today. With deep industry skills in the petroleum marketplace, IBM oil and gas industry experts — together with extensive independent software vendor (ISV) and IBM Business Partner networks — can help you develop a strategy and implement an infrastructure that can help improve data collection, install intelligent alarms, develop targeted work scheduling and implement knowledge sharing that promotes collaboration.

From onshore to deep-water oil, from shallow-water to onshore gas, IBM solutions for the intelligent oil field have the potential to dramatically improve net present value by enhancing the focus of reservoir and production engineers through cost-effective deployment of automated surveillance systems and issue detection and resolution systems. Better well management solutions from IBM can lead to improved hydrocarbon production. Oil recovery rates can dramatically improve through more effective reservoir management. And IBM predictive problem management solutions are designed to lower overall field operating and capital costs, enabling oil and gas companies to better achieve profitability in today's volatile global marketplace.





For more information

To learn more about IBM Business Consulting Services and IBM solutions for intelligent oil fields, contact your IBM sales representative or visit:

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