PetroChina Rolls Out Enterprise-Wide E&P Information Management Systems

Customer: PetroChina Company Limited
Location: China

OPERATOR’S CHALLENGE – Create an integrated E&P technical data management system to support multi-domain workflows. Develop a standard oil/gas/water production volume management system to enable transparent daily access to data across the enterprise.

HALLIBURTON’S SOLUTION – Contracted with Landmark Information Management & Infrastructure (IM&I) consultants to design, build and rollout two new enterprise-wide information management systems at 14 sites throughout China.

ECONOMIC VALUE CREATED – Improved data quality, reduced data gathering cycle time by 50 percent, enabled knowledge retention, standardized oilfield performance indicators across the corporation, enhanced decision-making, and lowered IT costs.

PetroChina Company Limited (PetroChina) is the largest oil and gas producer in both China and Asia, as well as one of the largest energy companies in the world. Formed in 1999 as part of the restructuring of state-owned China National Petroleum Corporation, PetroChina successfully went public in 2000. In November 2007, PetroChina’s listing on the Shanghai Stock Exchange tripled its market value, making it the world’s largest corporation at that time.

From the beginning, PetroChina has been committed to becoming a strong, highly competitive international energy company. To support its vision, the company developed a comprehensive information technology (IT) blueprint aimed at centralizing, standardizing and integrating mission-critical IT systems. PetroChina made an enormous investment in approximately 50 IT initiatives, seven of which were in the upstream sector. Two of the most important upstream initiatives included the A1 Project: creation of an E&P technical data management system to support integrated multi-domain workflows from seismic through simulation; and the A2 Project: development of a centralized oil/gas/water production volume management system to enable transparent access to daily production data across the enterprise.

PetroChina planned to pilot new systems first at the giant...
Daqing Oilfield, then roll them out to its 13 other oilfield subsidiaries throughout China as well as corporate headquarters in Beijing.

“No IT project of such a large scale had ever been conducted at PetroChina before,” said Tian Feng, IT Director for Daqing Oilfield, whose department supervised the pilot projects. “The scale was unprecedented in terms of people’s expectations, levels of the corporation involved, range of users affected, number of consultants engaged, and volumes of data processed.”

**INFORMATION MANAGEMENT CHALLENGES**

PetroChina’s 14 oilfield subsidiaries are made up of numerous affiliated oil production companies (OPCs), which had implemented diverse data management systems over time, based on their special needs. While decentralized management supported the unique requirements of individual technical domains, the lack of an integrated E&P data management platform created various obstacles to E&P research projects.

“In the past, seismic, logging, drilling and other well data were scattered in different places,” explained Tian. “It was quite difficult for our research teams to gather all these data for a particular project. According to our Chief Geologist, it typically required about 120 days to collect data for a project in a large oil field. Often, data quality was not very good, and teams could not be certain they had the most current information. After finishing a project, team members usually stored data on their personal computers. If they were transferred or left the company, those results might completely disappear.” These were some of the issues the A1 project intended to resolve.

The A2 project, on the other hand, focused on standardizing and integrating oil/gas/water production volume data management for all of PetroChina’s fields. “Eight years before, PetroChina implemented a system to capture, manage and report daily production information,” said Tian. “But once the system was rolled out, each OPC carried out its own customization work. Each produced different kinds of hydrocarbons from different formations, and calculated key indices based on different business rules. So there was no way for headquarters to compare performance data equally across all of the OPCs. Because the company invests in different oilfields based on performance, it was critical to find a way to evaluate them all based on the same criteria.”

In addition, because daily reports were delivered to each level of the production department both on paper and in electronic tables, PetroChina’s senior management typically saw reports rolled up...
weekly or monthly. They could not easily monitor daily performance. “Unless there was some kind of problem, headquarters would not ask for daily reports. It would have been too much paper,” Tian emphasized. “So what they wanted was a centralized data management system with standard rules that could deliver daily production information on time.”

IMPLEMENTING APPROPRIATE SOLUTIONS

Landmark won the multi-year, multi-million dollar contract based on its expertise in delivering state-of-the-art information management solutions to energy companies worldwide, and its willingness to provide PetroChina with global support. “In addition to demonstrating a very strong technical and financial background,” recalled Tian, “Landmark was the only one of the two main E&P vendors whose overseas headquarters promised to commit whatever resources were needed to achieve our goals.”

According to Frank Zhong, Landmark’s Country Manager for China, about 30 consultants were involved in the initial consulting phase for the two projects. “During that phase,” he noted, “we performed a detailed outside assessment of the current state of PetroChina’s E&P information management infrastructure—looking at data types, legacy data management systems, and applications. We mapped out 61 workflows in terms of input data, tasks and processes, software, data models, naming conventions, business rules, and output data. For the first time, PetroChina had an exact picture of how the different oilfields were handling data from an IT system perspective.”

During the design phase, consultants faced a significant challenge in balancing the corporate need for enterprise-wide standardization with each OPC’s desire for local customization. Based on meetings, interviews and onsite investigations, Landmark and PetroChina—supervised by a Program Governance Board with managers from every level of the corporation—eventually agreed on appropriate A1 and A2 system designs.

“The A1 technical data management system is basically a three-tiered architecture, supporting two key data flows,” said Zhong. “First, it brings data from a wide range of domain data sources into a standard master database, which, in turn, feeds the project data environment that supports research applications. Second, it enables integrated data flows from seismic and well log interpretation through earth modeling, simulation and economic analysis.”

The application layer, he explained, is based on Landmark’s OpenWorks® project data management system, with a newly developed data converter for connectivity and sharing among Landmark and other vendors’ applications, as well as PetroChina’s proprietary software.

The A1 master database consists of three physical databases integrated via enterprise middleware and viewed through a common, Web-based GIS application. “From a user’s perspective,” Zhong added, “these three databases act like one multi-domain database.” Landmark’s PetroBank™ Master Data Store™ software manages the seismic and well log data. A customized extension of Landmark’s Engineer’s Data Model™ (EDM™) application, known as PetroChina EDM (PCEDM), manages all structured wellbore data. And a customized extension of Landmark’s Corporate Data Store™ software, called Archived Objects, manages all the interpreted results. Landmark’s PowerHub™ middleware integrates the databases, and PowerExplorer® software provides a combined GIS map view of both surface and subsurface features.

The A2 system is also a three-tiered architecture: data entry, master database, and application platform. Oil and gas well data, meter data, pressure, temperature, operations, workover and other field data are entered into a new Web-based system co-developed by Landmark and PetroChina, and launched through Landmark’s Team Workspace® E&P portal software. The system meets the needs of literally thousands of users who enter data. The A2 master database consists of a single physical database—PCEDM—deployed as a centralized and integrated solution for 14 oilfields. Finally, the application layer incorporates tools for data query, reports, key

Joint team of Landmark consultants and PetroChina technical specialists testing the A2 system at Daqing Oilfield.
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performance indicator monitoring, charting and visualization—including a new management dashboard.

“Through the A2 project,” said Zhong, “PetroChina established standard business rules and procedures for oil/gas/water production data management that every oilfield must comply with. The centralized database and Web applications allow users and managers anywhere in the organization to access the system conveniently from their desktop, as long as they have a connection to the intranet.”

The A1 pilot project at Daqing Oilfield was finished in October 2006 and the A2 in August 2007, at which time rollout began to PetroChina’s other oilfields. During implementation, as many as 200 consultants worked onsite, including Landmark personnel from Asia, Europe and the United States. Enterprise-wide rollout wrapped up in late 2008.

Digital seismic, well log and borehole data were cleaned up, remastered, and run through rigorous auditing and quality control prior to loading. All told, about 56 terabytes of high quality data were loaded into the new systems, including data for nearly 70,000 wells.

ACHIEVING SIGNIFICANT RESULTS – Key benefits
PetroChina has achieved from its new integrated information management solutions include data quality improvement, research cycle time reduction, knowledge retention, enterprise-wide access to vital information, enhanced decision-making, and lower IT costs.

“With the A1 master database, our project research teams can use information easily now, without worrying about data quality or wondering if anything is missing,” said Tian Feng. “With an integrated system, they can conduct better, faster decision-making processes throughout the workflow from exploration to production. Another objective we achieved is information sharing. We now have a mechanism for uploading results back to the system so they are available to the next team. This has led to greater sharing of research results.”

Data gathering for a project in a large oil field, he added, has been reduced from an average of four months to two months or less—a 50 percent improvement in cycle time.

Standardized field data collection, business rules and production reporting via the new Web-based A2 system is providing managers and decision-makers throughout the organization with timely access to accurate information. For the first time, senior management ranging from PetroChina’s headquarters to various departments can view key performance indicators across the enterprise. They can drill down from a selected oilfield to view a particular OPC, a production station, or any one of just under 200,000 individual wells—all from their own desktop.

“Only through this system can management gather the data they need from each subsidiary on time—daily,” Tian observed. “By establishing a unified data model and rolling out this system to all OPCs, now we can calculate their performance using the same rules. As a result, management can properly evaluate and compare OPCs, and better allocate budget and resources based on performance.”

In the past, he added, every oilfield’s IT department had to maintain separate servers for each OPC’s custom data management solution. Having a single, centralized platform for all operating companies reduces certain expenditures and improves efficiency. “Each year,” he concluded, “we also save a significant amount of money on server hardware, software and maintenance costs.”