Landmark/Client Team Prepares Integrated Conceptual Development Plan in Eight Weeks
Customer: Offshore Division, National Oil Company

**CHALLENGE** – Perform a thorough review of an existing field development plan for two offshore gas fields in two months. Provide documentation necessary to obtain exploitation permits and accelerate time to first production.

**SOLUTION** – Operator teamed with Landmark’s Consulting and Services group to conduct a detailed Front-End Loading (FEL) study using an integrated Landmark suite including Decision Management System™ (DMS™), Nexus®, and FieldPlan® software.

**RESULTS** – Completed project on schedule. Obtained required permits. Improved collaboration among departments. Optimized well locations could save $80 million in drilling costs, while boosting production by 30 percent.

During 2007, when the newly organized offshore division of a national oil company faced an urgent and unmovable deadline, the company turned to Landmark’s Consulting and Services group for help. Management was familiar with Landmark’s unique technological capabilities and proven expertise using Front-End Loading (FEL) methods for rapid field development planning.

Front-End Loading is a formal three-step methodology for capital project planning that improves project definition up front and increases the probability of business success by avoiding uneconomic investments and forestalling costly changes during project execution.

The team identified more than 200 potential well locations based on reservoir quality. Using dynamic modeling of the reservoirs, surface facilities and economics, it identified 16 optimum locations.

In just eight weeks, a joint Landmark/client team thoroughly reviewed all viable exploitation scenarios for two strategically important offshore gas fields and presented a fully integrated conceptual development plan that met all project objectives. Management was so impressed with the people, processes, and tools, it decided to license the full suite of Landmark technologies used in the study, and Landmark consultants will soon participate in planning for two other gas fields in the area.

**THE RIGHT PEOPLE, PROCESS, AND TECHNOLOGY** – Approximately five years ago, an initial development plan for the asset was created. However, because of significant changes in partner relationships and the operator’s internal organization, much of the original documentation was no longer available. What remained was
a single Most Likely scenario, but little remained of the rationale behind it or any alternative scenarios that had been evaluated.

In response to evolving market conditions and geopolitical pressures, the government recently set aggressive new gas production goals. Suddenly, it became urgent to accelerate exploitation activity in these fields. To obtain drilling and environmental permits quickly and to make well-informed decisions while meeting a number of inflexible constraints, the operator needed to fast-track a thorough review of the original development plan with a focus on generating economically viable alternatives that could ensure first production by 2010. Other objectives included efficiently recovering 70 percent of the original gas in place in 20 years without environmental impact, while addressing social development issues in the region.

Due to the complexity and urgency of the challenge, the division’s new management decided to approach Landmark. “They felt a rapid FEL study would facilitate their thinking process, allow them to generate more valuable scenarios, and support decisions they needed to make in a short period of time,” said Alessandro Ungredda, senior managing consultant, Production, Landmark. “They knew we had a lot of experience with FEL studies, and there was really no time to train their personnel. So we formed a multidisciplinary team, giving each Landmark specialist a ‘mirror’ in the operator’s organization.”

A vital component of the FEL methodology involves pulling together all the domain experts to brainstorm input parameters for integrated modeling and planning decisions at the very earliest stage. In this case, the integrated approach improved collaboration among the operator’s departments, many of which had not worked together like this before. “When you put a diverse mix of people in one room, interesting things happen,” observed Ungredda. “Different perspectives and levels of experience are extremely important and enrich the discussion.”

Luigi Saputelli, Landmark’s global practice manager, Field Development and Asset Decision Solutions, who acted as advisor to the project, said a FEL conceptualization study like this normally takes up to six months. “In this case, we had just two months,” he noted. “So, we rapidly sourced up to 14 consultants from around the world and applied the full breadth of Landmark’s integrated technology, which enabled us to speed up the entire process.” Often, he added, consultants have to cobble together tools which the client already uses from many vendors. However, to save time and to streamline workflows, it made more sense to utilize a suite of state-of-the-art technologies already tightly integrated. In addition to AssetView™ software and other DecisionSpace® applications, three critical tools the team relied on were DMS™, Nexus®, and FieldPlan® software.

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The DMS system is an open, adaptable framework for uncertainty analysis and decision optimization. Nexus software technology is Landmark’s next-generation simulator, which seamlessly integrates reservoir and surface-facility modeling. FieldPlan software is a unique offshore facility evaluation, scheduling, and costing solution, which models everything from wells and subsea systems to production platforms and export systems.
Overview of Front-End Loading (FEL) methodology. Due to fast-track implementation, certain pre-FEL tasks took place in parallel with FEL Visualization and some elements of FEL Conceptualization.

**FAST-TRACK FEL IMPLEMENTATION** – Initial brainstorming and parameter analysis took place in a dedicated collaboration room equipped with access to the necessary technologies. Due to fast-track project implementation, certain pre-FEL tasks were undertaken simultaneously with FEL Visualization tasks, as well as with some elements of FEL Conceptualization. The team met twice daily to ensure everyone stayed in sync and held frequent reviews with the company’s high-level decision makers.

Using DMS software and analytic reserve models with existing deterministic data, the team established a workflow to calculate original gas in place and reserves using stochastic simulation. Team members generated probabilistic distribution curves for each reservoir and total distribution curves for both fields. Linking DMS and Nexus software technologies, they validated gas in place and reserves, and estimated the impact on gas recovery of key reservoir uncertainties, including porosity, permeability, the extent of sand bodies, gas-water contacts, and net pay.

Team members built an integrated asset model using Nexus software, enabling them to run dynamic simulations of the reservoir, wells, and surface facilities all in a single system. “This is one of Landmark’s key technological differentiators,” Saputelli said. “Other systems connect separate pieces of software to couple the surface with subsurface, so simulation runs take longer. We imported the existing numeric reservoir model into the Nexus system, added new well trajectories and the surface pipeline network, and still reduced run times from an hour and a half to mere minutes—almost 10 times faster. As a result, we could make several hundred runs per day to find the optimal solution.”

Using an integrated workflow of DMS, Nexus, and Microsoft® Excel® software, the team identified more than 200 possible well locations based on reservoir quality, with multiple well architectures, completion zones, and surface locations. Next, the team optimized target selection based on the dynamic response of the integrated system—reservoirs, surface facilities, and economics. As a result, 16 final well locations for the 2 offshore gas fields were selected as the optimum reservoir exploitation strategy.

Based on extensive group discussions of decision and uncertainty variables, the team used FieldPlan software and the DMS system to visualize more than 100,000 potential field development scenarios. “In the traditional planning process, you come up with Best, Worst, and Most Likely scenarios,” Ungredda noted. “But you don’t really know what’s best or what’s worst, because you haven’t scanned all the opportunities. With the appropriate technology, you can assign economic value, risk, and uncertainties to each of your main parameters and let the system do the number crunching on thousands of different possibilities. Only then can you understand whether Scenario 1 is technically or economically better than Scenario 2,000.

“This process is very helpful,” he continued, “because you tend not to eliminate ideas prematurely, and you evaluate a much broader range of options.” The team paid special attention to generating realistic alternatives to the original drilling program, logistics, subsea installations, and surface facilities, while accelerating time to first production. Those alternatives established important fallback scenarios that could assure effective development despite tight market conditions for offshore equipment and services.

**BENEFITS AND RESULTS ACHIEVED** – The joint Landmark/client team successfully met the operator’s demanding project deadline. At the end of the eight-week study, the team gave a high-impact presentation of the integrated conceptual exploitation plan to the Energy Ministry, including a live 3D rendering of the entire asset. As a result, the company received the necessary regulatory permits to commence operations. Development drilling, which began in Spring 2008, will continue for two years. First production is expected in 2010, on schedule.

“This project was of particular significance to Landmark,” said John Smyth, Business Development, Landmark Consulting.
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and Project Management, “because it was our first offshore field development plan to go directly to execution. The level of Landmark’s commitment and the integration of all the disciplines were unprecedented, as was the use of our latest technologies and processes for field development planning optimization.”

Many of the original study’s decisions proved to be sound, while others had to be revised in light of major changes that took place over the past five years, including technological advancements. For example, all but one of the original well locations were modified, based on the FEL study. “With the optimized well locations, we showed that they could drain multiple compartments more effectively with one or two fewer wells than the previous plan,” Saputelli explained. “And each well in this area costs $80 to $100 million,” a substantial savings.

The integrated plan also demonstrated that gas production could be higher for the first five to eight years than previously thought. “We found we could comfortably boost early production at least 30 percent with better recovery of reserves, while delaying water production several years, all for the same level of investment,” Ungredda added.

Finally, the FEL study provided the operator with a more realistic understanding of the economic value of the project, the associated infrastructure, and all potential markets, local and international, for the gas. It also provided a plan of action for mitigating appropriate technical risks within the project’s scope identified during uncertainty analysis and asset modeling.

Intangible benefits of the project included better communication and decision-making among previously disparate departments, an accelerated learning curve in the adoption of FEL methodology, and technology transfer related to critical Landmark technologies. “In a year’s time, if market conditions, risks, uncertainties, or anything else change significantly,” Ungredda concluded, “they will have the knowledge and technical capabilities to revisit the process and validate or update the plan in just a few weeks’ time.”

Editor’s Note: Due to competitive and proprietary aspects of this project, the name of the operator, the geographic location of the asset, and other identifying information have been withheld. For more about Landmark’s approach to integrated field studies using FEL, see SPE 111250: “How Integrated Field Studies Help Asset Teams Make Optimal Field Development Decisions,” L. Saputelli, et al., 2008.