

# **Agile and Iterative Workflows for Swift Development Planning: Transforming Oil Field Development in Central Oman**

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## **Abstract**

In late 2021, a single-well field discovery in Central Oman was handed over from the Exploration Department to the Asset Team.

This structure features a low-relief 4-way dip closure, including elements of stratigraphic closure along its southern edge. Hydrocarbons are hosted in the fluvio-deltaic Permian Upper and Middle Gharif reservoirs.

In line with the agile development approach for early monetisation of the discovery, it was important to design a workflow to not only adequately evaluate the potential range of uncertainties but also to effectively communicate the impact of those uncertainties on development concepts, urban planning, and surface facility design, in one cohesive analysis and visualisation system.

The workflow allows the generation of hundreds of deterministic subsurface models by sampling probabilistic distributions of key uncertainties. Consequently, it enables testing numerous alternative configurations and parameter spaces over a series of Agile sprints. An automated quality assurance mechanism was built into the workflow to ensure that every alternative subsurface configuration conforms with the observed well data.

This facilitated a thorough assessment of appraisal well locations. Consequently, when two flank appraisal wells were drilled in mid-2022, the workflow allowed for quick incorporation of the new information, integrating lateral shale out observation in appraisal wells with velocity and thickness-driven structural closure scenarios, validated by fluid level information from wells.

The project used foresight to initiate early urban planning and designed a general blueprint of potential surface locations for future wells. Each of the hundreds of subsurface scenarios automatically computed possible effective oil column outcomes for each location on the blueprint. This process produced a vast amount of data, necessitating extensive cleanup, analysis, and effective visualisation, to enable answering development questions such as well count and distribution, development phasing, and strategies.

Advancing beyond traditional subsurface software suites, the workflow incorporated custom Python code blocks to automate data splicing and volumetric ranking. The interactive data dashboard increased the effectiveness of peer reviews and stakeholder communication. Many alternative development concepts and well-pattern configurations were tested quickly. A crucial feature of the workflow is its ability to virtually eliminate most of the manual data entry and output processing, enabling a sharp focus on the impact of the long chain of parameters

on the outcomes, reducing the time between receiving a development concept question and having an answer, to minutes and seconds rather than days and hours.

The resulting base case hydrocarbon in-place volumes estimates doubled from the initial discovery note estimate and was polarized towards the initial high case estimate.

First oil from the pool proposed by the field development plan was achieved in Q4 2023, mere months following the project's final investment decision.

By the close of 2023, five additional wells were drilled and completed as oil producers, with all the wells encountering hydrocarbon-bearing reservoirs within less than 10m from the base case depth prognosis. This more than doubled the field's output from the discovery well and the two appraisal wells, just two years post- discovery.