PROJECT REVIEW
JACK-ST MALO

Chevron has plans to make the boundary-pushing Jack-St Malo development in the US Gulf a Walker Ridge hub and a proving ground for enhanced recovery in the notoriously difficult Lower Tertiary. Jennifer Pallanich gets the details.

Discovered over a decade ago, the Jack and St Malo fields lie 40 kilometres apart in the Gulf of Mexico’s emerging Lower Tertiary Wilcox trend, in water depths of 7000 feet. After briefly considering developing the fields separately, operator Chevron opted for a joint development using a single deep-draft production semisubmersible in Walker Ridge Block 718 as an anchor platform that could support a number of tiebacks in area.

The Lower Tertiary Wilcox trend poses some significant development challenges, such as high pressures and longer intervals. Reservoirs lie below a layer of salt, and are frequently extensive and stretch across many blocks, making them hard to develop from a single location, says Billy Varnado, Jack-St Malo project leader.

The fact there are few or no Wilcox trend field analogues means Chevron has no “go-bys” for how the Jack-St Malo fields will produce, he says. As a result, the operator chose to develop the project in stages. Stage one is largely complete, with the infrastructure in place and the initial wells drilled and completed, although some drilling and completion work will continue throughout the rest of the year.

Stage one will have 10 producing wells, with four at Jack and six at St Malo. As of early March, four wells were onstream, with production averaging over 50,000 barrels per day, and Transocean’s Discoverer Clear Leader was drilling the seventh well.

Stage two, which will consider
the possibility of injection wells, is in the front-end engineering and design stage now. As production information becomes available and Chevron can better evaluate the reservoir, the company will consider the possibility of future development beyond stage two.

“We’re also looking at lower recovery factors relative to the Miocene. That makes these much more challenging to develop. There’s a lot of oil in place” — an estimated 500 million recoverable barrels of oil equivalent — “but we’re not getting as much of it. That is something that Chevron is looking at, how to improve the overall recovery,” Varnado says.

And so Jack-St Malo is a complex project covering multiple fields, two sets of partners, high pressures, deep wells and few or no analogue fields. Moving from discovery to first oil on this $7.5 billion project took 11 years and some significant technology advances.

“What we’re running in the wells is beyond what we’ve used before,” Varnado says. “It seems like every time we have a project, we’re either adding new technology or advancing technology beyond where it’s been before.”

Chevron attributes completion technology advancements to saving an estimated $28 million and 25 days per completion on the 10 wells in stage one. In long intervals, historically it has...
been necessary to make several trips to pack the well. At 27,000 feet below sea level and with a $1-million-per-day rig cost “it’s very expensive,” Varnado says.

The open-hole and cased-hole multizone completion systems developed and provided by Halliburton allowed Chevron to frac pack zones totalling over 1400 feet of reservoir in a single trip. The longest system, carried out in 2013, was 1492 feet spanning six zones, with the bottom at 28,500 feet.

The enhanced single-trip multizone system is intended primarily to segment long intervals and perform multiple stimulation treatments, while the individual frac pack itself remains essentially the same.

“It’s definitely an improvement in our economics and improves our schedule,” he says.

Seismic technology has made several leaps since the Jack-St Malo fields were discovered in 2004 and 2003, respectively.

“Because these fields are below the salt, it’s very difficult to image the reservoir. It makes it harder to see where faults are located, and compartmentalisation of a reservoir is something we want to know about so we don’t drill an expensive well in to small compartment.”

Ocean bottom nodes, or recorders, are placed by remotely operated vehicles on the seafloor to provide better imagery of the subsurface. The nodes collect seismic data that provide reservoir information up to 30,000 feet below the seabed. The information helps guide well-placement decisions. Nodes can be returned to the same location to carry out follow-up 4D time lapse surveys that show how the reservoir performs over time.

When the technology was extended to water depths up to 7000 feet and battery life was improved, Chevron evaluated it and decided to have seismic shot as soon as possible. The company hired Seabed Geosolutions to deploy the technology globally, including at Jack-St Malo, and CGG to process the data.

In late 2013, Chevron started deploying the nodes in the Jack-St Malo fields. The ocean bottom nodes will provide information for a few wells in stage one, but will be used more widely in stage two and further developments.

“Ocean bottom node benefits are known in theory,” Varnado says. “It appears to give us a better image than before, so we’re optimistic this will benefit us in characterising the field and going forward with our programmes.”

Sanctioned in October 2010, the Jack-St Malo project is massive. The 53,100-metric ton deep draft semi is the largest floating production unit (FPU) installed to date in the Gulf of Mexico in terms of displacement, at more than 146,000 tons, more than the displacement of the world’s largest aircraft carrier. BP’s Thunder Horse semi is heavier and covers a larger footprint, but the payload for the Jack-St Malo facility is higher.

“Something that size, it would struggle to fit in any drydock,” Varnado says. “As you get bigger and bigger, you’ve got to have the infrastructure to build these things.”

Samsung Heavy Industries had to upsize one of the floating drydocks at the Geoje, South Korea, yard just to build the semi’s hull, which was designed to minimise
PUMP TESTING: Jack-St Malo pump stations in the test pit at OneSubsea’s facility in Horsoy, Norway, and (right) the single-phase pump during technical qualification.

vessel motion. KBR subsidiaries Granherne and GVA Consultants collaborated on the engineering of the deep-draft semi, which measures 105 metres by 105 metres with a draft of 41.5 metres.

The heavy-lift transport ship Dockwise Vanguard carried the hull in 2013 from South Korea to the Kiewit Offshore Services yard in Ingleside, Texas, where the topsides modules were built, fitted and integrated. Wood Group Mustang designed the topsides, which weighs 19,000 tons and comprises three main modules, for production, generation and compression.

Chevron had the Jack-St Malo host designed with the expectation of future development for the original fields as well as tiebacks from neighbouring fields. The production semi can accommodate 43 risers.

“It’s large because it can handle all those tiebacks,” Varnado says.

The first tieback will come in the form of the ExxonMobil-operated Julia field (Upstream Technology, July 2014) 23 kilometres away, with first oil scheduled for 2016.

Frame, now owned by OneSubsea, delivered the single-phase subsea boosting system, which Varnado says is the largest...
In the industry to date, due to the combination of depth, pressure and power requirements. The system comprises three pump stations, three subsea pump control modules, three transformer modules, topsides equipment and tooling. The 3-megawatt single-phase pumps are rated for 13,000 psi design pressure and installed water depth of 7000 feet.

“We started looking at seafloor boosting in 2008. We didn’t sanction the project until near the end of 2013, and we didn’t have it available to us to install until 2014. It took a long time to qualify and design it,” Varnado says.

“It’s higher pressure than we’ve had before, higher power than we’ve had before. All these components had to be qualified.”

The subsea boosting system, while not used for initial production, will be put in service as natural reservoir pressures decline, he says.

“These [pumps] are installed and ready to go, but we’ll use them when our producing business unit decides they’re ready to fire them up.”

The boosting system is set up initially to handle the single-phase state when gas volume fractions are very low. For stage two of the field’s development, Chevron is considering multi-phase pumping capability installed in series with the current boosting system to allow for maximized recovery of the field.

The Amberjack Pipeline Company, a joint venture between Chevron and Shell, installed the 219-kilometre, 24-inch diameter crude oil pipeline from the Jack-St Malo hub to a platform in Green Canyon Block 19 owned and operated by Shell. Saipem’s pipelay vessel Castorone installed the export pipeline, the first large-diameter, ultra-deepwater pipeline in the Walker Ridge area of the Lower Tertiary trend.

Chevron views the Jack-St Malo oil export pipeline as the energy equivalent of the US Interstate Highway System, which eased trade among states and spurred economic growth in the 1950s. While providing a reliable, long-term export solution for Jack-St Malo, Chevron says the pipeline will accommodate third-party use, creating an economic solution for deepwater oil transportation and reducing the industry’s seafloor footprint.

Technip welded over 85 kilometres of 10½-inch outside diameter flowlines and steel catenary risers at its spoolbase in Mobile, Alabama. The pipelay vessel Deep Blue carried out the installation of the flowlines and risers in 2013, along with pipeline end terminations, manifolds, pump stations and tie-in skids.

OneSubsea supplied subsea production systems for the first stage of the development, including a dozen 15,000 psi horizontal subsea trees, production control systems, four manifolds and associated connection systems, and engineering and project management services. The equipment was delivered between 2011 and 2013 at a cost of around $230 million.

Aker Solutions supplied three subsea production control umbilicals, which provide hydraulic, electrical and fibre optic service. The company also manufactured 85 kilometres of electro-hydraulic steel tube production umbilicals at its facility in Mobile.

McDermott’s subsea construction vessel North Ocean 102 transported and installed the three control umbilicals, two power umbilicals and other related subsea structures. McDermott also fabricated 21 high-specification rigid flowlines, manifold and pump jumpers and installed the structures using the Derrick Barge 50. The Barge also installed more than 80 flying leads, five additional rigid production well jumpers, and other subsea control and production boost components, including three pump stations weighing 209 tons each.

Transocean’s Discoverer Spirit drilled the St Malo discovery well in 2003, striking net pay of 1400 feet. The field lies in Walker Ridge Block 678. The Jack discovery well, drilled the following year by Transocean drillship Discoverer Deep Sea in Walker Ridge Block 759, encountered over 350 feet of net pay. Chevron has used several Transocean drillships, including the Discoverer Clear Leader and Discoverer Inspiration, to carry out drilling and completion activity on the two fields.

Chevron sanctioned the project in 2010 and achieved first production, on time and within budget, in December 2014. The facility itself has a production capacity of 170,000 barrels of oil and 42 million cubic feet of natural gas per day, with the potential for future expansion. Output from stage one development is expected to ramp up over the next several years to a total daily rate of 94,000 barrels of crude oil and 21 million cubic feet of natural gas. Jack-St Malo is expected to add 43,000 barrels of oil equivalent per day net to Chevron in 2017, increasing to 50,000 boe at peak production.

Chevron has set a worldwide production target of 3.1 million barrels per day by 2017. Successive development phases employing enhanced recovery technologies could enable substantially increased recovery at the Jack and St Malo fields, which are thought to hold over 500 million barrels of recoverable oil equivalent. Chevron expects a production life exceeding 40 years for the facility located about 280 miles (450 kilometres) south of New Orleans.

“We don’t often see the industry deliver a project on time and on budget. We nailed both of those on this one,” Varnado says.