

# Ghana's Jubilee Celebration Nears

John Sheehan, Contributing Editor

After more than 100 years of oil exploration and the drilling of 90 wells, the Republic of Ghana is now on the verge of truly benefiting from its offshore oil and gas riches. The partners in the country's Jubilee field—one of the most exciting developments offshore west Africa in recent times—are on track to produce first oil in the second half of 2010.

The speed of progress on the USD 3 billion development has been exceptional since the initial discovery was made with the Mahogany-1 well in 2007. The field, which is being developed with a conventional subsea system with 17 wells initially, tied back to a turret-moored floating production, storage, and offloading (FPSO) vessel, is located 60 km offshore in 4,101 ft (1250 m) of water and straddles two deepwater blocks—Tano and West Cape Three Points offshore Ghana.

Partner Tullow said this month that conversion of the Ohdoh VLCC tanker into an FPSO to tap the field and the fabrication of subsea equipment are well advanced. Five development wells have been drilled on the field, with a further seven wells planned for the remainder of this year.

The need for speed means that everything for the development is being kept as simple as possible, said Dave Hanley, Tullow's subsurface manager for Ghana. "Due to the compressed time frame for the development of phase 1 on Jubilee we are using designs for everything that are off the shelf. We are not really pushing the boat out in terms of technology. I do not think we could claim that we are on the cutting edge.

"We have a very tight time frame for construction and installation, which really prevents us from doing that. We are doing a tanker conversion for the FPSO to a design that is off



Hanley

the shelf and all the other equipment is well proven and readily available for this sort of water depth. Future phases may of course use more technology, based on learning from phase 1, but everything we are doing is well proven and has been done many times before."

Modec is currently converting the tanker at the Jurong shipyard in Singapore and on completion it will have the capacity to process 120,000 BOPD and 160 MMcf/D (4.48 million m<sup>3</sup>/d) of gas, as well as being able to inject 232,000 B/D of water. The FPSO, which is scheduled for delivery before the second quarter of 2010, will have a storage capacity of 1.8 million bbl of oil and will be able to hook up to 15 risers.

The partners are currently awaiting the delivery from FMC of nine production trees, three gas-injection trees, five water-injection trees, and eight four-slot manifolds that will make up the subsea infrastructure for the field. The well-trying and -tested subsea solution with an FPSO was chosen by the field partners because of the 2,953–5,578 ft (900–1700 m) water depths, the remote location of the find, and the seabed conditions which include a subsea canyon.

"There is an eastern gathering system and a western gathering system on either side of the seabed canyon that traverses the middle of the field. The FPSO will be moored directly above that, so the gathering system straddles that canyon," says Hanley.

## Phased Development: Continuing Appraisal

The field was discovered when the partners began to look at seismic surveys shot by CGG and Veritas DGC over the area. When the two surveys were merged, Jubilee—a turbidite fan, or a "bird's foot"-shaped deposit of sand dumped on the seabed by a turbidity flow—was unearthed. The Mahogany-1 well, which was drilled with the Belford Dolphin into the structure, hit a 270 m gross oil column and this was followed up by Hyedua-1 in the Deepwater Tano block, which encountered a 202 m gross reservoir interval.

Because of the Ghanaian government's desire to bring the field onstream as quickly as possible, it has agreed to continued appraisal and exploration activities while a phased development gets under way. As Hanley explains: "The philosophy of phase 1 is essentially to appraise the core of the Jubilee field area while further drilling takes place on the periphery to prove up potential future phases."



The Jubilee field is on track to produce first oil in the second half of 2010.

He said the first phase would be used to gain information not only in terms of the areal extent of the field but also in terms of its dynamic performance capabilities. "As part of the early phase 1 drilling, we will be conducting a series of interference tests. We have successfully placed pressure gauges in two of the development wells already.

"The last operation on the Blackford Dolphin right now is a drill stem test over one of the main reservoirs and we hope to see a pressure response in these two observation wells, which will obviously give us an idea of continuity and connectivity, at least in the main reservoir sand that we are targeting. It is a deliberate attempt to try and resolve some of the uncertainties as early as possible in the program," Hanley said.

### Rigs in Operation

Currently, two rigs are operating on Jubilee. The Eirik Raude is contracted for three years until the end of 2011 and is 100% dedicated to drilling and completion operations. "That contract takes us beyond the first oil date, which is fourth quarter 2010 next year," Hanley said. "We are not going to have all wells completed by first oil, so there will be some continuing completions after first oil. We also have an option for an additional two years on that rig should infill drilling or an expansion occur immediately after phase 1 drilling."

At the end of May, the Blackford Dolphin completed its last piece of work on Jubilee and went off contract. At least two more rigs are due to arrive this year, one of which will concentrate on some appraisal drilling around the periphery. One of the rigs is being contracted by Kosmos and at least two wells will be drilled in the West Cape Three Points block. Another rig will also be doing some exploration drilling and there is an option to use that rig for additional Jubilee development drilling should that become necessary.

Already this year, the field partners have made considerable progress in both frontier exploration drilling and the appraisal and development of the Jubilee field. In January the Mahogany-3 well was completed successfully, proving a significant southeastern extension of the Jubilee field. The Hyedua-2 appraisal well was flow tested at approximately 17,000 BOPD, confirming good reservoir connectivity and very high well productivity. Testing on the Jubilee-9 well (previously Mahogany-1) kicked off at the end of May, while the Mahogany-4 appraisal well was scheduled to begin in June.

Once production gets under way, the field partners will be looking to optimize recovery by balancing their water-and gas-injection strategies. "We are going for full voidage replacement using water injection in both of the reservoirs, upper and lower, and that is because our oil is not too far from the bubble point, so we will have water-injection capacity for full voidage replacement before first oil," said Hanley. "That is very critical here, otherwise we will see a lot more gas here than we want to."

The gas initially will be injected to boost recovery rates with two or three gas-injection wells planned. Ghana, however, is energy deficient and needs as much gas as possible for its own energy needs, so off-taking the gas has been accounted for in field planning.

**Tullow Oil (49.95%) operates the Tano block alongside partners Kosmos (18%), Anadarko (18%), Ghana National Petroleum Corporation (GNPC) (10%), and Sabre Oil & Gas (4.05%).**

**Kosmos (30.875%) is operator of the West Cape Three Points block with partners Anadarko (30.875%), Tullow (22.896%), GNPC (10%), EO Group (3.5%), and Sabre Oil & Gas (1.854%).**

**Tullow is unit operator for the field while Kosmos is responsible for delivery of the floating production, storage, and offloading vessel and subsea equipment.**

### Future Phases on Horizon

Future phases on Jubilee will depend on the results from the first phase of operations and the exploration and appraisal drilling to be carried out. Hanley said, "Right now there is very wide scope for what a phase 2 might be. A range of outcomes are that it would be a tieback to the existing phase 1 FPSO or potentially an additional FPSO could be justified."

Two wells to be drilled in Kosmos' block will help determine planning. "It depends on future drilling," he said. "If any find was to be included in the Jubilee unit area, there would have to be an extension to that area, mechanisms for which do exist within the partner agreements. If that accumulation is considered separate from Jubilee, then it becomes a Kosmos development, so you have to bear in mind the various block ownerships.

"We will need these two further wells to be able to define that with any certainty. That is something that is possibly two or probably three years behind phase 1, possibly 2013," he added.

There is also additional potential on the west side of Jubilee, which would become a Tullow-operated development should it pan out. While there are no further appraisal wells scheduled for Jubilee in Deepwater Tano, there is a plan for a further appraisal well to the west of the field (Hyedua-3) in the same sequence.

### Ghana to Reap the Rewards

While there are no requirements for local content on the project, Tullow is putting together a significant resource base in Ghana and Hanley says Tullow's desire is "very strongly in the direction of using qualified national staff wherever possible." Immediate plans call for Tullow staffing levels rising to in excess of 200 by early next year in Ghana.

There are Ghanaian engineers working with international oil companies around the world and the country's universities have taught petroleum-related subjects for the past 10 years. Tullow itself currently has 14 Ghana National Petroleum Corporation secondees working in the company on a two-year cross-discipline training program in various Tullow locations including London and Cape Town.

Hanley adds, "They have people we can draw on to allow us to keep up the Ghanaian flavor to the operations there. The intent has always been to actively recruit qualified and experienced Ghanaian people."

**JPT**