‘One-For-Two’ design demonstrates benefits of consistency for production facilities

Adopting a single basic topsides design for two multibillion-dollar deepwater facilities in the U.S. GoM is helping the operator save both time and dollars.

We are accustomed to daily opportunities that promote “two for one.” Usually they involve discounts on consumer products or offers of special rates to attract customers to hotels or restaurants. These promotions are often worthwhile but don’t necessarily demonstrate a high degree of ingenuity, risk reduction or long-term savings.

Contrast them with Anadarko Petroleum’s approach of building two multibillion-dollar deepwater production facilities for separate U.S. Gulf of Mexico (GoM) development projects using a single basic topsides design. That is the intended outcome for the operator’s twin spar facilities, Lucius and Heidelberg.

Anadarko is a recognized player in the deepwater sector. The company operates six spar facilities in the GoM and until recently operated Neptune, the industry’s first classic spar (installed in 1998). It was the first company to design and install a truss spar and the only one to design and install a cell spar (Red Hawk in 2004), which has since been successfully decommissioned and now serves as an artificial reef in the GoM.

Its newest and largest deepwater facility, the Lucius truss spar, began producing in January 2015.

It also operates the Marco Polo tension-leg platform (TLP) and Independence Hub, its deepest operating semisubmersible floating production unit (FPU) in the GoM at a water depth of almost 2,438 m (8,000 ft).

With its notable position and experience in the deepwater GoM, Anadarko decided to duplicate its previously successful “Design One, Build Two” approach used for its Boomvang and Nansen twin spars for the design and construction of the large spar floating production platforms destined for Lucius and Heidelberg.

The idea germinated during the development of Lucius in the Keathley Canyon area offshore Louisiana. During the early construction phase it became apparent that the nearby Heidelberg Field in the Green Canyon region had sufficient potential to warrant the operation of another stand-alone facility. The projected 80,000 bbl/d of oil throughput design of the Lucius facility lent itself well to the intended output at Heidelberg.

The Lucius truss spar is moored in 2,164 m (7,100 ft) of water, while Heidelberg will reside in 1,615 m (5,300 ft) of water when it reaches its expected initial production date during 2016.
Replication to generate savings
Among the main objectives in the Design One, Build Two approach is the opportunity to generate significant cost savings in engineering and construction of facilities replicated from a proven design.

The main ingredients for accomplishing this objective include a cost-efficient topsides production facilities design and a reduced cycle time from project sanction to first production. For Lucius, first production came just three years after the project was sanctioned, and Heidelberg is expected to reach first production within about the same time frame.

For its program, Anadarko relies on companies that have positive track records in the design, engineering, construction and follow-on of their previous deepwater facilities. This approach minimizes the learning curve and applies knowledge of the project participants from prior projects. The decision also reduces risks, and partner continuity provides a compatibility and communication that helps to ensure reliability and predictability for delivery.

For the hull, Anadarko selected Technip Offshore, which designed and constructed the company’s previous spars at its fabrication yard in Pori, Finland. Technip’s responsibility on Lucius extended to transporting the hull across the Atlantic to the GoM. Similarly, Kiewit Corp. was selected to fabricate the multilevel deck structures at its Ingleside, Texas, construction facility.

Wood Group Mustang, meanwhile, was chosen to design and engineer the topsides production facilities. The company’s credentials are well recognized in the industry, having had responsibility for more than 60% of the topsides facilities installed on deepwater floating production units of all types in the GoM as well as a significant number of international facilities.

For Anadarko, Wood Group Mustang had previously provided the FEED and detailed design services on four of the operator’s existing spar facilities—Boomvang, Nansen, Gunnison and Constitution. The company also provided expansion and brownfield modifications for the Neptune and Constitution spars.

Its earlier spar designs, incorporating lessons learned and innovative technologies, provided Anadarko with
cost savings and schedule reductions in reaching first production. Additionally, Wood Group Mustang provided topsides design for Anadarko’s Marco Polo TLP and Independence Hub FPU.

For Lucius and Heidelberg, Wood Group Mustang’s goal was to again assist Anadarko in optimizing project economics through cost and schedule efficiencies. The approach was to provide a flexible solution that would allow further expansion of both facilities as they integrated production from future subsea tiebacks in adjacent blocks. As with many of its projects, design elements were standardized based on prior successes and lessons learned.

Changes were limited to only those that would be technically required to operate the facility. As the design for Lucius progressed, revisions were incorporated into early documents for Heidelberg, accelerating the FEED for that project.

The design package created by Wood Group Mustang was an essential part of achieving the financial investment decision (FID) for the two developments. For Heidelberg, the “copy” method enabled a reduction in pre-engineering, procurement and construction phases. The common package elements of Lucius enabled swift production of a complete set of engineering deliverables including process and instrument diagrams for Heidelberg.

Coupled with equipment standardization, Wood Group Mustang relied heavily on close communication with the Anadarko project teams and other participants chosen for their experience and continuity. Using Lucius equipment information, engineering and established processes, the company was able to fine-tune its procurement and contracting strategies for Heidelberg, dramatically shortening cycle times.

The approach allowed the cutting of first steel for the topsides to be done with confidence within one month after sanction. Modularization of several production components facilitated the required onshore and offshore lifts for the 14,000-ton operating topsides.

Personnel safety and environmental protection are high priorities for Anadarko and its project participants. During Lucius’ engineering phase Wood Group Mustang assisted Anadarko in developing additional procedures, analyses and documentation as is now required in the post-Safety and Environmental Management Systems regulatory environment. The company was part of reviewing and/or developing additional or modified safe work procedures, documentation, implementation and reporting that was valuable to the Lucius project and that will largely carry over to Heidelberg.

The safety culture embedded within the project participants enabled the Lucius project to be completed with more than 10 million hours and a total recordable incident rate of 0.38. This achievement, along with the experience gained during the development of Lucius, will be used when building and, if necessary, modifying methods and procedures for the Heidelberg facility.

**Reduction in man hours**

The Lucius-Heidelberg platform duo has already produced tangible results in efficiency and financial savings.

The Heidelberg facility is on schedule to achieve first production in mid-2016, improving slightly on the cycle time for Lucius. Its pre-FEED and FEED phases have already reduced man hours by more than 60% with benefits extending throughout detailed design and fabrication.

As Table 1 shows, the schedule compression has, additionally, led to significant fabrication man-hour reductions on both the hull and topsides. Heidelberg’s procurement efforts have resulted in a 50% cycle reduction for topsides equipment modules, further reducing costs.

The combination of participant, design and procedural continuity, world-class experience and close communication among project teams should deliver the results Anadarko, Wood Group Mustang and the other partners expect. The expectation is that this will likely result in total facilities project cost savings running into hundreds of millions of dollars on these large-scale, world-class megaprojects.

<table>
<thead>
<tr>
<th>Project</th>
<th>Concept selection to cutting first steel</th>
<th>Reduction in fabrication man hours</th>
<th>Reduction in engineering man hours</th>
<th>Major topsides equipment procurement cycle</th>
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</thead>
<tbody>
<tr>
<td>Lucius hull</td>
<td>18 months</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Lucius topsides</td>
<td>22 months</td>
<td>-</td>
<td>-</td>
<td>22 months</td>
</tr>
<tr>
<td>Heidelberg hull</td>
<td>5 months</td>
<td>18%</td>
<td>15%</td>
<td>-</td>
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<tr>
<td>Heidelberg topsides</td>
<td>12 months</td>
<td>22%</td>
<td>33%</td>
<td>11 months</td>
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</table>

**TABLE 1:**