

Figure 1. DCV *Balder* at the *Thunder Horse* platform.

underwater engineering



# Installing on time

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Marine Contractors  
(HMC), The Nether-  
lands, describes the  
Mardi Gras Project, in  
which the company  
pushed deepwater  
pipeline installation  
records.

results are even more remarkable as HMC was established as a deepwater pipelay installation contractor only five years ago.

## Project background

In November 2000, HMC was awarded the Mardi Gras Project, which comprised the installation of the export pipelines and steel catenary risers (SCRs) for *Holstein*, *Mad Dog*, *Thunder Horse* and *Atlantis*.

The overall scope of work for HMC included a total of eight pipelines with an overall length of 330 km and diameters ranging from 16 - 28 in., eight SCRs and twenty inline pipeline structures in water depths varying between 1300 and 2200 m.

In 2001 HMC started a deepwater investment programme and converted the Semi-Submersible Crane Vessel (SSCV) *Balder* into a Deepwater Construction Vessel (DCV).

Features of the DCV *Balder* specification include its 1050 t capacity J-lay system and a 650 t A&R winch, which in combination with the world's largest mooring line deployment winch provides the unique capability to lower pipelines with loads of up to 1200 t. The combination of the J-lay tower with the two main cranes of the DCV *Balder*, allows for handling of large structures such as PLETs and inline sleds complete with mudmats.

In December 2002, an extensive test and trial programme was performed in which all *Balder* features

In January 2006, Heerema Marine Contractors (HMC) successfully installed the Mardi Gras export steel catenary risers (SCRs) on *Thunder Horse*. Both the 20 and 24 in. gas and oil SCRs were installed within schedule and without any lost time. For HMC this is a major achievement, as the 24 in. SCR is the heaviest SCR ever installed. This builds on the successful installation of the Atlantis Export pipelines (16 in. and 24 in.) in 2200 m water depth in December 2005, which is the deepest 24 in. pipeline installed to date.

With the successful completion of the Mardi Gras project, HMC has proven to be a reputable pipelay installation contractor working on the frontier of deepwater technology. The

were tested to the full capacity. This testing programme included the installation of 10 km of 28 in. and 24 in. pipe, including inline structures, in order to prepare the execution of pipeline installation work in the best possible way and to ensure that the execution offshore was done safely without affecting the environment and providing a healthy workplace for all.

Subsequent to successful completion of the test and trial programme, the DCV *Balder* started with deep water pipelay installation in April 2003. So far, the vessel has successfully completed all eight export pipelines and six SCRs.

In between the various Mardi Gras scope of work portions, *Balder* also successfully completed the installations of the BP deepwater facilities. The last part of the Mardi Gras project for HMC will be the installation of the Atlantis 16 and 24 in. export SCRs.



Figure 1. Heavy inline structure ready to be submerged.



Figure 2. Heavy inline structure installed in J-lay tower.

During the installation of the various export pipelines, *Balder* installed numerous large inline structures (120 t). The combination of the heavy lift cranes and the open structure of the J-Lay tower proved to be very efficient.

### Challenges

During the various SCR installations, the DCV *Balder* sometimes required installation windows of more than seven days, which is much more than the maximum predictable duration of a reliable weather window. These weather windows were required due to the large bending radii needed to lay down the pipe on the sea bottom, and the limited space on the sea bottom due to mooring line patterns.

To minimise lost time in this weather window it was essential that weld rejection was reduced to an absolute minimum. Installation of VIV strakes, to be installed on large parts of the SCRs, and strain monitoring systems on two of the SCRs, had to be as efficient as possible.

If deteriorating weather conditions required the pipelay operation to be stopped, the highly redundant DP system, in combination with the high J-Lay system capacity, made it possible to remain on location with the pipe in the J-Lay system and to ride out the adverse weather periods.

The main challenges in developing the Weld Procedure Specification (WPS) for the industry's first 24 in. heavy wall SCRs were in achieving the required weld area toughness, fatigue performance and pipe end fit up criteria.

To achieve these stretched targets while keeping the weld rejection rates to an absolute minimum, a rigorous weld testing and qualification programme was executed, which resulted in low cut out rates (< 5% average in the J-Lay tower).

### Conclusion

A combination of the right equipment, knowledge and teamwork were key to the successful completion of the project:

- *Balder* has proven to be a stable work platform with excellent motion characteristics for pipelay operations and adequate deck space.
- The J-lay equipment has proven to be state-of-the-art machinery and fit for the installation of large diameter deepwater pipelines and SCRs.
- The combination of heavy lift cranes and J-Lay equipment is ideal for the installation of large, heavy inline structures.
- Extensive welding procedure development and testing programmes were performed in-house to meet the stringent welding requirements.
- HMC's pipelay and welding expertise in combination with excellent on- and offshore teamwork was key to the successful achievements.
- Overcoming the major technical hurdles was a combined effort from HMC, Intec and BP.
- Apart from the Mardi Gras Project, HMC is in the process of preparing for the next pipelay projects to be executed with the DCV *Balder*. Some of these projects will also involve heavy Pipe-in-Pipe installations resulting in new expertise.

HMC is looking with confidence to future deepwater pipelay projects based on the company's present equipment performance and experienced personnel.