Photo by Flying Focus-Bussum, The Netherlands

DSV DON AMADO

First of three diving support vessels for Gulf of Mexico

Builder:
De Hoop Lobith International BV, Lobith, The Netherlands
Owner:
Oceanografia SA, Mexico

The *Don Amado* is the first vessel of a series of three diving support vessels built by de Hoop. It is the result of the collaboration between Oceanografia of Mexico, and Shipyard De Hoop of Holland.

Shipyard de Hoop has a long track record in building diving support vessels back to the 1980'S with the Deepwater 1 and 2. Oceanografia is succesfully operating two other De Hoop built Diving Support vessels (Caballo de Mar and Caballo Trabajo).

Another De Hoop designed diving support vessel is currently under construction at Niigata shipyard in Japan for Dutch account.

The vessels are suitable for World Wide Service in shallow- and deepwater and will be engaged in Construction and maintenance of offshore installations, surface and subsea crane operations, Diving /ROV support, and standby-rescue activities. The *Don Amado* is designed as a special purpose ship for 200 persons special personel.

The earning power of the vessel is defined by:

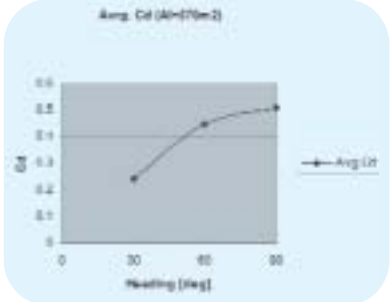
- the big 300 ton Liebherr Offshore crane on aftdeck, which is able to reach up to 60 m above sealevel or 55 meter overboard;
- further a large wide open deck with removable railing totaling over 1000 m^2. Below deck a large store is arranged which can be reached through the 20 ft flush hatch in maindeck;
- forward an accommodation is situated for 250 offhore personnel;
- in the centre of the vessel a 12 men diving system is arranged.

The design is kept simple, leaving out all nice to haves. The vessel will be operated with a manned engine-room and a low level of automation.

Hull design

The high block hull is optimized for stationkeeping, showing a low draft hull, with minimal drag. An U-shaped fore ship with bulbous bow to minimize fuel consumption when steaming ahead. The aftship is a pram type stern in order to maximize stability for heavy lift operations. The aftside of the moonpool is provided with a spoiler to reduce drag and avoid turbulations during transit.

Modeltests at DST in Duisburg have proven the hull design to have a very low



drag in all directions (Cd= 0.51 in beam seas condition). The low draft enables the vessel to enter very shallow offshore ports in Mexico. Above the waterline the hull and superstructure are low-profile in order to reduce wind-forces as much a possible. The steelplated heli-deck is integrated in the vessel construction to reduce weight and cost and also to keep the helideck low, to reduce horizontal movements/accelerations as much as possible.
The low airdraft is also an advantage for transfer of the vessel from Lobith to Rotterdam. In this case only the wheelhouse needs to be lifted of the vessel. In the sides large wingtanks are arranged for carriage of waterballast and protection against collision damage.


Veth-Z-drive with Droste installed E-motor

Motion behaviour

Although the vessel has a relative high beam and high GM value necessary to operate the crane, the roll motion is better then might be expected due to the high roll-damping values which are a result of the high B/T ratio.
Furthermore the high bilge keels improve the roll motions further. The pitch and heave motions of the vessel are comparable good due to the high block of the vessel. In a seaway the vessel will loose significant speed due to the blunt noose.

Generating plant

The vessel is fitted with an environmental friendly diesel-electric propulsion plant. Four Caterpillar 3516B generators each rated at 1825 kW at 1800 rpm are fitted in the central engine room.
The generators are connected to the main-switchboard, which is splitted in a port- and starboard side for redundancy. A low tension system 480 Volt, is choosen in order to keep the cost down. In case all generators are on line the bus-tie breaker will be open.
The main-switchboard is fitted with a power-management system which prevents overload of the generators in all circumstances by reducing the propeller loading. Start/stop of the generators is manually from the bridge or locally.
In case of loss of the complete generator-plant, essential services will be supplied from the emergency/harbour generator. Fresh air intakes are situated in SB funnel/boomrest. Ventilation of generator room is from SB to PS, where the air leaves together with exhaust pipes in PS funnel.

Propulsion

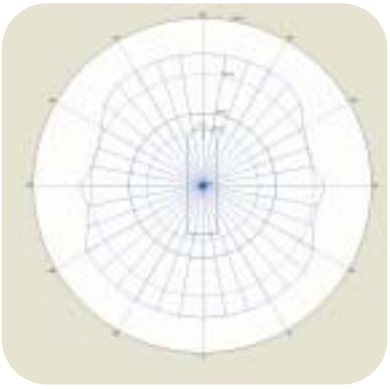
At the stage of ordering of the thrusters a surge in new-build offshore vessel occurred leading to an overstressed market of thruster-suppliers. Leading to very long delivery times and extreme price levels. Considering our good experience with Veth for offshore/inshore thrusters we asked them to develop a 1500 kW unit .
The first two of these units are fitted in this vessel and have proven to be without child-diseases and operate remarkably silent. At this moment Shipyard De Hoop has 10 of these units on order with Veth. The aft-trhusters are designed for bollard-pull condition in order to have maximum efficiency in DP operation. In transit the vessel reaches 12 knot with 2*1500 kW input power.
The 3 bowthrusters are each 900 kW with fixed pitch propeller. The propellers are fitted with 5 blades in order to reduce cavitation noise/vibrations. Tunnel diameter amount 1600 mm. The tunnel situated most aft, is integrated with the forward seachest for the box-coolers. All thrusters are powered by asynchronous E-motors produced by Woelfer in Germany. Motors are tested together with the frequency drives in the factory in order to avoid long tuning

Four environmental friendly generators in a spacious engineroom

times or other surprises during trials.
Frequency drives are supplied by Ingeteam, a Spanish company who have supplied over 11.000 similar frequency drives for windmills.
For the main propulsion, including bow-thrusters Active-front end frequency converters are utilized. With this configuration very low THD(harmonic distortion) values are reached (less then 1%). No break resistors are fitted, as the vessel's hotel-load is sufficient to absorb any power feedback from the propellers.

DP system

The vessel is fitted with a duplex Dynamic Positioning system according DP Class 2. The total transverse power is 2*1500 kW aft plus 3* 900 kW forward, equalling to only 0.8 kW/ton displacement. With this thruster-arrangement the vessel can achieve a transverse speed of 3.5 knots. The DP capability plot shows that the vessel can keep position (in DP2 mode) up to windspeed of 20 m/s and a sign.waveheight of 5.0 m (beam on).

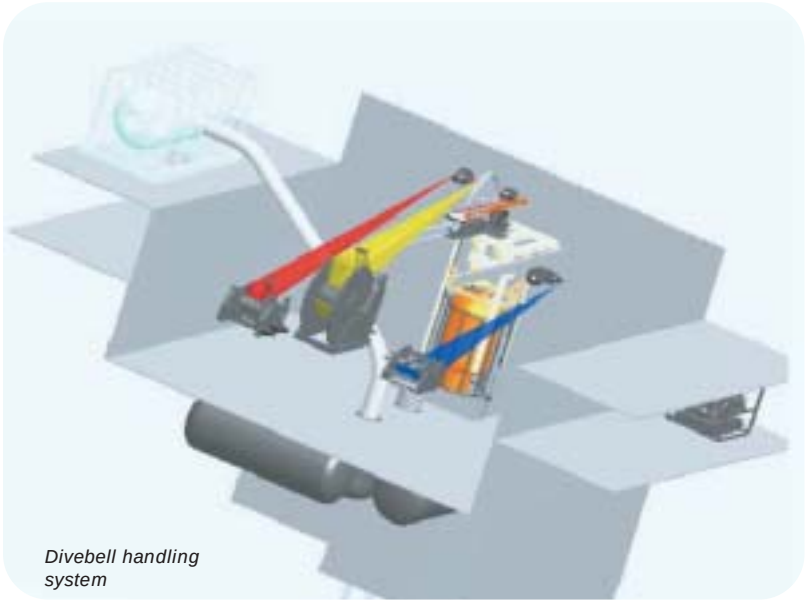


The NAVIS DP system is supplied by Alphatron. Advantages of this system compared to the well known systems are:
- Simple and fast operation, from transit to DP is just two time pressing,
- Tough-screen operation and speaking computer (keeps your eyes on deck),
- Low cost,
- On screen, online capability plot showing limits of operation,
- Integrated autopilot (class approved),
- And last but not least Fast tuning time (just two hours) and high performance.

For example maximum overshoots measured when sailing the square-test at sea (Bft 5) was only 0.2 degr. on heading and 0.7 m in surge.

The system uses 4 position reference systems:
- 2 DGPS, make C-Nav /Trimble,
- 1 Sonardyne hydro-acoustic system,
- 1 Cy-scan optical position reference,system.

In the future a taut-wire system can be fitted.



Divebell handling system

For correction of the signals 2 VRU's and 3 Gyro's are fitted. In case all systems lost track a conventional magnetic compass is fitted on the top of the wheelhouse.

Diving system

Upon arrival in Mexico a 12 men diving system will be fitted. The diving moonpool is fitted in the centre of the vessel. To enable bell deployment/recovery in rough seas an aeration system is fitted at the bottom of the moonpool. Furthermore a passive heavecompensation is arranged, which will allow diving operations in significant waveheights up to 5.0 m. The vessel is fitted with a twelve men saturated diving system for waterdepth up to 300 m. The decompression complex consists of two Tubs for transfer and two DDC's for accommodation. On D-deck a Davit Launched Hyberbaric Rescue Chamber will be fitted.
The divebell handling system is designed by Caley and shows a conventional overhead gantry, which moves the dive-bell from the mating position(s) to the moonpool.
Winches are placed on a platform in the hangar, protected from the weather. Operations can be monitored from the Dive-control room on maindeck, with assistance of two camera's. Lifesupport equipment including He-Ox bottles are located on tanktop level. All diving spaces are protected by a single water-mist system, which also protects the engine-room.

Firefighting

The 3 firefighting pumps, each supplying 2400 m^3/hr to the fi-fi monitors, are directly coupled to the dieselgenerators. Fire-fighting operations can be done in manual thruster control mode or in DP mode.
Pumps can only be started if sufficient spinning reserve is available.
The fi-fi monitors are located on the aft-ship in order to be able to reach as far as possible with the jet-spray. In this way the accommodation can be kept away from the fire/explosions. For sub-sea jet-

Firefighting on the aft deck

On top a large wheelhouse is fitted measuring 144 sq.meter

ting work and hose-cleaning operation a 4-th branch is available with constant pressure valve.

Crane

For maintenance on offshore platforms a Liebherr Boss 7500-300 crane has been fitted on the aft-ship. The crane is able to lift 300 ton at 20 m, or 100 ton at 43 meter. A counterweight of 150 ton is fitted to counteract the heeling-moment of the boom and reduce the overturning moment on the slew-bearing. The boom can be extended with 12 meter to achieve a reach of 55 m with the main hoist. To support the operation of the crane an anti-heeling system is fitted with a pumping capacity of 1500 m^3/hr. This system can keep the heel of the vessel within preset ranges.
Only in extreme conditions the ships ballast system should be used for creating extra heeling moments. On the aftside of the hanger an auxiliary crane is fitted supplied by Sormec, lifting 10 ton at 15 meter with a telescopic boom.

Accommodation

A large accommodation for 250 persons in single, double- and 4-person cabins is arranged forward . Personnel transfer can be arranged by helicopter (up to D=22.8 m) and by crew-boat (Surfer landing). Crew instructions can be given in the large cinema on B-deck.
On tweendeck-level all service spaces are arranged like coldstores, linen/laundry etc.
On maindeck , changeroom, mess- and dayroom are arranged together with the large galley. Storing can be done using the elevator with access from open-deck, and galley.
The messroom is fitted with a serving counter and has sufficient seats for half the personell on board.
On B and C-deck the majority of the crew cabins is arranged around a central staircase. Furthermore a cinema, 3 large offices and an Hospital are fitted on these decks.
On D-deck all officiers, client representatives and diving superintendents are berthed in roomy single- and double cabins fitted with carpet and wood-paneling.
On top a large wheelhouse is fitted measuring 144 sq.meter.
In the front the navigation desk is fitted and on PS a combined chart-table/radio table is fitted. At the central aft postion the DP desk is arranged. On both sides there is sufficient space for survey equipment, online office etc.

Crew-Comfort

Very low noise levels have been achieved by paying attention to this subject.
Contributing factors are:
- Engineroom located in midship, aft of accommodation (allowing also late installation of main generators).
- Variable frequency bowthrusters, with 5 bladed propellers
- Floating floors on maindeck, flexible mounted pumps, walls, ceilings ,
- Adoption of perforated ceilings in large public areas
- High noise damping bulkheads in ships side and in between cabins.

Furthermore each cabin is equipped with a fan-coil unit enabling individual temperature control. This fan-coil unit is integrated in the wet-cell combining power-supply and drains, this allows very short installation time onboard (plug and play).
Public spaces have been finished to a high standard with large flatscreen TV sets and Artwork.

Conclusion

Don Amado is a very cost-effective workhorse and will certainly contribute to an increase in the production of the Mexican oilfields. It will serve as a comfortable hotel for many offshore workers.

Subcontractors and suppliers of equipment fitted on board the 'Don Amado'
(partial list)

ADDA van Dullemen, Oud-Beijerland ...: rolling shutter
Ajax Fire Protection Systems,
Amsterdam .....: foam system for the deep fat fryer & heli deck
Alfa Laval Benelux, Breda .....: fuel oil separators; fresh water generator
Alphatron Marine, Rotterdam .....: navigation, *NAVIS* dynamic positioning & communication equipment
Axces Industrial Exhaust Systems,
Schiedam .....: exhaust silencers
Boer Staal, De, Uitgeest .....: steel plates & profiles

Droste elektro took care of the complete electrical installation

Bovi, Tubbergen ..... : upholstry
Deno Compressors, Krimpen a/d IJssel : compressors for starting, working and bulkhandling
Droste Elektro, Lobith-Tolkamer ..... : complete electrical installation; motors, drives, transformers propulsion
Econosto Nederland,
Capelle a/d IJssel ..... : valves
Electrolux Professional, Diemen ..... : washing- and drying machine
ESI-Trade, Oosterhout ..... : accommodation-, engine room-, flood- & navigation lights
Facet International, Almere ..... : bilge water seperator
FFS, Moss (N) ..... : FI-FI pumps & monitors
Frank Mohn, Bergen (N) ..... : anti heeling pump
GTK, Dieren ..... : galley equipment
Haan, v/h Gebr. De, Hoogezand ..... : chiller
Hatenboer-Water, Schiedam ..... : *Demitec Sea Standard RO* seawater desalnation system, fresh water treatment & hydrophore unit
Inexa, Hedehusene, (DK) ..... : modular bulkheads
Ingeteam Marine, Zamudio (E) ..... : frequency drives

Kraaijveld, Machine & Lierenfabriek,
Sliedrecht ..... : anchor- & mooringwinch; capstans
Kroon Technische Groothandel,
Hoogezand ..... : *Alvedoor* firedoors; *TNF* accommodation systems; *Wetcab* prefab wetunits
Lemans Nederland, Bergen op Zoom .... : bollards; chocks
Liebherr, Nemzing (A) ..... : *Board Offshore Crane (BOS)* 300t
MacGregor, Kaarine, (FIN) ..... : lashing equipment
Marco Lifttechniek, Alphen a/d Rijn .... : elevator
Marioff Corporation, Vantaa (FIN) ..... : water mist system
Nautische Unie Hunfeld, Farmsum ..... : liferafts
Nicoverken Marine Services, Schiedam : *Blücher* marine pipes, fittings, drains & channels; stainless steel sanitary discharge system
Ned-Deck Marine, Barneveld ..... : MOB & rescue boat, inclusive davit for both, hydraulic pivoting davit, life boat
NRF, Mill ..... : coolers
Pon Power, Papendrecht ..... : *Caterpillar* engines & harbour diesel generator

QUA-VAC, Almere ..... : combined vacuum sewage plant
Reikon, Spijkenisse ..... : Azcue pumps
Roden Staal, Drachten ..... : ship sections
Smits Neuchâtel, Utrecht ..... : underfloors
Sormec, Alcamo (I) ..... : marine crane
Temaro, Rotterdam ..... : Solasafe anti glare sunblinds
Theunissen Technical Trading,
Malden ..... : Pesch Seematz searchlights
Toekomst, Scheepswerf De, Waspik ... : gangway
Veth Motoren, Papendrecht ..... : *Veth-Z*-drives; *Veth*- tunnel thrusters
VDI, Rotterdam ..... : insulation
Veld Koeltechniek, Groenlo ..... : provision cooling
Vries Gesta, Jac. De, Middenbeemster .. : hotwater boiler
Vries, R.J. de, Delfzijl ..... : mooring ropes
Wetcab, Gdansk (POL) ..... : wet units
Winel, Assen ..... : *Albatros* WTS doors, musketeer doors; tank vent check valves
Wingerden en Zonen, Gorinchem ..... : portholes & windows
Wölfer Elektromachinefabrik Osnabruck,
Frans, Osnabrük (Ger) ..... : E-motors
Wortelboer, Rotterdam ..... : anchors & chains

GENERAL ARRANGEMENT

Principal particulars

Length o.a. .....105.13 m
Length b.p.p. .....91.28 m
Breadth m.l.d. .....24.00 m
Depth .....7.00 m
Draught .....4.00 m
Service Speed .....T=3.5M, 11.0 kn.
Deadweight abt. .....3500 ton
Complement .....250 pers