What originally was to become a series of six ships for Oceanografia, resulted in a series of two and a series of four. After two vessels were built, named *Caballo As de Oros* and *Caballo Siete Leguas*, shipyard De Hoop put their spare engineering capacity at work to see how these ships could be further optimised. Guided by the KISS-principle (Keep It Stupid Simple), the designers achieved an astonishing result: the cargo tank capacity was increased by 30%, while a cost reduction of 30% was achieved. Furthermore, a new and optimised hullform resulted in fuel savings of approximately 10% or a 0.2 knot higher top speed.

30% increased tank capacity

Increasing the cargo capacity required the designers to restart with a blank slate, with a mission to take as much 'air' away from below the main deck. Perhaps the most significant move was to relocate the engine room to the main deck, which made the space below the accommodation available for cargo tanks. Another modification, which was both a cost-saving and a tankspace-winning measure, was to build the tank divisions of corrugated bulkheads, as is commonly done on chemical tankers. Gone were the space-consuming cofferdams and with it, a lot of welding work.

The third decision was to turn the cargo tanks into dedicated tanks for a specific purpose. Most offshore supply vessels feature cargo tanks which can be used for multiple purposes, be it mud, fuel or brine. Tank washing systems and several segregated cargo lines to each tank take up a lot of space and additional cost. On *Caballo Galiceno* however, each tank is dedicated to one type of cargo, which significantly reduces the amount of pipe work and systems.

The central walkway below the deck was omitted in favour of tank space. Access from the accommodation to the thruster room in the aft is now only by the side decks. For this reason, the cargo rails were closed with bulkheads all the way until the deck. This protects crew members on the side decks from shifting deck loads. These longitudinal bulkheads also

CABALLO GALICENO

KISS SUPPLIER WITH 30% MORE TANK CAPACITY AT 30% LESS COST

Builder
Shipyard De Hoop, Foxhol, the Netherlands

Owner
Oceanografía, Ciudad del Carmen, Mexico

Principal particulars

Length o.a.	67.00 m
Length b.p.p.	61.93 m
Beam mld.	12.80 m
Depth mld.	5.50 m
Design draught	4.55 m
Scantling draught	4.65 m
Deadweight	2450 ton
Gross tonnage	2085 ton
Net tonnage	1150 ton
Crew complement	30 persons

Capacities

Free deck space	422 m^2
Fuel	600 m^3
Fresh water	150 m^3
Drilling water	797 m^3
Liquid mud	647 m^3
Brine	330 m^3
Dry bulk	225 m^3

Propulsion

Main engines	3 x 950 ekW Caterpillar C32
Main thrusters	2 x 900 kW Veth Z-drives
Bow thrusters	2 x 450 kW Veth tunnel thrusters
Max speed	12 knots

A part of the aft working deck is covered to protect the mud-processing plant from the elements

provide an excellent supporting surface for the cargo lines and power cables for the thrusters.

30% reduced cost

The building cost was reduced through the combination of many improvements. A new hullform was developed which consists entirely of developable plating, thus eliminating the cost of double-bended plate.

The optimised hullform, fruit of a collaboration with MARIN, has a wavemaking resistance of 30% less than the hull of *Caballo As de Oros*. Due to the steepness of the resistance curve, this translates to an increase in top speed of only 0.2 knots. But, when sailing at the same cruising speed as *Caballo As De Oros*, *Caballo Galiceno* burns about 10% less fuel. A late modification however has eliminated this advantage, of which later more.

The accommodation was also reviewed. Costs were saved by building an accommodation with one tier less. By increasing the width and the length of the accommodation, the same floor area was maintained, but less space was used for hallways and stairs.

Diesel-electric propulsion

In the design of *Caballo Galiceno*, full advantage has been taken of the fact that diesel-electric propulsion allows to locate the propulsion engines freely. The location of the engine rooms above the main deck has significantly reduced the space normally 'lost' for exhaust lines and engine room ventilation ducts.

Three diesel generator sets, based on Caterpillar C32-ACERT engines, are located in two engine rooms on either side of a central changing room on the main deck. Each rated at 950 ekW, they can work in parallel to provide sufficient power for two azimuthing thrusters from Veth in the aft and two tunnel thrusters in the bow. A power management system prevents overloading of the engines by matching the number of gensets running to the required load. Over 95% loading, the propulsion power will be reduced by the Dynamic Positioning system. Over 100%, non-essential consumers will be cut off from power, such as cargo pumps or the galley.

The location of the engine room on the main deck has another practical advantage. Should a generator need replacement or a thorough overhaul, a transport opening can easily be made in the aft bulkhead and the generator driven out to the working deck with a forklift truck. When the series of six vessels for Oceanografia will be completed, they will have 18 identical diesel generators in service, which makes it practical to carry out overhauls on a spare unit onshore and substitute a diesel generator for the spare one each time, thus reducing the downtime of the entire ship to a minimum. Carefull consideration has been given to noise-insulation, with the generators now on maindeck level. This has resulted in very acceptable noise levels complying with IMO regulations and equivalent with Comfort Class 3.

The engine room is located above the main deck, creating more space for cargo tanks below

Cargo tanks

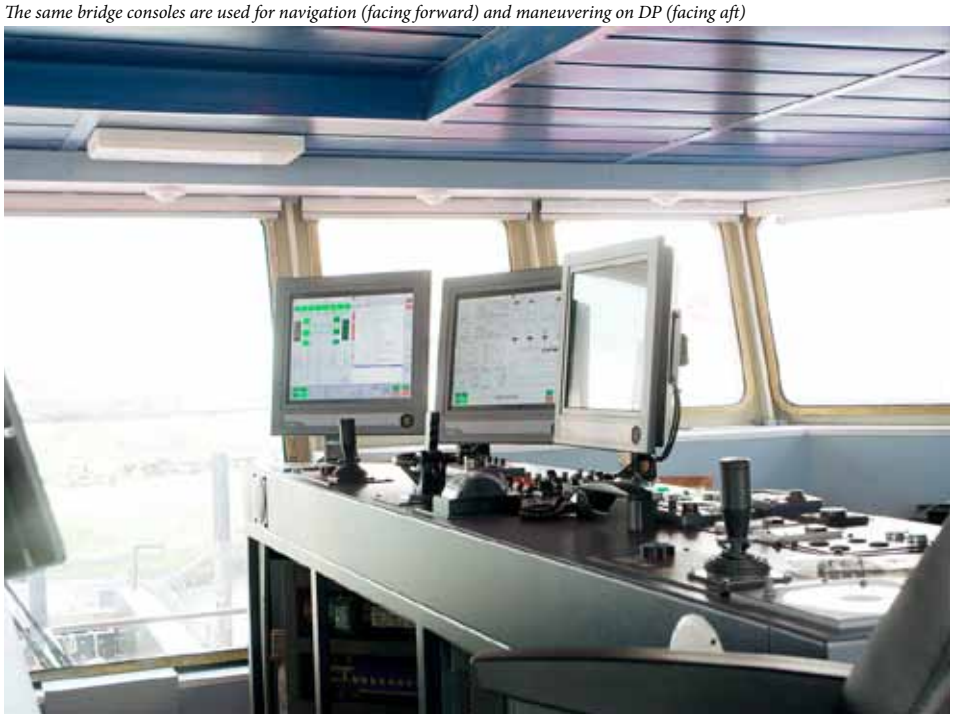
While there is no longer a central walkway between the tanks towards the aft, the void space on centreline in the double bottom has been maintained. This proved extremely practical, as the tank suctions for the cargo lines are joined from below to the bottom of the tanks, resulting in much better emptying than with regular tank suctions from the top. It also helps that the tank bottoms slope downwards towards the centreline, leaving very little residue after complete emptying. To keep the mud in suspension, the four mud-tanks are fitted with a mud mixing installation. Both the mud tanks and the brine tanks are also equipped with a jetwater system on the bottom, which can be used to inject either water or air into the tanks, making the mixture lighter. Transferring of the cargo is with two mud pumps and a brine pump which are located in the aft cargo room, where two of the four cylindrically shaped bulk tanks are located. These bulk tanks are used for either cement or barite.

DP always in command

Another cost reduction was possible in the wheelhouse. Instead of having two navigation desks, one facing forward and one facing aft, the pilot seat is now located on a sliding track between two consoles, which can be used when navigating in both directions. This is an arrangement comparable with those often seen on harbour tugs. In the control system, a simplification was made by running all operational modes through the dynamic positioning system (from Navis). Even when the captain uses the manual controls or joystick control, his commands are actually translated to generator and thruster orders through the DP system. The result is that the power management system of the DP system is always in charge, omitting the need for a separate power management system in the main switchboard.

A further simplification was made by concentrating all variable frequency drives (VFDs) in one large air-conditioned switchboard room, just forward of the engine room on the main deck. As a result, the thruster room in the aft and the bowthruster room did not require air-conditioning anymore and could do with mechanical ventilation. Some extra filters were needed on the electrical system to prevent harmonic distortions.

The same bridge consoles are used for navigation (facing forward) and maneuvering on DP (facing aft)



Contract in the Gulf

During the final stages of construction of the first ship in the new series, named *Don Alfonso*, shipowner Oceanografia secured a five-year contract for all four vessels in the Gulf of Mexico. Instead of regular supply service, the vessels will be employed as so-called mud-vessels. They will remain permanently stationed at a drilling platform to deliver drilling mud, which is used to lubricate the drilling bit and create sufficient hydrostatic pressure in the well to prevent the escape of oil or gas. This drilling mud is a mixture, of which the ingredients, such as mud and brine (heavily salted water) are balanced based on the need. For this purpose, a mud processing plant is installed on the aft working deck. This part of the aft deck is covered with removable hatch covers to protect the equipment from the elements. The piping connection with the drilling platform is permanently intact, allowing an immediate response with an appropriate mix of drilling mud when needed. The only problem with the five-year contract was that for this application, where a particularly heavy type of mud is needed, the deadweight of the ships needed to be increased.

After launching in Foxhol, each of the four vessels receives sponsoons in the drydock in Harlingen

Sponsoons

Various options were considered, such as lengthening the ships, but the most economical solution was to add two-metre wide sponsoons to either side of the vessel. Because of the limited beam in De Hoop's Foxhol shipyard, this work was carried out at Shipdock Harlingen. The sponsoons are connected to the side tanks which are used for water ballast or drilling water. The modification increased the deadweight from 2050 ton to 2450 ton. Another modification, specifically needed for this contract, was the upgrade of the dynamic positioning system from DP class I to DP class II. This required all power supplies to be routed along two different paths, along with the addition of an extra DP computer and an extra visual position reference system (CYSAM).

Shipyard De Hoop managed to do everything in a very short time. While the order for the extra modifications was given in April, *Don Alfonso* was already on its way to Mexico in July. While the sponsoons look anything but elegant, initial worries about a significant loss in top speed proved unwarranted. The speed reduction was only 0.2 knots, exactly the same amount as was gained by optimising the hull form. The same modification was done to *Caballo Galiceno* and will be done to the two remaining KISS suppliers in the series.

Low cost per ton deadweight

Technical director Fré Drenth points out that this new series of KISS suppliers are built at a lower cost per ton deadweight than comparable Chinese-built suppliers, but with a shorter delivery time, more room for customisation by the owner and less need for owner supervision during construction. Indeed, Oceanografia, which has a long history with De Hoop, did not have a build team in the yard during construction. The relation with the Mexican oil industry actually already started in the 1970s, when De Hoop built tankers and tugs for Pemex, short for Petróleos Mexicanos. Oceanografia have worked for Pemex for the last forty years. Current work on hands at Shipyard De Hoop includes two more KISS suppliers for Oceanografia, four river cruise vessels and accommodation units for a cable layer.

Bruno Bouckaert

Subcontractors and suppliers of equipment fitted on board the Caballo Galiceno - YN 435

Alphatron Marine, Rotterdam : radio equipment; dynamic positioning
Bazo Staalbeer, Westervoort : ventilation grills
Blommaert Scheepsluiken, Wijnegem, Belgium : sliding roof
Boer Staal, De, Uitgeest : steel
Bovi, Tubbergen : curtains
Carlsen Offshore System, Krimpen a/d IJssel : bulk handling system
Chemetall, Oss : *Ampak* magnesium anodes
Datema, Delfzijl : fire-fighting and live saving equipment
Deno Compressors, Krimpen a/d IJssel : compressors
Droste Elektro, Lobith-Tolkamer : propulsion drives, bowthrusters, mudpump systems, transformers propulsion
Econosto Nederland, Capelle a/d IJssel : valves
Eekels Elektrotechniek, Hoogezand : complete electrical installation
Facet Industrial, Almere : bilgewater separator
FFS, Norway : Fi-Fi pumps and monitors
GEA Westfalia Separator Nederland, Cuijk : fuel separator
Haan Gebr. De, Hoogezand : airconditioning; ventilation; freshwater installation
Imtech Marine & Offshore, Rotterdam : *GTK* galley equipment
Kraaijeveld Machine en Lierenfabriek, C, Papendrecht : anchor winches
MacGregor, Kaarine, Finland : lashing equipment
Nautische Unie Hunfeld, Farmsum : liferafts
Ned-Deck Marine, Barneveld : rescue-boat; Hydraulic slewing rescue boat davit
Noordhof Schilderwerken, Kropswolde : painting
NRF, Mill : boxcoolers
Pars-Navis, Westerbroek : prefab accommodation
Pon Power, Papendrecht : *Caterpillar* engine; harbour diesel generator
Qua-Vac, Almere : *Evac* sewage plant; Electrolux washing- and drying machine
Reikon, Spijkenisse : *Azcue* pumps
REMAT, Breda : main propulsion; bow thrusters; mud pumps
Roelofs en Zn, Nijverdal : stainless steel stairs and handrails
Rubber Design, Heerjansdam : flexible mounts
Seafix, Rotterdam : fire extinguishing system
SEC, Ship's Equipment Centre, Groningen : bollards and cocks
Shipdock, Harlingen : construction hull sponsoons
SIN, Oranjewoud : piping
Smits Neuchâtel, Utrecht : underfloors
Technisch Buro Koehein, Scherpenzeel : stair steps
Temaro, Rotterdam : *SolvaSolv* sunscreens
Theunissen Technical Trading, Malden : *Eltek* addressable fire detection system
Toekomst, De, Waspik : gangway
Top, Boskoop : *SOPEP*, cargo securing manual *CSM*
Trinoxx, Hardinxveld-Giessendam : walls, doors and ceilings
VAF Instruments, Dordrecht : flowmeters
VDI Isolatie, Ridderkerk : insulation
Veld Koeltechniek, Groenloo : provision cooling
Veth Propulsion, Papendrecht : *Veth* z-drives; *Veth* tunnel thrusters
Vries, R.J. de, Delfzijl : mooring ropes
Jac de Vries Gesta, Middenbeemster : hotwater boiler
Westerman, Winschoten : aluminium main mast, compass platform and radar masts
Wetcab, Poland : wet cells
Winel, Assen : tank vent check valves and watertight musketeer doors
Wingerden & Zn, H.K. van, Vuren : portholes and *Wigo* windows
Wortelboer, Rotterdam : anchor and chains