# The giant in the sea

Siemens' Power Package System drives the ultra deepwater semi-submersible drilling rig BLUEWHALE I on a journey to explore far beneath the waves.

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**Standing on the rig, it can feel as if you are on a small island. The deck sways so gently that you might forget you're on the restless seas. Equipped with derricks and a variety of mechanical jibs, the drilling rig is really a steel giant working hard to extract energy from the sea.**

The best of its kind, BLUEWHALE I, built by CIMC Raffles, has been described as the "aircraft carrier of offshore engineering". It is 117-meters long, 92.7-meters wide and 118-meters high from the hull to the rig top – the equivalent of a 37-story building. With a deck 1.5 times the size of a standard football field, BLUEWHALE I costs as much as two Airbus A380 aircrafts Airbus.

It comes with a restaurant, a hospital and dormitories as well as leisure and entertainment facilities, capable of meeting the needs of nearly 200 workers. They work on rig without mobile phone signals in a 28-day shift system. The working area is noisy with the roaring of machinery, while the living area is quiet with noise kept below 45 decibels -- the equivalent of the sound made by a mosquito.

Boasting a maximum operating water depth of 3,658 meters –more than twice the height of Mount Taishan – and a maximum drilling depth of 15,240 meters – deeper than the Mariana Trench – it is the semi-submersible drilling rig with the greatest operating water depth and drilling depth in the world so far. It can operate in 99% of the world's seas.

Deep seas are the reservoirs of energy resources. In particular, ultra-deep (3,000 meters or deeper) waters are rich in oil and gas reserves. However, the deeper a sea is, the higher the technical difficulties as well as the cost of oil and gas exploration and development. In addition to adverse sea conditions like waves, tides and winds, complex submarine topography may make the development work very dangerous.

Semi-submersible drilling rigs are constructed to meet these challenges. Compared to conventional fixed and jack-up rigs, semi-submersible rigs have a greater flexibility of movement, and can work in very deep waters with great efficiency and a large, variable deck load.

Since their creation in 1961, semi-submersible rigs have experienced rapid development. The latest model is capable of working in deeper seas with greater operational capacity, higher automation and better wind resistance. BLUEWHALE I is an example of the latest generation of semi-submersible drilling rig, and Siemens has played a key role in its development.

**Supporting "Made in China 2025"**

Offshore engineering equipment, known as "the flowing territories", is a strategic lever in the development of the offshore oil industry. The national blueprint "Made in China 2025" identifies the offshore engineering equipment industry as one of the 10 key state-supported fields aiming to transform China from a large shipbuilder to a more powerful one. As "the crown jewel of the offshore engineering equipment industry", semi-submersible drilling rigs are the most complex and technically demanding offshore engineering equipment.

China is trying to break the monopoly of offshore engineering powers like South Korea and Singapore. CIMC Raffles is in the vanguard of this technological battle. It is a world-leading offshore engineering equipment manufacturer and the only Chinese enterprise capable of mass production of deepwater semi-submersible drilling rigs.


"The future of worldwide development of oil and gas resources will come primarily from deep waters especially ultra-deep (3,000 meters or deeper) waters. Its success will largely depend on the availability of supporting equipment, particularly ultra-deep water drilling rigs," said Yan Yongjun, the assistant director of Yantai CIMC Raffles Offshore Ltd. "The building of BLUEWHALE I marks a significant improvement in the ability to build semi-submersible rigs for CIMC Raffles and China, and an important milestone in our attempt to enter the ultra-deepwater field."

**The "heart" of the rig**

Constructing such a gigantic and complex rig requires cutting-edge technologies and reliable key components. The Power Package System from Siemens has made significant contributions to the stable, safe and energy-efficient operation of the rig.

The offshore giant weighing around 42,000 tons consumes a huge amount of electricity. As the "heart" of the rig, Siemens' advanced Power Package System is a one-stop solution encompassing transformers, distribution panels, drives and propulsion motors, which enables the rig to operate stably, reliably and efficiently in the sea.

In the Power Package System, the transformers convert generated power to what is applicable to the drive system and domestic needs. The NXPlus C medium-voltage distribution panel and the SIVACON 8PT low-voltage distribution panel effectively distribute and transmit electricity to each key section. In addition, the eight GM150 propulsion frequency converters and eight H-compact PLUS propulsion motors are integrated to provide continuous power for the 360° rotation of the propellers. The BlueDrive drilling frequency converters regulate the speed and torque of the drilling motor in a flexible manner.

These fully integrated solutions can help reduce energy consumption, operating costs and risks. The quality products Siemens designed especially for offshore engineering can fully meet Det Norske Veritas' stringent requirements for fire and moisture protection and water tightness.

BLUEWHALE I was not built in the conventional block building-like bottom-up manner. Instead, CIMC Raffles constructed the upper and lower parts of the hull simultaneously and then joined them in one stroke by using the Taishan Crane, the bridge crane with the world's biggest lifting capacity. Their synergy thus greatly shortened the turnaround time, as any delays in the operation of such a rig could cause huge economic losses to an energy company.

With a designed lifting weight of 20,160 tons, the Taishan Crane has become the world's safest and most efficient crane. Its reliable frequency converters also come from Siemens.

"We chose Siemens because we think highly of its strong technical innovations and abundant expertise worldwide," said Hou Liping, the manager of the TCT Department, Yantai CIMC Raffles Offshore Ltd. "In our close cooperation over the past few years, Siemens has never let us down."

Siemens' century-plus history in offshore engineering dates back to 1879 when it installed a generator and a bright arc lamp on the submarine cable-laying ship Faraday, making it the world's first electrified ship. In 1886, Siemens built the world's first electrically driven ship "Elektra". Since it established a partnership with CIMC Raffles in 2005, Siemens has provided Power Package Systems for six semi-submersible rigs delivered by the offshore engineering giant. The rigs are now operating in the South China Sea, Norwegian North Sea and Brazilian waters.

**A stable "anchor" in turbulent waves**

BLUEWHALE I can accurately locate wellheads with satellite positioning and high-precision sonar. With the world's most advanced DP3 dynamic positioning system, it can locate itself

in seas even during hurricanes and strong ocean currents.

Unlike traditional anchoring systems, the DP system makes precise calculations and analyses based on propeller speed and direction as well as environmental parameters such as winds, waves and currents. It controls the speed and direction of the eight propellers to offset the forces of the winds, waves and currents to the hull, so as to achieve precise and balanced positioning. It thus prevents the rig drifting.

DP3 is the top class of dynamic positioning system of the International Maritime Organization, with the highest accuracy and strongest risk resistance. A dynamic positioning system can keep the rig stable in 25-meter waves or hurricanes just by operating switches in the central control room.

Siemens' Power Package System ensures stable electricity supplies for dynamic positioning, and its DP3 Closed Ring Power Solution is also crucial for the energy efficiency, stability and safety of the rig. It can optimize the generators' control system to effectively reduce the main engine's operating and maintenance time and improve its operational flexibility.

It has been proved that this technology can cut down fuel consumption by 11%, reduce nitrogen oxide by 35% and carbon dioxide emissions by 20%, as well as saving half of the main engine maintenance costs. During maintenance of the main engine, the noise can be reduced to zero.

Standby generators can start in a very short period of time in the event of a sudden generator failure, so the rig will avoid drifting when it is out of power.

This is the first time that the DP3 Closed Ring Power Solution has been used in China. Siemens launched the solution in 2010 and it is the only company that has used the technology in a real-world project and had it certified by classification authorities.

In November 2015, Siemens and CIMC Raffles jointly established the world's first DP3 Closed Ring Digital Lab. It focuses on R&D of digital technologies in a bid to improve the application of closed-ring distribution systems in deepwater equipment and strives for breakthroughs in key offshore engineering power system technologies for China.

"In the future, we will further strengthen our strategic partnership with Siemens, especially to achieve the highly-efficient customized mass production of offshore engineering equipment through digital manufacturing technologies," said Yan.

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