China leading in Geo Strategic Deep-Ocean Race building deep sea “space station”, for mineral mining and military purposes

The mineral scarcity and rising prices of gold, copper and rare earth minerals is creating great interest among many nations for deep ocean mineral mining. The oceans, which covers seventy percent of our earth’s surface are believed to be able to satisfy our need of minerals like gold, copper, silver, zinc, cobalt and manganese for the next hundred years. There is enough gold on the seafloor to give every person alive nine pounds, scientists estimate. That would be worth about $150 trillion, or $21,000 a person.

The Canadian mining firm Nautilus Minerals Niugini Ltd plans to undertake first commercial undersea mining from Papua New Guinea by extracting metals from a field of hydrothermal vents. The company operations to harvest gold and copper from about 3,400 feet (1,036 meters) under the water, under Solwara 1 project could begin as early as 2018.

China’s manned submersible Jiaolong finished a dive in “Challenger Deep” in the Mariana Trench, the world’s deepest known trench, in May 2017.The latest dive was the first of 10 dives planned for the third stage of China’s 38th oceanic expedition.The dive began at 7:09 a.m. local time. Nearly three hours later, the submersible reached the planned depth of 4,811 meters, where scientists worked for more than three hours. They conducted observation, sampling and surveying, and collected seawater, rocks and samples of marine life, including a sea cucumber, a sponge and two starfish.

China has achieved mastery in utilizing civilian technologies for military purposes. Deep sea reach is also important to Navies which can collect the information about enemy submarines as well as carry out their own operations undetected. China continues to make progress in deep sea exploration following the three-month mission of a new underwater glider in the South China Sea, which experts said will also help in maritime warfare.

China is planning to build a deep-sea “space station” capable of accommodating dozens of people and able to reach depths of 1000 meters, according to Yan Kai, director of the State Key Laboratory for Manned Deep-sea Equipment, reported by Science and Technology Daily. This kind of long-term inhabited underwater station would be packed with a variety of equipment, such as small manned submersibles to facilitate deep sea research work. The station could accommodate scientists to cultivate deep sea creatures, discover oil and gas resources, as well as analyze the genes of organisms for potential medical use.

This deep sea station like a space station, the deep-sea station would have multiple ports to support the docking of smaller manned or unmanned vessels. These manned and unmanned vessels could become Chinese navy’s force multiplier by carrying out variety of missions like submarine detection, anti submarine warfare and mine warfare.

Deep sea geopolitical race

International Seabed authority (ISA), formed under the UN convention of the law of the sea has granted 26 licenses since 2001 including China, Russia, India, Japan and South Korea. South Korea has launched operations in sea areas off the island of Tonga.

China and Russia have procured licenses for eastern Pacific oceans. Two of the new licenses – for German and Indian organizations – cover deep ocean ridges where hydrothermal vents have created potentially rich deposits. The total area of seabed now licensed in this new gold rush has reached an immense 1.2 million square kilometers.

India has secured an exploration contract from the International Seabed Authority to mine polymetallic nodules in the Central Indian Ocean over 1,50,000 sq km. According to an estimate, the total mass of nodules in the area allocated to India in the Indian Ocean region is 380 million metric tonne.

Tokyo and New Delhi have signed a significant agreement in September 2014 on the commercial contract between Indian Rare Earths Limited (IREL) and Toyota Tsusho Corporation (TTC) for the exploration and production of rare earths and are working towards finalising the commercial contract and commencement of commercial production at the earliest.

Currently, 13 national consortia operate exploration leases on 4.5 million km2 of the Clarion-Clipperton (Fracture) Zone (CCZ), between Baja and Hawaii. The U.S., as a non-party to UNCLOS and ISA, issued exploration leases on its own to Ocean Minerals Company (OMCO), a subsidiary of defense contractor Lockheed Martin, to explore for nodules in the CCZ

Many states and private industries have also joined the fray, like UK Seabed Resources (UKSRL), a subsidiary of the British arm of Lockheed Martin which is planning operations in south of Hawaii and west of Mexico has conducted a baseline environmental survey of its licence area in the Pacific.

China’s huge need for minerals

In order to sustain its high rate of economic growth and an increasingly affluent and expanding middle class, China needs huge amounts of minerals. This has led to China has been securing access to minerals all around the globe from Africa, Latin America, Southeast Asia to central Asia. China is investing heavily in submersibles, manned and robotic, that are able to at least provide superficial documentation of what is in the deep ocean.

Now china has adopted strategy for mineral mining from Moon, ocean floor, Arctic and Antartica. China wants to arrange a joint Arctic expedition with Russia, while deep-sea mining and a deep-sea station in Antarctica are also on the Beijing agenda, according to the Chinese State Oceanic Administration. "[The] administration will advance innovative development patterns for the ocean economy involving internet and big data, and a number of state oceanic laboratories will be built," said Zhang Zhanhai, the SOA's head of strategic planning.

China building an undersea lab for deep sea mining and military purposes

The Mobile deep-sea station equipped with a nuclear reactor shall be able to support 33 crewmen for up to two months at a time. The designs show the station resembling a nuclear submarine, with two propeller fans at the tail. It would measure 60.2 metres long, 15.8 metres wide and 9.7 metres tall, weighing about 2,600 tonnes.

But an oceanic manned station poses many mobility and technical challenges, says Yan Kai. Considering the length of time it would stay submerged he suggests it would need to use fuel cells, nuclear power or even a yet-to-be-discovered new undersea energy. In addition, there would need to be breakthroughs in deep-sea communication and navigation, accuracy and precision controls, and special lightweight materials designed to take account of it large scale, and the intense pressure at a depth of 1000 meters.

Although Beijing frequently says its deep-sea programme is for civilian purposes, however since 2002, the deep-sea project has been financed by the 863 Programme, a government effort that is widely known to focus on military needs.

“If a submersible were a plane, this station would be an aircraft carrier,” Ma Xiangneng , a researcher with the project, told China National Radio. “The station will be an underwater palace, with showers, a living room and laboratories.” Like a space station, the deep-sea station would have multiple ports to support the docking of smaller manned or unmanned vessels.

Researchers such as Ma have said the station’s main purpose would be deep-sea mining. With an underwater “mother ship” hovering above the station, located just below the surface and undisturbed by weather conditions, mining facilities could be built much more quickly and cheaply than if surface ships were used.

Professor Cui Weicheng first deputy chief designer of the Jiaolong, the China’s record-breaking manned deep-sea submersible that created a record by descending almost 7km into the Pacific Ocean in 2012.

Cui has now joined a little-known startup registered in Hong Kong with an ambitious goal – to build the world’s first commercial deep-sea submersible fleet, the Rainbow Fish.

“Cui envisages that the vessel will eventually be part of a fleet containing a large mother-ship fitted with several ultra-deep landers (unmanned devices a little like underwater elevators that are tethered to the ship) as well as manned and unmanned submersibles.

“The landers will be used to study fixed spots while the submersibles will move about freely and be fitted with high definition cameras and robotic arms. All will be capable of reaching depths of 11km – equivalent to the deepest part of the oceans, the Challenger Deep in the Mariana Trench," writes Stephen Chen.

Underwater Glider Haiyi 1000 Completes Mission

China continues to make progress in deep sea exploration following the three-month mission of a new underwater glider in the South China Sea, which experts said will also help in maritime warfare. Codenamed Haiyi 1000, which means "sea wings" in Chinese, the underwater glider reached a record distance of over 1,880 kilometers during its mission, collecting data for scientific research, as reported by China Central Television (CCTV) in oct 2017.

Developed by the Shenyang Institute of Automation under Chinese Academy of Sciences, the Haiyi had successfully endured turbulent sea conditions caused by typhoons, which proves its reliability and stability, the report said. Advanced underwater gliders will not only assist China's deep sea scientific research but also serve military purposes, Xu Guangyu, a senior adviser of the China Arms Control and Disarmament Association, told the Global Times.

"As an unmanned deep-sea machine, underwater gliders can acquire deep-sea data through multiple sensors, and will help submarines better complete their military missions as well as detect foreign submarines in China's waters," Xu explained. The Haiyi 1000 began its mission on July 14 in the northeastern part of the South China Sea together with 11 other underwater vehicles, the CCTV said.

The Haiyi 1000 doubled China's underwater gliders' endurance, the CCTV report said.

“Unlike an underwater robot, the underwater glider has no propellers. But it can adjust its buoyancy by changing the size of its oil pool. The underwater glider moves like a wave, like a dolphin,” Yu Jiancheng, a research fellow at the Chinese Academy of Sciences’ Shenyang Institute of Automation, told CCTV.

The underwater glider is efficient and high on endurance, Yu said, adding that while the machine is slow, it could be recycled and is cheap to make and maintain.

In terms of ocean exploration, the glider can detect ocean currents, mineral resources and oceanic geology, Lin Hongmin, an adviser at the Hainan Provincial Maritime Environment Protection Association, told the Global Times.

“More importantly, it helps research into ocean pollution by obtaining samples from different depths,” Lin said, adding that scientists have found large amounts of plastic waste particles in oceans.

China made its first underwater glider in 2005, which passed tests in 2009. Over the years, the Shenyang Institute has developed more than 20 such vehicles at depths of 300, 1,000 and 7,000 meters, the CCTV said. (Global Times)

Deep sea Minerals and Rare Earth Elements

These deep sea minerals exist in two forms. Massive sulfide deposits (MSD) form of minerals expelled via deep sea hydrothermal vents. Water is heated in the Earth’s crust by magma and rises up through fissures, venting into the ocean and bringing with it many minerals. Rich beds of deposits form around them as the plumes settle.

The minerals form chimneys tens of metres high around the springs through thousands of years of accumulation. These contain high-grade copper, gold, silver, zinc, and other trace metals.

Mining MSDs involves sending down remotely operated vehicles (ROVs) between 1,500 m – 5,000 m deep to break up the deposits on the sea floor. The resulting debris is sucked through pipes to a ship or platform on the surface, where the precious minerals are extracted. Up to 90% of the material is a waste. These tailings are dumped back onto the sea floor.

Other minerals exist in potato-sized (diameters from 5 cm – 50 cm) rocks called polymetallic nodules. The nodules contain a high proportion (about 28 %) of metals, which is ten times larger than found on land. These nodules are rich in manganese, nickel, cobalt, copper, lithium, molybdenum, iron, and Rare Earth Elements.

They are found on the sea floor, covering up to 70% of it in some places These nodules are much deeper (4,000 m – 6,000 m deep), mining them would involve vacuuming them up to a processing ship on the surface.

Extraction technology

One mining method is to use a conveyor belt system of buckets to bring soil containing metal and mineral deposits from sites on the sea floor up to a mining ship for processing. A second method is to use pipes to hydraulically suck up soil from sites on the sea floor, also to a mining ship for processing.

The technology for vacuuming the minerals has been made possible using hydraulic pumps and bucket systems devised to raise ores to the surface for processing. Lockheed Martin, Soil Machine Dynamics, IHC Mining and Nautilus Minerals are developing ROVs, which they say can operate down to five kilometers.

The Australian-Canadian company Nautilus Minerals' has completed Construction of the world’s first deep-sea mining machines that will work 1,600m down on the seabed off Papua New Guinea to mine for copper and gold.

Nautilus Minerals’ three remote controlled machines that shall be operated remotely from control rooms on a ship. The ship that sits on the surface of the ocean will be connected to a central pumping system that will pipe minerals upward.

The auxiliary cutter begins the work by grinding down the seafloor to make it level enough for the second piece of equipment, the bulk cutter. That machine grinds the resulting slurry up fine enough for the collection machine to suck it up before it is sent to a ship on the surface. On the ship, the water is separated from the rock, particles larger than 8 microns are filtered out and the water is pumped back to the seafloor.

Each of the machines are around 50 feet long, 15-20 feet wide, weigh anywhere from 220 to 340 U.S. tons with combined value of $100m.

Impact on Ecology and Marine life

MIDAS project, which is made up of scientists, industry figures, NGOs and legal experts from 32 organizations across Europe, gathered data to gain a good picture of what damage might be done by mining and so inform regulators of what needs to be put in place to protect the deep sea environment.

MIDAS scientists have found that new environmental issues need to be considered, such as the large surface areas affected by nodule mining, the potential risk of submarine landslides through sediment destabilization in gas hydrate extraction or the release of toxic elements through oxidation of minerals during mining.

There is a risk that the mining process will release metal ions into the water column, either in the benthic plume created by mining vehicles or, following dewatering on the surface vessel, in a mid-water plume. Such plumes can potentially travel hundreds of kilometers, carrying potential toxicants with them. Mid-water plumes may impact photosynthetic microalgae or animals within the water column.

“Environmental risks and impacts of deep sea mining would be enormous and unavoidable, including seabed habitat degradation over vast ocean areas, species extinctions, reduced habitat complexity, slow and uncertain recovery, suspended sediment plumes, toxic plumes from surface ore dewatering, pelagic ecosystem impacts, undersea noise, ore and oil spills in transport, and more”, writes Richard Steiner Professor and conservation biologist, Oasis Earth.

Thus, there is need for adequate legal and environmental regulations for this activity. Currently the U.N. Convention on the Law of the Sea (UNCLOS) governs activity on the seabed. UNCLOS states that international waters are the “common heritage of mankind” and that the International Seabed Authority (ISA), based in Jamaica is the body responsible for administering it. The ISA has signed a number of mining deals and is in the process of drawing up a mining code to govern deep-sea mining before 2018. The basic principle of the ISA is that seabed riches should be shared globally.

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