City Talk

Part of the OceanGate submersible that imploded near the wreck of the Titanic is unloaded in Newfoundland, Canada.

TAKE CARE FOR TROUBLE BECKONS DOWN DEEP

Submarines operate at depths of a few hundred meters and are limited by practical factors mainly to do with pressure differences between the inside and outside the vessel.

As a rule of thumb, for approximately every ten meters of depth, pressure increases by one atmospheric pressure.

Hence when subs dive deep, the pressure on their shells increases immensely.

Using a cylindrical shaped body and thick metal shells subs can withstand higher pressure, but there is a physical limit as a thicker shell will result in increased weight.

Pressurizing the cabin to equalize it with the high water pressure outside is not feasible, as the human body cannot withstand high air pressure.

Also, oxygen at high pressure produces superoxide anions and peroxides that are toxic to humans. Hence combat subs seldom operate at depths below 500 meters for fear of crushing.

But for deep-sea exploration and surveys, and rescues, different forms of submersible vessels will be required.

These bathyspheres, or deep-sea vessels, are not self-contained vessels like subs, and technical support from floating vessels are required for them to operate.

Modern deep diving vessels can operate at depths of over 5,000 meters, and there are at least 10 DSVs operating in the United States, Russia, France, and Japan.

China recently joined the race, with its Jiaolong diving to some 7,000 meters just over 10 years ago. Even more recently the Fendouzhe proved its ability to operate at a depth of about 10,000 meters, the greatest seabed depth known to date.

Such DSVs are useful in exploration exercises as it is commonly believed that we know more about the surface of the moon than the deep ocean seabed.

It is with this in mind that scientists and explorers love to dive deep to survey shipwrecks and the bottoms of oceans.

A favorite activity is to view the wreck of the Titanic in the North Atlantic.

A recent incident occurred when a DSV dived to 3,800 meters to view it.

A special diving vessel, capable of carrying five persons, was lowered into the ocean.

It is reported that this craft was made from a composite material, with the cylindrical body crafted out of carbon fiber, but the front and rear domes were shaped out of titanium.

Its cabin was small, with dimensions similar to that of a goods van. A barge was used to hold the machinery to allow it to sink deep into the ocean and rise back to sea level by adjusting the volume of air in the floating buoys.

Sadly, the vessel imploded, and the explorers did not survive.

Investigations are continuing, but its shell is believed to have failed , crushed by pressure of about 350 atmosphere.

There would be no chance of people surviving under such high pressure as the human lung would collapse instantly like a burst balloon, and most other components disintegrate.

A DSV needs careful design and extensive certification to guarantee its safe operation. Its shell must be able to withstand the enormous pressure, there should be ample oxygen supply and effective carbon dioxide absorption, and redundant means of inflating the floating devices are essential to ensure the vessel can return to the surface even in an emergency.

Human safety is paramount in any system that involves use by the public.

Machines must be carefully designed and thoroughly tested before the public should be allowed to use them. A lack of attention can often lead to casualties.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over features of modern life