Building the first ABS Classed Housing for Subsea use of Cinema Cameras

Liz Taylor
DOER Marine

High definition 4, 5, and 6k video is becoming a given for film production. Favorites including Avatar, Spiderman, and The Hobbit are examples of big budget films shot in these formats. Documentaries and natural history films are also benefiting from this technology; particularly as these cameras come down in cost, making them more readily available. Predictably, with greater access comes the desire to use these cameras in challenging environments. DOER Marine was asked to house three different high definition cameras for use on human occupied submersibles to capture video at depths of up to 1000m/3300ft.

Building deep-water housings for cameras, sensors, and other instrumentation is not new to the DOER team. Many existing DOER products have been used at depths to 6000m and some to full ocean depth, 11,000m. James Cameron utilized DOER's expertise during the build of his Deep Sea Challenger submersible, helping to assure a round trip.

1000m is the de-facto minimum depth for most DOER designs for both manned and unmanned systems. Shooting natural history footage in 6k provides filmmakers with the ability to take wider-angle shots from moving platforms and post process to yield incredible, sharp 4k end products. The desire to show footage in large format and dome venues is another driver for high definition camera systems, giving audiences an even greater sense of being there.

Filmmakers and directors know the value of being there when hunting the perfect shots subsea. While ROVs are remarkable in their capabilities and can carry large cameras/lighting packages, the over arching story often includes that of direct human exploration, observation, and discovery. The challenge is in creating housings for these large cameras that protect the hardware and the people using them. A cinema camera and lens requires a large, dry, one atmosphere environment. At the surface, atmospheric pressure is about 14 pounds per square inch. Every thirty-three feet of descent adds one atmosphere of pressure. As a result, the pressures at 1000m are a formidable 1430 pounds per square inch. A failure occurring at this depth has the potential to cause extensive damage to surrounding machinery, in addition to the loss of the camera. In a human occupied submersible, the biggest concern is for the potential for damage to the personnel sphere or other catastrophic damage to the submersible.

The camera system that DOER was asked to house required an enclosure with an 11-inch diameter and 26 inch length. Adapter rings can be added to extend length depending on the camera/lens combination selected. This represented a large "implode-able volume". The solution to managing the risk was to design and build the housings following the same rigorous rules and standards used to build and class the submersible vehicles. The submersibles being used were classed under the American Bureau of Shipping, ABS rules. DOER worked closely with ABS from the onset, involving them from earliest discussions on through design, selection of certified materials, inspection of

said materials, manufacture and witnessed pressure testing of the housings, acrylic view ports and connectors.

The main housings are made from solid billets of T-6061 aluminum that are anodized hard black for durability in harsh marine environments. ABS rules prohibit the use of glass for domes or ports exceeding six inches in diameter. Although glass is a preferred material for its optical qualities, obtaining class on the housings required use of acrylic. The acrylic specifications were reviewed both by ABS and optical specialists prior to manufacturing. The domes, fabricated in the UK, require hand polished post manufacturing. Given the ability of the high definition cameras to pick up very fine details, this proved an essential step. Two connector configurations were developed for the housings. The first style incorporates one power connector and two fiber optic connectors. This configuration pairs the fiber signals from the four available on the cameras but does not impact or reduce signal quality. The second configuration provides one power connector and four dedicated optical connectors.
Both options deliver comparable results. The choice is more about personal preference and cost control as subsea fiber connectors are expensive, long lead items.

To date, four different production companies have used these ABS classed housings on two different brands of submersibles. RED, Sony, and Canon camera systems have been utilized with both wide and macro lens arrangements. Whether integrations are carried out by camera-housing specialists or by end users, the housing design allows the cameras to be installed without dis-assembly or other camera modifications. The same camera used for surface/land-based shoots can be readily installed in the housing for sub sea use.

The decision to build camera housings to the same exacting standards as those for the submersibles themselves protects personnel and equipment. It means that operations are insurable as the potential risks are very well managed.

DOER is the first to build camera housings to class. Now, after the build of multiple units, testing sequences with zero failures, and approval of all designs submitted without comments, ABS granted DOER the right to use the ABS seal and sell future housings of this design type as “ABS Classed”. As more human occupied submersibles become available for film production, expedition yachts, and science, so does the need to capture the highest resolution video with safe, insurable equipment. DOER will continue to deliver deep solutions. As companies like RED move towards 8k and higher while maintaining standard camera body/lens form factors, the DOER ABS classed housing stands to be a lasting investment.

For more information contact:
DOER Marine 1827 Clement Ave. Alameda CA 94501 Tel: 510-530-9388

DOER
Deep Ocean Exploration and Research