This is a reprint of an article written by Pieter de Vries ACS on his experiences working on the 3D Imax documentary, "Ghosts of the Abyss"

The 45 minute 3D Imax film ***"Ghosts of the Abyss"*** was based around a return visit to the site of where the Titanic sank and was staged aboard the Russian Government owned research ship the 6,240 ton Akademik Keldysh, a ship which featured in the movie "Titanic". This documentary was directed by James Cameron, and the plan was to go back to the site and dive on the wreck of the Titanic, this time shooting with new camera and lighting technology. Along with us were some of the cast of the film, who had never actually visited the wreck, even though in the movie they appeared to be in a submersible diving on the wreck. The Keldysh, which is 123 metres long, is operated by a crew of 45 and together with the film production personnel, research scientists and oceanographers, a total of almost eighty people were on board. It was leased from the Russian government, and is equipped with two 18 ton exploration submersibles, MIR-1 & MIR-2. I was asked to join Cameron's Earthship Productions, in part because of my background in 3D cinematography and also, High Definition 3D experience I gained, shooting an Olympic project for a German production company along with a number of other international 3D video productions.

The camera technology used to shoot "Ghosts of the Abyss", was a joint venture collaboration between Sony, Panavision USA and to a large extent James Cameron. The film was shot using Sony's HDC-950 High Definition cameras, which were specially modified for 3D acquisition. A custom designed deep water lighting "chandelier" was built and consisted of twelve 1.2 kilowatt remote controlled HMI lights attached below a 3 meter square weighted grid. This was lowered 12,000 foot and suspended above the wreck by it's cable which was attached to a winch welded to the deck of the dynamic global positioning ship, the Esa. This little number lit up almost a third of the main section on the wreck.

Much of the day-to-day filming involved shooting preparation for the 12,500 foot dives to the Titanic. Development of dive strategies was done moving miniature models of the subs by hand around a 9 meter dimly lit model of the wreck. Briefings, the testing of submersible systems and preparations to dive were all covered in this simulation - it would mean being up before sunrise and waiting often late into the night to shoot the submersible's recovery. We would typically cover this using one camera on an 10 meter Techno Crane plus 2nd unit camera sitting on a Panther dolly, but there was also a fair number of hand held shots. This is where the camera's portability allows for some exciting footage and it got very interesting when the weather turned nasty.

Working with cutting edge technology in the relatively hazardous environment of a ship at sea is not without it's stresses, and the crew felt the very demanding nature of the shoot very tough at times. Much credit has to go to underwater expert, Vince Pace, of Pace Technologies, a Los Angles underwater equipment manufacturing and rental company. Vince played a vital role by designing and manufacturing

the deep water 3D camera housing and optics and was also the underwater DOP. My principal role was to light the ship's spaces and to act as DP for the 'topside unit'.

Whilst I didn't dive down to the wreck (at US37,500 a trip per person, it was reserved for the essential crew each of the twelve missions) my role was performed on the mother ship and one which involved a lot of pre-production planning. I spent just a day in L.A. before flying to St John's in Newfoundland with Jim Cameron. We spent the next few days walking around the Keldysh looking at shooting locations above and below decks, considering the lighting that would be required for the job. Control centres, meeting rooms, cabins, the interior of the subs, the night operations staging areas on deck and in addition to that, our lighting support ship the Eas. They all had to be lit and this was an enormous task. Cables were the biggest pain of the shoot; cables were everywhere. It took about seven days for me to light the ship with the help of my LA based gaffer, Mark Goodwin.

Shooting 3D for large format films requires special equipment and traditionally this has been bulky in nature. You'd have to haul around a huge camera weighing around 130 kilos with it's twin thousand foot magazines of 65mm film, giving you only about three and a half minutes of shooting time, a half hour to reload, and very little portability. There was no way we could have worked with this kind of camera, and the problem had to be overcome for this particular project.

The solution lay in choosing to shoot using Sony's High Definition video cameras. The process of achieving portability was enabled by removing the CCD optical blocks from the cameras and placing the two camera bodies in 'pelican' cases. Connected to the bodies by a multi-core cable, the optical blocks were set side by side on an electronics base plate with two specially modified Fujinon 5mm to 50mm lenses mounted to them, effectively creating a very compact 3D HD camera weighing less than 14 kilos. The benefit of this camera is that you can shoot (handheld if you like!) for up to two hours per tape - the edited "data" then later transferred from hard drives directly to 70mm film via Arri laser printer for large format projection. Panavision played in developing the 5mm and 7mm Digital Primo lenses for the modified HD camera and without their input, the project would have been made much more difficult.

One of the important aspects of 3D imagery is to maintain accurate convergence of the left and right images to create a final projected image that is easy on the eye. To achieve this with the modified HD - 3D camera lens set up, a software controlled active convergence system was devised. This involved utilizing the servo motors that were built into the electronic base plate. These plates automatically pivot the CCD optical blocks and lenses, in or out in the horizontal plane, to set the correct convergence point as determined by the distance focused.

The cameras chosen to be modified were Sony HDC-950 High Definition cameras, which are the portable version of the Sony HDC-900 High Definition studio cameras and are designed to be switchable between 24/25/30fps Progressive and 60i/50i Interlace. Recording in the submersibles was done using two Sony

HDW-250 60i HD VTR's with Evertz 3/2 pulldown sequencers to enable the 23.98 progressive scan frame rate to be recorded by the interlaced VTR. This process is later reversed in order to strip out the 24P image. The reason for this is that there was no portable 24P field HD VCR's available at that time. There is however no loss of picture quality when taking this route. The footage shot on board the Keldysh was also recorded on the 250's at 60i as well, directly into a pair of Sony's HDW-F500 HD VTR's via an HD-SDI cable.

Shooting 3D in High Definition video, hasn't been a major learning curve. I've been shooting 3D Digital Betacam for a few years so the transition has really been in train for some time. The jump up to HD was not such a huge thing.

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