BEYOND THE BOLEX

We've come a long way in the world of underwater cinematography over the past four decades. This retrospective takes an inside look at a few of the many and varied advances in subsea filmmaking technology

Text by Neil McDaniel



Photo: Russell Clark

I must admit to being more than a bit bemused when I see divers hitting the water nowadays with 4K GoPros on selfie-sticks. How did we ever get to this? It seems like only a few years ago (alright, it was actually several decades!) that I shot my first roll of 16 mm film underwater on a hand-cranked Swiss-made Bolex movie camera.

I had a chance to work with some outstanding cinematographers and gradually became more interested in shooting movies as well as stills. In 1981 Jack McKenney came up to film in BC waters. Jack was a very personable guy and I was impressed with his professionalism and determination to get the shots he needed.

In 1987, Jack asked me if I would assist him on a PBS NATURE documentary about the marine life of BC entitled *Under the Emerald Sea.* Of course, I jumped at the chance to work with him and gifted writer Barry Clark. In early 1988 he and John Crother drove up from California in his van jammed to the roof with camera and dive equipment. We somehow manage to stow it all aboard the charter vessel *Oceaner,* and with Larry Mangotich at the helm, headed off on a three-week expedition. Using his well-travelled Eclair NPR 16 mm camera and various portable lighting systems, we filmed at dozens of prime dive sites as we wound our way up the inside passage as far north as Port Hardy.

I didn't have much experience at the time but Jack was a patient mentor, encouraging me to shoot behavioral sequences with the Jordan Klein Arri-M housing that Gary Bridges and I had acquired. We dived like maniacs for three straight weeks and shot everything from tiny nudibranchs to killer whales.

Jack's camera housings for his Eclair NPR and Milliken high-speed camera (which could run at up to 400 fps) were designed and built by his friend Bob Hollis, the founder of Oceanic Products. Bob had also designed unique underwater housings for Arri-S 16 mm cameras which he modified to accept compact 400 ft (120m) coaxial film magazines. Jack and Bob used these extensively during their crazy dives to the 700 ft (214m) long wreck of the Italian liner *Andrea Doria*, lying in 235 ft (72m) of water 50 miles (80km) off the coast of Massachusetts. (The full, hair-raising story is a must-read: see Jack's book *Dive to Adventure*, published by Panorama Publications, and Gary Gentile's feature last issue of this magazine.)

Another professional underwater cinematographer I worked with in the early days was Paul Mockler. Paul had a custom-made housing for his Bolex EBM 16 mm camera with 400 ft (120m) magazine and was hired to shoot underwater scenes for several episodes of CBC's international hit *The Beachcombers* and *Danger Bay.* Paul is a very meticulous shooter and always took the time to thoroughly rehearse everything on the surface before we dived so that the actors and support divers knew what to do. Paul continues to have a distinguished career as a cameraman, director and producer.

In 1989, commercial diver and photographer Gary Bridges and I incorporated Subsea Enterprises and began working on underwater films under the name Wet Film Productions. We acquired an eclectic array of used 16 mm film equipment such as some spring-wound and electric Bolexes, an Arri-M with a Jordan Klein Mako housing and an Eclair NPR.

As the years passed video became more efficient for much of our underwater work and we used a long list of 8 mm, High-8, mini-DV, DVCam, HDV and HD equipment. Cameras came and went as technology and image quality improved at a stunning pace. It was nearly impossible to keep up with the latest and greatest.

Over the years we used many different cameras, housings and lights, each of which in its day was a marvel of technology. Here are a few of the notables:

Opposite page: This precision-made cast aluminum beauty housed a 'new' (introduced 1959) Bolex H16 REX



The spring-wound, Swiss-made H-16 Bolex movie cameras first appeared in 1935



The Bolex REX had a three-lens rotating turret and a reliable spring-wound clock-work motor



The beautifully engineered Hugyphot housing for the Bolex EBM



The compact Arri-M 16 mm camera with a 400 ft (120m) magazine attached



Our reliable 16 mm topside film camera, the Eclair NPR, fitted with the 12-120 mm



Mako housing #112 all gussied up with a 'signal orange' paint job



Jack McKenney's underwater housing for his Eclair NPR camera, which he used for most of his underwater work

Bolex H-16 M

This Swiss-made movie camera came out in 1958 and had a spring-wound motor and parallax-correcting viewfinder. It accepted a single C-mount lens, 100 ft (30m) rolls of film and provided auto threading and speeds from 8 to 64 frames per second.

Bolex H-16 REX

First released in 1959, the sturdy REX featured a three-lens rotating turret for RX C-mount lenses and a variable shutter. It had a spring-wound motor (an electric motor could also be attached) and provided speeds from 12 to 64 frames per second.

Bolex H-16 EBM and Hugyphot housing

This Bolex was first released in 1971. It featured a built-in electric motor and a beefy bayonet mount that accepted the heavy Vario-Switar zoom lenses. It could be used with 100 ft (30m) film reels or 400 ft (120m) magazines and provided passable reflex viewing. We used it primarily with the Switar 26 mm lens, which was ideal for shooting close-ups of marine life when installed in the Hugyphot housing. The housing, designed by Belgian engineer René Hugenschmidt in 1957, was a thing of beauty: cast aluminum and with sophisticated controls with slip rings to register the lens aperture and focus with the settings on the housing knobs: a feature that was far ahead of its time.

Bolex Paillard underwater housing

This robust, cast-aluminum underwater housing came out in 1955 to accommodate the spring-wound H-16 cameras. It was rated to 330 ft (100m) and weighed 22 lb (10kg) without the camera installed. In 1958, you could buy one for US$430 brand-new, complete with a spiffy wooden carry case.

Arriflex 16 M with Jordan Klein Mako housing

This 16 mm movie camera was produced between 1960 and 1969 by the acclaimed German camera-maker Arriflex. It is a compact camera that accepts gear-driven 400 ft (120m) and the impressive 1200 ft (365m) 'rabbit-ear' magazines. We acquired it in 1987 along with a Jordan Klein Mako housing from Rick Mason, a Toronto underwater cinematographer who had moved to Vancouver to work in the feature film business. Rick had purchased the housing from Stan Waterman, who used it on many documentaries, including the classic *Blue Water White Death*.

This system, which we dubbed the Ocean-Eye 16, was a real workhorse for about a decade when we built a diverse library of stock footage, and also used it for documentary work. Its most prestigious gig was during the filming of *The Legacy of Truk Lagoon* in 1994. With the super-wide-angle Angenieux 5.9 mm lens mounted (which we acquired in a swap for one of our Bolex housings) it was an excellent underwater camera for its day.

Eclair NPR 16 mm (Noiseless Portable Reflex)

This French film camera was first made in 1960 and was a favourite of documentary makers because its fairly quiet operation allowed sync sound recording. It also featured a rotating viewfinder with a respectable reflex image, adjustable shutter angle from 45 to 180 degrees and innovative, instant clip-on coaxial magazines that enabled film changes within a few seconds. Paired with the 12-120 mm Angenieux zoom lens, this was our go-to topside camera.

Jordan Klein Mako housing for the Arriflex 35-3

In 1996, we bought this well-travelled housing from Jordan Klein with the idea of servicing the growing need for underwater equipment in the Vancouver movie scene. The housing already had an impressive pedigree, having been used by Jordan to film the underwater scenes in *Thunderball* and *Cocoon*. We had to carry out many modifications to the focus and aperture drive-train in order to accommodate the much wider variety of lenses that Directors of Photography (DPs) insisted on.

The Arri 35-3 is a very reliable camera featuring a powerful 12/24 volt motor, shutter speeds up to 100 fps with a claw registration system that ensures a perfectly steady image. For a few years we got plenty of interesting jobs for the housing on such features as *The Edge*, *Deep Rising*, *Double Jeopardy*, *Reindeer Games* and *Firestorm*. But the much-improved Arriflex 435 came along and was soon preferred by DPs.

JVC VHS video system in Jaymar underwater housing

This was our first underwater video system, which we bought from dive buddy Nick Lawlor in 1986. The system was comprised of three

Photos: Nell McDaniel



Our first underwater video system; believe it or not, almost all of the bits and pieces flying in front of the Jaymar housing had to fit inside it

Photos: Neil McDaniel

separate components, the JVC GZ-S3 compact video camera, the TM-P3 colour video monitor and the recording deck which took full-size VHS tapes. The playback deck was another separate unit.

It was quite liberating to be able to shoot for up to two hours on cheap media and to view the results shortly after surfacing. The quality of the VHS images was only so-so by today's standards but it proved very effective for many commercial inspection jobs and for documenting shipwrecks along the BC coast.

Birns Snooper II Surface-supplied Light

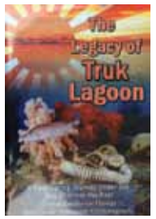
Over the years we tried numerous underwater lighting systems with varying degrees of success. This was well before LEDs became available so most lights used some type of incandescent bulb with a colour temperature around 3200 degrees Kelvin (tungsten). When it was feasible to have a generator on the surface, our favourite was the Birns Snooper II light. These heavy-duty lights were commonly used on submersibles and rated to 10,000 ft (3,000 m). The Snoopers could be fitted with several different lamps including the powerful 120-volt, 1,000 watt bulb and had a broad beam ideally suited for use with wide-angle lenses.

Farallon ML350 Portable Light

In 1989, we acquired a couple of used Farallon ML350 portable lights. These impressive lights had been designed by Ralph Osterhout (who started Farallon and later, Tekna) and came on the market in 1974. They have a sand-cast aluminum housing and a polycarbonate dome. Inside is a removable plastic doughnut containing 24 Ni-Cad D cells wired in series surrounding the bulb mount and a parabolic, peened aluminum reflector that puts out a wide beam pattern.

Although the MLs came with an articulated arm, we used them hand-held where Gary would light up the scene from a suitable angle. This was very effective at cutting down on backscatter, the nemesis of underwater shooters. We had a few mishaps with the MLs too, such as the time we accidentally left one turned on in shallow water when we climbed aboard the boat. The intense heat from the lamp built up inside the housing and melted a hole through the dome. The light then flooded in an instant; what an ugly mess that was.

While surfacing from a dive on the *Nippo Maru* in Truk Lagoon I happened to look behind me only to see one of our MLs sinking slowly but surely toward the bottom 200



***The Legacy of Truk Lagoon*.** **Producers: Nick Versteeg and Gary Bridges; Director: Eva Wunderman; Underwater DP and script writer: Neil McDaniel**



Rated to 10,000 ft (3,000m), the Birns Snooper II surface-supplied light could be fitted with a 1,000 watt bulb, ideal for lighting up big underwater scenes

Filming stunning soft corals draping the wreck of the *Fujikawa Maru* in Truk Lagoon in 1994 for A&E's *The Legacy of Truk Lagoon*

Photos: David Fleetham



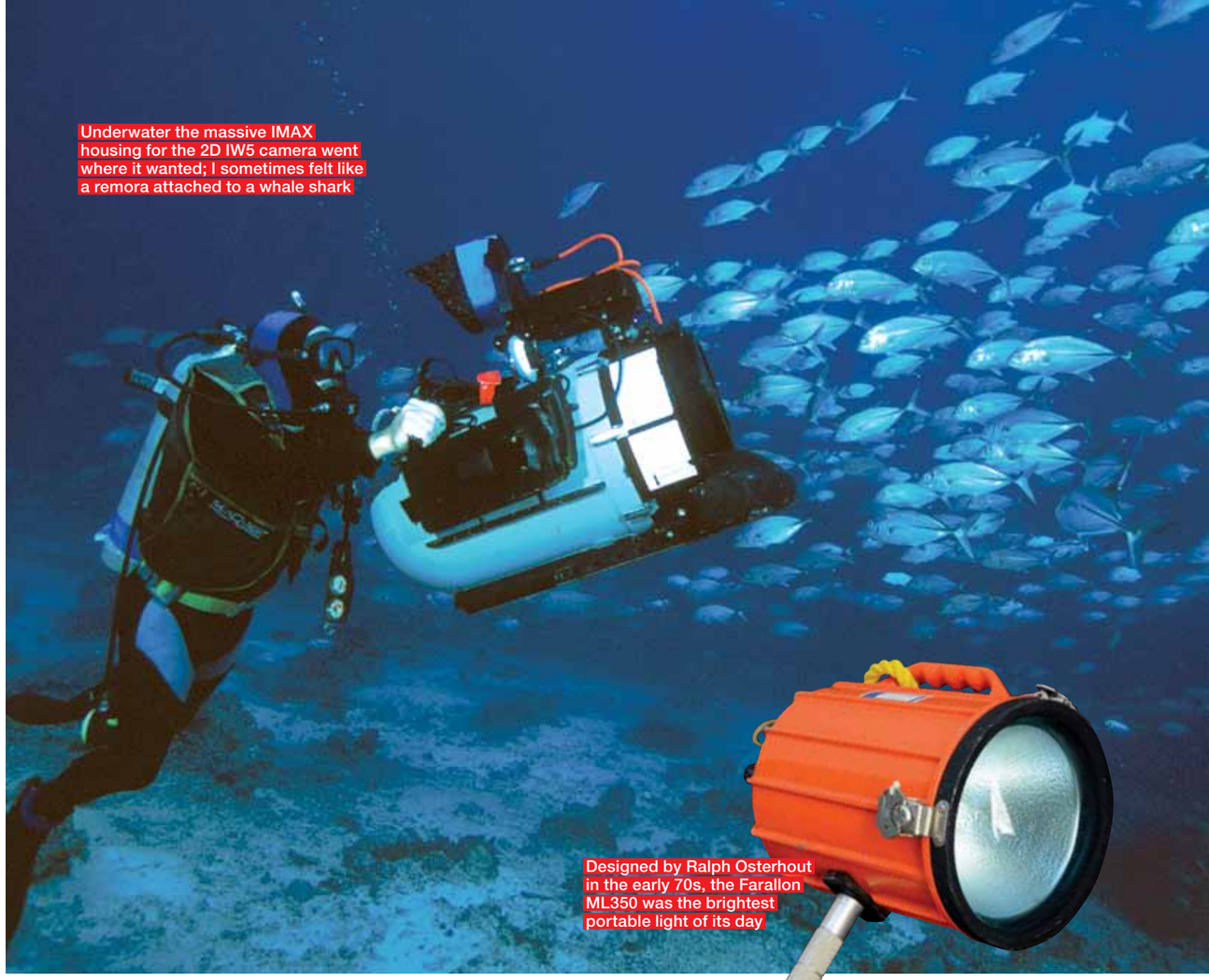
The Sony VX1000 video camera alongside the well-crafted Amphibico housing



Phenom housing for the Sony Z1U camera



One of the finest and feature-rich underwater housings ever made, Amphibico Pro Housing



Underwater the massive IMAX housing for the 2D IW5 camera went where it wanted; I sometimes felt like a remora attached to a whale shark

Designed by Ralph Osterhout in the early 70s, the Farallon ML350 was the brightest portable light of its day

feet (61m) below. While hanging off the side of the boat in the surface chop it must have unclipped itself and was about to become another deep wreck in the lagoon. Fortunately I was able to catch up to it before it got away, but it was a close call.

Our three MLs are now over 40 years old but they still work just fine—how's that for long-lasting equipment...

Sony VX1000 and Amphibico VH1000 housing

We started using this camera system in 1995 and it soon proved to be a remarkable underwater image-maker. The camera produces 530 lines of horizontal resolution, recording in the Mini-DV format. The Canadian-made Amphibico housing features electronic push-button controls, a built-in microphone, a standard 74-degree lens with a filter slot, an external plug so that a video signal could be run to the surface by coaxial cable and an optional 100-degree aspheric lens.

Sony Z1U and Amphibico Phenom housing

In 2005, we made our belated leap into High-definition video with the Sony HDR-Z1U camera that features 1440 x 1080 resolution in 16:9 wide-screen format and an excellent Carl Zeiss 12x zoom lens. It's a versatile camera with a wide variety of recording formats and frame standards. Amphibico's feature-packed Phenom housing was icing on the cake. The Z1U has a top-mounted, flippable monitor that can be viewed through a port on the top of the housing. With Amphibico's elegant pentaprism attached, it provides excellent viewing without requiring an expensive monitor. This camera system produces excellent images and served us well during the making of several episodes of Danny Mauro's *The Blue Realm* and many other documentary programs.

Sony EX1R and Gates housing

Technology rapidly increased the quality of video cameras, so much so that a number of fairly modestly priced High-definition cameras started to hit the market around 2010. The Sony EX1R is a full High-definition camera featuring 1920 x 1080 resolution and a 14x Fujinon zoom lens. It records to solid state SxS Pro memory cards at multiple bit rates, resolutions and frame rates. The non-linear format is a significant breakthrough since conventional video tapes are not used and the recording can be directly captured onto a computer and edited using any number of programs.

We housed the EX1R in a robust Gates housing that has manual controls for reliability and simplicity. The housing is fitted with a superb SWP44C super-wide port that features 110-degree rectilinear wide angle field of view, full zoom through and distortion-free images.

IMAX IW5-A

In 2002, I had an opportunity to shoot in the amazing IMAX format during the making of T*he Sacred Planet*, released by Walt Disney Pictures in 2004. Shooting in this super-sized film format (the image of the 70 mm film frame is 10 times larger than 35 mm anamorphic) was a daunting challenge. The underwater housing for the camera is a beast, weighing several hundred pounds in air. At 24 fps, the 1,000 ft (300m) magazine ran out in only three minutes, making shot selection and set-up critical. Every time I pulled the trigger hundreds of dollars worth of film were at stake so it was more than a little intimidating. Typically I got only five or six takes per roll before having to swim back to the boat for a reload.

The massive housing handled like a piece of plywood in a wind-storm. On one dive at Sipadan Island, Malaysia, Jason Isley and I were caught in a strong current and despite digging our heels into the sandy bottom to try to slow down, were blown right off the reef. I also found the housing hard to hold level until I tied a plastic apple-juice jug to the top of it and used it as a buoyancy compensator. It looked silly but worked like a charm.

The Amphibicam Pro Housing

At the start of filming for Danny Mauro's *The Blue Realm* in 2001, we started using this superb housing designed by Val Ranetkins and Robert Ruffolo at Amphibico for the full-size Sony HDW High-definition cameras. It was like driving a souped-up Maserati after shooting with Sony VX1000 cameras, and the learning curve was a steep one. It took many dives to get comfortable with the multi-function electronic controls.

While some of these older cameras and housings are obviously outdated and perhaps seem even quaint by today's advanced technological standards, each one represented a small but significant step forward in the development of the art of underwater cinematography. Where will we be in another 40 years? It's hard to even imagine... [ ]

Photos: Neil McDaniel

Photo: Jason Isley