

JULES O'LOUGHLIN, ACS  
SANCTUM

JOHN BAILEY, ASC  
COUNTRY STRONG

JOHN SEALE, ASC, ACS  
INTERNATIONAL AWARD

# American Cinematographer

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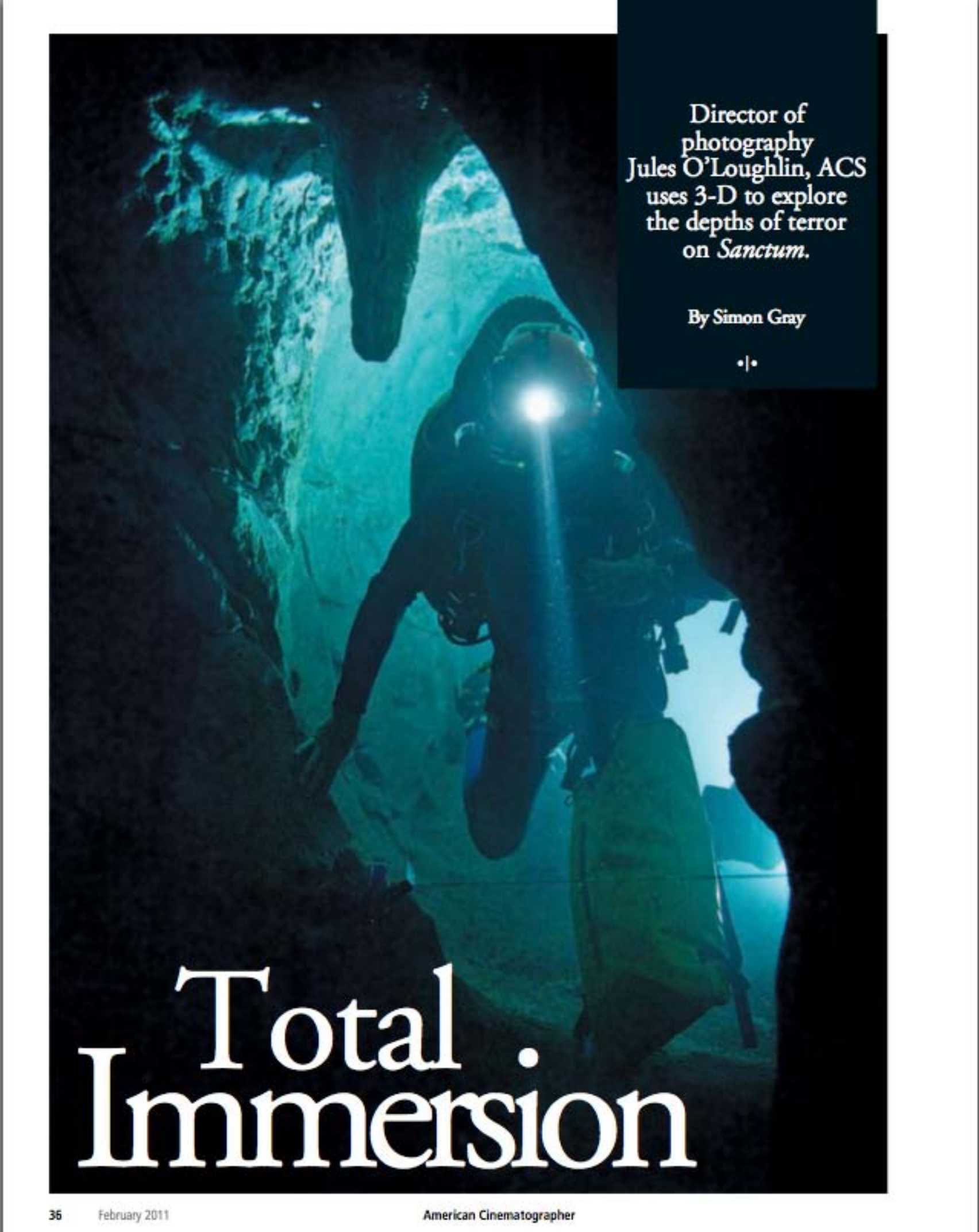
## THE GREEN HORNET

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A full-page background image showing a diver in a dark underwater cave. The diver is wearing a mask and a light, and is reaching out towards a large, textured rock formation. The lighting is dramatic, with a strong beam from the diver's light illuminating the scene.

Director of  
photography  
Jules O'Loughlin, ACS  
uses 3-D to explore  
the depths of terror  
on *Sanctum*.

By Simon Gray

•|•

# Total . Immersion



Based on the experiences of renowned underwater explorer Andrew Wight (*Ghosts of the Abyss*, *Aliens of the Deep*), the new thriller *Sanctum* combines executive producer James Cameron's fascination for underwater environs with the latest 3-D image-acquisition technology. In the Australian production, which was directed by Alister Grierson and shot by Jules O'Loughlin, ACS, things go from bad to worse for an expedition of cave divers, who are led by Frank McGuire (Richard Roxburgh). When a tornado causes a flash flood while they are exploring a cave, the divers are cut off from their original point of entry and forced to descend deep into the cave system to find another way out.

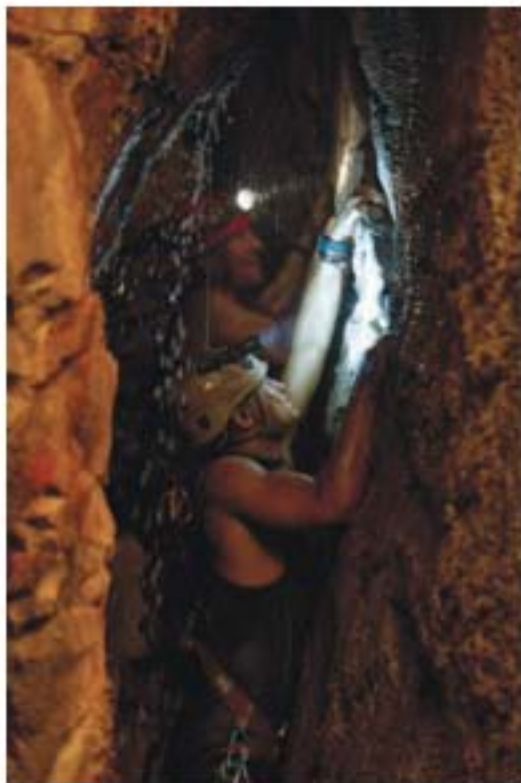
After meeting as students at the Australian Film, Television and Radio School, Grierson and O'Loughlin collaborated on the feature *Kokoda*, a harrowing account of the famous trek by Australian soldiers in New Guinea during World War II. Wight showed the movie to Cameron, who subsequently invited Grierson to New Zealand's Stone Street Studios while he was working there on *Avatar* (AC Jan. '10). "A few hours after Alister landed in Wellington, I received a call asking me to catch the next plane over," recalls O'Loughlin. The pair spent almost a week with Cameron, discussing the logistical and creative concerns of shooting 3-D and how best to tackle *Sanctum*.

Principal photography for *Sanctum* took place over 60 days at the Warner Bros. Studios on Australia's Gold Coast during the latter half of 2009. The production used two soundstages and, for underwater sequences filmed at night, the facility's main outdoor water tank, which has a surface area of 12,915 square feet. During two months of prep, Grierson and O'Loughlin discussed how best to achieve a film aesthetic with 3-D technology. "It was very important for this movie to exude a kinetic, onscreen energy that would constantly drive the narrative forward," says O'Loughlin.



"From the beginning, Alister and I wanted to use 3-D to immerse the audience in a world they've never seen before, a world they would respond to viscerally. The audience should feel that they're inside these caves with our characters, but not to the point where it's too uncomfortable. As soon as you physically strain an audience using 3-D, you're in real danger of drawing them out of the picture."

O'Loughlin used three configurations of the Fusion 3-D system, which was teamed with Sony HDC-F950 cameras and Fujinon Premier HD 16x zoom lenses. The A camera was a top-mounted beam splitter operated by Greg Gilbert that spent most of its time on a Lev Head at the end of a SuperTechno 50. The B camera used an under-slung beam splitter for Steadicam work (also done by Gilbert) and handheld work (operated by Ian Thorburn). The C camera was a side-by-side rig operated by Simon Christidis and used for underwater work; this rig was limited to an interocular (IO) of 63mm, whereas the other rigs allowed the IO to be reduced to 0.



Opposite: Cave divers find themselves on an increasingly dangerous expedition in the 3-D film *Sanctum*, shot by Jules O'Loughlin, ACS. This page, top: Group leader Frank McGuire (Richard Roxburgh, left), and his son, Josh (Rhys Wakefield), search for an escape route. Bottom: The pair climbs the Inverted Squeeze.



# ■ Total Immersion

Right: The production occupied two stages at Warner Bros. Studios in Australia. In the Forward Base set (pictured), "there was only 5 feet of clearance between the set and the studio wall," notes O'Loughlin.

Below: Capturing stuntmen at work in Dante's Inferno are Ian Thorburn (foreground left), operating the B-camera beam splitter, and the A-camera beam splitter on a Lev Head and Super Technocrane.



Stereographer Chuck Comisky (*Avatar*) controlled the 3-D technology from a facility dubbed The Pod, a modified shipping container that featured a 46" JVC passive 3-D monitor, a 2K digital projector outfitted with a Real-D system, and an 8'-widesilver screen. Live camera feeds enabled Comisky to monitor in real time, directing IO settings and convergence points, the latter of which were generally

coupled to focus settings. Pace controllers were used to adjust both IO and convergence during a shot when required. In keeping with the filmmakers' desire for a realistic look, Comisky used conservative settings for the interspatial distance between the lenses "so as to provide a sense of scale to the images, to make them feel life-size and not miniature," he says.

Adding the two beam splitters to

the F950s reduced the cameras' effective ASA to 160. "If we'd shot *Sanctum* on 500-ASA 35mm negative, I would have needed 3½ times less light!" notes O'Loughlin. Data from the F950s was recorded onto two SRW-1 decks per camera rig. Both the left-eye and right-eye images were laid down to a single HDCam tape at 4:2:2 compression, with the second tape serving as instantaneous backup.

One of O'Loughlin's initial concerns was the increased depth-of-field inherent in the F950's  $\frac{2}{3}$ " chip. "There are quite different schools of thought when it comes to depth-of-field and shooting 3-D," says the cinematographer. "Some believe 3-D is best served by deep focus. My view is that selective focus with short depth-of-field is a powerful tool in 3-D, just as it is in 2-D. We still want to direct the audience's eye, and the focus plays a role in that, as do lighting, camera movement and staging. The only answer was to shoot almost wide open, at T2." He also discovered that very specific care was required with camera moves. "At times, the nature of shooting 3-D is restrictive either physically, because of the size of





Top: McGuire pauses for a moment in Forward Base. Middle: The A-camera/Super Techno combination is used to capture the scene as Carl (Ioan Gruffudd) and Victoria (Alice Parkinson) fight the torrent in the Flowstone Falls. Bottom: Director Alister Grier (left) and O'Loughlin discuss the next setup.

the camera rigs, or because the shot simply doesn't work in 3-D. An unmotivated pan executed too quickly might be unappealing but passable in 2-D, but it will be unwatchable in 3-D.

"Alister and I spent a lot of time in prep nailing down camera moves and how to motivate lighting in the caves, which had to look both realistic and awe-inspiring," he continues. "The film treads a fine line between the beautiful and terrible — a 'magnificent desolation,' to borrow Buzz Aldrin's famous description of the moon."

In pursuit of a realistic aesthetic, O'Loughlin and his crew subjected the 3-D rigs to the repeated rigors of water, heat, fire, and then more water. Key grip Adam "Skull" Kuiper recalls, "The sets featured massive, high-flow irrigation pumps and full-height studio waterfalls that created huge volumes of mist and humidity. Protecting the 3-D systems in such an adverse environment was a top consideration of the grip department. We had to not only ensure the reliability of all the electronic equipment, including the SuperTechno 50, stabilized remote head and beam-splitter camera packages, but also keep all that water and spray off the lenses! The matte-box system on the 3-D rigs precluded using





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Right: C-camera/underwater operator Simon Christidis uses the side-by-side rig as Gruffudd (left) and Roxburgh (right) enact a scene. Below: Judes (Allison Cratchley, left) and McGuire prepare to enter the Devil's Restriction. Looking on at left is the remotely operated Virgil.



a spinning-glass system, so I thought some form of compressed-air system might work. Through testing, we found that Air Knives, a blade-type technology that delivers a laminar airflow, could be modified and re-shimmed to create a 'twin-blade' primary and secondary compressed-air system. Pure filtered air was delivered to the blades from a large-capacity air compressor via two main feed lines and filters. The system

included a small-flow feeder line into the camera body bag to keep camera temperatures down." The air-delivery system was controlled on set and could be manually adjusted to the requirements of each shot.

When McGuire and the other explorers first enter the caves, they establish what's known as a Forward Base, the staging post for forays into the cave system. It is the flooding of this

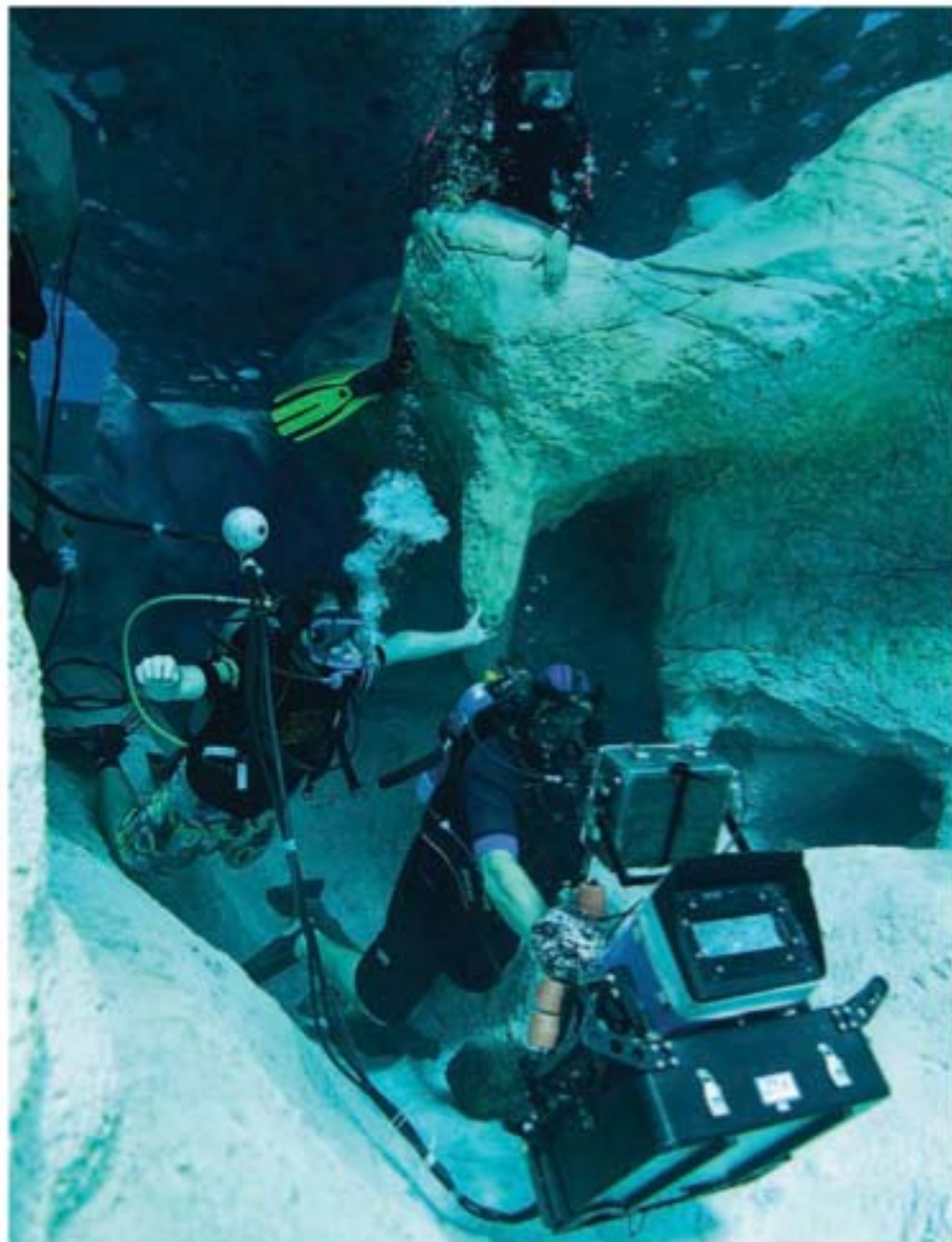
area that sends the team on its desperate quest for another exit. "Forward Base was the first set we encountered," recalls O'Loughlin. "It was both a dry and a wet set, and space was at a premium — there was only 5 feet of clearance between the set and the studio wall, and at one end the set was only 3 feet below the lighting grid. Pre-lighting was an interesting undertaking, to say the least!"

The location is introduced to viewers with a 200' Technocrane move that reveals the full scope of the underground cavern by following one of the explorers through the space. O'Loughlin lit the dry sequences with overhead soft boxes containing four 1,000-watt Parcans through CTS and H1000 cotton-based diffusion, and Arri T-24s gelled with Full CTS that were fired into Ultrabounce at both ends of the stage. A mix of 800-watt Tota Lights, 1' Kino Flo tubes, and Pelican 9430 24-watt LED Remote Area Lighting Systems acted as practical lamps. Strategically placed 5Ks, 1Ks and 650-watt lights, all gelled with Half to Full CTS, brought out the set's texture, and additional Kino Flo units hidden amongst the expedition-equipment



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Right: Christidis lines up a shot of Roxburgh. Below: Grierson (left) and a safety diver look on as Christidis works with the side-by-side rig.



props were used to light the actors.

Important sections of the Forward Base set are the "sumps," submerged passages constructed at each end of the set, and several water pits scattered around the front of the set. To create the impression that the expedition has positioned its own lights in these chambers, O'Loughlin's crew placed 650-watt SeaPars gelled with Full CTB into each of the sumps, and underwater Kinos in the pits. Water-ripple effects against the cave walls were provided by a combination of 200-watt, 575-watt and 1,200-watt HMIs across the surface of the water in the sumps. "When the full fury of the cyclone rapidly floods the Forward Base cave, we switched our dry-light gel packs from CTS to  $\frac{1}{2}$  CTB to create a cool ambient fill, and we knocked out all the practical lights except for the submerged Kinos," explains O'Loughlin. "To simulate the light from the characters' headlamps on the cave walls, gaffer Peter Bushby and his team bounced handheld Parcans off a variety of soft-silver and white reflector boards. Powerful flashlights fired onto the cave-set walls behind the actors heightened the sense of chaos during the flooding sequences."

Bushby details how the Parcans were constructed and used: "To keep the crew mobile, free from cabling and safe, I designed four 24-volt battery pack backpacks for them to wear. We then ran 28-volt aircraft landing lights retro-fitted into Par 64 fittings from the backpacks. The boys could easily move around the wet set, repositioning quickly for each new setup and providing a very realistic replication of the practical lights being carried or worn by the actors. This approach also enabled the electricians to keep pace with the cast when they were running through the waist-deep water!" O'Loughlin radioed instructions to the electricians about the strength and direction of the individual lights during the course of each shot. "It was a complex but finely tuned choreography of actor, camera and lighting, and the guys very quickly became adept at it," says O'Loughlin. "Each and every one of



them did an outstanding job."

Another significant subterranean set is the Cauldron, which almost reached the studio's lighting grid and is best described as a U-shaped shaft with a voluminous tank of water at the base. Grierson wanted to shoot sweeping Technocrane moves across the length of the set. "I asked Alister if we could limit the moves to 180 degrees, so that we could light the set to shoot everything in one direction and make only one major adjustment to shoot in the other direction," says O'Loughlin.

Concerned about lighting the Cauldron with an appropriate level of contrast, O'Loughlin asked production designer Nic McCallum to have the set's walls painted charcoal gray. That way, only the actors' clothing and skin tones sat in the mid-tonal range, while the headlamps created highlights on the walls. "We then hung several 12-by-12-foot Ultrabounces from the grid above the opposing walls of the set, into which we fired [Arri] T-12s with double chocolate gels from the floor to provide a soft but directional  $\frac{3}{4}$  backlight," says O'Loughlin. "Two 18Ks and six Dinettes were directed into a 20-by-20-foot artificial silk from the front of the set; the exact combinations changed with the shooting direction. A T-24 on a dimmer was fired into the sump water on the edge of the set, and, depending on the camera angle, this played as either a subtle, shimmering bounce or a more dramatic edgelight."

When the expedition team is deep underground, lighting is motivated by the sources the characters could take with them when the Forward Base flooded. "If a practical was attached to or being carried by one of our characters, then the light had to grow and decay within each shot as the characters moved," explains the cinematographer. "There are many forms of light utilized by the characters throughout the course of the story, including cyalume sticks, candlelight and even, in one sequence, the light from a single wristwatch." The latter scene features a tracking shot through a narrow tunnel that was achieved with a 6"x12" LED Rosco LitePad attached to the

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O'Loughlin takes a light reading at the A camera.

camera head on the end of a GF-6 crane linked with two lengths of string running back to the monitor. As the actors inched their way through the tunnel, O'Loughlin manipulated the light to match the actor's movements. The effect was further trimmed in the digital grade with the use of a subtle

vignette. Bushby notes, "We were able to retrofit several of the underwater wrist lights for the divers from LED to quartz 35-watt halogen, and the battery packs ran for about 20 minutes. We also modified 300-watt and 650-watt Fresnels from 240 to 24 volts."

The filmmakers built a distinct

color arc into the narrative. For the first section of the cave up to Forward Base, O'Loughlin established a sense of "warmth and wonderment" using mainly tungsten units with various grades of CTS. After the flooding, the spectrum becomes cooler, and as the action progresses well into the cave system, full and sometimes double chocolate gels give the light a "dirtier, earthy feel," says O'Loughlin. "In the section of the cave where the characters are down to using candlelight, we predominantly used flame bars. Some of the final sequences used cyalume sticks as practicals, replicated by Fern Green gels on small China balls." The general approach to color was replicated in the underwater scenes; tungsten sources placed in the stretches near the Forward Base give the light a green hue, and HMIs in the farther reaches of the caves provided a bluer environment.

Underwater scenes were shot at night in the studio's main tank. At the

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beginning of each "day," O'Loughlin, Grierson and Christidis dove down to the set to work out their plan. Back on the surface, Grierson and O'Loughlin used a model of the set to demonstrate the night's work to the cast and the rest of the crew. Using small LEDs, O'Loughlin then outlined the setups for the underwater lighting crew. During actual shooting, O'Loughlin and Grierson worked from a topside video village using aqua-com and open-coms to coordinate any changes.

Throughout the shoot, O'Loughlin viewed dailies on a 46" JVC LCD monitor using a passive 3-D system. "We weren't able to see every single shot on set in 3-D, so viewing 3-D dailies every night was a vitally important means of ensuring that we were on the right track," he says. "[Post facility] Digital Pictures calibrated the monitor before we started principal photography, and I was satisfied that what I was viewing was an accurate approximation of

what we were shooting."

O'Loughlin did *Sanctum's* final digital grade at Digital Pictures in Melbourne, where he worked with colorist Brett Manson. "3-D cinema display devices have an inherent drop in luminance that's caused by the glasses and, on the Real-D system, the Z-Screen," notes Manson. "As a rule of thumb, the grade needs to be pushed a little harder in the brightness values than a 2-D finish to avoid a contrast ratio that's too low onscreen." The picture was graded on a Lustre using the Real-D system. "Once the 3-D grade was complete and rendered out, the DI was done," continues Manson. "The 'best eye' from the timeline was chosen to assemble the 2-D timeline that would be used for the DI, HD and DCP deliverables. For the film pass, footage was converted to a logarithmic color space using a custom-built print LUT. Further grading was undertaken with the print LUT emulating what we

would see on film. Trim passes were also necessary for the HD and 2-D DCP versions because of the luminance differences."

"*Sanctum* was an exciting challenge both technically and creatively," concludes O'Loughlin. "With a world-class team behind me and a director willing to push the boundaries, it was a total blast taking it from concept to the screen." ●

## TECHNICAL SPECS

**1.85:1**  
**(16x9 Original)**

**3-D Digital Capture**

**Sony HDC-F950**

**Fujinon HA 16x6.3BE RM/RD**

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