Camera clarifies underwater inspections

New systems overcome traditional hurdles.

Andrew Safer, Contributing Editor

An underwater camera that takes both high-definition (HD) video and 12-megapixel digital stills has become the camera of choice for a number of contractors and survey companies.

Chris Echols, vice president of Ashtead Technology Offshore Inc., said that the two-in-one feature "allows you to stop at any point along the way in the video and do frame grabs, zooming in very tight and closing in on a certain object such as a crack in a pipe or buildup of marine growth. The image quality is far superior to what people have used previously."

Echols said that since the *Deepwater Horizon* blowout, companies are required to do inspection, repair, and maintenance (IRM) as part of the permitting and regulatory process, which has resulted in increased demand for the camera.

Camera specifics

Developed by SubC Control of Clarenville, Newfoundland, the 1Cam MK II and 1Cam are rated for a water depth up to 6,500 m (21,327 ft). SubC Managing Director Chad Collett worked for Welptega Marine Ltd. as a project manager for subsea inspections of high-strength members such as chain and wire rope that moored FPSOs to the ocean bottom in Australia, the UK, Spain, Norway, Africa, Canada, and the Gulf of Mexico (GoM) prior to joining SubC Control.

"I wasn't happy with the quality of the [video] footage we were getting," Collett said. "We were using some of the best equipment possible. I figured I could do better." The norm in the industry is to use block cameras that are five to 10 years behind what is commercially available.

"We're not limited to the industrial block cameras available from the major camera manufacturers," Ron Collier, sales and marketing director for SubC Control, said. "We use our own circuit boards and proprietary technology to control the camera and interface components."

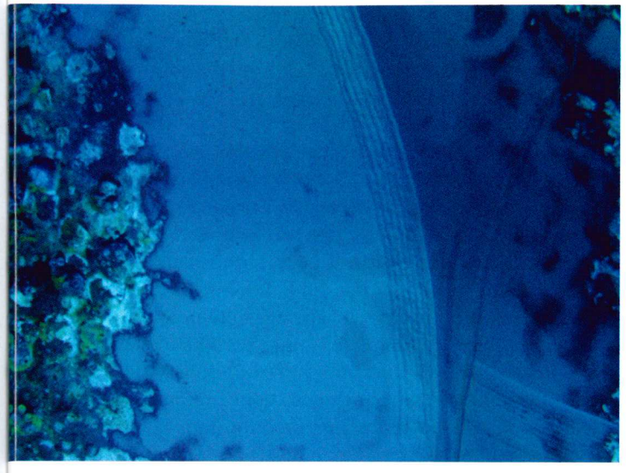
He added that the latest version of the 1Cam includes options for live high-definition (HD) video transmission over fiber or coaxial wire, integrated flash for stills, reference lasers to gauge the size of an object, and an auxiliary output for powering and controlling an external LED light. The company's most recent offering is a wireless video transmission system capable of transmitting HD and standard-definition video up to 5 km (3 miles).

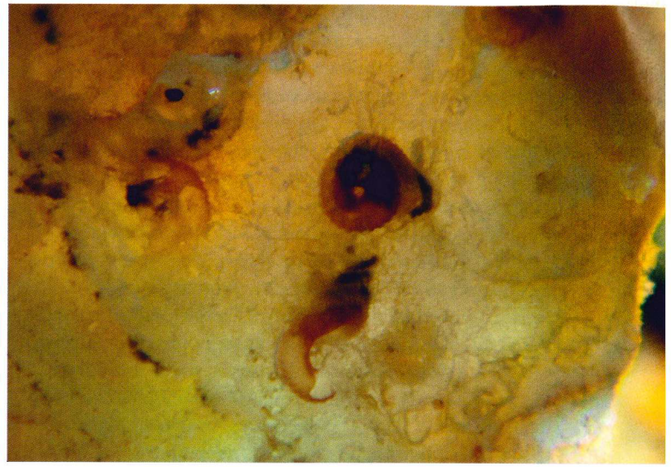
ROVs

Seanic Ocean Systems provides a standard line of ROV tooling including torque tools, flying lead orientation tools, hot stabs, manifolds, and Interface panels. The company designs and engineers products for subsea solutions. Over the last three years Seanic has used a variety of cameras in the process of developing an IRM program for a client.

"Our goal was to provide the best-quality photos and video to the integrity management department of a major oil company," said Mike McGuyer, Seanic's offshore project manager. "The challenge was integrating some of the technology as we moved from one ROV to another. Depending on the age or brand of the ROV, we always struggled with getting quality video." Video quality boils down to the type of video multiplexer, cables, and connectors on the ROV.

SubC Control's 1Cam underwater digital stills and HD camera with lasers includes options for live HD video transmission. (Image courtesy of SubC Control)





LEFT: This pipe photo shows the node weld on a jacket that supports a production platform in the GoM on the continental shelf at 365 m (1,200 ft). RIGHT: This image shows a barnacle that fell on top of the camera lens during a cleaning operation of the welds on a platform. The picture was taken using autofocus in 30 m (100 ft) of water. (Images courtesy of Seanic Ocean Systems)

"You can have a really good color camera, and when you run the signal through 3 miles (4.8 km) of umbilical from the ROV to the control shack, you end up with interference by the time it reaches the topside monitor." This is sometimes caused by the way the junction boxes and pods on ROVs are wired. The problem was that the ground wires often would be twisted together to form a common ground in the junction boxes, and this energized the shield in the coaxial wire. ROV operators would be reluctant to spend time pulling the pods apart to eliminate the interference topside.

About two years ago McGuyer's team became aware of SubC Control's camera through Ashtead Technology. "You could attach this camera to any ROV by hooking it up to standard-definition video or virtually whatever connection the operator had available and have a high-resolution picture because everything's stored in the camera," he said.

When Seanic is asked to participate in an underwater inspection on a floating production platform, engineers typically recommend 1Cam for the high-resolution inspection of the welds, gussets, stress plates, stakes, and risers. "When the topside crew zooms in on the welds, it's as if the weld is 3 in. away," McGuyer said.

Pipe integrity

DimEye of Los Angeles creates 3-D CAD models and high-accuracy measurements from 2-D images, a process known as "photogrammetry," for three oil companies as well as other industry sectors. A key application of this technology for the oil and gas industry, said DimEye President Arnauld Dumont, is to determine the as-built of facilities. "They're never exactly like in the drawings," Dumont said.

Precise dimensions from the 3-D model are required when the company wants to modify an existing installation. Another application provides the dimensions of infrastructure such as a pipe, valve, or riser following an inspection. For example, the company created a 3-D model of a dent in a pipe. Subsea photogrammetry provided the dimensions that showed the extent to which the dent had impacted the pipe's surface. This information enabled the client's engineers to run finite-element computation and determine if the pipe's structural integrity had been compromised.

DimEye uses photographs taken with the 1Cam MKII as part of this process. "For photogrammetry calibration, the optical-mechanical parameters have to be very stable," Dumont said. "We need to know all of the optics, the distortion of the lenses, and the mechanics of the camera." The camera has had fewer failures than others the company has used.

Taking pictures for photogrammatic purposes typically involves manually placing targets on the object and then taking pictures from a number of angles. The targets assist in image correlation. Since this is not feasible underwater, DimEye developed software that circumvents the need to physically place targets on the object. E&P