QUARTERLY / VOLUME 3, NO. 1, SPRING 1998

$6.95 U.S. / $12.95 CANADA / DM 10,50 GERMANY / £4.95 U.K.

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THE INTERNATIONAL TECHNICAL DIVING MAGAZINE

Gearing Up for Design

Research, configurations and field tests

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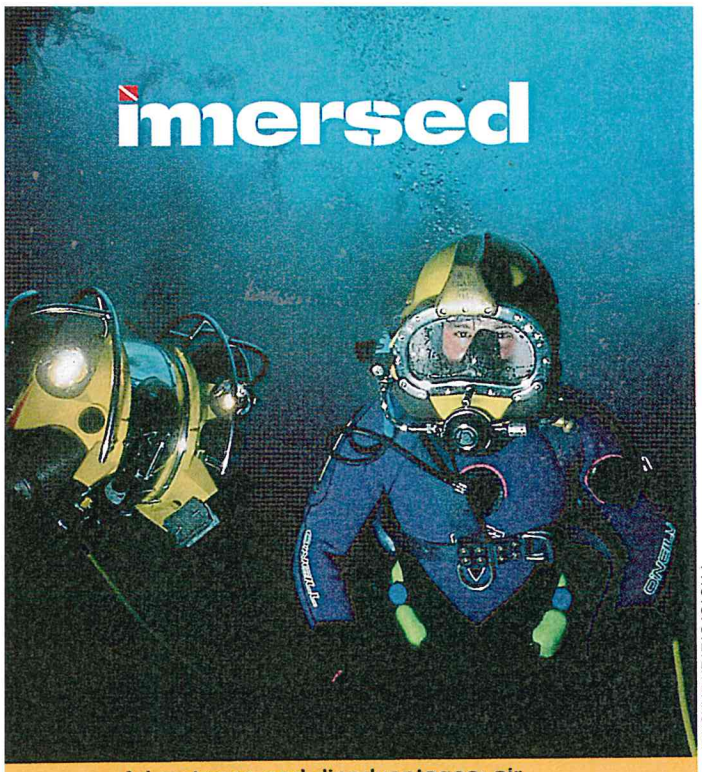

PHOTO: STEVEN BARSKEY

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A technician inspects the Mark 16 rebreather.

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PHOTO: TIPTON PHOTOGRAPHY

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"IMMERSED: THE INTERNATIONAL TECHNICAL DIVING MAGAZINE" is published four times a year/quarterly by Immersed, LLC, 32-74 30th Street, 2nd Floor, Astoria, NY 11106-2957. Subscription rates are as follows: Within the US and US territories – US $25 per year; Canada and Mexico – US $30 per year; all other countries – US $35 per year. Application to mail PERIODICALS postage rates is pending at Long Island City, NY and additional mailing offices. POSTMASTER: Send address changes to: IMMERSED, F.D.R. Station, Post Office Box 7934, New York, NY 10150.

COVER IMAGES COURTESY OF DIVING SYSTEMS INTERNATIONAL (SUPERLITE 27, AND BLUEPRINT DIAGRAM), SARTEK INDUSTRIES (FULL FACE MASK), TAUCHERBIEBL (REBREATHER), DIVEMATICS, INC. (SHACKLE BLOCK WITH 3 SHUTOFF VALVES)

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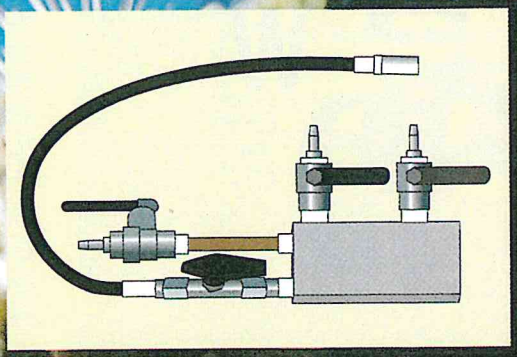
The Universe Below* and *Torchlight 64

How deep sea spying is bringing on a new age of discovery is explored by Pulitzer Prize winner William J. Broad in *The Universe Below*. Robert Louis Stevenson III draws on his own wreck-diving experiences to give realism to *Torchlight*, fast-moving arms-smuggling novel.



Observations on block systems, full face masks and helmet rebreather configurations.

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Rebreather design affects perceived and true low work of breathing.

BREATHING IN REBREATHERS, PAGE 30

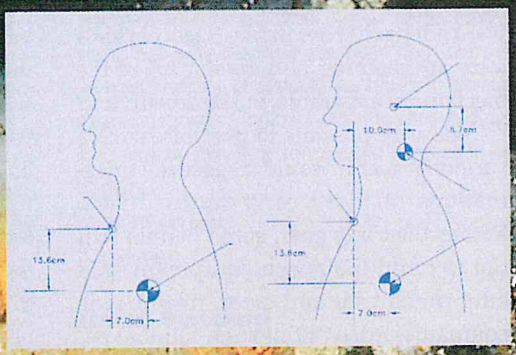


DIAGRAM: JACK KELLON

PHOTO: LARRY COHEN

The beauty of diving North Carolina wrecks.

TECHNICALLY DESTINED, PAGE 50

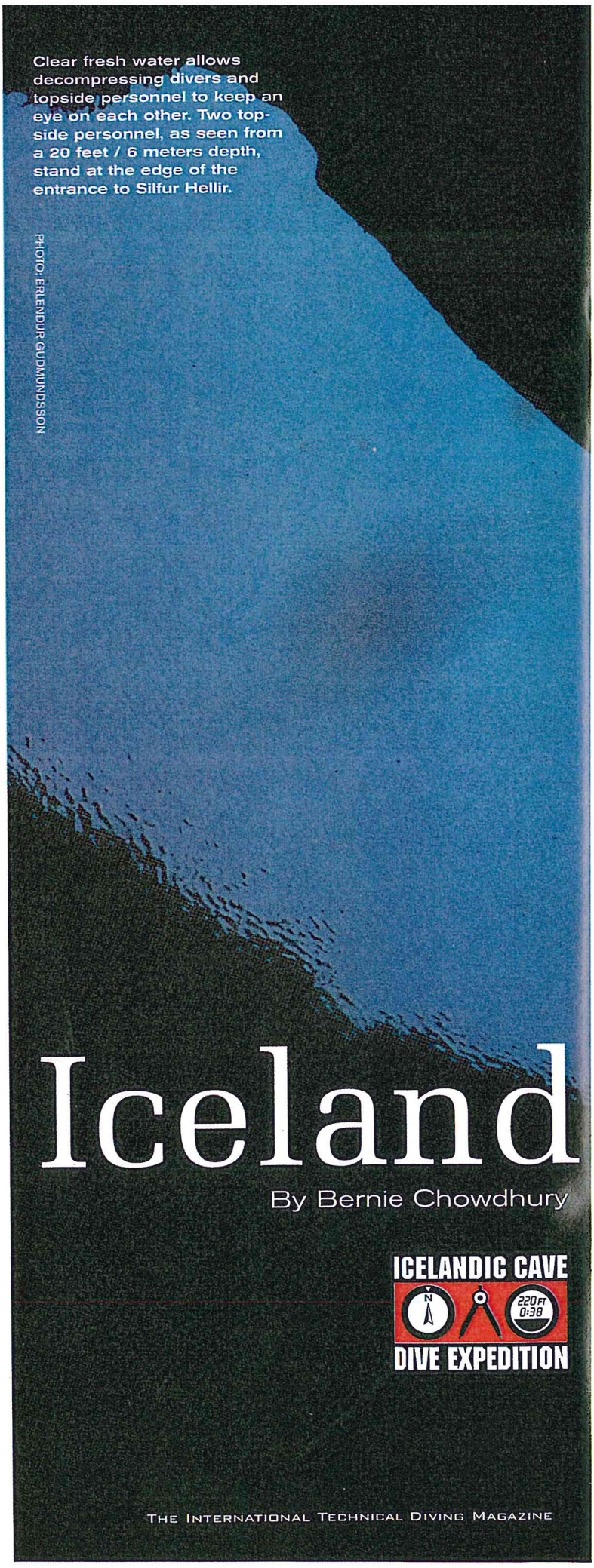
The bone-chilling cold of Icelandic waters was cut by use of a commercial diving helmet on an expedition to survey the only cave system formed by the separation of tectonic plates known to be diveable.

Change is the only constant in this rugged land held sacred by the Vikings. Caves here are less than 10,000 years old, mere infants in a geologic sense, so they provide a chance to document the effects of earthquakes and volcanic eruptions on cave formation. Indeed, geologic activity has altered the landscape since *Immersed* first visited it in 1995 (*Immersed*, Spring 1996). The impressive basaltic-rock-column-lined rooms of Kerauga Cave can no longer be seen by divers—the entrance to the long, shallow lava tube has been sealed by a ceiling collapse. "These rocks will create a complete avalanche if they are disturbed," Canadian cameraman Terry German said. "People shouldn't even be in the mouth of this cave."

SPECIAL REPORT

Return to Iceland

By Bernie Chowdhury



Clear fresh water allows decompressing divers and topside personnel to keep an eye on each other. Two topside personnel, as seen from a 20 feet / 6 meters depth, stand at the edge of the entrance to Silfur Hellir.

PHOTO: ERLENDUR GUDMUNDSSON

With Kerauga beyond reach, the survey team focused on Silfur Hellir, or "silver cave," the rift between the European and North American tectonic plates that forms Iceland's most geologically significant cave. The expedition pushed known bounds to the system to a walled-out restriction at 192 feet / 59 meters. Linear penetration now extends 275 feet / 84 me-

Sunny skies of a preliminary visit to Silfur Hellir in June were starkly contrasted by the driving rain awaiting the team in the fall.

PHOTO: LAUFEY BODVARSDOTTIR

Tight walls of the rift system frame the entrance to Silfur Hellir.

PHOTO: ERLENDUR GUDMUNDSSON

ters, encompassing 783 feet / 239 meters of surveyed line.

While encountering geologic activity is a chance divers take in this volatile region, hypothermia is a condition guaranteed to be faced on every dive. The 35-degree F / 2-degree C water holds a chill that cuts to the bone, especially during extended decompression stops when strains of the dive are most apt to be felt. A Kirby-Morgan SuperLite 27 diving helmet provided significant insulation, reducing thermal protection needs to two, rather than three, layers of underwear.

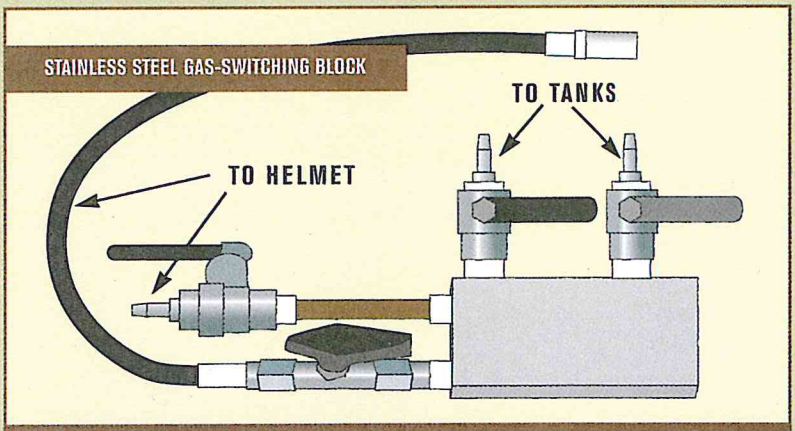
Using the helmet with conventional scuba gear required a bit of adaptation. Its manufacturer, Diving Systems International Inc., Santa Barbara, Calif., does not recommend this use, nor is the liner supplied with the product compatible with oxygen-rich gas mixes used to shorten deco stops. The liner could cause static electricity to form, which is not something a diver wants while offgassing on O2 at 20 feet / 6 meters. Fortunately, the liner of the earlier SuperLite 17 model is O2 compatible and fits the later model. To use the helmet designed for surface-supplied air with scuba, a block system had to be developed. (See Rigging for Success, pages 38-43)

After a custom block machined in Iceland proved to be too bulky and leaky, a unit made by Divematics U.S.A. Inc., Fullerton, Calif., was found to cut both size and air consumption. Air use is increased somewhat by the need to purge the helmet of excess CO2, in spite of an oral nasal mask around the face. However, comfort with the system reduces the urge to purge. As air use approached that of open-circuit scuba, the only drawback of the system is reduced visibility, especially when looking up while swimming horizontally. And although SuperLite is not so light at 27 pounds / 12 kilograms, the unit is neutrally buoyant underwater.

Thermal protection below water added comfort and safety to the effort to document the system. Keeping warm was a necessity because difficulties in assembling the multinational team delayed the start of the project from the summer months

Block Systems for Full Face Masks and Helmets

Full face masks or helmets can greatly reduce risk of hypothermia during long duration dives, and thus add to safety. Yet many of the divers who have tried them have become disillusioned for several reasons, with the lack of adequate and easily available gas switching blocks being high on the list. The following are suggestions to ease their use.



Stainless steel gas-switching block with simple on / off ball valves. The nipples are intended for ScubaPro QuickConnect hose fittings from the diver's gas bottles.

THIS SYSTEM PROVIDES:

- Redundancy in gas supply to both block and full-face mask or helmet.
- Ease of use.

DRAWBACKS:

- Bulky and heavy.
- Ball valves are non-locking and may be turned on or off accidentally at depth, especially while negotiating tight restrictions in caves or tight areas of wrecks.
- Gas mixes that are toxic at depth should not be connected to this system during the entire dive. See above.
- Attaching pressurized gas hoses to nipples requires some force and may take several attempts, especially if you're wearing heavy mitts or your hands are cold. This is not a fast gas-switching system.
- While attaching pressurized gas hoses, gas may be lost as the QuickConnect vent is opened but not fully attached to the nipple .
- A tube extension made to fit both mask / helmet supply hoses (left side of block) with ball valves makes the system unnecessarily bulky.

OBSERVATIONS:

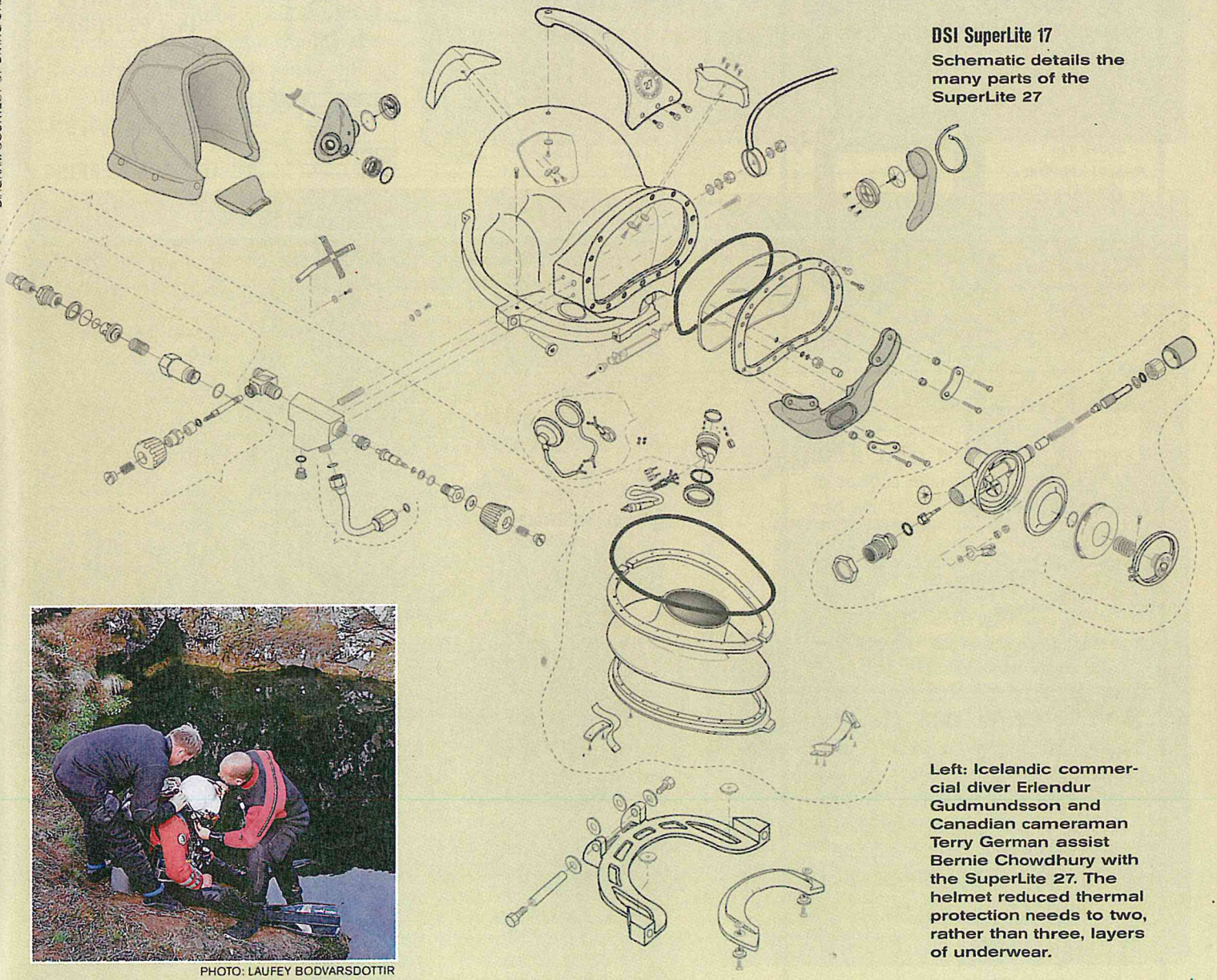
- When both gas supply hoses are connected and ball valves

DISCLAIMER: DIVING SYSTEMS INTERNATIONAL INC., THE SANTA BARBARA, CALIF., MAKER OF THE KIRBY-MORGAN SUPERLITE 27 HELMET PICTURED HERE, DOES NOT RECOMMENDED ITS USE IN SELF-CONTAINED CONFIGURATION. THE HELMET IS DESIGNED TO BE USED WITH SURFACE-SUPPLIED GAS, A DIVING TENDER AND A SUPERVISOR WHO ENSURES THE DIVER'S SAFETY. THE COMPANY DOES NOT WARRANT NOR RECOMMEND THE SUPERLITE'S USE AS DEPICTED HERE. *IMMERSED* PRESENTS THE FOLLOWING FOR INFORMATION PURPOSES ONLY.

PHOTO: ERLENDUR GUDMUNDSSON

A blue helmet liner, standard on the SuperLite 17, was used on the SuperLite 27 because the liner is compatible with the oxygen being used during decompression. There was ample room in the helmet for vision-correcting prescription sports goggles.

DIAGRAM COURTESY OF DIVING SYSTEMS INTERNATIONAL



DSI SuperLite 17

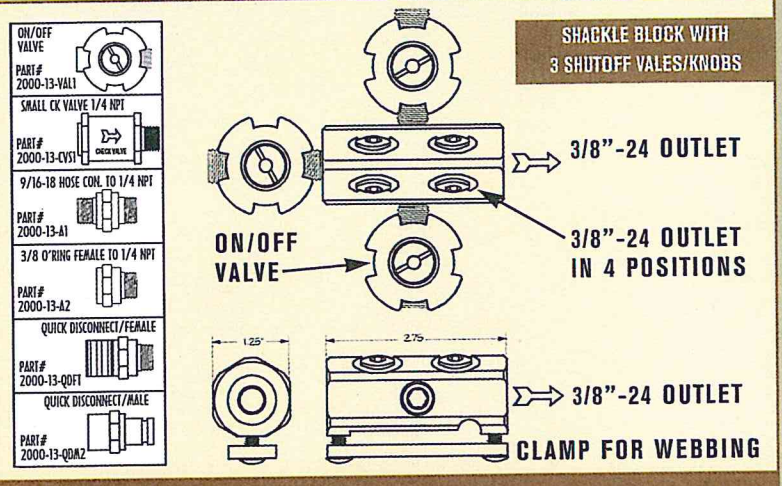
Schematic details the many parts of the SuperLite 27

PHOTO: LAUFEY BODVARSDOTTIR

Left: Icelandic commercial diver Erlendur Gudmundsson and Canadian cameraman Terry German assist Bernie Chowdhury with the SuperLite 27. The helmet reduced thermal protection needs to two, rather than three, layers of underwear.

are on, the hose leading to the first stage with the highest intermediate pressure will supply gas. For dual, independent singles, this means that one tank would be breathed down first, unless the valve leading to the higher intermediate pressure first stage is periodically shut down to ensure both tanks are breathed down equally.

- When using a dual-valve tank manifold, it is critical to know which of your first stages has the highest intermediate pressure. Should a failure require a tank valve to be shut down, you need to know which stage is supplying your gas, and to which ball valve it is connected.



DIAGRAMS COURTESY OF DIVEMATICS, INC.

Commercially available from Divematics U.S.A. Inc., Fullerton, Calif., the Shackle Block is lightweight, trim and has angled ports to allow for multiple hose connections.

OBSERVATIONS:

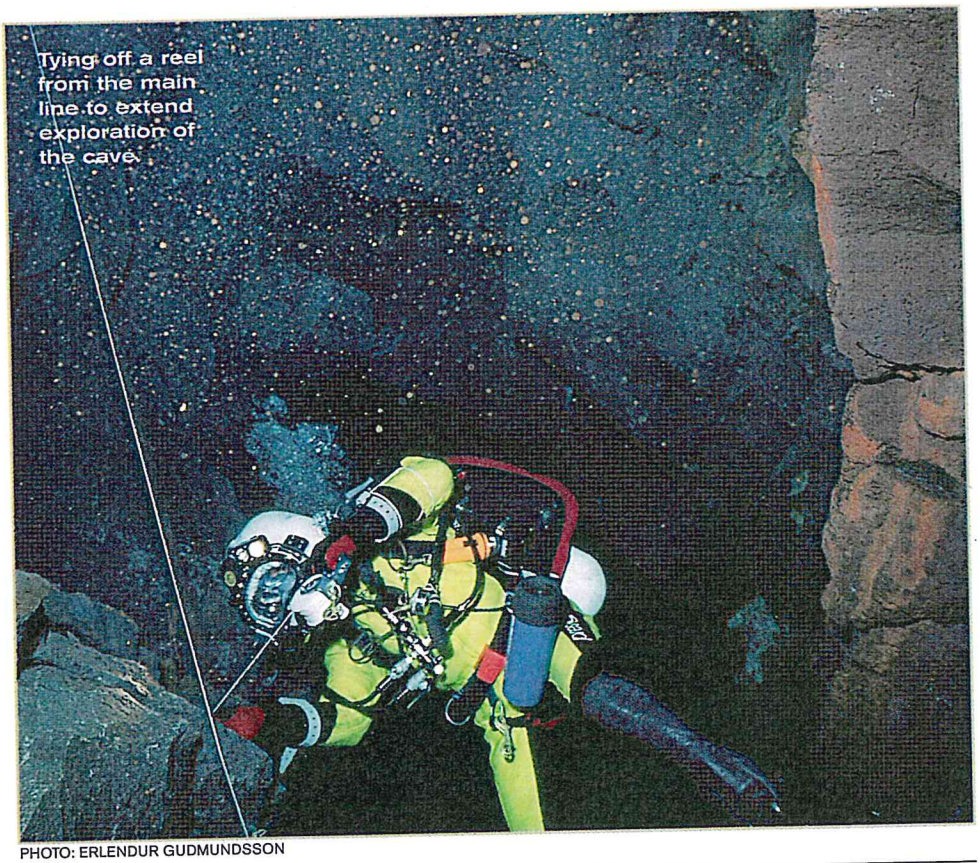
- One or more L connectors are useful in attaching hoses to the block and keeping the system streamlined.
- This system allows QuickConnect hose fittings available from several suppliers or the nipple fitting for ScubaPro QuickConnect hoses to be attached.

PHOTO COURTESY OF SARTEK INDUSTRIES, INC.

Gas-switching block from Sartek Industries Inc., Medford, N.Y., allows divers to use masks without a bulky system or doffing a mask to switch regulators. The gas switch is activated by pushing the white button down or up. A safety clip must be removed before the switch can be made, preventing accidental gas switch activation.

as planned. Instead, crews from ES Productions and SKH Entertainment, both New York, and German's Extreme Explorer Productions assembled in Iceland in the fall of 1997, when a cold driving rain met divers after ascending from hour-and-a-half dives. Filming seemed to cut into exploration when shots had to be set up specifically for the camera, but the effort actually helped to unlock secrets of Silfur Hellir.

Kim Martin initially squeezed through a restriction at 170 feet / 52 meters, but had difficulty on the return. "Kim kept getting stuck," German said. "I think the rocks moved inward and down as he had grabbed them on the way in the restriction. I kept filming him and then after a while, I realized that I was going to have to stop filming and help him get back out." He added with a grin, "You know that would have been a great shot, but I had to save my buddy in-



Tying off a reel from the main line to extend exploration of the cave.

PHOTO: ERLENDUR GUDMUNDSSON

stead of filming his last moments clawing away at the rock!"

After reviewing the film that evening, it was decided to refilm the passage with one diver going through the restriction using a side-mount rig while another diver stood by as a safety. There was the possibility that the dual 400-watt video lights might reveal a passage over the top of the restriction. This would be desirable as the line lay directly under two large boulders whose weight rested on two smaller rocks. Sure enough, the safety diver saw light on the other side of the

Silfur Hellir Cave

THINGVELLIR NATIONAL PARK, ICELAND

TOTAL SURVEY LENGTH:
783 FEET / 239 METERS

TOTAL SURVEY DEPTH:
192 FEET / 59 METERS

CAVE IS COMPLETELY UNDERWATER

SURVEYED BY THE ICELANDIC CAVE DIVE EXPEDITION, SEPTEMBER 1997

OBSERVATION:

- The mask from Ocean Edge, San Marcos, Calif., allows for attaching two regulators, providing second stage redundancy.

ADVANTAGES OF FULL FACE MASKS OR HELMETS

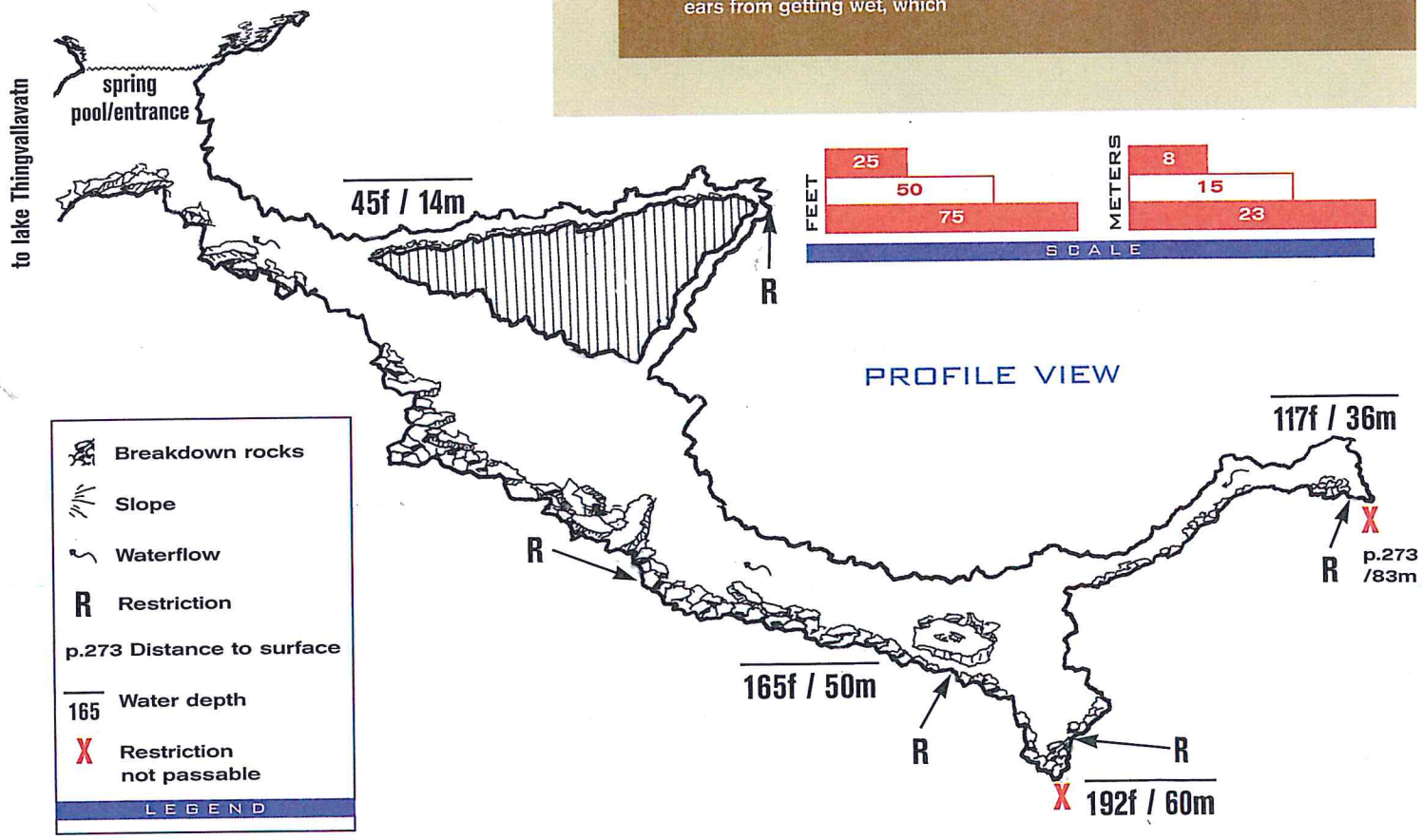
- Far greater insulation, which is critical for dives of long duration or any dives in cold water.
- Optional ability to add diver-to-surface or diver-to-diver communications gear.
- Should toxicity occur, the diver will still be supplied with gas, since the regulator will not fall out of his mouth during seizure. A buddy can switch the diver's gas or bring the diver to a shallower depth where the gas is not toxic. The diver has a far greater chance of survival than if he were using conventional scuba.
- A diver who loses consciousness is much more easily revived if brought to the surface within five minutes than a drowned diver who is on conventional scuba
- A helmet seals the diver from the neck up, preventing the ears from getting wet, which may be a consideration for divers with sinus or ear conditions.

DISADVANTAGES OF FULL FACE MASKS

- Increased gas consumption.
- Increased diving rig complexity requires many hours of training and experience to achieve a high comfort level.
- Greater profile adds drag in high flows or high currents.
- Taking the regulator out of the mouth at the surface to converse or breath air is impossible.

DISADVANTAGES OF HELMETS

- Same as full face masks.
- Although neutrally buoyant in water, the extra weight on the head, neck and shoulders makes climbing back onto land or a dive boat more challenging.
- Limited visibility.
- Once the helmet is donned, the diver is sealed and must breathe from either gas bottles or a hose attached to a compressor. This is true while suiting up or waiting for optimal dive conditions, for example, while wreck diving.

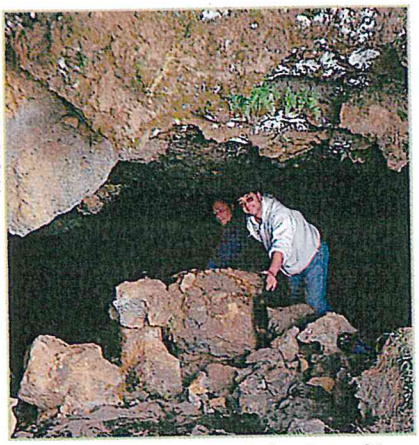


- The helmet cannot be taken off in the water. The diver must get onto a platform—either land or a dive boat—in order to remove helmet and breathe from non-artificial gas supply. This point is critical in open ocean diving: a diver who cannot get back to the dive boat is in serious trouble.

NOTE: Attaching a helmet to a rebreather may offer the advantages of using a helmet and greatly extend the time that it can be worn in self-contained mode, partially overcoming its disadvantages.

PHOTO COURTESY OF TRACY ROBBINETTE

PHOTO: TERRY GERMAN



A visit into the impressive basaltic-rock-column-lined rooms of Kerauga Cave can no longer be made. The long, shallow lava tube has been sealed by a ceiling collapse

Change is the only constant in this rugged land held sacred by the Vikings. It is hoped that the ongoing project will further the understanding of how caves develop and change in a land of intense geologic activity.

rocks when he backed to avoid German, who was ascending to get a better shot. This newfound passage enabled the crew to descend to the end of the system at 192 feet / 59 meters, where a third restriction is now jammed with rocks.

Once the depths of the section had been established, the team focused on the higher section that Steve Berman had been mapping. One team looked for new passages at the 70-foot/21-meter level, while another probed around 120 feet/37 meters. The higher team continued about 100 feet/30 meters off the main line, where a passage became too tight to proceed. A strong flow was coming through the rocks in this area, hinting of openings beyond. Another passage that was too tight to be negotiated with back-mounted tanks seemed to hold promise, but it proved to be a circuit back to the main line when a side-mount configuration allowed further exploration. Although team members were disappointed that the cave did not present long, going passage, it is hoped that the ongoing project will help further the understanding of how these caves are developing and changing in a land of intense geologic activity. ■

Team members were Erlendur Gudmundsson, Palmi Dungal, Vilhjalmur "Villi" Hallgrimsson, all Iceland; Terry German, Kim Martin, both Canada; Steve Berman, Bernie Chowdhury, United States.

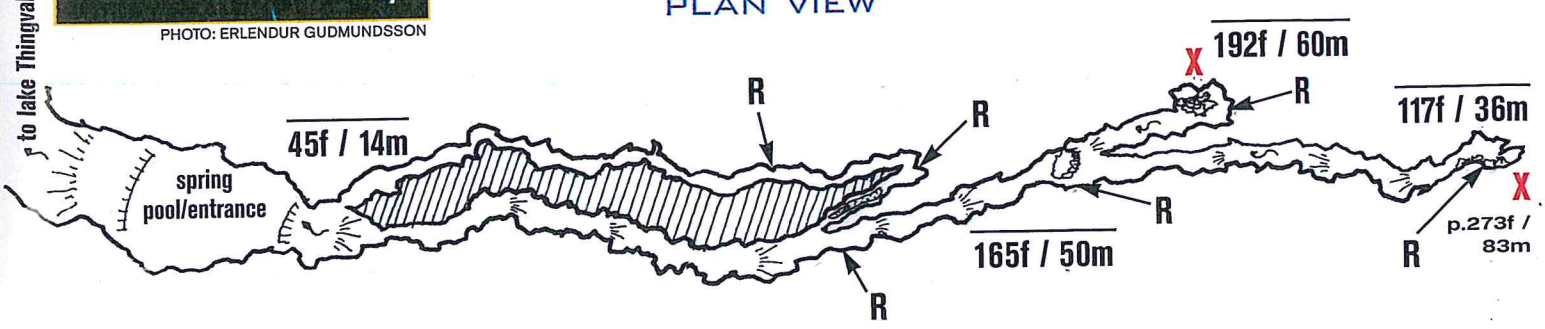
PHOTO: ERLENDUR GUDMUNDSSON

Bernie Chowdhury and Villi Hallgrimsson inside Silfur Hellir with Explorers Club Flag No. 193.

SPONSORS

Assistance for this expedition was provided by Apollo Sports USA, Breathing Gas Technologies, Brownie's Third Lung Co., Diving Unlimited International Inc., DuPont Co., Hertz Car Rental Co., Icelandair, Icelandic Tourist Board, LamarTech/Dive-Rite Manufacturing Co., Manta Industries Inc., Martin Lenahan/Daher Golden Eagle, Nite-Rider Technical Lighting Systems, Northeast School of Scuba Technology, Ocean Management Systems Inc., Unterwasser Kleemann, Lenny Speregen and Captain Joe "Zero" Terzuoli.

PLAN VIEW



MAP CARTOGRAPHY BY STEVE BERMAN