

speleonics 6

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"BETTER CAVING THROUGH ELECTRICAL STUFF"

VOLUME II NUMBER 2

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SPECIAL ISSUE ON LIGHTING



« Axel! Axel! est-ce toi? »

SPELEONICS 6

Volume II, No. 2, Fall, 1986

SPELEONICS is the quarterly newsletter of the Communication and Electronics Section of the National Speleological Society. Primary interests include cave radio, underground communication and instrumentation, cave rescue communications, and cave-related applications of amateur radio. NSS membership is encouraged but not required.

Section membership, which includes four issues of **SPELEONICS**, is **\$4.00 in USA/Canada/Mexico, \$6.00 elsewhere**. Send subscriptions to section treasurer **Joe Giddens** at the address below. If you have a radio callsign or NSS membership number, please include them when subscribing.

Overseas subscription can be paid in U.S. "paper" dollars in the mail. We are informed that an international money-order costs as much as the

subscription! Several have sent cash without problems.

Editorship rotates among the officers. **Volunteer individuals or groups are invited to guest-edit or produce an issue**. A technical session, followed by election of officers, is an annual event held during the NSS Convention.

Complimentary copies of **SPELEONICS** are mailed to NSS offices and sections, the U.S. Bureau of Mines, U.S. Geological Survey, and the Longwave Club of America. Due to the rules and economies of bulk-mailing, a number of promotional copies are sent to NSS Grottos, NSS members, and potentially-interested people, on a random irregular basis. We will send one free sample issue to anyone recommended by a Section member.

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(C-64 graphics by Dan Fox)

Most newsletters suffer from Creeping Administrative Trivia which crowds out real news and articles of lasting interest (See, for example, the August 1986 NSS News). We have plenty of "real" material, so the editorial has been kept short!

We salute our 24 Section members who live outside the U.S. (representing Australia, Austria, Belgium, Canada, Great Britain, New Zealand, Sweden). Their enthusiasm is exemplary, and their cave-electronics are innovative and advanced. Get with it, Yanks!

ANNOUNCEMENTS

Caving Publications Updated: The NSS publication, **Caving Basics**, is now being re-edited by **Tom Rea** to be printed in 1987. **Manual of U.S. Cave Rescue Techniques** is being updated by **Steve Hudson**, for publication this year. Both will have chapters on Caving Electronics and Rescue Communications, written by **Frank Reid**.

Back Issues: All back-issues are currently available. The price is \$1 per issue US/Canada, \$1.50 overseas. Supplies of offset-printed issues 1, 2 and 3 are nearing depletion; we may have to raise the price for Xerox copies. Perhaps we'll publish a "Best of Speleonics" anthology in the future.

Cumulative index available. We maintain a cumulative index of articles published in **SPELEONICS**. We send the index to each new member. Copies are available for SASE, from Joe Giddens or Frank Reid.

Coming next issue: We have a backlog of VLF info including **more cave radio plans**, and experiments with E-field radiators below 10 kHz.

THANKS!

Special thanks to **Don Lancaster** for nice reviews of **SPELEONICS**, and promotion of cave radio, in his monthly "Hardware Hacker" column in **Modern Electronics Magazine** (September, 1986, p. 71 and October, p. 69). Approximately 30 new members have joined as a result, and subscriptions continue to arrive. There were a few inquiries from people who didn't realize that we deal with underground radio in the literal sense, who wanted info on spy stuff, satellite descrambling, etc!

National Speleological Society and "Bats Need Friends" brochures have been sent to our new members who are not NSS-affiliated.

COVER

An engraving by Edouard Riou from the 1867 French edition of Jules Verne's **Journey to the Center of the Earth**. This illustrated edition was the second edition of the novel published. Subsequent English editions have lost the engravings' original resolution, and have obliterated the artist's name. Our cover illustration, reproduced here from a volume owned by **Angelo George**, shows explorers using an electric Ruhmkorff lamp; see the article in this issue.

LETTERS

Dear J. Giddens,

I read with great interest your advertizement in our BCRA Bulletin for your world-wide Newsletter on Cave Communications.

As you may be aware, I have long been interested in this subject, and have written a number of articles on the principles of Magnetic Induction Communication and Location System Theory and Design in the British Caving press.

I include a Xerox copy of the most comprehensive of these with this letter, for your interest.

I would very much like to subscribe to your Newsletter, and possibly contribute to future issues, since I am convinced that the development of an International Standard, in terms of Frequency and Modulation Method will, if adequately publicized and adopted, lead to a breakthrough in Communication Methodology.

This, in turn, will find its place in Expedition and Rescue technology, as well as enabling the keen, active and technologically aware Caving Club, Speleo Group or Grotto to push their discoveries to the limit, and at the same time give them an accurate estimation of the extent of any newly discovered passages.

Yours sincerely,

Dick Glover 258, CROSS FLATTS GROVE,
BEESTON,
LEEDS LS11 7BS
ENGLAND

Dear Joe,

Please put me back on the list and continue my subscription... I will be doing some cave radio work this fall and am constructing now. I will try a simple downlink using a large loop and a very low-power AM just below the edge of the regular BC band. In that way, a cheap radio can be used in the cave. I am basically lazy. Uplink is usual pulse/cw 3495.65 Hz.

Sincerely,

Brian Pease 567 Fire St.
Oakdale, CT 06370

Dear Joe,

If we have expertise in the section on making videos, should we consider making some short videos on cave radios, cave communication, to be available through the NSS or the section to interested people?

Perhaps we could use some of the \$200 [grant from the Alberta Speleological Society] to "develop the tech library." I don't think that would stretch things too much!

Ian Drummond

5619 Dalwood Way NW
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CANADA

[Great idea! Hopefully, we can get video segments from several people, showing the variations in equipment and procedure. I thought that a video camera might interfere with my audio-frequency cave radio, but in a recent test there were no problems.] --FR

Dear Joe,

Thank you for the issues of Speleonics. I enjoy reading them and thus enclose payment for a few more.

The Michie Phone system [reprinted in SPELEONICS 4] is proving to be very reliable and convenient to use. One problem we do seem to have with them occurs during those occasions when the user and cave passage are dry. The solution is simply for the user to place their other hand on the ground to provide the earth path. Unfortunately these conditions are not common and thus cavers tend to forget the need and the principle of operation.

When there is little moisture around their performance is very good. They will even operate (rx) when placed in the pocket of a caver with damp clothing, providing semi-mobile operation.

We are developing a VOX unit to connect the Michie Phone to hand held UHF/VHF radios for true portable operation both above and below ground.

Keep up the good work with SPELEONICS.

Kindest regards,

Barry Were
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5 Hazelwood Ave
HAMILTON
NEW ZEALAND



The next phase of the project is to complete the interface to the telephone (phone patch). Although patch operation is not legal in NZ we feel that it can be justified for emergency use...

We have recently held our second annual Search and Rescue Communications training weekend for cavers. This involved two days of lectures, discussion and practical experience with Michie Phones and the Link plus the HF, VHF and UHF radios likely to be encountered on a rescue. We had 27 cavers involved and as a result expect considerably less apprehension by cavers faced with a communications role during a rescue.

A couple of months ago we had a major rescue - 6 cavers trapped by flood waters. It happened on a Saturday night after I had spent Friday night and all day Saturday finishing the Link. Ironically, I led the underground rescue party and had to communicate with the above-ground Search Headquarters via a relay operator because the radio conditions plus hills, etc rendered VHF signals inadequate for Link operation. No system can be perfect.

We are all into Taiwanese IBM PC Compatibles over here... We are also very envious of the prices you people are able to pay for this type of machine and accessories, i.e., disks at US\$49c compared to the cheapest equivalent here - US\$1.60.

We are contemplating the manufacturing of a run of Michie Phone handpieces, or at least the bulk of it, being the PC board and wiring to the switches. If anyone is interested we could produce a few extra with little additional effort. This is not likely to occur before March or April next year.

Perhaps we could even be paid in floppies or something.

Barry Were

[Contact Barry directly if you want one! --]

86-09-25

I really appreciate to have been on your list of "potentially interested people." ...During the meeting of the Technical and Material Commission at the UIS-congress in Barcelona we decided to use Speleonics as a worldwide forum for information about caving electronics...

In the near future I will send a paper on my DSB cave communication device...to be published in Speleonics... I am a ham since 1961 and my interest in hamradio is constructing and building of equipment. I am also very active in "fox hunting" [hidden-transmitter hunting]. My call is SM5CJW. As a caver in Sweden I have built the different communication devices we use in cave diving.

Just a few days ago we managed to dive four new sumps in one of our biggest caves in Sweden, **Lummelundagrottan**, which is now 3210 m long. Now it is possible to dive a roundtrip in the cave through 8-9 sumps!! The potential of the cave is at least 5-6 km... In order to make our diving more safe we also need more electronic equipment.

73,

Bo Lenander

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S-723 42 Vasteras
SWEDEN

NUCLEAR FLASHLIGHTS!

Terri Fermi

Perhaps the ultimate long-duration cave light is the British-made "Betelight Torch," a tritium lamp with light-emitting area 22 mm (13/16") in diameter, in a durable rubber housing with lens cap, attachment ring and neck lanyard. The thick tritium-gas-filled glass tube contains phosphor which emits soft yellow-green light, a color to which human eyes are especially sensitive. After one 12.26-year half-life, the light is half as bright as when new.

The Betelight Torch, also known as "ranger eye," is intended for commando operations. I bought one from the U.S. Cavalry Store, a military-surplus dealer in Radcliff, Kentucky (near Fort Knox), for \$30, reduced from \$70. The device is marked "SAUNDERS-ROE DEV Ltd HAYES MIDDX UK NATO No. X4/6260-99-965-3582."

Its age is unknown; the light intensity is roughly equivalent to that of the lightbulb inside an electronic wristwatch. It's adequate for reading maps if the eyes are fully dark-adapted, and is especially nice for cave-survey compass illumination. Exiting a cave with only a Betelight Torch would be difficult but possible.

Tritium emits low-energy (18.61 KeV) beta particles which cannot penetrate glass. Less than one percent of the beta particles convert their energy to soft X-rays as they are absorbed, by the

bremmstrahlung effect. **Kevin Komisarck**, physicist at the Indiana University Cyclotron Facility, measured 40 counts per second of 12-KeV X-rays coming from my Betelight Torch. The detector completely surrounded the device under test.

Tritium is dangerous if ingested. The Betelight Torch is estimated to contain a harmless quantity, however, one shouldn't break the tube, allow children to play with it, or carry it in the pants pocket.

Several years ago, Texas Instruments Co. sold LCD digital watches with tritium background-illuminators. These are no longer manufactured, following a scandal about TI's alleged mismanagement of the radioactive substance. You may be able to disassemble a junked watch (carefully, outdoors) and recover the flat glass tritium capsule, which would make a nice compass illuminator. (Suunto and some other brands of compasses are available with internal tritium lights.)

Tritium (${}^3\text{H}$) is made by bombarding lithium with neutrons in a nuclear reactor. It's quite expensive. The government understandably restricts its distribution. Edmund Scientific Co. once advertised rice-grain-sized "betalights" for about \$10 each. A limited number could be sold to one person, and some paperwork was required.

FLASHLIGHT MAINTENANCE

Frank Reid

A cardinal rule of caving is that each caver must carry three independent sources of light, typically, a carbide or electric head-lamp, a flashlight, and a candle. Many "backup" flashlights are unreliable even for changing carbide.

The major cause of flashlight failure is bad electrical contact. TWO MINUTES' PREVENTIVE MAINTENANCE monthly or before a cave trip greatly improves the reliability of any flashlight:

1. **Clean both ends of all cells.** An ink eraser works best, or you can use rough paper, the rough inside of a leather belt, or a pants-leg.
2. Similarly, **clean the spring in the base of the flashlight.** Remove any rust or corrosion with sandpaper or a knife blade. If the spring has become weak, stretch it slightly. If the spring is unreachable because of the construction of the flashlight, retire the light from cave service and get one with a removable base.
3. **Clean other electrical contacts,** including the flat spring that touches the back of the reflector. If necessary, bend the spring inward to increase tension. Some flashlights use this spring as part of the switch mechanism; if a spring used as a switch is bent too far inward, the light cannot be turned off.
4. **Remove and inspect the bulb:** The bottom tip is made of soft solder which gets flattened by contact pressure. A flattened tip may make poor contact. The solder oxidizes rapidly, becoming dark gray and a poor conductor. If the tip is flat and dark instead of round and shiny, replace the bulb or use a small soldering iron to re-form the tip. In the field, remove oxidation by rubbing the bulb tip on a rough surface.

In some flashlights, the battery's positive terminal contacts the bulb tip directly. Constant hammering by the batteries will flatten the tip, and can break the insulation in the base of the bulb if the flashlight is dropped. If the insulation around the tip of the bulb base is broken, replace the bulb or try to repair the damage with glue if new bulbs are unavailable.

If the flange around the top of the metal bulb-base is bent, straighten it with small pliers, or replace the bulb. (Screw-base bulbs have no flange.) If the glass part of the bulb is loose from its metal base, replace the bulb or glue it back together. Silicone glue ("RTV") is best for bulb repair because it sticks to glass and withstands high temperatures.

A quick on-off test is NOT sufficient; essentially-dead batteries will give a few seconds of bright light after a period of inactivity. If the light stays bright for one minute, assume it's good. If the flashlight dims within a minute, flickers when shaken, or must be shaken to make it stay on, "field strip" it as described above before replacing the batteries.

Flashlight components are made of inexpensive metals, and depend upon spring tension to maintain connection. Dissimilar metals + moisture +

electric current = instant corrosion! Condensed moisture can cause almost-invisible films of corrosion inside flashlights, including the best waterproof units. Heavy-duty "professional" flashlights require the same preventive maintenance as less-expensive types.

If water gets inside a flashlight, remove the batteries immediately to prevent discharge and corrosion. Completely disassemble the light as soon as practicable, wash everything with clean water, and dry in a warm place. Before reassembly, clean all contacts as described above.

Flashlight switches can be destroyed by dirt and water. Switches can seldom be repaired. They should not be oiled. In an emergency, use a piece of wire or foil to make a short-circuit across the switch, and partially disassemble the flashlight to turn it off.

A typical flashlight with a type "PR-2" bulb and two fresh carbon-zinc (Leclanche) D-cells is good for only about 2 hours of light. It is designed for maximum brightness but intermittent duty--the bulb takes so much current that the cells can't supply it continuously. Alkaline cells are best for high current. Replacing the PR-2 bulb with a PR-6 will more than double battery life, at some sacrifice of brightness. Avoid continuous duty when possible; batteries last longer when allowed to rest a few minutes between uses.

My favorite flashlight is the 2-cell military-surplus "elbow" flashlight (beware of the "Official Boy Scout" lookalike). The Army flashlight is inexpensive, durable, waterproof, and has compartments in the base containing spare bulb, colored filters (for that commercial-cave effect!) and diffusing lens. There's also a thick white plastic filter which attenuates the light to almost nothing, presumably for combat use. The light comes with a pair of low-current, long-life PR-6 bulbs; uninformed cavers have complained that "Army flashlights aren't bright enough." The PR-6 bulb and alkaline D-cells can provide 30 hours of light. The flashlight has a spring clip on the back and a lanyard ring on the bottom. For night driving or flying, I clip the light onto the shoulder harness for hands-free operation.

Disposable flashlights are not cost-effective and are not recommended. They are built as cheaply as possible, on the false premise that the batteries will die before anything else can go wrong. I've dissected several types-- Like other flashlights, they use spring tension to maintain contact. Some of their non-leakproof carbon-zinc cells showed signs of corrosion even when "new." Disposable flashlights cannot be disassembled for repair, and are too unreliable for caving.

Alkaline cells ARE worth their extra cost; an alkaline D-cell contains 9 to 10 ampere-hours, depending on manufacturer. Cells are marked with the date of manufacture but the information is usually encoded.

Cells stored for long periods should be kept outside the flashlight. Cavers sometimes keep cells nose-to-nose inside their spare 2-cell flashlights, to prevent discharge if the switch is accidentally turned on. Remember, however, that in an emergency you need light immediately and can't afford to fumble in the dark and risk losing pieces.

