

speleonics 7

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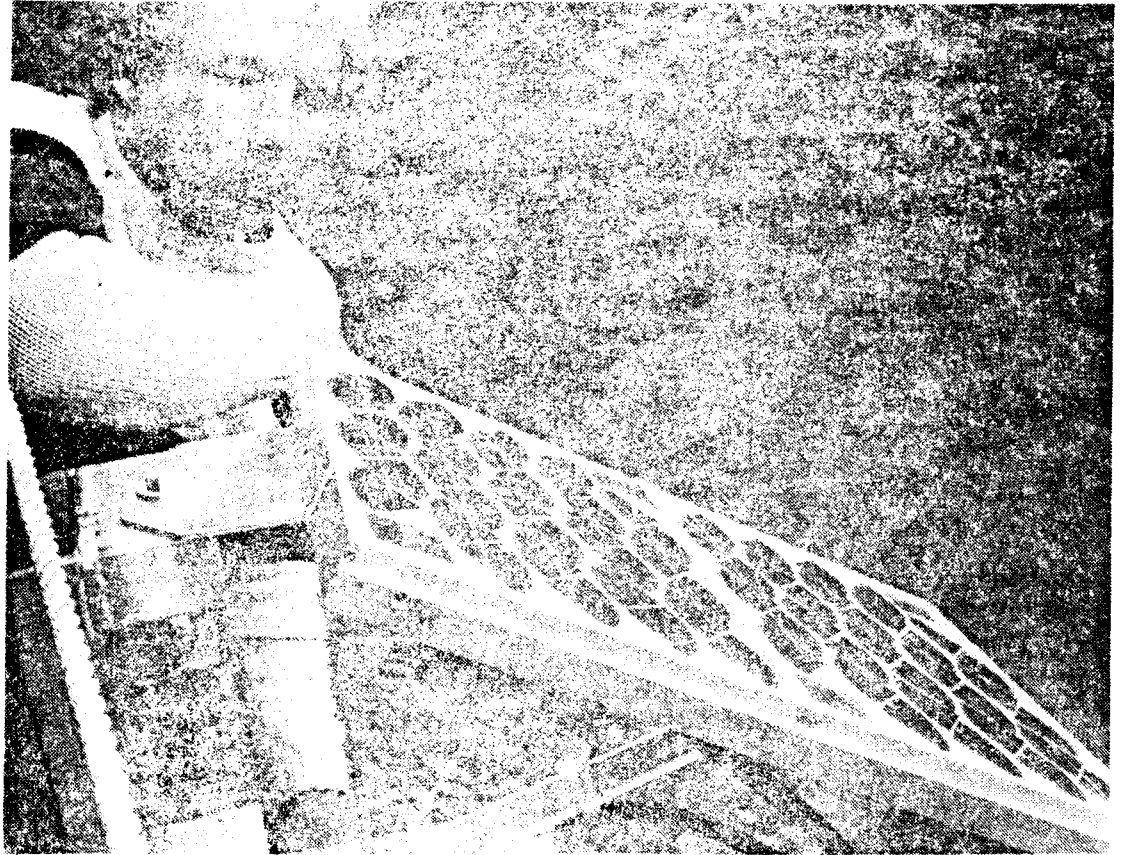
1987

"BETTER CAVING THAN HIGH ELECTRICAL BUDGET"

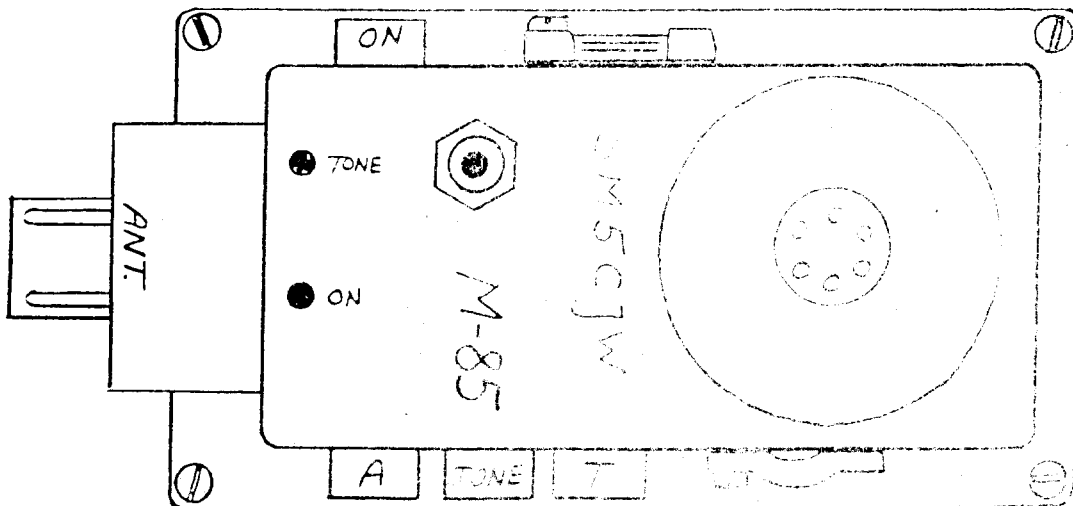
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SOLAR POWER AT A CAVE RESEARCH FIELD STATION

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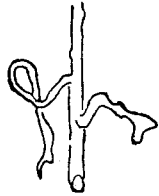


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DOUBLE-SIDEBAND
VOICE CAVE RADIO
TRANSCIVER FROM
SWEDEN

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ANNOUNCEMENTS

Information Wanted: CAVEMOBILE ELECTRONICS

Many cavers spend more time travelling to and from caves than they spend underground. If you have unique ways for making this most dangerous phase of caving safer or more pleasant, please write an article or send a letter to the editor. We'd like to hear about radios, sound systems, lights, radar detectors, navigation, heaters, coolers, auxiliary power systems, anti-theft systems, also ingenious nonelectric devices or strategies (tools, safety equipment, ways to hide valuables, etc.).

ERRATUM

We apologize for omitting Mexico from the list of countries represented by our foreign members [SPELEONICS 6].

COVER

(Top): Dave Zoldoske inspects the photovoltaic array that powers radio, cave telephone, and instrumentation at the Cave Research Foundation's study site at Lilburn Cave in Kings Canyon National Park, California. The installation is 130 feet up in a fir tree. [See article by Howard Hurtt]

(Bottom:) Swedish caver Bo Lenander's 32-kHz double-sideband cave radio (top view, actual size). The 6.4cm-thick unit contains the battery. Complete plans in this issue!

LETTERS

Dear Frank,

87-01-20

...Julian Coward and myself are about to make some more ASS Cave Radios [SPELEONICS 5], so we will be getting a batch of PC boards made-up. We will sell extra sets at cost, so if you know of anyone who is interested, tell them to write.

I tested my "giant" antennas last weekend. Using 10 watts PEP, we were able to get two-way speech between two points on the surface, one 480 m above the other with 1100 m separating the two sites. The 13 m square antennas are not moveable, of course, so there was no rotation to try and get an optimum orientation. We just slapped them down and turned on. I am hoping to try them in Castle-guard this spring. We can get about 550 m depth at one point in the cave. At this range and frequency we will have lost the classic directional properties of the magnetic field, so the giant antennas are only of use for communication and not for surveying.

Ian Drummond

5619 Dalwood Way NW
Calgary, Alberta
CANADA T3A 1S6

Dear Ian,

28-Jan-87

As you know, I have been interested in the development of reliable and "idiot-proof" cave radio systems for over 20 years, but it is only within the last 10 years that advances in micro-electronics have resulted in the availability of small, light-weight and cheap integrated circuits for use in low frequency magnetic induction two-way speech systems.

While working at Lancaster University in the 1970's, I collaborated with... Bob Mackin to design and build a prototype SSB system operating at 102.4 kHz, and generating 10w of transmitter power. We used 12-way ribbon cable, mounted on collapsible X-shaped perspex frames, to give 1m by 1m square loop antennae, for both underground and surface sets. We experimented with this equipment, which we called the SPELEOPHONE, mainly in the Gaping Gill system, and found that the range for both speech and tone... was in excess of 350 feet, except where the surface was covered with an appreciable (10m) thickness of peat bog and glacial drift. This reduced the range significantly, to about 100-150 feet, due to the relatively high conductivity of the boggy ground cover... The other major limitation on range that we found was the occasional very high level of LRF signal we encountered with the surface set, particularly when operating on top of the limestone benches in certain south-westerly facing Dales. We never positively identified the source of the interference, but assumed it to be some sort of aircraft navigation beacon system, or VLF radar. The curious feature was the way the shape of the valley appeared to focus the interference, almost as if the valley was acting as half a horn antenna!

In the late 70's, Bob Mackin and I parted company... He was grant aided by Yorkshire Television to produce a version of the Speleophone for use by cave divers, to enable Geoff Yeadon and Oliver Statham to talk to the surface, and their position followed on the surface, while they completed the Kingsdale Master Cave - Keld Head

through dive. The dive was filmed by Yorkshire Television as it happened, and later broadcast as "The Underground Eiger." ...We never published any details of the Speleophone, other than a brief abstract in the Proceedings of the 1977 Sheffield ISU Conference.

Subsequently, Bob Mackin moved to the Engineering Department at Lancaster, and enlisted their aid to further develop the system and market it, under the name of the MOLEPHONE. This, I am told, can be purchased from the Engineering Dept, for 1300-1400 Pounds + VAT, for a pair of sets, batteries and loop aerials. At this price, only the grant-aided Northern Cave Rescue Organizations have been able to buy it. However, both the Settle-Ingletton CRO and the Upper Wharfedale Cave and Fell Rescue Organization now have several systems each, and use them regularly both on practice and actual rescues. I am told that the equipment is so ruggedized and reliable that it is taken for granted, and that the rescue teams have pre-prepared lists of correlated surface and underground locations for all the major cave systems in their respective areas. There is no doubt that the Molephone now regularly plays an important and time (and life) saving role in cave rescues in the Yorkshire Dales.

I know of three recent British expeditions which used... cave radios. Two were cave diving expeditions to Greece and Norway, both made in 1985, and documented in the Cave Diving Group Newsletter No. 78, January 1986. Filmed reports of both were shown on TV in this country late last year. The third expedition was last summer's CRO/Army visit to the Gouffre Berger and the Scialet de la Fromagerie. I... will enquire as to what use was made of the Molephone during the expedition.

As far as I am aware, no use is being made in Britain of cave radio techniques for data transfer from underground equipment or for measuring ground conductivity.

In May, June and July 1986, 3 parts of an article describing the TROGLOGRAPH, a CW cave radio system transmitting at 3.2768 kHz, and designed by Mike Bedford, appeared in the British hobby electronics magazine ELECTRONICS TODAY INTERNATIONAL, published by Argosy Specialist Publications Ltd., 1 Golden Square London W1R 3AB. I contacted Mike through the editor, and found that he was a micro-electronics software/hardware engineer working... on CAD graphics display terminals... We have met several times since then, and I have given him copies of all my articles etc., together with SPELEONICS Nos. 1-6. He is trying to re-create your A.S.S. system using ICs currently available in Britain, and operating at the Molephone frequency... We hope to commence prototype tests sometime this year. In particular, we want to examine the spectrum in the 100-200 kHz band to find the frequency with the least RF noise consistent with acceptable attenuation through limestone with 5-10m bog and drift cover, and to experiment with ribbon cable loop antennae to find a design giving a depth range of 200m+ without being too cumbersome. We will keep you posted...

One of the problems we face in this country which does not appear to trouble you so much in North America is one of licencing. It took me a lot of time and a visit to London to get even a develop-

(LETTERS continued)

ment licence for the Speleophone, and I do not know what licencing arrangements are necessary for the Molephone. Once I find out, I will let you know so that the details can be published in Speleonics. In addition, I will try to get a general article published in the BCRA Caves and Caving Bulletin mentioning Speleonics, and requesting all interested British cavers to get in touch with you and I and suggesting they become subscribers. We might end up with our own specialist BCRA Communications Section!

Regards,
258 CROSS FLATTS GROVE,
BEESTON,
LEEDS LS11 7BS.
United Kingdom
Phone: (0523) 701062

Dick Glover

[Sidebands of the 100.0-kHz LORAN-C navigation system (see SPELEONICS 5) might cause interference. The LORAN transmitter nearest the British Isles is in West Germany. There are 14 LORAN stations in continental US (more are planned) and 11 in Canada and Alaska. --F. Reid

Dear Frank,

Thanks for the Smart Compass plans [see SPELEONICS 6]. I've ordered one of the coils to experiment with. I disassembled the code and found out how it works: T and L are $\sin \theta$ and $\cos \theta$. They are divided in software to give $\tan \theta$ over 0-45°. An arctan is done via table lookup, corrected for quadrant, and displayed. The accuracy is ultimately limited by the coil winding accuracy (i.e., T & L are exactly 90° to each other). To get sub-degree accuracy will require a better A/D and bigger arctan lookup table, but that's easy. I'll keep you posted.

Jim McConkey
7304 Centennial Rd.
Rockville, MD 20855

Someone requested information on WWVB receivers. We lost the letter, but here are some references:

WWVB is a time/frequency-standard station operated by the National Bureau of Standards at Fort Collins, Colorado. The 60-kHz frequency is relatively free of propagation-anomaly errors. Time information is digitally encoded; see [2] below:

1. "A WWVB 60 kHz Frequency Comparator Receiver" by Ernest P. Manly appeared in 73 Magazine, Sept. 1972. The now-obsolete RTL integrated circuits in this design can probably be replaced with CMOS. It's similar in function to the Hewlett-Packard 117A VLF Comparator but has no phase-locked oscillator output.
2. Don Lancaster published plans for a 60-kHz WWVB receiver with time-code output, in Radio Electronics magazine, August 1973, p. 48. Methods of phase-locking are discussed.
3. "Low-Frequency Receiving Techniques," a series of articles by R. W. Burhans in Radio Electronics, March-July 1983, describes state-of-the-art LF/VLF active antennas, and a method for using LORAN-C (100 kHz) for time and frequency calibration. These are valuable references for cave-radio experimenters. A set of reprints, with errata/addenda, is available from the author for \$4.00 postpaid:

Burhans Electronics
161 Grosvenor St.
Athens, Ohio 45701

Send SASE for catalog. See also Dr. Burhans' three-part article about Omega navigation receivers (10-14 kHz) in Byte magazine, February, March, April, 1977.

EMERGENCY WATCH-REPAIR FOR CAVERS

Frank Reid

I've successfully repaired several cavers' digital watches which failed after taking water during cave trips, just by opening the cases (as soon as possible), removing and drying the batteries, and putting the watch guts in a warm (not hot) place for a few hours. An electric hand-dryer also works-- A National Cave Rescue Seminar participant was amazed to see an electronic watch repaired in a National Park campground bathroom, using only a Swiss Army knife!

Clean all battery terminals and contacts before reassembly (I use a pencil eraser). The only difficult part is making sure that pushbutton contacts are not bent during reassembly.

Here's more watch-repair advice, received through <rec.ham-radio> an international computer-mail distribution. It was signed "Joe N2XS":

When taking-apart digital watches it is important not to touch anything inside with your bare hands. The DNA from your skin is enough to cause a bad

contact. Almost all problems with digital watches are contact or battery problems. Dampen a VCR cleaner swab or lint-free cloth with tuner-spray and clean all visible contacts. Do not spray the inside directly from the can. Also, look for bent contacts; they are very small and easily damaged.

YOU, TOO, CAN BE A BIG-NAME CAVER!



Just Xerox the above emblem on colored paper, cut out, glue onto an old political campaign button, and wear it at the NSS Convention!

