SPELEONICS 23

COMMUNICATIONS AND ELECTRONICS SECTION OF THE NATIONAL SPELEOLOGICAL SOCIETY

Volume VI #3
August 2002

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SPELEONICS is published irregularly by the Communications and Electronics Section (CES) of the National Speleological Society (NSS). Primary interests include cave radio, underground communication, cave lighting, and cave related applications of amateur radio. NSS membership is not required.

Contributions of articles for publication is **highly encouraged**.

Better Caving Through Electrical Stuff

The Section logo and motto, *Better Caving Through Electrical Stuff*, which first appeared in *SPELEONICS* 1, was presented in it's color form in *SPELEONICS* 22 and can be viewed on the Section web site. The URL for the site is : http://www.caves.org/section/commelect/

The logo on the right was modified by Paul Jorgenson from that proposed by Steve Reames for the Survey and Cartography Section, which, in itself, was inspired by the International Caver Symbol. I propose that this be the International Cave Electronics Caver Symbol. Steve's logo was presented at the NSS 2002 Convention in Camden, Maine.

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Future Articles Needed

Message from the Editor

Publish or Perish was the message from the last issue of *SPELEONICS.* While hardly a regular publication schedule has been established, you ARE reading the second in one years time - as much as was accomplished in seven years previously. *SPELEONICS* still has a long way to go before we can get the respect of all of our members. There are papers being published elsewhere of projects being done in our back yard. I don't blame the authors for wanting their ideas put forth in a timely manner, but hope that consideration be given to having *SPELEONICS* be that forum. The email boxes (and snail mail...) are always open. When more articles are are submitted, the faster the next issue comes out.

Section Status with the NSS has been clarified and codified. It seems that the NSS Section paperwork (if there ever was any...) was lost. A great deal of work was done behind the scenes by Brian Pease and others to get a viable Constitution and By-Laws written for the times that we find ourselves in. Great discussion and streamlining was accomplished at the Section Meeting during the 2002 Convention. A lean Constitution and By-Laws was passed by the very good turn out of members. A new structure, slightly different from the past, has emerged and will serve as the framework for the future of the Section.

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Constitution

Communication and Electronics Section
of the
National Speleological Society

I. NAME

The name of this organization shall be the Communication and Electronics (C&E) Section of the National Speleological Society.

II. PURPOSE

The purposes of this organization shall be the same as those of the National Speleological Society, with the additional purpose of organizing NSS members and others with an interest in communications and electronics to better promote the objectives of the NSS.

III. GOVERNING

(1) The Communication and Electronics Section shall be governed by an Executive Committee made up of the following officers (Chairs) elected annually by the members: (a) Executive Chair, (b) Secretary-Treasurer, (c) Communications, (d) Publications. (2) The Executive Committee shall have complete power to manage the business of the Section. (3) Decisions or actions of the Executive Committee may be overruled by a two-thirds majority vote of the members.

IV. MEETINGS

(1) Executive Committee and General Meetings shall be held at such times and places as are determined by the committee.

(2) A petition signed by two-thirds of the membership shall be mandatory upon the Executive Committee to call a special meeting for the purpose stated in the petition.

V. MEMBERSHIP

(1) Full Membership is limited to members of the NSS.

(2) Other classifications of membership may be defined in the bylaws.

VI. NATIONAL SPELEOLOGICAL SOCIETY

The Constitution and Bylaws of the National Speleological Society shall be binding on the Communication and Electronics Section. Any action inconsistent therewith shall be null and void. In the event of dissolution of the section, all assets remaining after meeting outstanding liabilities shall be assigned to the National Speleological Society. However, if the named recipient is not then in existence or is no longer a qualified distributee, or unwilling or unable to accept the distribution, the assets of this organization shall be distributed to a fund, foundation, or corporation organized and operated exclusively for the purposes specified in Section 501(c)(3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future U.S. Internal Revenue Law).

VII. AMENDMENTS

Amendments to this constitution may be proposed either by the Executive Committee or by a petition of ten percent of the members in good standing. Adoption of the amendment(s) shall require a three-quarters vote of the members voting, provided that notice of the General Meeting and the content of the amendment(s) shall have been announced to the membership by mail, email, or at a meeting at least 30 days prior to the time at which the vote will be taken. The total votes cast must constitute at least 51% of those members who sign in at the meeting where the voting takes place.

Bylaws
Communication and Electronics Section
Of the National Speleological Society
July 15, 2002

MEMBERSHIP

The Membership consists of those who attend an annual General Meeting and/or the C&E session at the Annual NSS Convention and who sign the roster with their name and email (or regular) address. The duration of membership shall be 5 years from the last meeting attended if the members dues are not in arrears.

Applications

Applications for membership shall be in writing, as specified above, and shall be accompanied by dues as specified herein. All applications for membership shall be acted on by the Executive Committee. There shall be two classes of members:

Full: Is an NSS member, has full voting rights, may hold office, and receives any generally distributed publications.

Associate: Are not NSS members, may vote on matters not affecting the NSS, may not hold office, and receives any generally distributed publications.

Dues

The amount of the dues, if any, their due dates, and the collection procedures shall be determined by the executive committee.

Termination of Membership

Membership shall be terminated for nonpayment of Section dues. A member dropped for non-payment of dues may be reinstated automatically upon payment of current Section dues. Membership may be terminated if the member fails to respond to inquiries from a member of the Executive Committee.

Expulsion

Members may be admonished, suspended from certain privileges, or expelled from Section membership for any of the following reasons:

(1) Willful misuse of Section property or facilities.
(2) Willful disregard of the safety of themselves and/or others while participating in a Section activity.
(3) Conduct detrimental to the Section and/or the National Speleological Society.

Disciplinary action under this provision shall be taken only upon a three-quarters vote of the Executive Committee by a secret ballot. Disciplinary action shall be initiated only upon presentation to the Executive Committee of a written petition for disciplinary action, submitted by at least two members of the Section not in the same household.

Upon receiving such a petition, the Executive Committee shall take such actions as are deemed necessary to notify the accused members or members, in writing, of the petition, and of the place, date, and time at which the petition will be considered by the Executive Committee. The accused member or members shall have the right to speak on their own behalf. Such considerations shall take place no sooner than twenty-one days and no later than seventy days after the Executive Committee receives the petition.

ASSESSMENTS AND GIFTS

No special assessments may be made against members of the Section. The Executive Committee may solicit voluntary contributions of money or time for specific purposes. A charge may be made for the Section's special publications and extra copies of regular publications, and fees may be collected for the use of the Section's property when approved by the Executive Committee.

Gifts and bequests may be made to the Section in any form or amount and for any use compatible with the purpose of the Section.

A charge may be made to non-members for: attendance at Section-sponsored activities; use of the Section's equipment and library; copies of publications, maps, and other data, and inclusion of non-members on the Section's mailing list.

EXECUTIVE COMMITTE

Duties

In addition to the general duties of governing the Section, the Executive Committee members shall have the following specific duties:

Executive Chair: The Executive Chair shall be the executive head of the section: call and conduct meetings; prepare and submit the yearly report to the NSS; create and maintain a membership database; and shall be the designated Section contact person.

Secretary-Treasurer Chair: As Secretary, the S-T chair shall keep the minutes of all general membership and Executive Committee meetings, maintain all Section correspondence except for that which has been delegated to other officers by the Executive Committee, and maintain a file of all Section directives. As Treasurer, the S-T chair shall care for all funds of the Section and disburse and manage the funds as directed by the Executive Committee; distribute back issues of *Speleonics*; and be prepared to provide a report of the treasury status at any meeting.

Communications Chair: The Communications Chair shall be responsible for publishing the Section Web Pages including the electronic version of the newsletter *Speleonics*.

Publications Chair: Solicits editors and articles for *Speleonics*.

Elections

Executive Committee Elections will be held during the annual General Membership Meeting of the Section at the NSS convention. The Executive Chair with approval of at least two-thirds of the rest of the Executive Committee members shall select candidates for the Executive Committee from among the Section members (who are also NSS members). The Executive Chair shall appoint one of the Section members to act as moderator and preside over the elections. The moderator shall not be a candidate in the upcoming election that they are moderating. Additional nominations of members may be made from the floor at the general meeting provided that such nominations are seconded and subject to acceptance by the member so nominated. Approval of a candidate shall require 51% of the members voting.

Term of Office

Those elected each year shall take office on the day following the annual meeting at the NSS convention.

The Executive Committee shall have the power to remove any Executive Committee member who, without just cause, fails to fulfill the duties of their office, including simple neglect, in such a manner as to cause potential harm to the Section.

Vacancies on the Executive Committee that occur shall be filled for the balance of the term by chairman's appointment, subject to majority approval of the rest of the Executive Committee.

Proxies

Any member of the Executive Committee may appoint a member of the section as a proxy to act for him or her at a meeting of the Executive Committee. Proxy may act at one meeting for only one Executive Committee member. The presiding officer must be notified of such proxy appointment directly or in writing by the absent Executive Committee member before the proxy may be allowed to serve. Authorization should state if discretionary voting powers have been given to the proxy.

Other Attendees

Committee chairmen may attend meetings of the Executive Committee and have the privilege of speaking on matters relevant to the committee's function but shall have no power to vote by virtue of their chairmanship. Any other member of the section may attend Executive Committee meetings and may be granted the privilege of the floor at the discretion of the presiding officer but shall have no power to vote.

Executive Committee Meetings

There shall be at least one Executive Committee meeting each year. The time, place, and date shall be provided to the membership before the date of such meeting. The Executive Committee shall determine the date, time, and place for any special meetings. A quorum at an Executive Committee meeting will be fifty percent of the members of the Executive Committee.

Directives

Each action approved by the Executive Committee, which establishes new policies or administrative procedures can be designated as a "directive" or "act". The secretary of the Section can be made responsible for maintaining a file of such directives and be responsible for notifying the membership directly or in writing of their adoption. This is similar to "standing orders," described in Roberts Rules. This is optional.

GENERAL MEETINGS

There shall be at least one General Meeting of the membership each calendar year. The date, time, and place of this meeting, normally at the annual NSS convention, shall be provided to the membership before the date of such meeting. The Executive Committee shall determine the date, time, and place for these and any special meetings.

A quorum at a General Meeting shall be 51% of those members who are present at the meeting.

PARLIAMENTARY AUTHORITY

Robert's Rules of Order, as revised, shall govern all procedural questions arising at all meetings of the Section when they are applicable and when they are not inconsistent with the Section's constitution and bylaws.

COMMITTEES

Committees shall be established by the Executive Committee to execute the work of the Section. Chairs of the committees shall be appointed by the Executive Chair of the Section, subject to the approval of the Executive Committee. Each committee chairman shall select shall select the personnel and promote the activities of his committee. All committees will operate under the direction and approval of the Executive Committee other than the Elections Committee.

FINANCES

The Section may acquire real and intangible property, including equipment, literature, and other materials for use by and on behalf of the membership. The fiscal year is the calendar year.

PUBLICATIONS

The Section will issue and distribute to the members in good standing issues of *Speleonics* when they are published, through the section's website or by other means. The Section is also empowered to issue and distribute special publications, subject to regulations governing the subject matter, publication dates, sales, and distribution as prescribed by the Executive Committee.

STORE

The Section may maintain a Section Store for the convenience of members, friends, and associates, which will be limited to speleologically related goods appropriate to the policies of the Section.

DISSOLUTION

In the event of dissolution of the Section, all assets remaining after meeting outstanding liabilities shall be assigned to the National Speleological Society. However, if the named recipient is not then in existence or is no longer a qualified distributee, or unwilling or unable to accept the distribution, the assets of this organization shall be distributed to a fund, foundation, or corporation organized and operated exclusively for the purposes specified in Section 501 (c)(3) of the Internal Revenue Code of 1954 (or the corresponding provision of any future U.S. Internal Revenue Code).

AMENDMENT

All proposed amendments in these bylaws must be presented to the entire membership and notice given to the members of the place, date, and time of the General Meeting at which the amendment(s) will be considered for adoption. This notice shall be given not less than twenty days prior to the designated meeting. Adoption of the amendment(s) shall require a two-thirds vote of the members voting, and the total votes cast must constitute at least 51% of the full members who sign in at the meeting where the voting takes place.

Section Officers 2002-2003

With the new Constitution and By-Laws have come slightly different Officer positons than in years past. The Secretary and Treasurer positions have been combined. New positions for Communications and Publications were created. Each term runs from NSS Convention to NSS Convention. The duties for each office can be read in the By-Laws.

Serving the Section this year will be:

Executive Chair

John T. M. Lyles
P.O. Box 95
Los Alamos, NM 87544-0095
505-455-2565
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Secretary-Treasurer Chair

Brian Pease
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Communications Chair

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614-801-2066
gary@wgbush.com

Publications Chair

Paul R. Jorgenson
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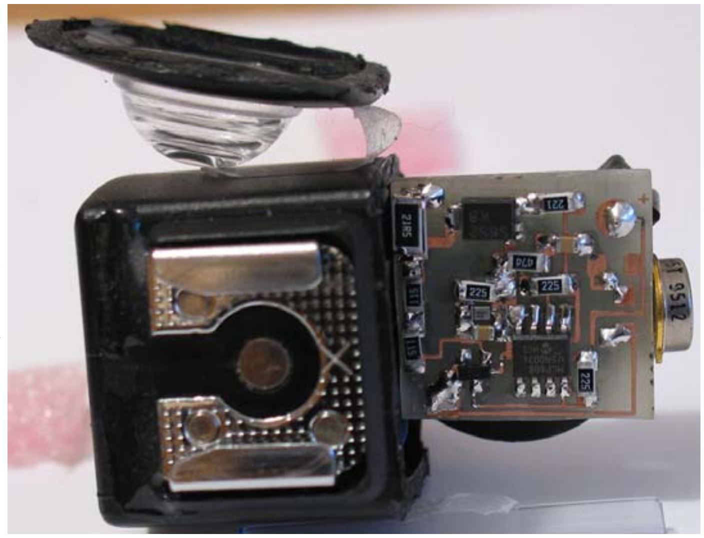
Yet another Sensitive Slave for Flash Photography

by Ted Lappin NSS #22298



Introduction

I designed and built a photo flash slave unit to connect to my existing commercial flashes. As an occasional cave photographer, I find myself using an off-camera flash. I bought a Vivitar slave many years ago to trigger a flash. However, this cheap slave is not very sensitive, frustrating my picture taking. As an engineer, I decided to design my own slave. I had been working with low power op-amps and decided that it might be possible to build a sensitive flash slave with stingy enough power requirements to run on a single coin battery.

Overview

An acceptable slave must be reliable, small, low power, mostly unaffected by ambient light, and sensitive. I wanted a slave that requires no special handling. I did not want to have a bulky box or a fragile cord. All of my flashes use a hot-shoe connector and I decided that I could use that connection for the slave. A small battery is acceptable as long as I don't have to worry about leaving it on or replacing the battery every month (or year). Since the primary use of the slave is in a cave environment, the ambient light requirement is not quite as critical since very high intensity ambient is rare (but can occur in entrances and in commercial caves). Finally, the slave had to be sensitive enough to work around corners and other obstacles.

Design

A flash slave consists of a light sensor, amplifier, and switch. In addition, I added components to turn off the amplifier when a flash is not connected to the slave, removing any requirements for a power switch.

The light sensor is a Centrovision silicon photodiode that I found at a local electronics store. This is a surplus part that is probably similar to photodiodes available from Digikey. The active area is 15 square mm and is most sensitive to light at 850 nm. The photodiode is zero biased. According to the documentation, the photodiode is most sensitive when reversed biased. However, for a photo slave, the sensitivity is sufficient when zero biased. Light on the photodiode causes a positive current to flow out of the anode. The photodiode is connected with the anode at ground, causing a negative current to flow out the cathode.

The amplifier is really an AC amplifier since we want to detect a fast increase of light from the triggering flash. Ambient light, which is assumed to change relatively slowly, is filtered out to prevent the majority of false triggering (bright LED lights can create the fast increase of light when switched on, causing a false trigger in some cases). However, higher ambient light tends to decrease the sensitivity, presumably due to saturation of the sensor causing lower sensitivity to small changes in light energy.

The op amp chosen is an ultra low-power op amp manufactured by Microchip. In addition to having a low power consumption in the 20 uA range, it has a low input offset current (important for amplifying the pulse from the sensor), rail to rail operations, and a chip select. When the chip select is held high, the power consumption drops to 50 nA.

The output of the photodiode is coupled through capacitor C1 to the op amp. This coupling removes (most of) the ambient component of the current developed by the photodiode. The op amp amplifies the resulting current pulse. R1 is required to pass the charge through C1. Most of the current from C1 flows through R2 since the input of the op amp is essentially 0 volts (and therefore, R1 has 0 volts across it). Therefore, the output of the amplifier is –R2*(input current). The input current is negative, resulting in a positive output. To create the output voltage of .8V required to trigger Q2, the current through C1 must be –(.8/R2) or approximately 350 nA. From what I can determine without spending hours on the math, this translates to something on the order of 2 foot-candles at 550 nm (close to the peak wavelength of the flash). However, this approximation assumes a single wavelength of light. Since the flash radiates at a temperature instead of a wavelength, the minimum light from the flash required

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Sensitive Flash Slave

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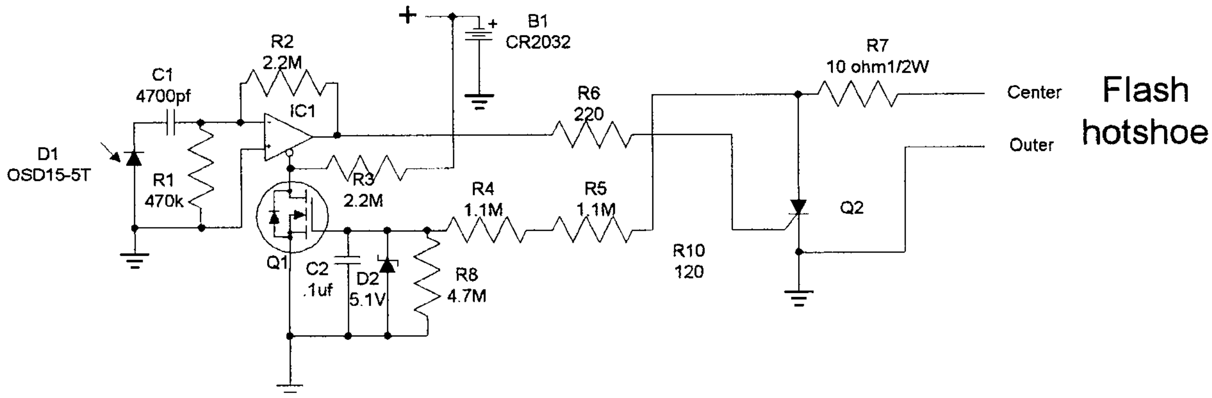
Edward Lappin



		Digikey part
B1	CR2032 lithium battery	BS-3 (holder)
C1	4700 pf	311-1133-1
C2	.1 uf, 50V	311-1140-1
D1	OSD15-5T CentroVision	
D2	5.1V, 200mW Zener	BZT52C5V1SDICT
IC1	MCP608 low power op amp with CS	MCP608-I/SN
Q1	BSS138 N-channel MOSFET	BSS138ZXCT
Q2	S6S2 600V SCR	S6S2CT
R1	470K 1/8W	P470KECT
R2,3	2.2M 1/8W	P2.2MECT
R4,5	1.1M 1/8W	P1.1MECT
R6	220 1/8W	P220ECT
R7	10 1/2W	P10WCT
R8	4.7M 1/8W	P4.7MECT

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to trigger the slave is probably much lower.

This output is connected to the switch, Q2, which is a sensitive gate SCR. This shorts the terminals of the flash, causing it to trigger. When the flash completes its cycle, the voltage on the hot shoe is released, causing Q2 to turn off. In my testing, a Vivitar 283 flash creates a current spike of many amps for approximately 1 uS. This may damage Q2, hence the addition of R7. However, R7 may be causing more problems than it solves. If R7 is too high, the Vivitar does not trigger correctly. Also, if the load on the flash (R4 and R5) is too high, the Vivitar flash refuses to trigger. My other test flashes (Olympus T20 and T32) are low voltage trigger flashes and do not require much current to trigger. Neither of the Olympus flashes are affected by R7 since each triggers with a current in the 10 uA range. The circuit requires a flash to present a positive voltage on the center terminal of the flash (relative to the edge connection to the hot shoe).

To minimize power consumption, the chip select of the op amp is held high when the slave is disconnected from the flash. Q1

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pulls the chip select low when a voltage is detected on the hot shoe as C2 is charged through R4 and R5. D2 protects the gate of Q2 and R8 discharges C2 when the flash is removed. Since all of my parts are surface mount, I used two resistors for R4, R5 since each resistor has a maximum rated voltage of 200 volts. This allows a 400-volt flash to work with this circuit. To turn on the circuit, a voltage of 2.5 volts (approximately) must be present on the hot shoe. This is based on the gate turn-on voltage of Q1 and the values of R4, R5, and R8. Raising the value of R8 will allow use of even lower voltage flashes. I did not do this since the minimum voltage is sufficiently low for my purposes. Alternatively, R4 and R5 could be lowered but that will increase current for high voltage flashes, possibly preventing their triggering (as in the case of my Vivitar 283).

In summary, this circuit requires a flash to have a center positive voltage of 2.5 to 400 volts when ready to trigger. The peak current is limited to approximately 5-6 amps for a 100-volt flash by R7 and Q2. When the flash is connected, the battery drain is approximately 20 uA, resulting in a life of over 1 year for the 220 mA-hour CR2032 battery. When the flash is disconnected, the battery drain is approximately 100 nA (at the limit of my amp meter), resulting in far less current drain than self-discharge.

Construction

To keep the package small enough, I designed and etched a circuit board and used surface mount components. The board is single sided with all components, other than the light sensor and battery holder, on the copper side. All of the components on the copper side are surface mount components, available from Digikey.

Packaging

To package the unit, I bought a no-name flash slave from a local photo shop. I cut off the front of it using a Dremmel like tool. Then, I removed the old circuitry (which consists of a photodiode, SCR and a couple of resistors). The inside of the slave package is big enough to hold a board that is 21x21mm in size with a modified battery holder for a CR2032 battery. The battery holder required some shaving to fit in the limited space.

The board is inserted in the old slave with a piece of plastic (I used flexible plastic that can be stuck on glass without any adhesive) to insulate it from the contacts of the hot shoe. Then, after soldering the wires to the old slave hot shoe and inserting the battery, I added some foam and epoxied the front back on the unit. The resulting slave is the same size as the original, slightly heavier, and works much better.

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Testing

To test the unit, I took the slave and a couple of flashes out to a nearby soccer field during the night. Using an Olympus T32 flash at quarter power (resulting guide number of 52 feet at ASA 100), I was able to trigger the slave at a range of 1/4 mile! I figured that was sufficient sensitivity. Later, I took my camera to the local museum of natural history and found that the slave flash would fire when someone else used their flash in another room. I have not determined a range in a cave, but it seems to work. Even with a digital camera that fires the flash twice, I can use the slave with my Olympus flash on automatic (or 1/4 power), flashing the slave flash twice. I suspect that not all flashes can cycle quickly enough to do this and if the flash is used at anything near full power, it will not work correctly. Luckily, my camera has various ways to prevent the double flash.

Conclusion

So far, the only problems I have with this slave are related to the old Vivitar 283 high voltage flash. The voltage on that flash is over 200 volts with no load and even a few uA of load causes that voltage to drop in the 100-volt range. When the voltage is reduced, the current required to trigger the flash seems to go up. Given that the flash requires at least 6A for 1 uS to trigger with no load, this is a problem. When it fails, the flash fires on every other trigger, perhaps because of some state change in the triggering circuit of the flash.

In addition, connecting a powered-up and ready Vivitar 283 to the slave results in the firing of the Vivitar. I am working on a fix for this but it may be more complex than it is worth (instead, either leave the slave on the flash or turn on the flash after connecting).

Alas, one of my prototypes had failed. Opening it up, I found that a wire between the hot shoe and the board had broken. Careful packaging is required to prevent the wires from bending too much when the unit is dropped. Using a heavier gauge wire will help.

Instead of epoxy, I tried silicone sealant and that seems to work. It is messier to work with than the epoxy but it is easier to open the unit to replace the battery (or broken wires, whatever the case may be).

The photos show the slave inside the old commercial slave housing.

I am not interested in manufacturing this unit myself at this time. If anyone is interested, please contact me.

Ted Lappin

A Camera Flash Adapter Cord

by Ted Lappin NSS #22298

Introduction

Recently, I bought a Canon digital camera. This camera has a hot shoe on it for Canon flashes (particular ones, namely expensive ones). I, however, do not have any Canon flashes and have no desire to spend lots of money on one. Searching the web for the camera hot shoe specifications, I found that some people believe that the camera hot shoe tolerates no more than 6 volts (current not specified). That seemed like a reasonable limit for a solid-state switch. Given that I have a Vivitar 283 flash, which presents over 200 volts to the camera and generates a spark when you trigger it manually (i.e., a surge of many amperes), I needed an adapter. There are commercial adapters available but I wanted one with a cord for off-camera flash

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without a slave.

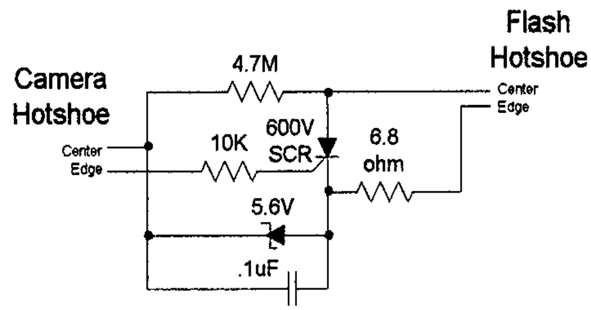
WARNING

I offer no guarantees that this will not fry your camera. If the SCR were to short out the wrong way (very unlikely), it could present a high voltage to the camera. Additionally, anyone building this circuit should check the voltage on the camera connection with the fully changed flash before connecting the camera to make sure there are no wiring errors. Personally, I prefer to use my lower voltage flashes (but greater than 6V) for most of my work.

Note

Note that the resistor values are wrong in the pictures. I later changed the design to make sure the Vivitar would fire by lowering the resistor in series with the SCR. I also lowered the gate resistor value to make sure that there is enough current to fire the SCR. Use the values in the schematic.

Flash cord adapter



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Overview

One website that I visited had a circuit for using an opto-isolator to protect the camera from the flash. I thought that this was overkill since the camera needs protection from current and voltage, not isolation. Additionally, that particular circuit required a battery (or power from the flash which then removes the isolation). Given that the flash provides power through it terminals, I figured that a sensitive gate SCR could be triggered from the energy provided by the flash.

Design

The flash cord adapter consists of a switch and a power source for the switch. When the camera opens its shutter, it shorts (more or less) the flash terminals together. This triggers the flash. However, to protect the circuitry in the camera, the flash cord adapter reduces the voltage presented to the camera and limits the current presented to the camera when the flash is triggered. This is simply done by regulating (loosely speaking) the voltage from the flash into the 6V range. The zener diode acts as a shunt regulator along with the 4.7 Mohm resistor. The high value is necessary to prevent the power source from firing or loading the flash. My low voltage flashes only need a current on the order of 100 uA to trigger. The .1 uF capacitor stores the charge to give sufficient current to trigger the SCR. The 10 Kohm resistor limits the current flowing through the gate of the SCR when the SCR is triggered (and to provide more protection to the camera if the SCR were to short out the wrong way). If you re really paranoid, try adding another zener diode across the camera terminals (something like 10 volts so it will not interfere with the rest of the circuit; I have not tried this). The 6.8 ohm resistor is protection for the SCR, limiting the initial current pulse when an old high voltage flash is triggered. I used a SCR rated for 10 amps and a surge of 100 amps (EC103M from Digikey), which may make this resistor optional.

This design assumes that your flash is center terminal positive. If this is not the case, you will either have to reverse the connection or possibly add a bridge rectifier to the circuit to make the adapter work for any flash. I believe that almost all flashes are center positive. Use a voltmeter to confirm your flash's polarity.

Construction

I built the adapter using a hot shoe connection at both ends. To connect to my camera, I used a coiled cable with PC connections (those small pin connections) at each end. My camera only has a hot shoe connection. I bought an adapter (no electronics in it) that plugs onto my camera and has a socket for the PC connection. I removed the connector from one side of the cord for direct connection to the adapter board. If your camera takes a PC cord without a hot shoe, you can skip the extra hot shoe plug adapter and just connect the cord directly into the camera.

I etched my own one-sided circuit board with room for all of the components and a place for the flash to connect. The circuit board has a connection in the middle (a big round one) and two long and skinny pads for the outer connection of the flash hot

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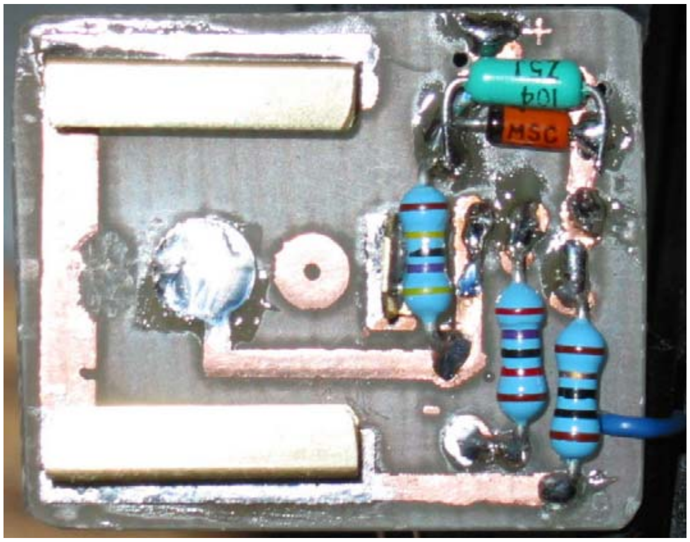

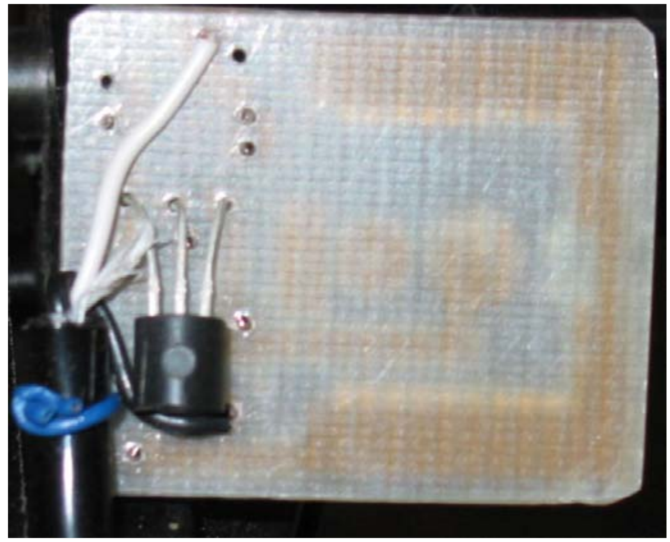

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shoe. To make this outer connection, I bought some brass U-bracket at the local hardware store that was big enough to fit around the flash base (it measures 1/4 inch outside the U and 3/16 inch inside the U). I cut 2 U-brackets to the same length as the hot shoe on the flash and soldered each piece on the board (you want it fairly close in but not so close that the flash does not slide easily). I also cut and sanded the corners to get rid of the sharp points. Then, I cut another piece of the U-bracket in half (making a L shape) and soldered it down on the board to act as a stop (again, trimming the corners). Make sure your flash's center contact aligns with the board's center contact when the flash slides into the stop. The center contact is also soldered to provide protection for the board copper. Note that the center contact should not interfere with extra connections your flash may have. I have an Olympus T32 flash that retracts the extra contacts if a mating hole is not in the right place. The rest of the board has the parts other than the SCR mounted on the flash side with the cord tied off on the back (for strain relief). The SCR is mounted on the cord side to save space (it lays flat on the board). The circuit and the cord are covered with silicone sealant to protect the circuit and to protect the cord connection.

Unfortunately, I bridged the outer connection of the flash hot shoe by going across the front of the connector. This means that the flash contacts are shorted as the flash is inserted. Next time I will go around back with the trace or use a wire jumper. Also, the circuit has an extra pad behind the center connection. This is not necessary and can be removed.

My flashes clamp down on the hot shoe using either a lever or wheel. This provides a firm connection to the adapter. Some outer hot shoe contacts push up or down and others push from inside out. Check your flash to see if the U-bracket sticks far enough in to make a good contact. Also, it is likely that only one side of the flash really connects to the hot shoe (the other side may not have any metal connection at all).

Testing

To test this adapter, connect the flash to the adapter board, charge the flash, and measure the voltage across the connector for the camera. The voltage should be below 6 volts and the center of the hot shoe should be positive (for a direct PC connection, the center wire connection should be positive). You should be able to fire the flash by shorting the camera connector. If all is well, try it out on your camera. On my camera, a micro switch senses whether or not a flash is present on the camera. If a flash is present, my camera does NOT fire that annoying pre-flash. The flash control on the camera is disabled and the external flash is triggered every time. The internal flash is disabled as well.

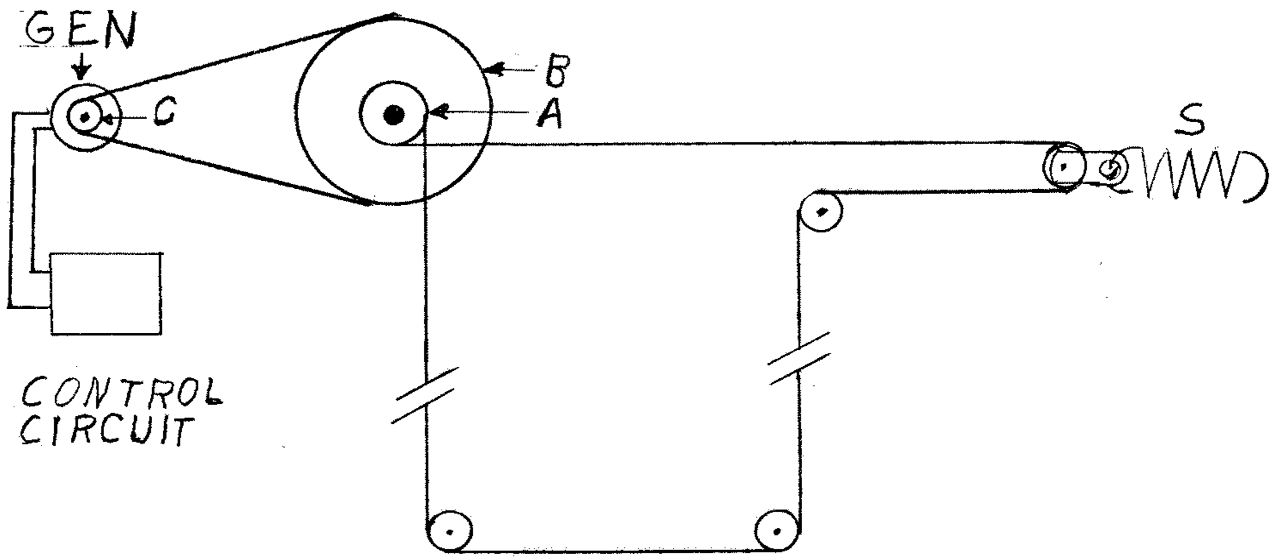
Conclusion

This adapter cord has been very handy for taking pictures. I just have to be careful not to put my flash directly on the camera by mistake. However, since the high voltage Vivitar 283 flash is bigger than my camera, it feels "wrong" to put it on the camera. Thus, I am not tempted to directly connect it to my camera. Leaving the cord on the flash also reminds you that it is not a good idea to directly connect the flash to the camera.

Ted Lappin

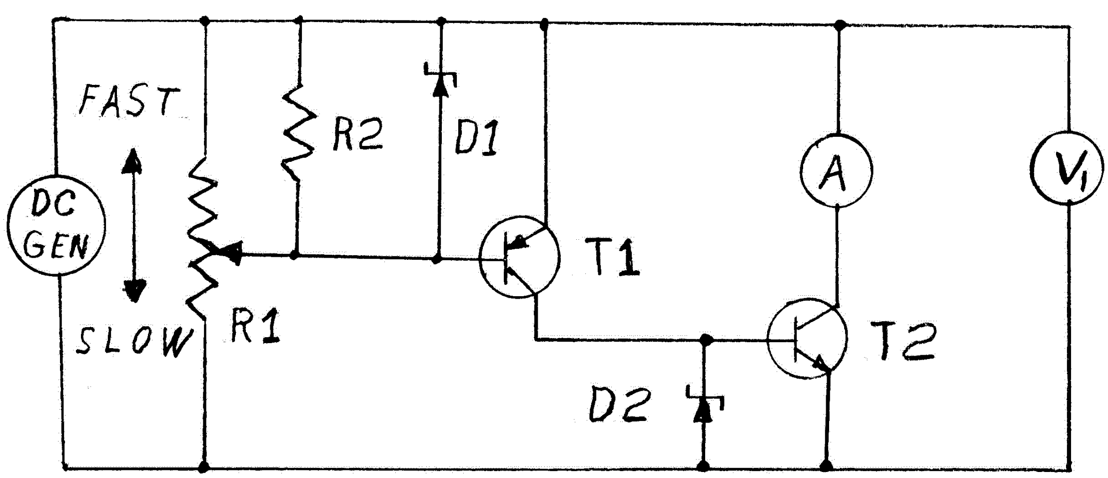
Endless Rope Climbing System with Dynamic Speed Control

Roy Barton NSS 31516



The basic system sketched above, with the control circuit, allows a climber to set the speed at which he (or she) climbs an 'endless' rope by using a DC generator as a dynamic brake. The entire system was designed to accommodate available junk box and junkyard components.

The climber climbs the rope that is coming down from pulley A. The torque ratio from pulley A to pulley C is 18:1. The spring, S, is to keep enough tension on the rope to prevent it from slipping on pulley A. Pulleys A, B, and C are "V" pulleys and a "V" belt connects B to C. Pulleys A and B are locked onto the same shaft. I had a lot of difficulty getting the 11 mm rope not to slip on a 4 inch diameter pulley even with 270 degrees of contact. I would suggest using a 12 inch pulley for A instead, and using a mechanical gear reduction system of about 18:1 to connect to the generator. I added a counter salvaged from a stair stepper. It utilizes a reed switch for a pick up and I operate it with a magnet mounted on pulley B. I use a conversion chart to change 'counts' to feet of rope climbed.

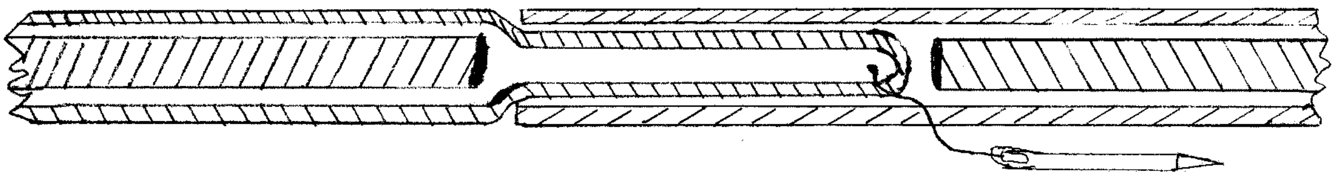


The circuit controls the electrical load put on the DC generator, and this sets the speed that the rope feeds down from the ceiling. No external power source is needed. V1 shows the output voltage from the DC generator that is set by R1. **This setting stays constant** regardless of varying loads on the rope and can be calibrated to read 'feet climbed per minute'. If a heavier climber gets on the rope, the

(Continued on page 14)

(Continued from page 13)
setting does not change. The increased weight tries to make the DC generator turn faster, the circuit puts a heavier load on the DC generator so that it still maintains the speed/voltage set by R1. I used R2 to make the rotation of R1 control the speed more evenly throughout the range of its rotation. D1 and D2 were added after an accidental catastrophe that took out the Emitter-Base junction of T1. The amp meter is just for amusement. The heavier the load on the rope, the more the current. It also measures a sudden downward rope thrust, like when you stand, using a 'sit-stand' system.

To make the endless rope from 11 mm Blue Water, I slid the mantel down the kern and cut off 6 inches of kern. Then I fused the kern fiber ends together. Do this to both ends. On both ends, slide the mantel back up so it ends at least 6 inches above the cropped kern. On one end only, fuse the tip and end of the mantel and mold it into as small a diameter as possible. Next , using a very strong thread and needle, attach the thread to the fused mantel (see below).



On the other end of the rope, run the needle 6 inches deep into the hole of the kern and then out through the side. Now, draw the fused end into this end. Next, use a stitch awl to put 3 rows of stitches radially spaced at 120 degrees apart to lock the two ends together. I used a vise to hold the rope while I stitched it. If you pull the stitches too tight it will tend to flatten the splice. The endless rope that I made has been in use for over one year and is still holding. **WARNING,** serious injury could result if the splice fails. I always wear a helmet when I climb and have a soft mat below to break a fall.

Water Tracing Experiments in Belize
Using an Inexpensive Total Dissolved Solids Meter

Brian Pease
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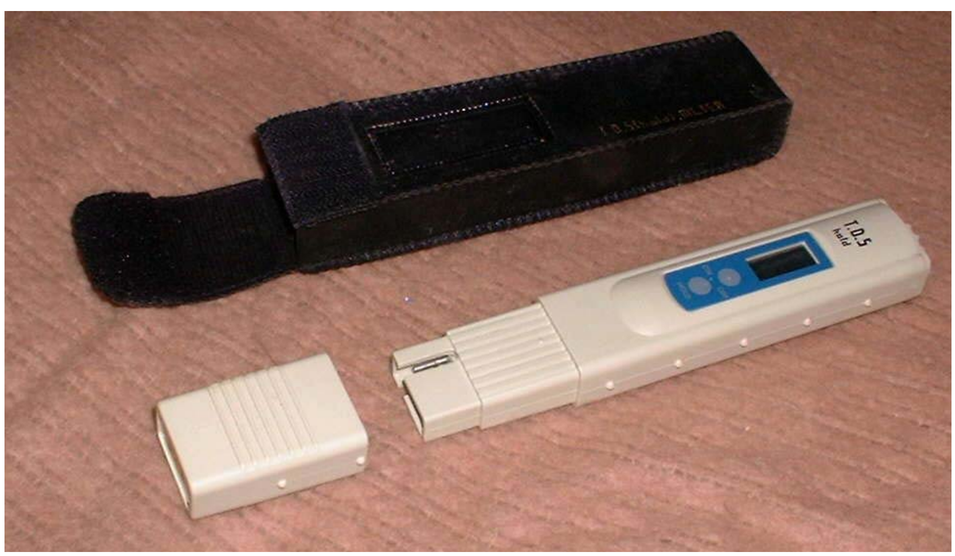
Abstract

A low-cost ($39 US) pocket-sized, temperature-compensated, digital, Total Dissolved Solids (TDS) meter and a alcohol/glass thermometer were used to collect data from several water sources in the Barton Creek Cave System and from associated insurgences, springs, and surface streams. A TDS meter measures electrical conductivity, corrected for temperature, but is typically calibrated in parts per million (ppm) of calcium carbonate. The data collection and dye tracing were part of the 2002 Barton Creek Cave Mapping project under the auspices of the Western Belize Regional Cave Project directed by Dr. Jaime Awe for the Belize Department of Archaeology.

Several insights resulted from these simple measurements. We concluded that three streams (120 ppm/21.4 deg C; 127 ppm/22.2 deg C; and 367 ppm/24.4 deg C) found near the terminal breakdown in Barton Creek Cave come from separate sources. Our on-site guess was that the Slate Creek insurgence (18 ppm/21.1 deg C on the surface) was the main source of the first stream and the insurgence in the "Vega" near Mountain Equestrian Trails (45 ppm/22.2 deg C) was part of the source of the second stream. Dye tracing, with materials and analysis generously donated by Dr Nicholas Crawford of Western Kentucky University, later proved these guesses to be correct. The third stream comes from a large crystal clear siphon. It may not be a good bet for diving because the TDS and temperature suggests that the water has been underground for a long time and may come from diffuse sources in the karst aquifer.

The Instruments

Upon arrival in Belize for the 2002 edition of the Barton Creek Cave Mapping Project, David Larson, the trip leader, handed me a little pen-sized digital meter that claimed to measure the Total Dissolved Solids (TDS) in water. He purchased it for $39 from the Premier Filter Company (premierh2o.com) who markets the meter for testing the effectiveness of the company's in-home reverse osmosis water filters. It was calibrated in parts per million (ppm) of calcium carbonate, with a range of 0-1999 ppm, and a resolution of 1 ppm. The accuracy is not known, but was probably 2%. The meter actually measures the electrical conductivity of the water, which is directly proportional to the TDS. The meter incorporates a sensor for automatic temperature compensation. Some TDS/conductivity meters have a temperature readout, but this raises the price a lot. In use, the meter's electrodes are held underwater (in flowing water if possible) for a few seconds until the reading stabilizes. While a direct reading conductivity meter would be typically calibrated in microSiemens per centimeter (with a range of 0-1999 uS/cm [0-0.1999 S/mtr]for our purposes), the TDS meter is calibrated in uS/cm divided by 2, which is the correction factor for calcium carbonate. The TDS meter thus reads one-half the value of a direct conductivity meter, but is otherwise just as useful. Because these karst solutions are quite dilute, **ppm** and **mg/Liter** are numerically equal, which means that if a TDS meter is calibrated for calcium carbonate, it directly reads the amount of dissolved calcium carbonate in the water in mg/L. For those interested in the chemistry, Chapter 5 of Reference 1 gives all the details. Pg 131, fig 5.2 has solubility and pH curves for calcium carbonate as a function of temperature and carbon dioxide partial pressure. I also had with me an accurate alcohol/glass thermometer in a metal case, normally used for cross-country ski waxing, readable to 0.5 degrees F (0.3 deg C).



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Data Collection

The data collection and dye tracing were done as part of the 2002 Barton Creek Cave Mapping project under the auspices of the Western Belize Regional Cave Project directed by Dr. Jaime Awe for the Belize Department of Archaeology. The instruments, along with a waterproof notebook, were taken along while cave mapping and exploring, as well as on ridge walking, dye injection, and bug placement trips. A set of readings took about 2 minutes, with most of the time spent waiting for the thermometer to stabilize. Most readings were taken in flowing, clear, water. A total of 40 readings were taken (some without temperature) with some repeats in order to get same-day comparisons.

The Raw Data

The data were collected in the winter at the beginning of the dry season in Feb/Mar, but there were still occasional showers. Stream flow was about average for the time of year. Outdoor streams tended to be slightly cooler on average than the cave streams, typically 70 deg F (21 deg C). The air in Barton Creek Cave was 74 deg F (23.3 deg C). All of the surface streams originate on the granite Pine Ridge area to the south. They flow north where most sink at the limestone contact. The Pine Ridge water has low Total Dissolved Solids, typically <20 ppm before it first encounters the limestone, but it does contain dissolved Carbon Dioxide and thus carbonic acid that can dissolve limestone. Once the water is in contact with limestone, TDS starts to rise. Given enough time, equilibrium is reached in both calcium carbonate and temperature.

Interpreting the Data

Two of the sinking streams (#1 and #16) had TDS of >100 ppm, indicating that they likely have already spent time underground in limestone somewhere upstream. This has not been checked yet.

The TDS in Slate Creek rose from 18 ppm on the surface near the insurgence (#3) to 120 ppm where it issued from the breakdown (#6) at the rear of Barton Creek Cave, ~3 km straight line distance and <23 hours dye transit time (probably 12-16 hours). Dr Nicholas Crawford of Western Kentucky University generously donated materials and analysis services from his Crawford Hydrology Lab for the dye tracing done during this years project.

The high-TDS water from the small stream in Slate Creek Cave (#2) must mix with the much larger Slate Creek stream (#3) causing an "up-front" boost in TDS. Interestingly, water temperature only rose from 70 deg to 70.5 deg F (21.1-21.4 deg C) over this distance, which implies rapid open-conduit flow without much ponding.

The TDS in the stream near MET (#4) rose from 45 ppm on the surface to 127 ppm at the siphon in the oxbow passage (#5) at the rear of Barton Creek Cave, where it was dye traced. Interestingly, there was no temperature change as the water passed through the cave. Despite the shorter distance, the dye took much longer to transit this path than Slate Creek.

The small insurgence near 7-mile village (#16) likely flows to the travertine spring (#17) because dye injected at (#16) showed up in Barton Creek upstream of Barton Creek Cave and there are no other known sources on the west side of the creek. The relatively small rise in TDS over the ~1.5 km distance (132 to 199 ppm) indicates that this is probably open conduit flow, i.e. a cave. The same level of dye also showed up in the resurgence stream (#12) which indirectly confirmed that the source of this stream (which is dammed and used as a water source) must be directly from Barton Creek through its bed and the limestone rubble under the valley and not from a cave. This is not surprising, as in really dry weather Barton Creek does sink into its bed upstream with (#12) as the only obvious resurgence.

The outdoor measurements made along Barton and Roaring Creeks show that a TDS/Conductivity meter can be used in the field to locate cave resurgence water in real time by simply making periodic measurements along the stream. This has been done successfully in the past but is now cheap and easy. If the stream is navigable, a conductivity meter with a remote probe and a GPS could be used to create a continuos record.

Water that has been underground long enough to nearly reach equilibrium (saturated with calcium carbonate), such as the "right hand" siphon (#7) in Barton Creek Cave had TDS of 367 ppm and the warmest temperature, 76 deg F (24.4 deg C). This, plus the fact that the flow (and TDS) remains relatively constant with time, indicates that the source of the water is diffuse flow rather than an open conduit from the surface.

(Continued on page 17)

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Purchasing a TDS/Conductivity Meter

The TDS meter sold by Premier (premierh2o.com), of unknown manufacture, is perfectly satisfactory and probably the lowest cost “pen-style” unit available. It is not waterproof. It has the correct range (000-1999 ppm) and the desired resolution of 1 ppm. Be aware that many of these meters have only 10 ppm resolution and some older designs don’t even display the last digit!

An internet search turned up several pen-style conductivity and TDS meters; some waterproof,; some with 2 ranges (unnecessary); and one with temperature readout (useful but expensive).

I purchased a Hanna (http://www.hannainst.com)) HI98353 (also called the DiSTWP3) waterproof conductivity meter from http://www.allometrics.com/hanna_cond.htm for $44.40 US. They also sell calibrating solution, which is not really necessary for this application. This meter reads 0-1999 uS/cm, with 1 uS/cm resolution, which is 0-999 ppm TDS, or .0001-0.2 Siemens/mtr. They sell a similar meter calibrated in TDS.

A more expensive handheld meter with a remote submersible probe would be a great tool for continuous readout while “trolling” in navigable waters.

Conclusions

Compact, waterproof, TDS/conductivity meters are now available at very low cost that can give information about the source of surface and cave streams with virtually no time or effort. Streams can be walked or boated looking for abrupt changes in the TDS. Field TDS measurements are also a great complement to dye tracing.

References

1) White, W.B., 1988, *Geomorphology and Hydrology of Karst Terrains*, Oxford University Press, New York, 464 p.

Acknowledgements

1) Dr Nicholas Crawford of Western Kentucky University generously donated materials and analysis services from his Crawford Hydrology Lab for the dye tracing done during this years project.

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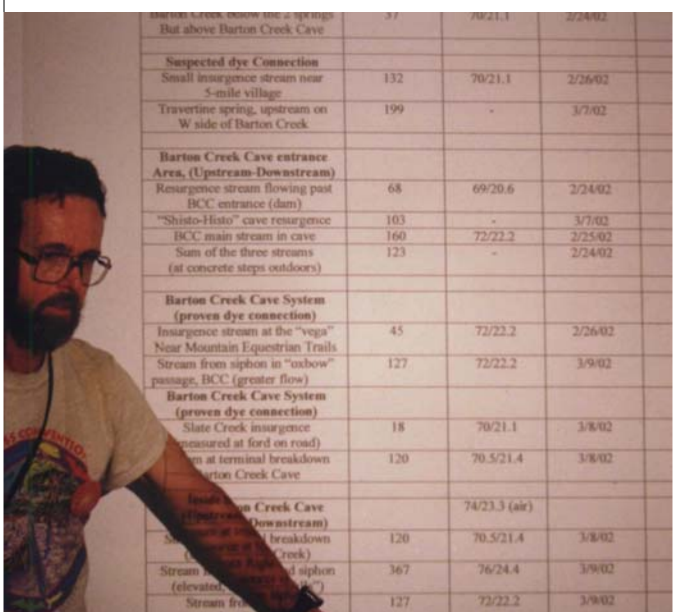


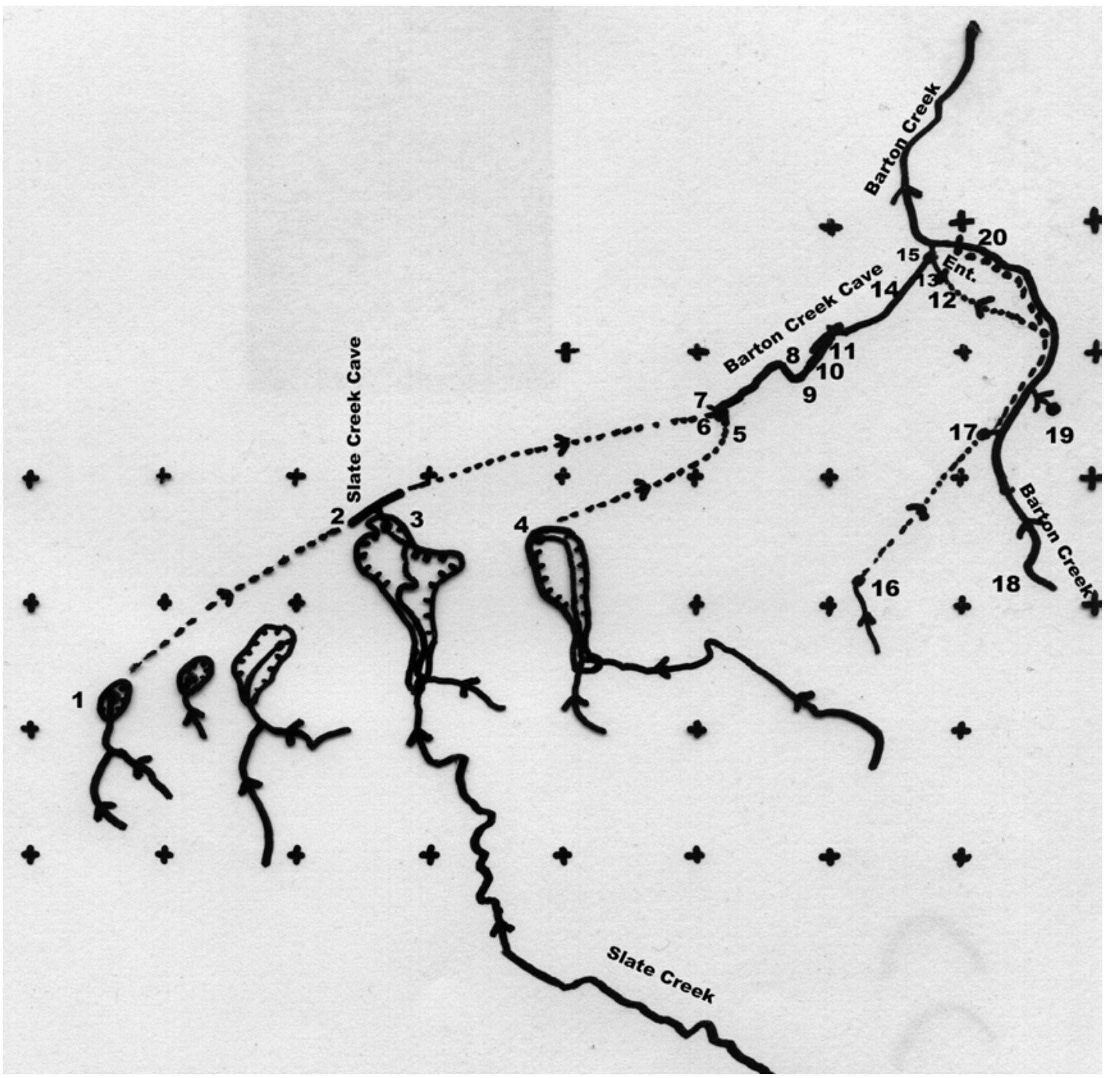
Brian presenting this paper at the 2002 NSS Convention. Photos by Paul Jorgenson.

Raw Data, Ordered and Grouped by Associated Streams

Barton Creek (Upstream to Downstream)	**TDS (ppm)**	**Water Temp (deg F/deg C)**	**Date**	**Reference Number (#)**
Barton Creek, well S (upstream)	21	-	3/7/02	18
Travertine spring, W side of BC	199	-	3/7/02	17
Spring, E side of BC	282	-	3/7/02	19
Barton Creek below the 2 springs But above Barton Creek Cave	37	70/21.1	2/24/02	20

Suspected dye Connection	**TDS (ppm)**	**Water Temp (deg F/deg C)**	**Date**	**Reference Number (#)**
Small insurgence stream near 5-mile village	132	70/21.1	2/26/02	16
Travertine spring, upstream on W side of Barton Creek	199	-	3/7/02	17
Barton Creek Cave entrance Area, (Upstream-Downstream)				
Resurgence stream flowing past BCC entrance (dam)	68	69/20.6	2/24/02	12
"Shisto-Histo" cave resurgence	103	-	3/7/02	13
BCC main stream in cave	160	72/22.2	2/25/02	14
Sum of the three streams (at concrete steps outdoors)	123	-	2/24/02	15
Barton Creek Cave System (proven dye connection)				
Insurgence stream at the "vega" Near Mountain Equestrian Trails	45	72/22.2	2/26/02	4
Stream from siphon in "oxbow" passage, BCC (greater flow)	127	72/22.2	3/9/02	5
Barton Creek Cave System (proven dye connection)				
Slate Creek insurgence (measured at ford on road)	18	70/21.1	3/8/02	3
Stream at terminal breakdown Barton Creek Cave	120	70.5/21.4	3/8/02	6
Inside Barton Creek Cave (Upstream to Downstream)		74/23.3 (air)		
Stream at terminal breakdown (source at Slate Creek)	120	70.5/21.4	3/8/02	6
Stream from Right-hand siphon (elevated, source of "falls")	367	76/24.4	3/9/02	7
Stream from siphon in "oxbow" passage	127	72/22.2	3/9/02	5
Small infeeder on right (going in) Just upstream of 2nd breakdwn rm	347	-	2/25/02	8
Very small stream depositing White flowstone	360	74/23.3	3/9/02	9
Main stream in BCC (sum of above)	162	72/22.2	3/9/02	10
Small "shower" in roof ~4000 ft from entrance	303	75/23.9	3/9/02	11
Roaring Creek (Upstream to Downstream)				
Roaring Creek (way upstream of Tunichil)	17	76/24.4	3/02/02	21
Tunichil resurgence at entrance (W side of Roaring Creek)	135	73/22.8	3/02/02	22
Roaring Creek crossing (Just downstream of Tunichil)	18 (E side) 57 (W side)	75/23.9 75/23.9	3/02/02	23

Roaring Creek cnt'd (upstream to downstream)	**TDS (ppm)**	**Water temp (deg F)**	**Date**	**Reference Number (#)**
Roaring Creek Crossing (next crossing downstream)	26	74/23.3	3/02/02	24
Yaxteel Cave resurgence (E side of Roaring Creek)	163	72/22.2	3/02/02	25
Roaring Creek Crossing (downstream of Yaxteel)	46	73/22.8	3/02/02	26
Barton Creek Cave System (suspected, not yet proven)				
Insurgence far to West near Chiquibul Road	105	65/18.3	3/8/02	1
Small stream in Slate Creek Cave (above Slate Creek infeeder)	238	73/22.8	3/11/02	2



Hydrology of the Barton Creek Cave System (Confirmed or Suspected)
Cayo District, Belize. North is up. Arrows show direction of stream flow. Dashed lines are confirmed or suspected underground streams. Tic marks form 1km squares.
Numbers are features referenced in the raw data table.

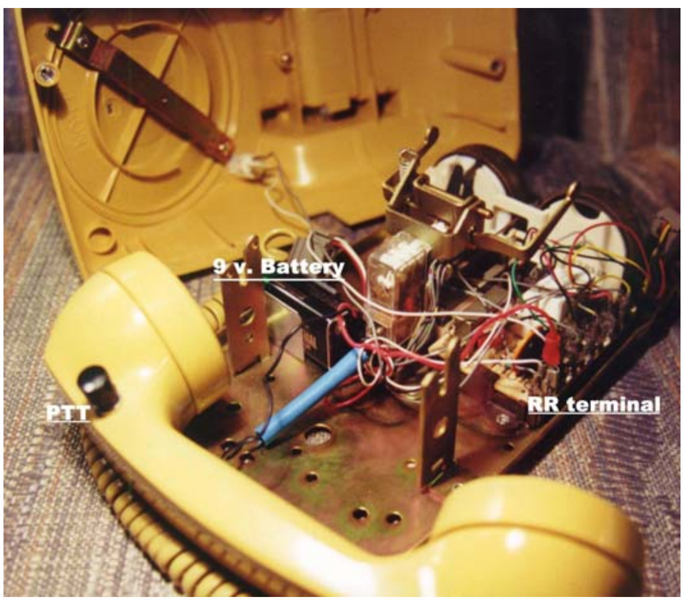
Cheap Field Telephone

Paul R. Jorgenson NSS 39382 FE

I recently purchased a desk telephone at a swap meet for $2 US. It is the type of phone that is used as an extension phone (no dialing capability) at hotels or businesses. It has a bell type ringer and a neon light that flashes when the line is ringing. I was hoping that it would be a suitable candidate for use as a surface phone on a field telephone network. My starting reference was the article by John Halleck, in *SPELEONICS* 12, on cave rescue telephones.

After inspecting my purchase, I found that it was in perfect working order. A connection to one of my old Army field phones rang the bell, lighted the light, and listened very well. The only problem was the talk power was not what I had hoped for. Not bad for a $2 US purchase.

The next area of investigation centered around getting battery power and a push to talk switch, like the real field phone. This would make my find into a useful instrument. With no schematic, I tried different points with a battery. The point marked RR (with a red wire) was the sweet spot. With the battery attached, the phone talked and listened just as well as the 'real' field phone. The battery was supplying power to the microphone element. A 1.5 volt battery did not give enough volume, so I used a 9 volt transistor battery. This gave the same volume on both desk and field phones. I installed a push to talk switch in the handset. The wires to the switch interrupt the red wire at the microphone element. Now, pushing the switch places the battery in the circuit allowing operation like the regular field phone and only draws current from the battery when the switch is engaged. The addition of screw terminals on the back of the phone (to the red and green line connections inside - not shown in photos) allow direct line connection without using the delicate flat phone wire and jack.



The only drawback is the lack of a ringing generator. This makes the phone unsuitable for a primary surface element. There always seems to be more than one person that wants to listen and speak on the surface, so this phone will be used as a cheap second extension to the primary phone. It is, of course, less rugged than the military style phone and would not be a good choice for underground.

The lack of a ringing generator will be solved (shortly) by the addition of a magneto style generator available on the surplus market. Surplus Sales (www.surplussales.com) has the push lever generators from the TA-1/PT type sound powered phone for $20 US. While this is ten times more than I paid for the start of this project, it will be worthwhile to free up one of the rugged (and more expensive) phones for underground use. Surplus sales also advertises the hand crank type of ringing generator for $45 US each.

Minutes of the 2002 Annual Meeting of the Communications & Electronics Section of the NSS
6/24/02 , 12:30 PM

Attendance:

37 people put their names on the sign-in list either at the noontime Luncheon/Business Meeting or at the Program session.

Minutes from 2001:

Brian Pease (Secretary & the only officer present) made a motion to approve; Ray Cole seconded, unanimously approved.

Treasurer's Report:

Joe Giddens reported (by phone) that there was $1592.20 in the treasury, presently in the form of a money order to be sent to the new treasurer.

Old Business:

Brian discovered from Evelyn Bradshaw that the Section does not have a Constitution or Bylaws on file with the NSS. Brian presented a proposed Constitution & Bylaws, which were adapted from the NSS, samples and a Grotto's recent Constitution & Bylaws. Copies were distributed for later discussion.

Brian said that Joe Giddens has a substantial number of back issues of Speleonics that we will have to decide the fate of.

There was a discussion of what to do with the funds we have if we go to electronic publication. Should money be refunded to people who have prepaid for future issues, or should they be sent paper copies? Should the money be kept to pay for complementary copies and postage for archives, etc? Bob Hoke said that we should put the money in an account that earns interest. Ray Cole said that we might have tax implications. Bob said that the small amount of interest we will earn would not cause a tax problem. It is apparently really easy to get a Tax ID (TID) which is then attached to the savings account. Incorporation is not required for an organization of this size. Ray said that he would rather donate his prepaid dues money (intended for paper copies) instead of getting it back.

There was general agreement that electronic publication be in .pdf format. There was a discussion on getting good paper copies from .pdf files when printed in black and white. The online files are in color but mailed paper copies would be black and white to keep cost down. Bob Hoke was concerned that it works would non-postscript printers. Henry Schneiker said that it should work.

New Business:

There was agreement that the back issues of Speleonics should be posted openly on our Website. The back issues will have to be scanned as graphics files because they are not available electronically and it would be tedious at best to use OCR. Henry volunteered to convert the back issues to relatively small .pdf files. Dave Larson volunteered to provide Henry with a complete set of back issues, which Henry can keep.

There was a general agreement to try running the section without dues. The question then is how to define who is a member. Bob Hoke suggested that membership be open to anyone who is interested in caving electronics (or some such). Anyone is welcome to attend the annual meeting. Ted Lappin asked if members are needed for the quorum? Henry suggested that the quorum be based on the members who attend the annual meeting. E-mail addresses could be used to identify members. Anyone who has an e-mail address would be a member. Brian said that many websites have members-only sections where the only thing you have to do is register. Ray asked if we really need to do that. We could send a mass email indicating that a new issue of Speleonics is out. The suggestions converged on:
On the e-mail mailing list or
Show up at the annual meeting (at the NSS convention) and sign in.

This was refined to define Section members as those who:
Show up at the annual meeting and/or the session (at the NSS convention) and sign in.
Membership is good for 5 years.

Bob Hoke said that our website needs to say explicitly that there is no benefit to membership other than voting and (for NSS members) holding office.

(Continued on page 22)

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Henry said that we need to send a letter to everyone on Brian's membership list (obtained from Joe Giddens) who has paid for future Speleonics issues, giving them the option of donating the money, getting future paper copies (in black & white), or getting the money back. The old membership list will be good until the next meeting (2003 NSS convention). After this meeting, the new definition of membership will apply, with those who opted for future paper copies becoming non-voting subscribers (unless they meet the new definition of membership).

Paul Jorgenson said that he has 2 or 3 articles for the next issue of Speleonics, so far.

Brian said that we need to decide on the officer jobs and their duties before we can have elections. The current officers are Chair, Secretary, and Treasurer. The proposed Officers are Executive Chair, Secretary-Treasurer, Communications (website), and publications. Another suggestion is to have a Vice-Chair. Henry said that the proposed Officers looked ok as-is, so we will leave it. The term of office will continue to be one convention cycle.

We need to define quorum rules. A quorum at a General Meeting will be 51% of those who sign in at the meeting, as several may leave prior to the elections. A change to the Constitution requires ¾ of those voting, 2/3 for the Bylaws, and 51% for any other business, including elections.

Bill made a motion to approve the changes mentioned above into the Constitution and to adopt the new Constitution and Bylaws. The motion was seconded by Henry and passed unanimously.

Bob Hoke made a motion to approve the proposed slate of officers for next year:

John Lyles – Executive Chair
Brian Pease – Secretary-Treasurer
Paul Jorgenson – Publications
Gary Bush – Communications (webmaster)

Henry seconded the motion, which passed unanimously.

Program Session:

Programs started at 2 PM in a nearby room.

A packed house for the Program session at the 2002 Convention
photo by Paul R. Jorgenson

(Continued on page 23)

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Ray Cole presented his paper *Operating LED HeadLamps at Three Volts and Below*. The circuit is the same as the 24-LED lamp Ray presented last year, with the addition of a LP2950-D low dropout linear regulator to provide a constant 5 Volts to the Maxim 1698 switching boost current regulator regardless of battery voltage. The circuit will work on a supply voltage of 2-9 volts, but requires at least 2.6 V to start running. Once running, the circuit supplies ~20 VDC to 4 strings of 6 LEDs (20 mA per string), each with a 15 ohm sense resistor, and the low-dropout linear regulator converts 20 V to 5V for the IC. Matching of LED voltage drops is not as critical as in a fully parallel array. The circuit will run from a single LiSO2 D cell with 0.5 A max. Light output is adjustable over a wide range to extend battery life. Over 4 hours of light is possible from 4 1.8 AH AA NiMH rechargeable cells.

The circuit board uses surface mount parts except for the Nichia 20 degree LEDs. The mounting pads for the LED cathodes are large to absorb heat. The only difficult part to mount is the Max 1698 IC, which has pads on .02" centers. Ray's mounting technique is to tack it down in one corner then solder all the other pads not worrying about shorts. Solder wick is then used to remove the excess solder. A stereo microscope helps. Using a stereo microscope with x10-x15 power, Brian Pease has been able to solder the individual IC pins with a very small iron tip and small (.02" cored) solder. He uses a common pin to check that the pins are really soldered down. Brian bought his 10-40 power stereo-zoom microscope new on Ebay for $240. Henry Schneiker said that "angle-hair" solder and separate flux works well. He also talked about using epoxy mixed with aluminum dust on the underside of the LEDs to provide an insulating thermal conductor. Ray suggested using a liquid.

Ray had a problem with the conventional power MOSFET used in the earlier design and switched to a "logic level" MOSFET that requires less gate voltage to switch to full-on.

Ted mentioned using a microprocessor to control brightness. Brian and Ray like the continuously variable pt control.

Ray measured about 90% efficiency with 4V and 6V batteries at full brightness using LEDs and a large external inductor. Brian used a resistive load to test efficiency with a smaller on-board inductor, which varied from 83% with a 3 V battery to 89% with 6 V.

Ray gave a list of why LED lights are good. He knows of one failure due to a shorted LED, and two due to older type MOSFET failure at extreme low battery voltage.

Brian Pease presented his paper on using a pocket-sized low cost ($39) Total Dissolved Solids (TDS) meter for water tracing experiments in Belize. A TDS meter really measures electrical conductivity (corrected for temperature) but is calibrated in parts per million (ppm) of calcium carbonate rather than microsiemens/cm (uS/cm). This TDS meter, plus an accurate thermometer, was used to show that the 3 streams found near the terminal breakdown of Barton Creek Cave come from different sources. They were 120 ppm/21.4 deg C; 127 ppm/22.2 deg C; and 367 ppm/24.4 deg C. Prior to conventional dye tracing, we made educated guesses as to which surface streams became the first two streams in the cave. Both guesses were confirmed by the tracing. The third stream in the cave is nearly saturated with calcium carbonate and comes from an area where there are no known surface streams. The crystal clear water probably originates from diffuse sources in the aquifer. The second and third streams originate in siphons, which will probably be dove in 2003.

Other Things

Henry Schneiker will sell 20 degree Nichia LEDs at $1.50 each (10 min) until his supply is gone. He said his headlamp has the capability to overdrive the LEDs at 30 mA for 30 seconds every 5 minutes.

Ted mentioned the photo slave and cord projects he is working on. The photo slave electronics are installed inside an existing cheap commercial slave housing. The cord connects a digital camera to an electronic flash, reducing the voltage to prevent destruction of the camera.

Ted mentioned the caver sensor project he is working on. The sensor detects cavers and logs their presence in a cave by using a light sensor. The unit uses a microprocessor and interfaces to a Palm PDA to transfer data. It uses a plastic 35 mm film can for its housing and can run for months on a single coin cell.

The session adjourned at 4 PM.