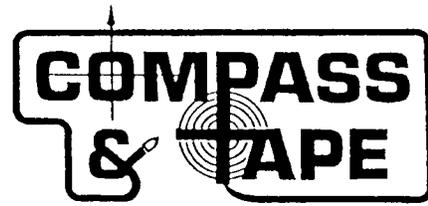


# Compass & Tape

Volume 12, Number 1, Issue 37



# Survey and Cartography Section



The survey and Cartography Section (SACS) is an internal organization of the NSS that is devoted to improving the state of cave surveying and mapping.

**MEMBERSHIP:** Membership in the Section is open to anyone who is interested in surveying caves and in cave cartography. Membership in the National Speleological Society is not required.

**DUES:** Dues are \$4.00 per year and include four issues of Compass & Tape. There are normally four issues of Compass & Tape each year, but if there are fewer, then all memberships will be extended to insure that four issues are received. Dues can be paid for up to 3 years (\$12.00). Checks should be made payable to "SACS" and sent to the Treasurer.

**COMPASS & TAPE:** This is the Section's quarterly publication and is mailed to all members. It is normally published on a quarterly basis, but if insufficient material is available for an issue, the quarterly publication schedule may not be met. Compass & Tape includes articles covering a wide variety of topics including equipment reviews, hints and techniques, computer processing, mapping standards, artistic techniques, publications of interest, and appropriate material reprinted from local caving publications. It is the primary medium for conveying information and ideas within the cave mapping community. All members are strongly encouraged to contribute material and to comment on published material. Items for publication should be submitted to the Editor.

**NSS CONVENTION SESSION:** SACS sponsors a Survey and Cartography session at each NSS Convention, at which papers are presented on a variety of topics of interest to the cave mapper. Everyone is welcome (and encouraged) to present a paper at the session. Contact the Vice Chair for additional information about presenting a paper.

**ANNUAL SECTION MEETING:** The Section holds its only formal meeting each year at the NSS Convention. All Section business, including election of Officers, is done at that meeting.

**BACK ISSUES:** SACS started in 1983 and copies of all back issues of Compass & Tape are available. The cost is \$1.00 per issue, plus \$0.50 postage for one issue or \$1.00 for two or more issues ordered at once. Order back issues from the Treasurer.

**OVERSEAS MEMBERS:** SACS welcomes members from foreign countries. The rate for all foreign members is US\$4.00 per year and SACS pays the cost of surface mailing of Compass & Tape. If you need air mail delivery, please inquire about rates. We regret that all checks must be payable in US\$ and drawn on a U.S. bank.

## CURRENT OFFICERS:

**Chair:** Carol Vesely, 817 Wildrose Ave., Monrovia, CA 91016-3022 (818) 357-6927

**Vice Chair:** Roger Bartholomew, 910 Laurel Street, Rome, NY 13440 (315) 336-6551

**Secretary:** George Dasher, 5096 W. Washington Street, #101, Cross Lanes, WV 25313, (304) 776-8048

**Treasurer:** Bob Hoke, 6304 Kaybro Street, Laurel, MD 20707, (301) 725-5877

**Editor:** Pat Kambesis, 2466 Drew Valley Road, Atlanta, GA, (404) 248-9538

## From the Editor:

With this issue of *Compass & Tape*, the Survey and Cartography Section hopes to get back on publication schedule. The Section wishes to thank Bob Lewis for his willingness to take on the responsibility as editor. Unfortunately Bob was unable to proceed with the editorship due to other time commitments. We hope that he will be able to serve the SACS in some other capacity as his time permits.

As of this issue I am taking on editor responsibilities for *Compass & Tape*. Shirley Sotona and Mike Yocum will be serving as editorial staff and it's our intent to publish four issues this year.

Though we are always looking for new material for *Compass & Tape*, there are a number of articles already in the works which include a review and comparison of the available data reduction/plotting programs, a section on survey, sketching and/or cartography tips, and publication of survey standards that various long-term survey projects have developed, to name a few. Also, we would like to start featuring more cave maps. Everyone is encouraged to submit their maps for publication in *Compass & Tape*.

We welcome any suggestions or comments to the subject matter and format of *Compass & Tape*. Anyone who is interested in being part of the editorial staff can contact me and I'll put you to work.

*Pat Kambesis, Editor*

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The editor reserves the right to select which of the submitted material will be used for publication. Of the material selected, the editor reserves the right to delete redundant or inappropriate material, to correct errors of spelling, grammar, or punctuation, and to edit for clarity, so long as such alterations do not change the meaning or intent of the author(s). In the event that significant changes are contemplated, the author(s) will be consulted and given the opportunity to review the changes prior to publication.

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ISSN: 1074-5696

Published in January 1995 by the The Survey and Cartography Section of the National Speleological Society

### SUBMISSIONS

All types of materials related to cave survey, cartography and cave documentation are welcome for publication in *Compass & Tape*. Manuscripts are accepted in ANY form but are most welcome on magnetic media (5.25 or 3.5 inch diskettes) either IBM compatible or Mac format. Typed material is next best though we will accept handwritten material (as long as its legible). Artwork in any form, shape or size is also welcome.

Send all submission for *Compass & Tape* to:

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# THE MINUTES OF THE 1994 SURVEYING AND CARTOGRAPHY SECTION MEETING

July 6, 1994  
George Dasher  
Secretary

The annual meeting of the Surveying and Cartography Section (of the National Speleological Society) was held on June 24th, 1994, in conjunction with the Society's Convention in Brackettville, Texas. The meeting was held in the Salon Building West, and was called to order by Chairman Carol Vesely at 12:15 PM. Attending were 31 members and friends of the section. These were:

Bill Balfour  
Roger Bartholemew  
Dave Black  
Bob Bucher  
Don Coons  
Hubert C. Crowell  
George Dasher  
Thom Engel  
John Fogarty  
Mike Futrell  
Dick Graham  
Dale Green  
Rebecca Holden  
Mark Johnston  
Pat Kambesis  
Jan Knox

Orion Knox  
Robert Lenz  
Kirk MacGregor  
Doug Medville  
Hazel Medville  
Anela Morgan  
Art Palmer  
Peg Palmer  
Mel Park  
Dick Sanford  
Scott Schmitz  
Ted Steinke  
Dave Taylor  
Bob Thrun  
Carole Vesely

First were the officers' reports. Carol made no report. The Vice-Chairman, Roger Bartholomew, said that the combining of all the technical sessions at the Texas Convention had robbed him of any responsibilities; however, he was already lining up papers for the 1995 Virginia Conven-

tion. In addition, he had been in communication with Dale Pate concerning standards for Carlsbad Caverns National Park.

The Secretary, George Dasher, stated that he had not attended the 1993 Oregon Convention; however, Bob Hoke had recorded the minutes, they had been printed in *Compass & Tape*, and no one had complained.

The Treasurer, Bob Hoke, was not present. He had, however, mailed both treasurer's and editor's reports to George Dasher, and George now gave a synopsis of those reports. This was:

Bob Lewis is now the editor of the *Compass & Tape*. He had promised to have the next issue to Bob Hoke for printing by the end of May; however, Bob Hoke had not received such a copy by the time of Convention.

*Compass & Tape* needs articles very badly!

SACS needs a ramrod person to coordinate the SACS session at the 1995 Virginia Convention.

The SACS income for the past fiscal year was \$273.11; expenses were \$112.82. SACS opened the year with \$2657.10, and closed the year with \$2817.39. Ex-

cluding our "implied liability monies," SACS has \$1963.00. The implied liability monies are those monies received from members for several years of membership and which must be reserved for the payment of future issues of the *Compass & Tape*.

At present, SACS has 143 members.

At the 1993 Oregon Convention, SACS voted that the membership dues are now \$1.00 per issue of the *Compass & Tape*. Thus the length of membership in the Section is not related to the calendar or fiscal year, and all SACS members are members until they receive (for their \$5 dues) five issues of the *Compass & Tape*.

The SACS membership list is available at the meeting for all those who wish to review it.

Most discussed of this report was the need for timely issues of the *Compass & Tape* and the need for articles for it. All were concerned that the May issue had not yet been received by Bob Hoke, but all also agreed that Bob Lewis clearly needed a chance to edit the *Compass & Tape*. Members were *strongly* urged to send articles to Bob Lewis. His address is P.O. Box 505, Dublin, Virginia 24084.

George Dasher next gave a report on the surveying and cartography book, *On Station*. After six-plus years of work by George (and God-only-knows how many by Lang Brod), this publication is now finished, has been printed, and is for sale by most of the Convention vendors. The cost is \$16. George said that the book includes most everything he knows on cave surveying, and that Tom Rea finished the book--George just plain ran out energy when the publication was about 95% finished.

George then gave a report on the Cartographic Salon. The 1994 Texas Salon was the biggest ever, with 59 entrees and 32 entrants, and it had been a *very* brutal salon to coordinate and judge. Pat Kambesis won with her map of Wu Dong, there had been two electronic entrees, and there had been a map entered of the interior of a Pleistocene rhinoceros cast (which had been mapped by a NSS member). Next year, George hopes to put together a display of all the past medal maps and he asked that all past medal winners mail good copies of their maps to him in the near future.

The discussion for a need for a Salon for electronic entrees followed, and--although there was a great deal of discussion concerning the criteria for such a salon--the end result was the organization of a committee to formulate such a salon. Those persons volunteering to be on the committee included Angela Morgan, Thom Engel, Scott Schmitz, Mark Johnston, Pat Kambesis, Bob Thrun, and Hubert Crowell. Thom Engel volunteered to be the chairman; however, Carol Vesely said that the committee should pick their own chairman. Hazel Medville suggested that the committee consider a Poster Session at next year's convention to show off this new cartographic medium.

There has long been a need to further honor those persons in the Cartographic Salon who have been awarded Honorable Mentions and Merit Awards. This was done, when Ernst and Karen Kastning were the Salon Evening Coordinators, by bringing those people who had won these awards up on stage on Salon Night. Paul Stevens, when he took over as the Salon Evening Coordinator, did not allow this. He wanted to keep the evening moving quickly toward the Slide Salons, and he had more Salons which required time during the evening. He suggested, at the time he took over the job, that all the Salons present slides of their winners and that he show these on the

large screen as the awards were being presented. Unfortunately, George--as well as all the other Salon Chairmen--were not receptive to this idea. Despite this fact, Paul made a ruling that entrants for all the BOG Salons should submit slides of themselves with their entrees.

It has been now suggested by several members of SACS that the Cart Salon provide slides of its winners. George was more agreeable, but he was frank in that the Cart Salon has just become too-time-consuming for him to do this. It was agreed that Angela Morgan shall take pictures of the entrees (and possibly the entrants) during the Salon, have them developed, and make them available to Paul as overall Salon Evening Chairman. George also stated that the Cart Salon is becoming a two-person job, and that he would prefer to have Angela as an assistant, not as a person who was concerned solely with taking pictures of the maps. Angela was agreeable to this. All future Cart Salon entrants should, when they submit their maps, also submit a slide of themselves.

Art Palmer next stood and personally thanked the two persons--Fred Wefer and Hubert Crowell--who had entered the electronic entrees in this year's Cart Salon for submitting their "maps." These entrees were not judged--because they were so individually different and because the judges had no criteria by which to judge them--and Art thought that this was unfortunate. Afterwards, George again thanked all of the 1994 judges--Art and Peg Palmer, Angela Morgan, and Dick Graham--for their assistance, and he said that this year's Salon had been one of the most-labor intensive for the judges that he had been associated with.

Also at this time, George gave part of a belated secretary's report, and said that he had signed the award certificates for Hubert Crowell's Convention surveying course. This course was not in any

way a part of SACS, but George had signed the certificates as a SACS' officer.

There were also several new issues. Hubert reported that his surveying course had gone rather well, five people had entered, and that he would submit an article for the C&T. The contest had been won by Dale and Cathy Lankford. There was also some discussion of the OTR compass course and compass courses in particular, Dick Sanford stated that he felt there is a need for a standardized computer data format, and it was reported that Ray Keeler will review On Station for the NSS News.

Last were elections. Thom Engel made a motion that SACS keep the same slate of officers, Art Palmer seconded this motion, and it was approved by acclamation and without objection.

Carol adjourned the meeting at 12:57 PM.

**SECRETARY'S NOTE:** I later spoke to Paul Stevens in my capacity as Cart Salon Chairman. He said that, because of electronic programming constraints on the many projectors run on the Salon Evening, that he will need to know exactly how many slides of winners the Cart Salon will require. He said that he will require this information by May. Because the Cart Salon winners are not picked until the Tuesday or Wednesday of Convention (and in 1994 in the wee hours of Thursday morning) I personally feel that it will be impossible to comply with this requirement. As for the possibility of judging the maps before Convention, this year 19 maps were sent to me before Convention, and an additional 40 arrived at Convention. Thus, pre-convention judging would severely reduce the number of entrees at each Convention, plus mailing the maps to and from judges in different parts of the country is not an option I really want to attempt.

**SECOND SECRETARY'S NOTE:** I spoke to Paul Stevens at OTR. I gathered, from this conversation, that it would now be no problem for Angela to take the pictures of the contestants (and possibly maps) at Convention, have them developed, and show them on the Salon evening. There may be problems in that it takes a certain kind of film

to produce a good slide of a map, and the only kind of slide film which can be developed in a few hours is Ectachrome. This is something we will have to work out. In addition, and this is something Paul intends to mention prominently in the annual NSS News announcement, all entrants should send me a slide of themselves with their entrees.



## ANNOUNCEMENTS

### ON STATION

The National Speleological Society's handbook for surveying and mapping caves, *On Station*, was available for purchase at the 1994 Texas Convention. The cost is \$16, and the book is 242 pages in length.

The publication contains information on the basics of cave surveying, instruments, tapes, note keeping and sketching, project and long caves, "Tricks of the Trade", data reduction and coordinate plotting, loop closure, computers, drafting the working and final maps, and the components of the final map.

On Station can be ordered from the NSS bookstore or from any of the various speleo-vendors. The author: George Dasher.

### BUCKEYE BULLETIN

The West Virginia Association for Cave Studies (WVACS) has finally completed West Virginia Speleological Survey (WVASS) Bulletin #12, The Caves and Karst of the Buckeye Creek Basin, Greenbrier County, West Virginia. The Bulletin was on sale at the 1994 Old Timers for a cost of \$16. The Bulletin is about 240 pages

in size and contains a ton of pictures and maps. It is not only about the Buckeye Basin, but includes that area between Spring Creek and the Buckeye Basin. The principle author and editors were Bill Balfour and George Dasher. The publication can be ordered either directly from WVASS (P.O. Box 200, Barrackville, West Virginia 26559) or from any of the speleo-vendors.

### CONVENTION 1995: CALL FOR PAPERS

Its time to starting thinking about getting together papers, maps, displays etc. for presentation at the Survey and Cartography Session at the Blacksburg, Virginia convention. Abstracts for the session should be submitted to SACS Vice Chair Roger Bartholomew. Tentative deadline for submissions is June 1, 1995.

And don't forget the Cartography Salon. We welcome all types of maps and cartographic representations. The Cartographic Salon Coordinator is especially excited about entries with difficult to pronounce names (the more consonants the better).

More information about the Sessions and the Salon will follow in a separate mailing.

# 1994 NSS CARTOGRAPHIC SALON

*George Dasher*  
*Cartographic Salon Coordinator*

This year's Cartographic Salon was held at the NSS Convention in Brackettville, Texas. Thirty-two cartographers entered 58 maps. Despite previous reports to the contrary, this year's Cart Salon was the second largest ever, ranging only behind the Salon at the 1981 International Congress in Bowling Green, Kentucky. Still, the 1994 Salon was--both for the judges and myself--nothing but work, work, work. In addition, the Salon room this year had neither lighting or air-conditioning. It was not a fun Salon.

But enough bad news. The good news was that this was also the Salon--in my poor, pitiful opinion--with the highest quality of

maps. The Cartographic Salon's purpose is to foster a higher level of speleo-cartography and to allow the Society's map-makers a chance to view each other's work and different techniques. No one who toured this year's Salon could doubt that a higher standard of quality has been achieved among the NSS' cartographers.

This year's judges were Angela Morgan--Huntsville Grotto, Fern Cave Project, and LEARN; Dick Graham--Droop Mountain Cave Club, 25 years of cave surveying in West Virginia and Virginia; Peg and Art Palmer. Art is a professor of Hydrology at the University of New York; Peg is a Professional Consulting Geologist. Together they have mapped over 100 miles of cave in approximately 12 states using a variety of instru-

ments. Art judged the first NSS Cartographic Salon at the 1978 Texas Convention, and he was the Cartographic Salon Chairman at the 1979 Massachusetts Convention.

The maps this year were from 7 countries: Belize, Dominican Republic, Guatemala, Mexico, Peoples Republic of China, Switzerland, and the USA. The maps were entered from 5 Mexican states--Chiapas, Nuevo Leon, Oaxaco, Tamaulpas, and Quintana Roo, and 18 U.S. states-- Alabama, Alaska, Arizona, California,

Colorado, Kentucky, Hawaii, Illinois, Indiana, Kansas, New Mexico, Oklahoma, Oregon, Pennsylvania,

Texas, Virginia, Washington, and West Virginia. 11 Honorable Mentions (green ribbons), 7 Merit Awards (blue ribbons), and 1 Medal (overall) awards were given. During the award presentation on the Thursday night of Convention, I was only required to abuse six languages--Mayan, Hawaiian, Chinese, German, English, and that all important Spanish.

Of note this year, one map was of a basalt cast of a Pleistocene rhinoceros--which died in a lake bed in Grant County, Washington and which was later mapped by a NSS member, three maps were of underwater caves, two maps were electronic entries--these were caves viewed and manipulated using a computer and CRT screen, and two maps were for display only. Unfortunately, the

**...this year's Cartographic Salon was the second largest ever, ranging only behind the Salon at the 1981 International Congress in Bowling Green, Kentucky**

electronic entries were not judged as they were each very unique and each displayed the caves in entirely different manners. Plus, there was only a very small sampling of the electronic entries and the judges had no criteria by which to judge the two entries.

The Surveying and Cartography Section, at their meeting on Friday, formed a committee to discuss this electronic entry situation, and to form criteria by which such electronic entrants may be judged. The end result may be a new NSS Salon.

The winners of the 1994 Cartographic Salon were:

**GREEN HONORABLE MENTIONS:**

1. Biggers Cave  
Bert Ashbrook  
Greenbrier County  
West Virginia USA
2. Hartman Cave  
Bert Ashbrook  
Monroe County  
Pennsylvania USA
3. El Capitan Cave  
Carlene Allred  
Tongass National Forest  
Prince of Wales Island  
Alaska USA
4. Mutteehöhle  
Projekt Multsee 1987-1994  
Linthal, KT Glarus  
Ostschweizerische Gesellschaft  
Hohlenforschung  
Switzerland  
(Swiss Society for Speleology)
5. Elk River Cave  
Bill Balfour  
Randolph County  
West Virginia USA
6. Cueva de Heidi  
Nancy Pistole  
Att Verapez  
Guatemala
7. Langford Pit  
Pat Kambesis  
Jackson County  
Alabama USA
8. Hei Dong  
Pat Kambesis  
Zhijin County  
Guizhou Province  
Peoples Republic of China
9. Cenote Mayan Blue  
Jim Coke  
Tulum  
(underwater cave)  
Quintana Roo Mexico
10. Blue Creek Cave  
Carol Vesely and Tom Miller  
Toledo District  
Belize
11. Pele's Abyss  
Don Coons and Carol Vesely  
Walali  
Hawaii USA

**BLUE MERIT AWARDS:**

1. Olaa Cave  
Bob Richards  
Big Island  
Hawaii USA
2. Cueva del Rio Corona  
Mike Futrell  
Yerbabuena  
Municipio de Guemes

Tamaulpas Mexico

- 3. Green Cave  
George Veni  
Kickapoo Caverns  
State Natural Area  
Edwards County  
Texas USA

- 4. Green Cave  
George Veni  
Kickapoo Caverns  
State Natural Area  
Edwards County  
Texas USA

- 5. Natural Tunnel Caverns  
Bill Balfour  
Natural Tunnel State Park  
Scott County  
Virginia USA

- 6. Sistema Sac Actun  
Jim Coke  
Tulum  
(underwater cave)  
Quintana Roo Mexico

- 7. Cueva Amontilado  
Carol Vesely  
Oaxaco Mexico

**OVERALL MEDAL:**

Wu Dong  
Pat Kambesis  
Duyin County  
Guizhou Province  
Peoples Republic of China

**NSS Cartographic Salon Criteria**

**Classes:** 0-500 meters (0-1640 feet)  
500 meters to 1.6 kilometers (1640 ft. - 1 mile)  
Greater than 1.6 Kilometers (>1 mile)  
Special Class

**Mandatory Requirements:**

Cave Name  
Obvious Entrance or connection  
with remainder of cave  
North Arrow (True North preferred)  
Bar Scale with linear units  
Vertical Control  
Date (Survey date preferred)  
Cartographer or survey group name

**Quality Factors:**

Balance and Layout  
Drafting Technical Quality  
Detail Thoroughness  
Vertical Control Quality  
Lettering  
Visual Impact

**Perks:**

Site details (Surface, geology, etc.)  
Complex Representations  
Innovations  
Cross-Sections  
Legend (or symbols credit)  
Other

# PROTECTING SUUNTO INSTRUMENTS

by Mike Yocum

Maintaining instruments in the best possible condition is crucial for quick yet accurate surveying, and for saving the time and money required to repair or replace damaged equipment. For the past five years I have been testing a method of protecting Suunto compasses and clinometers which not only meets that need, but preserves them in near mint condition (assuming that they are treated when new). The technique is simple and relatively inexpensive.

The procedure consists of dipping them in thermoplastic rubber, a liquid compound that dries to a tough coating which seals each instrument in its own protective case. Thermoplastic rubber is the material used to insulate the handles of pliers and other tools. It is also used on the handle of the Petzl "Stop" descender. When used on survey instruments, the coating protects against water, mud, sand, grit and abrasion. When dry it will not crack, although it may split along the edges if the coating is too thin, a problem which is easily prevented.

Locally, thermoplastic rubber is marketed under the names "Color Guard" and "Plasti-Dip", but there may be other brand names for the same product in other parts of the country. Plasti-Dip does not come in a clear finish, Color Guard does. The clear finish allows light to pass through the large top window above the compass card, and is necessary unless you have internally illuminated Suuntos. A 14.5 ounce can of Color Guard currently costs about \$8.50. One can will coat your instruments and leave plenty to use in other ways. If you have trouble finding Color Guard, you might write to the distributor: Permatex Industrial Corporation, 30 Tower Lane, Avon CT 06001.

My first effort resulted in instant panic - two brand new Suuntos, both internally betalight illuminated, ruined! I had placed a self-adhesive 1/2-inch dot label (the kind you buy at office supply stores) over the small viewing lens to prevent coating it. Although the rubber is clear, it distorts light sufficiently to invalidate any readings taken through it.

After carefully covering the viewing lens, I dipped the compass into the liquid, removed the dot, and waited an hour or so until the rubber had dried enough to handle. Looking through the lens, I saw a fuzzy outline of the numbers, rather like looking through frosted glass. I didn't cry, but I felt like it. I assumed that the liquid had seeped into the compass and coated the internal side of the lens. I peeled off the rubber coating and left the compass for a couple of hours. Returning to mourn the dead instrument, I was delighted to find that the "frosting" had disappeared. Apparently, the fumes from the compound had leaked inside at the join between the edge of the large top window and the aluminum body. Like water



vapor, but more quickly, they had evaporated.

The next time I began by sealing the join between the edge of the large top window and the aluminum body, using a glue needle filled with thermoplastic rubber to lay a bead of rubber around the edge of the window. (A glue needle is a syringe-like tool used to spot-apply glue. If you can't find one, you can probably get the same result using the finest nozzle on a cake icing bag.

I next sealed the join between the viewing lens and the body by repeating the procedure, taking care to get enough rubber on the edge of the lens itself to ensure a good seal. I took even greater care not to get any over the center of the lens, the location of the viewing slit.

After letting both seals dry for about an hour, I placed another self-adhesive dot over the viewing lens and again dipped the compass. This time it worked. I did the same for the clinometer. The seals not only prevent vapor from entering the inside of the body, they also deter the formation of bubbles in these areas when the instrument is dipped. Bubbles cause thinning of the rubber, and this can lead to holes after a few months use.

After several months of active surveying, I noticed that the coating was beginning to split along two edges, near the corners of the compass. They had been subjected to some rough treatment and the coating had worn through along the edges where it was thin anyway. I tried several methods of alleviating this problem. The one that works best, and is easiest, is to triple-dip the instruments.

An interesting feature of cured thermoplastic rubber is that it is very tough; it has a tensile strength of 3,000+ psi and an ultimate elongation of 300-400%. If the surface is intact it is very difficult to remove. However, if there is a cut or a worn-through place, and if it is on something which is very smooth, like the aluminum body of the Suuntos, it can easily be peeled off. I peeled

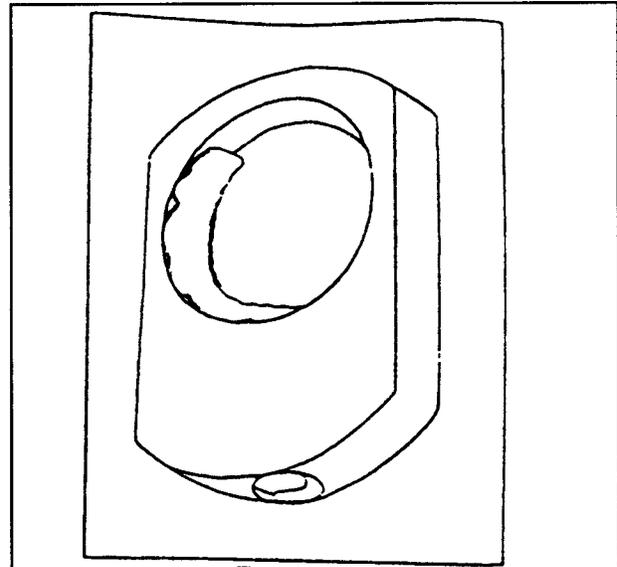


Figure 1

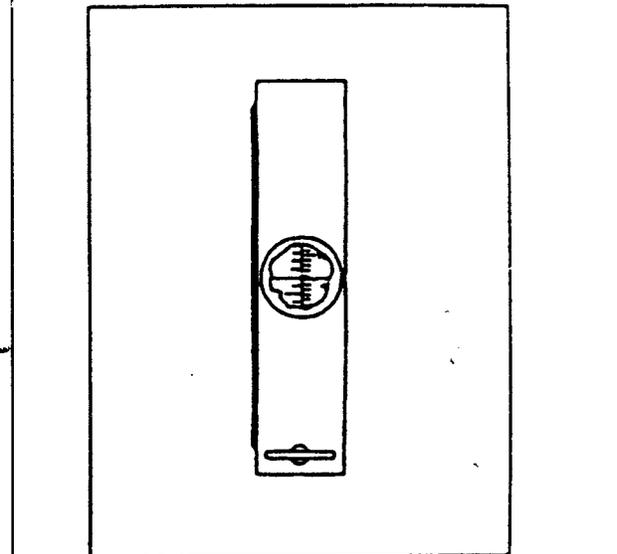


Figure 2

both of my instruments and discovered that beneath the abraded, muddy, scummy surface were a pair of instruments in mint condition! In case they ever have to be sent in for repair, this will please the technicians who work on them, and who hate epoxied instruments!

Before dipping your instruments, make sure that they are clean. They needn't be spotless; thermoplastic rubber will stick to almost any-

thing. But anything covered by the rubber will stay there until you decide to peel the rubber off. I left the lanyard that comes with the instruments attached to the ring. The ring and part of the lanyard will become rubber-coated, but that hasn't caused me any problems, and you will need some way of holding the instruments when you dip them and while they are drying.

**I peeled both of my instruments and discovered that beneath the abraded, muddy, scummy surface were a pair of instruments in mint condition!**

The first step is to lay a bead of rubber around the seam between the edge of the top window and the aluminum body (Figure 1).

Repeat this procedure, sealing the seam between the viewing lens and the body, taking care to get enough rubber on the lens itself to ensure a good seal (Figure 2). Also be sure to put some all of the way around the top (outer) edge of the lens aperture.

The edge of the aperture will be covered by a self-adhesive label during the dipping stage, and must be coated with rubber before the label is applied. Basically, you want to cover the aperture edge, the aperture wall, and the seam between the wall and the lens. Because this is a small work area, this is the trickiest part of the operation. Thermoplastic rubber is very sticky. Be careful not to get any over the center of the lens, the location of the viewing slit. Now hang the instruments up and let the rubber dry for an hour or so. It will lose most of its bulk as it dries. If you make a mess of it, just peel off the dried rubber and start again.

After you are satisfied with this stage, place a round, self-adhesive label over the viewing lens. It should just barely cover the entire lens opening. Half-inch labels fit perfectly. You will need some way of removing the label immediately after dipping. I use a straight pin, pushed through from the adhesive side of the label. The head prevents pull-out, and the end can be gripped with a pair of pliers.

The cans that thermoplastic rubber is packaged in (unless you can afford \$60.00 or so for a gallon!) are too small in diameter for a Suunto instrument to fit. Decant the rubber into a suitable container: big enough to immerse the instrument, small enough to ensure that you don't have to buy more than one can to do the job. Dip the instrument, following the instructions for dipping on the side of the can. Wait no more than 30 seconds before removing the label covering the lens aperture. Hang the instrument to dry for at least four or five hours. I usually let it dry overnight. Repeat the labeling and dipping, but you only have to seal the seams the first time. Let dry again. Dip for the third and final time. This triple-dip process has lasted on my instruments for well over four years, with no signs of wearing through. I can't guarantee that your instruments will be waterproof, but I haven't had any problems with water getting into mine, and now I can even dip my instruments in a pool to clean the viewing lens; sometimes that even defogs it.

I mentioned that you would have plenty of the rubber left over. I have used it very successfully to protect the toes of caving boots, repair coveralls and packs, and in general, just about any time that I would have used Canvas Grip. For boots, you have to make sure that there is no wax, polish, Sno-Seal, neatsfoot oil, or whatever you normally use on them. I buy boots with unfinished, unoiled leather (about \$25.00) and coat them with Color Guard. Instead of lasting a year or so, treated boots now last four or five years. It also works well on canvas boots.

# THE OTR COMPASS COURSE

## Or: The Need for Compass' Courses

by George Dasher

In 1988, I took over the responsibilities of the OTR Compass Course. This is an eight-station, seven-shot course, where contestants compete to see who can close a loop with the smallest error. Each year the layout of the course is changed, and there are often severe vertical shots incorporated into the design of the individual courses.

The end result of these six years is that I have managed to collect a good deal of data on the instruments most cavers use to survey in caves. Predominate among these instruments are Suuntos; Sistecos are a poor second, and Bruntons a poorer third. I have tossed out all the weird and strange data, averaged the azimuths and inclinations for each individual shot, compared the individual azimuths and inclinations to these aver-

ages, calculated a difference for each shot, and then averaged these differences. The end results are that I have found Suuntos to be the most accurate of the three instruments, and that clinometers are more accurate than compasses.

There are several catches. First, pretty-much the same people are running the course year after year. Second, they are borrowing instruments from each other, so--in actuality--there are a lot less instruments being used to run the course than the data might lead one to expect. Third and regarding the Brunton users, I really have far too little data to make any significant comparisons. And I would expect with so few people using Bruntons, that the majority of the users are unfamiliar with their instruments.

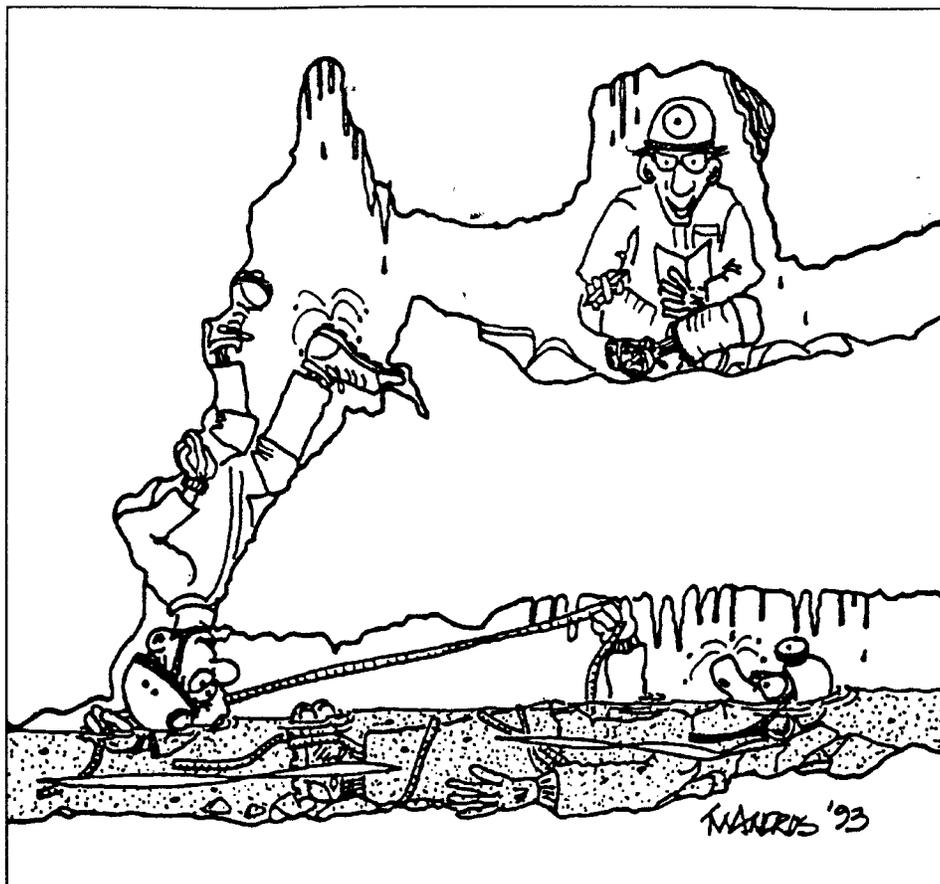
OSR Compass Course			
Average Instrument Errors			
Type	Number	Compass	Clinometer
All	167	1.011832°	0.403434°
Suuntos	150	1.01152°	0.39491°
Sistecos	11	1.47027°	0.449289°
Bruntons	6	1.7103°	0.512653°

But the bottom line is how much do most cave surveying instruments deviate from the averaged norths and horizontals? The compasses were typically 1 degree off the averaged north, and the clinometers 0.4 degrees off the averaged horizontal.

What does this mean? Well, if you are surveying a small cave with only one set of instruments, there is absolutely no need for you to calibrate your instruments against a known standard--like the OTR Compass Course. This is particularly true since it appears that most cave surveying instruments are really pretty accurate, and since it is probable that more error will creep into the survey from the instruments' users' inability to accurately shoot the instrument, or hold the instrument over the survey station.

On the other hand, if you are surveying a large cave and incorporating your data into a large overall data set, where many, many different instruments have been used to map in the cave, then it is to your advantage to calibrate your instruments against a known standard like the OTR Compass Course. That way all the instruments will be shooting to the same north and horizontal, not a bunch of norths and horizontals that are just a tad different. That last is bad for the olde loop closures.

And if anyone who has run the course in the past and who wants to know what the exact correction factor for their compass and clinometer are, then track me down. I can provide those values.



# Survey Standards

*The trend in recent years is for long-term survey projects is to establish a survey standard. The purpose of these standards is to alleviate inconsistency in data collection, extreme variations in the quality of survey notes, and significant loop closure errors.*

*The Cave Resource Office at Carlsbad Caverns National Park has worked with many different cavers and various survey groups who are involved in survey projects within the Park. With comments and suggestions from cavers involved with the Park's different cave survey projects, the Cave Resource Office has developed and instituted an official survey standard for all ongoing mapping projects within Carlsbad Caverns National Park.*

*The cave specialists check and critique all the survey notes after every survey trip and expedition to ensure that the standard is being met and to offer suggestions to individuals aspiring to meet that standard. Following are the official survey standards for Carlsbad Caverns National Park.*

## Cave Survey Standards for Carlsbad Caverns National Park

*from the Cave Resource Office at  
Carlsbad Caverns National Park*

“Modern day” cave exploration and surveying began in Carlsbad Caverns National Park (CCNP) in the 1960’s with the advent of the Guadalupe Cave Survey. Carlsbad Cavern, many back-country caves, and more recently, Lechuguilla Cave have seen large numbers of teams surveying and resurveying many miles of cave passages and rooms. Though all surveyors have good intentions, there have been extreme variations in the notes that were actually produced. Recent management of the caves of CCNP have relied more and more on well-kept notes that document more accurately and completely what is actually contained in the caves of the Park.

In order to impact the caves as little as possible while gathering a maximum of information from each survey trip, we have developed a set of

survey standards that must be adhered to by all parties interested in surveying in the caves of CCNP. The Cave Resources Office will work with each group to help bring everyone up to the standards we are setting. The objectives of surveying teams should be the gathering of quality data.

A survey team may **not** have more than 4 individuals per team. In addition, no one may enter unexplored or unsurveyed passages without surveying as they go.

All original notes should be kept in the park unless a written formal agreement, such as a Memorandum of Understanding, specifically states that original notes will be kept by the originating party. The notes should be turned in to the Cave Resources Office before the survey team or expe-

Carlsbad Caverns National Park		
Cave	Data Entry Date/Initials	
Area of Cave (Quad)	Survey Date	
Objectives	Survey Desig.	
	Survey Stations	Tie Ins
Sketch/Notes		
Instruments		
Lead Tape		
Inventory	Feet/Tenths	Meters
Other	Scale: 1" =	
Compass Type #	Clinometer Type #	
Date & Time IN	Compass Test	CRF Accession #
Date & Time OUT		
Notes		

Station	Carlsbad Caverns National Park			left	right	up	down	Notes
	Distance	Azimuth	Vertical Angle					
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	fs	fs						
	bs	bs						
	Total Survey this page							

GPO 1993 - 777-248

dition leaves the park. Copies of notes will be provided to those doing the work upon request.

### THE SKETCHER

Once the team begins to survey, the sketcher is the leader of the team and controls the speed and ultimate direction the team takes. All other team positions should work with the sketcher to help accurately survey the cave passage. Park provided cover sheets and data sheets should be used unless specifically stated in a written formal agreement that the originating party can use their own sheets. This is to help bring consistency to the various surveys being performed in the park. All surveys should have a cover sheet which should be filled out completely. Data sheets are straight forward and should make note-taking easier. Enter one station per box with the distance, azimuth, vertical angle, and passage dimensions in the corresponding boxes. **DO NOT** write two station numbers per box. This is confusing when it comes to data entry.

Sketchers should have designated letters to use for new stations before entering the cave.

The sketcher's goal is to produce a quality sketch that accurately depicts the passage that has been surveyed and to record all necessary notes, numbers, etc. that accompany the sketch. The sketcher is responsible for making sure that all needed items are done correctly.

**There are three types of drawings that must be produced for all surveys.** These are the plan, profile, and cross-sectional views. All views must be drawn to scale, on graph paper and should have a north arrow and distance scale on **each page**.

Heavy dots or small triangles can be used to denote survey stations. Make sure the stations are marked accurately and labelled clearly on the sketch. If during the course of the survey, you change scale on your notes, be sure to clearly indicate that a scale change has taken place.

The sketcher should also strive to make legible notes that are clean and neat.

**Plan View:** This drawing should be done with a protractor and ruler, to scale on graph paper. The plan view should concentrate mostly on floor detail. Cave walls, boulders, columns, flowstone, drops in the passage, etc. should be drawn in their proper positions and orientations. Smaller features should be added with general symbols such as gravel, sand, mud, dirt, etc. The use of floor-slope symbols are OK and necessary in places but the composition of the floor should also be apparent from your sketches.

**Profile View:** A running profile, taken from survey point to survey point, should accurately depict ceiling height changes, floor changes, height of station above the floor, formations such as stalagmites, stalactites, soda straw areas, rocks, boulders, bedrock, and other important features that help relay more information about that particular passage. Be sure to include ceiling leads on the profile as well. The profile should also be plotted accurately. It can be located next to the plan sketch or done on a separate sheet of graph paper. Label the survey points with heavy dots or small triangles and the station name.

**Cross Sections:** Cross-sections are an important part of the sketch and should be done whenever there is a significant change in the character of the passage or every 100 feet or so. You can never have too many cross-sections. Make sure the view direction of the cross section is clearly marked on your sketches. Like the profile view, they should depict all important features that are found when looking in cross-section at that particular point in the passage. Obviously, this should include the general shape of the passage. When surveying a large room, cross-sections as well as a running-profile down the middle of the room are very helpful.

### Passage Dimensions:

It is very important to record passage dimensions for every station. This data is important for generating 3-D plots of the cave.

In most cases, the distance from the floor and ceiling as well as left and right wall will be an estimate. Floor and ceiling distance dimensions should be measured directly above and below the survey station. For left and right wall try to estimate the distance across the passage from the station. Measure across the passage if this is feasible and more helpful. If the ceiling height is very high, try to triangulate to a point on the ceiling and a point on the floor.

### Mapping Rooms and Large Passages:

When mapping a large room, you can either pick a spot in the middle of the room and do a series of spray shots to determine wall locations or do a perimeter survey around the room.



## INSTRUMENT PERSON

The instrument person is a very important position and requires diligence and care. This person is responsible for making sure the instruments are in good working order and have been run through the test course near the CRF huts before using.

Several different types of instruments may be used; however, they must all be in degrees and must be oriented to magnetic north. Instruments utilizing quadrants or degrees and minutes may not be used. Readings should be at least to the half degree, i.e. 105.5 degrees. If the instrument reader can comfortably read to the nearest quarter degree, then that is acceptable also.

In order to prevent resurveys because of loop closure errors, **backsites and foresites** must be read. When executed, the resultant readings should be no more than 2 degrees different. If a discrepancy of larger than two degrees occurs, then the readings should be redone. REMEMBER, the goal is to provide a QUALITY SURVEY. This is not a race. Sometimes, the foresite or the backsite is going to be a better reading than the other because of conditions at those particular points. If after checking both the backsite and the foresite and the instrument reader feels that one is better than the other, then circle the better reading. Certainly, this will not be the case at all stations, but should help when looking at loop closure errors. Loop closure errors of greater than 2% are considered unacceptable and may show the need for resurveying a portion of that loop. In order to avoid resurvey, it is very important that the instrument person be experienced and careful.

For those using Suunto compasses and inclinometers, be sure to use just ONE eye and move the instrument back and forth or move your eye up and down

to accurately line up the station point and the line in the instrument. Using the two-eyed method often introduces errors in your readings because the eye looking through the instrument and the eye looking at the station point are in two different locations.

## LEAD TAPE POSITION

This position on the survey team is as important as the sketcher and the instrument reader. The lead tape determines the route to take unless the sketcher overrides his/her decision. (Remember the sketcher controls the survey team at all times). It is the responsibility of the lead tape to locate survey stations an optimum distance from the previous station while planning ahead to the next station. A station should also be set at any leads that will be surveyed at a later date. While setting stations, the lead tape must set them with the idea that the instrument person has to be able to read the instruments from that point.

The tape to be used should be in feet and tenths/hundredths or feet or meters and tenths/hundredths of meters. **Tapes in feet and inches are not acceptable.**

The lead tape position is also responsible for flagging the trail as it is being surveyed so as to minimize the impact of future visitors to these areas. Other members of the team should help in this endeavor also.

## INVENTORY POSITION

If cave inventory is part of the trip objective, the fourth person on the team inventories the

**Just remember, the goal of each survey trip is to produce a quality set of notes with minimal impact on the cave features.**

## CAVE MAP SYMBOLS FOR CARLSBAD CAVERNS NATIONAL PARK

draft of 10/24/93 drawn by Peter Bosted

### PASSAGE SYMBOLS

-  passage walls with cross section and depth
-  underlying passage
-  unsurveyed or indefinite walls
-  breakdown walls
-  survey station with depth from entrance
-  too tight
-  describe leads and passage endings

### VERTICAL CONTROL

-  ceiling height
-  ledge or drop with height in box
-  climb (c), vertical gear needed (r), handline (h)
-  pit, entrance pit
-  canyon in floor
-  ceiling lowers (hatch points to low side)
-  dome
-  ceiling channel
-  slope (narrows at top)
-  natural bridge

**AREA NAME (14 pt)**

**PASSAGE/ROOM (12 pt)**

*notes, descriptions (9 pt italic)*

### FLOOR/WALL FEATURES

-  bedrock
-  silt, clay, corrosion residue
-  sand
-  gravel, cobbles
-  small breakdown
-  large breakdown, drawn to scale
-  stalactites
-  stalagmites
-  columns
-  soda straws
-  gypsum
-  flowstone
-  rimstone, mammillaries
-  flowstone walls
-  flowstone column, mammillary mound
-  aragontie bushes
-  helictites
-  rafts
-  gypsum flowers
-  shields
-  drapery, bacon
-  spar

### FLOOR FEATURES (cont.)

-  guano
-  moonmilk
-  large raft cones (hoodoos)
-  boxwork
-  popcorn
-  chandeliers
-  trail
-  paved trail
-  archeological material
-  paleontological material

### WATER SYMBOLS

-  stream
-  intermittent stream
-  lake/pool with depth
-  sumped passage

### EXTERNAL SYMBOLS

-  typical air direction
-  scallop direction
-  strike and dip
-  fault, D side moved down relative to U side

features found near every station. If there are less than 4 people on the survey team, then one of the others can produce the general inventory of the areas being mapped. Recognizing cave features are essential for whoever does the inventory process. Novices should not be doing inventory.

The mineral inventory process being accomplished in Lechguilla Cave is a more complex inventory that requires specialized training. The contract leader for the mineral survey has the final say over who may participate in that inventory.

### DESIGNATED SURVEYORS

In order to ensure that quality information is gathered on surveying trips, the following designation system will be used.

**Sketchers** will be assigned a rating based on their adherence to the standards outlined in this document. The ratings will only be assigned to the potential sketchers by the Cave Specialist or the Assistant Cave specialist. Sketchers not demonstrating that they meet at least **Level 2** requirements may not sketch in the caves of CCNP. Areas and caves may be designated in the future that require sketchers to meet **Level 1** criteria.

**Level 1:** Sketchers assigned to this level consistently meet and exceed these standards. Notes are never confusing and are easily readable. Sketches show extreme attention to detail and are always neat. Level 1 sketchers seldom, if ever, require critical evaluations of their work.

## Sketchers Critique

<b>SKETCHER:</b>		
DATE:		
SURVEY:		
<b>COVER SHEETS &amp; DATA PAGES</b>	<b>YES</b>	<b>NO</b>
Is there a coversheet and is it completely filled in?		
Is the data legible?		
Have the passage dimensions been recorded?		
<b>SKETCH</b>	<b>YES</b>	<b>NO</b>
Is there a North arrow and scale on every sketch page?		
Is the passage drawn to scale and plotted at the measured orientation (plan & profile)?		
Is the sketch drawn at a scale that shows adequate passage detail?*		
Is the sketch legible?		
Are the stations clearly labelled on the plan and profile?		
Is there adequate floor detail?		
Does the sketch contain cross sections?		
Is there a running vertical profile?		
<b>OTHER</b>	<b>YES</b>	<b>NO</b>
Have all the pages been numbered and labelled with the sketchers name & date?		
Is there a lead list?		

\*\*For most purposes 50'/inch is acceptable. However, if passage width is less than 10 feet wide 25'/inch is recommended. It is OK to change scale in mid-survey as long as the change is indicated on the sketch

Comments & Recommendations

**This form is used by the Cave Resource Office to evaluate sketches and to make recommendations for improvement**

**Level 2:** Sketchers assigned to this level usually meet, and sometimes exceed, these standards. Sketches are neat, but may lack detail in

one respect or another. Notes are usually not confusing and if they are not neat, are at least readable. Level 2 sketchers occasionally require critical evaluation of their work, but the recommendations are usually minor in nature.

**Instrument Readers** who consistently show unacceptable loops closure errors will not be allowed to read instruments in the caves of CCNP.

### **EXPLORATION**

Please remember that caves in CCNP are contained within a National Park and, as such, there are strong conservation mandates that relate to the caves. It is essential that everyone do whatever possible to minimize their impact to the caves of CCNP.

**NO ONE HAS PERMISSION** to explore virgin or unsurveyed passages in any of the caves of CCNP. Survey is a required activity that must be done in conjunction with exploration. Looking at (SCOOPING) passages without surveying them is totally unacceptable and will not be tolerated.

The caves of CCNP contain very fragile, very sensitive areas. Digging, breaking or altering formations, or enlarging any passages requires permission from the Superintendent or his designated representative. Breaking trail through ultra-sensitive areas, such as aragonite bushes is strictly prohibited. You are required to notify the Cave Resource Office so that the NPS can be involved in making a decision of such magnitude. This also includes wading in, swimming through, or disturbing any newly found pools. **Failure to comply with these conditions may threaten your future access to the caves of CCNP.**

*Any comments or suggestions on this survey standard can be made to the Cave Resource Office at Carlsbad Caverns National Park. Anyone wishing to be considered for sketcher status at the park can contact the cave specialists for information. -Ed.*

# Cave Mapping

by Jim Nieland

*(This article originally appeared in American Caves, Volume 6, Number 2, Fall 1993 issue, published by the American Cave Conservation Association.)*

Caves can capture the imagination and fill the mind of youth with the excitement of exploration and the thrill of discovering places no one has ever seen before. When in grade school, I was caught in this excitement by reading the adventures of Casteret, Attout, Lavaur, Gemmell and Myers. Cave maps illustrated their writings, and allowed me to visualize and follow their travels along winding corridors, over drops and through rushing streams. By tracing their travels it was almost like being there, sharing in the thrill of discovery. I learned the underground landmarks of the great cave systems and in my mind's eye could almost see and feel the blackness and mystery of the great caves.

**I learned the underground landmarks of the great cave systems and in my mind's eye could almost see and feel the blackness and mystery of the great caves.**

As I think about their adventures the cave maps remain prominent in my memory. The maps they scribed form a detailed and lasting record of their achievements. Without maps illustrating their writings, the text would somehow be incomplete.

The importance of cave maps can not be overstated. Early explorers in all countries have left record of their travels and explorations on maps. Without maps it is difficult to describe the extent or features found in caves, or their relation-

ship to the surface or each other. Early surveyors often recorded important information about formations, bone deposits, historic structures, and travel routes.

Explorers have always enjoyed naming features in caves, such as the ubiquitous "Fat-Man's Misery" or the "Big Room." Named features often add to the rich history of caves. Anyone who has seen the formation called "Mae West"

in Nevada's Goshute Cave can't help but be amused. Cave maps give us the chance to look back and to appreciate a time when

values were different than those today.

On many occasions maps have been used as a "finger print" to re-identify lost caves. As rural population centers flourish then decline it is common for once popular and well known caves to be lost to memory and forgotten. Cave maps provide a permanent identification record while giving glimpses into history and exploration.

To my way of thinking, cave maps may be the single most important and lasting record one can leave. They not only provide information about the past, but also provide vital information for future cave managers.

Today mapping of caves is increasing in sophistication, with ever greater accuracy and collection of information. Computers have allowed surveyors to depict caves in three dimensions and to rotate the point from which caves are viewed in space. By the addition of surface topography, geology, and hydrologic information, one can gain an understanding of the factors influencing cave development. They can also be used to predict where additional cave passages may be found and help guide future exploration. From the standpoint of managing caves, cave mapping is considered an important first step. Cave inventories require a framework on which data can be displayed, a cave map provides the frame. Biological habitat zones, formations, historic features, trails, cave geology and hydrology can all be shown.

Cave maps superimposed over caps of the surface topography allow managers to detect important interrelationships between surface and underground water movements. When compared with geological maps, important clues to cave formation become apparent. By having caves mapped before proposed surface disturbing activities take place, potential detrimental impacts can be detected, and if necessary avoided.

Cave maps not only stimulate the imagination of youth, but are important tools for exploration, study and management of caves. So the next time you look at a cave map, begin to consider all it is telling you. Think not only about the excitement of the first explorers but reflect on the other information it is conveying and how important maps are in describing the underground.



## Survey & Cartography Section Membership List -- January, 1995

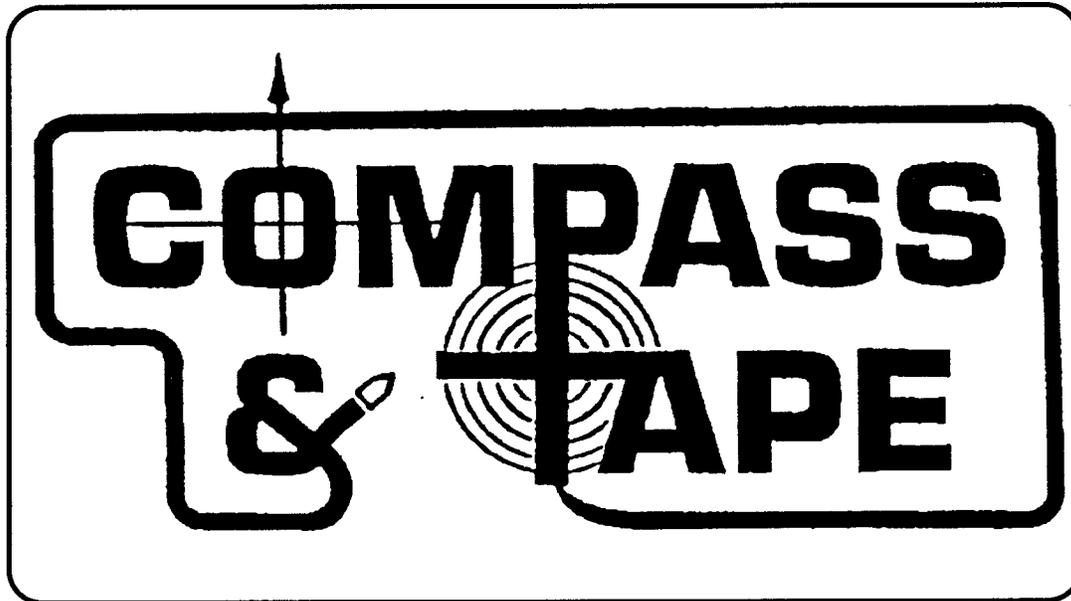
The following is a list of Section members as of January, 1995. The number following each name is the last *Compass & Tape* issue number that the person's membership includes. Separate renewal notices will soon be sent to anyone whose membership expires with Issue #37. Please send any address corrections to Bob Hoke, 6304 Kaybro St., Laurel MD 20707

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