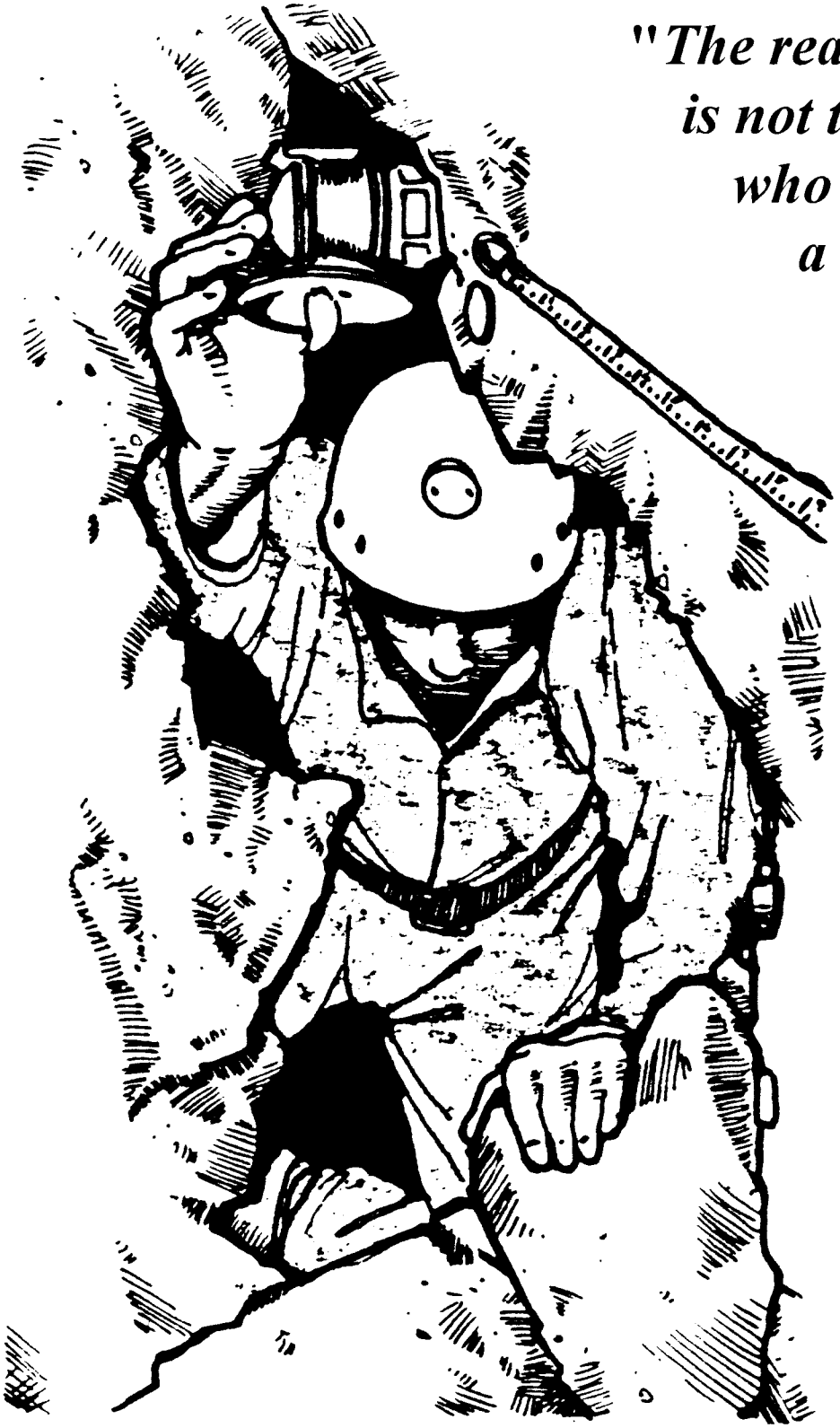

"The real explorer is not the man who is following a map, but the man who is making one."

-Paul Theroux

COMPASS & TAPE

Volume 12, Number 3, Issue 39

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 issue 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 membmers are strongly encourage 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.

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From the Editor:

We've known for a long time that computers were going to change the way we make and present maps. These days, just about everyone who's into cave mapping is using some form of data-reduction/plotting program to get a line plot. Within the last several years, some cartographers have been exclusively using computers to actually draft the maps. And for just as long, people been saying that computer-drafted maps don't have the same aesthetic appeal that characterize hand-drafted ones. Bert Ashbrook has blown that argument out of the water.

Fred Wefer has been warning us for years that maps will be presented on a computer screen rather than just on paper. He entered his version of such a map at the 1994 NSS Cartographic Salon and blind-sided the judges who didn't quite know how to deal with such a cartogaphic presentation. The SACS tried to come up with judging criteria for such maps but with little success. This is not because the task was impossible but rather because it was felt that innovation and creativity shouldn't be defined by a committee. Fred is still waiting for the rest of us to catch up to his vision of cartography.

This issue's "Letters to the Editor" shows that coexisting with the evolution of high-tech map-making and presentation techniques are a healthy variety of opinions on basic data collection and recording methods. And to keep things interesting, the Cartographic Salon, the Section's "showcase" event, is being scrutinized again.

So enjoy this bit of controversy and debate. Hopefully you will learn a little about the fast-evolving state of computer cartography, maybe pick up some cool, new survey techniques, and perhaps gain a little insight into what the heck goes on at the Cartographic Salon.

Pat Kambesis

Inside:

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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 although we will accept handwritten material (as long as it's legible). Artwork in any form, shape or size is also welcome.

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Letters to the Editor

Electronic maps, marking stations & sketch quality

Dear Editor:

I would like to comment on four of the articles in the most recent *Compass and Tape*. First, regarding Pat Kambesis' Guidelines for Electronic Maps article, it was my feeling, after attending the second SACS Session at the 1995 Convention, that the Survey and Cartography Section (and most certainly the Cartographic Salon!) have decided not to judge the electronic entries at this time. The type of entry is too new, and judging would provide direction for future entrants. This direction would not be a good thing at this moment of evolution (this last is also a problem with the regular Cartography Salon). Innovation should go in the direction the designer chooses, not in the direction specified by a committee.

Second, concerning Tom Moss' article on lead tapes, while it is important not to over mark the survey station in the cave, it is also important to mark the station prominently enough that future survey parties, particularly those not familiar with the cave, can find the survey station. Permanent stations should be well labeled at all junctions and, as indicated in Mike Yocum's article near the end of the issue, permanent survey stations should be labeled at least every ten stations. I personally prefer at least every five stations and, like Tom Moss, my survey parties often make use of very obvious features in the cave, such as prominent breakdown, jutting wall projections, and 'tites and 'mites, the last of which the survey party does not touch or mark.

My third point concerns the sketches provided in Mike Yocum's "Observations on Survey Sketch Quality." I thought that all the sketches, with the exception of Figure #1, were of a quality that I could easily (and without regret) incorporate into a working cave map provided that the sketches in Figure #2 and #4 were of small passages. All the sketches had adequate detail, lots of cross- ections, stations usually well marked, etc. Some could have used some more written details, or contained more interior passage details, and as I said previously, #2 and #4 had insufficient passage detail for large passages.

Also, none of the sketches had cave symbols that I found confusing or incomprehensible. I have, in my cartographic career, been forced to make use of far worse sketching. In addition, I see no reason to provide a scale or a direction on the sketch. Once the data is reduced and rendered into a line plot, direction and scale are automatically provided. Standardization of the sketch, and particularly standardization of the sketching scale is, on the other hand, most desirable if one cartographer is incorporating a whole bunch of different persons' sketches into the working map. I, unfortunately, always end up using a bunch of very unstandardized stuff. Put another way, I often find myself trying to save someone else's very messed up project.

The item I absolutely cannot live without is the left-right-floor-ceiling dimensions. Without these dimensions, I cannot render the sketch into the working map. I need these dimensions to determine how wide the passages are, to reconstruct the size and proportions of the cross-sections, and to figure the vertical extent of the profile view. If you are ever sketching in one of my projects, include left-right-floor-ceiling dimensions. Otherwise you are going to have to draw the working map yourself.

That's all. I'm out of here....

George Dasher

On Mapping Techniques

Dear Editor,

Congratulations Pat, on your last newsletter (Vol. 12, No. 2, Issue 38). It was a good issue and contained some good articles.

Tell your authors that I read their articles and enjoyed them. There are some points that I would like to discuss a little further with them.

To Carol Vesely on her "Message from the Chairman": I, too, am in somewhat the same boat as the long time caver who has not attended a convention for a while. I first helped Bob Thrun, (Potomac Speleological Club), map the Sinks of Gandy Cave in West Virginia. That was 25 years ago.

I was fascinated with his attention to detail. He drew a map inside the cave, on mylar using a scale and protractor, while standing knee deep in a cold cave stream. Since I had 5 years of mechanical drawing and architectural drafting experience, it was easy to copy his methods. (My thanks and appreciation to Bob!)

So now I have found out that during the last 5 to 10 years the cave mappers (who compete at the conventions) are matching my style and methods; and exceeding the quality of my maps. Its nice to see you mappers "finally doing it right."

I'm mapping more than ever before lately. (Even get paid to ridge walk and cave map professionally at times now.) I have a few keen mapping techniques I would like to pass on to the readers for *Compass & Tape*. Try them out. There is no "one best way" to map caves. Experiment. Challenge all your assumptions to mapping.

To Peter Sprouse, "LRCFs - We Can Do Better". Nice article! That was a real hard hitting sentence where you stated,

"I reject the whole Left, Right, Ceiling Floor technique." You followed this shortly with, "I believe that the Left, Right, Ceiling, Floor technique is a relict of a rough sketching style that involved scaling and orienting the sketch on the drafting table, in other words fudging."

How can I state this clearly? I agree with you Peter, that LRCF is a relict; but that I follow George Veni's principle of measuring LRCF. I'm challenging that principle now though. I am finding that I am not using my LRCF data. Its redundant! Its a waste of my time. I am strongly considering dropping it altogether from my survey notes.

This sounds radical, but it isn't. It's a development of a technique that I have become very comfortable with. My mapping partner several years ago was Mike Russell. We made quite a team. This was our "whole mapping team," all two of us. Being two people short was standard for years. To compensate, we took along two books. I would draw to scale, while he read instruments and recorded the survey data. We would "drape and tape" and then Mike would take a 25-foot steel carpenters tape and measure what I call "perpendiculars" off the draped fiberglass tape. (Don't need a tape man now.) These are 90-degree perpendicular shots from the nearest foot mark on the fiberglass tape to the cave walls, where they bend and turn. It accurately places cave walls to within 6 inches. See Figure 1.

We recorded this new data in the right hand column of the survey book, just past the LRCF data. An example would look like: 15L8, 15R6, 25L15. This means that 15 feet down the draped fiberglass tape, turn 90-degrees left and go 8 feet to the cave wall. Also 15 feet down the draped tape, go 90 degrees Right for 6 feet to the right side cave wall. The last one is left up to the reader to determine.

That was then. I carry this method another step forward now. On the in-cave sketch (Figure 1) you will see several places where there are two side shots spaced very, very close together. If you look closely you will see that one will go all the way to the cave wall. The other one is a shorter shot measuring the toe of a slope, front edge of a wall left etc.

Now I find that having my book person write these perpendicular side shots down is a waste of his time. Why you ask? Because I don't just sketch to scale any more. I draft to scale! MY FINISHED MAP IS THE SAME SCALE AS MY IN-CAVE SKETCHES. It eliminates the need to write this data down.

All I do now is get on the computer and calculate XYZ's of survey stations. I then plot these points on graph paper (to scale), and tape my mylar film over the top of the graph paper. I next xerox the cave field notes, slide them between the two sheets, turn on the light box and directly trace the field notes onto the mylar. It's real simple and fast.

As for the need of LRCF, that has evolved too. I came up with a simple solution! I want and need more cross sections now. This slowed me down too much, so I gave this "job" of doing cross sections to the book person as part of their responsibilities.

The tape man has a new responsibility now too. He has a 16-foot steel carpenters tape attached to his belt. Besides taking the mark end of the tape forward, he now measures LRCF - for the book man doing cross sections.

This works surprisingly well underground. The mapping team stays busier. They are not sitting around waiting for me to finish up sketching anymore.

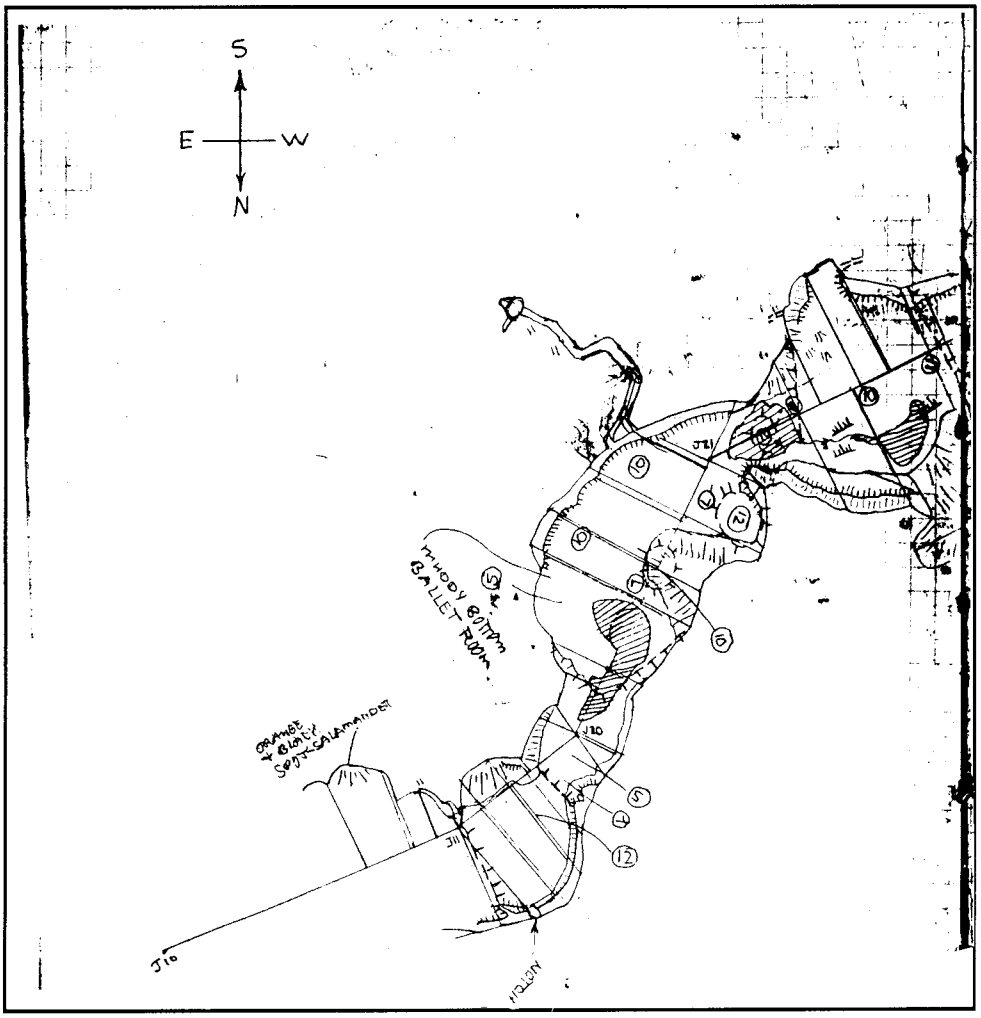


Figure 1. In-cave sketch by Bruce Zerr

So now at each station I have a cross section of the cave passage drawn. Now tell me why do I need to record LRCF? Just a waste of time. I use the cross section sketch instead. It's drawn on graph paper to scale.

To Tom Moss: "The Art of Lead Tape and Other Related Ramblings". Nice article you have here on placing stations. I concur down to your paragraph that starts out, "Place recoverable stations whenever possible," I challenge this statement. Why? I have been using floating stations for the last two years. I bring along a pair of 3-foot dowel sticks for stations. These are stuck in the ground in the middle of the passage until they are steady. I try to position directly underneath the "ceiling joint" that formed the passage. This method of station placement better captures the passage orientation. It works great! It's also super easy to read front and back shots off the dowels. When you remove the dowel and move one, the station disappears except for a small round hole.

About every third or fourth station I usually run across a very nice prominent cave outcrop point or top of a breakdown block that is easy to read in both directions. This becomes a recoverable hard point. I mark these with a small carbide dot, and a slip of heavy gauge aluminum foil that I indent/scribe with a ball point pen.

I carry two rolls of this foil, (200 inches each) rolled up and stored inside a 35-mm film canister that has a knife slit along side the edge. This lets me pull out a 3 inch piece of aluminum tape just like using a scotch tape dispenser. I cut, scribe the station number on it, then tear it off. The bright shiny aluminum makes the station easy to see. I have used it to mark my dowel holes in a cave and covered them this way.

So far I only have had trouble with pack rats in one cave. He moved the aluminum tape from stations for as far as 100 yards. Sometimes people remove them too - but generally I am forever finished with most stations once I move on to the next one. If I lose a station I still need, I have the carbide dot and my draft. Tom states that he surveys a big room by splay shots. I tried that method and was not satisfied with how slow it was. I survey either right down the middle using perpendiculars, or if the room is really big, survey a loop right around the perimeter.

Now I have stated above that I use carpenter tapes for measuring my side shots. In the last 2-3 years the price of these steel tapes has been cut in half. They only cost $6-$7 now at Walmart. This makes them so cheap that they can be considered an expendable, replaceable item.

Your lead tape person may grumble about the extra work you are putting on him. He quickly warms up to the idea and becomes much more reasonable when he "DOESN'T HAVE TO KEEP CRAWLING THROUGH THE TIGHT CRACKS TO MEASURE WALL DISTANCES." He quickly finds that he can stand right beside the sketcher - and just push the steel tape over to the far wall. Then he pulls the tape back, moves up the draped tape and quickly measures another couple of wall shots. Real quick and simple.

These steel carpenter tapes have become handy tools in measuring ceiling heights. Because they are steel they will let you measure upwards to 15 feet before they kink. This range, though small, covers most of the ceiling heights you will measure. Don't get one soaked though. They rust badly when wet.

When I first started using the steel tapes I guessed ceiling heights, then measured them. I found that even at these close ranges that I missed guessing 10-25% of the time. Now I tell the tape man to measure and we get it right the first time.

Three weeks ago I took a full survey crew of four out on the Oak Ridge Reservation. The cave we were mapping had important cave features concerning domes, and up-dip infeeders along bedding planes. For this cave I experimented with bringing along "three books" and "two steel tapes". My instrument man got the third book. His added duty was to do a cave profile. I got the extra steel tape.

So on this trip, I got a plan map of the cave. I also got full cross sections at all survey stations plus domes and infeeders, and a full cave profile. The arrangement worked fairly well considering that it was an experiment. My instrument man was getting behind due to the lack of experience sketching. To compensate for this I took over the instruments and had the rest of the survey team work as a three-man team until he caught up.

So my recommendation is to try three books at one time and see if you like the extra results. Do some cross-training before hand and be prepared to fill in if someone is not quite ready to do the next shot. In some respects if feels nice for a change not having the crew sit around waiting for me, the sketcher, to finish up.

To Pat Kambesis on "Graphical Solution for Determining Ceiling Heights". Cavers are probably not going to use your "Graphical Solution for Determining Ceiling Heights." It has some serious drawbacks. You have to draw everything out, using a protractor. It takes too long. It detracts from the goal of surveying. It is also clumsy. There's a faster way to do it in the cave. It's just as accurate and it's easy to do and use.

Your method and mine are very similar. When you compare them there are only a few small differences between them.

The very first step is to have the sketcher measure the distance from the ground to his eyeballs accurate to the nearest half-foot. This would be 5.5 feet for most guys, 5 foot for most gals Do this step before you start mapping. Then remember this number.

Next find the exact place where you want to determine a ceiling height. It can be a point, a projection, even a flat featureless ceiling. It doesn't matter once you determine the spot you want to measure.

Now dig in your cave pack and pull out your spare electric flashlight. Use your friends if necessary. Turn it on. Grasp the top of the flashlight with the left hand.

The fourth step is to have your instrument man come forward with the fiberglass tape in hand. He gives you the tape. You give him the dumb end.

Now grasp the fiberglass tape with your right forefinger and

thumb, and drop the rest of the tape to the ground. Make sure that the spool is unlocked so that tape can be pulled through your fingers easily. Keep holding onto the flashlight with your left hand.

For the sixth step have your instrument man start walking away from you while pulling out fiberglass tape. He makes sure he still gets a real good view of the ceiling target.

The next step requires coordination on your part. Grasp the flashlight in your left hand by the top. Use your thumb and forefinger. Now here is the secret. Pinch it by the top part of the reflector - so that the flashlight pendulums by its own weight. When it quits moving it will be pointing straight up. Now move directly underneath your ceiling target. Shine the beam upwards so the spot beam is directly where you want it.

Now move the flashlight in your left finger up to your left eye and hold it. Check the ceiling beam spot. Is it shining on your target? Now move the right hand with the tape up in front of your right eye. Squeeze the tape to put some drag on it.

Now your instrument man should move backwards looking through his Suunto clinometer. He should be looking at the percent of grade, right side scale.

When the instrument man gets a good shot on the center point of your flashlight beam, while lined up to 100 percent of grade, (45 degrees) he yells back mark. You pinch the tape and read the distance.

You are not quite finished. The instrument man now takes a quick horizontal shot on you with the clinometer. If you are eye ball to eye ball, he tells you to add 5.5 feet to your tape measurement. If not, he tells you how much to correct for.

Chris Tunket and I used this method for the first time in the Fire Place Room in Eblen Cave. We were shooting station to station down a very tall trunk passage. I had estimated ceiling height of this trunk passage above the next station at 40 feet. Using the extended steel tape and estimating, I came up with a lower estimate of 35 feet.

Since we already had the survey tape aligned on the floor, I picked it up. Chris did the same. We got out a flash light to spot light the ceiling. We invented the above method with a little trial and error. I came up with the ceiling height of 27 feet.

This seemed short so I tried it again. This time I came out with 28 feet. The second time was rock solid, accurate. I then switched positions with Chris. He quickly shot to the ceiling and came up with 28 feet too. So much for estimating ceiling heights anymore.

I like this method because it only takes about 10-15 seconds of your time to get a ceiling height, with just a little practice. Think about it: more than likely you already have the tape stretched out; your instrument man is on the "other" end of the tape. Shoot the ceiling height right above the next station!!

If a ceiling shot at 100 percent of grade is impossible or inconvenient, try using a 50 percent grade shot. Just divide your tape length in half. Then add the eye-ball height correction factor to the result. For a 40 percent grade shot you would move your decimal place one place to the right. This is the equivalent of dividing the tape length by ten. Now multiply your answer by four.

Again, it's a real quick method, no special ceiling target needed, no protractor, no sketches, and you have everything you need all laid out in front of you ready to go.

Good Cavin,

Bruce Zerr

NSS Cartographic Salon

An Open Letter to All Cartographers of the NSS:

For some time now, I have had a nagging suspicion that our NSS Convention Map Salon may not be adequately recognizing the talent it displays. A prime example would be the Swiss entries in the 1994 Brackettville Convention. The scope and dimension of their maps was awesome. The meticulous detail and innovative representations opened a whole new vista of possibilities for me. Their maps, however, were eliminated from the competition because they lacked certain information in the title blocks and the entrances were not clearly defined.

Another situation that I feel has been long overlooked is the underwater cave maps that have been entered in recent years. The work that is involved in mapping a multi-mile cave all on scuba support cannot be overlooked. Segments of work can only be one to two hours long and demand long decompression stops at the end of each dive. Obstacles such as one to two foot visibility and narcosis below 100 foot depth make the job even more challenging. Most projects involve literally hundreds of dives. In spite of the effort involved, these maps have faired rather poorly in competition with their air filled counterparts where cartographers can sit more or less at ease and take as long as they like in completing a perfect sketch.

My own entries in this year's salon were intentionally something of a mixed bag. I basically picked up whatever was lying near the top of the pile and entered it just to see that would happen. Some of the maps were prepared specifically with the Salon in mind, while others had been done with very different objectives. I attended the critique session, listened to the comments given by the judges for every map entered and studied my own critique sheets very closely. The end result of these efforts is basically a state of advanced confusion. Let's start with the critique sheets. They are divided into four sections.

The first section is entitled Classes. This section is intended to divide the entrants into groups according to length. The four groups are 0-500m, 500-1600m, >1600m, and a last group entitled simply Special Class. I thought it was interesting to see that one of this years judges ignored this section almost completely, using it only once for what they deemed a Special Class entry. All of the judges ignored the section more than once, and stated in the Critique Session that, "The length of a cave was considered to be insignificant. Everything was basically lumped in together." Hmmmmmmmm, well, OK. Let's move on to....

The second section is entitled Mandatory Requirements. It contains seven items: cave name, obvious entrance or connection with the remainder of the cave, north arrow (true north preferred), bar scale with linear units, vertical control, date (survey date preferred), and cartographer or survey group named. As the title suggests, lack of any of these requirements results in the elimination of the entry.

The third section is entitled Quality Factors. It contains six items: balance and layout, drafting and technical quality, detail thoroughness, vertical control quality, lettering, and visual impact. Each item is scored from zero to ten. This seems to be the heart of the competition. One judge set an arbitrary cutoff of 45 points (75%). Anything below that level was eliminated from further consideration. The other two judges scored consistently higher in this section, so I assume their cutoffs were also higher, although there are no annotations to this effect on the critique sheets.

The fourth section is entitled Perks. It contains six items: site details (surface, geology, etc.), complex representations, innovations, cross-sections, legend (or symbols credit) and, of course, other. Each item is scored from zero to five. If an entry is eliminated in the earlier running this section is often not even scored. So here we are at the cutting edge. The difference between the medal, blues, greens, and..... oblivion!

The remainder of the sheet allows for the cave name and the judge's name at the top and a comment section at the bottom. So, the rules are written. Now let's go back and compare all this to the entries that I was critiqued on for the year.

Mertz Cave is a 2.5 mile long sinkhole plain cave located in Perry County, Missouri. The map was drafted in 1974, four years before the Salon was initiated. I thought it might be interesting to see how the times had changed. The bulk of the survey was done 24 years ago in a system with a gradient too low to detect with a Brunton compass. The map was eliminated in section one, no vertical control. When I pointed out the circumstances to the judges during the verbal critique I was told, "Well then, I guess you'll just have to go back and resurvey." My, the times certainly have changed!! In all fairness, though, I should add that the same judge allowed under comments that it was a "Nice map for its time!"

Caves of the Dripping Springs Escarpment is a compilation of 535 miles of cave survey contributed by the members of seven separate projects working in the Mammoth Cave Area. All of these caves drain to an interconnected series of springs along the Green River. The political interactions alone made this one of the most difficult maps I have ever produced. A project of this magnitude could obviously not be rendered in a normal cave map. The media chosen was a splice of six topographic maps printed in a gray shade with a second overlying negative showing cave passages in black. The map was eliminated on two counts!! The entrances were not marked (a mandatory political maneuver), and there was no vertical control (The only way to do this would be with colors. A nice idea, but prohibitively expensive at the moment.)

Oh, wait a minute! Even though the map scored lower in Quality Factors than any other that I entered, the shear magnitude of the project must have triggered something. By unanimous decision the map was placed in the Special Class back in section one and awarded an Honorable Mention. OK, so now we see that even though a map scores abominably low

by all accepted standards it can still receive "special dispensation" and be awarded a ribbon anyway. All at the judges discretion, of course. Hmmmmmmmmm!

Moving on to map #3. Sistema Cheve is the second deepest cave in the western hemisphere. Its surveyed depth is 1386 meters with a length of over 20 kilometers. We needed a map for the recent project publication, so a plan and profile were prepared with the intention of reducing them to an 11 X 17 format. I drafted the plan view from working quadrangles while Nancy Pistole reworked an original larger profile drafted by Carol Vesely. The two maps were entered together.

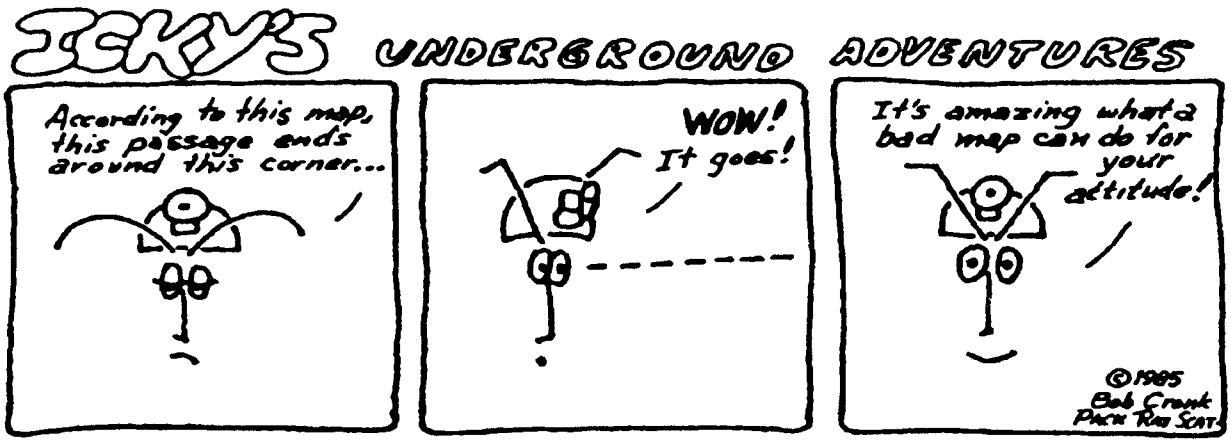
The judging met all the Mandatory Requirements. The first two judges awarded 97% and 96% in Quality Factors. The third judge was consistently tougher in this section, but still allowed 82%. This gave an average score of 92%. There were additional points scored in Perks by all judges. Under comments, on the plus side one judge wrote "Ah-a new concept, judge the map as it has been published." On the negative side another judge commented that if two maps were to work together as a set, they should have similar lettering fonts. The map was eliminated without further comment! WOW !! Stiff competition this.

Buzzard's Roost Cave is a short cave in Barren County, Kentucky, with a vertical extent of about 200 feet. The cave has never been completely surveyed and probably won't be until the current litigation over the death of a visiting tourist on the "wild cave tour" is completed. The map was prepared under contract to the prosecuting attorneys with a very exact set of requirements in mind. It was to show only the areas of the cave involved in the accident. They wanted a 3 foot by 3 foot map that would be entered as evidence and viewed by a selection of random jurors from the confines of their seating arrangement in the court. To meet these requirements a number of the more commonly accepted characteristics were changed. The line weights chosen were very bold in order to be seen from 10 feet or more away. The legend occupies fully a third of the space to better explain the map to a lay audience. The first and last cross sections are marked with A-A' and O-O' to better explain which way they face. The map begins in the visitor center last visited by the ill-fated tourist and ends at the point where he took his unfortunate header from the top of an 18 foot ladder. The map scored very low (surprise, surprise) and was eliminated because of, you guessed it, "line weights too bold", "legend is too large", "inconsistent cross-section lettering", and the Mandatory Requirement "Entrance not obvious or connection to the remainder of the cave". Obviously not a salon quality map this, but then, that was kind of the whole point! I might add that although the Salon Judges did not think much of the map, the attorneys and a commercial cave owner-operator who viewed it all loved it. I guess I'll have to wait for the trial to receive the final judgment on this one.

Gua Kulit Siput (Snail Shell Cave) is a multi level phreatic maze cave located beneath the Gunong Buda Massif in the Malaysian state of Sarawak on the north side of the island of Borneo. The cave is 5.8 kilometers long and 470 meters deep. The map was drafted with an upper level offset and a complete vertical perspective for depth control.

Although it was reasonably well received by the judges, they were not impressed with the balance or layout. Given the steepness of the competitive curve this was apparently its fatal flaw. The map was eliminated.

Blunder Hole Cave in Jackson County, Alabama, was my last entry in the Salon. It is 1600 feet long and 408 feet deep. This map, too was presented with a complete vertical perspective. The views in both of these caves were drafted from a SMAPS computer plot tipped 20 degrees above true horizontal. This gives a better view angle to include both floor and wall detail, and better handles the problem of one segment of passage lying behind another in an "S" bend. Unfortunately, it also foreshortens some passage segments and tips the gradient at an unusual angle. To my knowledge this is the first time a vertical perspective has been represented in this manner. Previous such perspectives have all been described to me by their authors as "artistic renderings and not necessarily true to life." The Swiss data reduction program, TOPOROBOT by Martin Heller uses this same type of true angle representation.



Pack Rat Scat

Although one of the judges commented on the view as being a "New profile idea," I was amazed at their unanimous decision. In section 3, Perks, under innovations the maps received a resounding ZERO from all three judges. Not only this, but it was clear from one judge's written comments and verbal review that the map had been eliminated largely BECAUSE OF the attempt to use a different technique.

The intended purpose of the Cartographic Salon as it is announced with the awards each year is "to promote excellence and raise the standards of cartography." This year's judges stated quite simply, "We don't know or care if a map represents reality or not. All we are judging is its artistic excellence." I can not help but wonder if we have not left something behind in the pursuit of this excellence. The words of one of this year's judges keep coming back to haunt me. The comment was made in regard to another entrant's eliminated map. They had used an ink sketch for a logo on their draft. The judges deemed it too dark and overpowering for the balance of the rest of the map. The summation of one judge was simple and to the point. If you're not an artist don't try! A pretty bold statement this, but the judge felt firmly enough to repeat it a second time, so let's try it again ourselves. "IF YOU'RE NOT AN ARTIST, DON'T TRY!"

Is this really the message our NSS Cartographic Salon should be projecting? To me this one simple question unleashes a whole host of others. What about the visiting cavers from foreign countries who attend our conventions with maps of a very different style? Why were the cave length classes simply left out in this year's judging? What about the Special Class that is used now at the judges' discretion? Should this perhaps be installed as a permanent category that can be entered at the cartographer's discretion rather then the judges'? Could a short description of each map be submitted along with the entry to give the cartographer a chance to explain their own work in their own words? Whatever happened to the Display Only category where a venerable old map could be left to rest in peace? What about the aspiring younger map makers? Should they be given a chance to exhibit their first time productions in a less rigorous environment? And what about innovative new ideas? Should they be given a slot of their own as well? TOPOROBOT is the most amazing thing I have seen in cave cartography in a decade. After the luck of last year's Swiss cartographers it wasn't even entered in competition!

Promoting excellence in cave cartography is without doubt a very noble goal. I hope to be chasing this elusive dream for many years to come. But are we overlooking a few things in our pursuit of perfection? Are we perhaps creating a set of blinders that allows only tunnel vision? Should we perhaps stop for a minute to consider just what we might be overlooking? Is the pursuit of aesthetic beauty the be-all end-all of cartographic excellence? Or should we perhaps allow a little more room to recognize innovation, history, pubescence, and reality?

I have spent a good deal of my life simply being different. It doesn't bother me to buck the current and stand alone if need be. My last question is very simple. Do I stand alone this time, or are there others of you out there who believe that it might be time to have a close look at changing the system? Would it be a good idea to appoint a committee to reconsider the critique format of the salon?

Thanks to the editor for allowing me a chance to vent my spleen. I feel much better now, and look forward to hearing additional comments.

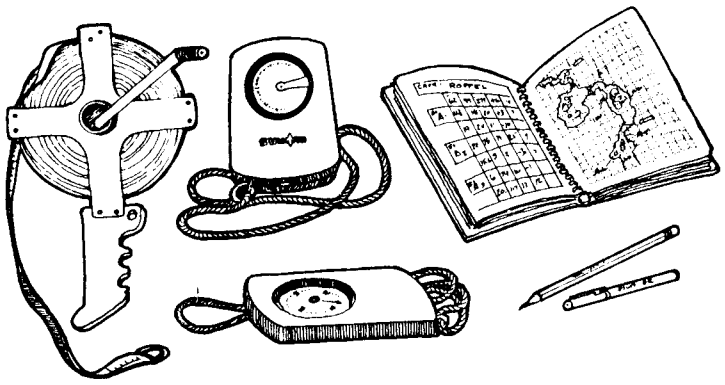
An artist who tried,
Don Coons

Reply from George Dasher

I would like to respond to Don Coons' concerns regarding the NSS Cartographic Salon. I too have entered maps in the Cartographic Salon since the late 1970's. I helped judge the Salon in 1988 and 1992. I was officially made chairman of the Salon for the 1990 Convention, but because the previous Salon Chairman had troubles attending the 1888 and 1889 Conventions, I was also more-or-less in charge of those two Salons.

It is my opinion that the Cartographic Salon has some problems. Most of these problems, I suspect, are shared by the other eight NSS salons. One of the biggest problems is that the judging in all the salons is subjective, and this has caused problems in the Cartographic Salon. Incredible looking cave maps have been entered and have won nothing. All were missing what the judges considered to be critical or quality requirements. In an effort to define what is needed on a cave map, the Survey and Cartography Section (SACS) formed a committee in 1990 which formulated criteria by which the Salon is judged. I personally feel that these criteria and the judging form that followed are positive things. To repeat: all the judging in all the NSS salons is subjective, and all NSS members and convention goers should remember this when they view each salon. The criteria in all salons varies somewhat from year to year, and the differences between the entries can be very small, particularly among the top choices in each salon. Given a different year and different judges, the results could be different. For this reason, the salon judges can give more than one overall Medal award if they choose. This has happened twice with the Cartography Salon, in 1981 and 1992.

This is the bad-news of all the NSS salons. You usually hav one winner, but you also have losers. And some of these losing entrants are incredibly, incredibly good. There are at least five people who routinely enter maps in the Cartographic Salon and who could have, had things been a little different, won one or two or even three Medal awards. These people are among the top cartographers in the Society, yet they have never won a Cartographic Salon. They are the dead bodies left behind by the vampires of the winning maps. This to me, is the genuine bad news of the Salon. We are not honoring all of our best cartographers.



As I said previously, I have entered many maps in the Cartographic Salon. My maps have been criticized, cut-down, and other-wise demoted. In 1988, when I first judged the Salon, I attempted to judge by the criteria by which I had been judged. Quit judging by such silly criteria, the other two judges said. You've been screwed in the past. Go stand in a corner. Now, because of SACS, the Salon has official criteria by which we judge. I like to think it makes things better, but Don is correct: the judging criteria can be trite, and there is always room for improvement.

But there is a good side to the Cartograhpic Salon. It does improve the overall quality of cave maps. Compare the new maps to the old! It gives the Society's cartographers a chance to compare their work, and it gives them a chance to communicate with other cartographers. In addition, and this is something I feel is very, very important, the Cartographic Salon gives the Society a chance to recognize not only the best of our cartographers, but also to recognize the work of all cave cartographers. The Cartographic Salon is one of the most popular displays at each convention, and the salon critique, usually held each Friday morning, is extremely well attended. We often have more people than room, and the attendees' attention always lasts far longer than my abilities to concentrate on the maps.

For the record, I don't often agree with the judges. They tell me to shut up and order me into a corner. I pick the judges (there are between two and four) before or at the beginning of each convention, and I usually try to pick people who have entered good maps in past salons. I too, do not like it when the judges rank artistic merit over technical merit, and it is my opinion that this year's three judges were technically orientated. I did not, during their judging, find any faults with their judging, and I thought they did a fine job. I did, the following day, wonder if other maps should have been given awards but then I always do this after each salon. Predominate among my 1995 concerns was Don's map of Buzzards Roost Cave. I know, I know. Back to my corner....

As for Don's other concerns: the Cartographic Salon judges have the full authority to use or not use the three historical length categories, and they have the authority to create special categories, as do all of the NSS salon judges. The cave length categories have been ignored every year since at least 1988. This is done entirely at the judges' discretion and it was done in 1990, a year that Don judged. The categories force the judges to give a Merit Award in each category when perhaps no Merit is deserved. They also force the judges to give one Merit when perhaps two or more are deserved. I personally do not like these categories, and I throw them out when I judge. They may be a historic and unneeded relic from the salon's past.

The Special Class category is a permanent category. This year, the Cartographic Salon judges elected to create a special category of maps showing the regional locations of caves, and they gave two awards in this category. This year's special class will not be installed as a permanent category. If it were, we wouldn't have another such entry until the year 2005. Special classes come and go. It is my feelings that the authority to create these classes should remain with the judges and not be given to the entrants. Other special classes have included maps of underwater caves and computer-drawn maps. If a teenager or pre-teen would ever choose to enter a map in the salon, it is my guess that the judges would then create a special class for these maps.

The Display Only category is not only alive and well, but four of this year's maps were Display Only. One was mine, the other three were produced by Martin Heller. He and I discussed (on Monday morning) whether his maps should be shown as Display Only. I can remember very little of this conversation, but the decision was made to go Display Only. As far as I am aware, Martin showed his maps in the Display only portion of the salon only because of our conversation, not because of the performance of the previous year's Swiss entry.

As far as judging Martin's maps, I personally would prefer that the salon not do this at this time. His work is too new and too innovative. Judging would provide direction for future entrants, and I am not sure giving this direction would be good thing at this moment of evolution. Innovation should go in the direction the designer chooses, not in the direction of an arbitrary committee. Also, at present, we have no criteria for judging these complex and very large computer line maps. As Don said, the quality factors are the meat of the competition. They are, despite all attempts at standardization, subjective and change from year to year and from judge to judge. Legends and titles which are too bold (or too small and too light) are also a common problem among Salon entrants. The comment about Mertz Cave that it should be resurveyed was not called for. The Cartographic Salon is a very time-consuming and demanding event, and everybody working with it is flat-out exhausted by the end of the convention. All cave maps, however, should display some sort of vertical declination. How else will the map user know if the cave is horizontal? In 1992 I won the Salon with one of the world's most flat-lying caves, the Sinks of Gandy. Despite the flat nature of the cave, the map showed the vertical in two methods.

Don's "Caves of the Dripping Springs Escarpment" map was moved into a special category where the judges did not have to be limited by the mandatory requirements. The Blunder Hole Cave showed a perspective, titled as a profile

view, which had certain passages above and below other passages. Unfortunately, the below-passages occasionally had labeled elevations higher than the above-passages. I cannot comment on either Sistema Cheve or Gua Kulit Siput (bad memory.) I do know that these maps had some problems. The problems were not that severe, but they were enough to move the maps out of the award categories. As Don said, the competition was very stiff, and perhaps one solution would be to simply give a lot more awards.

All of Don's maps were very good. Most came very close to winning awards. A majority of this year's salon maps were in this situation, including several maps drawn in color by one of the Society's newest cartographers. I am sorry that Don felt that his maps did not place as well as they should have. I know it will not make him feel better, but I often felt that way with my own entries. I now often feel that way with other people's entries, and this year one of those people was Don Coons. I hope that he continues to enter his maps, and I hope that he will also help judge the salon in future years.

I personally have never drawn a map to please the Cartographic Salon judges. I have used their critiques to correct what I felt were appropriate concerns. I know that many of the Society cartographers also feel this way and, although these people frequently enter maps in the salon, they do not tailor their maps explicitly for the salon.

As for Don's other questions: first-time salon entrants have not only won Merit Awards, but they have won the Medal award. I do not, however, recall a first-time cartographer receiving any award. Foreign entrants have won Honorable Mentions, Merit Awards, and the Medal Award. Maps of underwater caves have won Honorable Mentions and Merit Awards. Some of these are very good, but none so far have won a Medal. Last year, one was a contender for the Medal award. The 1994 Swiss map won an honorable mention. It was a very good and very impressive map, and perhaps it should have received a higher award. On the other hand, last year's judges were very meticulous and very conscientious and, if we had their critique sheets in hand, we might agree with their decision.

I can only hope that we in the Society and the Cartographic Salon are not overlooking critical items and important map styles in pursuit of a single line of perfection. It is my opinion that a person does not have to be an artist to win, and there has been in the past some very unartistic maps that have received awards. The purpose of the cave map should not be the pursuit of artistic beauty; it should instead be the quest for cartographic excellence. And although artistic ability can greatly enhance the map, the map should represent reality. But, to quote Doug Medville (is this now getting serious?), Don's questions are good questions, and they are ones that the Cartographic Salon should periodically ask itself. As far as forming a committee, this is a two-edged sword. Committees standardize and give the entrant a clear direction in which to move to win an award. On the other hand, such direction also restricts the inventiveness and willingness of the entrant to experiment. The Cartographic Salon has worked with committees in the past to better define the quality of our maps, and the result has been a standardization of factors that will eliminate a map from receiving an award. The bad side is that this standardization has helped move the salon maps into the realm of large-scale, large maps with intricate plan views. My personal choice is that no committees be immediately formed. We recently traveled that road. Don, if he would like, can judge the 1996 Salon.

I am going to have to stand by the mandatory cave map requirements. All caves have a name, and the map should show this name. The political and geographical location, by the way, are not mandatory requirements. All caves have an entrance, and the map should display this entrance. All cave maps should have a north arrow and scale to show the orientation and size of the cave. Caves are developed in both the horizontal and vertical dimensions, and all cave maps should show both the horizontal and vertical, no matter how horizontal the cave. All cave maps should indicate when the cave was surveyed. This is so the map user knows how up-to-date the map is. And all maps should display the chief cartographer, surveyor, or survey group that mapped the cave. This is so another caver, be that person a geologist, biologist, cave rescuer, or another exploratory group, can contact the cartographer or the original survey group for inside information about the cave. The cave map is a scientific document, and it should have an author.

Don's letter raised some good points, and I wanted to address all that I could. I know that, with any competition, feelings will be hurt. But I am also aware that this competition brings more maps into the Salon, and it is my sincere hope that Don, and all those persons who have not received the awards they feel they deserve, will continue to enter in the salons. The Society has many, many talented people and it is unfortunate that no matter how extensive or just the medium, we are never going to be able to properly recognize or honor them all. This is particularly a crime in Cart Salon, the most work-intensive of all the NSS salons, where the entrant may spend a thousand, tens of thousands, and even millions of man-hours mapping the cave, then spend between a few and several hundred hours reducing the data and drawing the maps, and still not win any type of award what so ever, or be given any recognition from our Society.

To summarize, I hope that all persons viewing any of the NSS salons will remember that they are subjective, that any one year's winner could well have been a non-winner, and that any non-winner could have easily have been a Medal winner. That's all. I know.... Back to my corner....

Sincerely,

George Dasher
NSS Cartographic Salon Chairman

1995 SURVEY AND CARTOGRAPHY SECTION MEETING

The 1995 meeting of the Surveying and Cartographic Section (SACS) of the National Speleological Society was held, as a part of the NSS' annual convention, on Tuesday, July 18th in the Music Room, Squires Hall, of the Virginia Polytechnical Institute.

The meeting was called to order at 12:15 pm by Chairperson Carol Vesely. Attending were 28 members and friends of the Section. These were: Bert Ashbrook, Roger Batholomew, Jeff Brummel, Don Conover, Don Coons, Hubert Crowell, George Dasher, Dave Engel, Frank Filz, Andy Franklin, Andrea Futrell, Mike Futrell, Dick Garnick, Martin Heller, Bob Hoke, Pat Kambesis, Robert Lenz, Dave Lromberg, Kirk MacGregor, Mel Park, Steve Reames, Dick Sanford, Dave Seslar, David Taylor, Bob Thrun, Carol Vesely, Fred Wefer, Stephanie Woodward, Joe Zokaites

First were the officers' reports. Carol did not give a report. Roger Batholomew, the Vice-Chairman, said that there were two SACS sessions at this year's convention. One of these had just concluded; the other would be the afternoon of the following day. He also said that he intended to write letters to line up papers early for the 1996 convention and give members plenty of time to prepare their presentations.

George Dasher, the Secretary, then gave the Secretary's Report. He said that the minutes of the 1995 meeting had been published in Volume 12, No. 37 of *Compass and Tape* and that no one had complained. Bob Hoke, the treasurer, next gave the Treasurer's Report. He said that the section had approximately $3400. Bob also said that $1300 of this money is tied up in future issues of *Compass & Tape*, that a bunch of the Section's money has been placed in a 6% CD, that only one issue of *Compass & Tape* (#38) had been published in the past year, and that the next issue was at his house waiting to be printed.

Carol asked for a report from Pat Kambesis, the editor of *Compass & Tape*. Pat was not present in the meeting at this time.

George gave a report on the Cartographic Salon. He said that 41 entries and four display-only maps had been submitted to the Salon. He also said that for the fourth time in the seven years he had run the Salon, that there had been problems with the facilities. This year, the original room given to the Salon had been far too small. The Salon was moved to the room just beyond the bowling alley. Of interest in this year's Salon, as per George, was a map of Systema Chipmunk, a 100-foot long Randolph County cave entered by Ron Simmons. George also said that there was a display of all the previous Cartographic Salon Medal-winning maps in the same room as this year's Cartographic Salon. These maps were from the 1978 through 1994 Conventions. He also said that after the convention he would donate these maps to the NSS Library in Huntsville.

George next gave a report given to him by George Veni, who was at the Geo^2 Section meeting and could not attend the SACS meeting. Veni had wanted to say that the committee formed by Geo^2 to review cave map symbols had been dissolved. Geo^2 thought that this committee was no longer needed after the publication of *On Station*. Dasher said that this Geo^2 committee had been working in combination with a SACS committee. He also said that for the most part, the NSS symbols are very good but one popular symbol is unusable in small passages. George had realized this before the publication of *On Station*, and had tried to change this symbol (the bedrock pillar symbol). However, Tom Rea refused to change any symbols without the prior approval of Geo^2's symbol committee. Thus the symbol was not changed and the NSS is now stuck with it. George recommended that SACS also dissolve their symbols committee. There was no opposition of this suggestion.

Pat Kambesis arrived. She said that the next issue of the *Compass & Tape* was at Bob Hoke's for printing and asked that everyone send her articles for future issues. George asked if she were giving each issue an individual number or if she were giving each issue volume and number. Pat said that she was doing both.

Next was old business, and a discussion of the committee set up at the 1994 convention to discuss electronic map entries. Pat, the committee's chairperson, said that committee members had been corresponding and now had a good idea of the criteria everyone on the committee wants. She said that a discussion of these criteria had been scheduled as the last talk of the following day's SACS session. It was suggested by Fred Wefer that the committee test their criteria against his computer program in his workshop on Wednesday. Pat agreed to do this.

Hubert Cromwell next gave a report on his Convention surveying course. He said that five persons had entered, and that the course would be open until midnight on Wednesday.

Next was new business. Carol and Pat both said that they would like to see the Section host a hands-on CAD workshop at the 1996 Convention. There was some discussion regarding this, and Carol asked if anyone would volunteer to run the workshop. Bert Ashbrook volunteered, and said that someone would have to provide him with a computer in Colorado. Dave Engel said he might be able to do this. Bert said that there might be problems because the CAD software and hardware is very specialized, and it could take him several days of fiddling to get it working correctly. He did not want to spend his entire 1996 Convention fiddling with these problems.

The election of officers was next. Dick Garnick made the motion that all four officers be re-elected. Dave Taylor seconded this motion and it passed unanimously. Carol adjourned the meeting at 12:38 pm.

Bob Hoke then announced that everyone should check with him to see if they owe Section dues. He also said that the Section typically sends out a few extra copies of *Compass & Tape* to raise the number of mailed copies above the minimum number required for the Postal Service bulk rate discount. If any Section member has a friend or knows of anyone who might want to receive a free copy of *Compass & Tape*, they should contact Bob so that they could be added to the mailing list for one or two free issues.

Minutes submitted by George Dasher

Call for Papers - 1996 NSS Convention

The 1996 NSS Convention, to be held in Salida, Colorado, promises to be of interest to cave mappers and cartographers. The Survey and Cartography Session already has a major presentation planned to discuss cave survey blunders. There may be one or more presentations and tutorials on the use of computers for drafting maps.

If you are doing anything interesting, please consider presenting a paper at the Convention to let other folks know what you are up to. Presentations do not have to be formal or scholarly. And you can be assured that you will have a friendly and appreciative audience. Abstracts are due by May 1, 1996 and should be sent to the SACS Vice Chair Roger Bartholomew.

And don't forget the Cartography Salon. Cave maps of all types are welcome. You have plenty of time to complete that map you have been working on and bring it to the Convention.

Additional information about the SACS Session and the Salon will be sent to SACS members in a separate mailing.

Cartographic Salon - 1995

by George Dasher

This year's 1995 Cartographic Salon was held in Room 116 of Squires Hall, Virginia Polytechnical Instutite, Blacksburg, Virginia. Forty one maps were entered, an additional four for-display-only maps were also shown and, during the week, there were three hands-on displays of electronic maps. All told (and not including the electronic maps), 45 maps were prepared by 24 cartographers. They were from six countries and 11 U.S. states. The countries were Iceland, Malaysia, Mexico, Switzerland, Uganda, and the United States. The U.S. states' maps were from Alabama, Alaska, Colorado, Hawaii, Kansas, Kentucky, Missouri, Pennsylvania, South Carolina, Virginia, and West Virginia. On the wallsurrounding the Cartographic Salon entries, was a display of all the previous Cartographic Salon Medal Winners, from the first Salon in 1978 to last year's 1994 Salon. This equaled 17 maps by 11 cartographers.

This year's judges were Mike Futrell, Pat Kambesis, and Hope McAdam. Mike has surveyed extensively in Virginia and Mexico. Pat has mapped caves in Arkansas, Colorado, Kentucky, Iowa, Illinois, Missouri, South Dakota, TAG, New Mexico, Texas, Mexico and China. She is a project cartographer for Lechuguilla Cave and for Cave Research Foundation. Hope McAdam was, last year, Hope Uhl. She has surveyed in Costa Rica, Pennsylvania, Virginia, and West Virginia. Between the three of them, Mike, Pat, and Hope have won five Medal Awards in past Cartographic Salons.

This year, six green ribbons (Honorable Mentions), five blue ribbons (Merit Awards), and one overall Medal Award were given. In addition, the judges created a special category for maps showing the regional locations of caves and cave entrances. They gave one green and one blue ribbon in this category.

This years Honorable Mentions (Green Ribbons) are:

Whispering Cave
Wrangell-Saint Elias National Park, Alaska
Carlene Allred

Sinks of the Run Cave
Greenbrier County, West Virginia
Bill Balfour

Manitou Cave
El Paso County, Colorado
Paul Burger

Bolivar Track Cave
Westmoreland County, Pennsylvania
Walt Hamm

Earth Mother Cave
Pocahontas County, West Virginia
Ron Simmons

Caves of the Dripping Springs Escarpment
Barren, Edmonson, and Hart Counties, Kentucky
Don Coons
This map was in the Special Aerial Location Category

This years Merit Awards (Blue Ribbons) are:

Blue Marble and Waterworks Caves
Prince of Wales Island, Alaska
Kevin and Carlene Allred

Coon Cave
Westmoreland County, Pennsylvania
Bert Ashbrook

The Fault Cave System
Jefferson County, Colorado
Hazel Barton

Sinks of Potts Creek
Alleghany County, Virginia
Bob Alderson

Casey Quarry Cave Location Map
Westmoreland County, Pennsylvania
Walt Hamm
This map was in the Special Aerial Location Category

This year's overall Medal Award went to:

Paxton Cave, Alleghany County, Virginia,
Tom Spina, cartographer.

There was a review of the Cartographic Salon and a critique of the entered maps on Friday at noon. The Cartographic Salon judges were present to answer questions on judging criteria, cartographic standards in general and questions about specific maps. This review was attended by approximately 35 people and lasted until after 3 pm.

Cave Cartography using AutoCAD®

by Bert Ashbrook

Reprinter from Pack Rat Scat, *Number 58, p. 6-12*

Introduction

AutoCAD® is perhaps the most popular computer-aided drafting (CAD) program today. We began using it at my workplace (a home design and construction firm) in 1990 on an IBM-compatible 80386-33 desktop PC, and I have been using AutoCAD since then for cave maps. I've put some of my ideas about the general principles of CAD cave cartography into print before (*Pack Rat Scat* #47, Spring 1992: reprinted in George Dasher, *On Station*, Huntsville, Alabama: NSS 1994), pp. 110-114). What I'm talking about is drawing the entire map on the computer, then putting it on paper to see it. This is what Fred Wefer calls a "Stage 3" cave map. This article consists of some observations I have made about the nuts and bolts of how cave cartography works with AutoCAD. The concepts are, of course, valid for other CAD software, although the specific methods will be different.

Hardware and Software

At my work, we now use 80486-DX-66 machines with 8Mb RAM, which you can pick up for under $2000. This is almost four-year old technology, but it is easily able to handle a mile-long cave filled with detail at 1:600 (1"-50') scale (which corresponds to a ".dwg" file about 1.5 Mb in size). That's because we have a decent graphics accelerator card inside the computer, one that costs $1,000 extra. We use a $300 digitizing tablet, which is a pointing device akin to a high-tech mouse. The display screen is a high resolution, 20-inch diagonal that costs almost as much as the computer. Putting the map on paper is low-tech: we use a 24" wide pen plotter which can be had new for about $3,000. Today, state-of-the-art is an electrostatic version which is like a wide laser printer. These are expensive ($10,000 and up) but can print that mile-long cave in 30 seconds, compared to over an hour for our pen plotter.

The AutoCAD software (we use version 12 for DOS) costs something like $3,000. It works fully in 3-D. Other programs cost just a fraction of that but do less. You can add a lot of specialized modules (cartography, for example) that do a lot of nifty things for thousands of dollars more. As an aide, you might be interested to learn that you can buy predigitized topo maps. A USGS 7-1/2 minute quadrangle goes for about $50.00.

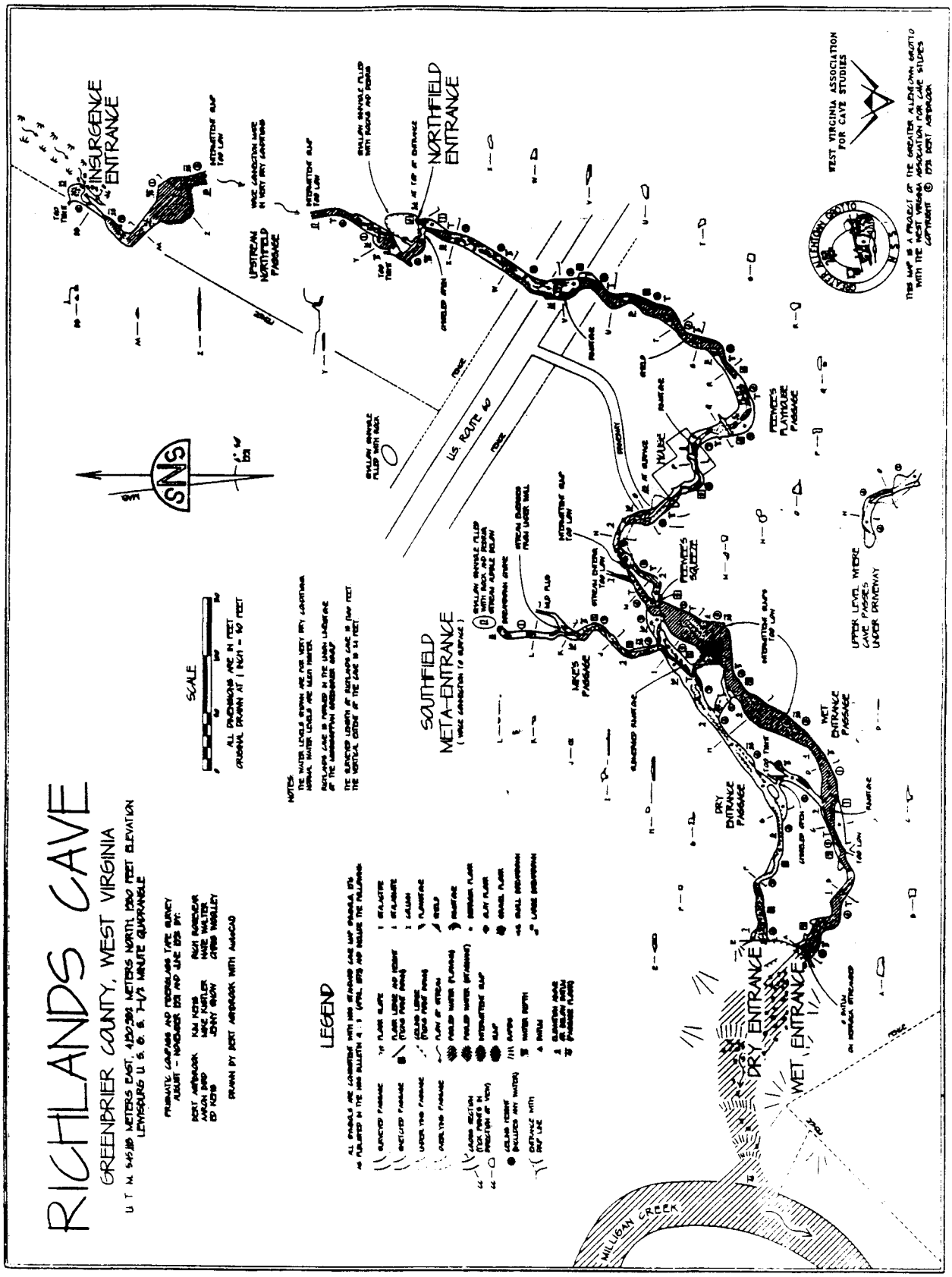
My point is this: not everybody can afford to play cave cartographer with AutoCAD-yet. I remember sometime around 1970 when my company bought electronic calculators that could add, subtract, multiply and divide. Back then, they cost $300 each. Like calculators, CAD hardware and software will become cheaper.

The Traverse Line

The traverse line comes from the raw survey data and some trigonometry. It is a "solved problem.". There is not much room for creativity in this type of math.

My spin on this problem is to enter the data directly into AutoCAD. This is possible because AutoCAD is what's referred to as "open architecture" software. This means that you can write your own commands and add them into AutoCAD. A short routine I've written in AutoLISP (LISP programming language adapted for AutoCAD) converts the raw data to X-Y-Z coordinates, and a 3-D traverse line is immediately drawn between the stations. A survey station mark (consisting of a triangle with a dot inside) is put at the new station, and the station name is placed nearby. If you start the next shot from where the last shot left off, the traverse line continues to be created before your eyes as you enter the data. If not (i.e. at a splay shot), you must use the cursor to place the start of the traverse line where it belongs.

This method allows you to watch the traverse line grow as you enter the data. To retrieve the raw survey data, one simply asks about one or more segments of the traverse line using AutoCAD's List command. This gives information about an entity on the screen. In this case this is a segment of the traverse line which includes its length, horizontal angle, and vertical angle, which are simply the tape, compass, and inclinometer data. A lot more could be done with this sort of routine, but if



A completed cave map drawn entirely with AutoCAD.
This map won a merit award at the 1992 NSS Convention. The original was drawn at 1" = 50'.

Even a cave with many different levels would be more easily drafted by putting the levels on different layers rather than drawing them in 3-D.

anyone wants a copy of my simple program, send me a diskette.

AutoCAD's 3DRotate command allows the traverse line to be rotated for viewing at any angle. This is useful for getting a sense of the extent of vertically significant caves and in creating profiles. Except for profiles, I do not draw the remainder of the cave in 3-D. This takes more time and trouble and since the map is intended to be plotted on paper as a plan view, it doesn't do much good. Even a cave with many different levels would be more easily drafted by putting the levels on different layers (see the next section) rather than drawing them in 3-D. The traverse line remains in 3-D, of course, but I generally use only the horizontal projection of it. This is not what Fred Wefer calls a Stage 4 cave map.

Way back in 1987, Jim Nepstead (*Compass & Tape* 5:1, Summer 1987) described a way to import SMAPS data into AutoCAD. When there are lots of loops to close, I do a least-squares fit with Lotus 1-2-3 and save the coordinates in a file. I've written another short AutoLISP routine which reads that data and converts it into an AutoCAD .DWG file. I'll send anyone a copy who sends me a diskette.

What is not a "solved problem" is the closure of survey loops. This brings up a troublesome aspect of AutoCAD cartography. When a loop is closed, or when data is simply changed or corrected, it is quite easy to correct the traverse line in CAD. However, the rest of the map (cave walls, passage detail, etc) is not so easily corrected; although it is not difficult to move and stretch everything on the screen (AutoCAD allows entities to be stretched as if they were drawn on Silly Putty), it is a laborious task to keep the same proportions when adjacent stations move relative to one another.

This problem arises when, for example a later survey closes a loop which requires the error to be distributed throughout the loop or an error is discovered after the sketch is completed.

What is needed is a way to tie the position of the walls, passage detail, sections, etc. to the nearest survey station(2). In this way, if the stations had to move relative to one another, the walls between would "stretch" as needed while keeping the same passage width. Detail like floor ledges would stretch also, but symbols like stalactites would just move; they would not become distorted. Unfortunately, this is a tall order and one for which even AutoCAD does not provide the solution.

Layers

Layers are groups of related entities which AutoCAD normally draws on the screen with the same color and plots with the same pen width and color. Everything drawn in AutoCAD is assigned to a layer. Layers may be included in or removed from either the screen or the paper copy in their entirety. This makes layers useful for a number of things.

For example, the traverse line, survey stations, and station names are put onto three different layers by my data entry routine. To look at where the cave is going, I generally only display or plot the traverse line and leave off (in AutoCAD, the Layer Off or Freeze commands) the outer layers. While entering passage detail, I usually display only the survey station layers. The station names and traverse line tend to clutter things up, so I usually leave them off unless needed. All three of these layers are turned off before putting the final copy onto paper.

This idea has other applications as well. Passage walls and passage details go on separate layers. Surface surveys and detail (property lines, fences, dig locations, etc) also go on a different layer. Hatch borders (the limits within which hatch patterns are placed) are saved on their own layer so they may be modified later if necessary. Notes to the surveyors ("Need a section here;" "Resurvey here;" "Check leads here") go on a layer which is only used on maps carried into the cave by survey teams. Jim Nepstead (*Compass & Tape* 6:2, pp. 3-8) has suggested other uses as well, such as biological information, instructions on how to rig pits, which could go on other layers.

If you know beforehand the scale at which the map will be plotted, all the passage detail can go on a single layer. However, the scale needed for the final product might change during the process of drafting. For example, a small cave drawn at 1:240 (1"=20') might later have an extension discovered, necessitating the map to be replotted at 1:600 (1"-50'). Since the detail drawn at 1:240 would look like a jumbled mess when plotted at 1:600, I would create more than one set of passage detail drawn on different layers. Saving both sets of detail gives more flexibility in choosing how to present the map. At very large scales (i.e. more than 1:1200, or 1"=100), it is often sufficient to only show the passage walls or the traverse line. In this case, all the detail layers can be turned off.

Before moving your cave around in AutoCAD, don't forget to turn on and thaw all of your layers. Many is the time when I have regenerated the drawing to find that I moved the cave within the paper borders, but left the traverse line (which had been frozen) in the original location! Of course, AutoCAD's Undo command always comes in handy in these situations.

Remember, your choice of layers affects the default pen width of your black-and-white plot, or the default of your color plot. This means that passage walls or text intended to be drawn with a thick pen should go on a different layer than those to be drawn with a narrow pen. The layers I typically use are summarized in Table 1.

Walls

Both in hand-drafting and CAD, after the traverse line is completed, the walls are added. My method is to place a block

(a block is a set of lines, circles, text, etc. which AutoCAD treats like a single entity) which consists of concentric circles typically of 2, 5, 10, and 20 feet radius, onto the drawing at each survey station. Using the sketch and the left and right walls measurements, I draw a Polyline (also called P-Line, a string of line segments which AutoCAD treats like a single entity for the wall. Later, the block can be erased or moved on a layer which is turned off. I stared out using a grid to help sketch in the walls, but found this unsatisfactory. Scanning the sketch from a survey book into AutoCAD is not practical (but I'm waiting for a powerful, rugged palmtop computer which I can take into caves to input the data directly!).

For unsurveyed passage, underlying passage, or overlying passage, most maps used dashed lines, dotted lines, and dash-dot lines. To do this in AutoCAD, the appropriate linetype is created (this only need be done once, and then the ".in" file can be loaded into any drawing. Set the variable LTSCALE for each drawing to an appropriate number depending upon the scale you will plot at. In order for the linetype to generate properly, make sure that LineTypeGeneration is turned on (either with a PEdit, or using Setvar). Otherwise, small segments of splined P-Lines will wind up being continuous lines.

I draw surveyed passage walls on a layer called WALL50, which will plot with a .50mm pen -- approximately equivalent to a #1 ink pen. Sketched passage walls go on WALL35 and are plotted with a slightly narrower pen. Often the linetype for this entire layer is made dashed, since this is the only type of data on it and these walls are always a dashed line. Overlying or underlying walls go on WALL25 layer and are plotted with a .25mm (#000) pen.

Layers (Table 1)

0	-Utility layer, miscellaneous uses for AutoCAD
DETAIL240	-Passage detail suitable for a 1:240 scale plot
DETAIL600	-Passage detail suitable for a 1:600 scale plot
DETAIL1200	-Passage detail suitable for a 1:1200 scale plot
HATCHBORDER	- Borders for hatch patterns
SECTION	- Cross Sections
SURVEYSTATION	- Survey station symbols
STATIONNAME	- The names of each survey station
SURFACE1	- Surface detail to include on final plot
SURFACE2	- Surface detail to omit on final plot
SURVEY	- Notes to survey team
TRAVERSELINE	- The traverse line
TEXT25	- Text drawn with the .25mm pen
TEXT35	- Text drawn with the .35mm pen
TEXT50	- Text drawn with the .50 mm pen
TEXT70	- Text drawn with the .70 mm pen
WALL25	- Passage walls drawn with the .25mm pen
WALL35	- Passage walls drawn with the .35mm pen
WALL50	- Passage walls drawn with the .50mm pen
WALL70	- Passage walls drawn with the .70mm pen

Details

As when drawing a cave map by hand, the passage detail gets filled in only after the walls are completed. In general, this is a straightforward process, but a few points deserve attention.

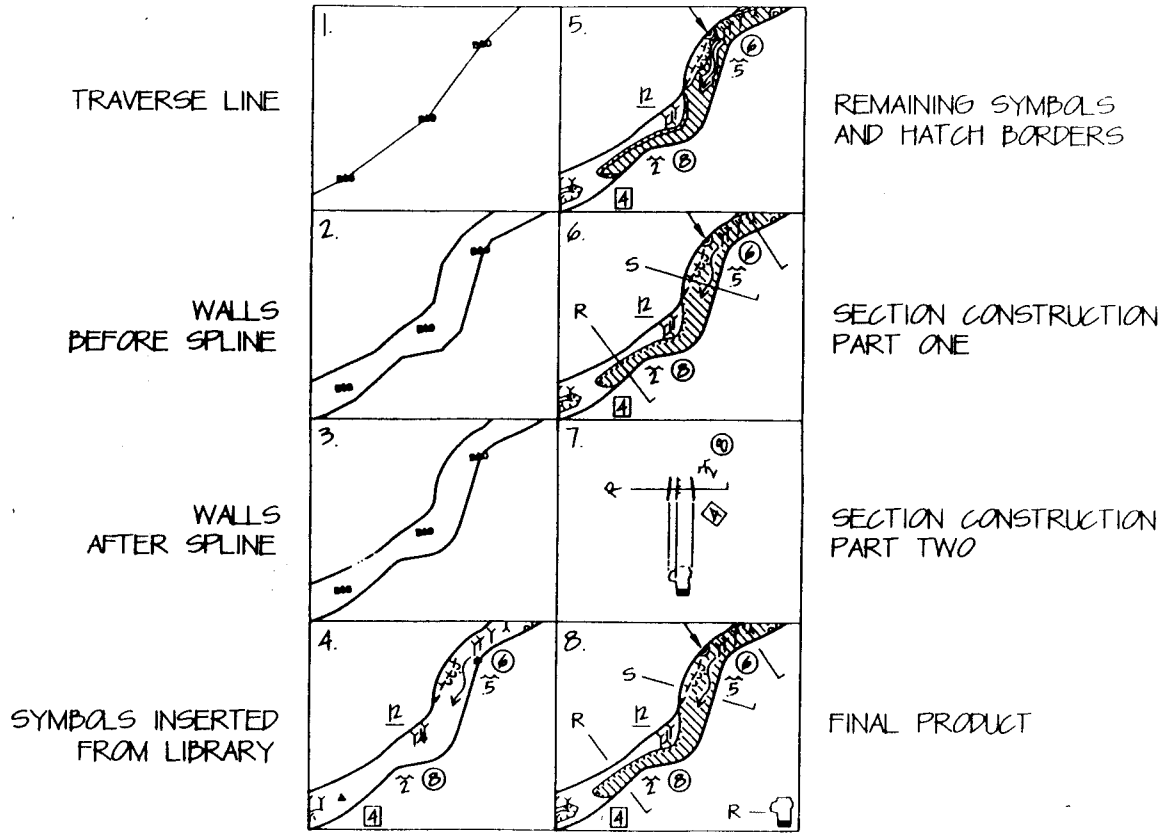
Symbol libraries are very useful for some passage details. Symbols for stalactites, bedrock floor, ceiling height, floor ledge depth, etc. can all be created and then saved for future use. Together, all these pre-made symbols are a symbol library and they can be (almost) effortlessly plopped down at any scale anywhere on the drawing when needed. A symbol library need only be created one time. From that moment on, the symbols can be used as many times on as many different maps as you want. Use of the same library gives a series of related maps a similar appearance.

In AutoCAD, my symbols are saved as blocks - a group of lines or other entities which AutoCAD treats as a single "thing." This not only saves time but computer memory as well. I find it much easier to create all my symbols at the same scale. For example, all my symbols have been created so that they will be the appropriate size for a map drawn at 1:1. They are inserted with a scale factor equal to the scale the map is plotted at, so that they appear the correct size. Of course, individual symbols can be scaled larger or smaller or exploded (their block definition rescinded) so they may be customized.

Not all passage detail can be put into a library. Floor ledges, for example, are generally created individually each time they are used, since each ledge is a different shape. Somebody ought to write an AutoLISP routine which allows you to draw the line on the floor ledge and specify the side, size and spacing of the ticks, and then inserts the ticks automatically. This would be a big time saver, but I have never gotten around to it. I continue to insert ticks one at a time with the Onsap Perpendicular command. The same thing could be done with ceiling height change marks, but until it is I will continue to use each dash-with-tick marker as a block.

Somewhere on my first AutoCAD cave map is the mother of all breakdown. It is the only breakdown block I have ever drawn on computer. My symbol library has a copy of it, along with copies of copies which have been stretched, mirrored, scaled, and rotated. I have taken that first breakdown block and made thousands of copies, each modified more or less from that mother of all breakdown blocks. These have been sorted by size and saved in an AutoCAD block creatively named "Breakdown." This block, after being placed into a drawing, is

Eight frames showing a portion of a cave map being draw in AutoCAD.



exploded. Then, I can pick and place any of the dozens of different breakdown blocks as needed. To show a piece of breakdown which is uniquely shaped, the most similar piece in my library is inserted and modified as needed. But usually, no modification is really needed.

I use hatching to show water areas and bedrock pillars. Others might use hatch patterns to show different floor material, such as clay or sand. It is not difficult to create your own hatch pattern in AutoCAD. When needed, I place hatch pattern borders on their own layer so they can be turned off for plotting but are saved for use when modifications are necessary. I create the borders as a PLine which makes the Hatch command go quicker. Remember, if you don't like the position of the hatch, you may change it by changing the Snap Origin. On pen plotters, dots in hatch patterns are tough on the plotter. Make your dots with a small pen, as thick pens tend to leave a lot of ink on the page, which can smear.

Cross Sections

The secret to accurate cross sections is to make them correspond to the plan view. For this reason, I wait until the plan view is complete before drawing sections.

The mechanics of section construction in AutoCAD are easier to demonstrate than to describe in words (see the figure opposite), but here goes. I draw a section line and its direction tick on the plan view. Next, I copy the section line and tick, the cave walls, and the detail at that area of the passage to another part of the screen. These copied entities are rotated so that the section line is horizontal on the screen and the direction tick points up. Now, the intersection of the horizontal section line with the passage walls marks the horizontal limits of the cross section. Details are now also in their correct horizontal locations and items like floor or ceiling ledges, breakdown etc, can be drawn in the same position they are shown in the plan view.

Vertical control in cross sections is not so exact, unless a profile has been drawn, in which case a similar technique can be used for vertical control.

Finishing Touches

By finishing touches, I mean some of the small but nice extras on a map which give it that certain *je ne sais quoi* that nice maps have. AutoCAD makes them easier to do.

I have, for some time now, been putting our grotto logo on every map I draw. It was a pain to draw (if I'd had a scanner at the time it would have been a snap), but it's now saved as a block so it's easy to put it on a map. I also use blocks like this for a north arrow and for a scale bar (remember to scale the latter block correctly!). My map notes generally include the same type of information: type of limestone, a reference to the NSS Bulletin article with the standard NSS cave map symbols, the length of the cave, etc. I store this as a block, too. After it's inserted, I can do an AutoCAD Explode command so I can edit the information. This method assures that nothing is forgotten.

In fact, I take this method a step farther - I have a prototype cave map file which contains the symbol library, a legend, the north arrow, a scale bar, a title block, notes, borders for different scales and paper sizes, etc., already included in it. To start a new cave map, I simply call up the prototype and I already have everything I need (except the survey data). If anybody wants a copy of my prototype, send me a diskette.

Soapbox

Let me use the soapbox to make a brief comment on what I am trying to accomplish with CAD map making. Of course I want my maps to be accurate, but I also want to be able to emulate the most artistic maps I have seen (all of which were hand-drafted!). I measure my success not only by how accurate and attractive the map is, but also by whether people who look at my maps fail to notice that they were drawn with a computer (except for perhaps a small notes which says so). CAD makes accuracy relatively easy to achieve, and it eliminates many of drafting's technical problems, things like neat inking and lettering. But CAD does not necessarily do a thing for a map's artistic qualities. I use a lettering font that appears hand-drawn because it looks less "sterile" than most computer-generated fonts. I take advantage of CAD's ability to change the layout on the page before committing to paper. But even with the advantages of CAD, cave cartography remains an art, not a science. CAD can made a sloppy hand-drafter like me into a neat one, but it cannot replace the artistic talent needed to draw a great cave map.

Birmingham Grotto Newsletter

Documenting Cave Entrance Descriptions and Locations

by George Dasher

Recently, I have completed a publication on the caves of a drainage area in Greenbrier County, West Virginia. My experience with this project shows that most cavers, including many experienced cavers, have no idea what to describe while locating caves in a given area or above the mega-monster-cave system.

The proper method, one which would prevent multiple trips to the cave to re-describe the entrance, should include not only marking the cave location precisely on a topographic map and accurately determining the coordinates of the cave entrance, but also providing good, written descriptions of where the cave is located, and of the appearance of that cave entrance. There is no such thing as too much written description.

The written description of the cave location should include items such as:

Is the entrance north or south of a fence?

What trees or obvious rock outcrops are nearby?

In what direction, and how far, is the entrance from the nearest road, valley bottom or stream?

Indication of the azimuths to obvious indicators (houses, barns, junkpiles, etc.)

Inclusion a sketch of where the cave is located.

The written description of the appearance of the cave entrance should include:

Depth, diameter, and shape of the sinkhole (where applicable)

The diameter and shape of the cave entrance

Is the cave entrance in bedrock or soil?

Are there any streams which flow into or out of the cave entrance?

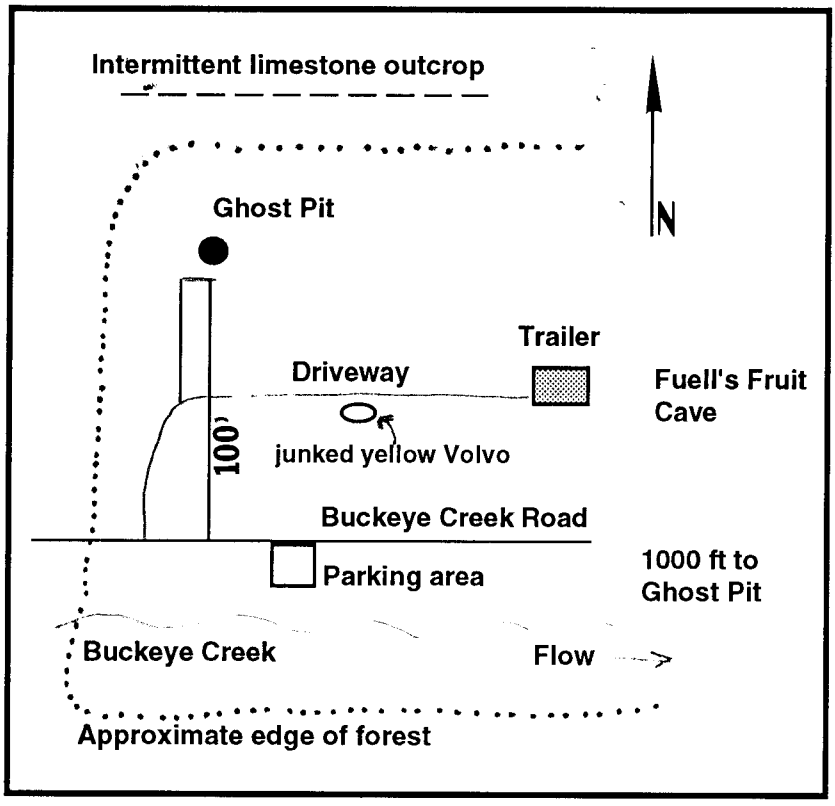
What is immediately above or below the cave entrance?

Are there any interesting features in the cave entrance?

This may include a photograph of the cave entrance.

It is important to know what the cave entrance looks like. To be honest, the technique used to look for a 20-foot wide cave entrance with a stream flowing into it, is different from the technique used for looking for an inobvious 1-foot diameter pit on the side of a hill.

To summarize, it is very important to keep lavish written records of where each cave is located and of the appearance of each cave entrance. The bottom line is overkill, and overkill. The other option is 501 trips to the same cave entrance to re-describe its location and appearance. Option two is not fun. I know from experience.



Example of detailed cave location description

Report on the "Criteria for Judging Electronic Maps" Session of the 1995 Convention - or Clueless in Blacksburg

by Pat Kambesis

The 1994 Cartography Salon saw a "different" kind of map entry in addition to the standard types. These "different" maps were presented on a computer screen rather than on paper and were being referred to as electronic maps. The electronic entrys were so unlike the traditional cave maps that salon judges were used to seeing, that the 1994 judges felt these could not even be considered, using the same criteria as those for traditional maps. Consequently, none of the electronic maps were judged.

At the Survey and Cartography Section meeting that year, the issue was discussed and a committee was appointed to look into salon judging criteria for electronic maps. When I volunteered to be part of that committee, I figured I was going to learn something about electronic maps and based on that, could offer some suggestions on setting judging standards. Of course, I did not consider that fact that I had not actually seen any of the electronic entrys. " What was the big deal," I thought, "a map is a map."

It was with this mind set that I worked with the other committee members in coming up with some proposed judging criteria. We corresponded, exchanged ideas, suggestions, criticisms and eventually came up with a set of questions that we felt could lead to setting up salon judging criteria for electronic maps. These were published in the last issue of *Compass & Tape* (Vol. 2, #38).

However, there was still a lot of uncertainty about electronic maps among the committee members and other interested parties. "No big deal," I thought. We just needed to get together face-to-face and talk about it. Hence the idea of a cartography session devoted to discussion about judging criteria for electronic map entrys. I was certain that the results of the session would be some solid criteria that we could start using - next year! We'd have a little discussion, agree on all of the wonderful standards that the committee came up with, and live happily ever after.

A day or so before the session, Fred Wefer offered me a personal demonstration of his electronic map. Now Fred, being the nice guy that he is, didn't actually want to come out and tell me that I was clueless - he was just going to demonstrate it.

I, along with a number of other carto-groupies, spent over an hour with Fred on a grand tour of his electronic map. In that time period, Fred succeeded in blowing away my idea of electronic maps. I guess I was expecting to see an electronic rendition of a standard map, but with a few more bells and whistles. Instead I saw an interactive and dynamic representation of cave. One that could be viewed from an infinite number of directions; where one could fly in, over, around and through the cave passage and where a tremendous amount of information about the cave could be displayed whenever you wanted to see it. This was nothing like the cave maps I was used to.

This demonstration, though mindblowingly enlightening, put me in a bit of a quandary with respect to my upcoming session. For one thing, I realized that I was truly clueless on the issue of "judging criteria for electronic maps" and totally unqualified to even be thinking about. I tossed out my notes and went to the discussion session.

The session went well and quite differently from what I had originally anticipated. There was quite a lively discussion on all aspects of electronic maps. Though some folks were still trying to pin down criteria, most people felt that setting up judging criteria for electronic maps was not a good thing to do at this time. The general feeling was that design and innovation should go the direction that the cartographer/programer chose and should not be driven by a "standards" committee. As Martin Heller pointed out, electronic maps are still evolving. Setting up arbitrary criteria on what makes a good electronic map would only be detrimental to their development. General concensus was to encourage more electronic map demonstrations at future cartographic salons and to forget about establishing judging standards at this time.

Several weeks later, Fred e-mailed me his ideas on future guidelines for electronic maps and also answers to the questions the Electronic Maps Committee had originally submitted. Being the acknowledged clueless one on this subject, I defer to Fred's knowledge and expertise on this matter. The following article addresses his comments and suggestions on judging criteria for electronic maps.

Comments and Suggested Guidelines for Judging Electronic Maps

by Fred Wefer

INTRODUCTION

I read with great interest the paper "On Guidelines for Electronic Maps" by Pat Kambesis (*Compass & Tape*, Vol. 12, No. 2, pp. 19-25, Issue 38, July 1995). Having worked in this "area" for more than a decade, I was looking forward to some new ideas, some enlightened input, and some food for thought. I was disappointed, however, at the level of understanding of the subject exhibited by some members of the committee charged with developing guidelines for the Cartographic Salon.

Instead of commenting on what various committee members said, hadn't read, or misunderstood, let me try to help move the process along by offering some suggestions, and also by offering what I think are the answers to the questions presented in Pat's paper. I follow this by a list and very brief summary of papers that the interested reader might want to peruse.

QUESTIONS & ANSWERS

Pat Kambesis posed a number of questions for the consideration of the committee and presented the answers of several of the committee members. These same questions are considered in the following discussion.

QUESTION-1 — What should be judged when dealing with electronic format maps?

First the committee needs to carefully define what it means by the terms it uses. Otherwise the committee members will never know what they are talking about. Frankly, I am not sure exactly what an "electronic format" map is. I am sure, however, that none of the maps presented in the article immediately preceding Pat's are (see "Creating Electronic Maps from True to Scale Cave Survey Sketches" by Garry Petrie, *Compass & Tape*, (Vol. 12, No. 2, pp. 16-18, Issue 38, July 1995). I recommend the committee forget about the term "electronic format" and concentrate on what is fundamental and important. The committee will never get past questions like, "Is a video tape of a color slide of a hand generated cave map an 'electronic format' map?"

One of my early papers in this "area" (see item (4) in the reading list below) concentrated on the "process" of the computerization of the cave map, and then defined the various types of maps by the stages in the computerization process from which they came. Because the situation is so complicated, I was unable to come up with single, adequate, succinct adjectives, either for the stages of the computerization process or for the maps that result from the stages. My solution was to simply number the stages. I ended up with four types of computerized maps which may be briefly defined as follows:

> Stage-1 Cave Maps — Data reduction by computer; plotting by hand using a straight edge and protractor; drafting by hand using an ink pen; final map viewed on paper or mylar.
>
> Stage-2 Cave Maps — Data reduction by computer; plotting by computer peripheral device; drafting by hand using an ink pen; final map viewed on paper or mylar.
>
> Stage-3 Cave Maps — Data reduction by computer; plotting by computer peripheral device; drafting by software with output via a hard copy device; final map viewed on paper or mylar.
>
> Stage-4 Cave Maps — Data reduction by computer; plotting on computer screen; drafting by software with output via a soft copy device, final map viewed on the screen. Stage-4 Cave Maps make extensive use of color and are interactive in both viewing and content.

It's a little more complicated than that, but not much. While I don't particularly like the names, these four types seem to result from fundamental and important distinctions.

An additional type, Multimedia, has since been identified. Note, however, that it is not clear that Multimedia maps belong in the Cartographic Salon. For example, as soon as someone puts color photographs into the mix, then the photographs have to be judged, which is the province of the Photo Salon. If someone were to include music in a map, as my Silicon Graphics workstation can easily do, then the music has to be judged too, which might be the province of the Cave Ballad

Contest. My advice is for the committee to stay away from Multimedia for now.

ANSWER-1 — The answer to the question depends on the type of map being judged.

Stage-1 and Stage-2 Cave Maps — These are what are currently being judged in the Cartographic Salon. The judges should continue the current practices.

Stage-3 Cave Maps — Judge them using the same criteria currently used for Stage-1 and Stage-2 Cave Maps. The software and hardware used to produce the map are of no concern to the judges. The judges don't need the software or hardware to view the cave map. Since they don't judge the ease of use of the ink pens used to draw a Stage-2 Cave Map, why should they judge the software used to draw a Stage-3 Cave Map? They should judge what they can see. The map. On paper or mylar. By the way, the maps in Garry Petrie's paper are Stage-3 Cave Maps.

Stage-4 Cave Maps — Judge the map, but realize that in Stage-4 the software and hardware are integral to the cave map, like the paper or mylar is integral to a Stage-3 Cave Map. You can't see a Stage-4 Cave Map unless you can see the hardware and at least the user interface manifestation of the software.

And remember, a hard copy of a Stage-4 Cave Map is a Stage-3 Cave Map. A color slide of a Stage-4 Cave Map is a Stage-3 Cave Map. A video tape of a Stage-4 Cave Map may even be a Stage-3 Cave Map. A video tape of a color slide of a hand sketch of a hard copy of a Stage-4 Cave Map is a Stage-3 Cave Map. The reversion from Stage-4 to Stage-3 happens not because of differences in the display media, rather because of the elimination of interactivity.

QUESTION-2 — What time frame should be allowed for each entry and how should the entry be presented?

ANSWER-2 — The contestant should present the entry to the judges at a prearranged time in a given time period and answer questions from the judges.

I don't think fifteen minutes is long enough for some Stage-4 Cave Maps. Just as it takes the judges longer to judge some Stage-2 Cave Maps, it ought to take longer to judge some Stage-4 Cave Maps. But some time limit needs to be set, otherwise we will get the situation we had in the International Exploration Session at the 1995 NSS Convention, where some slide presentations seemed to last longer than the expeditions themselves.

QUESTION-3 — How should the winners be determined?

ANSWER-3 — By selecting categories and judging each category from 1 to 10, with 10 being a perfect score.

But, the categories and the items within them need to be selected with care. Some of the comments in this area by committee members indicated a lack of appreciation for the sophistication of currently available software. The user manual for my program, called Interactive Cave Map (ICM), just presents the user interface, and it is 36 pages long!

What I mean by selecting the categories with care is illustrated by the discussion on north arrows in Pat's paper. The view direction certainly needs to be shown, but leave it up to the cartographer how to show it. Then judge the effectiveness of the cartographer's choice. I believe the committee should try to specify what information it wants shown, not how the cartographer should show it.

QUESTION-4 — What should be judged?

ANSWER-4 — The items listed under each category specify what is to be judged. I think the following would be a reasonable set of categories and items for Stage-4 Cave Maps:

* Requirements
  - Cave Name
  - Map Legend
  - Geographic Location
  - Entrance or Connection with Remainder of Cave
  - Date(s) Surveyed
  - List of Surveyors or Survey Groups
  - Cartographer's Name
  - Map Date or Version
  - Vertical Control
  - Map Description (Available Content Features)
  - View Direction
  - Scale
  - Projection Type (Perspective or Orthographic)
  - Auxiliary Information
    - Grid Spacings
    - Type of North (Magnetic or True)
    - Clipping Planes Locations

* Understanding the Cave
  - Appropriateness of Detail
  - Passage Morphology
  - Place Names
  - Symbology
  - Organization of the Map (Layers)

* Analytical Tools
  - Grid Planes (XY, YZ, XZ)
  - Grid Planes (Arbitrary Orientations) *
  - Clipping Planes
  - Traverse Lines
  - Station Identification
  - Station Coordinates *
  - Distance Between Two Stations *
  - Direction Between Two Stations *

* Innovations
  - Oscillation Functions
  - Cutaway View
  - Script Operations

* Software
  - Ease of Input and Control
  - Display of Viewer Options
  - Display of Current State
  - Viewer Documentation
  - On-Line Help *

* Hardware
  - Appropriateness
  - Speed of Drawing
  - Responsiveness to Input
  - Size and Resolution of Display

* Artistic Quality
  - Presentation
  - Visual Impact
  - Use of Color
  - Attention to Detail

This list needs to be fleshed out a bit, but should provide some ideas. I agree that some items should be weighted more heavily than others, but I don't know what the weights should be.

You will note that I have not included "cross sections" in the above list because that is too specific. Cross sections work well enough for Stage-3 Cave Maps, but there are more effective ways of displaying what I call "passage morphology." The criteria need to be less specific for Stage-4 Cave Maps. Give the cartographer some room to try new techniques. Then judge the results.

At the Cartographic Salon of the 1994 NSS Convention in Brackettville, TX, I entered my Stage-4 Cave Map of Cueva Catanamatias, a deep cave in the Dominican Republic. I believe that map would score highly in all the above items except those to which I have appended a *. The point here is that this list is based on current technology and, except for the *ed items, on functionality that is already available in ICM.

READING LIST

Since 1983 I have published or presented eleven papers in the "area" of the computerization of the cave map. In the introduction above I used the word "peruse" in referring to these papers. Most people don't know that "peruse" means to study in detail. Except for papers (2) and (3) below, anyone wanting to understand this subject really needs to peruse all of these papers. In the following I list each of the eleven papers and provide a few sentences stating the main subjects of the papers.

(1) Wefer, F.L., Igoe, J.W., and Gillen, P.A. (1983), "An Application of Interactive Computer Graphics to the Study of Caves", *NSS Bulletin*, Vol. 45, No. 2 (Insert), April 1983. This is the abstract of a paper we gave at the 1983 NSS Convention in Elkins, WV. We used a video tape to show traverse line maps overlain by surface contours. We demonstrated changing the content of the map, and showed various viewing operations including rotating, scaling, and translating the cave in 3D. This is the kind of stuff you can almost do today with a Pentium PC.

(2) Wefer, F.L. (1985), "A User Interface for the Manipulation of 3D Objects", *Proceedings of the 2nd Annual TEMPLATE User Network Conference*, New Orleans, LA, 25-27 February 1985, 25 pages. Included here for completeness, this is a rather esoteric presentation of the programming techniques which provided some of the functionality displayed in paper (1). It describes the user interface in detail and gives sample code. This paper is definitely not for the weak of heart.

(3) Wefer, F.L. (1986), "A Script Processor for the Manipulation of 3D Objects", *Proceedings of the 3rd Annual TEMPLATE User Network Conference*, San Diego, CA, 26-28 February 1986, 22 pages. Also included here for completeness, this is an even more esoteric presentation of the programming techniques which provided some of the functionality displayed in paper (1). It describes techniques used to generate video tape "movies" and again gives sample code.

(4) Wefer, F.L. (1989a), "The Computerization of the Cave Map", *Compass & Tape*, Vol. 7, No. 1, pp. 3-14, Summer 1989. This is must reading for anyone interested in computerized cave maps. It gives basic definitions, discusses in detail the four stages in the "process" of computerizing cave maps, and gives examples. If you haven't read this paper, you are probably having trouble understanding what the current discussion is about. The bibliography alone makes the paper worth reading.

(5) Wefer, F.L. (1989b), "A North Arrow and Scale for Stage-4 Cave Maps", *Compass & Tape*, Vol. 7, No. 2, pp. 3-12, Fall 1989. This is a rather detailed discussion of two elements of Stage-4 Cave Maps, viz., the north arrow and the scale. The aim was to show just how complicated things can get when you add the third dimension to cave maps.

(6) Wefer, F.L. (1989c), "Viewing Definition and Control for Stage-4 Cave Maps", *Compass & Tape*, Vol. 7, No. 3, pp. 3-19, Winter 1989-90. This paper discusses "viewing" in computer graphics as it is applied to Stage-4 Cave Maps.

(7) Wefer, F.L. (1990a), "Content Definition and Control for Stage-4 Cave Maps", *Compass & Tape*, Vol. 7, No. 4, pp. 3-23, Spring 1990. This paper presents the concept of content features (logical groupings of information), and shows how content may be defined and controlled on Stage-4 Cave Maps.

(8) Wefer, F.L. (1990b), "Miscellaneous Operations for Stage-4 Cave Maps", *Compass & Tape*, Vol. 8, No. 1, pp. 3-21, Summer 1990. Miscellaneous operations include such things as: multiple user interfaces, dynamic operations such as rotations, special processing such as cut away views, and changing the details of how the software operates while it is running.

(9) Wefer, F.L. (1991a), "Passage Walls Construction For Stage-4 Cave Maps", *NSS Bulletin*, Vol. 53, No. 2, pp. 124-125 (Abstract), December 1991. This is the abstract of a paper I gave at the 1991 NSS Convention in Cobleskill, NY. I showed how ICM uses cross sections at or near each survey station to construct passage walls in 3D. I also showed how to do such things as take the ceilings off the passages so you can look inside.

(10) Wefer, F.L. (1995a), "A 3-D Symbol Set For Stage-4 Cave Maps", *NSS Bulletin,* Vol. 57, No. 1, p. 65 (Abstract), June 1995. This is the abstract of a paper I gave at the 1994 NSS Convention in Brackettville, TX. I showed how ICM uses 3D icons to represent items in caves (e.g., formations, streams, rocks, ropes, and people) so that when you take the ceiling off the passage and look inside, there is something to see.

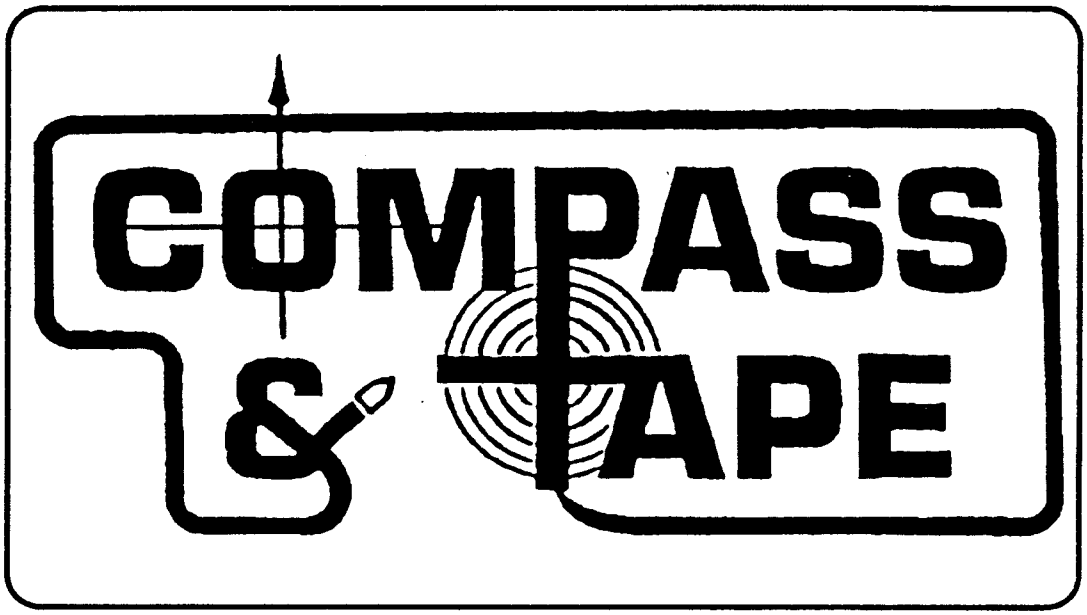
(11) Wefer, F.L. (1995b), "The Computerization Of The Cave Map", *Program of the 1995 NSS Convention*, p. 29 (Abstract), 17-21 July 1995, Blacksburg, VA. This is the abstract of the review paper I gave at the 1995 NSS Convention in Blacksburg, VA. I reviewed the history of the development of 3D cave maps, summarized the basic ideas presented in the above ten papers, and suggested avenues for future development.

CONCLUSION

Because of the nature of the work I do, I live in a different world than most cavers, so far as technological gadgetry is concerned. When I gave my first paper on the topic of computerized cave maps way back in 1983, I looked out into the eyes of an audience that didn't have a clue what I was talking about. What I was doing back then (interactive pan, zoom, and 3D rotation of traverse line maps) you can just about do today on your home machine (if it is a top-of-the-line Pentium PC and the cave isn't too big). Welcome to the technology of 1983!

I get the sense that the committee is limited in its thinking by the hardware and software they currently have available at home. But think about it. By the time they reach an agreement on these issues, the hardware and software that I have available today on my desk will be on your desk. You will be able to draw 1,000,000 vectors/sec, 250,000 Gouraud shaded polygons/sec, double buffered, in 24 bit color, and at a resolution of 1280 by 1024 pixels. Once you can draw that fast, then "everything" becomes interactive. At that point your thinking has got to change, else you end up with a TV picture of a cave map that you could just as well print on paper and pin to your wall.

At this point I need to remind myself of the theme of paper (11), "The man who goes alone can start today; but he who travels with another must wait till that other is ready. Thoreau (1817-1862)" I guess I have to wait some more for you guys to get ready. But I sometimes get the feeling that you are just milling around.



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