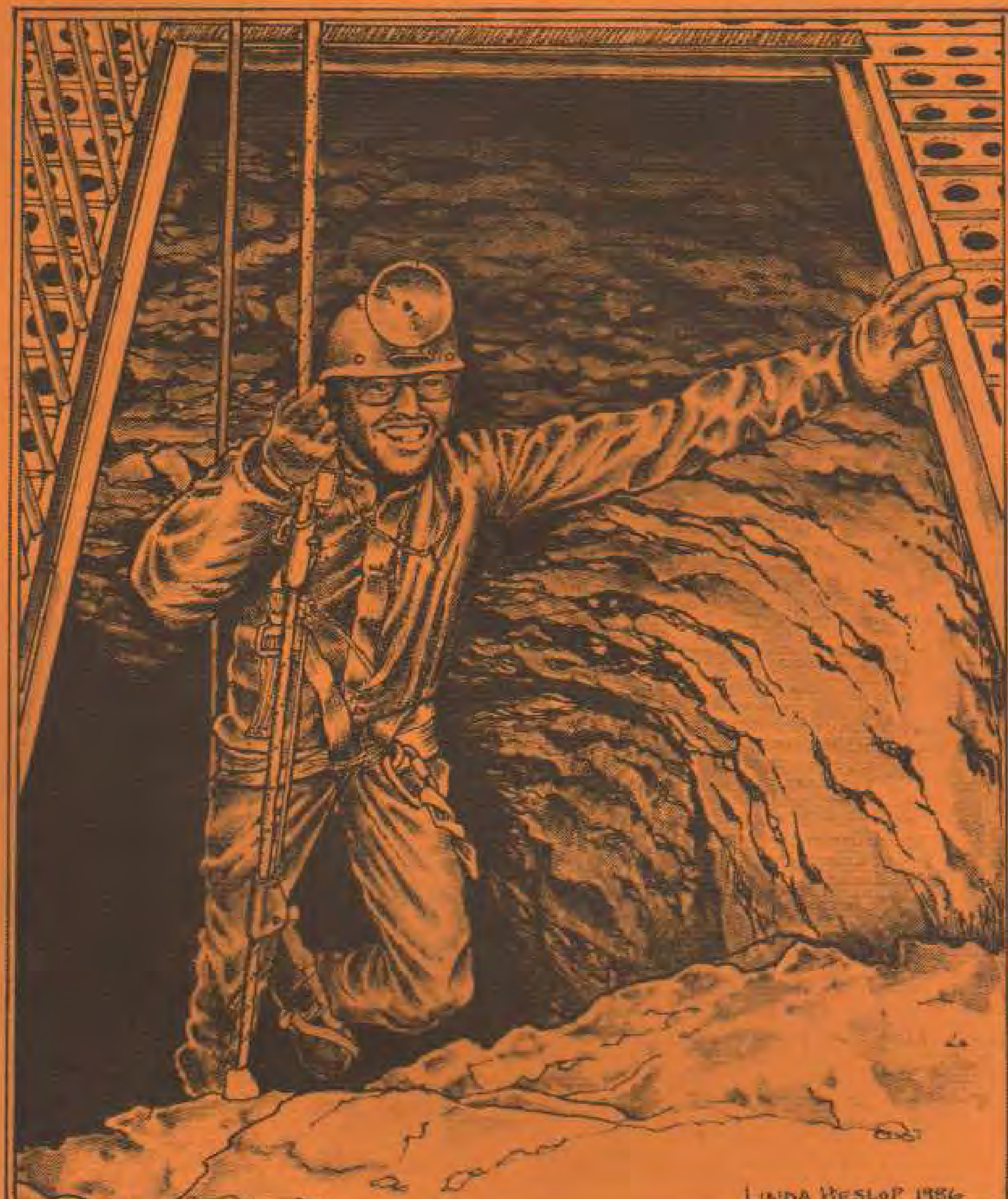
NYLON HIGHWAY NO. 36



...ESPECIALLY FOR THE VERTICAL CAVER

NYLON HIGHWAY

JUNE 1993

NO. 36

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THE NYLON HIGHWAY

The *Nylon Highway* is published on a semi-annual basis, pending sufficient material. It is the intent of this publication to provide a vehicle for papers on vertical work. All submitted articles containing unsafe practices will be returned to the author. With this issue, the Vertical Section has over 1100 members with a mail out of over 1200 copies of each issue.

Opinions expressed herein are credited to the author and do not necessarily agree with those of the Vertical Section, its members or its Executive Committee. Reprinted material must give credit to the author and source. Letters to the editor are welcome.

Cover: Barclay Foord climbing out of Bighorn Cave, Montana. Drawn by Linda Heslop.

Inside Back Cover: The European Frog System. Drawn by Mark Tornblom.

Section Business: There will be a discussion on changing the section constitution and by laws to accomodate incorporation and non-profit status at the annual section meeting. The meeting will be held at the 1993 NSS Convention in Pendleton, Oregon.

TABLE OF CONTENTS

FEATURE ARTICLES

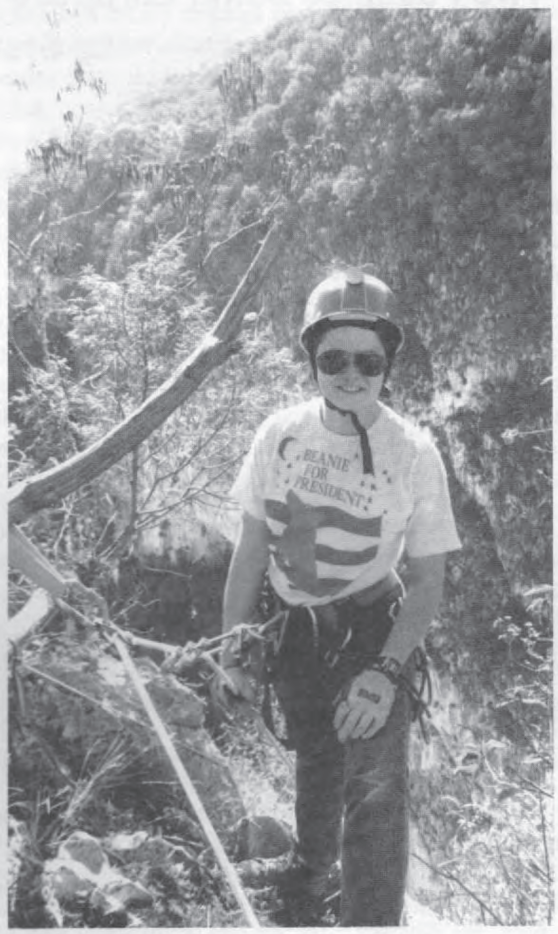
FROM THE EDITOR
by Maureen Handler

The completion of *Nylon Highway 36* marks the end of my third year as editor. When I first volunteered for the responsibility of publishing a high profile, top quality newsletter, I wondered if my enthusiasm would be as high in a few years. To my surprise, I am even more motivated now. I feel the quality of this issue is as strong as ever. For this, I thank the authors of the articles I have received. I have wanted to write a more detailed editor's column in the past. However, I usually find myself writing this column at 3:00 a.m. as I finish the layout, so this time, I wrote my thoughts before starting the layout. In my position as editor, I am kept informed of news and new developments in the vertical world and some major events have occurred in the last three years.

Our caving world has expanded. European techniques are commonplace now. We have been introduced to Soviet equipment and techniques. Single rope technique is recognized beyond caving and rescue, to such diverse occupations as window washers and arborists. Six years after first publication, the authors of On Rope are writing an updated edition. However, the most significant and disturbing development has been the increased number of accidents and fatalities involving caving, cavers and SRT.

In 1991, there were two fatalities, one in TAG at Megawell and one in Mexico at Cueva Cheve. In 1990 and 1991, there were two out of control rappels in TAG, at Moses Tomb and Fantastic Pit, resulting in serious injuries to the rappeller. Then, in 1992, a trip to El Capitan, in Yosemite, ended in tragedy when a rappeller lost control and lost his life. These are only a few of the more alarming accidents because they involved more experienced individuals. The first part of *Nylon Highway 36* deals with some of these issues. What happened at EL Cap? How is the mixture of European and American techniques affecting safety? Are people getting the proper information they need to approach vertical caving safely and efficiently?

In his article, Mike Futrell suggests that the *Nylon Highway* and other publications may inadvertently be promoting poor and unsafe caving practices. He explains that the novice has trouble filtering out basic from advanced techniques. The *Highway* may publish an article on a rope walker system and now some novice in West Virginia feels that it is the ultimate climbing system.



The *Nylon Highway*, On Rope, and other literature are not intended as a sole means of SRT instruction. None of this, or all of it combined, can be an effective teacher. Training, practice and experience must be combined with reading and research for truly complete instruction. Nothing can replace this hands on work. Local clubs and experienced individuals are responsible for novices they introduce to or take caving. The proper equipment and techniques for the region and type of caving, must be explained and taught. A double bungie is great for TAG yo-yoing and caving. I use one regularly. Yet I use a frog system in West Virginia.

Unlike Mike, the majority of cavers cannot climb deep pits on a Texas system. On an expedition to Resumidero el Borbollón, in Mexico, numerous short pits (200 feet and less) were encountered below the 718 foot free drop 200 feet into the cave. My rig provided me the luxury of a rope walker on the larger pits, a modified Texas on the lower drops and an easier time crossing the rebelay 710 feet off the floor of the main shaft. The point is, use the proper rig for the conditions you are most likely to encounter. Training and experience is required to analyze available literature and apply it to the obstacles that will be encountered where you cave.

Speaking of training, I would like to point out some standard rack techniques that many cavers I've encountered were never taught. Your main friction control comes from your bars, controlled by your left hand (if you are right-handed), not from the rope passing over your hip, like on a figure 8. Assuming you have the appropriate number of bars on the rope, pulling down or pushing up on the last two bars will usually give you all the varying friction you need. Notice, I said the appropriate number of bars. I cringe whenever I hear people say "I always rappel on five bars." Unless they always do the same drop on the same rope, this is an unsafe attitude. Conditions vary; some ropes are supple, some are stiff; some drops are wet, others are dry; some lips are nasty and others are easy. Only experience can tell you what is appropriate for the particular conditions.

The other question is, "Do I rig my rack parallel or perpendicular to my body?" The answer is, whatever is comfortable and you know how to use. Just remember, if the rack is parallel and you drop the fifth bar, the fourth bar can slide down to the nut, disengaging it from the rope. Now your on three bars. If you don't understand how this happens, look at the photo of me preparing to rig rope pads at El Sotano. I have four bars on the rack but only three are engaged with approximately 100 pounds of rope weight below me. If I had spacers between the upper bars, I would have had minimal friction.

The point of this editorial is simple. Know what to do and know what you are doing. If you're unsure about techniques or equipment, ask somebody, do your research. If you see someone using wrong, questionable, or unsafe mixed techniques, teach them the right way. Most of all BE CAREFUL!!! Be safe and enjoy.

Two Fatalities Using European Vertical Equipment and Techniques by Steve Knutson

It was unusual for two American cavers to die in one year in non-diving incidents. The very interesting aspect of this is that both died because of European techniques or equipment. At Megawell, Jackson County, Alabama, a European rope, rigged in a typically American way, failed. At Cueva Cheve, Oaxaca, Mexico, the victim was passing a European style rebelay when he fell.

The Megawell incident would be clear cut if the rope had failed solely due to abrasion. The rope was tested later and found to be greatly inferior to American caving rope in regard to abrasion resistance, and the obvious conclusion would be that if the victim had used American rope he would still be alive. By the same token, if he had rigged the European rope in a European manner, he again would have lived. The message would be clear - don't mix styles and equipment or, at least, that European rope is incompatible with American style rigging. One of the main reasons Europeans use rebelays is to keep their poor quality rope from abrading.

Forensic analysis, however, seems to indicate the rope was chopped by a falling rock, rather than abraded by rubbing on a surface. I don't believe American caving rope has been tested for such, so it is difficult to say what would have occurred if American rope had been used.

In the Cheve incident, it seems clear that the crossing of the rebelay, not the simple act of rappelling, resulted in the fall. This is not to infer that the rebelay was unnecessary. Indeed, there was a slope of loose rocks above the free portion of the drop, and the rebelay enabled one to rappel the free portion without danger of the rope dislodging rocks from the slope. Rather, I would like to urge cavers to be prudent in their use of rebelays. If you are using American caving rope, there is often no need for a rebelay, even though the rope passes over edges and contacts walls.

In my own caving, I don't use a re-anchor unless the rope begins to show signs of wear, and you might be surprised by how much contact an American rope will put up with. Every time you cross a rebelay, you expose yourself to danger that is not there in a continuous rappel. You must attach to the anchor, undo your rappel device, re-attach it to the rope past the anchor and unclip from the anchor. This process cost Chris Yeager his life.

Reprinted from the NSS News, December 1992, Part II, American Caving Accidents, 1991.

ACCIDENT REPORT
EL CAPITAN, YOSEMITE VALLEY
THURSDAY, SEPTEMBER 17, 1992
by Robert Coney, NSS 20939

PURPOSE

The purpose of this report is to summarize the known facts of Rob Moore's death while rappelling El Capitan in Yosemite Valley. Limited speculation will follow, based on the memory and experience of the expedition members. It is hoped that the reporting of this information will help prevent such tragedy in the future.

INTRODUCTION

The 1992 expedition to Yosemite Valley was organized over the preceding year with a goal of rappelling and climbing both Half Dome (approximately 1900 feet) and El Capitan (approximately 2650 feet) using standard vertical caving techniques. Both drops had been done before so this was a pleasure trip rather than an innovation.

The majority of expedition members came from Atlanta, Georgia with the second highest number from the aggregated TAG (Tennessee, Alabama, Georgia) caving area. All of these members planned to participate in the rigging and derigging of the two drops. Several other people expressed interest in flying into the area, rappelling or climbing and rappelling El Capitan, then leaving. These people would not assist with rigging or derigging. Invitation to join and acceptance was based on word of mouth and recommendations from people considered competent at vertical technique. At least two people had been on prior expeditions to Yosemite.

Organizational meetings were held in Atlanta to review prior trips and to plan for the current trip. Several newsletters were sent to participants, outlining discussions from the meetings as well as introducing other material for consideration. Final plans were for eight people to rig Half Dome, do the drop, and then move over to El Capitan. Eight people would also rig El Capitan, do the drop, and then move over to Half Dome. De-rigging of Half Dome and El Capitan would be completed Friday and Saturday, respectively. A loose schedule for rappelling each drop was organized to ensure that everyone got a chance to do both drops. The people who were only doing the drop gave notice of their arrival time and were scheduled for that time.

EL CAPITAN RIGGING

The main anchor was an evergreen, approximately two feet in diameter at the base. The rope was rigged eight feet off the ground to avoid rope wear. The rigging tree was about eighty feet from the lip. The rock was heavily padded at all touch points before the lip and the rope ran over two large rollers at the lip. A separate rope was rigged to allow travel down to a ledge at the lip. The end of this rope was coiled so that the free end barely reached past the lip. There was no tail, although the short rope could have been let down if a tail was needed. A haul system was in place if needed, consisting of a five to one pulley arrangement with a Jumar. This could be attached to the main rope for negotiating the lip without the weight of the rope. The haul system was used intermittently. It was found that the lip could be passed (with effort) by going to 4 or 5 rappel bars on the rack and picking up the 180 pounds of the main line. When requested, the haul system was used.

ACCIDENT SUMMARY

Rigging the two drops went smoothly and the first groups completed their rappels. Sixteen rappels of El Capitan were completed through Tuesday. Wednesday, Bob Coney and Kathy Minter hiked up El Capitan from Tamrack Flats, planning to do the rappel and climb Thursday morning. At that time, the plan was for Pat Smith to hike up to the top of El Capitan Thursday afternoon. Dan Daughtry and Rob Moore (from Colorado) were to enter the valley Thursday morning, hike up to the top of El Capitan, do the rappel, and leave. Hiking time on the Yosemite Falls Trail was estimated by the climbers in the valley at about six hours.

Kathy and Bob met Jim Yeomans on top. Jim was the last person from the El Capitan rigging crew on top and was planning to remain there through the week. Thursday morning Bob and Kathy rappelled and climbed. Bob first got on rope at 8:15 a.m. After Kathy began her rappel, the two Colorado men arrived at approximately 9:30 a.m.. Kathy and Bob finished climbing about 12:15 p.m.. The mood was light, with everyone elated at the situation. Dan and Rob had made the hike up the Yosemite Falls Trail in three and one half hours and commented on how good they felt.

Bob and Kathy went up above the rigging tree to eat lunch while Dan, Rob, and Jim went down to the rope. Dan got on rope, went over the lip and yelled back up to Rob that five bars was correct. Rob then walked back up to talk with Bob and Kathy. He asked them how many bars they had used. Bob replied that he had gone over on five bars and added a sixth. Kathy told him that she had used the haul system so she had gone over with six bars on the rack. She had then dropped one to start the rappel. Kathy and Bob were finished eating when Daughtry radioed back up that he was off rope. Rob said, "I guess it's my turn," and got his gear together. Kathy noted an appropriate anxiety in his eyes when he said this. Bob, Rob, and Jim walked down to the lip, leaving Kathy behind. Jim borrowed Rob's camera to take pictures of Rob as he went over the lip. Bob walked down the right side of the rope to a point where one could safely sit without being on belay. This was about six feet away from and slightly above the lip. Rob rappelled down the short rope to the ledge at the lip. He disengaged his rack from that rope and reached over to grab the main line while holding the short rope. He the rigged six bars in to the main rope. Bob noticed that he did not clip in a safety as he transferred ropes and thought that was odd. Bob glanced at Rob's sit harness and did not see a safety attached. In hindsight this seemed remarkable. Jim rappelled the short rope down to the ledge beside Rob, clipped his safety to the short rope, and disengaged his rack. Jim took six pictures in all. The pictures show that Rob had his foot stirrups* already attached and in place as he started over the lip. (*Sometimes foot stirrups are used on long rappels-ed.), Rob tried to start backward but could not due to having six bars on the rope. He did not request the use of the haul system. Jim and Bob told him he would have to drop some bars to be able to move. He dropped all but three bars and began to back up. Bob told him that he only had three bars on and he stopped, placed another bar at the bottom of the rack, and struggled backward. He then went over the lip and rappelled out or Bob's sight (about ten feet down). Jim was leaning over the edge and told him not to go too far or he would not be able to get his camera back. Rob stopped on rope and Jim took two pictures. Jim then leaned down, picked up the haul cord, and began attaching the camera.

Suddenly, Bob and Jim heard the high-pitched rope whine of a fast out of control rappel. Jim leaned over the edge and began yelling "Leg wrap, leg wrap!". He then grabbed the radio out of a pouch and began yelling at the bottom crew "bottom belay, bottom belay!" He looked away when it became obvious that Rob would not stop. Bob and Jim noticed that several (at least two, maybe three) waves came back up the rope hard enough to lift the rope off the edge rollers. The last wave was the hardest. Kathy heard all the yelling and started down toward the lip. As she passed the rigging tree she saw it heave forward suddenly.

The crew over at Half Dome began radioing back in to ask what happened. Jim radioed back "He augered in," a term he later told us came to mind from his recent reading of the autobiography of Chuck Yeager, a jet test pilot. The Half Dome crew radioed back "What?" and Jim again said "He augered in." Chuck O'Neil then radioed up from the bottom "We have a body recovery."

We continued trying to reach the Park Service since we knew they were monitoring our transmission. They soon tuned in and dispatched a crew to the bottom of the cliff.

OTHER ACCOUNTS:

Two climbers on the face of El Capitan witnessed the accident and may have captured part of it on 16mm film. They stated that Rob came over the lip, stopped, slowly rappelled down about 300 feet, stopped again for fifteen seconds or so, and then lost control and fell. They stated that as he rappelled initially he yelled a loud "Yeeehaaa." They stated that as he reached the bulge, he yelled "Look out below!" Dan Daughtry reported that he (Dan) yelled "Yeehaa," as he rappelled and that he stopped several times to take pictures. The people on bottom noted that when the call for a bottom belay occurred, they tried to give one. Dan Doughty pulled on the rope but the stretch was simply too much for this to have a significant effect.

Later, Ted Farmer and Mike Rhea, Park Service employees at Yosemite, attempted to duplicate the conditions on rope. They hung a new piece of PMI static rope, and fashioned a rack with the top three bars separated by spacers. Ted Farmer (who weighs approximately the same as Rob Moore- 230 pounds) got on rope with four bars and noted that he was barely able to stop and maintain control with the bars jammed up hard.

LISTING FACTS

* Rob's experience- Dan Daughtry and Rob Moore rappelled Golondrinas (approximately 1100 feet) in 1986. Rob took occasional trips to Canyonland National Park for rappelling. He had done these trips over many years. He was not a caver though he was a climber.

* Rob's practice for the drop- Dan and Rob hung a rope in a tree and weighted it with 250 pounds to simulate the expected rope weight at the top of the drop. They decided that five bars would be the correct number of bars for the top of the drop. They did not do any actual rappelling on cliffs in preparation for the drop.

* Rob's gear- Rob's rack had six bars (the top two were steel and the rest were aluminum) and was longer than the usual six bar rack. He carried his climbing gear in his pack.

* Events at the lip- Rob did not use a safety in changing from the short rope to the main line. He accidentally dropped down to three bars (told to add more by Bob Coney) as he started over the lip.

* Events past the lip, before the fall: He stopped, presumably in control, below the lip. He should not have started to rappel since he had to retrieve his camera before descending.

* Jim and Bob were alerted to the fast rappel by the sudden, high-pitched whine of the rope. There was no "warm-up," only a sudden sound no more than five seconds after Jim leaned back and down to pick up the haul cord.

* It is difficult to reconcile the story told by the rock climbers with the timing remembered by those of us at the top. Also, no one else report edhearing Rob yell. It is likely that the climbers were not paying close attention since Rob was the fourth person to rappel that day. Likely the yells they report were from Dan Daughtry.

* Pictures taken at the lip reveal that Rob had placed a fourth bar on the rack but that it was at the bottom of the rack not in contact with the rope. This means that he went over the lip on the friction of three bars that were spaced 1-1/2 inches apart. Examining the bars of Rob's rack revealed melted nylon on the third and fourth bars. This means that he had four bars on the rope for at least part of the rappel. He did not drop the fourth bar off the rope to cause the accident although the fourth bar could have slid down to the bottom of the rack to start the fast rappel. After reaching high speed, four bars would have been too few to stop.

SPECULATION AS TO THE CAUSE OF THE ACCIDENT

We do not know why Rob lost control and we will never know. It is clear that four bars were too few and provided too little friction. The mystery is why Rob did not place more bars on the rope immediately after passing the lip. If we assume that Rob remembered that he had to retrieve his camera before rappelling, we can assume that any movement down the rope was accidental. Two possibilities exist. One is that he began to move slowly down the rope (as reported by the climbers) as soon as Jim leaned back in to attach the camera to a cord for lowering. This would be the case if he were having trouble remaining stopped with just four bars. It seems that he would have added a bar or performed a leg wrap or both to stop. This also implies that something else happened when he lost total control, began the rapid rappel, and Bob and Jim heard the sudden whine of the rappel.

The second possibility conflicts with the report of the climbers. That is, he was stopped just below the lip and then suddenly lost control and began a fast speed rappel from the top. Rob had several things to do before rappelling. He had to retrieve his camera, place additional bars on his rack, and get adjusted for the long rappel. There are two ways he could have accidentally started a fast, out of control rappel. He could have simply let go of the rope and rack to do something else. Four bars might have been too little to hold him and then he took off. Alternatively, he could have accidentally dropped the fourth bar to the bottom of the rack. This could have occurred if he moved the rope aside intentionally or accidentally and took the weight off the fourth bar. He then would have taken off with such momentum that he could not stop with just four bars on the rope, even jamming them up as hard as he could.

Any theory regarding the specific cause of Rob losing control must take into account the five second (maximum) "window" from the time Jim Yeomans was looking at Rob to the time Jim and Bob heard the whine of the fast rappel.

LESSONS TO BE LEARNED

Unfortunately, we cannot give a specific cause to be avoided. This is a reminder that there is inherent danger in our endeavors and we must be ever vigilant to prevent injury or death. Those of us who have long been active remain unshaken in our belief that such vigilance allows continued safe rappels of this length.

Use of the haul system might have prevented the outcome of this accident. I say "might" because the cord with which the haul system was constructed was fairly small and might not have stood up to the impact. Also, the Jumar was on the rope upside down and could have slid down the rope if impacted properly. Another safety factor of a haul system is that it removes the rope weight, requiring the use of 5 or 6 bars when crossing the lip. As soon as the rope weight is released, this is too many bars for movement. In general, it is safer to start with too many bars than too few bars.

Another safety can be proposed to cover people as they cross the lip and decide how many bars are required for the rappel. A carabiner clipped to a separate rope and then clipped on to the main line and dropped down about twenty feet would serve as a catch point if control were initially lost. It would be easy to clip the carabiner off the rope and pass by so this would serve as a simple but reliable emergency brake during the initial adjustments.

ROPE TESTING

The rope used to rappel and climb El Capitan appeared to have a severe shock load applied at the time of the accident. Since the rope was tied off at the bottom, Rob impacted in a loop of rope at the bottom of the drop, causing significant stretch in the rope. The shock waves were seen by those on top (Youmans, Minter, and Coney), probably generated by the initial impact with the wall (at "the bulge") and by the final impact at the bottom.

The extent to which the rope was damaged has significance. If such an accident occurred during a trip to a remote area (such as Angel Falls in South America), the rope might be the only way to reach a victim or for people on bottom to return topside. Is a long rope useable after such a shock load?

The rope was inspected as it was lowered and later in a field near PMI (the manufacturer). Multiple areas of glazing were noted. Pull testing of the rope was performed by Smokey Caldwell. The top end of the rope (unstressed) past the main rig point tested at 6700 pounds. A piece between the rig point and the lip tested at 6600 pounds, probably an insignificant difference from the "new" strength. A section that passed over the edge rollers was noted to have two "hard" spots in it, each about 4 inches long and twelve to eighteen inches apart. This section of rope pull tested at 5500 pounds. According to Smokey Caldwell, this is the expected breaking strength of PMI once it has been used. Evidently, the load on the rope did not appreciably damage the rope, as estimated by the rope strength. ■

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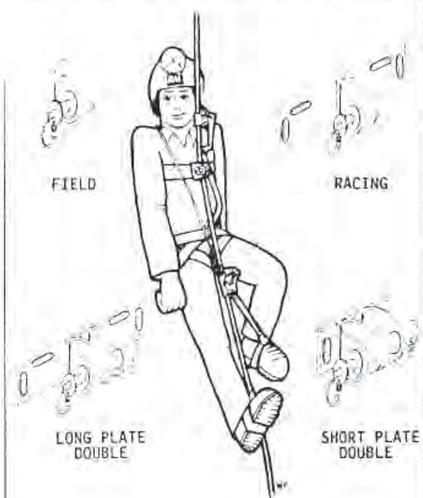

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Dear Editor

Bill Bussey's article "A Disturbing Incident" in *Nylon Highway 35* prompts a couple of comments. First, it had never even occurred to me that one might remove his rack from his seat sling as part of the process of passing a rebelay, and I'm astonished that in some circles it is apparently considered routine.

More importantly, it should be noted that it is much more dangerous to change over or pass knots or rebelays in a place where one can stand on a ledge (or a beam, as in the incident described). When you are hanging on the rope, it is practically impossible to remove your last point of support from the rope, whereas, when you have your weight on a ledge, accidents like that described are much more likely. Without a ledge to stand on, there would be no easy way to get your weight off the last ascender or cowstail without already having your weight on your rack. Of course, such shenanigans may be less awkward where a ledge is available, and in some cases that may justify the more dangerous placement, at least when those using the rope are experienced. And in the case of rebelays, there may not really be much choice about where they are put if their purpose is to protect the rope.

But is seems to me, that practice and training courses should always be set up so that the obstacles are in free space, or at most against a wall where there is no ledge. Besides being safer for a beginner, such a course will force him to master the more awkward situation of maneuvers in free space, before he encounters them in caves.

Bill Mixon, NSS 5728

Dear Editor

The rebelay is not the most forgiving of places to make mistakes or encounter problems. I would like to report a simple technique that should receive wider attention. The concept is not hard, not new and certainly not mine. It involves clipping both cowtails into the rebelay on descent.

If using the standard long and short cowtails, descend as normal to the rebelay. Clip BOTH cowtails into the anchor. Ease down until sitting on the short tail, then switch the descender to the downward rope. With the descender secured (locked or firmly held), step up, un-clip the short tail and sit on the descender. Everything was supposedly in proper order before un-clipping the short tail. Is everything still in proper order after un-clipping the short tail? If so, un-clip the long tail and continue the descent.

The long tail is never weighted and only serves as a safety. In the maneuver of raising oneself to un-clip the short tail (which at times can be awkward), the descender carabiner can turn or even open, particularly if it was not locked in the first place. Thus the caver may find the gate weighted, the carabiner unattached, or some other problem at a very inopportune moment.

Admittedly, this is a very rare possibility. But consider the distractions of fatigue, hurriedness, absent mindedness, cold, cumbersome pack or waterfall. It could happen to any of us.

In using this technique in real cave situations, I have found that the additional time required is insignificant, literally a few seconds. In lieu of the double cowtail, an ascender could be used for the same purpose.

(Editor-This simple and easy technique appears to reduce some of the potential dangers of rebelays and possibly could have saved Chris Yeager's life.)

Mike Futrell, NSS 25010

THE BOTTOM BELAY FOR RAPPELLING

by Geary M. Schindel & Sue Dowds Schindel

The bottom belay is the most common method used to belay a rappel for vertical caving. The bottom belay is intended to help arrest an out-of-control rappel, act as a safety or backup for the rappeller, and to assist or supplement the rappeller with control of a difficult rappel. The bottom belay does not require any additional equipment and is easy to apply. To optimize the use of the bottom belay, it is important to understand its limitations and applications. A bottom belay will not protect the rappeller from an equipment or anchor failure. In general terms, a bottom belay supplements or replaces the brake hand of the rappeller.

CONCEPTUAL UNDERSTANDING

There are two general categories of bottom belays: active and passive. An active bottom belay is initiated by placing tension (load) on the standing rope below the rappel device. A passive belay uses a stopper knot in the rope below the rappeller and above the ground. The passive belay will only prevent the rappeller from striking the ground. It does not affect the speed of a rappel until the rappel device intersects the knot.

Active Bottom Belay

An active bottom belay is initiated by placing tension on the standing rope below the rappel device. Applying tension to the rope increases the friction of the rope through the rappel device allowing the control of the rappel. During a rappel, the rappeller controls the amount of friction supplied by the rappel device with their brake hand for non-variable friction devices and, for variable friction devices like the rappel rack, with their brake hand and by varying the spacing between bars with their guide hand. A rappel device creates friction in the rope from the internal resistance of nylon fibers as they flex against each other and to a more limited degree, from the contact between the surface of the rope and the rappel device. In general, the amount of friction supplied by a rappel device is dependent upon the amount of tension supplied to the rope and the radius and number of bends in the rappel rope. The easiest variable for the rappeller to control with most rappel devices is the amount of tension supplied by the brake hand. The greater the tension below the rappel device, the greater the friction and control of the rappel. An active bottom belay is actually an extension of the rappeller's ability to control a rappel by supplying tension. The fact that most commercially available rappel devices allow the rappeller to control the rappel with their brake hand, even during fast rappels, indicates that the amount of tension required by the bottom belayer is manageable for most commonly used rappel devices. The application of an active bottom belay is most effective on rappels of less than 100 feet because of the increasing amount of stretch and slack in a rope of greater length. This is not intended to imply that a bottom belay for longer rappels should not be conducted, it's that they are not as efficient at controlling a rappel.

Passive Bottom Belay

A passive bottom belay is initiated by placing a slip knot (Ashley, 1944) in the rope below the rappeller and above the ground. The slip knot is usually placed within reach of someone on the bottom and is intended to stop the rappel by jamming into the rappel device. However, a slip knot can actually be placed anywhere in the rope below the rappeller This method is termed the auto bottom belay.

HOW TO APPLY AN ACTIVE BOTTOM BELAY

When applying a bottom belay, the belayer should allow enough slack in the rope to allow the rappeller to easily control their decent; rappels are best controlled by the rappeller. The method for bottom belaying should allow the quick and efficient removal of slack and application of tension. The active bottom belay is commonly applied or misapplied using one of a number of methods including: a standard "rock climber's" hip belay, and by loading the rope by gripping with the hands or with an ascender (hand belay). Generally, the load is applied from the belayer directly to the rappeller; however, the belayer must be out of the fall zone for their protection. This will normally result in the rope deflecting from vertical as it runs from the rappeller to the belayer. The deflection of the rope should be assessed to be sure that the rope will not come in contact with loss rock or cause the rappeller to strike a ledge.

The Rock Climber's Hip Belay

The rock climber's hip belay (usually called a hip belay) method is commonly misused by cavers and rescue personnel for a bottom belay. The hip belay has some inherent limitations for bottom belays not commonly recognized by rappellers. The hip belay was originally intended to arrest the fall of a top roped or lead (rock) climber and has also been adopted by cavers for use with cable ladders. A hip belay for climbing involves a set of very specific hand sequences (Figure 1) and a number of simple voice commands between the climber and the belayer. The responsibility of the belayer is to take-up or pay-out rope in a controlled manor to allow the climber enough

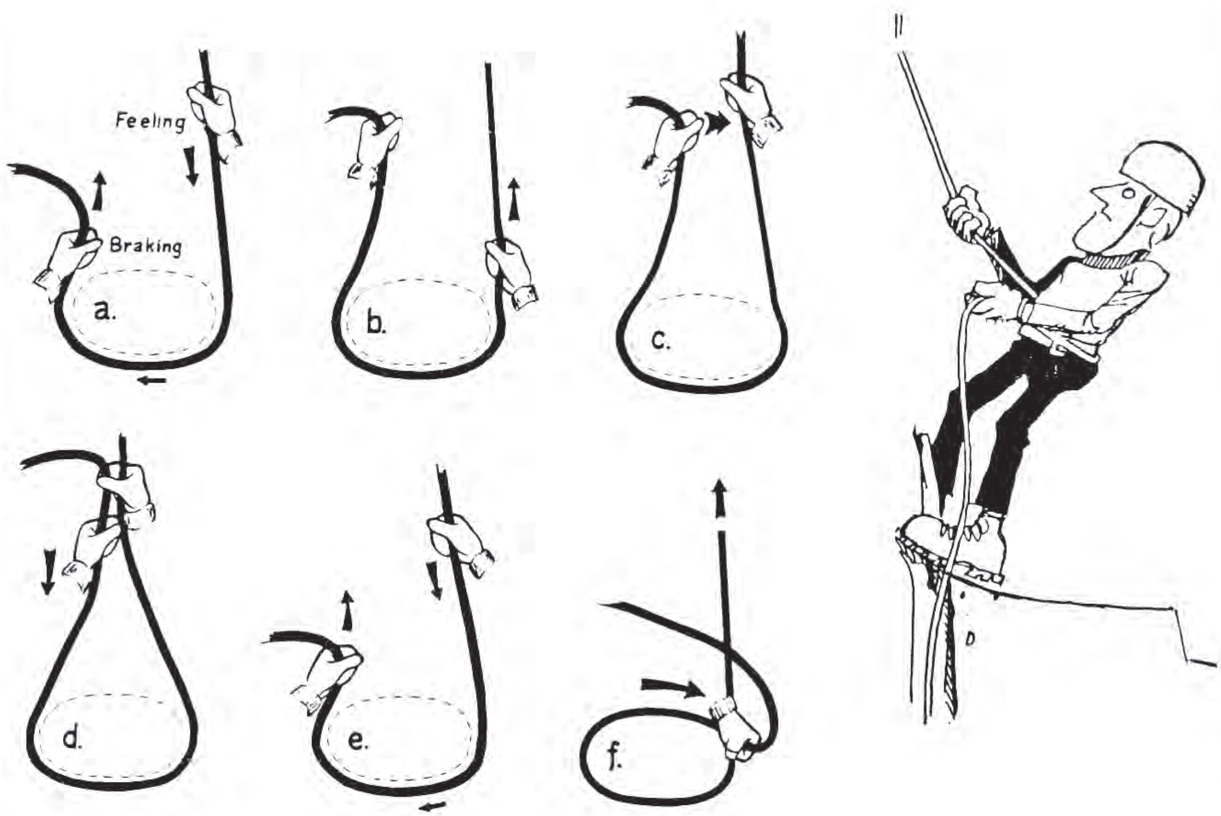

FIGURE 1
Rock Climber Hip Belay and Belaying Hand Sequence
Modified From: Mountaineering, Freedom of the Hill, 1974

Hand Sequence for Rock Climber Hip Belay for Belaying Lead Climber or Top Roped Climber

Taking up rope - left hand is braking hand, righ hand is feeling hand

a. Pull in rope with both hands on rope until braking hand is fully extended.
b. Hold rope with braking hand and slide feeling hand out.
c. Bring hands together
d. Hold both parts of rope with feeling hand, slide braking hand towards body, keeping it ready in case of a fall.
e. Repeat cycle.
f. Holding a fall: braking hand wraps rope around body and tightens grip to hold fall, feeling hand is off rope, helping to brace the belayer.

slack to climb and minimize any extra rope to decrease the length of a fall. If the climber does fall, the belayer locks down on the rope with their brake hand and holds tight for the loading of the system. If everything is working correctly, the fall is arrested. No rope is intentionally let out or taken in during the fall.

The use of the hip belay for belaying a rappel requires that the belayer be standing. To apply the hip belay, all slack and rope stretch must be taken in. This requires three hand movements for each 2-3 feet of slack removed (Figure 1). The hip belay is then applied by the belayer placing their weight in the loop of rope behind their hips. The belayer may be uncertain if enough slack and stretch has been removed from the system until they have applied their weight to the loop. If stretch in the rope is high, the belayer may actually reach the ground or lose their balance before sufficient slack is removed to allow enough weight on the rope to assist with control of the rappel. If the rope is deflected from vertical, the weight of the belayer will cause the rappeller to deflect toward the belayer increasing the slack and decreasing the control of the rappel. Again, additional rope must be taken in.

By placing the belay rope around the hips to initiate a belay, the belayer has a limited distance to apply weight. Some cavers apply additional weight by moving/running down slope with the belay rope; however, the hip belay allows very limited mobility for the belayer in relation to the hand belay. The hip belay also only allows one person to supply tension to the rope at a time.

Because very few cavers are also rock climbers or commonly use cable ladders, our observation is that most cavers do not know the specific hand sequences for a proper hip belay nor can they apply them quickly. The use of a hip belay for bottom belaying a rappel is much more difficult to apply than for lead climbing or top roping. It should be noted that many rock climbers realize the limitations of the hip belay and recommend the use of the hand belay for bottom belaying rappels (Luebbin, 1993).

The hip belay was used before the development of mechanical belay devices to maximize control of the rope during a fall and to also allow the controlled but limited movement of rope through the system. The hand sequence for the hip belay does not allow for the quick movement of rope through the belay, especially during a fall. While mechanical belay devices allow even more positive control of the rope for climbing, they are even more difficult to quickly move rope through and should not be used for bottom belays. In attempting to implement the hip belay, most people will realize the inefficiency of moving rope and supplying tension with this method and this is a reason that bottom belays are considered by some to be ineffective.

Hand Belay

The hand belay is initiated by having someone hold the rope at the bottom of the pitch out of the rockfall zone (Montgomery, 1977). The rope is usually held in the hands at chest height allowing the belayer to quickly apply tension with both hands, if needed. The remaining rope should be placed in front of the belayer so it does not tangle or trip them. Slack in the rope can quickly be taken up by "climbing hand-over-hand" up the rope and allowing both hands to supply tension. When the belay is not engaged, a limited amount of slack is given to the rappel allowing the belayer to initiate a quick belay if necessary. For long rappels, the belayer should also select a site that may allow them to move/run down a steep incline. The hand belay may also be applied by more than one person at a time if additional tension on the rope is required. If the floor of the drop is flat, or it is difficult to get out of the rockfall zone, the rope may be run through a pulley anchored to the floor. The belayer can then assert tension to the rope by pulling from a protected area or actually running across the floor. To protect the belayer's hands, we recommend that a heavy pair of gloves be used.

The advantages of the hand belay over the hip belay include the increased speed in which it can be applied, it is easy to learn and implement, it allows more than one person to apply the belay at a time, and allows the belayer greater mobility and balance during application offering the belayer and rappeller better protection. The placement of the hands above the chest when applying a hip belay also offers some protection to the belayer's face and body from an out-of-control rappeller.

AUTO BOTTOM BELAY (PASSIVE BELAY)

The auto bottom belay is a passive belay method and is initiated by tying a slip knot (Ashley, 1944) in the rope below the rappeller (Figure 2). The auto bottom belay does not affect the rappeller or rappel speed until they contact the knot. The slip knot should be tied at least 6 feet above the ground and should take into account the stretch in the rope from the rappeller's weight as well as the fact that the rappeller may flip upside down when they contact the knot. The auto bottom belay will not prevent the rappeller from hitting

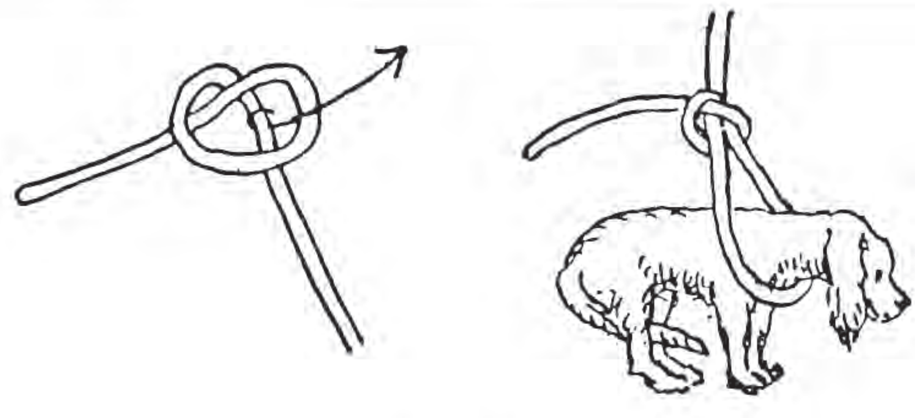

FIGURE 2
Slip Knot
From: The Ashley Book of Knots, 1944

objects above the knot. For long rappels, a slip knot may not be able to be tied high enough above the ground by a person on the bottom.

The slip knot should not be considered the same as, or replacement for a knot in the end of the rope to prevent the rappeller from rappelling off the end. The auto bottom belay is intended to jam into the rappel device upon contact: stopping the rappel. The auto bottom belay does not control the rappel in any way other then to stop it when the knot is reached. If an out-of-control rappel hits a slip knot in the rope, it will result in shock loading of the entire rappelling system including the rope, anchors, rappel equipment and the rappeller. However, this is a better alternative then the rappeller hitting the ground. The stretch in the rope will absorb some of the shock loading and should result in something less than a fall factor of 1 (see most general rock climbing texts or product catalogs for discussion of UIAA testing of ropes and application to static versus dynamic ropes). The slip knot may be removed from the rope by pulling on the tailing end allowing those on the bottom to lower the rappeller. If a rappeller hits the knot with enough force, a jamming of the knot may occur making it difficult to remove from the ground. Also, the rope should be inspected at the knot to determine if the rappel device has damaged it.

If the rappeller reaches the auto bottom belay knot during a normal rappel, the knot can be easily removed by pulling on the rope below the knot. If necessary, the rappel device can be locked off and the knot removed using both hands. The rappeller may actually use the auto bottom belay to belay themselves by placing these knots in a series below them either before or while on rappel. If a slip knot is placed by the rappeller in the rope below them, care must be exercised that the slip knot is tied tight to prevent the weight of the rope from pulling it out. The knot may be held tight by clipping a carabiner from the loop to the tailing end of the rope; however, this prevents the removal of the knot by pulling on the rope. When lowering a rope with a knot(s) in it, care must be taken that the slip knot(s) don't hang on projections making them impossible to remove or unreachable. The placement of slip knots in the rope by the rappel is not a common practice, but it is useful to know.

The auto bottom belay is the hardest belay on the anchor, equipment and the rappeller. However, it does not require anyone to activate it, removing the danger to the belayer from being struck by rockfall or by an out-of-control rappeller.

SUMMARY

The hand belay is the most efficient and effective method to apply a bottom belay for a rappel and should be considered for use in all rappels independent of the experience level of the rappeller. A combination of the hand belay and auto belay may be used to maximize protection. The belayer may tie a slip knot in the rope at the appropriate distance above the ground and the loop may be used to allow a better grip on the rope by grabbing both the loop and the tailing end of the rope. The loop acts as a hand hold and the top of the knot protects the belayer's hand from coming into contact with a moving rappel device.

SAFETY CONSIDERATIONS

Limitations of the Bottom Belay

The bottom belay does not protect the rappeller from an equipment or anchor failure. The bottom belay only helps to protect the rappeller from a loss of control incident. However, the rappeller is considered by many to be the weak link in the rappel system. A review of the annual NSS accident reports indicate that loss of control is a common cause of rappelling accidents. In many cases, the use of a bottom belay may prevent a loss-of-control accident during a rappel.

Under some conditions, the application of a bottom belay may not arrest an out-of-control rappel. If the rappel device is not correctly attached to the rope, there may not be sufficient contact between the rope and the rappel device for a bottom belay to operate. In this case, a top belay or self belay device would offer greater protection. A bottom belay may also compound problems if a rappel rack is threaded with the rope pushing open the bars rather than pushing them closed (if a rack is threaded the "wrong way"). In either case, these problems are most common with inexperienced rappellers. A top rope belay would be more protective in these cases. Also, proper instruction and observation would help prevent this problem for the inexperienced.

A bottom belay will reportedly not work on a pressure plate type rappel device (Martin, 1987). Our experience with this type of device is limited; however, this would appear to be a reasonable statement. Pressure plate rappel devices are very uncommon and this is not a concern for most rappellers.

A bottom belay should never be applied with the belayer in the rockfall zone. Rockfall is a much more common occurrence than an out-of-control rappel. The bottom belay should be practiced under controlled conditions on the surface with proper instruction. As cavers become move familiar with bottom belay techniques, their use and effectiveness will improve. An out-of-control rappel which was not controlled with a bottom belay can reach very high speed and, if the rappeller strikes a belayer, cause severe injury to both. This article is not intended to cover the moral dilemma regarding protection of the rappeller versus self-preservation of the belayer. Just remember that the belayer can be of little use to an injured rappeller if they are also injured.

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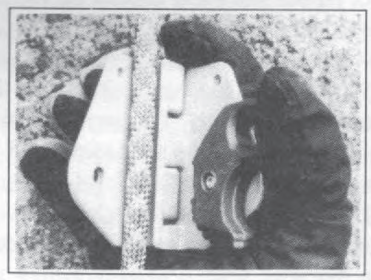

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Ropewalkers, Bowlines, and Serious Caving
by Mike Futrell

Part I

I write very little about vertical technique. Not because I don't have strong opinions, but because most of my ideas and views exist in the current literature. As cavers, we continually add to this literature in hopes of promoting innovation and improvement. Unfortunately this leaves us with a fair amount of information of varying quality and usefulness. We can all find articles that we agree with and other that we disagree with. Our opinions are often based upon our own experience and the type of vertical work in which we participate. The literature in the caving community covers all aspects of vertical work ranging from technique which has little to tremendous application underground. Add to this the high profile and emphasis given to racing in the NSS vertical section. This leads me to question whether the novice caver is able to appropriately filter the information and whether the *Nylon Highway* is inadvertently promoting poor or unsafe caving practices as a result.

Let me explain. Across the related facets of vertical work (caving, climbing, racing, yo-yoing, rescue, etc.) the gear, technique, and objectives all vary. An optimal system in one category is compromised in another. Yet I cannot count the times I've encountered novice cavers desiring/acquiring racing and yo-yo ropewalker rigs for caving use. Where do people get this idea, "Gotta have a ropewalker, gotta go fast"? Speaking for the vast majority of Virginia and West Virginia cavers, to use a ropewalker is not only laughingly absurd but in some cases a borderline liability. Excluding caves with very deep pits, I doubt the rest of the country is much different. In general, I view the Frog and Texas as caving rigs and ropewalkers as racing and yo-yo rigs. Note the distinction between yo-yoing and caving. Most U.S. caving calls for a rig which is small, simple, lightweight, maneuverable, versatile, and, of course, safe. It must go quickly from the pack, to the body, to the rope, and vice-versa, while allowing a reasonable rate of climb and negotiation of in line obstacles. Viewing the well documented shortcomings of most ropewalkers in the aforementioned features, and the fact that beyond our Ameri-centric borders ropewalkers are a joke, I conclude that ropewalkers are a poor choice for caving in all but very deep pits. So why do people feel compelled to get a ropewalker and 'go fast'?

Perhaps the emphasis on racing leads novices to believe that speed is it, you gotta be fast! A while back I was watching several people practice climbing through a pulley. They had the once common three Gibb buffoon rig with $40 of custom sewing. They would take a few deep breaths, thrash madly for about 50 feet, then stop and mutter between gasps something about the rig being out of tune. What is wrong with this approach? First, one should above all, climb smoothly and efficiently. Be kind to your body and avoid unnecessary strains on the rope, possible rub points, or rigging. Second I ask: How many can summon the energy for all out speed toward the end of a long trip? Is it wise to waste oneself on a climb? What is the importance of cutting a few minutes off of a climb? And all things considered, is the overall trip really being made shorter? There are a few asides that could be mentioned here. I maintain that near racing speeds are not needed nor desired, yet a reasonable rate of ascent is. Reasonable? Well it's fairly quick, but can easily be achieved or surpassed with a Frog or Texas. In deep multi-pitch caves, speed is achieved by maintaining a relatively slow climb velocity, consistently for a long period of time, not a series of jackrabbit spurts. And sure, we all go a little faster in cold waterfalls and a little slower when some scenery needs admiration. I now come to my conclusion; that the racing approach and mentality has almost no application in caving. (One of my reasons for never racing) But it may have some application in yo-yoing - like racing from the bottom of Neversink to the beer cooler, assuming of course said cooler was left up top.

So why do so many people think the ropewalker is THE system? I allow that some, with differing physical and mental proportions and capabilities, may be more or less predisposed to some form of ropewalker. An argument may also be presented advocating beginners starting with a ropewalker. Others who do little hard caving and much yo-yoing may find that a ropewalker meets their needs quite well. But writing from the caver position, I like to point out that the Frog and Texas variations can go anywhere, while one can easily point out caves where just getting the ropewalker to the bottom is a challenge, and using the full ropewalker to exit is not only difficult but nearly impossible.

Thus we come to the dual use rigs like the double bungie and expedition ropewalkers. The advantages are that one can yo-yo with the full rig or leave half of it home and go caving. One can also do caves with long and short drops by taking the whole rig and using the appropriate configuration. But we are still compromising! A single rig will lean toward one side or the other. So we make further modifications like removable stiffeners in the chest harness and foot stirrups. Or we use small quick links and attach different cords to the ascenders for differing uses. Soon the systems diverge, the basement fills with gear, and we witness the evolution of a caver. A caver with many systems can conform to the requirements of the individual cave in question. More-so, the caver can use the rig most suited to the particular trip into said cave. This is where serious cavers should be heading. And along the way they may find the they mostly go to type X caves requiring rig Q variations. But the following weekend they are equipped to do something entirely different with finesse. So why do so many cavers think, "Gotta have a ropewalker, gotta go fast."? They are poorly informed.

Part II

I've said a little about vertical systems in relation to caving and implied that some commonly held notions are flawed. I've stated that some published information is questionable or misleading; shall we say less than optimal. This is not surprising. Editors can only publish what is submitted. Anybody can write. Pick up the last issue of *Nylon Highway* and I'll show you what I mean. Turn to Bruce Smith's 'Double Bungie' article. The article is well written with excellent illustrations, but look a little closer. "Ah, a caving rig" might be the first thought. It is presented to cavers in a caving journal, and indeed so it is intended. See Part I.

Next I notice that Bruce uses a bowline to tie his primary ascender. I use bowlines when I need to tie a tarp over my truck. The single bowline can be virtually eliminated from the caving knot repertoire and in doing so improve one's safety and technique. "Blasphemy", you say? I acknowledge that the bowline is a good knot, but there are better knots for nearly every situation. Having seen the usual menagerie of knots on ascenders I recommend the traced-8.

In fact, I recommend 8 variations for most caving situations. I more or less learned caving with this philosophy and subsequently realized that the single bowline is not needed. I do however use the mountaineer's bowline occasionally while realizing that it is only a slight improvement on the single and I occasionally use other bowline variations. While on the subject of knots I'd like to encourage cavers to become familiar with the figure 8(9) variations. As the U.S. moves toward more Euro-technique and smaller diameter ropes, the bowline variations become even less applicable! That is the point I really want to emphasize. In my own experience 5/16", 3/8", and 7/16" diameter ropes are used quite commonly. A figure 8 takes a little more time and material to tie, but such is the nature of quality. By the way, don't look in the first edition of ON ROPE for the commonly used double 8 on a bite, it's not there. But do remember the bowline as some day you may need to tie a good knot in two seconds with one hand. Besides, it's a good coordination trick while having a few down at the pub.

Another bonus of the 8 is that it is less demanding of a back-off. To control flappers (the tail at a knot) on my ascending gear, I thread a three inch piece of one inch tubular webbing over the main line, the flapper, and partially into the knot. This works exceptionally well but it takes a little time and effort to tie and position.

In following my belief that a system should be versatile, I do the following. Instead of tieing the knot as close as possible to the ascender as Bruce recommends I leave a little space. Enough to insert a small carabiner. This will hold the ascender somewhat parallel to the rope if weighted in a traverse line situation. Though cowtails will get you across many traverses, some will require an ascender as an aid to gain elevation toward the end.

I remind you, I'm writing from a caver's viewpoint. So, I have this double bungie rig and am heading to Horror Hole #57. I throw out the chest harness and bungie. Maybe I put the foot jammer in my pack for safety's sake. Ready to go? Wrong. Where's the safety from the seat to the leg ascender? Though it is not needed in the full configuration it is advisable in the Texas configuration. We would like to assume the novice would remember this from another source.

I also prefer to use locking carabiners to attach my ascender cords to my seat maillon. I use a bungie loop 'rubber band' to prevent accidental weighting of the gate. This attachment allows me speed and convenience in removal between pits. Remember much of the speed in traversing a pit takes place before and after contact with the actual rope. I'm usually happy if I can wear my seat, let alone vertical gear, through between-pit constrictions. When aid climbing, my ascenders/descender are clipped to a gear loop and can be easily clipped in if needed. In a more rare situation, where the seat ascender were to become jammed or stuck, it could be removed without unscrewing the seat maillon to facilitate in correcting the situation. NOTE: using this carabiner does require one to be attentive to the gate's lock status. If one is incapable of monitoring their vertical gear, might I suggest tennis!

To conclude I hope this article at least provides fuel for thought. I realize a few of my thoughts run contrary to widely held beliefs. I emphasize the need to become well read on vertical techniques, continually learn and question things seen in print. Seek opinion beyond the small world of a single grotto.

At the present time my favorite book on the subject is Alan Warild's VERTICAL, which I strongly recommend.

"Rock on a Rope" Climb

by John Halleck

Little Brush Creek Cave has a feature called "The Pillar". This pillar is in a 6 meter wide, 13 meter high passage. It fans out until it touches both walls and continues up to a hole that is 3 by 6 meters. The problem was to climb the pillar so that the passage at the top could be surveyed.

Since the pillar touches both walls, it looks like a wall about 3 meters or so above the floor. However, there is a space behind it that reaches almost all the way to the ceiling and down to the floor. And (here is the important part), there are some holes that reach all the way through the pillar, this part of the cave having been redissolved. The rock will not hold a bolt, is covered with mud and attempts to free climb it had failed.

The method of attacking the wall (pillar), was theoretically easy. You tie a rock to the end of your rope, throw the rock through a hole, let the rope down the other side, tie the rock to the end of the pillar, prusik up the rope to the hole, and repeat the process with the new free end of the rope and the next hole. While this is clean and simple in theory, it has a number of problems in practice.

The first (minor) practical problem is that you crush the end of the rope that is between the wall and the rock when you miss. (That is, the last meter or so of your rope may have to be cut off when you are done.)

The second practical problem is that if you throw the rock straight up and try to get it in a hole, you may miss. (Can anybody guess what happens to the rock you just threw straight up above your head?)

Another problem is that if you miss, the rock may shatter. (What happens to the pieces then?) If this is not the first leg of the climb, you have to lower the rope and have the support team tie a new rock on it.

The rock can wedge into the hole. Then you don't dare trust climbing on it, since you don't know what's holding it. On the other hand, it does not want to pull back down either.

Well, (to make a short story short), we tried it, it worked, it was an *interesting* climb and Little Brush Creek Cave was 120 meters longer.

SRT IN TREES

by Bruce W. Smith

Single rope techniques (SRT) in trees has become an ever increasing skill to achieve such tasks as tree trimming, pruning, rescue, high lines, rigging, equipment extraction, such as hang gliders or ultralights, animal rescue or a methodical felling. Thirty years of experience has allowed the author to present here, extensions and modifications of specific techniques that extend arborist's skills and standard SRT approaches beyond the scope of most written methods.

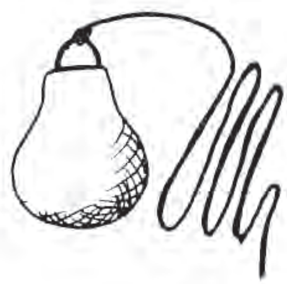


FIGURE 1
Throwing Ball and line made of very hard rubber and 100' of 1/8" cord

It is suggested that the climber have a good Texas prusik system with two Jumar safeties equipped with very short tethers. When attached to a seat harness, they should interface with the rope at about chest height. It will become very apparent as to why when in a tree and the need to reach high over your head becomes necessary. The other tool that can be purchased at any arborist supply house, is a throwing ball and line. (Figure 1)

TREE ROPES

Some ropes work much better in trees than others. As a general rule, the non-laid, static, flexible ropes work best. PMI EZ Bend, some Bluewaters, SSP and Samson 2-in-1 marine ropes are among some that work well. PMI Max-wear and other stiff ropes work against the climber during moves as you often depend on tree contact for surface friction. (Figure 5) On the same note, tubular webbing works better than the stiffer, flat webbing. Also the ability to tie small, compact knots is achieved better with supple ropes. Tree climbing is an exercise in achieving inches and if valuable inches are consumed with bulky knots at critical points, such as branches, upward progress can be hindered and even stopped because most ascenders work poorly on knots.

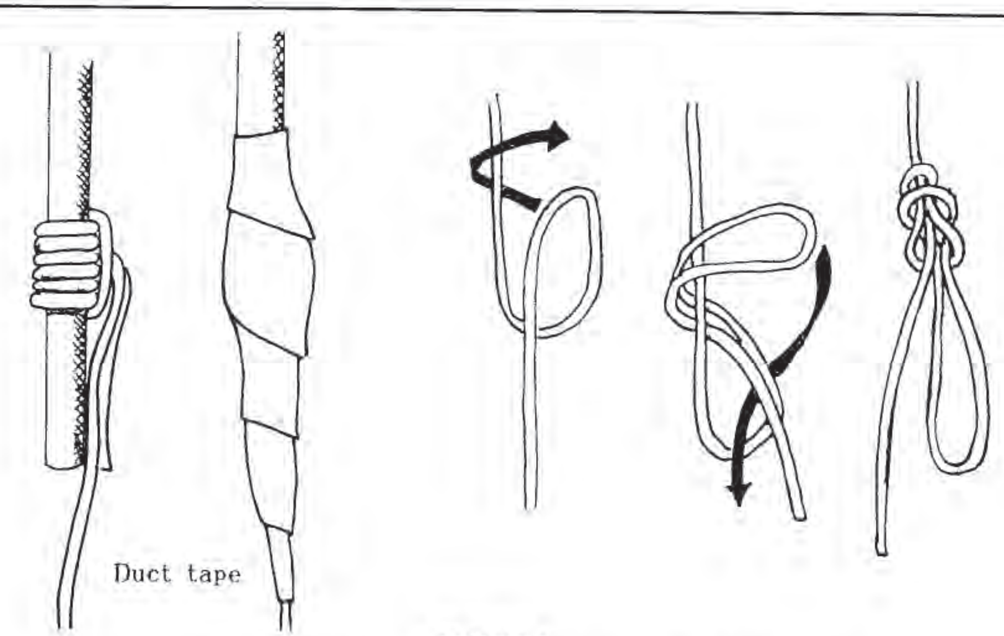


FIGURE 2
In-line figure 8 knot and a 6-wrap prusik knot. Duct tape the whole knot for smoothness

BIG TREES

Big trees with large limbs are first assaulted with a throwing ball. Practice aiming and achieving the highest crotch or branch you can achieve. Attach the main ascent rope to the free end of the throwing ball line using a six-wrap Prusik knot. (Figure 2) An in-line figure 8 knot could also work if the crotch is wide. Smooth out the knots with duct tape so the knots will slide over the branch or between a V crotch with hanging up. Attach all the height possible in attaining the first perch, as the throwing ball approach becomes relatively useless after that.

Plan Your Moves Carefully

Before starting the climb up the tree, you should plan, to some degree, every move you plan to attempt in the tree. Then attach all the ropes and webbing tethers necessary to your harness before you begin. A ground person can attach additional gear to a utility line, but your climbing ropes and straps should be with you.

* The climber will need:
* 2 ropes, 25' to 50' long
* 1 long rope, 150' to 200' for a double line descent
* 4 to 6 pieces of webbing, 10' to 15' long for prusiking and tethering
* 75' to 100' of utility line for hauling and lowering
* personal Texas climbing system with 2 Jumar-type upper ascenders
* 1 descent device can be used on a double line (rack preferably)
* 3 to 5 extra carabiners
* water, if it's a hot day
* other ropes needed to accomplish specific tasks in the tree

These tasks may include lowering branches, planes, people, or parachutists; to attach tree support cable; to do trimming; or attach electrical flood lights. Other ropes may be needed to achieve specific tree placement. (Figure 7) All these ropes are in addition to the first rope placed and pulled with the throwing ball and line. After the climber has attained the first perch, he can then pull up, using the utility line, other needed gear like a chain saw, pole saw, drill, electrical fixtures, cables, tools, etc.

NEXT MOVE

After prusiking as far as possible, whether perched on a limb or suspended below a larger limb, the next move is an innovative, critical technique. One could attempt to muscle one leg over the limb and attain a perch, but this is very dangerous as the climber, once on top of this first perch, has nothing to hold him in the tree but his balance. His throwing ball rope is probably attached to some anchor at ground level.

Method I

Take one of the short ropes (25' to 50') and tie a tight figure 8 on a bight in one end and, if possible, throw this rope over the next limb or tree crotch. Use the figure 8 as a slip knot, thread the loose end through the eye of the bight and pull the knot tight. With your second Jumar safety already hooked onto your seat harness, attach the Jumar to this new rope and then do a complete transfer from the throwing ball rope to this new shorter rope. Prusik up this new line and repeat Method I as often as necessary, alternating the use of the two short ropes and transferring back and forth between them. (Figure 3)

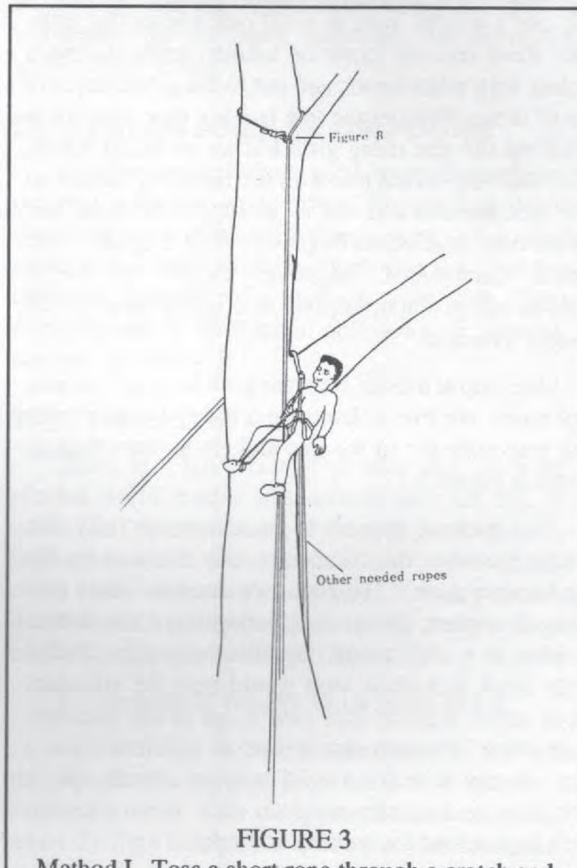


FIGURE 3
Method I. Toss a short rope through a crotch and secure the line by cinching. Transfer to the new rope.

Method II

Sometimes the climber cannot reach the next limb by throwing a short rope through a crotch or over a limb and you are faced with a long section of fat trunk to ascend without the aid of a limb or crotch. Simply reach as high as possible and girth hitch the trunk using one of the shorter ropes. (Figure 4) Transfer over from the throwing ball rope to this new shorter rope and ascend. Repeat the process using the second shorter rope and continue attaining inches. The need for the short tether on the Jumar safety will become quite apparent during this repeated move.

This whole process looks scary and defies many standard rigging axioms, but the girth hitches work and they will hold. This is where a soft supple rope is very necessary. When attaching these girth hitches, be sure to arrange the loops perpendicular to the trunk. Do not angle the girth cinch or cause it to be loose in any way. (Figure 5)

SKINNY TREES WITH NO LIMBS

Occasionally, the climber needs to get into a tree that is very tall and skinny (8" to 16" in diameter) with no limbs or the limbs present are dead or would not hold one's weight, such as a tall pine tree or flag pole. Take three endless loops of tubular webbing, made endless with water knots, and put locking carabiners in two of them. Pretend the tree is a big rope and Texas prusik up the tree using girth hitches as Prusik knots. Place one loop on the tree with the carabiner hooked to your seat harness and use as the upper ascender and use the non-carabinered loop as the foot ascender. The second carabinered ascender should be in a ready-to-use position, clipped to a utility loop on the climber's harness.

One loop at a time, slide the girth hitch up the tree, very much like Prusik knots up a rope. Position each loop perpendicular to the tree and cinch them tight as shown in Figure 5.

This method appears to be somewhat risky for, attachment wise, the climber is only attached by his seat harness girth. The foot loop hardly counts as a point of contact, but is surely necessary for ascent. Looking at it objectively, the knowledgeable climber might think a chicken loop would help the situation, but in actual practice, this idea is out of the question. Remember, however, that a tree is different from a rope. A tree is really a solid point of contact, like a rock face, and is easy to grab, slide down or wrap one's legs around for security and safety.

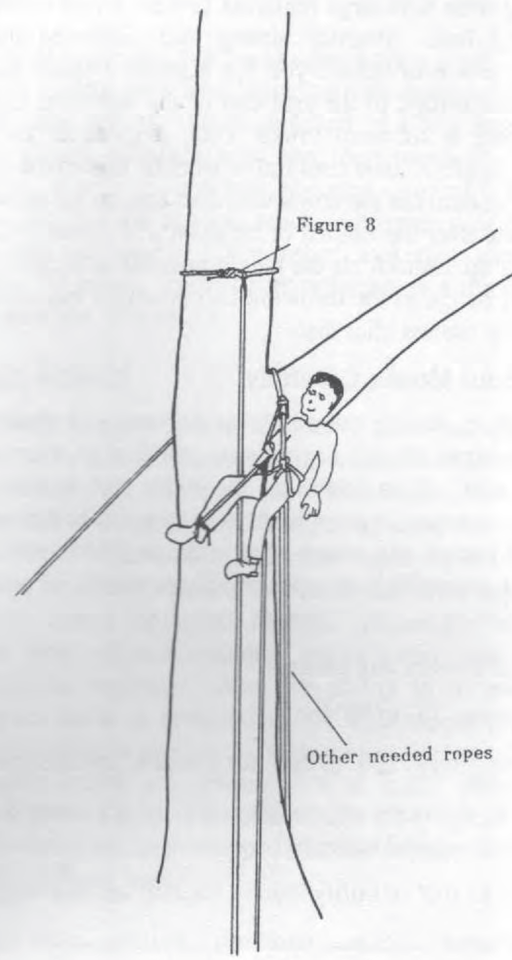


FIGURE 4
Method II - Girth hitch a rope as high as you can reach. Transfer your ascenders to this new rope and continue. Repeat as needed.

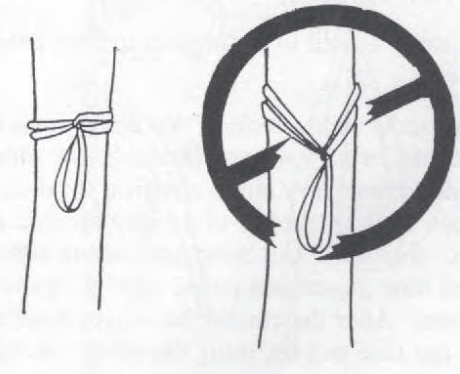


FIGURE 5
By girth hitching endless loops, a climber can prusik up a tree using the tree as a fixed rope. Never let the girth hitches sag or become loose.

When a non-support branch or tree bulge is encountered that won't allow the girth hitches to slide up, simply put the third loop into service by wrapping it above the obstruction and clip the locking carabiner into the climber's seat harness. Raise the foot loop, step up and raise the new upper loop higher, placing slack in the old seat loop and remove the seat loop from one's harness. Cycle up the tree until the need to remove the lower foot loop is necessary and reposition it above the obstruction. (Figure 6)

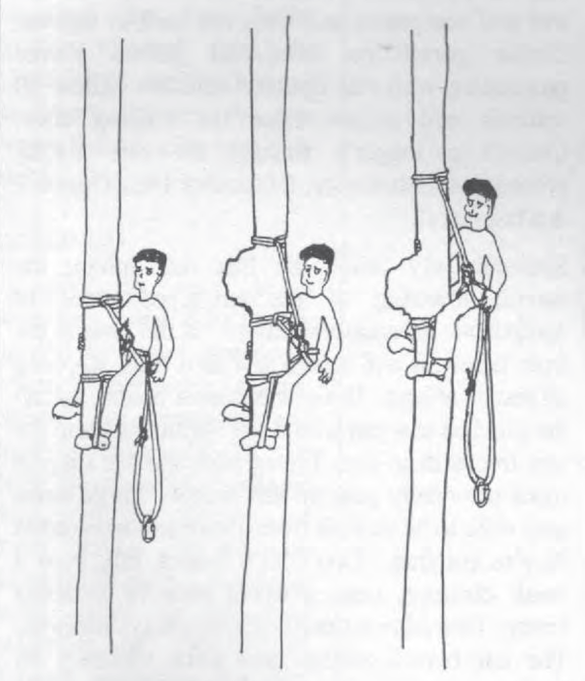


FIGURE 6
Using endless loops girth hitched around a tree, the climber can ascend a tree as if he were ascending a rope. When encountering a bulge, engage the third climbing loop and pass the obstruction. Clip the loop carabiners in an out of the seat harness as needed. Never open the seat carabiner while in the tree.

OTHER SKILLS AND METHODS

Cherry pickers

Wouldn't a cherry picker be nice? Unfortunately most trees are in forests or on mountain sides where this equipment renders itself useless.

Spiking

Spiking is a skill known by power pole workers, arborists and loggers and takes some practice to master. It does do substantial damage to a tree, so beware. They are fast and can solve ascent problems quickly. A pair of spikes cost about $150.

Ladders

Sometimes an extension ladder may be handy and can assist in obtaining a closeness to that first perch. A firm footing for both legs of the latter is essential, for the tope of the ladder rarely has a good balanced placement. When using a ladder, the instant the top ring is reached, girth hitch the tree and attach the girth hitch to the climber's harness. It may be advisable to secure the top of the ladder to the tree as well. Activities often require stretching and unbalanced moves cause sideways pressure at the top of the ladder, resulting in the ladder falling. An advisable suggestion may be to remain belayed to the tree whenever on a ladder.

Cranes

Many arborists use cranes very successfully, however, the same problems arise as mentioned with cherry pickers.

Helicopters have also been used very successfully to extract victims form tree canopies, but the techniques are far more advanced and beyond the scope of this article.

DESCENT OR DOUBLE-LINING DOWN

A common technique used by rock climbers to descend, is rigging a pull-down. Simply loop the long descent rope at about the halfway point (pre-mark the ropes with a safe colored marker) over a V crotch and rig both descent ropes through your rack. Rappel normally and at the bottom, pull down on one end of the rope to retrieve it.

TREE PHYSICS

There is a basic law of physics that can keep a climber out of trouble and possibly save his life. It is called the Law of Moments. Keep in mind, that as one walks out on a limb, the effect of the force on the limb at the trunk increases dramatically. Roughly speaking, the distance from the trunk times the weight hanging on the limb equals the force. (Figure 7)

* Distance (ft) X Weight (lb.) = Force (ft-lb)

Theoretically, the moment force on the limb when the rope is tight against the tree, is zero because the distance is zero. This all becomes rather complicated when the limb is angled and not extended horizontally, etc., etc. Just ask often, "Can the trunk-limb interface hold my weight times the distance to the trunk?". The desirable attack on a tree ascent should obviously focus on the trunk or main stem of the tree. Common sense is critical. A branch 2" in diameter can easily hold your weight in a hardwood tree if the trunk extends straight up and the climber is hanging straight down. When the physics change, such as the 2" limb is angled or the climber torques the trunk sideways, the reliability on small branches goes out the window.

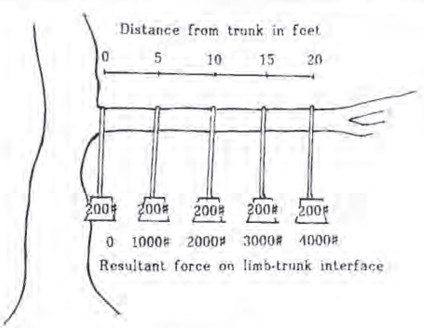


FIGURE 7
The weight on the limb X distance from the trunk equals the force on the limb measured in foot-pounds.

TREE RESCUE AND BRANCH CUTTING

Always remember that gravity dictates what will happen whenever there is a change in an existing condition in a tree. A standing tree is often balanced on its trunk. If half the canopy of a tree is removed, will the weight of the remaining canopy cause the tree to fall?

When extracting people or equipment from trees, here are a few tips. After reaching the sharp end of a situation, immediately secure the people or person to the trunk. Secure the equipment to stabilize the situation and avoid any shifting of people or equipment that could throw the rescuer off balance. Rig them higher than their physical position in the tree with static rope or webbing. If something slips or adjusts, the resultant new position in the tree will be close to its original position.

"The climber in the tree has the last word."

This is an old arborist's rule, that the person making the cuts, rigging and adjustments is closest to the situation and should know what will work and what won't. Obviously, ground advise should be welcome, but if the boss is on the ground, he needs to allow the person in the tree to make the final decision as to rigging and limb cuts.

After the person(s) (i.e., hang glider pilot) has been secured to the tree, attach a harness to them, put them on a fixed-brake lower, remove them from the tree tether and rappel them down. It's very possible that the ground crew, after rigging a rack to a nearby anchor, could lower the victim, assuming the lowering line extends up into the tree higher than the victim, through a tree crotch and then back down to the victim.

Equipment Rescue can get complicated

- Options

* Cut the tree down. This will obviously trash the tree and equipment and trees are hard to replace. Obtain permission from all parties before proceeding with this option. Caution: Clear all vehicles and people from the landing zone. Consult a logger's manual for tree felling procedures. Obviously, this author feels Option 1 is a last resort.
* Systematically prune the libs that inhibit the careful lowering of the entrapped piece of equipment. Remember gravity. If the limb is cut from below, it will bind a saw as it falls, stopping all rescue efforts. If a saw becomes bound, spread the pinched saw cut with a log splitter or chop the saw free with an axe. Flying axes and life support ropes personally concern this author. Large limbs may need to be tied off from above and lowered as they're cut free. Don't let a branch fall, even a small distance, onto a nylon rope or webbing tether. One of two things almost always happens. The cut branch swings and jerks violently on impact, greatly altering the balance that the rescuer has already attempted to achieve, or the webbing/rope breaks. It is amazing how little force it takes to break a nylon rope under these conditions. Anyone who has towed a car with climbing rope probably understands this statement. Tow ropes break readily.

CHAIN SAWS

A small word about chain saws. A chain saw in a tree is a viable option, but the tree climber must have extensive experience to know what he's doing. Arborists have been using them in trees for years. Yes, it is very dangerous. Yes, mistakes can happen. Just remember a chain saw is very unforgiving. Plan every chain saw move carefully. You are not allowed to make a mistake when using a chain saw in a tree. Use common sense, coupled with precision. Never use a chain saw when you're off balance or not stabilized. Don't screw up. A chain saw will never give you a second chance.

POSITIONING AND STABILIZATION OF THE CLIMBER

Often, the situation will require the rescuer to achieve a very stable position such as when placing a support cable or sawing a large branch. Simply place two ropes spread apart high in the tree and suspend the climber from both. By attaching the two Jumar safeties to each rope, the climber can position himself anywhere between the two ropes and remain relatively stable. (Figure 7)

WRAP UP

SRT in trees is a necessary, vital skill that is needed in many situations, whether personal, rescue, esthetics or recreation and requires knowledge of not only the material presented here, but the practice of these skills. In addition, these skills are not a starting point, rather an advanced extension of SRT skills. Anyone attempting tree SRT needs to be well skilled in changeovers, prusik and rappel skills and extensive knowledge of knots and rigging. So much so, that the user should perform the skills as a habit, since most of the thinking going on in a tree becomes directed toward accomplishing the task in the tree, not SRT skills.

Author's Note: There are many practices presented here that radically deviate from common accepted practices. Tree ascending can push the limits of gear and the physical endurance of a climber. Using good rock and cave gear in a tree often falls under the category of equipment abuse. I can only suggest that the methods work and when used as described, can allow a tree climber success in whatever he chooses to do in a tree.

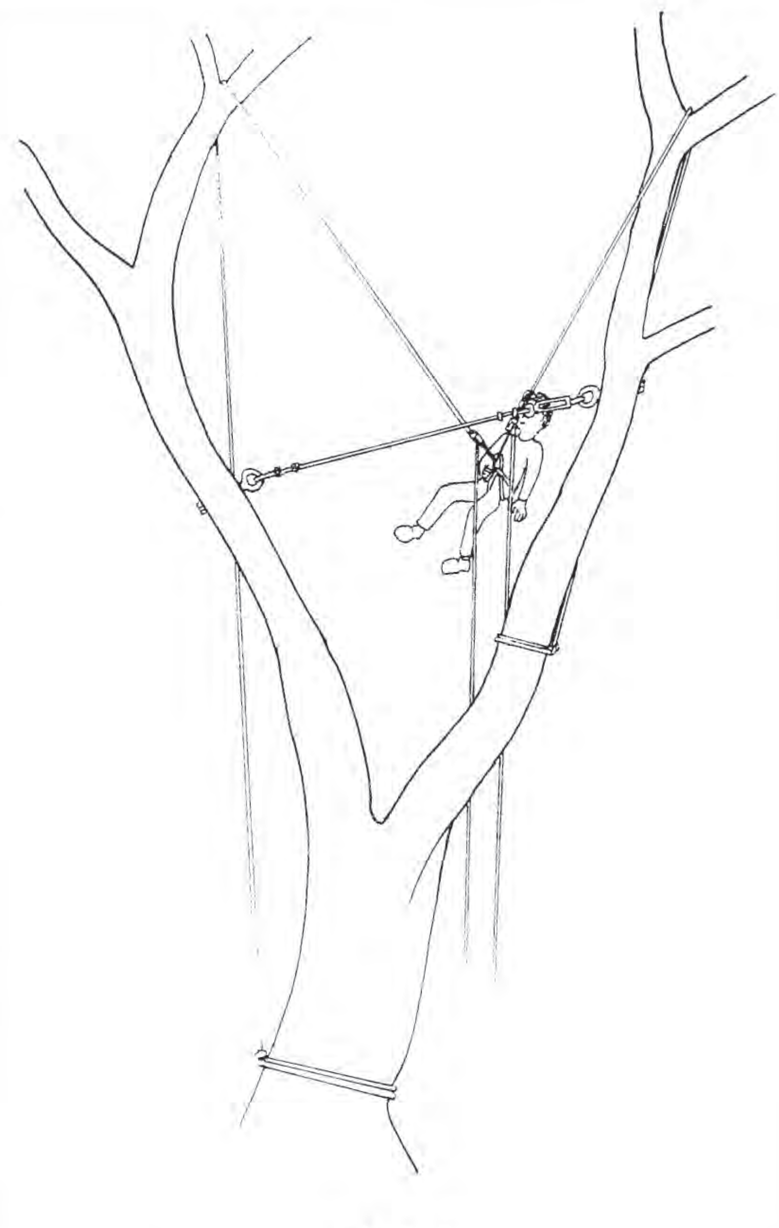


FIGURE 8
Stabilizing a climber on two ropes allows the climber to accomplish difficult tasks

Descriptions of the Russian Vertical Cable-Rope Techniques

by Dimitry Tarasov
Pluton Caving Club, Chelyabinsk, Russia

Introduction:

Caving techniques, in the former Soviet Union, were developed under isolated conditions. We had our self-developed techniques, which were very different from American and European techniques. Recently, due to democratic changes in our country, we have had the opportunity to see European techniques, work with foreign cavers and have access to caving publications, from which to compare our techniques. Of course, single rope techniques (SRT), are well developed. There is a good choice of commercial equipment of high quality.

Now we use SRT in our caves more and more, but we have noticed that our old steel cable technique is not bad. It is very helpful in many cases.

Why do we use steel cable technique?

Most of the cavers in Russia live far from the main caving regions, the Caucasus Mountains and Central Asia. These regions do not have any roads close to the caves and we sometimes had to spend up to 4 days carrying our gear from the end of the road to the caves. So our expeditions were 20 days long or more. To be more effective in exploration and surveying, we split into two to three groups with three or four persons per group.

Carrying all necessary ropes, food and fuel, the groups would reach depths of 1000 meters three to four days after leaving the surface. Of course, this is in known caves without exploring new leads. Subsequent groups continue the exploration when the first turns around, and may pass each other as they move in and out of the cave. Therefore, the ropes would see frequent use and quickly abrade in the wet and rocky conditions. Sometimes, cavers had to change out ropes on pitches during the expeditions.

So, 20 years ago, Soviet cavers decided to use steel cable as a backup. We never had specialized caving ropes and cables, so, to guarantee the safety of cavers on drops of more than 10 - 15 meters, we always used double rope or rope and cable. Perhaps, in the future, if we get satisfactory cable, we'll use single cable techniques. Current cable-rope techniques include two techniques that differ in the descending method.

Descending on rope:

This technique uses 3, 4 or 5 mm cable and 9 - 12 mm rope. Descent is done on the rope with any type of descender and the cable is used as a safety line. A

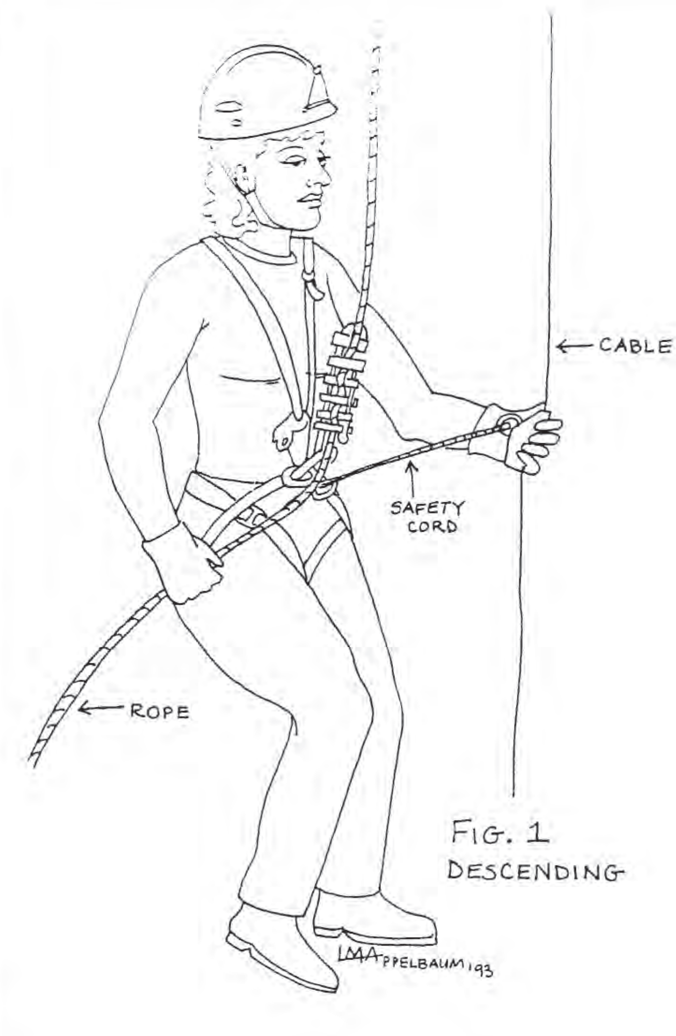


FIG. 1
DESCENDING

Gibbs type ascender is placed on the cable and it is attached to the seat harness with a short safety line made from 9 - 12 mm rope. The safety cord has to be short enough so that the caver can reach the ascender during rappel (Figure 1). The caver holds onto the ascender lightly during the descent and in case of an equipment failure must let go of the ascender to ensure it locks on the cable. The ascender is held lightly to help counteract the instinct to grab anything during a fall. There are some types of ascenders that allow the caver to squeeze to break the fall.

Ascending is done on the cable, using the rope as a safety line. The rappelling safety ascender is placed on the rope (we use universal rope-cable ascenders) and two additional ascenders (usually a Gibbs type) are placed on the cable. These two ascenders attach to the caver with different types of rigs. Two rigs are pictured in Figures 2 and 3. If the caver needs some rest during the climb, he can attach the upper ascender to his seat harness with a "rest carabiner" and sit down. Some cavers use a special rest carabiner which is attached to the harness and placed on the cable continuously during the ascent.

This technique gives the caver the ability to climb up without abrading the rope. Rope abrades more quickly during ascent, due to the cyclical loading with every step. This is especially true on large pitches (over 30 m) because the rope stretches and rubs over sharp rocks. The cable does not stretch making for a more comfortable and safe ascent.

Descending on cable:

To avoid abrading the rope, sometimes we use 6 - 8 mm cable for both the ascent and descent. We use the rope here only as a safety line. This sort of technique is useful on large pitches in the caves (80 - 100 m) and on rocky drops. (Figure 2)

The equipment differs from the rope descent only in the type of descender used. We use a special type of rack made for cable. If the bars of the rack are made of steel or titanium, the rack may be used on cable or rope.

In unexplored caves, if the caver needs to drop a pitch, he may have to rig in some rebelays or slings to re-direct the rope away from rub points. However, often the exploration is unsuccessful - no passage on bottom. Cable technique here is more helpful so time is not lost. Only one anchor would need to be set at the top of the drop. Additional rebelays would not be necessary since the rub points will not abrade the cable.

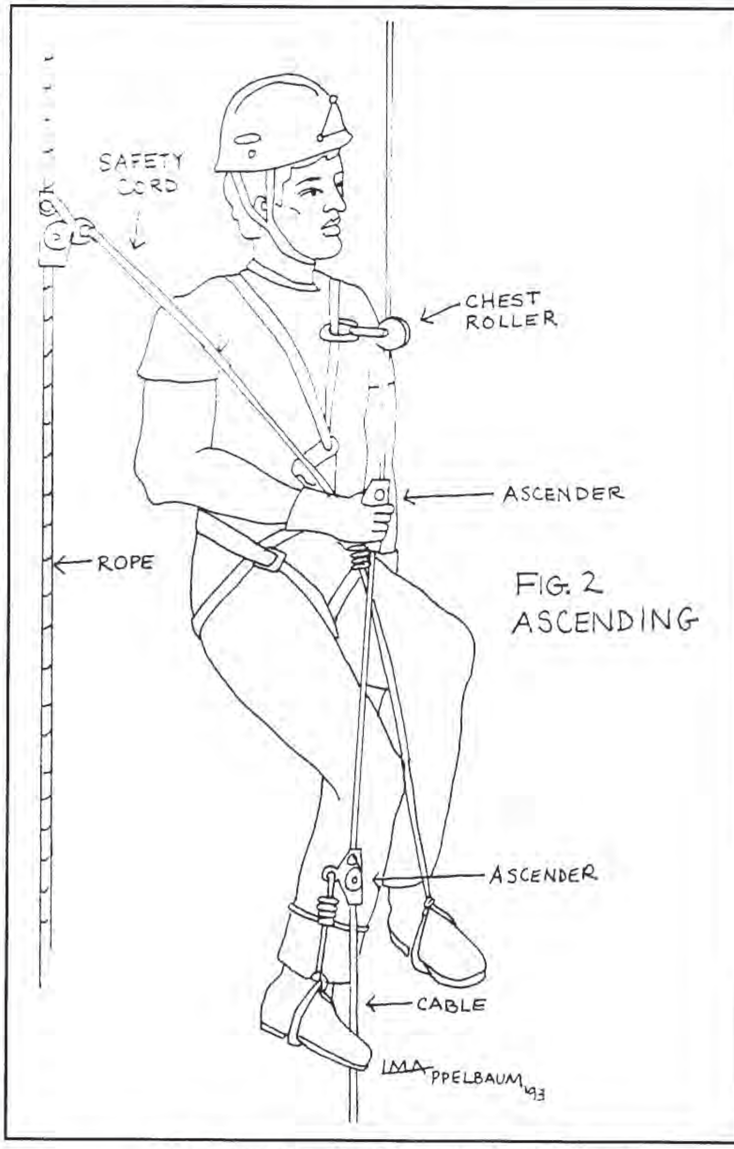


FIG. 2 ASCENDING

An example of cable technique in use:

In 1981, our club took part in a joint Russian-British expedition exploring the Hodja-Gur-Gur Ata range in Uzbekistan, Central Asia. The topography of the range consists of a 300 meter wall dropping down from a plateau, which is at 3000 - 3700 meters above sea level. There are numerous holes in the plateau and wall.

We used cable-rope technique, ascending and descending on cable. Working on the plateau, we dropped down pitches, usually 10 - 50 meter in depth. The edges of the pitches were surrounded by very sharp rocks, making rope use very difficult. We had no abrasion trouble with the cable and were quick enough to explore several different drops each day.

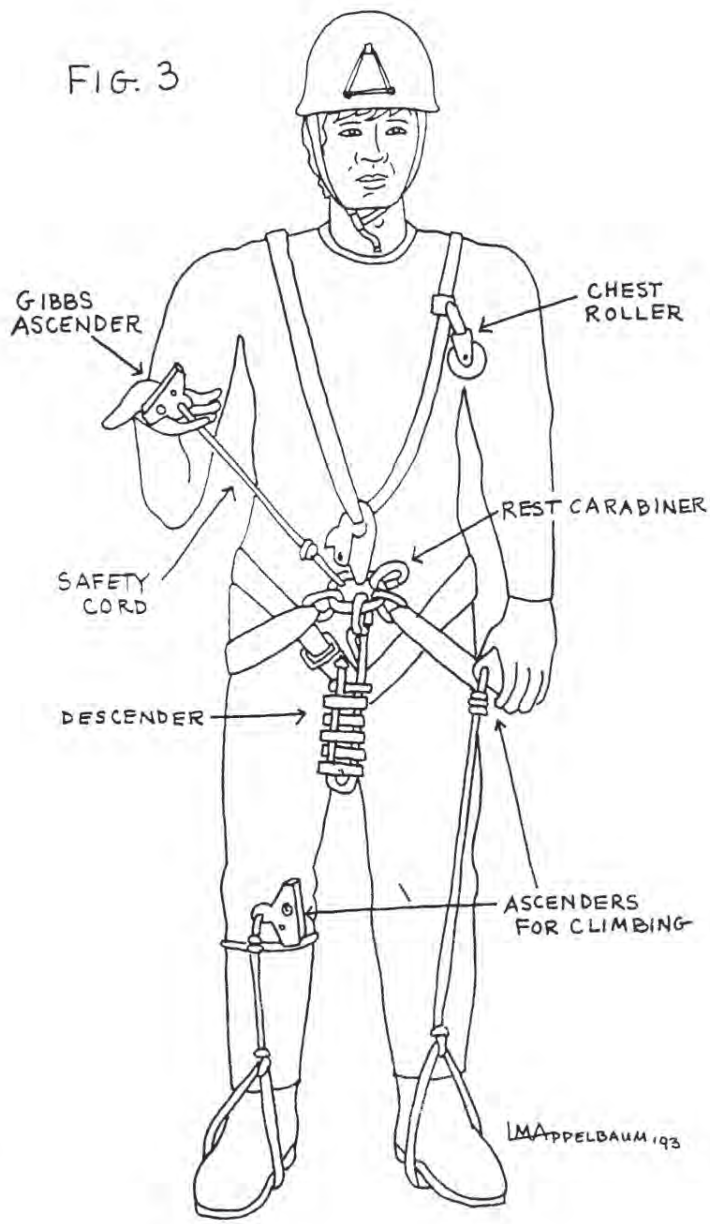
On the wall, our only successful exploration was using cable. We had seen numerous holes in the wall during helicopter fly-bys. However, when we arrived at the top we had a big problem. How were we to find the holes from the top of the wall? We usually couldn't see the holes from the top of the wall and we couldn't see them from down below either. Hanging on cable, we dropped down to search for holes, but the person on the rope could only see 10 - 20 meters on either side. Traversing hadn't given us good results either.

So, we had to drop down at every point where we had hoped to find the caves. During the day, we could make one or two drops to distances of -200 meters from the plateau. In the cave, we could re-direct the rope to position it away from the wall. On the rocks we did not have this ability, but with the cable we had no problems. It could lie on the rock without abrading.

If cavers are going to return to the same region the following year, they preserve the cave with oil, put it in a dry place (such as a dry area in the cave) and leave it for the next expedition.

In the history of Soviet speleology, cable-rope techniques have a special place. It was a major step forward and it had given us the ability to explore the deepest caves of the USSR (Snezhnaya, Kuibishevskaya, Pantyuhinskaya and others). Maybe in future years it will become history only, I don't know, but I have wanted to explain this method to American cavers for they may find it useful.

FIG. 3



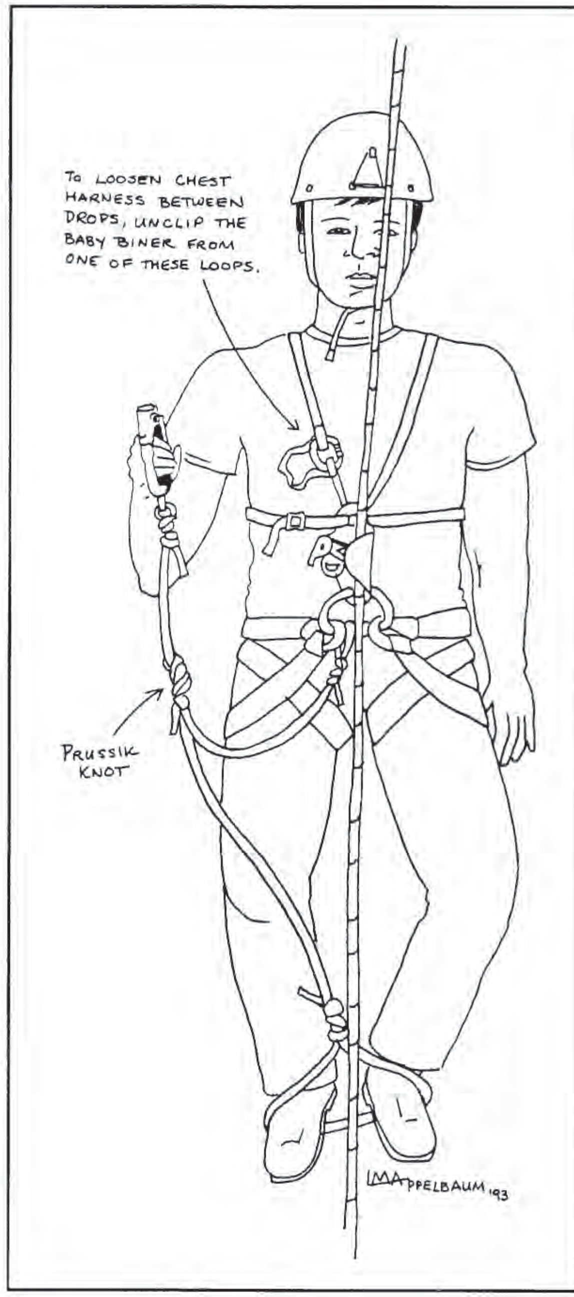
Fine Tuning the Frog Vertical System

by Sue Setzler and Doug Bruce

One of the benefits of the NSS vertical contests is the promotion of improvement in rope climbing technology. Constant training with a climbing system exposes its inefficiencies and encourages experimentation. Timed rope climbing is one of the few instances where changes in caving technique can be quantitatively analyzed for improvement. Here are some observations on the frog system based on our training for the 1992 NSS convention.

* **Croll Seat Attachment**: A lower seat attachment allows larger steps. This is important because there is inefficiency in each sit-stand cycle due to tightening of the chest harness, leg attachment cord, and seat harness around body parts. By minimizing the number of steps taken, less motion is wasted. For example, if 3 inches are lost per sit-stand cycle because of stretch in the various components of the system, then in 80 steps, there are 240 inches lost. However, covering the same distance in 60 steps leads to only 180 inches lost. In a 30 meter competition, that difference of 60 inches is worth about 4 seconds.

  Taking fewer steps also increases speed in another way. Time is lost in each sit-stand cycle during the transition from raising the legs to standing, and again in the transition from sitting to raising the legs. By increasing the size of each step, you decrease the total number of steps, thereby minimizing the loss from these transitions. Another important aspect of the Croll seat attachment, is a seat harness that clips the two sides of the seat together in front with a Maillon D (half circular) carabiner. This attachment holds the Croll flat against the stomach the way it was designed to be used. Using a seat harness with a perpendicular carabiner attachment, such as the Black Diamond/Chouinard or a tied seat, lets the Croll rotate outward which causes the rope to run against the carabiner and adds considerable friction during the standing motion.



* **Chest Harness**: Many people use bungie cord across the shoulders as a caving rig because it is lightweight and small. However, a non-elastic harness holds the weight of the climber closer to the rope so that the arms don't have to do as much work. With 1/2" flat webbing, a chest harness can be constructed that is just as lightweight as bungie, but much more efficient at supporting the climber's torso. The chest harness shown in the figure is a modification of a design shown to us by Matt Olipant.

* **Foot Loops/Toe Clips**: We found the fastest system to be a leg cord going down to bicycle pedals with toe clips. The toe clips allow you to

pedals with toe clips. The toe clips allow you to push up onto your toes, thus using calf muscles as well as thigh muscles and getting an extra inch or so with each step. In a practical sense though, no one is going to use toe clips in a cave. The best foot attachment for caving is a single line down to a loop into which both feet are placed. With this setup, the rope can be clamped between the feet during the standing motion to self-tension when climbing on muddy rope or when starting at the bottom of a drop.

* **Upper Ascender**: There shouldn't be more than an inch of space between the Croll and your upper ascender at the apex of a full standing motion. To get this length just right is very difficult, so we made an adjustable leg cord by running our foot attachment up to a prussik knot on a line attached to the upper jammer. This is a good way to get the length optimized. The figure shows this set up, as described to us by Paul Hess.

* **Selling Points**: For anyone interested in competition, the frog records at the NSS Convention are relatively new and there is still a lot of room for improvement. For example, prior to this year, the women's record time on 30 meter knots was faster than the 30 meter frog record! For anyone interested in the frog as their caving system, it is especially good for lips and rebelays, because it is so versatile and it is fast to clip on and take off the rope. (No more fiddling with that Gibbs pin!) This makes it ideal for the multiple short drops that are common in Virginia and West Virginia.

For a better general outline of the use and construction of a frog system, see the article Vertical Techniques - A European Method, by Peter Grant and Bill Bussey in *Nylon Highway #34*.

Reprinted from the Baltimore Grotto News, Volume XXV, Issue 10, October 1992.

Bridge Day - 1992
by Jeff Cody

Every year, on the third Saturday of October, the city of Fayetteville, West Virginia celebrates the opening of the New River Bridge. They close off two lanes of the four lane highway crossing the bridge and allow B.A.S.E. jumpers to parachute from the bridge and rapellers to rappel and climb. This year there was also a bungie jump that attracted most of the attention.

The New River Bridge is 876 feet tall at the highest point and over 3,000 feet in length. It is the second tallest arch bridge in the United States and the longest in the world. This bridge took four years to build and it replaces the old Fayette Station Bridge at the base of the gorge. Recently, the bridge was the scene of a GMC truck commercial, where they rolled an S-10 Blazer off the bridge on a bungie cord.

In early September, our group was awarded rope spot #6. A total of ten ropes were rigged with ten to twelve people per rope. Rope teams were selected by a drawing. The teams sent a bid outlining each member's experience and equipment, as well as, length and type of rope used. Our team consisted of Scott Cummings (team leader), Larry Bundy, Dave LeClerc, Steve Gentry, Chris Burgett, Ben Parish, Chris Gerace, Louie Kitcoff and myself.

We left Franklin, Indiana Friday morning at approximately 9:00. We stopped in Louisville, Kentucky to pick up Steve and arrived at the hotel around 4:30 p.m.. We had made all reservations ahead of time, knowing this event attracts 100,000 people, plus national media. After settling into our rooms, we raced to the bridge to get pictures before dark. What a sight! Pictures or words cannot do it justice. After we were finished taking pictures, we ate and attended a meeting for all participants, which is always held the night before Bridge Day, at a nearby campground.

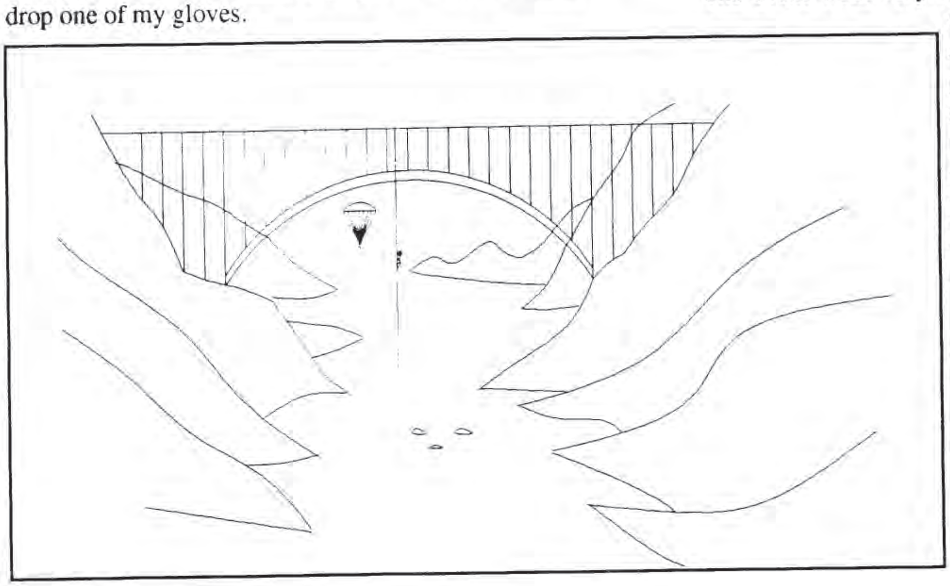
During the meeting, rappel coordinator Benjy Simpson, went over do's and don'ts, had us sign waivers and passed out parking and catwalk passes. The parking passes allowed us close vehicle access to the bridge. This was a lifesaver, since all of the spectators made it impossible to park close enough to haul gear. After the meeting, we went back to the motel for beer and small talk. Needless to say, it was hard to sleep that night.

Saturday morning we woke up at 5:30 and headed for the campground. At the campground, we sorted out gear, worked out details and then took off for the bridge. Each team was allowed three members on the catwalk at 8:00 to rig, with the first rappel to begin at 9:00.

All ropes were rigged from the narrow catwalk, which is suspended approximately 25 feet under the road surface. Rope spot #1 had the longest drop, with #10 being the shortest - we were #6. All drops, in my estimate, were over 750 feet, ours was about 800 feet. It was a treat to walk of over 1000 feet across the catwalk to the rope spot. Larry, Scott and Steve rigged the rope. Steve and Scott were the first two to drop, with Larry staying up top with a radio to assist with hookup. I stayed at the bottom of the catwalk ladder with a second radio to direct the remaining members of our team onto the catwalk when the rope became open. We had a third radio on the bottom with our wives.

Standing at the bottom of the catwalk ladder while looking out at the bridge, I could barely see the rappellers and B.A.S.E. jumpers through the massive steel structure. I was able to get an idea of how long the walk on the catwalk was by Larry, at the rope, telling me when each person I sent up arrived. It seemed like an eternity. After all others went down, Larry then called me to the rope.

I produced my catwalk pass for the guard at the bottom of the ladder and began the walk out on the catwalk. The catwalk is about two feet wide with a hand rail on each side, at waist level. It was not as bad a walk as I thought it would be. After a few hundred feet, I knew I was over 800 feet in the air (the view was fantastic). During the walk, before getting to rope spot #1, I passed by the bungie cord hook up. I finally arrived at our rope spot when Dave was about 300 feet down, so I had some time to prepare, not to mention, drop one of my gloves.



We received the call from the bottom that Dave was off rope, so I began to hook up. Larry had to pull up about three feet of rope while I rigged my rack, then once my rack was rigged, I had to climb between the hand rail and catwalk, and out onto a large beam abut two feet below. I then begged another glove from Larry and began my rappel. Our team used a 1200', 7/16" PMI rope. For the first few feet, I had to force feed my rack, then I popped the sixth bar off and began a smooth descent. I also used a Gibbs shunt, which I felt was good for changing bars. I could activate the shunt, add or subtract bars and then drop back onto the rack. It also came in handy for stopping during my rappel to look around. I could see the B.A.S.E. jumpers coming off the bridge, but their chutes opened well below the spot where I was on the rope. I used an SMC six bar rack with hollow steel bars. The rappel was great!!! After about 15 minutes, I was off rope. Larry followed, and then we watched the bungie jump from the bottom.

After everyone was down, only a few in our group wanted to climb. Chris and Steve went up first. It seemed like it took them about forty minutes to climb. Next Louie and I began our climb. Louie was about 50 feet up when I got on rope. I use a ropewalker with a Simmons roller, steel plate chest harness, a free running Gibbs on my foot and Petzl jammer as a knee cam. My system worked very well. I also used a Petzl expedition ascender above my roller to rest with. We were on rope about forty-five or fifty minutes and enjoyed every second. The view was great with jumpers coming off the bridge the whole time. Once we were up, we began to derig. We were off the bridge by the 4:00 p.m. deadline.

The event went very smoothly with no incidents or injury to any of the rappellers. The only problems were that the shuttle from the bottom to top was not organized and the people stationed at the bottom failed to wear hard hats. All in all, it went off on schedule.

I must thank Benjy Simpson and the State of West Virginia for one of my greatest vertical experiences.

SRT in 1944
by Bill Mixon

I recently bought a copy of a caving manual published in Paris in 1944. (It is a bit surprising that *anything* was published in Paris in 1944.) Its title is *Spéléologie, Le matériel et son emploi, Les explorations*, by Henry P. Guérin, at the time, vice-president of the Société Spéléologique de France and president of the Spéléo-Club Alpin de Paris. The chapter on equipment contains these illustration of single-rope technique, accompanied by the following text, which was translated from French by Gary Napper.

"The "descent brake" and the "singe" ["monkey"] allow rapid descent and ascent with a single rope, thus dispensing with the use of ladders, while still providing considerable safety.

The descent brake (Figure 1) consists of a spaced series of bars placed between two metal plates - one of which is detachable - through which the descent rope is fed. A brake, located below the bars, stops the descent instantly by obstructing the rope if, for some reason or other, the handle, which then acts as a counterweight, is released. Use of the brake allows variation in the rate of descent. The brake is attached to the seat harness by a carabiner. Depending on the thickness of the rope used and the weight of the explorer, the rope may or may not be doubled, and four bars or only three may be used. This system is used only for descent.

The "singe" complements the descent brake. It is used solely for climbing (Figure 2). The equipment consists of two brakes, which rather resemble the brake

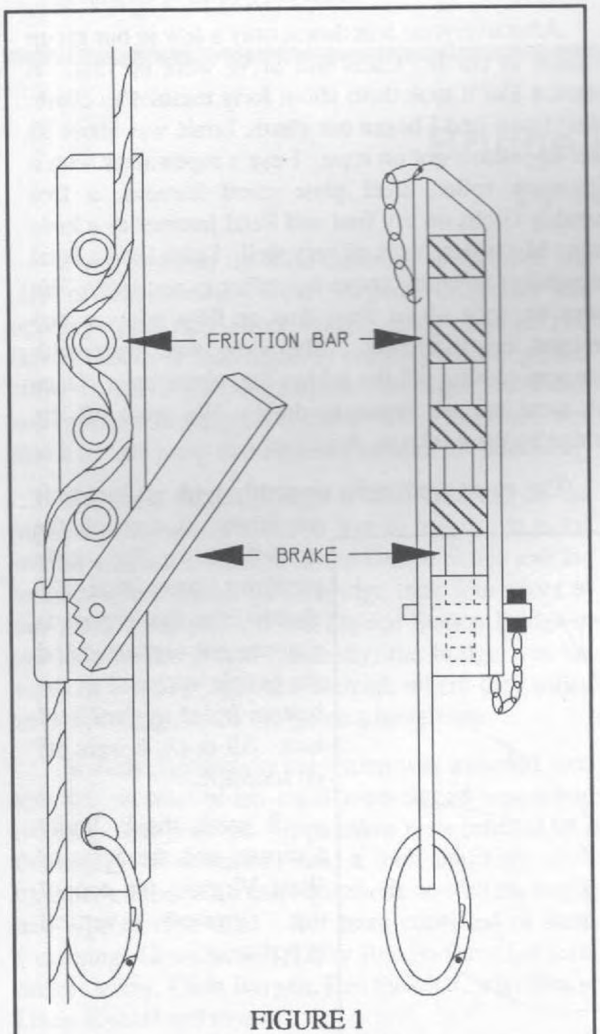


FIGURE 1
The Descent Brake

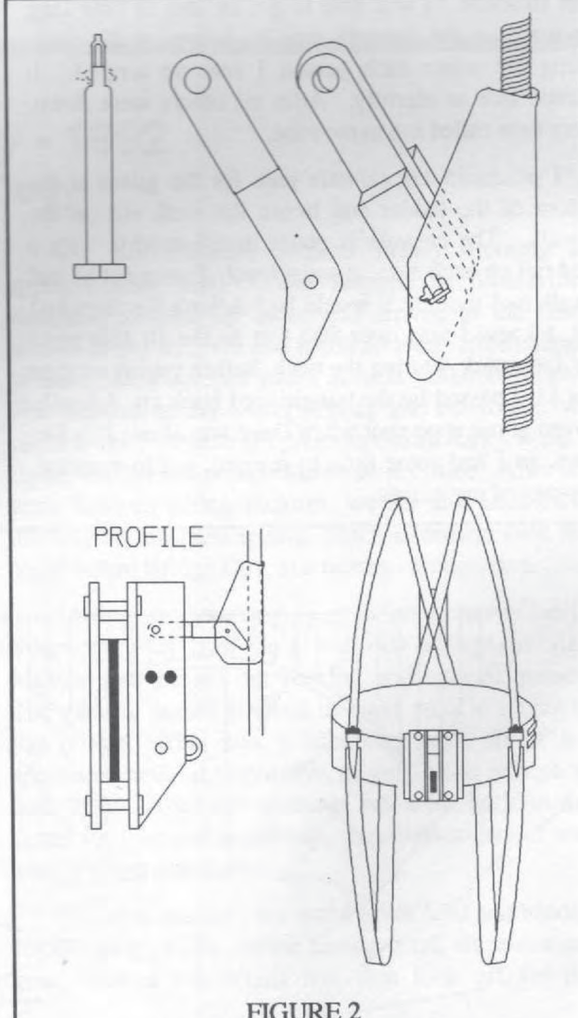


FIGURE 2
"Singe" (Monkey) Ascender

in the descent gear: one is attached to the seat harness by a pin, and the other is linked to one or two stirrups attached to foot (feet). The "singe" is attached to a special seat harness, with which it forms a unit. The harness is equipped with slings and crossed straps, allowing freedom of movement for the legs and at the same time, affording relative comfort (Figure 3). The foot "singe" is simply equipped with one or two slings that end in stirrups, and are of such length that it is always within arm's reach whether the leg(s) is extended or not. Use of the "singe," while theoretically simple enough, requires considerable familiarity to produce satisfactory results. Because of this, beginners frequently give up on it too quickly."

The descender looks much like a modern Petzl descender, but with four fixed spools instead of two. The brake is similar in principle to a shunt, but it is located below the bars, where much less friction should suffice to stop the rappeller. Nevertheless, the aggressive teeth illustrated don't look very friendly to the natural fiber rope of that day, and it certainly does not look like the device, as illustrated, allows the brake to be used to control the rate of descent, other than strictly stop or go. (Editor's note, the climbing and rappelling figures were re-drawn by Jesse Pyron from original sketches provided by Bill Mixon.)

The "monkey" ascender looks very much like a Gibbs. The technique shown is essentially the Texas climbing system, which I don't consider much good except on short climbs against the wall, although some athletic cavers have used it for long free drops. Anyway, it is easy to see why some beginners might have given up on it rather quickly.

The book also has a drawing of a prusik knot, which it says can be used for both ascending and descending short drops.

Descending and ascending systems very similar to those used today have a longer history than most cavers realize. Nevertheless, these early French devices don't seem to have really caught on, and it was only when techniques were independently developed during the 1960s, in the United States, that any large number of cavers anywhere began doing SRT.

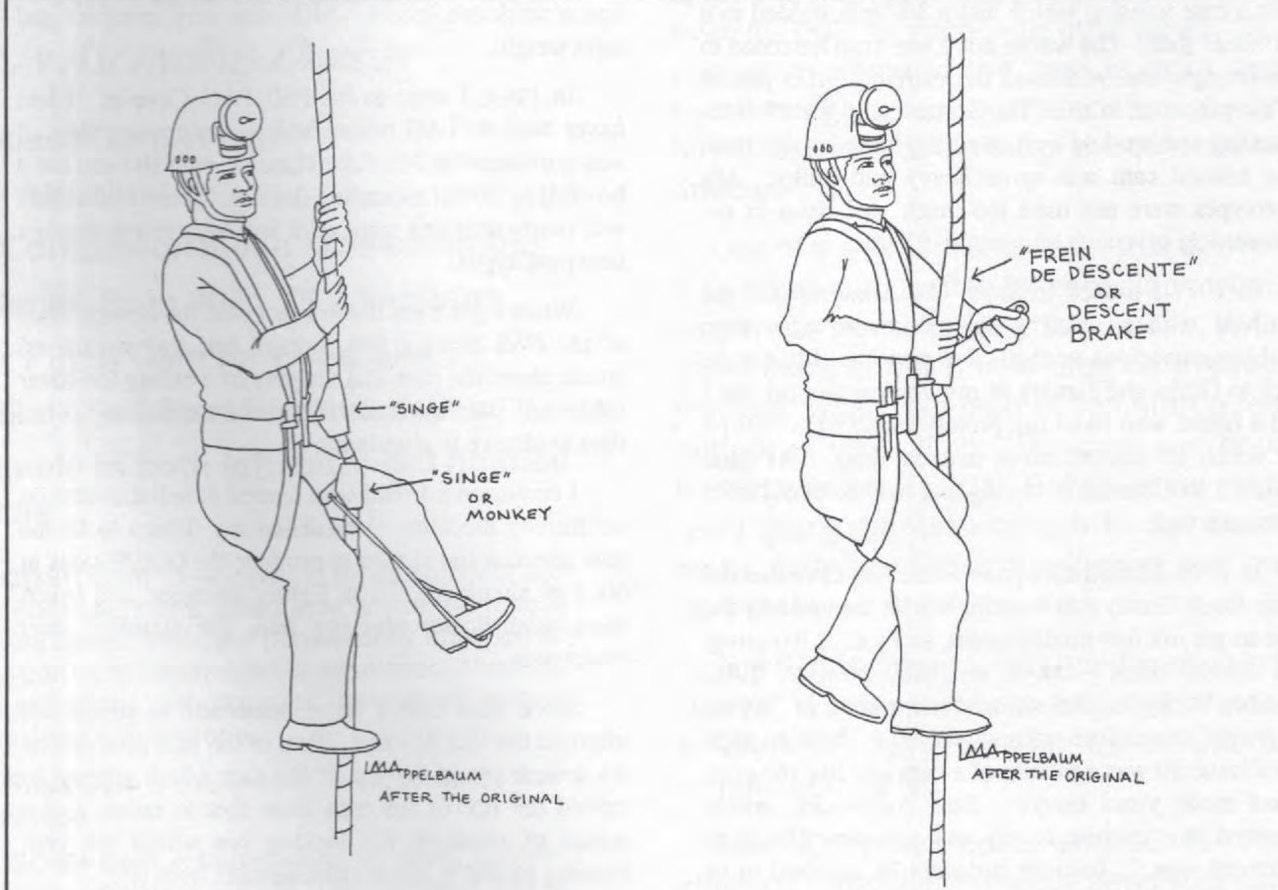


FIGURE 3
Ascending with the "Singe" and Descending with the Descent Brake

BE WARNED

The Figure 8 Is Dead

by Steve Knutson

Yes, we must mourn the passing of what many cavers thought was the ideal light, compact rappel device.

Experience has now shown the figure 8 twists the rope in a spiral fashion as it passes through, causing an apparently permanent kinkiness in the rope. As I understand, at least some rescue groups are banning use of the device, and cavers will undoubtedly follow suit. So, be warned. I intend to ban the use of figure 8's on my projects. It appears that mini-racks will be the device of choice for something compact.

If anyone goes to a carabiner brake bar setup, beware of the current style of aluminum oval that has a bump or enlargement of the gate. This prevents the brake bar from sliding up over the gate closure in use and makes for a weak device.

Reprinted from the NSS News, December 1992, Part II, American Caving Accidents, 1991.

HISTORY OF THE GOSH CAM

by R.C. Schroeder

In 1974, I conceived an idea that the Gibbs ascender might be improved if one side of the cam housing was left open, allowing entrance of the rope and omitting the need to disassemble the device. As a machinist/metal fabricator, I went into the shop and built a cam housing which had a 3/8" pin welded to a 1/8" steel shell. The whole thing was case hardened to add strength and withstand the extreme forces placed on the pin when in use. The device could lift 1000 lbs in testing and worked well on rope. However, this open side housed cam was quite heavy and bulky. My prototypes were not used too much as I lived in the non-vertical cave area of northern Illinois.

In 1977 I moved to Stone Co. Arkansas and got involved with a small group of cavers who were working on various vertical cave projects. I had gone back to Gibbs and Jumars as my vertical devices but I had a friend who liked my prototypes so I gave him a set which he started using and enjoying. As time passed, I lost interest in caving and only went out once or twice a year.

In 1990, I heard about a new exciting cave that the Little Rock Grotto was working on. It seemed like the time to get my feet muddy again, so I joined the group and started helping on the mapping project. LRG member Becky Holden showed me a copy of "Nylon Highway" (heretofore unknown to me). There on page 32 of issue 30 was a picture of a cam just like the ones I had made years before. Burt Ashbrooks' article reignited my interest in my old project. His final statement was, "...because it cannot be attached to or removed from a tensioned rope, it's usefulness may be limited." This became a challenge to me.

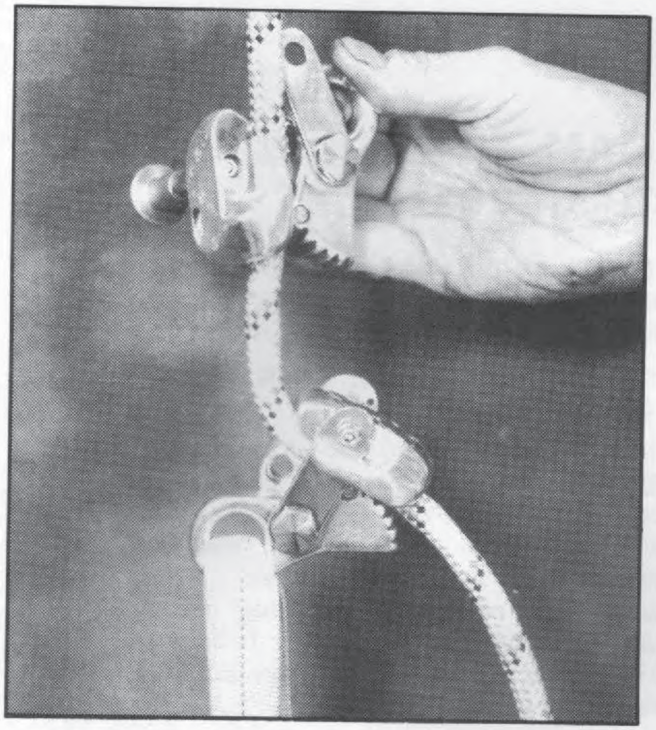
Lacking a milling machine, I was determined to make an improved version with the tools at hand. An option was to build the device out of stainless steel sheet metal and silver solder it together. My first attempts were rude and crude but by the fall of 1990 I had a workable model which was very compact and light weight.

In 1991, I went to the Fall TAG Cave-in. I had never been to TAG before and it was eye-opening. I was introduced to Maureen Handler, who showed me a box full of Soviet ascending devices. Some of the stuff was pretty neat and some of it was very much like my new prototypes.

When I got back home I received the newest issue of the NSS News. Bill Storage had just written an article about the potential dangers of welding (or silver soldering) stainless steel. That was the turning point, time to change to aluminum.

I contacted a friend who agreed to sell me time on his milling machine. I modified my design to fit the new material and started to produce the GOSH cams in 6061-t6 aluminum. It is lighter stronger, and much more atheistically pleasing than the stainless steel prototypes.

Since that time I have continued to make and improve the GOSH cams. Two of the best innovations are a wear pin at the top of the cam which appears to extend the life of the cam from feet to miles, and a means of retaining the locking pin within the cam housing so that it doesn't disassemble from it.



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The **GOSH** ascender, has one side of the cam housing left open for the rope entrance. A gate swivels from a 3/8" stainless steel bolt which is also the cam's pivot. When this gate is rotated down to its stop, it is secured with a standard locking pin, which self aligns with the gate's hole. This is a positive means of keeping the rope held within the device. The locking pin is independent from the cam. Therefore the pin is not loaded by the cam or rope. The pin may be pulled open to release the gate and remove the rope with ease, even if there is tension on the rope (such as at the top of a climb).

Some other design innovations are: 1. The locking pin does not disassemble from the cam housing. It is a totally self contained unit. 2. A wear pin has been added to the top of the cam so that its life expectancy is extended from feet to miles (one test cam has climbed over 42,000' of rope with little wear). 3. For ease of rigging, the hole in the cam is extra large so that a carrabiner gate can be rotated through with ease. 4. A hole is provided at the top of the cam housing for bungie attachment.

One of the design criteria for this device was to make it as small as possible for expedition work. The overall length was shortened for this purpose. With less surface area, there is much less drag on the rope allowing a properly rigged foot cam to self start a few feet off the bottom of your climb. The cam and housing are machined from solid 6061-T6 aluminium. No cast parts are used giving greater strength to the device. All other metal parts (excluding the locking pin) are made from 304 stainless steel.

The **GOSH** cam is totally hand crafted in the Arkansas Ozarks. Each one is carefully machined and polished before the 3 flying bats are carved into the front as a symbol of quality.

The **GOSH** cam costs $45.00 ea. Plus $4.00 for shipping & handling. Please send your name, address, & phone # along with a check to: R.C.S. Metal Fab, HC 73 Box 685, Timbo, AR 72680.

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THE G.O.S.H. CAM

PRECAUTIONS AND INSTRUCTIONS

The following is information explaining safety and maintenance of the GOSH cam. It is very important that you read and understand this information before using this device!

PROPER TRAINING IS ESSENTIAL BEFORE USE!

IMPROPER USE MAY BE DANGEROUS OR FATAL!

It is dangerous to use this or any other vertical equipment without obtaining expert instruction in its use. One should read vertical technique books as well as having hands on field training by a qualified instructor. The book section of the National Speleological Society has a good selection of vertical reference books.

THE GATE MUST BE CLOSED AND LOCKED BEFORE USE!

The gate's dual function is to secure the rope within the cam housing, as well as lend additional strength to the device.

* ALWAYS REMEMBER TO CLOSE THE GATE AND SLIDE THE LOCKING BALL PIN THROUGH THE GATE HOLE UNTIL THE LOCKING BALLS CLICK OUTWARD.

* AS A FINAL SAFETY, CHECK TUG OUTWARDLY ON THE PIN TO MAKE SURE THAT THE BALLS ARE IN FACT HOLDING.

DO NOT USE THIS DEVICE AS A FLOATING "SAFETY" ABOVE A CHEST ROLLER!

The cam in this device is not spring loaded against the rope while in use. Therefore the device may not catch if a sudden fall is experienced while climbing. **DO NOT USE AS A SELF BELAY DEVICE FOR THIS REASON.**

The GOSH cam may be used as a "safety" if the cam is rigged into your seat harness and a bungie cord is tied between the bungie hole in the cam and your chest harness. This will allow you to sit and rest at any time while climbing. The bungie cord keeps the cam loaded against the rope at all times.

The GOSH cam has been tested in various adverse conditions and has been found to have good gripping characteristics in mud and water. It is, however, the purchasers' responsibility to use good judgement while using this or any other vertical equipment. Make sure that you rig your rope clear of falling water and potentially loose rocks. CLIMB WITH CARE!

INSPECT YOUR VERTICAL GEAR BEFORE YOU LEAVE HOME!

Make sure that the balls in the pin are clean and that there is no debris which will hinder their ability to lock the gate. If there are any problems do not use the gear until the problems can be rectified. Wash your ascenders in warm soapy water and dry. A light application of 3-1 oil on the pin will help maintain good service. If any parts are loose or badly worn, please discontinue use and send the device back to the manufacturer for service.

SELF-START INSTRUCTIONS

The GOSH cam is extremely free running and self starting if rigged properly. For best results in a rope walker system, pass a loop of 1" webbing through the attachment hole in the cam. Have this loop sewn securely to a foot loop made of 2" webbing. The 1" webbing must be as tight as possible for the most efficiency, but loose enough that the cams free movement is not hindered. The one draw back in this system is that the climber must give a slight "side step" for the cam to catch the rope. Some people have trouble mastering this technique. It is well worth learning however, because when mastered, a person can self-start a few feet off the ground.

NOTICE: The GOSH cam does not self start well when a bungie is used to raise the foot cam. The double bungie system will probably cause difficult self-starts but gives great grip response to the rope.

The GOSH cam was designed and intended to be used to assist a single climber to ascend 11 MM - 13 MM static climbing ropes. Smaller, larger, dynamic or non-climbing ropes should not be used with this device. This device is not intended to be used to hold more than 225 lbs. of weight and should not be used in rescue work. For safety sake, always use 3 ascending devices when climbing.

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The Lightweight, Simple Knots System

by Robert Zimmerman

Illustrations by Linda Heslop

For the beginner in Single Rope Technique (SRT), the knots system is the ideal ascending system. Its advantages out weigh its disadvantages for the first time climber.

First of all, a knots system is very inexpensive to build. New students have no problem with spending the thirty to forty dollars necessary to obtain the whole system. It gets them started in vertical caving, and if they like it, they can splurge and spend the two to three hundred dollars needed for a more sophisticated mechanical climbing system.

Using knots requires one to become proficient in tying a variety of knots, including the figure eight, double-fisherman's, bowline, helical and Prusik. Since any caver who intends to do SRT should naturally know these knots, this system is an excellent one to teach beginners because it forces them to learn.

Using a knots system improves a person's rope climbing technique, which in turn helps them deal with the problems one faces when climbing with a mechanical system.

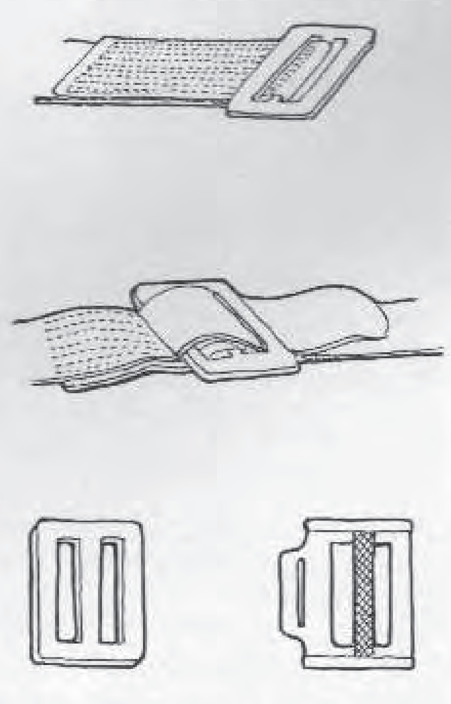

FIGURE 1
Seat Harness Ladder Buckle Attachment

Finally, success with this system encourages the beginner to learn and go on to more sophisticated systems. Though it has the reputation as the hardest and most difficult method for climbing ropes, in truth, it isn't that hard at all. I have had no trouble getting children as young as seven and adults as old as fifty to climb 80 foot cliffs with knots. Most important of all, the system provides the beginner with a more thorough understanding of the principles behind all climbing systems. This knowledge and the confidence it inspires, make for a more well-rounded vertical caver, better able to deal with future emergencies as they come up.

Since the system is so compact and light, one can carry it almost all the time. The whole system, including figure 8, carabiner, screw link, diaper harness and cords, will fit in a stuff sack the size of a quart sized ziplock bag. In caves where one doesn't know what obstacles are ahead, or caves that have many very short drops, a compact lightweight system like this is ideal.

What you need to get started

* 15 feet of 2 inch flat webbing
* 1 stainless steel ladder buckle
* 1 aluminum D-shape screw link
* 1 aluminum locking D carabiner
* 1 Figure 8
* 40 feet of 7 mm 'prusik' cord, sold in rock climbing stores. (It is important that this cord be flexible and pliant. Many rock-climbing stores now sell a more expensive, very strong cord that is very stiff. This is NOT what you want.)

Making the harness

If you own a standard mechanical vertical climbing rig, you almost certainly will also own a commercial seat harness, which can then be used in conjunction with your knots system.

However, one of the principle advantages of a knots system, is that it is very small and light and can be carried almost anywhere without effort. For this reason, one should build a diaper seat and include this with your knots system. It is simple, light, and totally

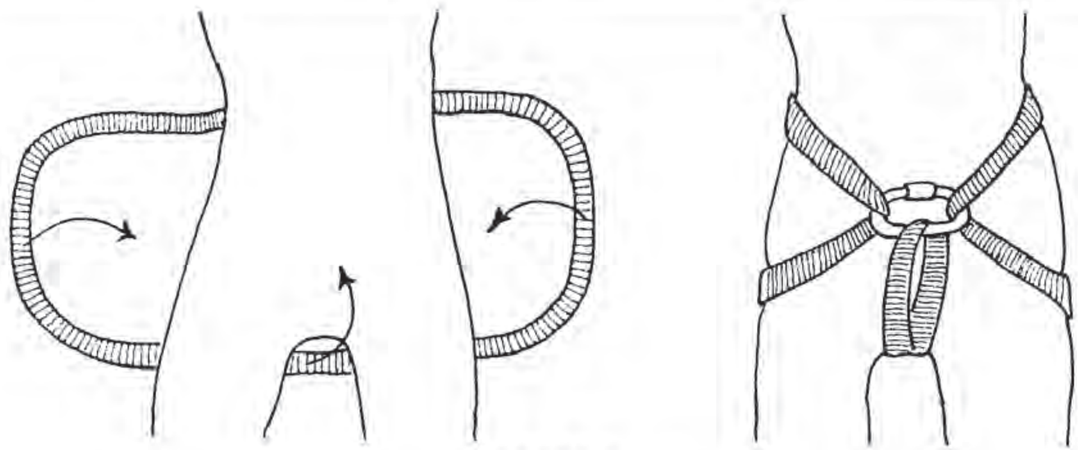

FIGURE 2
Diaper Seat Construction

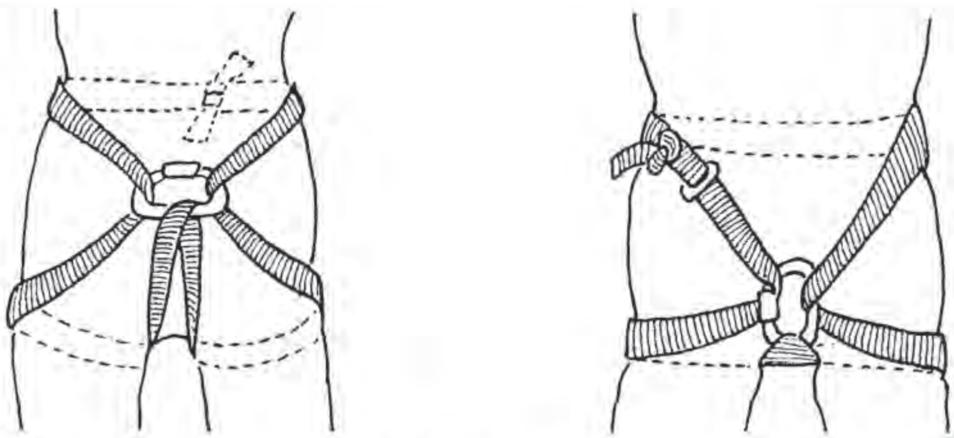

FIGURE 4
Diaper Seat Variations

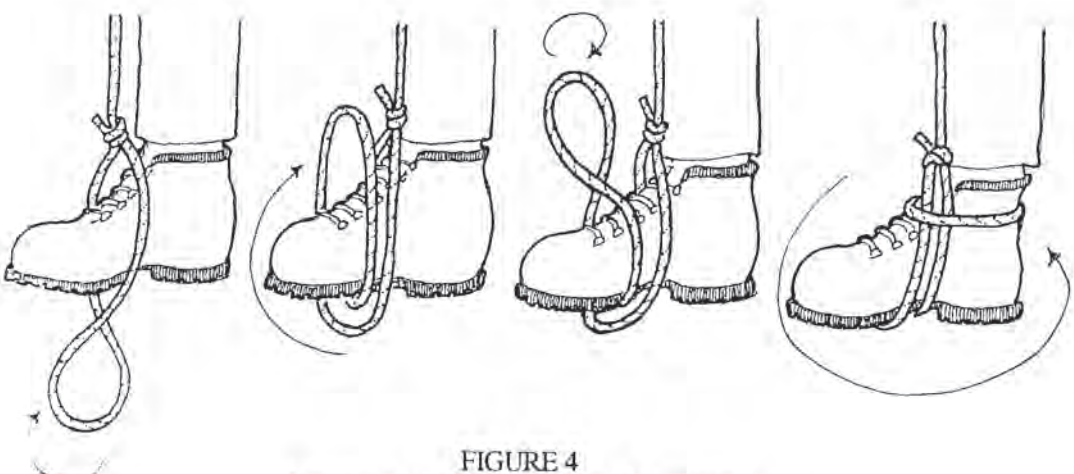

FIGURE 4
Foot Loop and Chicken Loop Construction

adequate for any vertical drop of less than 100 feet. For longer drops it can surely serve as an emergency harness.

Take the 15 feet of 2 inch webbing and sew the ladder buckle to one end, leaving at least three inches of overlap for the sewn area, as shown in Figure 1.

The harness is then worn as shown in Figure 2. Use the D shaped screw link to hold it together. DO NOT USE A CARABINER, since they can open on their own, causing a total failure of the harness.

Figure 3 shows the two versions of the diaper seat. The first option uses a water knot (Figure 8) to make the loop, the second uses the buckle.

Making the system

Wearing your caving boots, take the 40 feet of prusik cord and (without cutting it) use one end to make a proper size foot loop around one foot, as shown in Figure 4. This loop replaces a chicken loop. With the knot above the foot, the loop is dropped below the boot, twisted underneath, brought over the top, twisted again, and brought in front of the toe, under the boot and behind the ankle.

Adjust the size of this loop so that the knot is no more than 3 inches above the top of your foot. Use either a figure eight knot (Figure 7) or a double fisherman's knot (Figure 9) to make the loop. Leave about 2.5 inches of extra cord above the knot.

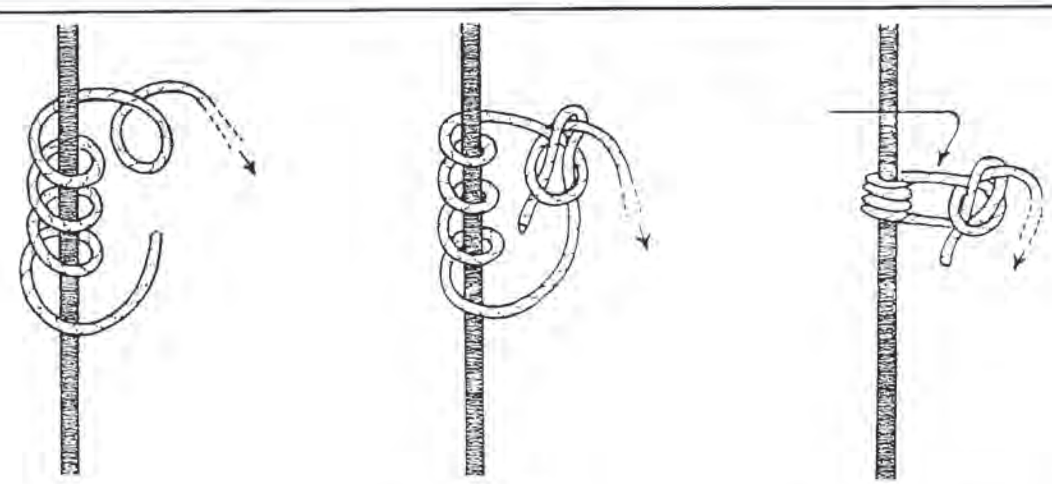

FIGURE 5
Helical Knot

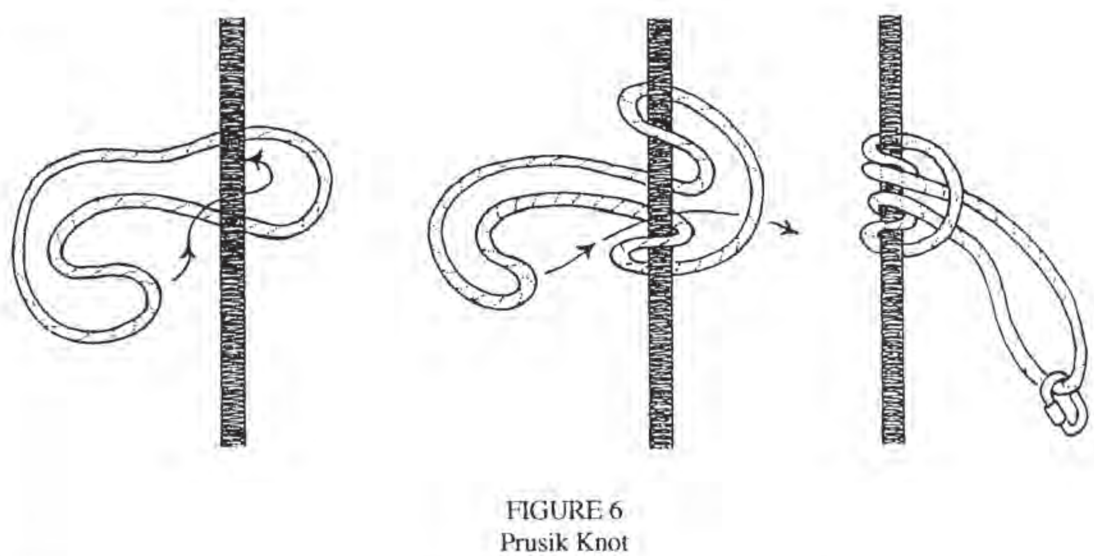

FIGURE 6
Prusik Knot

After the first leg loop is adjusted properly on you foot, lift the cord to your knee. Allow the remainder of the rope to drop back to the ground. Add three inches and cut it at this point. Burn both cord ends, and use the new end to make the second leg loop. Once this is adjusted properly on your foot, lift the cord to your crotch and allow the rope to drop. Cut it here and burn both ends.

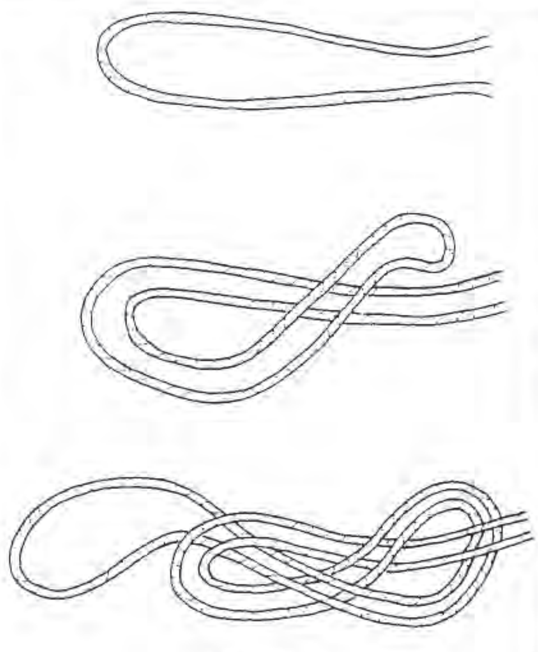

FIGURE 7
Figure 8 on a Bight

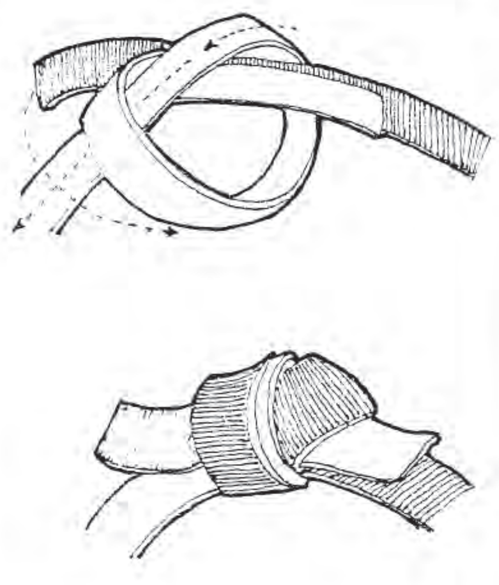

FIGURE 8
Water Knot

Take the new end and tie a very small figure 8 on a bight. See Figure 8. The loop does not have to be very big, since it only has to fit onto the screw link. The harness will NOT be tight enough if you only pull it tight while standing. If you do a keep knee bend, you can then take out the excess slack and make sure the harness in on tight enough. Feed the webbing back through the buckle and tie a safety knot as well. The buckle should be on your hip or behind.

Put the figure eight knot onto the screw link. Lift the cord to your chin, allow the excess to drop down to the screw link and cut it here.

The remaining cord is used to make a prusik loop, using a double fisherman's knot. The length should be adjusted so that when attached to your diaper seat harness with the locking D carabiner, it will attach to the rope above the top of the helical knot. See Figures 6 and 10.

Using the system

Beginning with the bottom rope, tie this to the main rope using a helical knot (Figure 5). For most people, this helical knot should be tied just above the knee. The other foot rope should be tied to the main rope just below the crotch and the upper rope is tied to the main rope no higher than your neck.

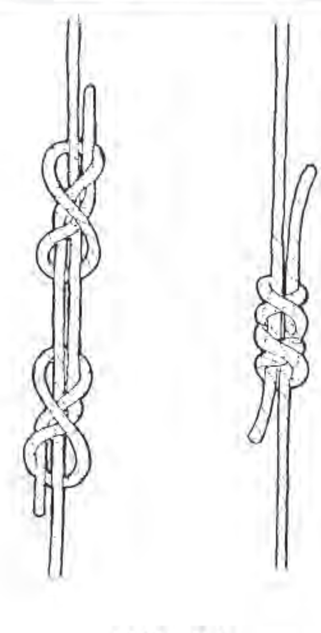

FIGURE 9
Double Fisherman's Knot

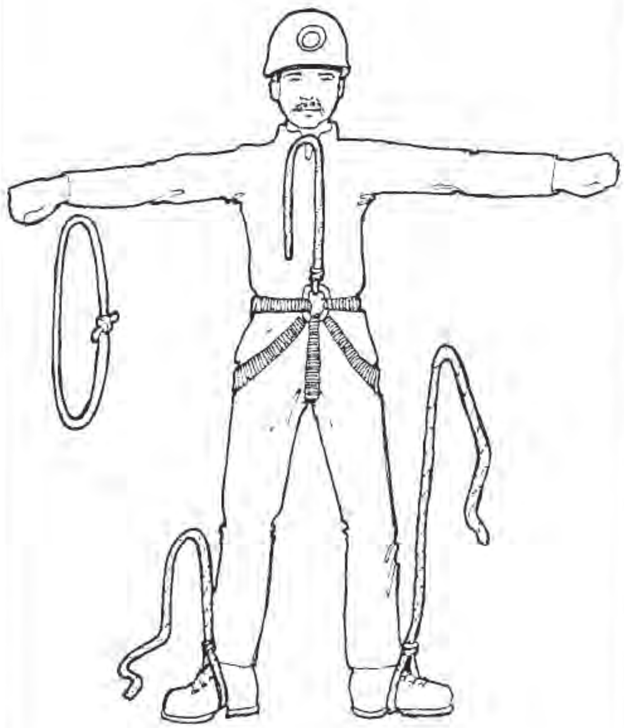

FIGURE 10
Assembled Knots System

When you climb, the trick is to stay seated in your harness as much as possible. In the seated position, you lift your legs to put slack in the cords and slide the foot knots upward. Then, in one motion, stand and slide the top knot up. When you have slid it upward, you immediately sit down again.

In order not to waste energy, it is essential that you practice standing and sliding the top knot simultaneously and sitting as soon as the knot has been raised to its maximum. Energy is used mostly in trying to keep your body upright and vertical. If you can get this technique down, you will be able to climb almost any distance without exhausting yourself.

In addition, you will be able to climb more comfortably if you practice keeping your legs tuck under your butt and your head forward (Figure 11). This keeps you more vertical and prevents you from flipping backwards.

Some people have a naturally higher center of gravity and cannot keep themselves upright with this system. For those individuals, add a simple chest harness (Figure 12), using 8 feet of 1" tubular webbing, a ladder buckle and a carabiner, made exactly like the diaper harness. The upper ascender is threaded through the carabiner, which keeps the climber close to the rope and upright.

After every climb, inspect the prusik cord for wear, especially the upper knot. This rope will wear out the quickest. It should be replaced when it begins to fray, usually after a dozen trips or so.

Keep the prusik loop easily available in a chest or hip pocket, or in a shoulder pack at your side. Should your main climbing ropes have a rebelay point, or should the lip be especially difficult, you can use this to pass such obstacles. You tie it to the main rope, above both the obstacle and top helical knot, then clip an attached carabiner to the screw link on your seat. You can now detach the other top helical knot and retie it above the obstacle.

In addition, the prusik loop provides you with a backup for your chest knot should it fail

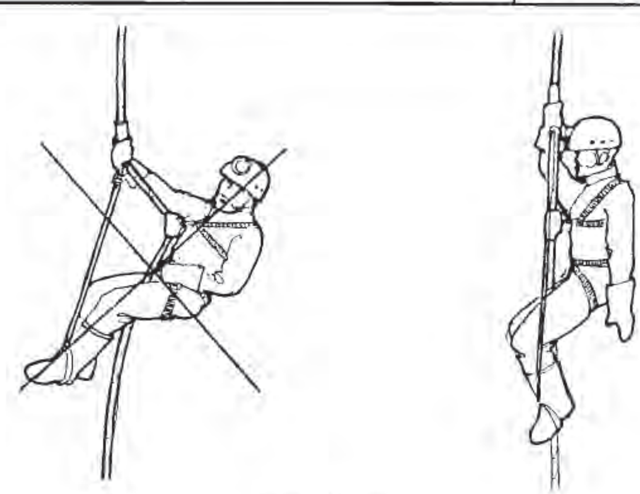

FIGURE 11
Proper Climbing Position

Though the system is very slow, with practice, it actually is no harder than any mechanical system that I have ever used. Its only drawback is its lack of speed.

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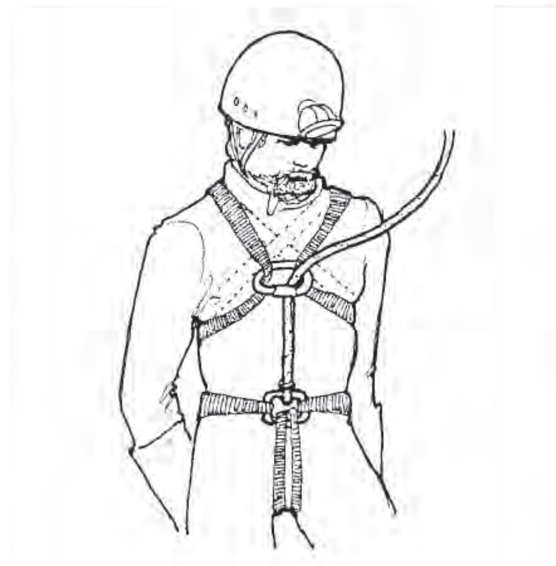

FIGURE 12
Chest Harness Attachment

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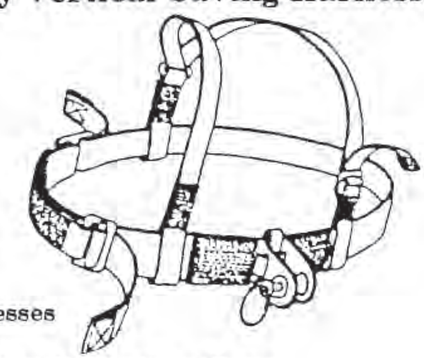

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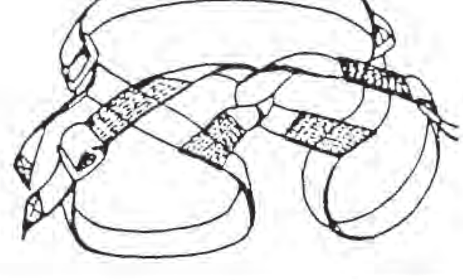

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Pre-Rigged Systems...An Opinion

by David A. Stewart, Sr.

Baltimore County Fire Department, Advanced Tactical Rescue Team

Many organized rescue teams often have time saving procedures that evolve as that team becomes more proficient with its equipment, systems and their intended use. One technique that often surfaces is the 'pre-rigging' of certain systems that have the potential for frequent use. The idea behind this is to save time and confusion "in the heat of battle" of a technical rescue. But does this shortcut really serve its intended purpose? In this article, I will examine the benefits and drawbacks of this common procedure and pose some alternatives.

Before proceeding, let my qualify my opinions by saying that they will not, of course, be the answer for all rescue teams. My team functions in the urban, suburban and industrial environment. We have the distinct advantage of having our equipment in a vehicle that can be positioned very near the rescue scene in most cases. We also have the great advantage of having the needed quantity of hardware and software to implement these suggestions. Hopefully, however, something positive can be gained by many of the readers.

For standardization, my team has decided to use a 4:1 piggyback (4:1 Pig Rig) mechanical advantage system (ref. On Rope, pg. 266) for hauling, hoisting and tensioning where ever possible and practical. This makes an ideal candidate for a pre-rigged system stored alone in a stuff sack.

When trying to visualize this system, most will picture a schematic like diagram, similar to the one referenced in On Rope. When this pre-rigged system is dumped out of its bag, however, I feel safe in saying that it will look very little like anything you have pictured. Valuable time must now be spent untangling and untwisting this system before it can be used. You must also carefully inspect every component and the total system for proper assembly, all this taking more time. The problems that arise in this relatively simple system are compounded greatly as the system in question grows more complex.

Alternatives? One is to simply keep all of the discrete components separate until assembly. That is, carabiners in one bag, Gibbs or Jumars in another and rope by itself, etc. While this eliminates the problems of pre-rigging, it offers no advantages. However, if you do not have the luxury of sufficient equipment to dedicate to a system exclusively, this may be your only choice.

Now that we have explored the extremes of the spectrum, fully pre-rigged to fully disassembled, let us examine a better alternative.

I would offer as an alternative to pre-rigging...'Pre-Packing'. Pre-packing is simply the gathering of all the component parts of a system and packing them together in a bag or case. There are advantages of this pre-packed system, such as having all of the needed parts in one location for rapid deployment, time savings over gathering and packing the discrete components, and rope and software can be much more neatly stuffed into and deployed from the bag. In addition, each component can be inspected as it is integrated into the system.

Of course, there are some trade-offs for this method. First, as earlier mentioned, you must have ample equipment to dedicate to one specific use. Second, one might respond that a pre-rigged system may help in the event of temporary loss of higher brain functions (i.e. you forgot how to do it!). My response to that is, that if your rescue is sufficiently technical to require an assembled system, your rescuers should be sufficiently technical to assemble and operate that system.

While pre-rigging your frequently used systems does offer some advantages, they are often outweighed by the deficiencies outlined above. A pre-packed system, however, can streamline rescue scene operations by allowing more efficient use of time and equipment.

For comments and suggestions, please contact me at: Baltimore County Fire Department, Advanced Tactical Rescue Team, 700 East Joppa Road, Towson, Maryland 21204.

Some Quick Comments on the "Caver on a Stick" Climbing Method, or...

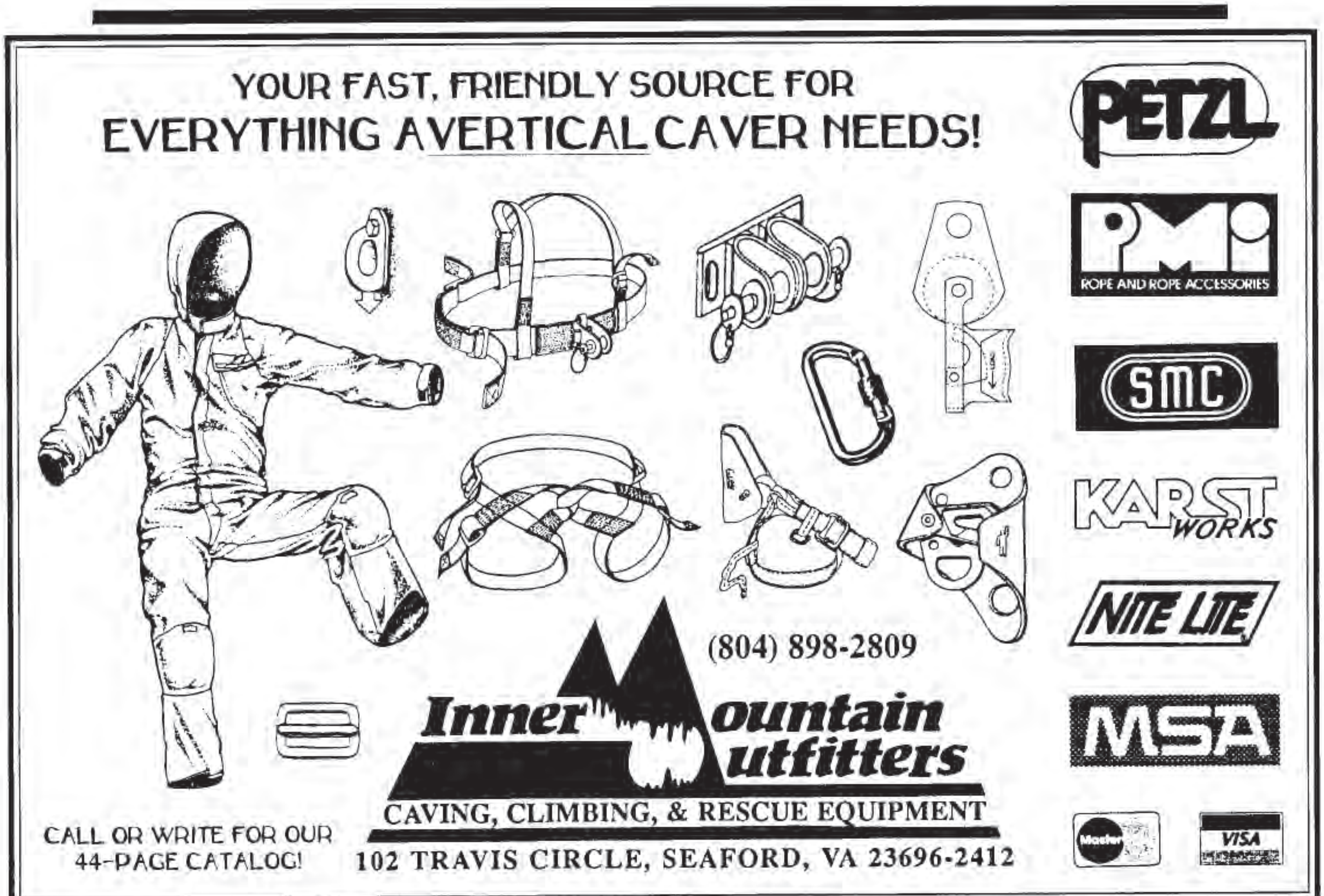
Why stop at SRT when you can go NRT?

by John Halleck

We have a cave here ("Little Brush Creek Cave"), that has a room with a high lead. Coming out of this lead is a flowstone fan from the lead to the floor (about 30 feet or so). This makes a hump in the wall that you could walk up, if it were not covered in mud and therefore, slick. So, we have an easy climb, smooth as flowstone, covered in mud. Efforts to climb it failed because people had 'almost' enough traction to get up, but not enough. There did not seem to be any way to remove the mud, nor did cleaning the mud off a spot make it much less slick.

It was clear that if we had any more traction, or the cavers had less weight, it would be a climb worth doing. The final solution was that one of the cavers carried a 2x4 of reasonable length into the room, and while another caver tried the climb, the first caver 'assisted' the climber by sticking the board into a convenient crevasse on the caver and giving him that added boot needed to climb the fan. If you think of what this looks like, I think you can see why the "caver on a stick" climb has stuck in the memories of the people involved.

This is not really recommended as a climbing method in general, but in those few cases where it could work, it has proven interesting.

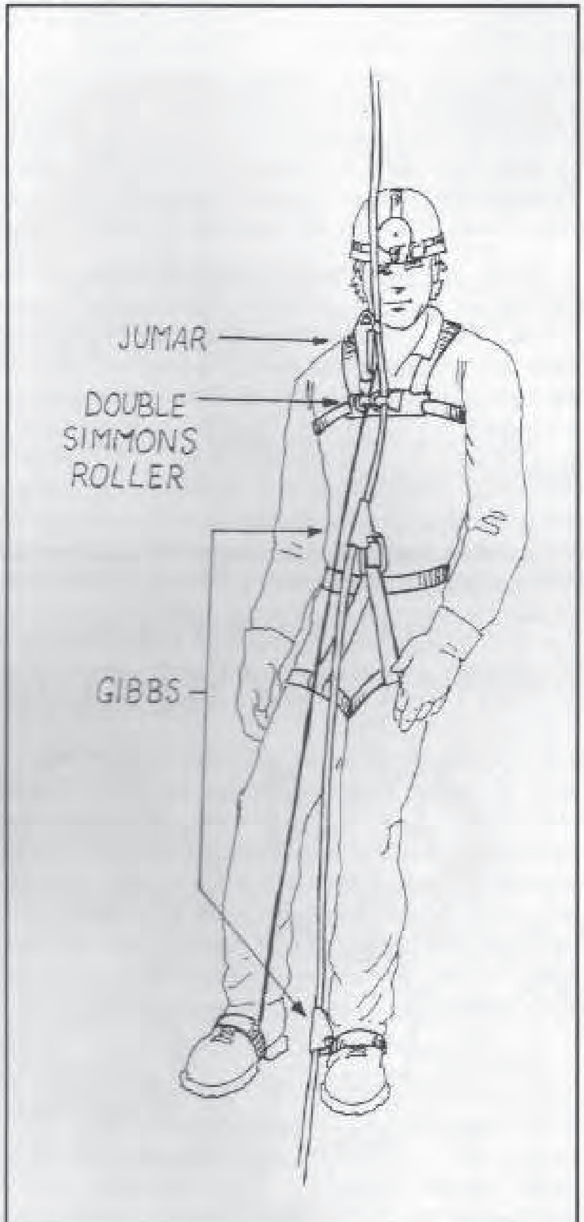


A Vertical Rig

by James Jasek

Like it or not, vertical caving is one aspect of cave exploring that is difficult to avoid. Even if you consider yourself a horizontal caver, there is always a short but unclimbable drop that can easily stand in your way of totally exploring a cave. I have never considered myself a hard core vertical caver, but since a large number of the caves I explore require some vertical work, I have come to terms with vertical caving on a limited basis. I get a great deal of enjoyment out of exploring any cave, and the ones that seem to be the most memorable, are the ones with a combination of horizontal and vertical.

I feel the biggest stumbling block to vertical caving, outside of just plain fear, is not having a good vertical rig that you can feel comfortable with during a climb. There seems to be just about as many climbing techniques as there are cavers, due to the fact that any climbing rig is highly personal to the individual using the equipment. So, how does one go about determining a good, personalized climbing technique? To begin with, the NSS provides some good books and publications on the subject. The books should only be used as an introduction to the methods and not as instruction guides by themselves. A local grotto is the very best place to learn and experience the different methods used to climb. They normally organize vertical training courses where people new to vertical caving can experience a number of different climbing methods along with the safest practices. Over many years of experimenting with different climbing methods, I came up with the following modification of the well proven Mitchell climbing system, that is simple and easy to use, and I thought it might be of interest to other cavers looking for new ideas. I refined this method by climbing rope in my back yard using a tall tree and a pulley system, along with practical application underground. I was able to safely try one technique after another until I found the one that was comfortable, easy to attach to the rope, easy to climb, good for short drops and required a minimum of expensive climbing gear.



As you can see from the illustration, the climbing rig uses a double Simmons roller, two free running Gibbs and a Jumar. I attach a Gibbs, that I modified so the quick release pin can be inserted on the opposite side of the Gibbs, to the left foot. Since the Gibbs is used on the left foot, the pin sticks out causing the Jumar sling on the right foot to hang up. With the pin on the other side, I was able to eliminate this problem. The Gibbs on the left foot allows me to step as far or as little as necessary during a climb. It is especially useful when going over a lip. When I reach the lip, and the Jumar is level with or below the lip, I am able to use the left leg to step high enough to get me totally over the lip.

The Jumar is attached to the right foot with the sling running up through one side of a double Simmons Roller. The Jumar makes it easy to clip off and back on to the rope, which aids in going over a difficult ledge, giving you added help when it is needed the most. The double Simmons roller is the key to smooth operation of the climbing method. The two rollers allow the rope and the Jumar sling to travel effortlessly as you climb. As in any climbing method, smoothness of operation is a very important factor. It is also very important that the chest harness be as tight as possible to hold you close to the rope. Being close to the rope will enable you to stand up straight as you climb. You will find that being close to the rope and standing straight will allow you to climb with little or no friction. Hanging back away from the rope will increase the climbing friction and bring on exhaustion.

On short climbs, I use only the Gibbs and Jumar in combination with the chest rollers. The Gibbs and Jumar give me two points on the rope and the chest rollers give me additional security to provide me with a safe climbing rig. It is possible to rest by sitting on a bent leg, but this is only good for a short period. On a short climb it should not be necessary to rest.

On a longer climb, I attach a free running Gibbs to the seat harness as a safety and for resting. When I am in the standing position, I can lock the Gibbs to the rope by pulling down on the Gibbs. I can then sit and rest comfortably as long as necessary. The Gibbs will automatically release when I stand up to resume climbing. The seat Gibbs can also be used for climbing should any other part of the system fail.

The main disadvantage to this climbing method is the use of the arms in climbing, but since only one arm is used at a time, it is possible to switch arms often to keep from total fatigue in both arms. I have used this method to climb 300 feet with no difficulties and have been using it for the past two years, again with no problems.

(Editor's note: As with all climbing systems, familiarity with the equipment and techniques is of utmost importance. The 'lightweight' version of the rig as described by James (without the seat safety), could result in the climber being in a double heel hang if the chest harness should completely fail. A single roller failure could result in a very uncomfortable position, however, it appears the climber would still basically be upright enough for an easy recovery. Attaching a safety cord from the upper Jumar to the seat would add redundancy to the lightweight version of the rig.)

Dear Editor,

This letter is in reference to the use of a spelean shunt as mentioned in *Nylon Highway 33*.

I would have to question the validity of Allen Padgett's comparison of the shunt to an eye protection device where the user is required not to blink to activate the device.

He is correct in stating that the automatic nervous system response is to blink and thus defeat the device. Rappelling is another matter all together. Rappelling is a learned skill, not an automatic response to an outside stimulus. The rappeller can be trained to respond correctly.

This is much like military service, where the soldier is trained to return fire when fired upon. The first response is to duck and run, but with training he is able to return fire, thus neutralizing the threat.

The spelean shunt would be useful in situations where the rappeller loses consciousness, threads the rack wrong or, as in the case mentioned in the February 1992 *NSS News*, Ray's Review, when a caver "froze up" on rappel, resulting in a free rappel.

I have used the spelean shunt on several long drops with no problems. I did have a fall once with a shunt on the line, near the lip of a pit and it worked just fine. I did not grab the rope or shunt. I had practiced with it before and had full confidence in the device. (I did scare the hell out of the people waiting at the lip.)

The only drawback to the shunt is when it locks off accidently, leaving you stuck on the rope. It is a hassle to free yourself, but less of a hassle than a body recovery.

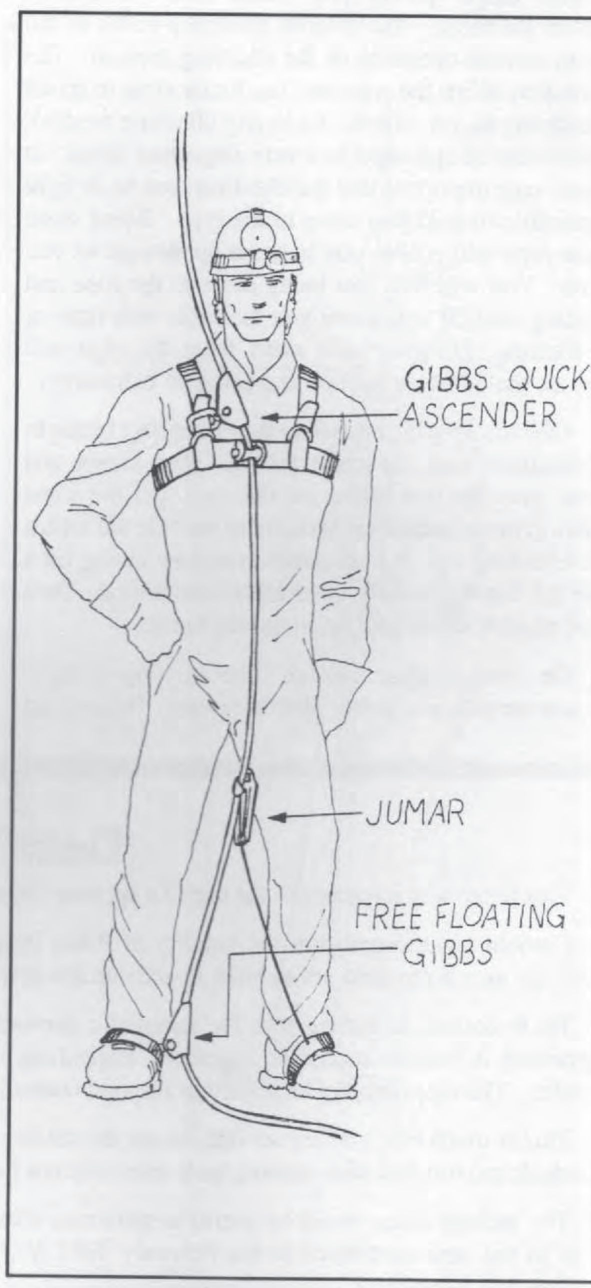
Michael Compton, NSS 33221

MARB's Vertical System
by M.A. Roman Barvinchack

What vertical system is the best? The system that works best for the climber. The system that I preferred for more than ten years was the Gibbs system that had evolved from the basic three Gibbs system to a full double bungie system with a chest roller. However, I observed there was merit to the Mitchell system. The age of 46 finds me 6 feet tall, with some stiff joints and weighing 230 pounds. My system must be easy to operate, strong and simple.

MARB's system incorporates a chest roller, two Gibbs and a Jumar. Beginning at the top, the shoulder cam is a spring loaded Gibbs secured to the chest harness and rides above the chest roller. The chest box pushes the Gibbs up the rope as the climber ascends. A spring loaded Gibbs grabs instantly when the climber sits down to rest while, a free floating Gibbs will not always grab the rope. The chest box and upper Gibbs gives the climber a redundant system to guard against getting into a heel hang. (ed.-The figure, sent me by Roman and redrawn by Jesse Pyron, does not show a redundant system. Given, if either the roller or Gibbs fails, the climber would not be in a heel hang. However, if the chest harness would fail, that is another story. To complete this rig, I would recommend a seat harness (who goes vertical caving without one?) and a safety cord from the knee Jumar to the seat.) When going over nasty ledges, the climber can alternately remove and re-attach the top Gibbs and chest box from the rope to pass the obstacle. This has proven easier than trying to move a Gibbs and/or chest box up a rope pinned tight against a rock by pushing out with both hands, especially when the feet have nothing to push against to help. (ed.-Another reason for the safety from the knee! Once either the Gibbs or roller is removed, any redundancy is also removed!) Extra carabiners or webbing can be used to reach around an obstacle to attach the Gibbs before removing the chest roller. After passing the obstacle, re-attach the chest roller and remove the extra carabiners or webbing from the Gibbs. The new Gibbs Quick Ascender is ideal for this position, since it is hinged and easily attached to the rope.

Replace the knee Gibbs with a Jumar. The Jumar eliminates the reason for the single or double bungie. It is very easy to put on the rope and helps pass over obstacles easily. The Jumar is below the chest box,



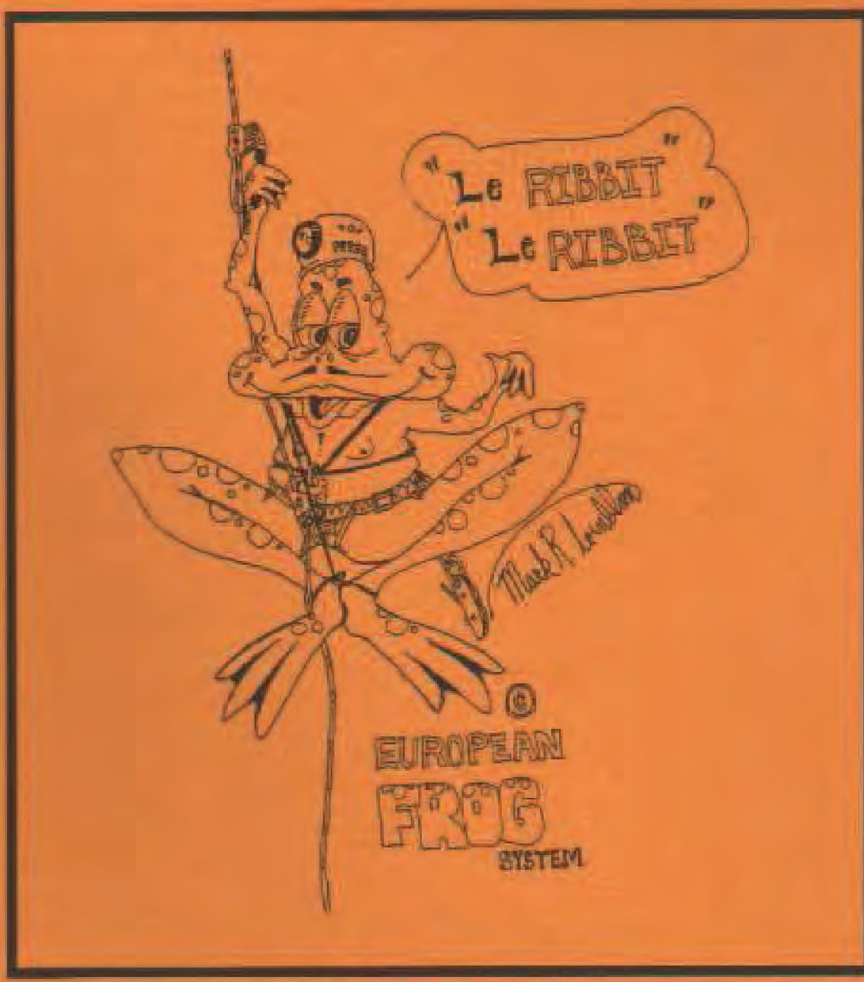
therefore, there is no need for a second roller. Since this foot is not directly attached to the rope, it allows more freedom for both feet.

The foot Gibbs has a worn cam (i.e. the teeth filed down so there is no drag on the rope). This free floating Gibbs allows the climber to easily self start or quickly go down the rope. However, the climber must kick out for the Gibbs to grab hold. Since the climber can stand on the Jumar foot, he can then use the Gibbs foot to reposition the rope or slide the Gibbs over an obstacle. Attach the Gibbs firmly to the foot with the eye of the cam directly on top of the foot and the shell beside the arch. Attaching the cam on top of the foot, allows the foot to remain flat and therefore, is very comfortable. The shell is removable. For a series of short drops, remove the shell and store between drops. The climber does not have to remove the cam and can easily move around. (ed.-This is not necessarily recommended since the shell can be dropped on those below, which becomes more dangerous as the pits get deeper.)

The advantages of this system for the climber are:

* Four points of contact on the rope with a redundant system to guard against getting heel hung.
* By alternating the removal of the chest box and top Gibbs, the climber sill maintains three points of contact when passing very difficult points.
* One foot is free of the rope and allows the other foot to reposition the rope or easily pass obstacles.
* Using the new Gibbs Quick Ascender a the top and bottom, the climber can quickly get on and off rope.
* One hand remains free.
* The variety of ascenders gives the climbers additional options for solving problems when a full climbing system is not needed.

(Editor-Roman's first two advantages do not necessarily hold true. (See earlier comments) Standard practice does not count the chest harness as a point of contact, since it alone will not prevent a fall. The system has some interesting qualities, however a seat harness should ALWAYS be used. A resting system that requires one to hang on the chest, instead of the seat, could result in stress on the chest and possibly suffocation in an exhaustion situation.)



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