

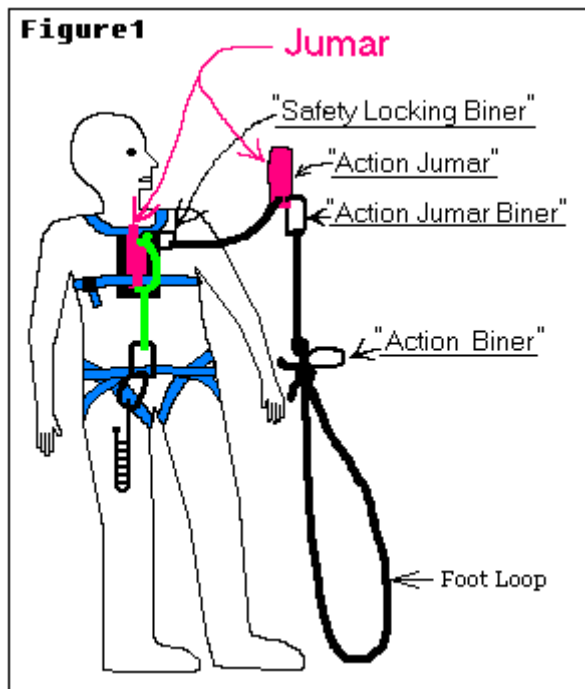
ONE MAN'S VERTICAL SYSTEM (Revision #17)

My name is Bob Johnson, NSS # 35023. I have been the Willamette Valley Grotto's vertical chairman for several years. I have been setting up vertical caving rope practices with an obstacle course. I try to simulate real cave conditions the best I can in the practice area. I like doing vertical rope work so I wanted to be able to do all of the obstacle courses easily. This forced me to modify my system many times to make it the easiest for all possible situations. I also wanted it simple and not too expensive. When fellow cavers would let me explain my system and tried it, they all wanted me to write to the NSS to share the features of my system. So here goes!

FIRST THINGS FIRST

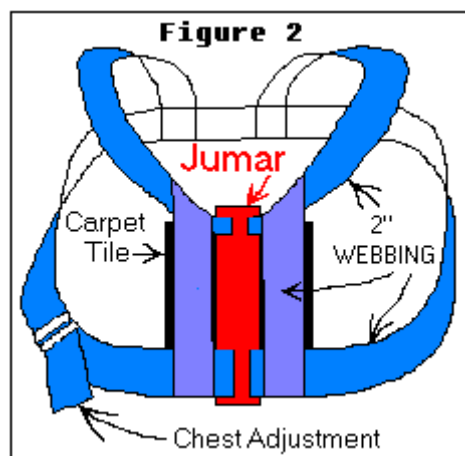
The first thing that I would like to do is to quote an article from the book "On Rope," Copyright 1987 National Speleological Society, entitled "Climbing Systems" on page 173, reprinted with permission from the NSS:

"The ideal climbing system should enable the climber to move comfortably and efficiently up the rope. It should provide a secure attachment to the rope, yet be easily removed as well as attached. It should fit the climber properly, be easily taken on and off with ease. It should be lightweight and not bulky. A good system is versatile, able to accomplish a variety of tasks such as being transformed into a rescue haul system. It should be redundant so that any failure will not place the climber in immediate danger. After a component failure, it should have the versatility to be transformed into a system enabling the climber to continue up or down safely. A system should be durable and incorporate interchangeable replacement parts. A good system climbs a wall as well as a free drop and allows a climber to ascend over difficult lips. Systems that fit climbers of different sizes are useful during rescues and training seminars. A great system incorporates the ability to downclimb."



DESCRIPTION / CONSTRUCTION (See Figure 1.)

The first important thing is a good seat harness. My seat harness is a modified Gibbs style. It has a back support and a seat support on it. (Not shown in the drawing.) The second important thing is a chest harness. (See CHEST HARNESS.) They must be connected together since rescue work requires that the seat harness be connected to the chest harness. (See CHEST TO SEAT CONNECTION.) I use two-inch webbing for all of my harnesses. Notice in Figure 1 that my chest rope attachment is higher up than the regular frog systems. Being more upright helps you climb the rope and allows your rest periods to be more relaxing.



CHEST HARNESS

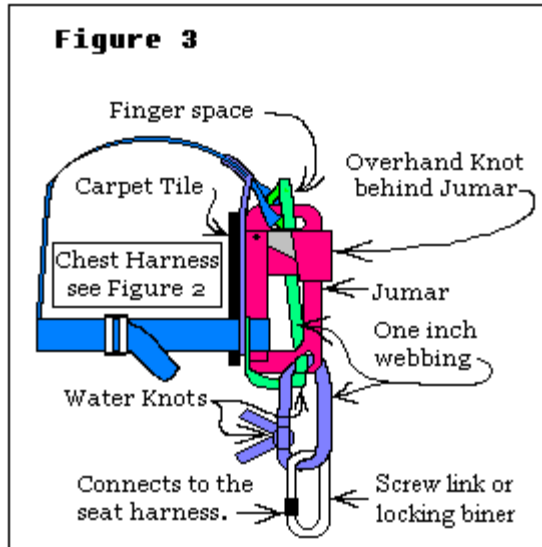
The chest harness is hand made using a Sewing Awl. (See Figure 2.) It has a webbing strap around the chest just under the tender area of the armpits and two shoulder webbing straps connected in back. The webbing around the chest includes an adjustable connection device making it comfortable for both male and female users. The chest webbing and shoulder webbing are sewed to a piece of carpet tile (for padding) and through a Jumar ascender. I used a Jumar ascender because that is what I had. Other ascenders will also work if you can keep them in the proper position. **Use a left-handed Jumar here for a right-handed person.** The webbing should be sewn tightly and attached securely to the Jumar so that the Jumar is held upright and as high as possible on the chest. The chest strap goes through the Jumar's handle and is sewn tightly to the Jumar. The shoulder straps go through the top hole of the Jumar. I added two short webbing straps, one on each side of the Jumar. These straps are sewn to the shoulder straps and to the carpet tile and to the chest strap. These short webbing straps help to prevent the shoulder and chest straps from pulling out of the carpet tile and the straps hold down the shoulder straps if the Jumar is broken. The Jumar's opening for the rope is held away from the body. The Jumar is free to operate smoothly but it is sewn securely to the chest harness so it will not move on the chest. If all was done correctly and you were lying on your back, you could be picked up by the Jumar's handle like a suitcase. This Jumar, when connected to the seat harness properly and on rope, will allow you to rest in a seated position.

My chest harness was made for my chest, but I would suggest that you make this chest harness with adjustable shoulder straps as well as the chest adjustment. This will allow you to custom fit the harness to several sizes of people. These adjustments, when loosened, will make it easier to connect the chest harness to the seat harness. Once this connection is made, you can then tighten the straps. The chest harness connection to the seat harness needs to be too tight when standing and very comfortable when sitting, or on rope.

CHEST TO SEAT CONNECTION

Connecting the chest harness to the seat harness is done with the best one-inch webbing. I suggest a piece that is about four feet long. Find the halfway point. Put one side through the top Jumar hole and tie in the shoulder webbing loop that is in this hole already with an overhand knot. (See Figure 3.)

Overhand knot procedure: Put both lengths of webbing in your left hand, palm down. The attached Jumar would be to the left of your left hand. The two ends of webbing should now be considered one. With the right hand grab the two ends and put the webbing on top of the left hand to form an eye or loop. Now use your left hand's thumb to pinch the loop so you can hold this loop in your left hand. With your now free right hand grab the webbing ends and put them through the eye from the bottom side to the top. Pull tight to make the knot.



The end loop should be neat and about two inches long and connected through the top hole of the Jumar and connects in the shoulder harness webbing. Adjust if necessary. Place one loose end through the bottom hole of the "Chest Jumar" and tie a water knot. (The water knot is an overhand knot tied on one end of the webbing with the other end laced into the knot by following the webbing's end into and through the knot to the other side of the knot.) If all was done right, the webbing should be smooth and tight when one finger is placed in the top loop above the Jumar. The webbing should be near the rope-guide cam area of the Jumar but on the other side of the metal rope guide. The ends should be sewed to the carpet tile's two short webbing straps and onto the chest loop so that the top loop maintains the finger space. (See Figure 3.)

Take another piece of one-inch webbing three feet long and place one end through the bottom hole in the Jumar and through the loop you just made near the water knot. Be sure it's through the webbing loop and the bottom Jumar hole because it's your "safety connection". The ends should be tied with a water knot at a length that will allow you to connect the webbing to your seat harness with a stainless steel screw link or a locking biner. (See Figure 3 and Figure 1.) I like to secure the ends by sewing them down after the final adjustments are made. (This loop may not be needed if the screw link can be connected to the bottom of the Jumar and through the existing webbing in that Jumar's hole.) (The **CHEST TO SEAT CONNECTION** procedure could be done with one piece of webbing. It's the connection to the seat harness that needs to be done correctly so that the ascender doesn't ride up into your face when you are on rope.)

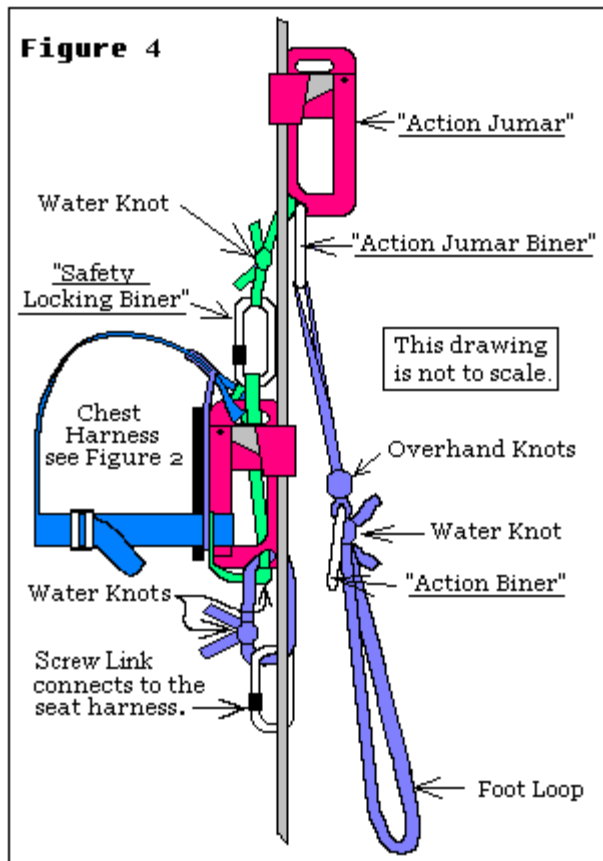
CHECK IT

If you assembled the chest harness and connected the seat harness connection properly you will stand hunched over. If you didn't, and you are standing straight up, then the chest harness will ride up and be in your face while you are on rope. Tighten the above paragraph's loop or make other adjustments to fix this problem. A properly adjusted harness allows you to be in a comfortable sitting position off rope, or on rope even if you are unconscious. When not on rope, I unscrew the

screw link connection and remove the "safety connection" loop. I clip in an additional biner between the "safety connection" loop and the screw link so I can stand up straight. Leave the two harnesses connected for safety! Be sure to remove the extra biner when you are about to go on rope and reconnect the screw link. If you made the chest harness with adjustable shoulder straps you can loosen those straps, instead of adding the extra biner, to allow you to straighten up when walking or standing.

COW'S-TAIL

A safety ascender or cow's-tail! Some climbing systems really need a safety ascender when making a changeover from rappel to climb, or climb to rappel, or when passing an obstacle, or anchor point. So I said to myself: "Why not incorporate it into the basic system. No chance of dropping it then." I use the "Inchworm" / "Frog" climbing system. This system uses a safety Jumar or "Action Jumar" (my name for clarity) and it has two things attached to the bottom hole in the Jumar. (See No. 1 and 2 below.) I used the best one-inch webbing for all of these.



1. This attachment is the safety attachment. Clip in a locking biner into the two-inch loop in the top hole of the chest Jumar. We will call this the "Safety Locking Biner." Be sure to clip it onto the webbing only that is in the top hole of the Jumar. This webbing is your safety connection if the chest harness Jumar is broken. It connects to the seat harness. (See Figure 4.) To make the next

webbing measurements easier put on your seat harness and your chest harness and connect them together. Clip your chest harness Jumar onto a suspended rope and sit in the harness. While hanging on the rope, clip on another Jumar (I call this the "Action Jumar".) above your "Chest Jumar." **Use a right-handed Jumar for a right-handed person.** Grasp the "Action Jumar" in the handle with your right hand and put your left hand on the top and sides, then slide it up the rope as far as it is comfortable. This is the travel length that you can use. (I get about 15-16 inches.) Be sure that the rope in the rope-guide cam is close to your head. This Jumar should be in a position so you can work the release easily with your right thumb. With a loop of webbing tie a water knot connecting the bottom hole of the "Action Jumar" and through the "Safety Locking Biner" that is clipped onto the loop at the top of the chest harness Jumar. Be sure that the "Safety Locking Biner" is held up tight with the same travel length after your water knot is tight. (See Figure 4.) I sewed the webbing together at a point close to the "Safety Locking Biner" so the biner doesn't get hung up sideways in the webbing. I also sewed the ends down once the final adjustment is done. The final adjustment is done after you have used the system for awhile.

2. Attach a non-locking biner into the bottom hole in the "Action Jumar" and include one side of the loop of webbing that is already in the hole for safety purposes. This biner will be called the "Action Jumar Biner." (See Figure 4.) While you are suspended on the rope and with the "Action Jumar" up as far as the attachment to your chest harness will allow, attach a piece of webbing about eleven or more feet long, depending on your height to the "Action Jumar Biner". To do this, find the halfway point and put one end through the "Action Jumar Biner." Pull the end down so it is about a foot and a half below your navel. The loose webbing should now be hanging in front of you. Grab the two lengths at about chest high and tie an overhand knot in the webbing with the knot at the midpoint of your "Chest Jumar." Now tie a water knot one inch below that with the two ends. The two ends loop should be big enough so you can place both feet and your knees in it comfortably; this is your leg resting position. Your knees should be held horizontal with the floor or slightly higher. Adjust this water knot so the legs are in that position. You may need to adjust this again after you see how it works, because it is your foot loop too. Spread apart the one-inch section between the two knots and put in a non-locking biner. This is the "Action Biner." (See Figure 4.) After you have used this system and you like the foot loop where it is, you then can sew the ends down.

RAPPELLING DEVICE AND EXTRA ITEMS

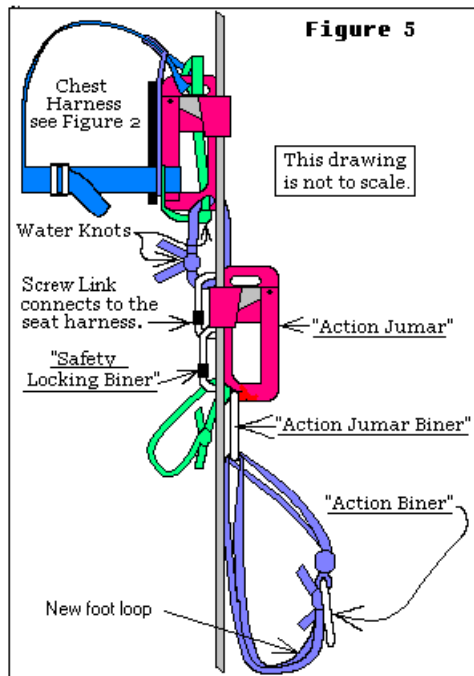
A standard Rack or SRT (Single Rope Technique) for rappelling is locked onto the seat harness screw link with a locking biner or just directly into the screw link. Notice here that a standard Rack is used with my design. This is possible because of the "Chest Jumar's" position on the chest and the use of the "Action Biner." This concludes the construction. Extra items for all the features, would be: a pulley, one locking and two non-locking biners, eighteen inch loop of small diameter climbing rope, and about nine feet of small diameter climbing rope for the 2 to 1 rescue procedure. For rescue and the Hauling System: one twenty foot piece of one-inch webbing, and a Prusik Minded Pulley "PMP". Note: Search and rescue requires a lot of locking biners, so you might want to just buy them.

NO CHICKEN LOOPS

Why such a big foot loop and no chicken loops? Chicken loops indicate to me that the system will let you go upside down if one component fails. No one should ever have that happen! If your system would do it, fix it with a safety connection! My system does not need the chicken loops because if one component failed it would not let the person hang upside down. You can use the big foot loop to climb with one foot or both. When climbing, and you want to rest, the big foot loop is used to put your feet and your knees in so you can rest your legs completely. Your legs now make a nice flat place to put things that you want to set down temporarily on. If the "Action Biner" is clipped to your descending device or above it on a long free drop rappel, the big foot loop can support your feet and help relieve the pressure on your legs caused from the harnesses leg loops.

HOW IT ALL WORKS

With both Jumars on the rope, sit suspended. You now can put one or both feet into the foot loop. **Raise your foot loop** leg(s) and at the same time slide the "Action Jumar" up as far as it will go with both hands. (I like to use both hands for exercise.) Stand in your foot loop and at the same time pull down on the "Action Jumar" and toward your "Chest Jumar." (Your "Chest Jumar" should allow the rope to feed through it, but sometimes it doesn't because the rope is very short below you. You can pull the rope down with one hand or trap the short end with your heels for starting.) Next, sit down in the harness and repeat the process. **Raise your foot loop..... Etc.** When I am against a wall, I use one foot for balance and one foot in the foot loop. The large foot loop enables me to switch feet easily. This sit-stand method of climbing can easily cause a bouncing rhythm when you climb. If you do this, the rope above you may be sawed in half by a protruding rock. To prevent the bouncing rhythm from occurring, make the end part of your movements with a smooth gradual stop. **The frog system needs to be adjusted just right to be efficient.**



A second climbing mode. Make this second climbing mode like Figure 5. To do this "on rope", first tie a loop on a bight, of the rope that you are climbing, below your Jumars. Clip your "Action Biner" onto the loop and to your seat harness screw link for a safety connection. Remove the "Safety Locking Biner" from the position shown in Figure 4 and clip it onto your seat harness screw link. (See Figure 5) Never unlock a locking biner unless you will still have two points on the rope connected to your harness like we do here. Move the "Action Jumar" below the "Chest Jumar" and clip it onto the rope. Unclip the "Action Biner" from the screw link and the loop. Untie the loop from the bight of rope. Take the bottom of the foot loop and clip it into one of the non-locking biners below the "Action Jumar." You now can use the sit-stand method with one finger pulling up the bottom Jumar, or put a bungee cord in it instead of your finger. You can climb up or down very easily. This position is ideal for climbing up over a difficult lip where the rope is on the ground at the top of the climb and you can't slip your top Jumar above the lip.

DOWNCLIMBING

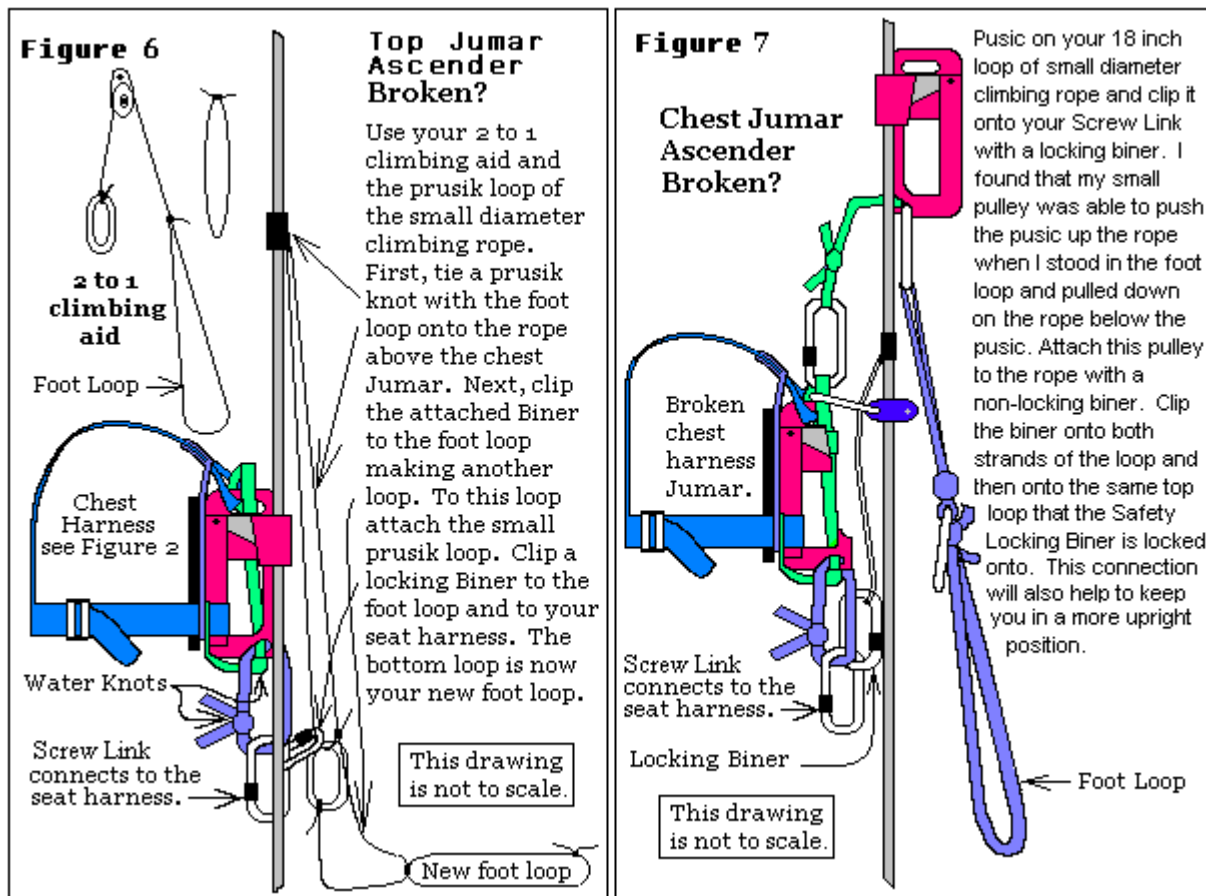
With both Jumars on the rope as seen in Figure 4, sit suspended. Lift your feet up and move the "Action Jumar" down close to the "Chest Jumar" and lock it. (Raising the Jumar slightly and at the same time releasing the cam with your thumb will release the rope, then you can slide down the "Action Jumar" and release it.) **Stand in the loop** and move the "Chest Jumar" down, (using the thumb release method), by squatting down almost as far as you can go and then lock it. Sit down and raise your feet and move the "Action Jumar" down close to the "Chest Jumar" and lock it. **Stand in the loop.....etc.**

RESTING

When you need to rest, the chest harness Jumar holds you in your last position. If you put the "Action Jumar's" foot loop at the right height you can rest in a seated position. In some other systems, when you stop climbing, you have to squat down to get a device to jam so you can rest your muscles. Then you have to waste energy by standing back up to continue climbing.

IF ONE FAILS

If one Jumar should be broken or damaged by a rock, you still have one left to climb with. This is done by looping the rope, below the Jumar, around one raised foot. Bring up the down side of the rope and put it next to the rope above your foot. Grasp the two ropes in one hand to make a crude ascender. The sit-stand method still works up or down, it just takes longer and more energy. You have to keep making another crude ascender each time you use it. You can also use your rescue 2 to 1 climbing aid and your eighteen-inch loop of small diameter climbing rope, from your extra items, to replace the broken Jumar. (See Figures 6 & 7.)



THE CHANGEOVER

The rappel changeover to ascend. I put on my climbing system when I rappel. You never know when you may have to change directions of travel when on rope. (See Figure 4.) First you tie off your rappel device, then clip your "Action Jumar" onto the rope above the rappel device by at least 8 inches. Stand in the foot loop and clip on your chest jumar above the rappel device. Then remove your rappel device from the rope. Start climbing.

The climbing changeover to rappel. Just stop climbing when the "Chest Jumar" is very near the "Action Jumar." You now have access to the rope below your "Chest Jumar." Place your descending device on the rope as high as you can. Lock it off. To remove your "Chest Jumar", your weight should be on the foot loop so pressure is relieved from your "Chest Jumar." After removing the "Chest Jumar", sit down in the harness, raise both feet that are in the foot loop, and remove the top Jumar. You may have to lean forward to do this. Release the descending device's lock carefully and rappel down. If, inadvertently, you let the descending device slip down so far that you can't get your weight off of the top ascender, just clip the "Action Biner" onto the rope above the locked off descending device. Stand in the foot loop and move the top Jumar down enough to get your weight onto the descender. (Some people have to remove the foot loop from the "Action Jumar Biner" to make this work.) Remove the "Action Jumar" and the "Action Biner" and you are ready to rappel. (Be sure to put back the foot loop on the "Action Jumar Biner" if you removed it.)

The tyrolean traverse changeover from a vertical rope. You just climb up, or down, so you can get your seat harness as close to the tyrolean traverse as you can. You will need from your extra items, the pulley, the eighteen-inch loop of small diameter climbing rope, and a locking biner. Use your "Action Jumar Biner" to hold them temporarily. Without unlocking the seat harness screw link, put a bite of the eighteen-inch loop through the seat harness screw links center area. Then take the other end of the loop and put it through the bite loop, trapping the loop on the seat harness screw link. Then use the extra locking biner and clip it onto the loose end of the loop. This now becomes an extra cow's-tail. Put the pulley on the tyrolean traverse and clip that locking biner onto the pulley and lock it. You may have to put your legs over the tyrolean traverse and raise your stomach to clip the locking biner, or just stand in your foot loop to clip it on. Another way would be to use your "Action Biner" by clipping it onto the tyrolean traverse rope and putting your feet in the foot loop to raise your stomach. The "Action Biner" is also used as a second point on the rope. Once you have locked the locking biner onto the pulley, downclimb so that almost all of your weight is on the tyrolean traverse pulley. You may have to unconnect the second point "Action Biner" to do this. Then put the "Action Biner" back on after the downclimb. Unclip your "Chest Jumar." Place some of your weight in the foot loop and pull yourself up the rope so your "Action Jumar" is loose. Hold yourself in this position, release your foot pressure, with one hand and with the other hand remove the "Action Jumar." If your tyrolean traverse is at a high point, you can go for a ride by letting go, if that is safe to do. Watch out for your hair, or whatever, getting caught in the pulley. If a ride is not appropriate, then go hand over hand down the rope. To rest, you can clip on your "Action Jumar." The "Action Biner" is still attached to the tyrolean traverse rope for the second point on the rope.

For a really steep tyrolean traverse. In this situation you may want to clip on your "Chest Jumar" and your "Action Jumar" above the pulley and downclimb until it's not so steep. Be sure to attach both Jumars to the tyrolean traverse in such a way that you don't trap the vertical rope. Once you get to the bottom of the tyrolean traverse sag and you want to go up the other side, use your "Action Biner" as your safety. Take everything else off the rope except the pulley and the loop hooked to your seat harness. The eighteen-inch loop that was put on the seat harness will allow you to turn around without binding the pulley. If you need to rest at this time, you can use the "Chest Jumar" to lock onto the eighteen-inch loop strands to hold you in an upright position. Don't forget your foot loop for your feet. This will also help you to get closer to the tyrolean for easier traversing. To continue up the other side, reverse the above procedures. Many variations are available to you at this point, experiment and enjoy.

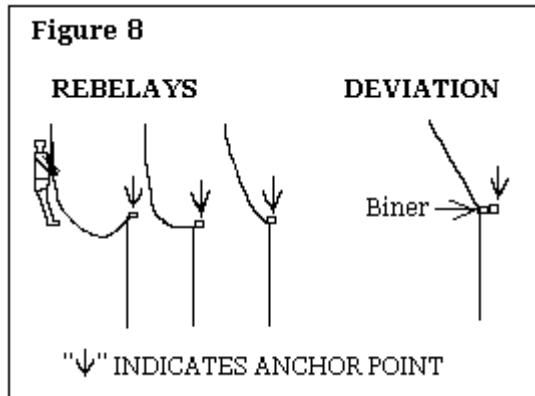
Upon reaching the other end's down rope, or up rope, just clip on your "Chest Jumar" and your "Action Jumar"; remove the "Action Biner" and climb up so you can take off the pulley attachment. You are now ready to climb up or down.

PASSING OBSTACLES

Climbing past a knot or anchor point. Move your two Jumars close together and close to the object. Tie a loop with a bight of the rope, that you are climbing, below the obstruction and clip your spare biner on it and to your seat harness screw link for a second point safety. Then move the Jumar that is closest to the object, past the object. Downclimb or climb up to put the remaining Jumar close to the object. Move the first Jumar some more and then pass the object with the last Jumar. Remove the spare biner and the bight loop from the rope.

To change ropes. Make a cows tail by capturing your seat harness screw link with your eighteen-inch loop of small diameter climbing rope and clip on a biner on the loose end of that. Clip that biner onto an anchor for a second point safety. You could have also made a loop on a bight of the climbing rope, which you are climbing, for a safety connection. Clip the "Action Jumar" onto the other rope, shift your weight and move your "Chest Jumar" to the other rope. Remove your second point safety connection and the loop if you made one.

To rappel past a knot. Execute a changeover to the downclimbing mode. Pass the knot, and then change back. Don't forget the second point for safety.



REBELAYS (See Figure 8.)

To rappel past a reanchor, a looped rebelay, a loose rebelay, or a tight rebelay, all you have to do is change over to climbing mode and downclimb past the knot, or the anchor, or whatever. Use your "Action Biner" or the cow's-tail, or both as a safety. Change back to a rappel and you are on your way.

DEVIATION (See Figure 8.)

To rappel past a loosely redirection biner rebelay (deviation) rappel an inch or two below the biner and lock off your descender. Take your "Action Biner", or your "Action Jumar Biner", and clip it to the rebelay anchor. Put your weight on the foot loop. Move the redirection biner from below your rappel device and attach it on the rope above your rappel device. Put your weight back onto your descender and unclip the "Action Biner", or your "Action Jumar Biner". Unlock your descender and finish the rappel.

When climbing up and past a rebelay, treat it like any other obstacle. Remember, you can use an "Action Biner", cow's-tail, or an "Action Jumar Biner" to help you shift your weight.

CLIMBING SLOPES

When ascending a slope, the foot loop is not needed. Secure your foot loop out of the way by using the "Action Biner" or your "Action Jumar Biner."

TANDEM CLIMBING

The "Action Biner" is useful when you are on the top of a "tandem" climb. The "Action Biner," when clipped to the rope, will redirect the rope away from your crotch. This makes you more comfortable, helps to keep you more upright, and makes your climb easier.

ROPEWALKER SYSTEM

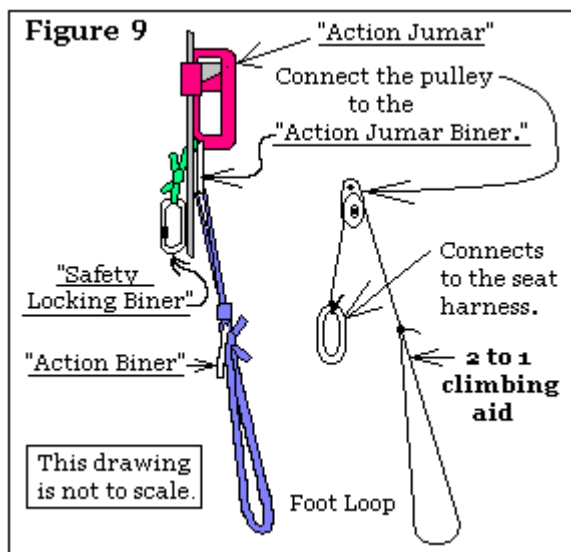
Some people just have to have a ropewalker system. On my system, for the very long climbs, I can add a foot ascender attached to the ankle/foot area. A bungee cord attached to the top of the ascender and to the harness makes this work very well.

RESCUE

If you need to rescue someone who is on the rope and you are below him or her, this system will let you climb past. You just treat them like any other obstruction, except that it is more awkward. As you pass the person, clip onto the upper part of the person's harness with your extra biners and webbing and then to your seat harness. Make the webbing length sufficient so you can climb above the person and you won't hit them with your feet when hauling them up. Your 18-inch loop clipped onto your seat harness and onto the persons harness can be used for a "Pick-off" rescue.

2 to 1 climbing aid

I found some people so heavy that I could only lift them about one or two inches at a time. This was unacceptable to me, so I found that a 2 to 1 climbing aid was helpful. This aid can also help you lift a heavy pack that is attached to your seat harness. (See Figure 9.) From your extra items, clip the pulley onto your "Action Jumar Biner" and make a new foot loop from the long line of small diameter climbing rope. Copy the one that's on your system, but leave off the extra knot and the "Action Biner." Take the free end of the rope and put it through the pulley. Tie the end to a non-locking biner and attach that biner to your seat harness screw link. With the "Action Biner" missing, you now can raise your legs higher in your new foot loop. By yourself, you can get about the same amount of climbing distance. With a victim, you still climb with the "Action Jumar" as before, but much easier. It helps to have the loaded rope in front of your foot loop and between your toes, maybe?

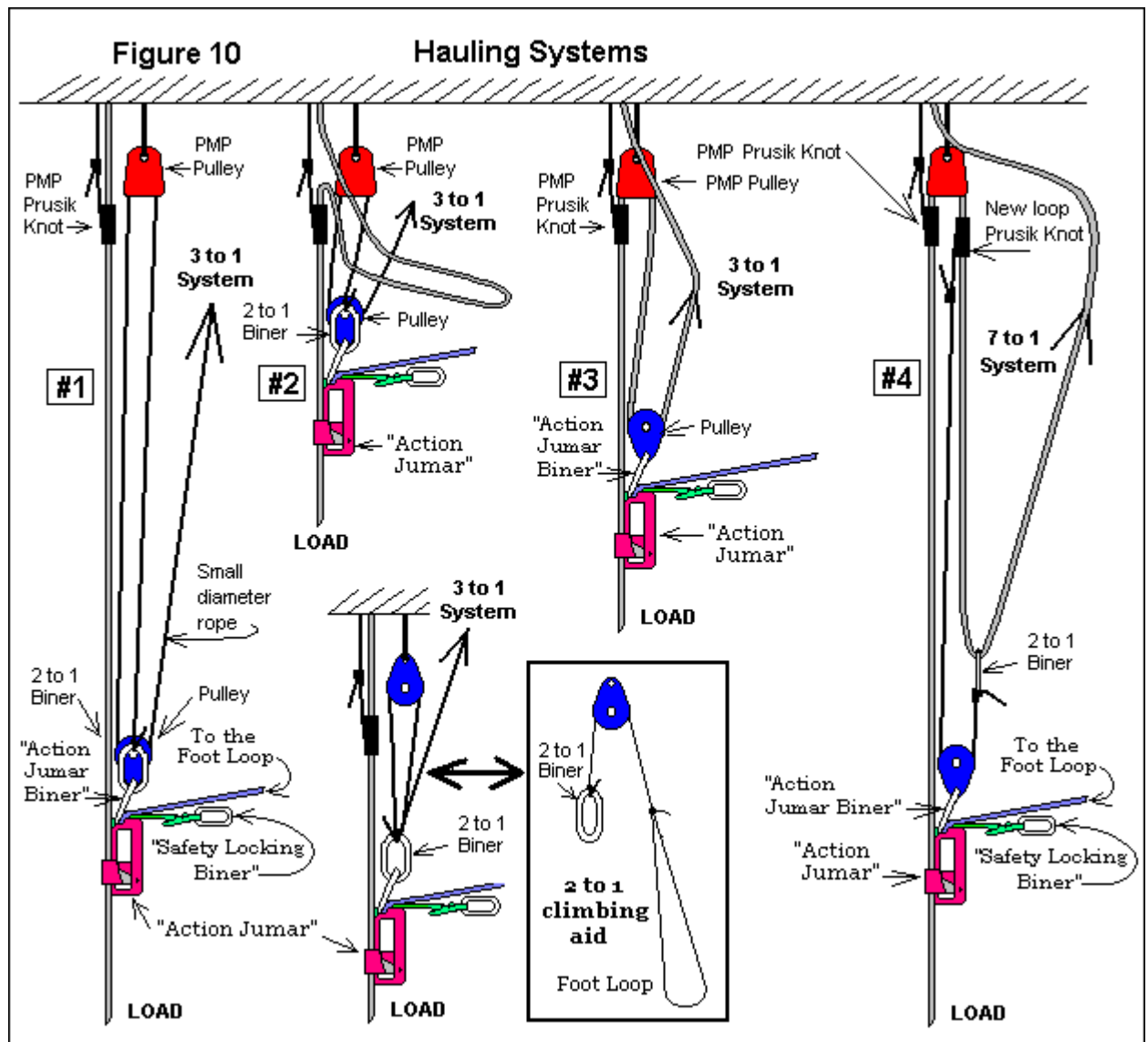


If you want to rescue someone who is below you, you may have to use a hauling system or you may have to downclimb all the way. If you have to downclimb, I think you will be glad to have my system for that. The setup in figure 5 works very well for downclimbing. The short cow's-tail works best for rappelling with another person attached to it.

HAULING SYSTEMS

The middle bottom of Figure 10 shows a technique to raise a loaded rope using my "2 to 1 climbing aid". Systems #1 through #4 use a PMP, Prusik Minded Pulley. In the description below, we will assume that you are to haul up someone who is on the loaded rope. Systems #1 through #3 are illustrated in the "British Columbia Cave Rescue" document that was shown to me at a "Small-party Cave Rescue Techniques and Considerations" class that I attended.

The first thing the rescuer needs to do is to check the anchor to make sure it is safe. Tie a prusik knot onto the rope with your 18-inch loop of small diameter climbing rope and secure the loop to the anchor. We will call this the "PMP Prusik Knot", see Figure 10 system #1 for this description. Attach your PMP to the anchor and then attach your "Action Jumar" to the load rope as shown. Attach your small pulley to the "Action Jumar Biner". Untie the foot loop in your "2 to 1 climbing aid", see the rectangular box in Figure 10, and run the small diameter rope as shown in system #1. Attach the 2 to 1 Biner onto the "Action Jumar Biner". Pulling the small rope in the direction of the arrow will give you a 3 to 1 mechanical advantage hauling system.



Pull the small rope until the two pulleys are close together. Set the "PMP Prusik Knot", or the "ratchet (or capture) Prusik", as shown in system #2. Slowly release the small rope to place the load weight onto the "PMP Prusik Knot". Now move the "Action Jumar", or "haul" Jumar, down the load rope until the small rope end is near the small pulley attached to your "Action Jumar Biner", this resets your system. A knot here at the end of your small rope is a good idea to stop the small rope end from going through the small pulley. Now pull the small rope again until the two pulleys are close together or until the load rope loop, that you are now making, is big enough to make system #3. Set the "PMP Prusik Knot" before releasing system #2 and making system #3. Notice in system #3 that the small rope has been replaced with the load rope. System #3 is also a 3 to 1 hauling system, but can be worked more efficiently because the "PMP Prusik Knot" will set itself. To operate system #3 you only pull on the rope, release it, move the "Action Jumar" down the load rope, and pull on the rope again. You will now be able to haul the load / person all the way up.

System #4 is used when the load weight is too much work for the hauler using a 3 to 1 mechanical advantage. In this new arrangement I have taken the "2 to 1 climbing aid's" foot loop and retied it into a one-foot long loop. Tie a prusik knot with this new loop onto the rope as shown. Place your pulley on the small rope and clip it onto the "Action Jumar Biner". Take the main rope and clip it onto the 2 to 1 biner as shown in system #4. With this new arrangement the hauler has a 7 to 1 mechanical advantage system. Operation: Pull the rope until the 2 to 1 biner touches the new loop prusik knot. Relax the rope and move the new loop prusik knot up to the PMP. Now pull the rope again until the 2 to 1 biner touches the new loop prusik knot. Relax the rope and slide the "Action Jumar" down the load line until the 2 to 1 biner hits your pulley, thus resetting the system.

DISCLAIMER

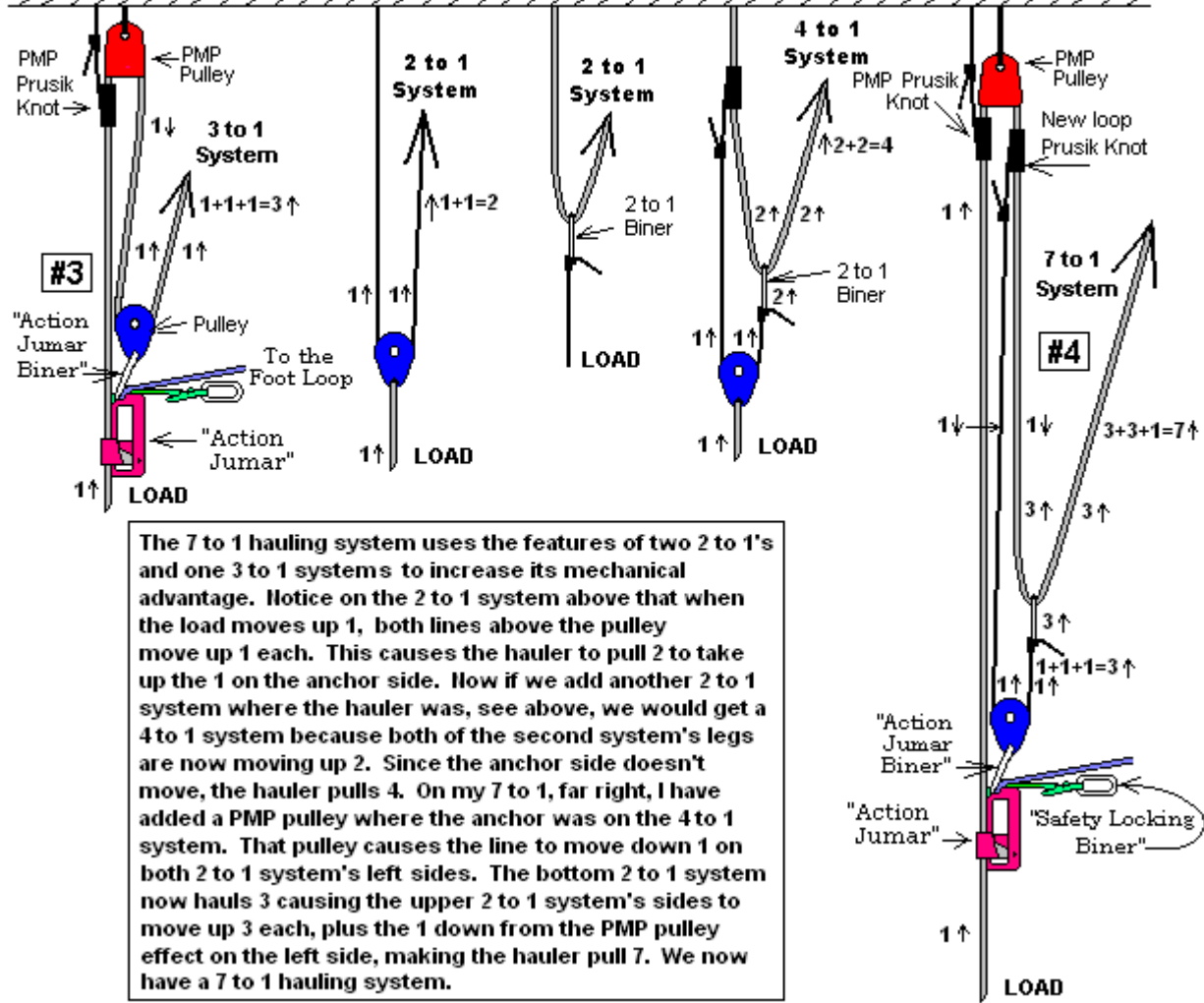
Caving and climbing ropes or rappelling is dangerous. If you would like to build my system, go ahead and do it, but have someone who has been doing vertical caving for many years check your work. After you've constructed the system, also have them make sure you are using it correctly. The frog system works best when adjusted right and with people of a slender to medium build.

QUESTIONS

If you have questions about my system or would like to communicate with me, I can be reached by email: verticalbob1@gmail.com. I'm also in the NSS Members Manual, in Oregon.

Hauling System Explanation

Drawn by
Bob Johnson



The 7 to 1 hauling system uses the features of two 2 to 1's and one 3 to 1 systems to increase its mechanical advantage. Notice on the 2 to 1 system above that when the load moves up 1, both lines above the pulley move up 1 each. This causes the hauler to pull 2 to take up the 1 on the anchor side. Now if we add another 2 to 1 system where the hauler was, see above, we would get a 4 to 1 system because both of the second system's legs are now moving up 2. Since the anchor side doesn't move, the hauler pulls 4. On my 7 to 1, far right, I have added a PMP pulley where the anchor was on the 4 to 1 system. That pulley causes the line to move down 1 on both 2 to 1 system's left sides. The bottom 2 to 1 system now hauls 3 causing the upper 2 to 1 system's sides to move up 3 each, plus the 1 down from the PMP pulley effect on the left side, making the hauler pull 7. We now have a 7 to 1 hauling system.