

Additional Knots and Knot Knowhow for CERT.

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Objectives

1. To continue the skills learned in the Basic Knots for CERT program. You will need the basic skills knowledge to do this program.
2. Discuss some tricks of the trade to learn more about ropes and knot systems.
3. Discuss construction of cordage and various types of ropes.
4. To provide the member with additional knots that are useful in the field.
5. To provide practical exercises that will be useful to apply these new skills.

Tricks to learn how to tie knots.

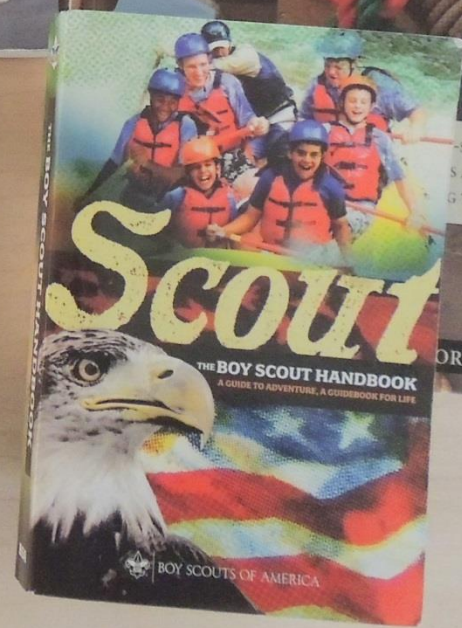
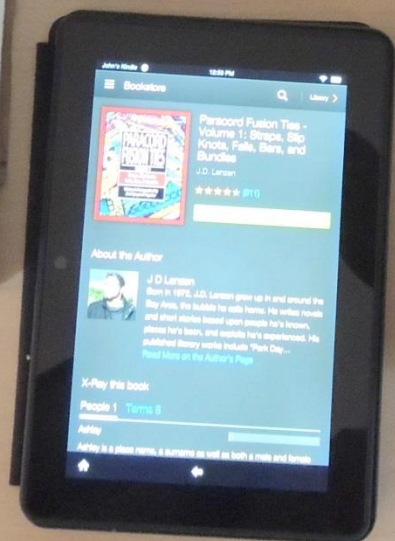
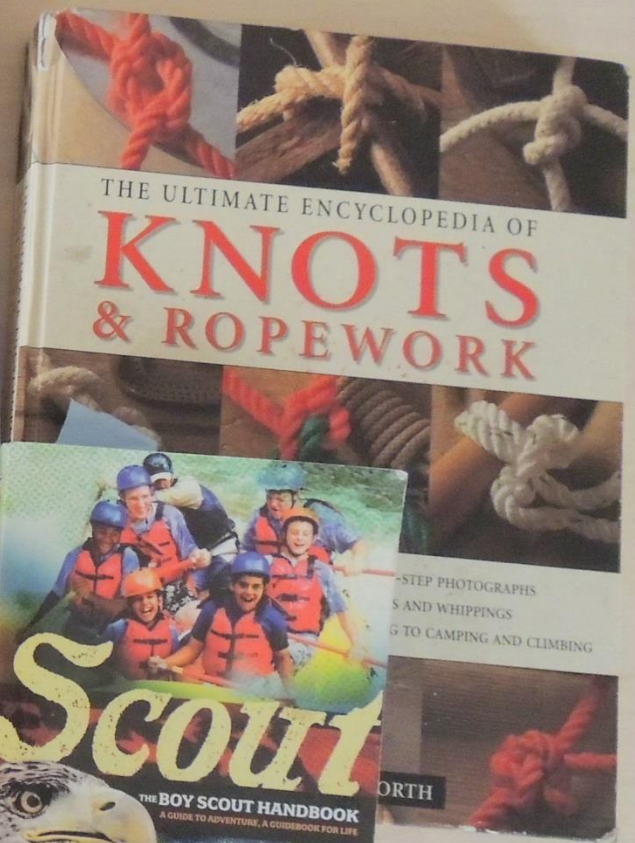
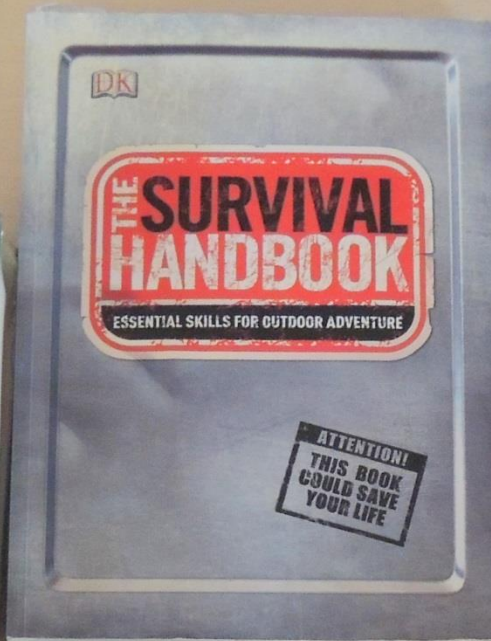
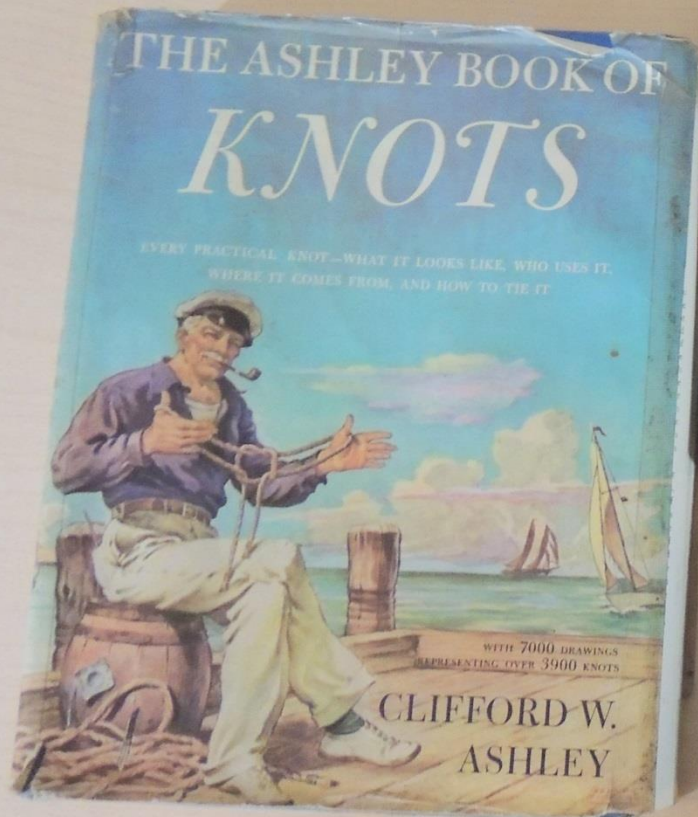
Get a good book or app of knots and practice the ones that interest you. This can get addicting since there are so many great books out there.

General Knot Books

Ashley's Book of Knots
Morrow Book of Knots
The Ultimate Encyclopedia
of Knots & Ropework
Survival Manuals
Boy Scout Handbooks and
Pioneering Merit Badge Book

Decorative Knot Books

Paracord Fusion Ties
Volume 1 and 2 by J.D. Lensen
Decorative Fusion Knots
by J.D. Lensen



A few of my knot references.

Tricks to learn how to tie knots.

Develop personal ways to think of knots like “knots families” or “knot uses families”, then practice that way.

Knot Families

Overhand knot

Granny Knot, Square Knot, Fisherman's Knot, Overhand on a bight, Slip Knot, Overhand Knot
Square knotting (macramé'), Double Fisherman's Bend, Chain Sennet, Handcuff Knot, Solomon's
Bar

Fisherman's Loop, Double Chain Sennet, Surgeon's Knot, Marline Hitch

Figure 8 Knot

Figure 8 on a bight, Figure 8 Follow Through, Chain of 8s , Stevedore's Knot
Double Figure 8, Figure 8 Bend, Figure 8 on a bight

Half Hitch

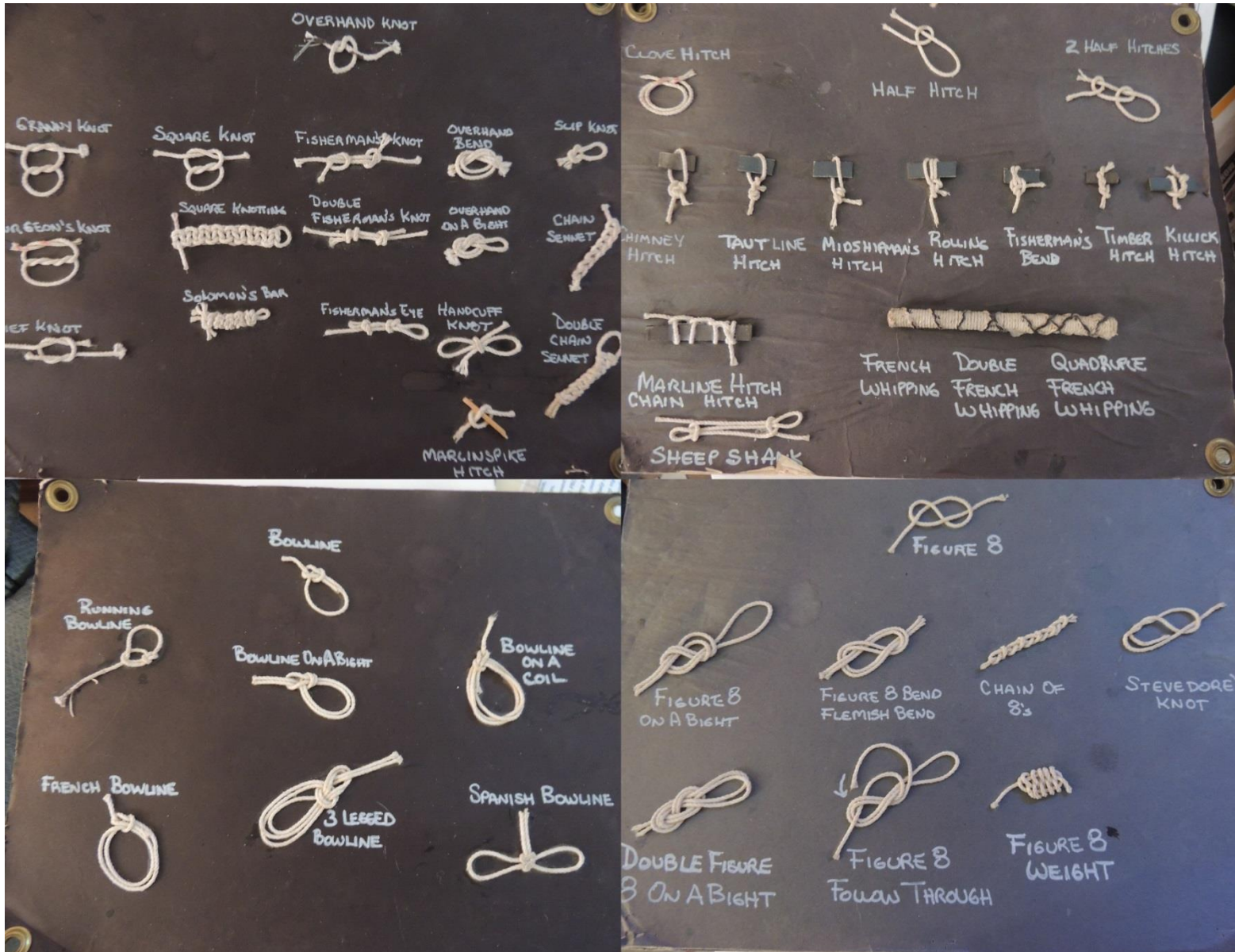
Clove Hitch, 2 Half Hitches, French Whipping, Chimney Hitch, Tautline Hitch
Double French Whipping, Midshipman's Hitch, Quad. French Whipping, Rolling Hitch

Bowline

Bowline on a Bight, Running Bowline, Bowline on a coil, French Bowline, 3 Legged Bowline,
Spanish Bowline

The knot at the top of the family is the one that all the rest are based on.
There are more knots based on these but these are ones I commonly use.

Knot Family Cards



Knot Use Families

Joining ropes together:

Square Knot, Sheet Bend, Figure 8 Bend
Fisherman's Knot, Double Fisherman's Knot

Attaching a rope to a post:

Clove Hitch, Rolling Hitch, Slippery Clove Hitch
2 Half Hitches, Figure 8 Follow-through, Bowline, Timber Hitch

Making a Loop in a rope:

Overhand on a bight, Fisherman's Loop
Figure 8 on a bight, Double Figure 8 on a Bight, Butterfly Knot
Bowline, Bowline on a Bight, 2 Half Hitches

Making an adjustable loop in a rope:

Tautline Hitch, Chimney Hitch, Pruisik Hitch

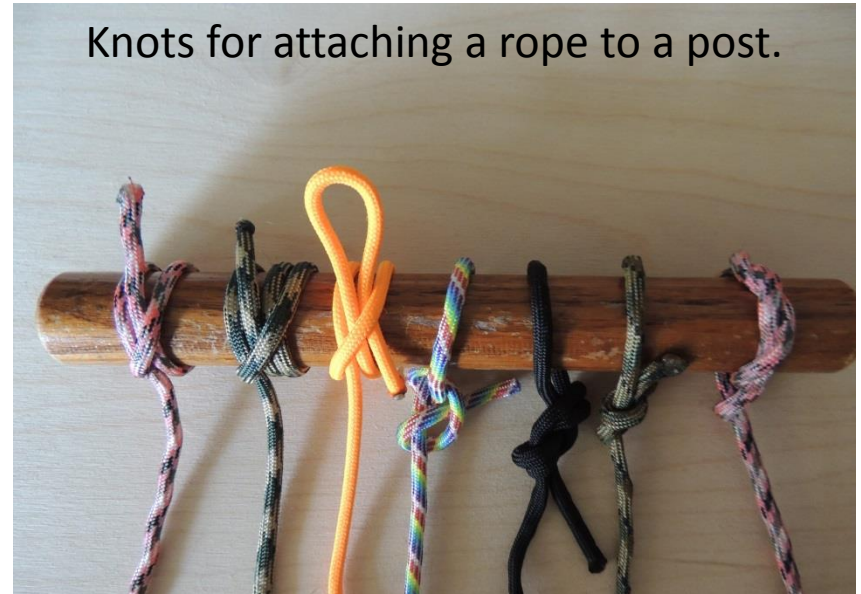
Develop your own groups of knots for these uses.
There are many other knots that will also work in these situations.

Knot Use Families Cards

Knots for joining ropes together.



Knots for attaching a rope to a post.



Knots for making a non-adjustable loop.



Knots for making an adjustable loop.



Tricks to learn how to tie knots.

Carry 10 feet of paracord to practice when you are waiting in line or on a long trip. It's good for passing the time and great exercise for your hands.

Tie all the knots in a knot family or use family without looking. Then see if there is anything that you need to practice. Then untie them again and try another group.



Tricks to learn how to tie knots.

Talk to someone who uses ropes and discuss what knots they prefer and why.

They may also show you tricks they use like how to tie a Clove Hitch in the middle of a rope by rolling the loops in hand, stacking them then placing over the post.



Tricks to learn how to tie knots.

Teach someone how to tie knots. This causes you to look at a skill a different way and helps you learn more.

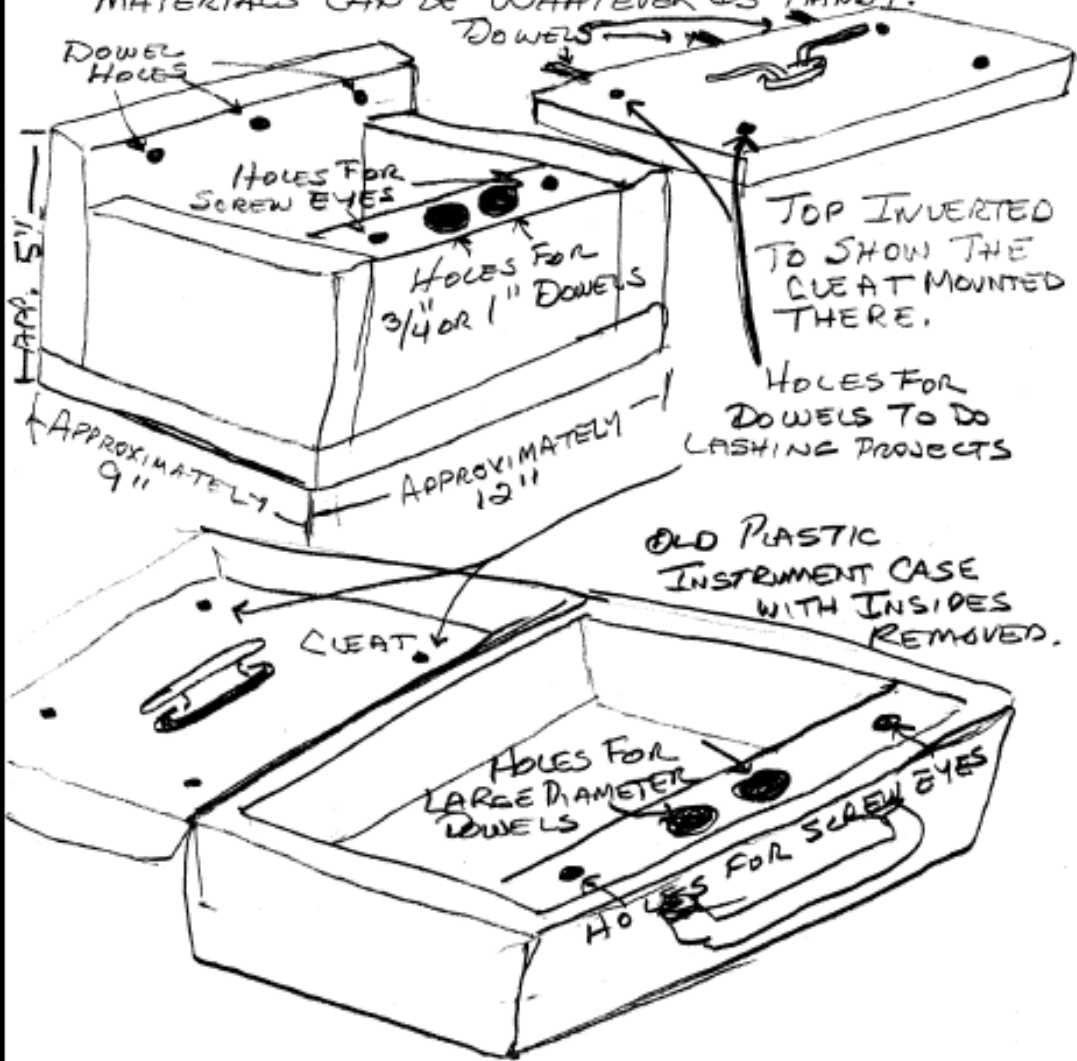


JOHN SANDERS' KNOT BOXES

TRY TO KEEP THE DIMENSIONS THE SAME SIZE AS A BOOK TO ALLOW STORAGE ON A BOOK SHELF.

INCLUDE VARIOUS TYPES AND SIZES OF ROPE IN THE BOX. TWINE FOR LASHING SMALL DOWELS

MATERIALS CAN BE WHATEVER IS HANDY.

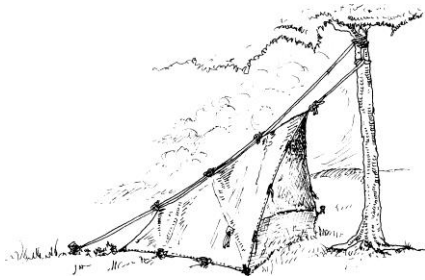


These knot boxes have proven to be one of the best ways to teach and practice knots. They are seen in some of the pictures in this presentation. I have 5 knot boxes and none of them are alike.



Tricks to learn how to tie knots.

Practice the knots you know by using them as much as possible. The more you use them the more likely you will use them. This will also help you find the ones you prefer for different situations.



Setting up tents or shelters.
Tying down a load in a truck bed.
Securing a boat to a dock or post.



Games or tricks using knots.

Making decorative items to use.



Cordage Materials.

Natural Fiber Materials

Plant fibers such as flax, jute, hemp or cotton.

Animal fibers such as horse hair, camel hair, wool or silk.

Typically spun first clockwise (right-handed) to create strands, then 3 strands spun counter-clockwise (left-handed) to create yarns, then 3 yarns spun clockwise again to form a typical rope.

Fibers – Strands – Yarns – Lines – Ropes – Cables – Hawsers.

Jute Twine



Sisal Twine



Bailing Twine



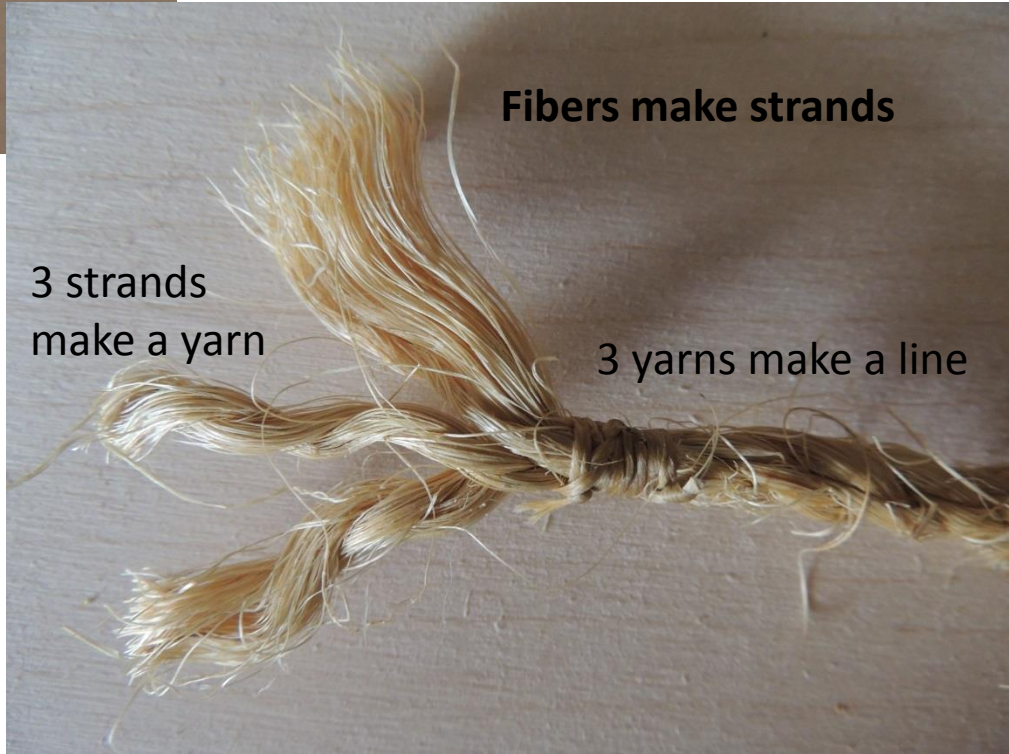
Cotton Twine

Natural fiber ropes

Fibers make strands

3 strands
make a yarn

3 yarns make a line



Cordage Materials.

Synthetic Fiber Materials

Kevlar, nylon, polyester, polyethylene and polypropylene

Typically $\frac{1}{2}$ the weight and twice the strength of natural fiber lines of the same size.

Able to withstand a sudden shock loading.

Typically last 4 to 5 times longer than natural fiber ropes.

Almost as strong when wet and rot resistant.

They are more susceptible to heat generated by friction.

They may be dyed a variety of colors.

Synthetic fiber ropes

Nylon Rope



550 Paracord



Polypropylene Cord

Cordage Construction

Laid rope

Twist and counter twist gives this rope its shape and geometry.

Spinning with little tension produces a soft laid rope that is more flexible and easier to tie knots in.

Spinning with more tension make a hard laid rope that wears better but are stiffer.

Three strand rope is sometimes called hawser laid.

They can be left-hand laid (S-laid) or right-hand laid (Z-laid) for the way the twists are set in the rope.

Laid Ropes



Cordage Construction

Braided rope

This construction is rarer in natural fiber lines except in the small sizes like sash cords or clothes lines.

This construction is more flexible, stretches less does not impart a spin when loaded and will kink less than laid rope.

Braided construction may be hollow or over a separate core of laid or braided fibers. Braid on braid construction is considered the strongest rope construction technique.

Braided synthetic lines are considered the most versatile of all ropes.



Braided Ropes

Cordage Construction

Sheath on core rope

Often called kernmantle construction that is used in paracord and climbing ropes to mention a few.

Static kernmantle ropes have little stretch but are designed for the wear and tear and occasional falls of regular climbing or rescue ropes.

Dynamic kernmantle ropes have extra elasticity that is useful in safety ropes in climbing.

The greater majority of the strength of the rope is in the internal core (the kern or core) and a lesser amount is in the outer sheath (the mantle).

Sheath on Core Ropes



Kernmantle Ropes

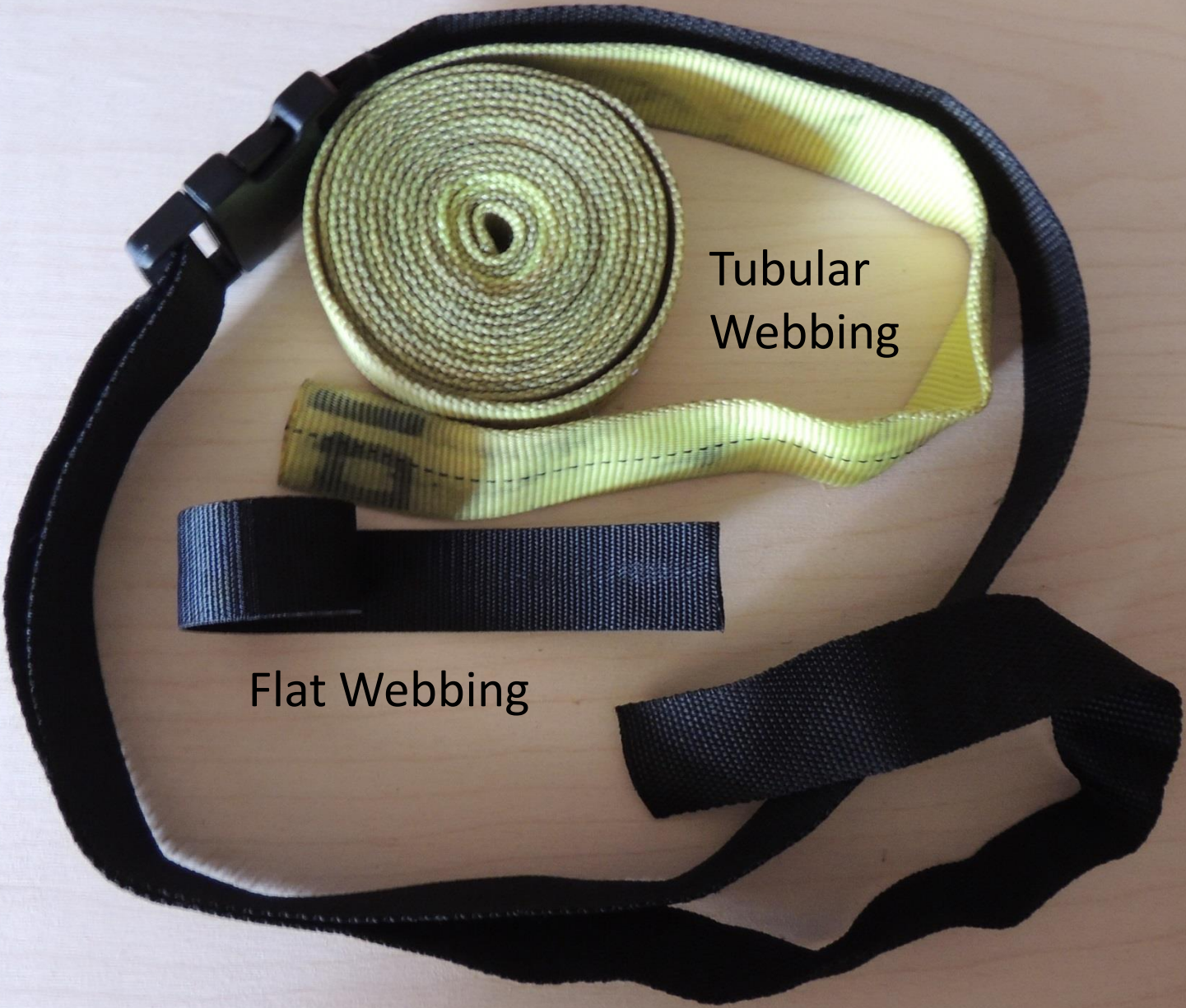
Webbing.

Tubular webbing is a versatile alternative to cordage in some uses. It is extremely strong and easy to tie certain knots in.

Webbing in general is a woven product and come in flat or tubular construction of various sizes.

Many rescue teams use this for anchor points, slings, making ladders and securing victims into a stretcher.

I use a roll of 1" tubular webbing as a throwing rescue tool that unrolls with an easy underhand toss. Tie a overhand knot in each end to keep it from slipping from you hand or the victim's hand.



Tubular
Webbing

Flat Webbing

Whipping or fusing cordage.

To prevent a rope from coming unraveled you can tie a stopper knot (overhand or figure 8 knot) whip the ends or fuse the ends in synthetic ropes.

Whipping is using a smaller cord to wrap the ends to prevent them from unravelling. This is the preferred method with natural fiber ropes.

Taping an end also works as a quick way to whip an end.

Fusing is where the synthetic rope is melted so that the ends will not unravel. Cutting a synthetic rope with a hot knife fuses the rope as it cuts. Melting the cut end with a flame or soldering iron also works but be careful since the melted material is extremely hot and may cause severe burns.

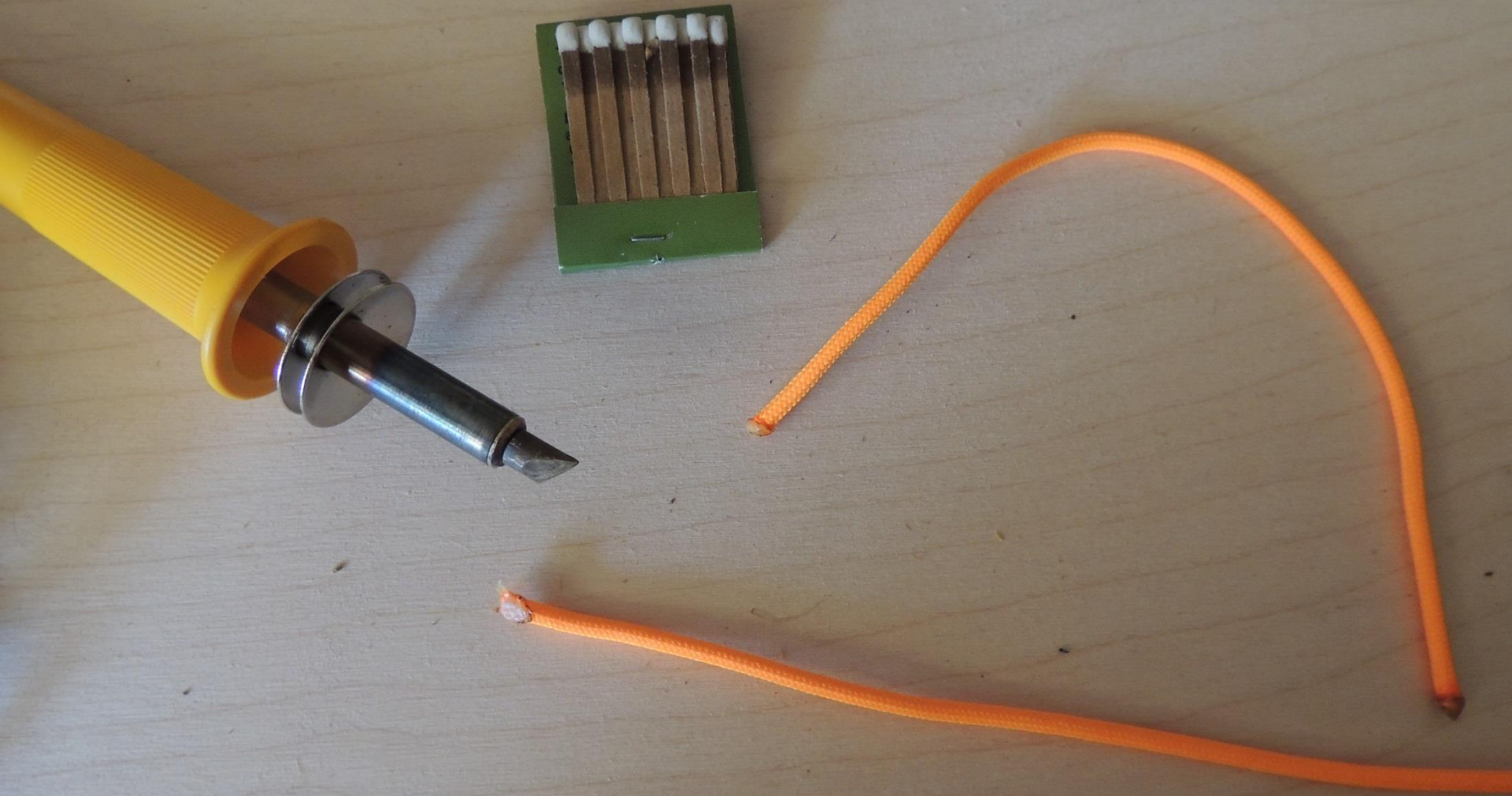


Common Whipping



Taped

Fusing Synthetic Ropes



1. Make a bight in the whipping material.



2. Tightly wrap the running end around the rope for about the diameter or the rope.



3. Insert the running end through the loop.



4. Pull on the standing part of the whipping cord until the running end goes under the wraps.



5. Trim the ends so only a small amount of the whipping cord shows.



Cowboy Whipping

French Whipping

Common Whipping



Cutting Cordage

The easiest way to cut a rope is to whip or tape it on either side of where you wish to cut it.

Then cut in the middle. If taped you can cut in the middle of the tape as well.

In synthetic ropes using a hot knife or soldering iron to melt the rope as you cut it also fuses the rope.



Cut between two common whippings

Cut in the middle of the tape.

Cut and fuse with a soldering iron or woodburner.

Knots we will cover in this program.

Figure 8 on a bight – used to make a loop in a rope that is extremely strong.

Bowline on a bight – used to make 2 loops in a rope that will not slip.

Water Knot – used to tie webbing into a loop.

Fisherman's Knot – used to join to ropes together.

Double Fisherman's Knot – used to join to ropes together where you need strength not the ability to untie the knot.

Cleat Hitch – used to secure a rope to a cleat.

Sheepshank – used to shorten a rope where you can untie it easily.

Fisherman's Knot

Cleat Hitch

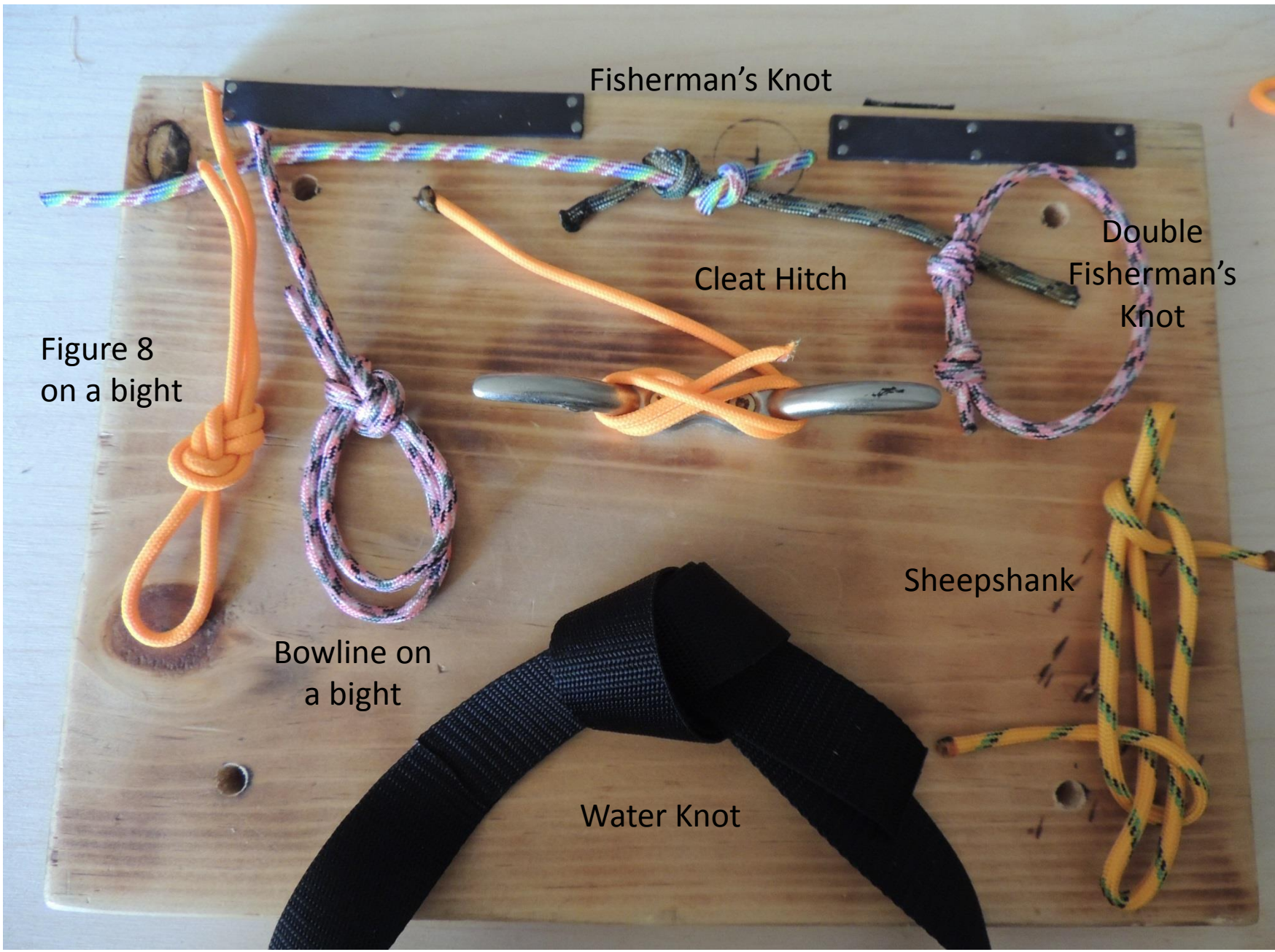
Double Fisherman's Knot

Figure 8 on a bight

Bowline on a bight

Sheepshank

Water Knot



Knots we will cover in this program.

Continued

Girth Hitch – used to secure a rope to a ring.

Marlinespike Hitch – used to make a temporary pulling point in a rope.

Butterfly Knot – used to make a loop in the center of a rope.

Prusik Hitch – used to have a movable attachment point on a line by using Prusik Loop making a Prusik Hitch.

Trucker's Hitch – useful in applying tension across a load to hold it in place.

Half Hitching – useful in securing long objects like a roll of carpet or tying a tarp to a pole with a line you do not want to cut.

Half Hitching



Marlinespike Hitch



Girth Hitch



Butterfly Knot



Prusik Hitch



Trucker's Hitch

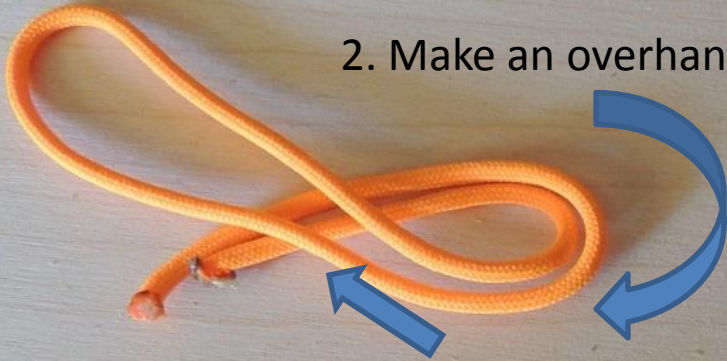


Figure 8 on a Bight

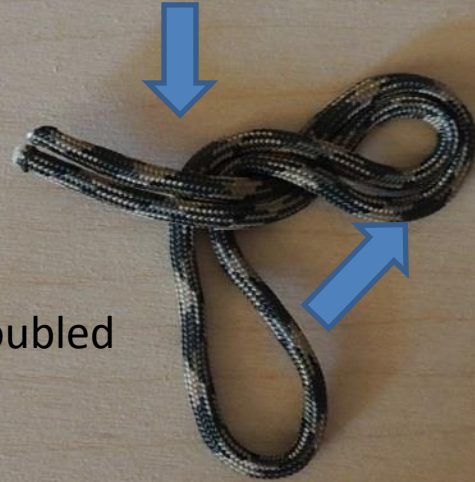
Used to make a loop in a rope that will be able to take a load yet is very strong.



1. Make a bight in the rope



2. Make an overhand loop with the bight.



3. Wrap the bight behind the doubled rope.



4. Insert the running bight through the loop.

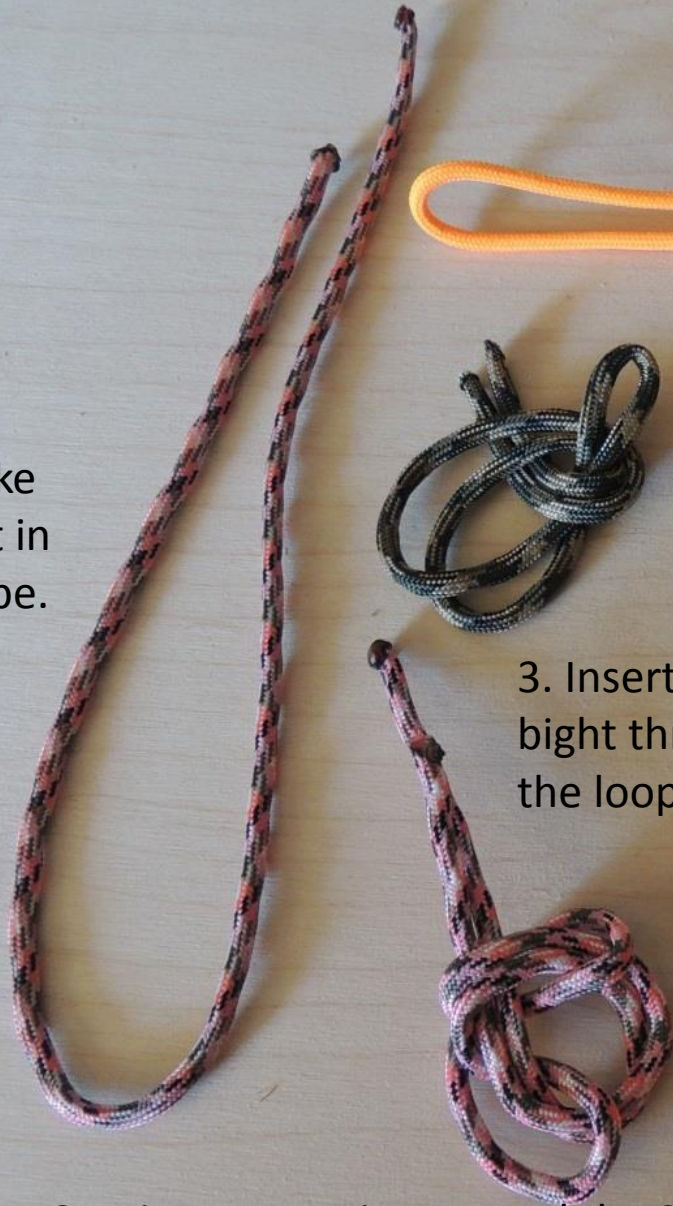


5. Pull the loop and the doubled rope.

Bowline on a Bight

Use to make 2 loops in a rope for making a seat to lower someone or tie off to a board with a round turn in each loop to make a bosun seat.

1. Make a bight in the rope.



2. Make an overhand loop with the bight.



4. Wrap the bight down and under the two loops



3. Insert the bight through the loop .



5. Continue wrapping around the 2 loops to behind the standing part of the rope



6. Pull the standing part and the bight to set the knot.



Water Knot

Used in tubular webbing to make loops that are useful for a variety of different tasks.

1. Tie an overhand knot in the end of the webbing.



2. Take the other webbing and insert it under the tail of the first knot.



3. Follow the knot around the original knot.



4. Continue around the knot and insert it under the last wrap of the original.



5. Leave a tail on both ends that are at least the same as the diameter of the webbing.



Fisherman's Knot

Used to join two ropes together. They can be the same size or different sizes.

If this is used in larger ropes it may be untied easily but if it is in small ropes like cords or fishing lines it may have to be cut the knot out of the rope.

1. Lay the ends of the rope parallel to each other.



2. Take one running end under the other rope.



3. Tie an overhand knot around the rope.



4. Take the second rope and go under the first.



5. Tie an overhand knot with this rope too.



6. Leave a tail after each overhand knot.



7. Pull the ropes in opposite directions to tighten



The finished
Fisherman's Knot.



Double Fisherman's Knot – Barrel Knot

This is a stronger version of the Fisherman's Knot.

Used to join ropes together but will be harder to untie if put under tension.

Used to make the Prusik Loops for the Prusik Hitch.

1. Lay the ends parallel



2. Take one end down across the other rope.



3. Around under both ropes.



4. Around a second time forming a X.



5. The running end goes under the X.



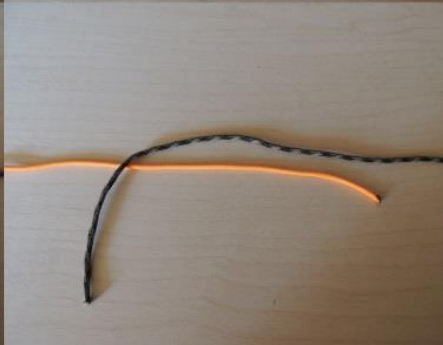
6. Leave a tail and pull tight.



8. Repeat the process with the other rope

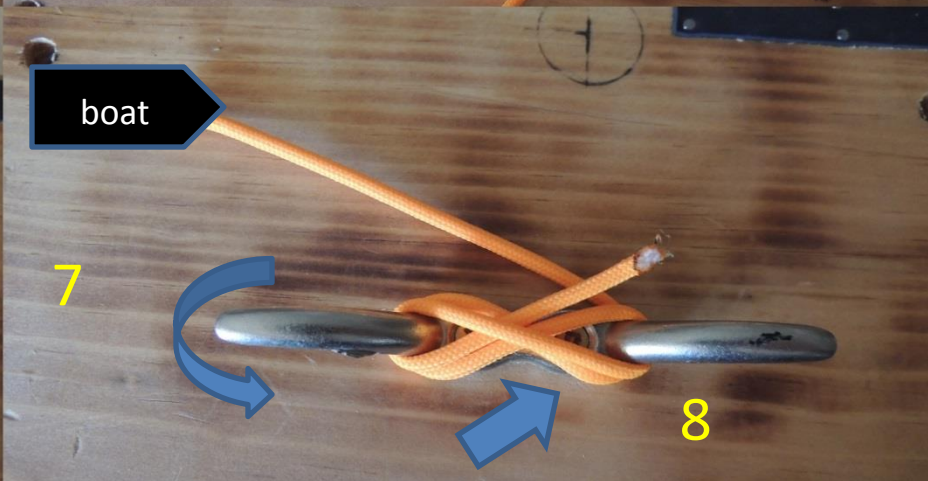
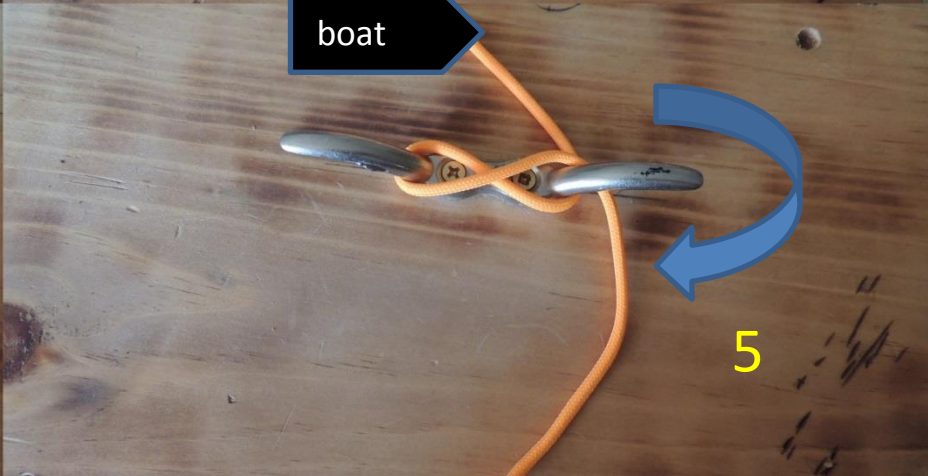
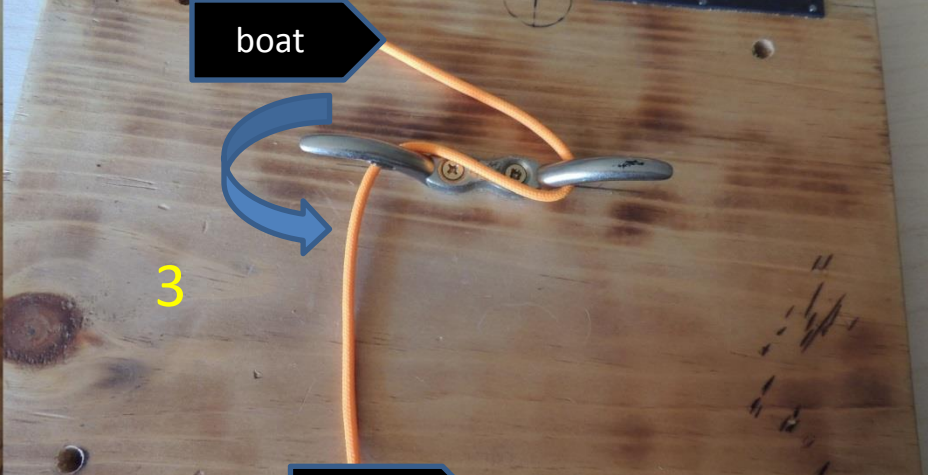
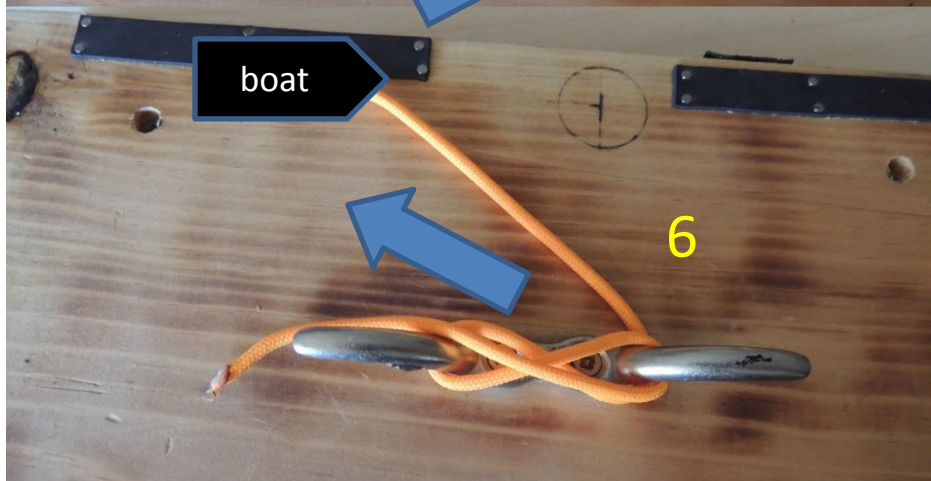
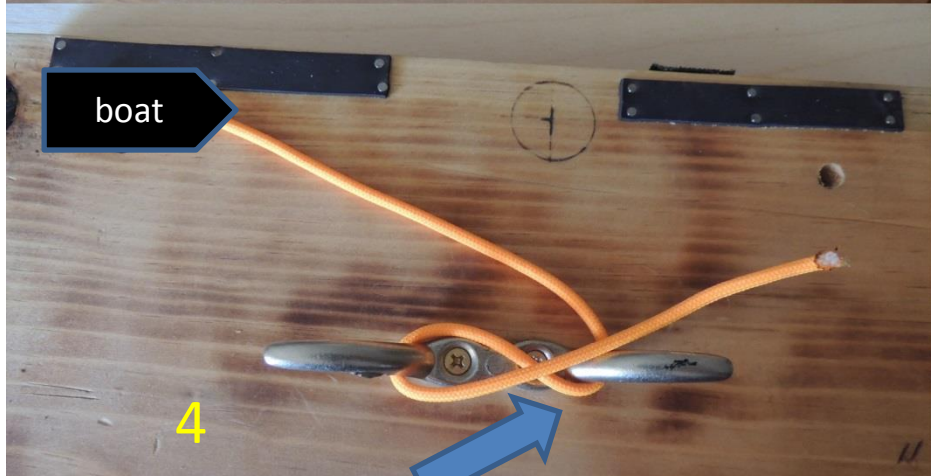
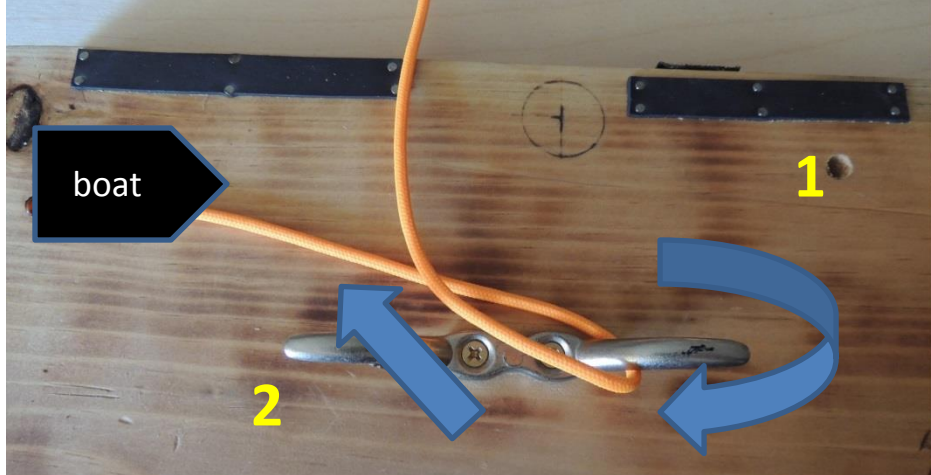


9. Pull the knots together and the knot is formed.



Cleat Hitch

This is the knot to use to secure a boat to a cleat on the dock or the boat. It may also be used to tie off a flag halyard to a cleat.



Sheepshank

Used to shorten a rope where you do not want to cut it. It would also be useful in the middle of a rope barrier to make it more visible than the rope itself.

It may come untied if tension on the rope is not maintained but it can easily be made secure.

1. Determine how much the rope needs to be shortened and fold it into rough thirds.



2. Draw one end down under one of the bights.



3. Bring the running end up to form a half hitch.



4. Take the other running end under opposite bight.



5. And down again form a second half hitch.



6. Apply tension across the half hitches to secure the knot



7. To prevent the knot from coming undone draw the ends through the bights.



Another way is to place a second half hitch on each end.



Girth Hitch – Cow Hitch – Lark's Head

So many names for this knot used to secure a rope to a ring or horizontal rope.

It is used to secure the belly band on a saddle to the girth ring, to secure a rope to the nose ring on a cow or to secure a rope around a horizontal rope to help make cloth or nets.

This knot would be used to attach a webbing loop to a handle or bar to make a strap to pull with.

1. Form a bight in the rope.



2. Draw the bight through the ring.



3. Draw the ends through the bight.



4. Pull tight to secure the hitch.



A. Pull the end from under the ring.



B. Pull the rope around under the ring.



D. Pull both ends to tighten.



C. Pull the rope around and over the ring, and down through the ring again.



This knot may also be tied using webbing with either technique.



Marlinespike Hitch

This is useful when you need to pull on a rope by putting a handle that is perpendicular to the pull. This helps make lashings very tight when it is used on the frappings.

1. Determine where you would like the marlinespike hitch.



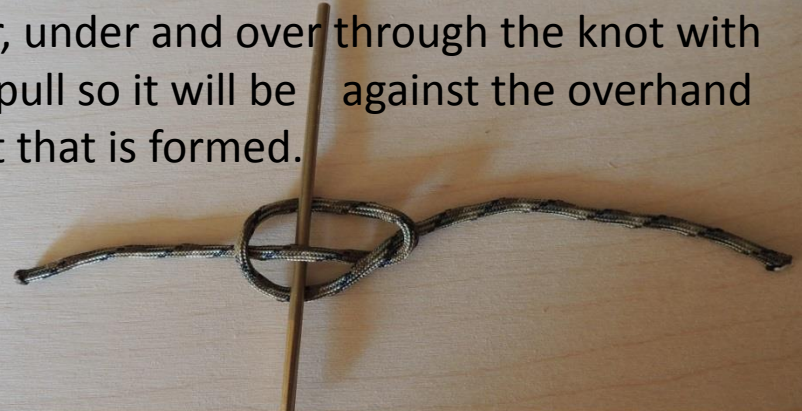
3. Draw the loop across the rope.



2. Make an underhand loop in the rope.



4. Take the marlinespike or stick and place it over, under and over through the knot with the pull so it will be against the overhand knot that is formed.



5. The hitch will tighten down when pulled.



This hitch can also be used to make a ladder.



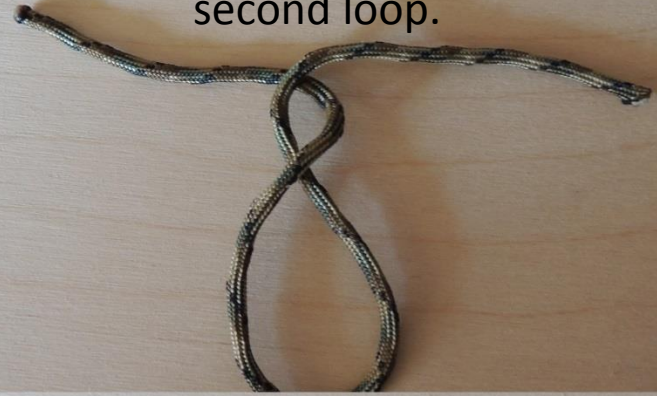
Butterfly Knot

This is useful when a loop in the middle of a rope is needed. It will not slip once tied properly.

1. In the position where you want a loop make an overhand loop.



2. Twist the loop a second time forming a second loop.



3. Roll the first loop under the rope.



4. Roll the loop over the rope and insert through the second loop.



5. Pull tight and the butterfly knot is formed.



The completed butterfly knot.



Prusik Hitch

This is a climbing knot that allows a moveable loop to be placed on a larger rope.

It is useful in climbing, rope rescue or tightening a load where a large rope is used to secure the load.

1. Run the ends parallel to each other.



2. Tie a double overhand knot.



3. Tie a second double overhand knot.



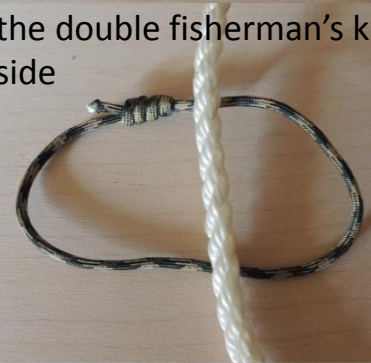
4. Pull tight to make a Prusik Loop.



5. Place the loop under the rope.



Notice the double fisherman's knot is on the side



6. Place the one end under the other side.



7. Wrap at least 2 but preferably 3 times around.



8. Ensure the wraps are inside the previous ones.



9. Pull tight to lock the hitch.



10. To lock in place pull across the bar of the Prusik Hitch

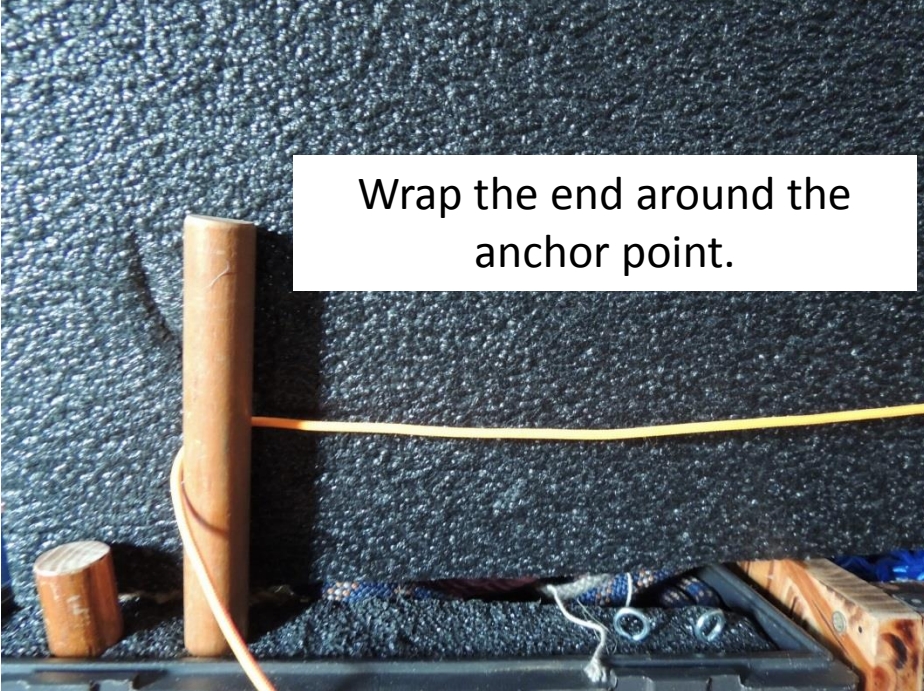


11. To slide the loop place it perpendicular to the rope.




Trucker's Hitch

This knot system can be used to tighten a rope taut when making a barrier or tighten down on a load or covering.



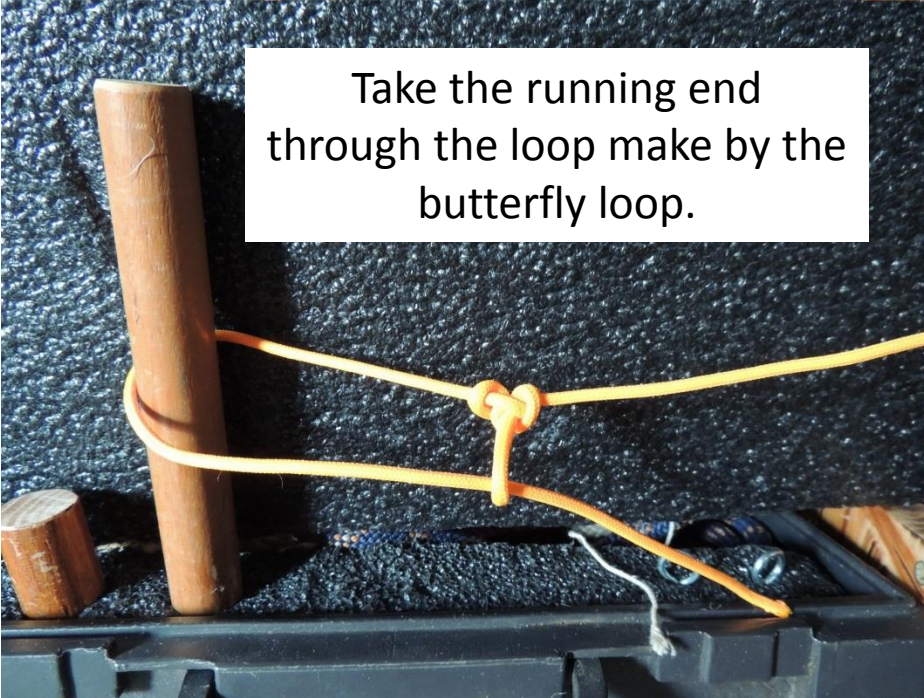
Wrap the end around the anchor point.

The image shows a yellow rope being wrapped around a vertical wooden post. The rope starts from the left, goes under the post, and then comes back up to the right. The background is a dark, textured surface.



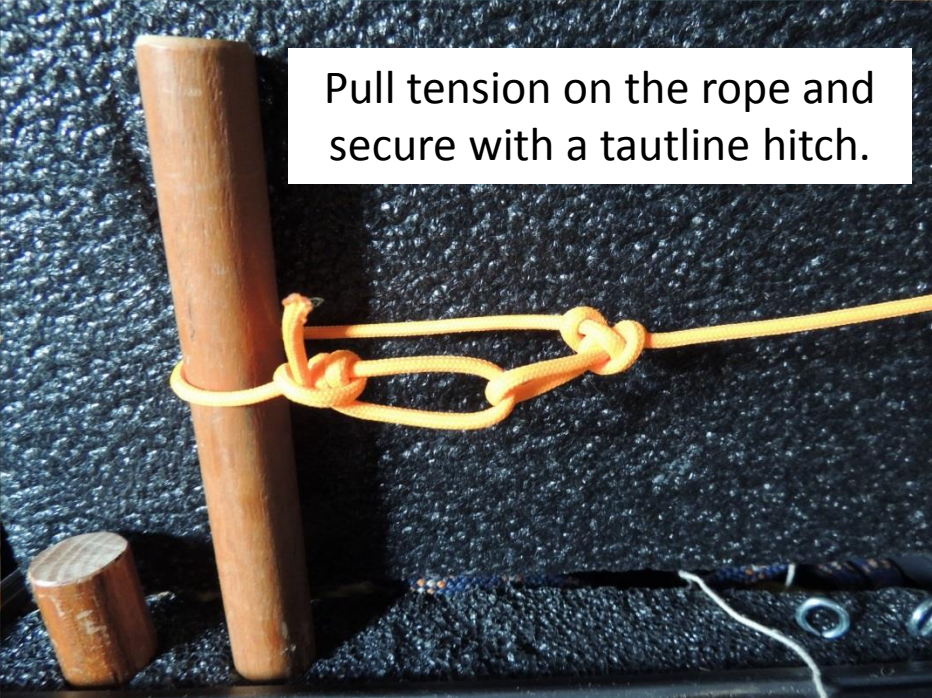
Make a secure loop in the rope a distance from the anchor. We are using a butterfly knot here.

The image shows the yellow rope with a butterfly knot tied in the middle. The rope is still wrapped around the wooden post. The background is a dark, textured surface.



Take the running end through the loop made by the butterfly knot.

The image shows the yellow rope with the butterfly knot. The running end of the rope is being passed through the loop of the butterfly knot. The rope is still wrapped around the wooden post. The background is a dark, textured surface.



Pull tension on the rope and secure with a tautline hitch.

The image shows the yellow rope with the butterfly knot and the running end passed through it. The rope is now secured with a tautline hitch around the wooden post. The background is a dark, textured surface.

Half Hitching

Half Hitching is useful when you need to tie off a long load over its entire length. It is useful when moving rugs or other rolled items.

1. Tie a loop in the rope. We are using a figure 8 on a bight here.



2. Make a slip knot and tie it around the end of the object.



3. Make an underhand loop and slide over the object.



4. Continue making half hitches so that 3 or 4 are evenly spaced along the object.



In large objects space the half hitches about every foot.



5. Secure with a second half hitch making a clove hitch.



Half Hitching using a figure 8 on a bight and secured with a clove hitch.



Half Hitching using a timber hitch and a tautline hitch.



Half hitching using webbing with an overhand on a bight and a tautline hitch.



Application Exercises.

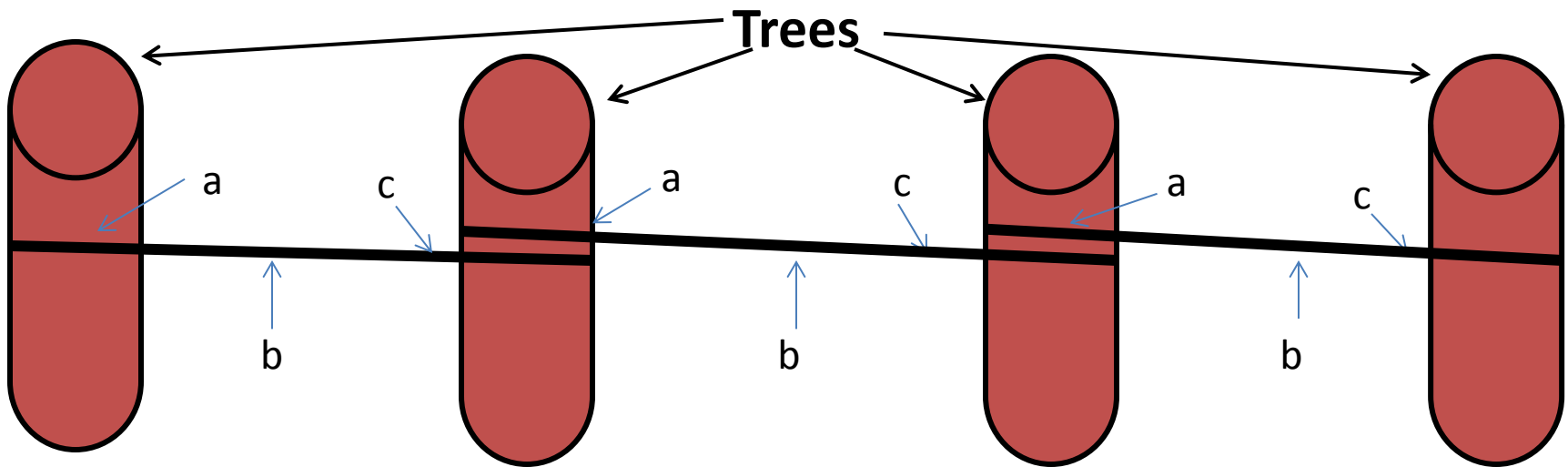
Using the knots in this program and the Basic Knot Program, describe what knots could be used to do the following at the places shown.

1. Making a barrier between trees.

You have been asked to make a rope barrier between 4 trees using rope. You were instructed not to cut the ropes if possible and to make the ropes as visible and tight as possible.

You have 3 – 50 feet ropes and the trees are 30 feet apart.

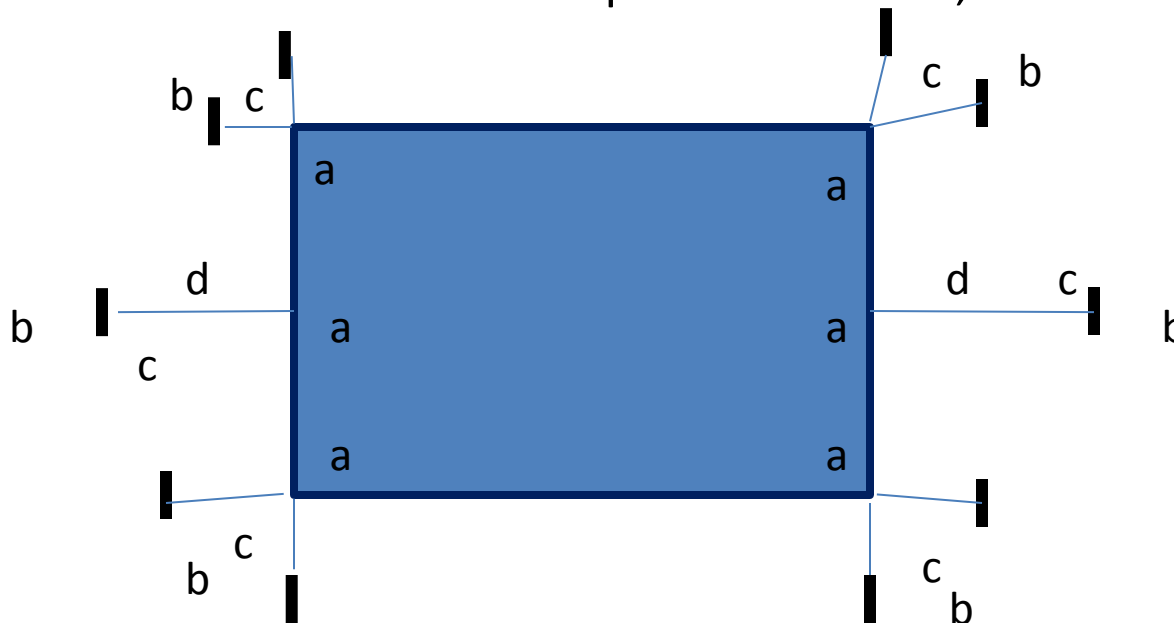
- What knots would be used to tie off to the trees?
- What knots could be used to shorten the ropes and make them more visible?
- What knots could be used to tighten the ropes?



2. Tying off a shelter to stakes.

You have been asked to tie down a shelter placed on the grass to some stakes that have been provided. You have a spool of small synthetic rope, some duct tape and 12 stakes. The diagram below shows how the stakes should be placed but you are to decide how to tie off the ropes and tighten them.

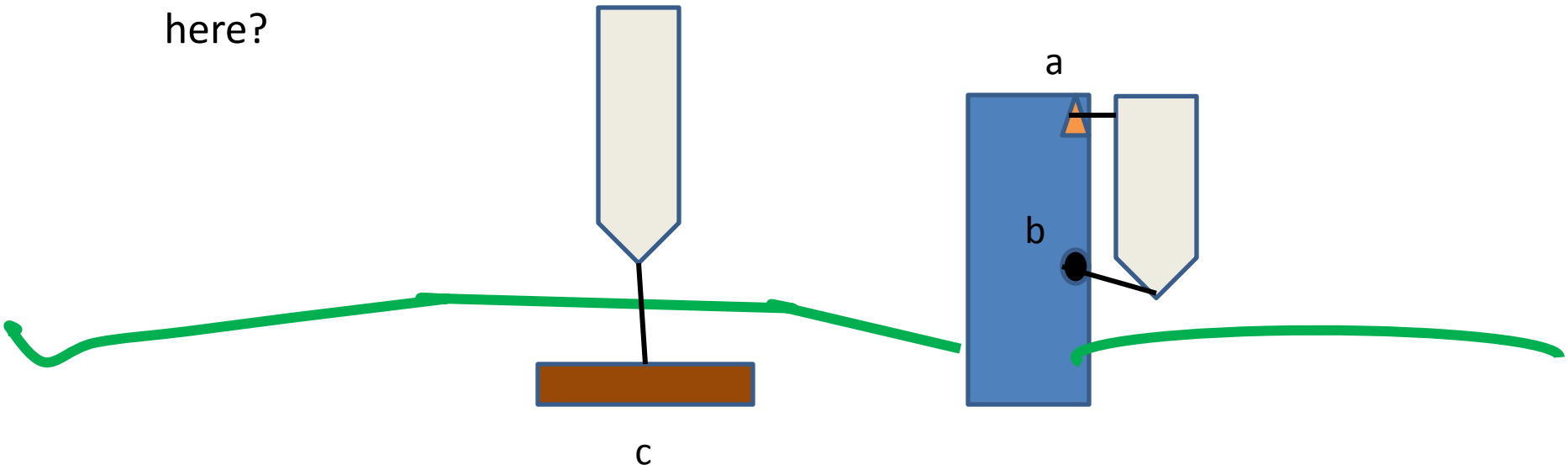
- What knots will you use to tie off to the shelter poles?
- What knots will you use to tie off to the stakes?
- How will you tighten the ropes?
- If you were asked to make the ropes more visible, what could you do?



3. Securing a boat to the shore.

The CERT has been asked to help with a water festival at the Rocky River Boat Ramps. While helping down at the docks a boat pulls up and asks that you tie him off please. There is a cleat on the dock at the stern of the boat but not one at the bow. There is a post at the bow though.

- How would you tie the stern off?
- How would you tie the bow off?
- Someone up stream needs some help tying off to shore. There is a log laying on the shore that you can tie off to. What knot would you use here?



4. Moving a victim.

You are helping with moving a victim in a stretcher. The victim is extremely heavy so you decide to drag him in the stretcher. You remembered you have some webbing in your bag for just such a situation.

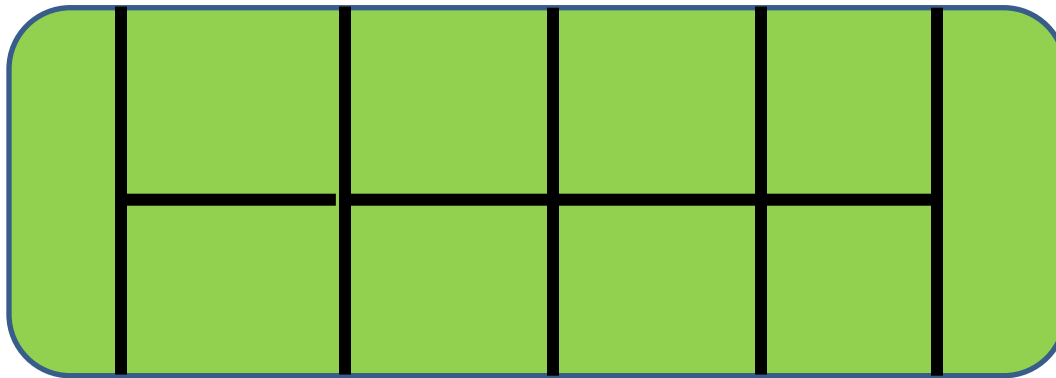
- a. How will you secure the webbing to the stretcher?
- b. What knot would be used to make a loop in the webbing?



5. Tying up a tent.

Following a big event where the team has been helping you see someone having trouble moving a long cabin tent. They have managed to roll it into a long cylinder that will not fit into the bag it came in. You ask if they have anything to tie it up with. They produce a package of 50 feet of small rope.

- a. What knot(s) would be best here?
- b. Would webbing have been easier to use and why or why not?



Answers

1. Making a barrier between trees.

a. What knots would be used to tie off to the trees?

A clove hitch with a stopper knot or a bowline with a stopper knot would work here.

b. What knots could be used to shorten the ropes and make them more visible?

A sheepshank that has been secured would make a larger section in the middle of the rope would both shorten the rope and make it more visible.

c. What knots could be used to tighten the ropes?

A tautline hitch or a trucker's hitch would both allow the rope to be adjusted tight. The trucker's hitch would stay tighter because of the acute angle it can be tied off at no matter how large the tree is..

Trucker's Hitch

Secured Sheepshank

Clove Hitch



2. Tying off a shelter to stakes.

a. What knots will you use to tie off to the shelter poles?

A bowline could be run around the pole in the expanding sections at the corners. Leave a 2 to 3 inch tail or secure it with a stopper knot to prevent slipping.

b. What knots will you use to tie off to the stakes?

A tautline hitch with a roundturn will be secure here.

c. How will you tighten the ropes?

The tautline hitch we used to secure the rope to the stake also allows us to tighten the rope.

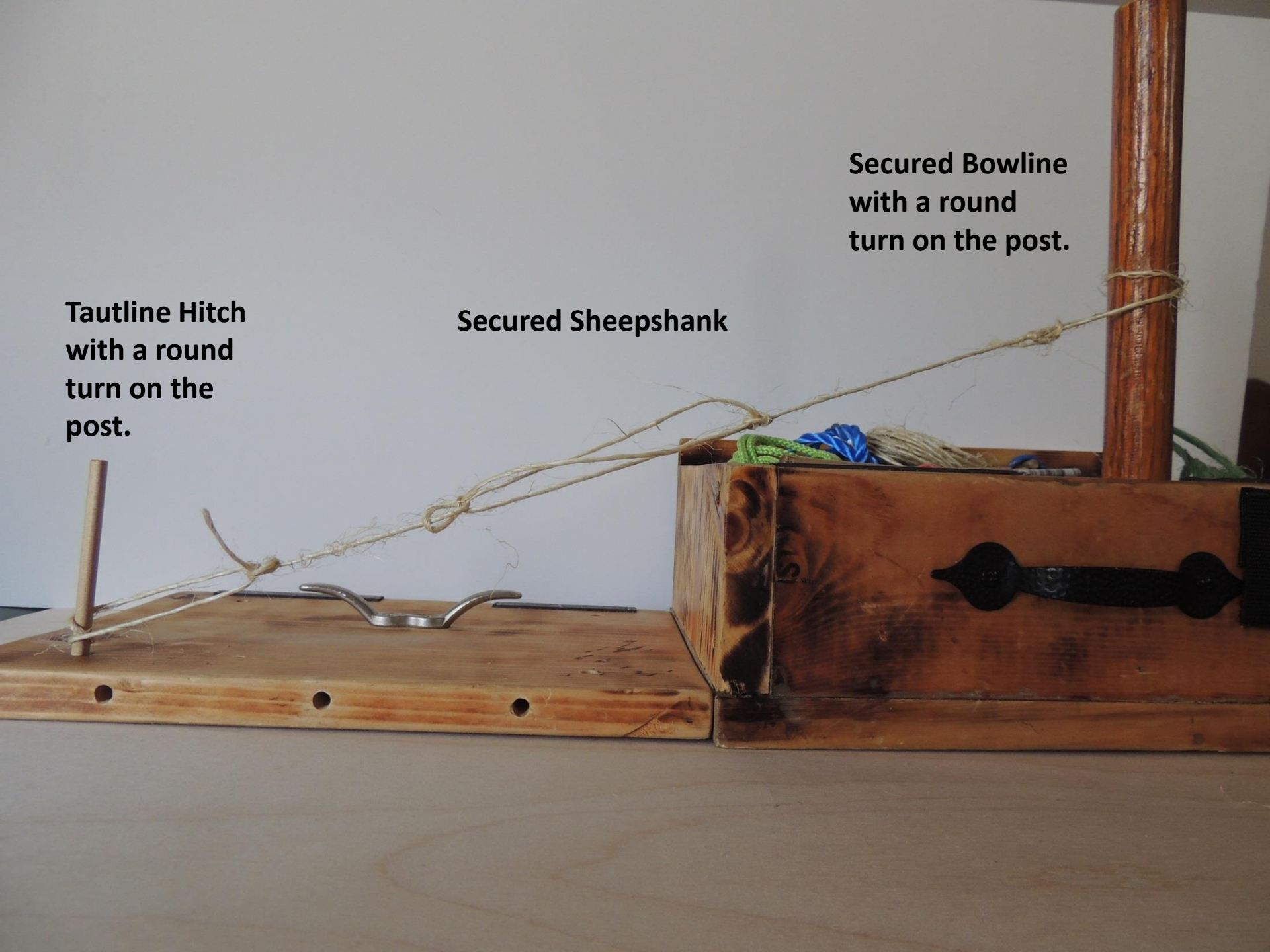
d. If you were asked to make the ropes more visible, what could you do?

A sheepshank in the middle of these ropes make them more visible. This would be tied between the bowline of the top and the tautline hitch on the bottom allowing room for the tautline to tighten the rope.

**Tautline Hitch
with a round
turn on the
post.**

Secured Sheepshank

**Secured Bowline
with a round
turn on the post.**



3. Securing a boat to the shore.

a. How would you tie the stern off?

Using a cleat hitch is the proper knot here.

b. How would you tie the bow off?

A clove hitch will allow you to secure this quickly. If there will be movement tie a stopper knot in the end rope to secure it.

c. Someone up stream needs some help tying off to shore. There is a log laying on the shore that you can tie off to. What knot would you use here?

You could use a clove hitch here as well. A timber hitch would also work here and be easier to untie when they leave.



Cleat Hitch



Clove Hitch



Timber Hitch



4. Moving a victim.

a. How will you secure the webbing to the stretcher?

A girth hitch will attach this to the bar handle at the top of the stretcher.

a. What knot would be used to make a loop in the webbing?

Use a water knot to make the loop in the webbing and provide a wide handle to pull with that will not pinch your hand as much.



Girth Hitch

Water Knot



5. Tying up a tent.

a. What knot(s) would be best here?

I would use some half hitching. A loop would be tied in the end of the line either with a bowline or a figure 8 on a bight. Then feed the other end through to make the slip knot around one end. Tie a half hitch every foot or so along the tent until you are about a foot from the other end. Tie your last half hitch and then a tautline hitch to tighten the last loop and secure the tent.

b. Would webbing have been easier to use and why or why not?

Webbing would be easier on your hands when loading this heavy object. All of the knots listed would work with webbing to.



Review of the Objectives.

1. To continue the skills learned in the Basic Knots for CERT program. You will need the basic skills knowledge to do this program.
2. Discuss some tricks of the trade to learn more about ropes and knot systems.
3. Discuss construction of cordage and various types of ropes.
4. To provide the member with additional knots that are useful in the field.
5. To provide practical exercises that will be useful to apply these new skills.

Did you learn something about each of these objectives?