



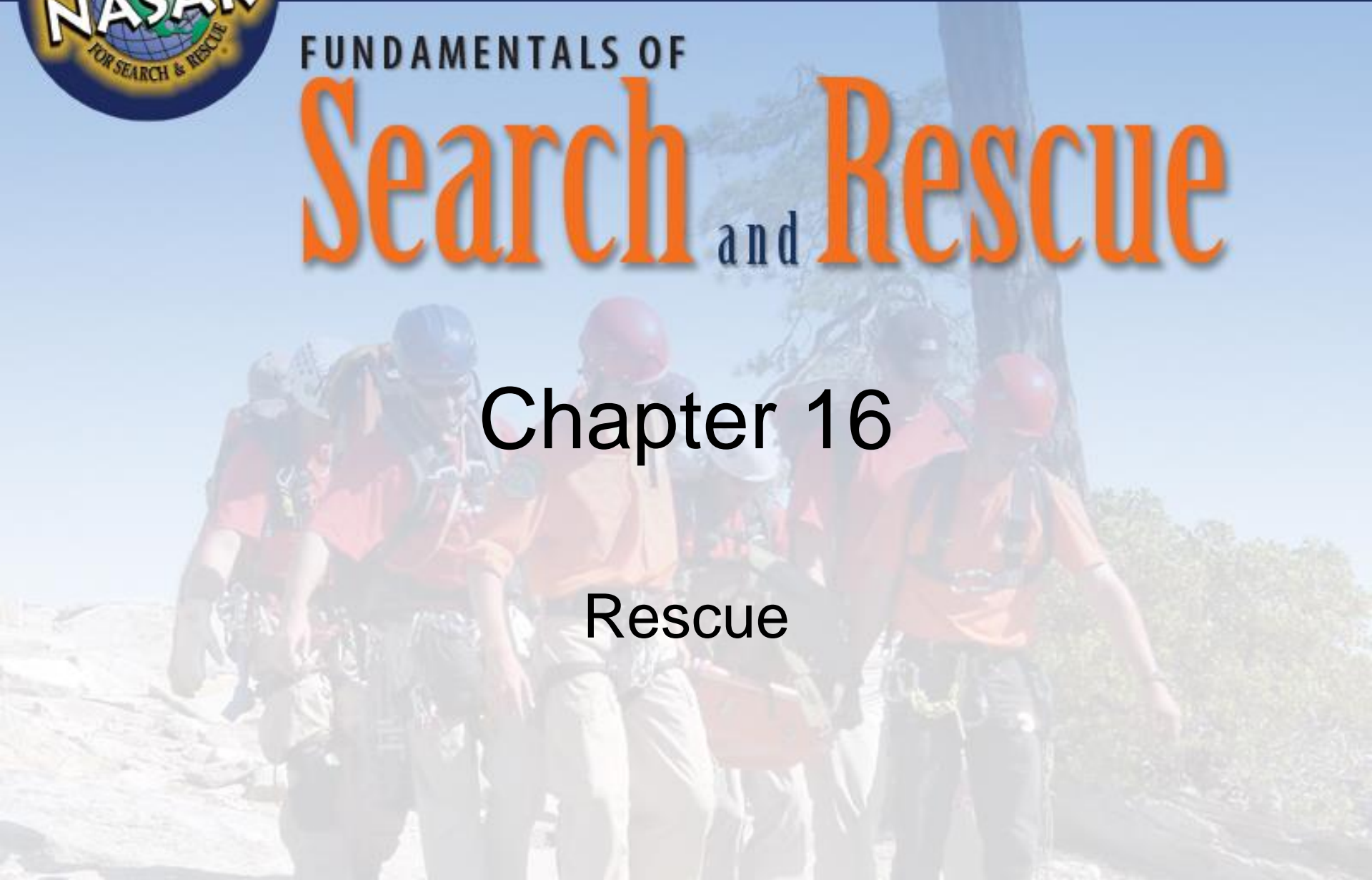
National Association for Search and Rescue

FUNDAMENTALS OF

Search and Rescue

Chapter 16

Rescue





Objectives (1 of 3)

- List at least two types of materials and designs used in rope manufacture.
- Define and describe the following:
 - Dynamic rope
 - Static rope
 - Webbing
- List at least five rules of rope etiquette.



Objectives (2 of 3)

- List three harness classifications.
- Describe how to correctly tie these knots:
 - Figure 8 on a bight
 - Figure 8 bend (follow through) around an object, joining two ropes together
 - Water knot (overhand bend)
- List the different advantages and disadvantages of materials used in carabiners.



Objectives (3 of 3)

- List the functions of at least two different types of carabiners and describe procedures used in caring for them.
- Describe the advantages and disadvantages of at least two types of stretchers or litters.
- Describe how to tie an improvised harness.
- Describe the procedures for packaging a patient and transporting him or her via litter.



Disclaimer

- This section is not intended to serve as a comprehensive work on rescue. This is an introduction for SAR personnel to some of the equipment, skills, and terms used in wilderness and rope rescue.



Rope Rescue

- Rope and rescue equipment has evolved to a high standard.
- This chapter is an “awareness” introduction.
- Rope rescue is inherently dangerous.
- Proper and extensive training and experience should be gained before using.



Rope Construction

- Most common materials used to manufacture ropes are nylon and polyester.
 - Do not rot
 - Easily inspected for repair
 - High strength-to-weight ratio
- Types of rope construction include:
 - Laid
 - Braided
 - Kernmantle



Laid Rope

- Small strands of twisted fibers combined to form the rope
- At one time, laid rope was the most common rope used for climbing and caving.
- “Untwists” when loaded with weight
- Not a good choice for a lifeline



Braided Rope

- Woven by overlapping multiple strands
- Fibers are exposed to abrasion
- No center core
- Not recommended for emergency use or as a lifeline
- Commonly used for utility purposes



Kernmantle Ropes

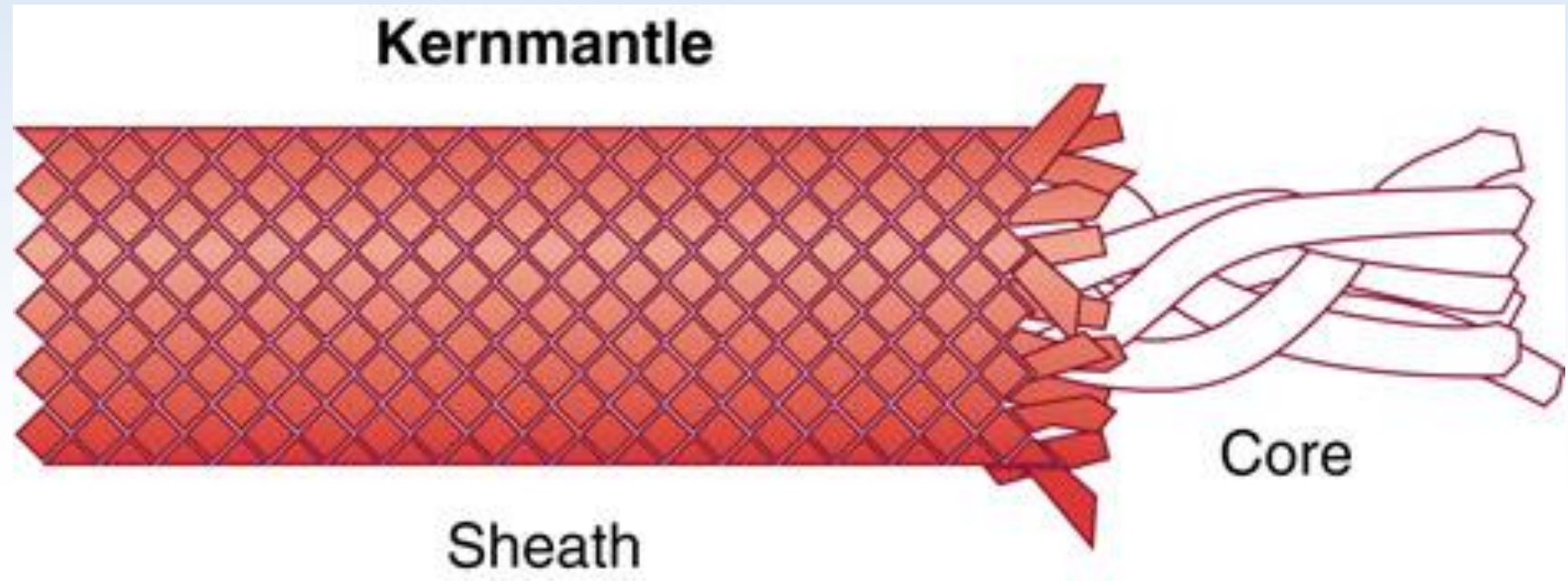
- Constructed using two parts:
 - Outer sheath (woven tube)
 - Inner core (strands of fibers bundled together)
- Very strong, easy to tie knots in, and abrasion resistant
- Good lifeline



Types of Kernmantle Rope

- Static or low stretch
- Dynamic or high stretch
- Both can be used by rescuers and emergency personnel.
- Rule of thumb:
 - *Static* when not climbing, only hauling
 - *Dynamic* when climbing or risk of a fall exists

Kernmantle Rope Construction





Webbing

- Light, easier to pack, and can be used in a variety of situations
- Two main types:
 - Flat
 - Tubular
- Can be used as an improvised harness or anchor attachment, or to secure a patient to litter



Static Safety Factor (1 of 2)

- NFPA 1983, Standard on Fire Service Life Safety Rope and System Components.
 - Requires a safety factor of 15 :1
- Defines a one-person as 300 lbs
 - 15:1 requires a 4500-lb breaking strength rating for rope



Static Safety Factor (2 of 2)

- Some wilderness SAR teams rely on a 10:1 safety factor
 - Allows for lighter equipment
 - Tend to be highly trained in the care and use of rope and aware of limitations
 - May be adequate for most situations



Knots and Safety Factor

- A knot in a rope will reduce its strength by 30%.
- A ring bend (water knot) in webbing will reduce its strength by 50%.
- Reduction is not cumulative.
 - A single knot will have the same effect as two or three knots.



Software Care (1 of 3)

- Keep a log.
- ID marking
- Size
- Type
- Manufacturer
- Date purchased
- Date in service
- Where purchased
- Lot number
- Detailed history of use



Software Care (2 of 3)

- Never step on or drag a rope or rescue software.
- Use in a responsible manner and keep a log of its storage and use.
- Protect from abrasion.
- Do not leave rope under tension for any length of time and remove knots as soon as possible.
- Store all software properly.



Software Care (3 of 3)

- Clean gently and properly.
- Avoid exposing software to sunlight (UV) and high temperatures.
- Avoid nylon running across nylon (synthetic running across synthetic).
- Avoid storing rope kinked; avoid kinking while coiling rope.
- Check all software for damage often: at least before and after use.



Software Inspections

- Discoloration
- Shiny areas
- Fuzzy or torn exterior
- Smaller or larger diameter areas
- Soft spots in rope



Harnesses

- NFPA categorizes life safety harnesses into three classifications:
 - Class 1: Seat-harness for one-person load
 - Class 2: For two-person load
 - Class 3: A full-body harness
- Chest harness is optional; will keep rescuer upright.
- “Swiss Seat” is an improvised harness.



Knots

- Only a few are needed in most rescue situations.
- Learn a few useful knots and practice them often.



Knots, Hitches, and Bends

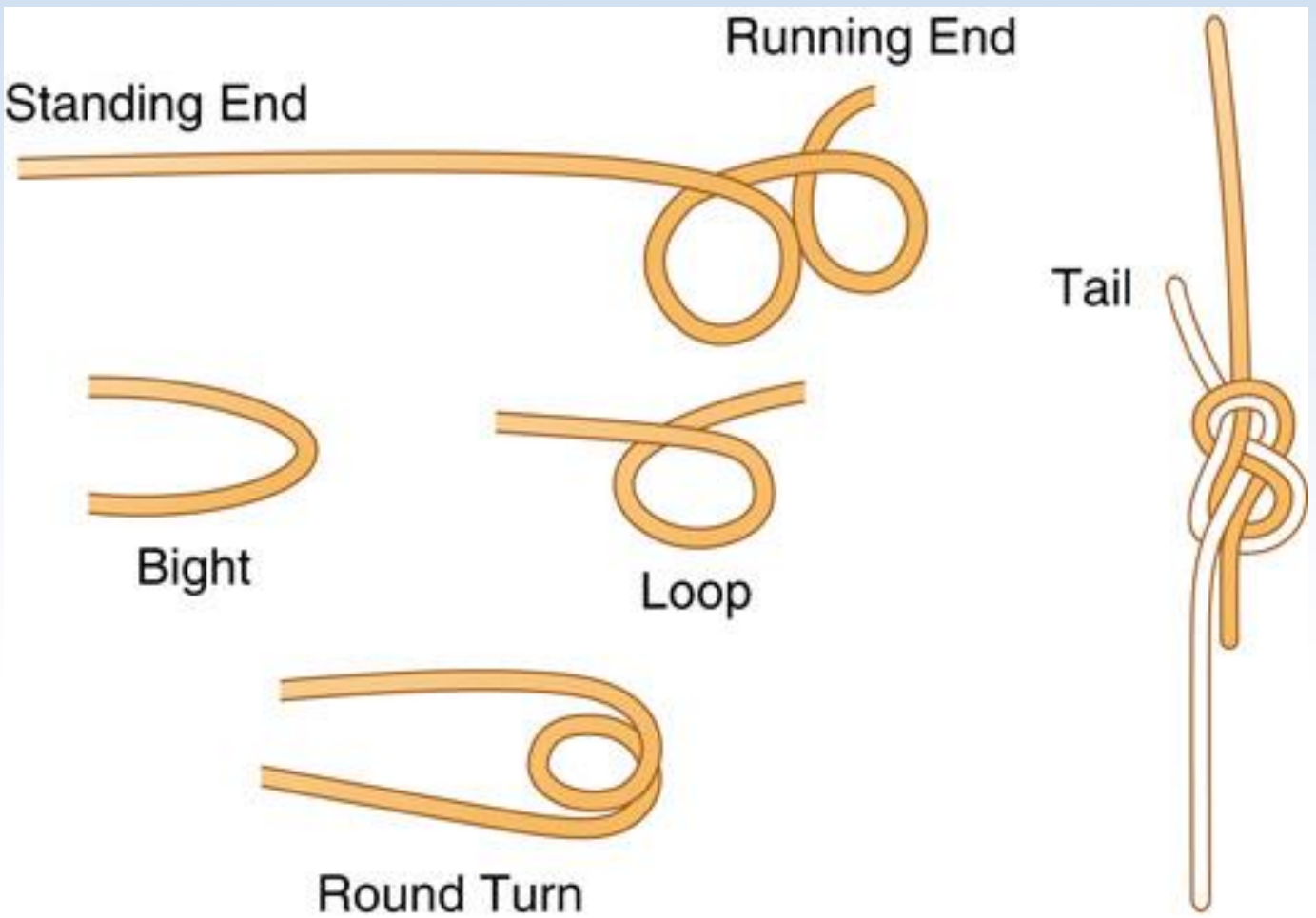
- “Knot” refers to a broad class of rope attachments.
 - Bend: Knot used to join two pieces a rope
 - Hitch: Used to attach a rope to a fixed object or fixed rope



Parts of a Length of Rope (1 of 2)

- Bight: A bend placed in a rope
- Standing End: Portion of the rope that does not move in the knot creation
- Running End: End that is being moved about in the tying of a knot
- Tail: Unused rope that is left over after the knot has been tied

Parts of a Length of Rope (2 of 2)





Family of Figure Eight Knots

- Most Versatile
- Easy to tie
- Easy to untie
- Easy to teach to others
- Easy to remember
- Hold Fast
- All characteristics of any good knot

Figure Eight Knots

- Figure Eight on a Bight
 - Attach the rope to a
 - carabineer or other
 - object

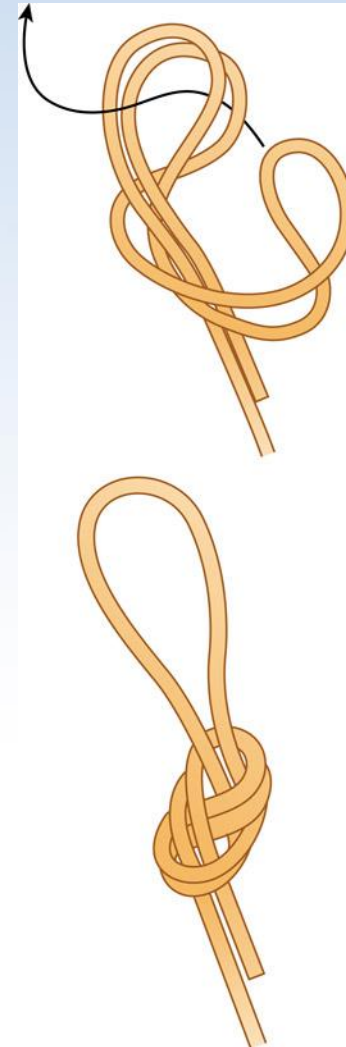
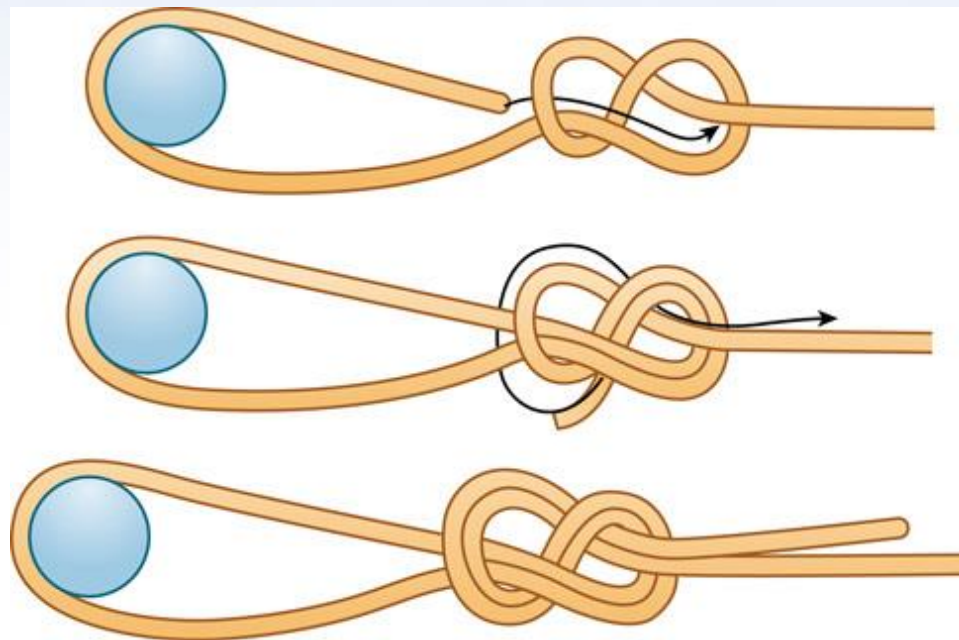


Figure Eight Knots

- Figure Eight Follow Through
 - Used when a loop cannot be placed over an object

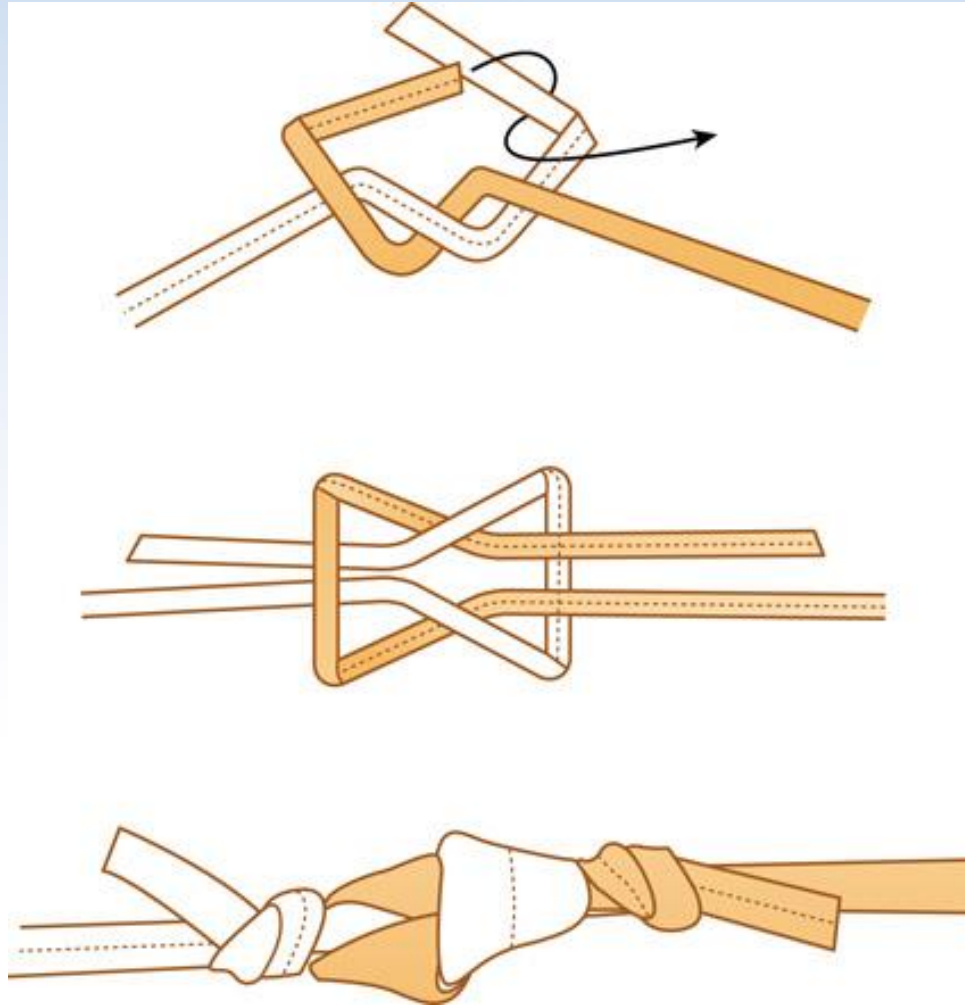




Knots in Webbing (1 of 2)

- Webbing will require specialized knots and bends.
- Webbing is generally used in the construction of anchors and field-expedient seat harnesses.
- Bends are more common in webbing than knots.

Knots in Webbing (2 of 2)





Prussik Sling (1 of 2)

- Accessory cord, tied into a loop with a secure knot
- Used to attach a harness to a lifeline
- Secure into a carabineer attached to the harness
- Attached to the lifeline with a three-loop wrap



Prussik Slings (2 of 2)

- When not loaded, the prussik will move easily along a lifeline.
- When loaded, the prussik grabs the lifeline and holds fast.
- It is important to receive proper instruction in the use of these slings.



Carabiners

- A metal link with a spring-loaded gate
- Connect webbing and rope to harnesses, litters, and anchors
- Come in many types, materials, and configurations

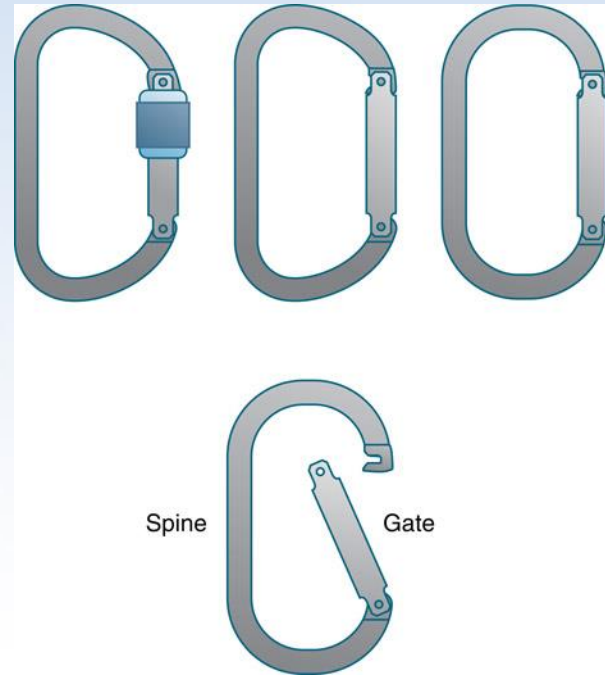


Carabiner Types

- Non-locking: Spring-loading gate that securely closes over a pin; nothing to keep the gate securely closed
- Locking: Means of preventing the gate from opening unintentionally
- Screw or sliding barrel-type mechanism
- Locking carabiners are generally preferred for rescue operation.

Carabiner Shape

- Oval
- “D”
- HMS (pear-shaped)





Carabiner Materials

- Steel
 - Strength and durability
 - Heavy
 - Tends to rust
 - Costs more than aluminum
- Aluminum
 - Lighter
 - No rust
 - Cheaper than steel
 - Easily damaged by dropping or shock loading



Litters and Baskets

- Used to carry a patient
- May be hand carried or used with ATVs, trucks, aircraft, or other machines
- Three main types
 - Improvised
 - Wire basket
 - Wrap-around/plastic

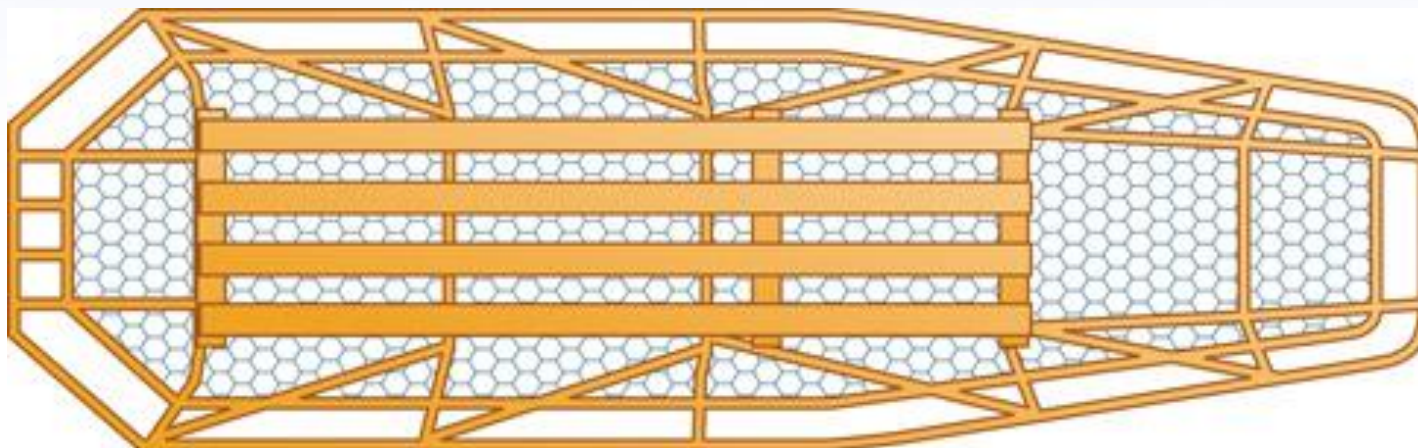


Improvised Litter

- Made from available materials
- Use pack and contents to construct
- Good choice for fast extrication of patient *without* spinal injuries

Stokes or Wire Basket

- “Stokes” is a generic term that includes all of the military basket-style litters.
- Metal tube frame with slat and wire supports
- Use caution with top rail strength.





Plastic Basket

- Metal tube with molded plastic support for patient
- Slides easily over surfaces
- May be weak depending on design
- Avoid sunlight.



Wrap-Around Litters (1 of 2)

- Essentially a drag sheet made from heavy duty plastic
- Designed to be used with the Oregon Spine Splint (OSS II)
- OSS is a short backboard and shoulder board that helps immobilize the head and neck.
- Keeps the SKED[®] from collapsing around the patient



Wrap-Around Litters (2 of 2)

- Great design for caves and confined spaces
- Easily transported
- Drawback is lack of rigid frame to protect patient and allow easy carry by rescuers



Packaging

- The manner in which the patient is packaged depends on:
 - His or her medical condition
 - Environment
 - Manner in which patient is to be evacuated



Litter Accessories

- Litter wheel
- Face shield
- Blankets and bags
- Helmets
- Rope or system for securing patient



Litter Handling

- Moving patients to a place of safety
- Lifted by rope
- Carried by vehicles
- Carried by rescuers



Litter Handling Rules

- Communicate with the patient.
- Do not refer to patient as “victim.”
- Do not step over the patient .
- Be careful with ends of webbing.
- Do not to shine lights into the patient’s eyes.
- Be careful when using knives or scissors around the patient and rigging.



Litter Handling Methods

- Standard carry
- Caterpillar/lap pass
- Turtle carry
- Strap carry
- Tag line carry