Last Updated:
3/4/2021

Dragonfly Aerial Company

Level 1 Teacher Training

Session 5

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Introduction Activity

- Introduction
- What do you remember from last week?

Agenda

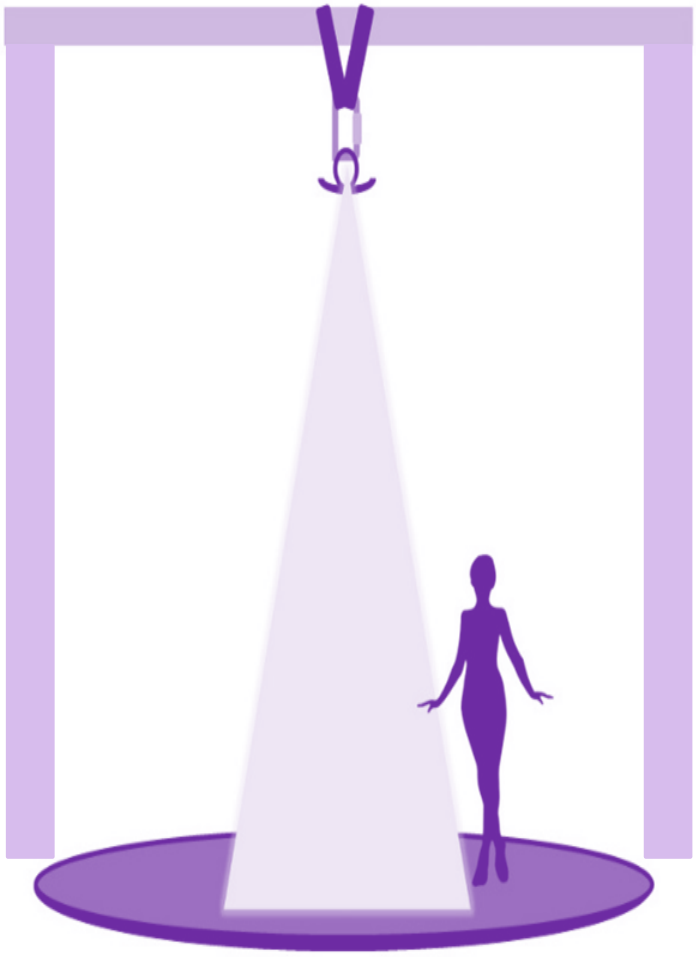
- Review
- Elements of Aerial Rigging
- Shock Load
- Safety Ratios
- Hardware
- D:d Ratio
- Wraps and Bridles
- Warm Up by Holly
- Review: Crochet & Double Knee Drills/Climb
- Focus: Single Tail Lock & Double Foot Lock
- Cool Down by Maya

Session 4 Review Quiz

Free Response:

1. What are the three elements that must be present for a Teach-Student Contract to be a success?
2. What are the three types of boundaries a teacher must maintain? Examples?
3. Give some examples of Respecting the Art Form
4. Give some examples of Diminishing the Art Form
5. Resistance is a form of _____
6. The root of fear is lack of _____
7. What are the four categories of resistance?
8. Name of the different influencing factors that can impact a students learning experience? (Know Your Students)
9. Name some of the challenges/fears a student might encounter while taking an aerial class?
10. What are the six Classroom Management tips for preventing catastrophic falls in your class?

Elements of Aerial Rigging



1. Overhead Anchor
   Secure point to rig from: I-beam, truss, or structural support
2. Software*
   Wrap-able material: spansets, slings, loops, webbing, and ropes
3. Hardware
   Used to connect to the next rigging element: rescue 8's, carabiners, swivels, shackles, quick links, O-rings, etc
4. Apparatus
5. Aerialist
   The only conscious element of the system and in charge of making all the decisions
6. Mats
   Fall protection: panel mats, landing pads, foam pits. Depends on the type of training an aerialist intends to do
   <u>Experience does not negate fall protection requirements!</u>

Understanding the Aerialist: What do you really weigh?

"It is not the fall that kills you, but the sudden stop at the end." -unknown

- The human body can only take 1800lbs of force before a person blacks out and has internal organ damage or failure, 2500lbs of force is fatal.
- The aerialist has the most control over the entire rigging system with the ability to change choreography to reduce the overall impact to the body and equipment!
- Shock Load: When an object in motion is met with and equal (or greater) opposite force, its motion is halted suddenly. The force of that sudden stop is the shock load.
- A shock load force is exerted on BOTH the object and whatever stops the object's fall.
  - You are the falling object
  - The rigging is what will stop your fall

Shock Load Formula

$$\text{Shock Load} = W * \left[\left(\frac{D_f}{D_s} \right) + 1 \right]$$

- W = Weight of the object
- Df = Distance object is falling
- Ds = Distance required to stop the object from falling
  - The most difficult part to ascertain in the formula
  - Stopping distance includes lengthening in rigging, stretch in fabric, crash pads, engagement, and cushion of the flesh (thighs vs ankles)
- Example:

  A 120-pound aerialist does a slack drop where the falling distance is 4 feet, and the stopping distance is 1 foot. How much shock load is created? What if the stopping distance is 6 inches?

Shock Load

- Load Cells are devices that measure the force with greater accuracy than the formula can provide since estimating the stopping distance is difficult and often inaccurate

- Most sports require equipment that has experienced a shock load be retired
- How do aerialists safely train/perform if they aren't retiring their equipment after each use?

How strong does it need to be?

- Safety Ratios provide a cushion of capability
- 10 times the Static Load
  - The weight of the performer and the equipment
  - Ex: 120 pound aerialist and 5 pounds of equipment need at least 1,250lbs of support
- 6 times the Characteristic Load
  - The dynamic force/shock load created by the performer
  - Ex: Choreography includes a drop that registered 700 pounds on a load cell needs 4,200lbs of support
- 3 time the Peak Load
  - Maximum force the equipment will exert, safety mechanism for breaking motor lifts
  - Ex: Motor with a peak force of 1,200 pounds needs 3,600lbs of support

Of the three calculations, choose the BIGGEST!

Hardware

- Use the information of how strong it needs to be to determine the rating you need when purchasing hardware
- All hardware used must have a rating from the manufacture, preferably stamped on the equipment
- Hardware Rating Information
  - kN: KiloNewton
    - Metric unit of force, 1 kN = ~225 pounds
  - WLL: Working Load Limit
  - Design Factor: Safety Ratio determined by the manufacturer
  - MBS: Minimum Breaking Strength
    - MBS = WLL x DF
- Circus standard: convert to working load to breaking strength
  - Nothing we use is designed for how we use it, makes WLL based on the manufacture's intentions misleading

Rigging Equipment Industries

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ANSI-Climbing

- Uses KiloNewtons to designate MBS/WLL
- Carabiners
- Rescue 8's
- Swivels
- Rope
- Slings
- Aluminum more common

Arena-Industrial

- Uses Tons/Pounds to designate MBS/WLL
- Shackles
- Quicklinks
- Chain
- Spansets
- Wire Rope
- Steel more common

Activity:
Hardware Handling

Metal Types

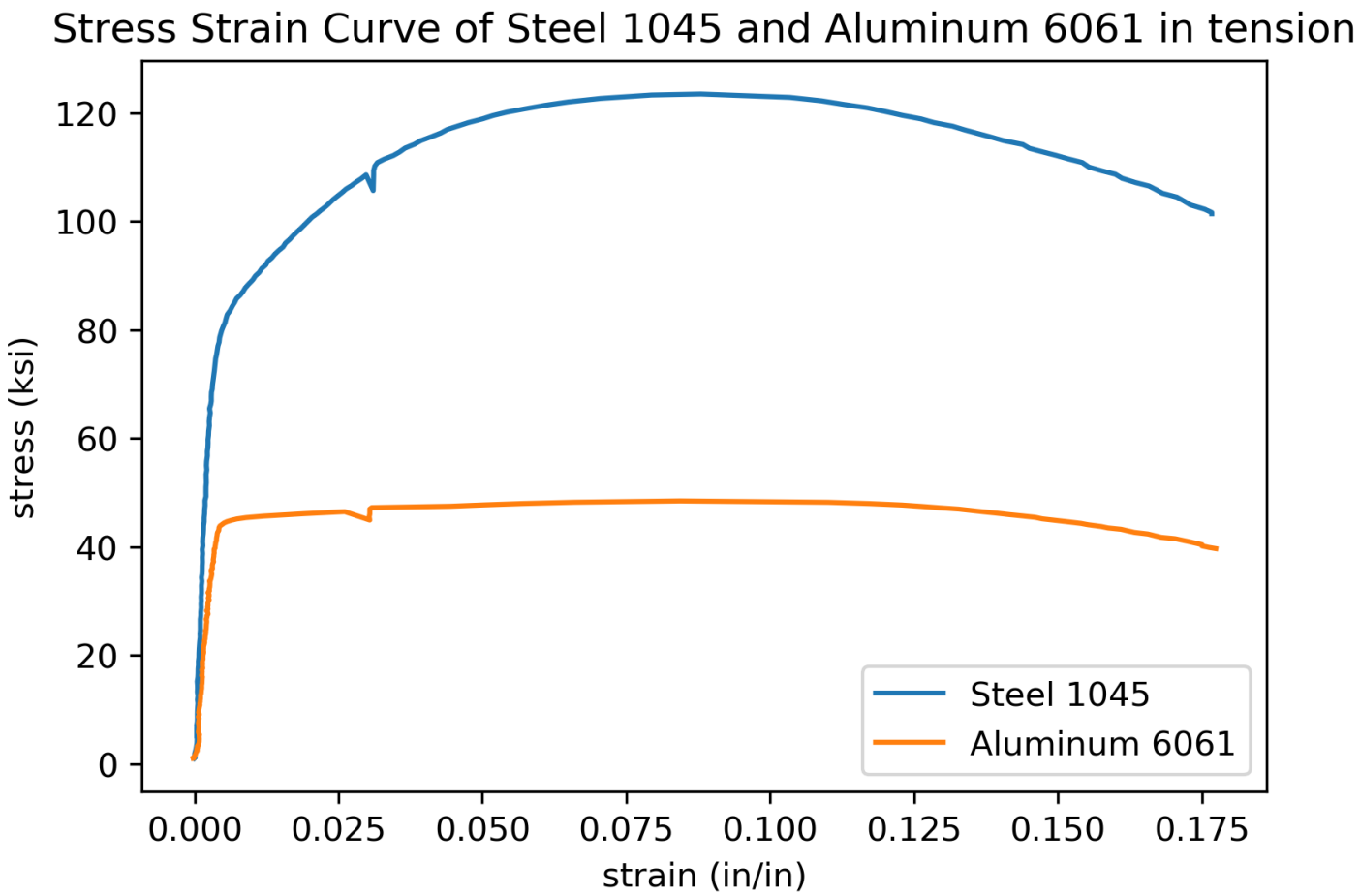
Aluminum

- Very little deformation past yield point
- Stronger by weight
- Rust resistance
- Milled to shape

Steel

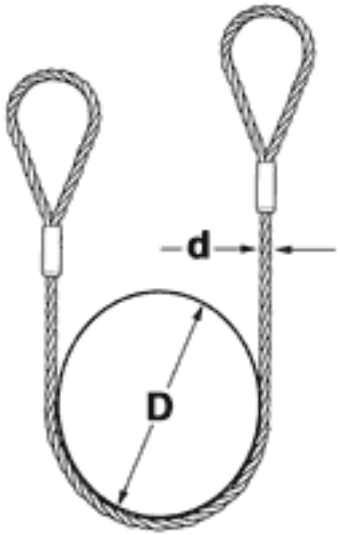
- Significant deformation past yield point
- Stronger by mass
- Abrasion resistant
- Forged to shape

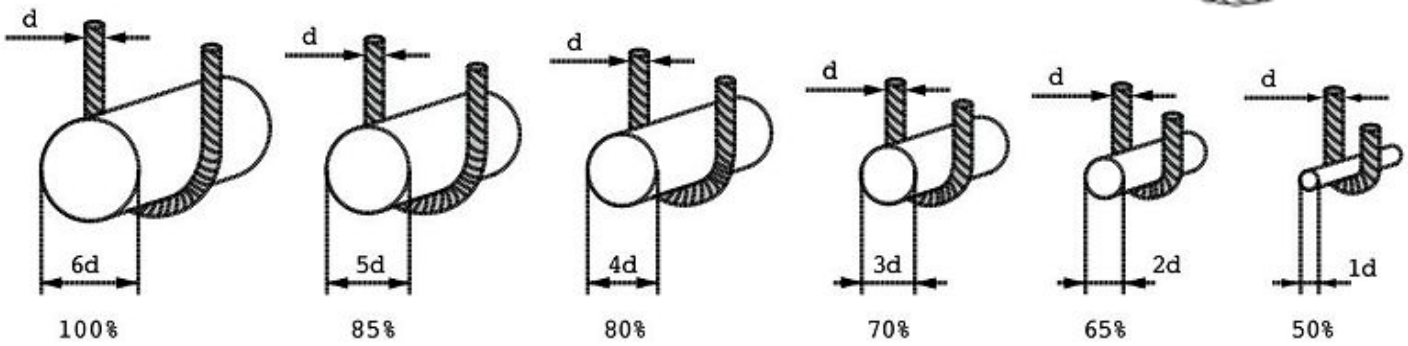
- Combining metals is debated a lot in rigging but steel will wear down aluminum faster
- Deflection: the amount of stretch an item has under strain and will return to its original form
- Deformation: when an item cannot return to its original form
- Yield Point: the point at which an items shifts from deflection to deformation



Software

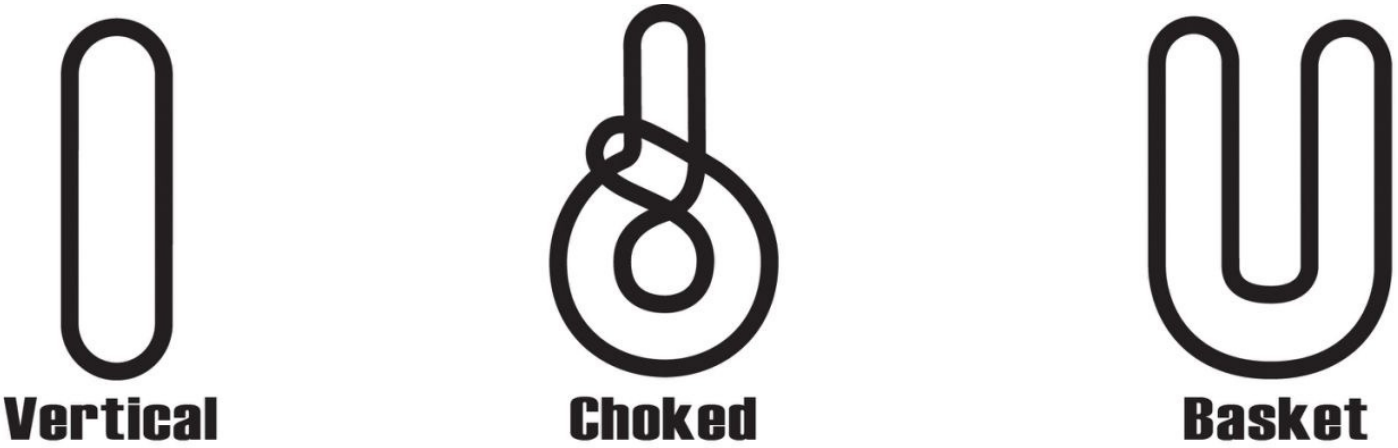
- Rigging that is utilizes wraps and bends to create connecting points
- D:d Ratio
  Comparing the diameter of the rope/sling to the diameter of what it is being wrapped around





- Wrapping around an object with a diameter that is too small will decrease the strength of the equipment being used
- Knots in ropes decrease the strength depending on the tightness of the bend in the knot

Wraps and Ratings



- Every wrap has it place in aerial rigging so long as it is intentional
- Baskets are the strongest
  - Basket strength can be undermined by bad bridling angles
  - What makes baskets the strongest of the three options?
- Chokes are the weakest
  - Choke strength can safely maintain height over a bad bridle
  - Why do you think the choke orientation is weaker than vertical orientation?

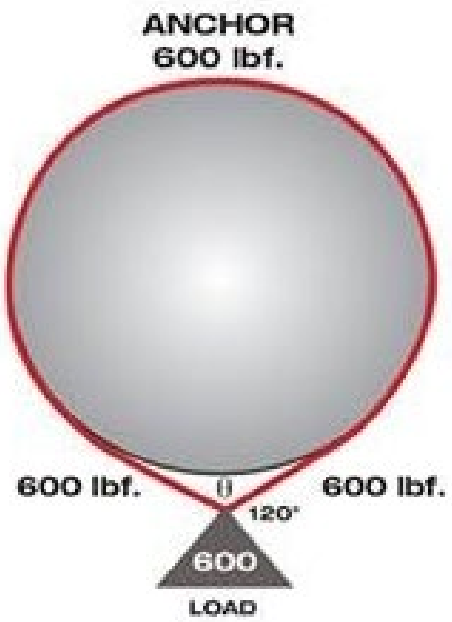
Bridling

ANCHOR FORCE AND LOAD RELATIONSHIPS

Forces on Anchor Web (Rope) Due to Critical Angle (θ)

0.5 x Load

0.7 x Load



1 x Load

Overhead Anchor

"For every action, there is an equal and opposite reaction."
-Newton's 3rd Law of Motion

- Factors with overhead anchors: height, length, location
  - Taller beams experience less deflection
  - Shorter beams experience less deflection
  - Rigging in the middle causes more deflection
  - Cantilevered Loads experience more deflection than Point Loads
- Load Path: the force as throughout the entire system
  - It is not just the anchor point, it is the entire pathway back to the ground

Where are the forces?