

All Things Climber  
from the manual and Q&A  
+  
Useful pictures from Ligerbots  
FRC 2877 ([link to their Flickr](#))

# Rules from Steamworks Manual (as of 2/4)

## 1.5 This Document [the manual] and its Conventions

The intent of this manual is that **the text means exactly, and only, what it says**. Please avoid interpreting the text based on assumptions about intent, implementation of past rules, or how a situation might be in “real life.” There are **no hidden requirements or restrictions**. If you’ve read everything, you know everything.

## 1.8 Question and Answer System

Questions about any 2017 Game and Season Manual content may be asked to FIRST using the official Question and Answer System (i.e. “the Q&A”), which opens on January 11, 2017, noon Eastern. Details on the Q&A can be found on the FIRST STEAMWORKS Game and Season Materials website. The Q&A is intended to help clarify rules, and sometimes the responses result in revisions to the text in the official document (which is communicated using Team Updates).

The Q&A is not a resource for rulings on hypothetical strategies or situations or a design review of a ROBOT system for legality. **The responses in the Q&A do not supersede the text in the manual**, although every effort will be made to eliminate inconsistencies between the two. **While responses provided in the Q&A may be used to aid discussion at each event, per Section 10.6 REFEREE Interaction and Section 9 Inspection & Eligibility Rules, REFEREES and Inspectors are the ultimate authority on rules.** If you have concerns about enforcement trends by volunteer authorities, please notify FIRST at [firstroboticscompetition@firstinspires.org](mailto:firstroboticscompetition@firstinspires.org).

# Rules from Steamworks Manual (as of 2/4)

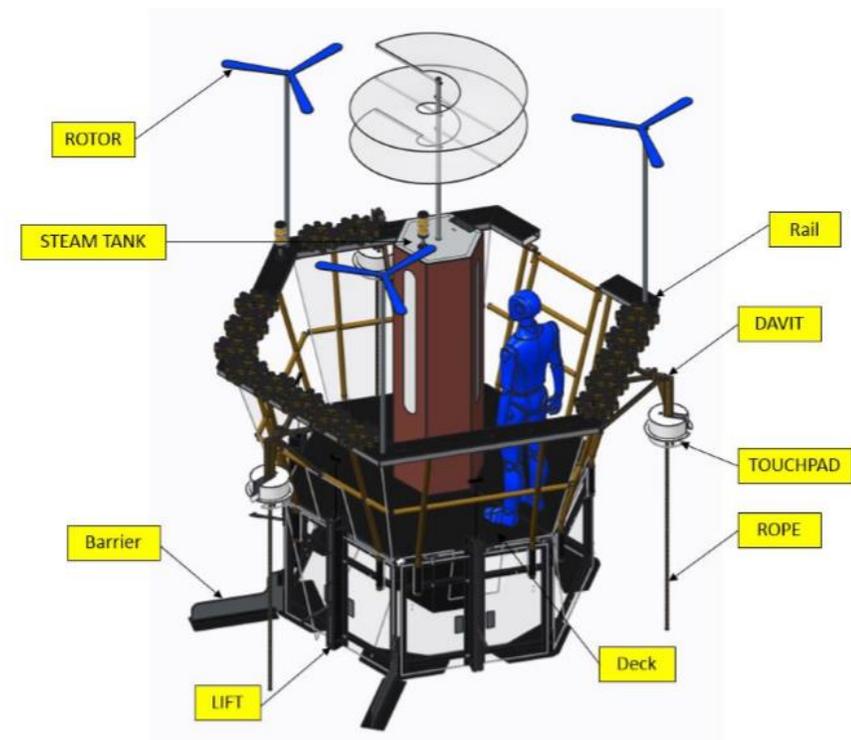
Figure 3-6: Gate locations



## 3.4 AIRSHIP

The AIRSHIP is a structure that features an elevated hexagonal deck, slanted walls, rails with AXLES to mount GEARS, four (4) ROTORS, three (3) LIFTS, a STEAM TANK, and three (3) ROPES attached to DAVITS. There is one AIRSHIP at the edge of each LAUNCHPAD. The AIRSHIP is positioned such that the three (3) LIFTS face the ALLIANCE wall. The maximum capacity of the AIRSHIP is two (2) people.

Figure 3-7: AIRSHIP elements

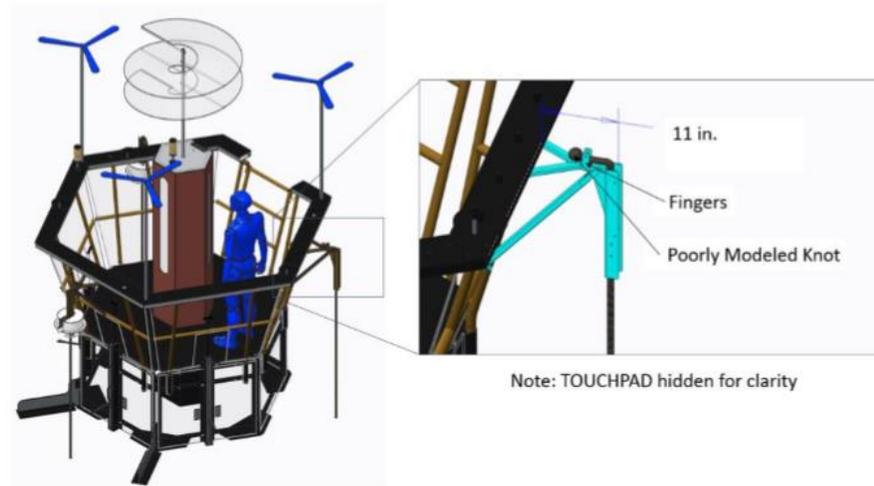


# Rules from Steamworks Manual (as of 2/4)

## 3.7 DAVIT

A DAVIT is one of three steel frames that attaches a ROPE to the AIRSHIP. Each DAVIT extends 11 in. (~28 cm) from the railing of the AIRSHIP. Each DAVIT has a 2-in. (~5 cm) wide by 2-in. (~5 cm) deep vertical steel channel used to cradle the ROPE and to mount the TOUCHPAD. There are two (2) steel fingers at the top of each DAVIT used to secure the ROPE. These fingers are 1¼ in. (~3 cm) apart and have a hole for a locking pin. The ROPE passes through the fingers with the top knot on the AIRSHIP side of the fingers.

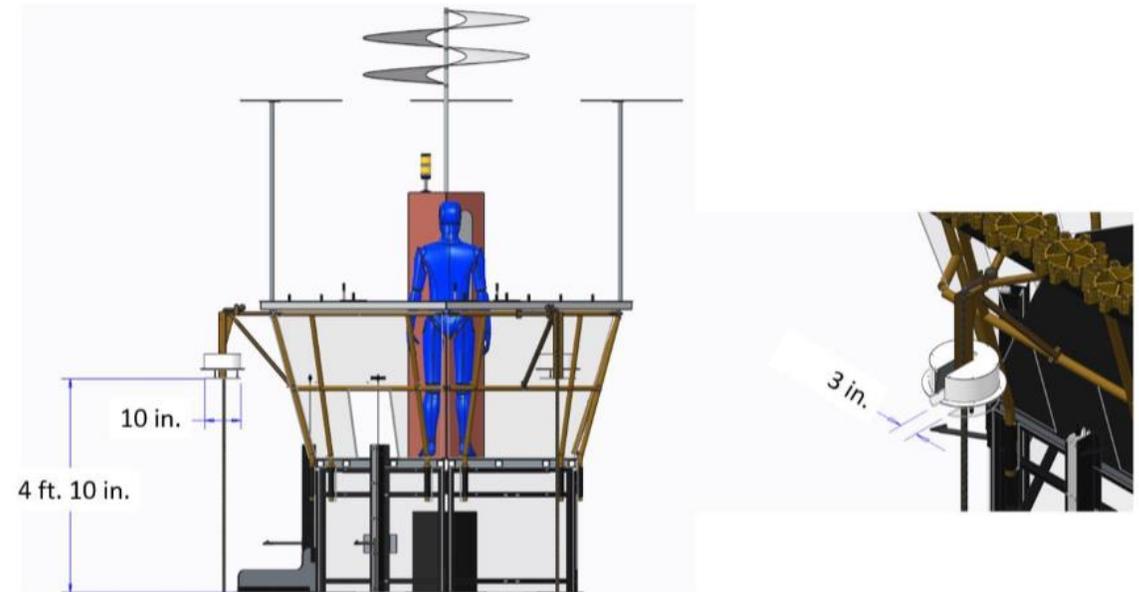
Figure 3-18: DAVIT location and geometry



## 3.9 TOUCHPAD

Each TOUCHPAD is a 10 in. (~25 cm) polycarbonate plate mounted 4 ft. 10 in. (~147 cm) above the carpet and used to determine if a ROBOT has successfully latched on to the AIRSHIP (i.e. ready for takeoff) at the end of the MATCH. The plate has a 3 in. (~8 cm) wide by 6 in. (~15 cm) deep rectangular cut-out to aid in assembly and ROPE mounting.

Figure 3-19: TOUCHPAD geometry



The TOUCHPAD plate must be pressed such that the following conditions are met for the ROBOT to be credited with being ready for takeoff at the end of the MATCH:

- A. it's minimally displaced by ½ in. (~1 cm),
- B. it's pressed for a duration of at least one (1) sec, and
- C. it's pressed when the Teleop Period ends at  $T = 0$

The force required to activate the TOUCHPAD (i.e. push the TOUCHPAD plate up by approximately ½ in. (~1.3 cm), causing activation of one or more of its microswitches) is no more than 1 lb. (~½ kg).

The force required to move the TOUCHPAD throughout its full range of travel (i.e. cause the TOUCHPAD plate to travel the full 1½ in. (~4 cm)) is no more than 2 lbs. (~1 kg).

# Rules from Steamworks Manual (as of 2/4)

## 3.9 TOUCHPAD (continued)

While a force less than 75 lbs (~34 kg) applied to the TOUCHPAD plate once it's fully pressed is not likely to damage the TOUCHPAD, be aware that any damage, even if a result of less than 75 lbs of force, is a violation of G15.

Teams may wish to consider a reasonable “safety factor” for TOUCHPAD activation and assume that no more than 3 lbs. (~1.4 kg) of vertical force is required to guarantee activation to account for tolerances, assembly variations, temperature/humidity differences, and other variances.

Figure 3-20 shows the two extreme states of the TOUCHPAD plate. The image on the left shows the TOUCHPAD unactuated and the figure on the right shows one example of an actuated TOUCHPAD (with the plate pressed all the way up). The DAVIT'S steel channel does not move with the TOUCHPAD plate.

Figure 3-21 shows examples where the TOUCHPAD has been sufficiently displaced, but timing varies. Activations in red indicate that the requirements were not met, and the ROBOT was not credited with “ready for takeoff” points defined in Table 4-1. Activations in green meet all criteria and credit the ALLIANCE with associated points.

Figure 3-20 Unactuated TOUCHPAD (left) and fully displaced TOUCHPAD plate (right)

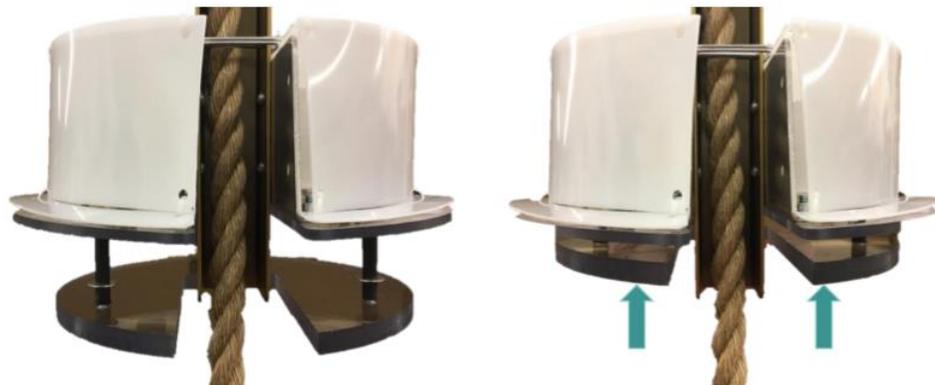
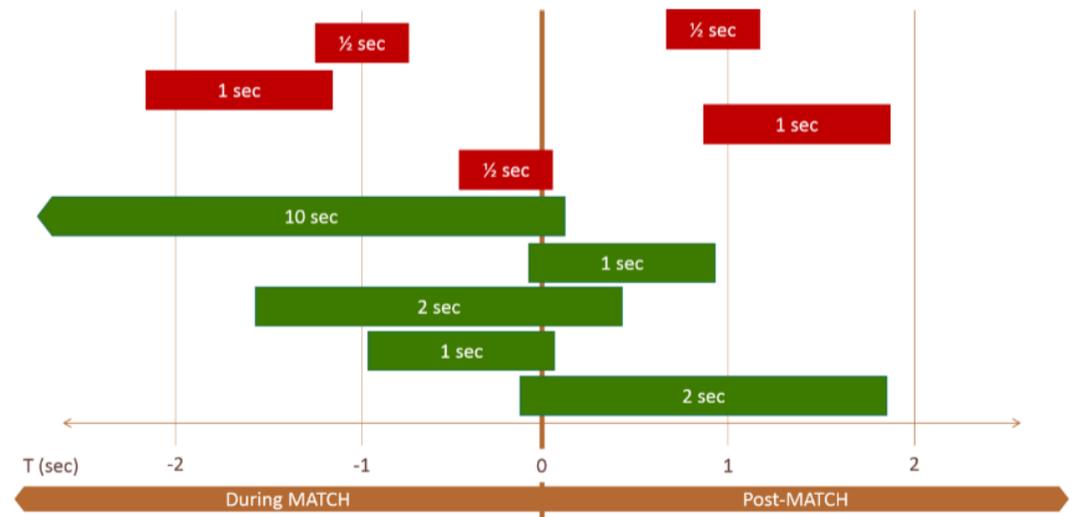


Figure 3-21: TOUCHPAD activation examples.

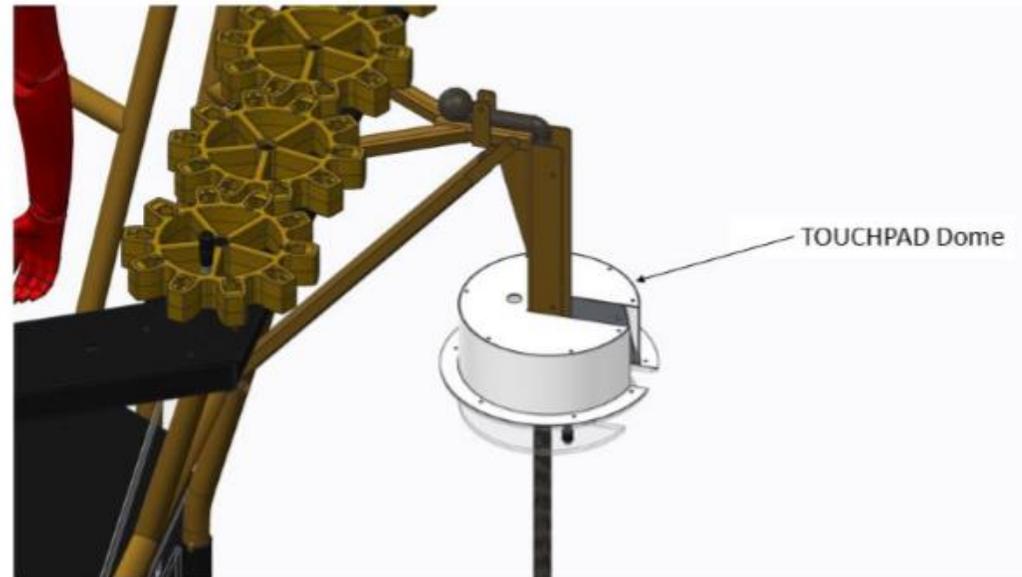


# Rules from Steamworks Manual (as of 2/4)

## 3.9 TOUCHPAD (continued)

A plastic dome is mounted above each TOUCHPAD and indicates if the associated ROBOT is ready for takeoff. When thirty (30) seconds remain in TELEOP, all six (6) domes briefly animate to indicate that they are active. If a TOUCHPAD is pressed by a ROBOT prior to this, the dome remains off. If a TOUCHPAD is pressed during the final thirty (30) seconds of the MATCH and for the minimal duration described in part B above, the dome illuminates in the ALLIANCE'S color and the associated points are added to the real-time score. If a ROBOT causes a dome to illuminate, but disengages from the TOUCHPAD, the dome turns off and the associated points are removed from the real-time score.

*Figure 3-22: TOUCHPAD dome*



# Rules from Steamworks Manual (as of 2/4)

## 3.8 ROPE

A ROPE is a strong, thick string composed of twisted or braided strands of manila, hemp, flax, or the like, secured to the AIRSHIP, and used to secure ROBOTS for flight at the end of the MATCH. As described in Section 4.2 Match Setup, Teams are invited to bring and install their own ROPE. If they don't, they can expect default FIELD ROPES installed. These default ROPES are three (3), 1 in. (nominal) thick by 7 ft. 2 in. (~218 cm) long polypropylene "Manila" style ROPES from Knot and Rope Supply, SKU 0162. Each default ROPE is knotted at the top, fused at the bottom, suspended from a notch at the end of each DAVIT, and coiled and stowed on the outside of the AIRSHIP. The ROPE passes through the center of the TOUCHPAD and hangs down to the FIELD carpet. The PILOT pulls the ROPE'S retention strap to deploy the ROPE.

## 9 Inspection & Eligibility Rules

**104. ROPES have to be inspected.** A Team must submit any ROPE they intend to use in a MATCH for Inspection. A ROPE must meet the following criteria (see Figure 9-2 for letter references):

- A. have a maximum width (W) of 1 in. (nominal) (e.g. exclusive of any knot widths)
- B. be designed/configured to be at least 5 ft. 3 in. (~160 cm) long measured from the side of the ROPE'S retaining feature (per I04-E) that abuts the DAVIT fingers (L), to the farthest point on the ROPE from this feature.
- C. be designed/configured to not exceed a length of 8 ft. (~244 cm) measured from the side of the ROPE'S retaining feature (per I04-E) that abuts the DAVIT fingers (L), to the farthest point on the ROPE from this feature.
- D. consist entirely of (except for an adhesive applied by the VENDOR as part of the normal manufacturing process for a COTS item and no longer tacky, e.g. a "binder coat") flexible, non-metallic fibers sewn, twisted, tied, woven, knitted, crocheted, intertwined, or braided together except for the last 4 in. (~10 cm) of any cut end (E) which may be whipped (with material that is flexible and non-metallic) or fused only to prevent fraying.

(See illustration next page)

# Rules from Steamworks Manual (as of 2/4)

Figure 9-1 ROPE examples

## 9 Inspection & Eligibility Rules

### I04. ROPES have to be inspected (continued)

- E. be configured such that it engages securely with the FIELD with a Retaining Feature (RF) that does not extend more than 2 in. (~5 cm) below the DAVIT fingers.
  - To interface with the field a ROPE must have a retaining feature (e.g. a knot) greater than 1 in. (~25.4 mm) in diameter to interface with the DAVITS (RF).
- F. if knotted, the top knot must be at least 29 in. (~74 cm) below the retaining knot/feature (K)
- G. if frayed, knotted or looped, the total diameter does not exceed 10 in. (~25 cm) (D)
  - If the ROPE has a loose loop such that, uncompressed it's 12 in. (~30 cm) in diameter, but it can be easily compressed by hand to less than 10 in., that ROPE has met the requirement of part I04-G.
- H. be designed/configured to not exceed a length of 5 in. (~12 cm) measured from the side of the ROPE'S retaining feature (per I04-E) that abuts the DAVIT fingers, to the closest end on the ROPE from this feature (S). (see text at right)
- I. be flexible such that it's not capable of being pushed to activate the TOUCHPAD.
  - Flexible means that if the ROPE is held at any point, it should not extend more than 12 in. (~30 cm) above the point where it is held. ROPES are meant to be pulled, not pushed.



The intent of I04 is to allow Teams the convenience of bringing their own ROPE for reliability and predictability purposes, as well as accommodate some modifications to ease the challenge associated with accessing the TOUCHPAD (e.g. tying knots).

The modifications allowed are limited, however. For example, consider the limitation of the purpose of whipping or fusing to prevent fraying in I04-D and that FIRST Robotics Community members are innovative and may discover a way to fuse the end of the ROPE in a way that can be leveraged for competitive advantage. This "superfusion" extends the fusing's purpose beyond only preventing fraying.

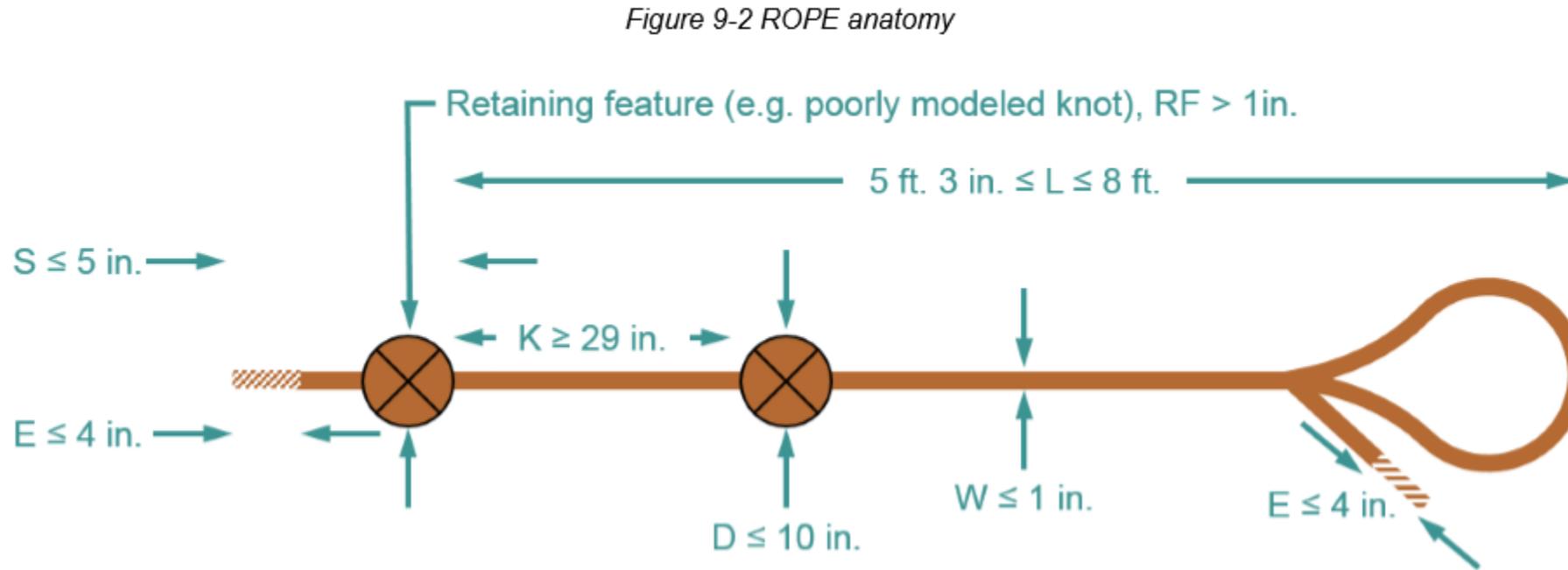
We acknowledge that this could result in temptation to implement the superfusion method anyway and hope an Inspector doesn't notice, or that you will be able to convince them the superfusion method really is "only to prevent fraying." Please don't do this. It will likely lead to a bad experience both for you and the volunteer who really does want you to participate in the event, but with a 100% legal ROBOT.

# Rules from Steamworks Manual (as of 2/4)

## 9 Inspection & Eligibility Rules

### 104. ROPES have to be inspected (continued)

See references to rope anatomy labeled below in text on previous pages:



**106. Changes to a ROPE need re-inspection.** If a ROPE is modified after it has passed its most recent Inspection, that ROPE must be re-Inspected before the ROPE is eligible for a MATCH.

# Rules from Steamworks Manual (as of 2/4)

## More on Rope from Q&A

**Question 9:** Are knots included in the length of a rope? Is the length of a rope measured before knots are added or after knots are taken into account?

**Answer:** The measurements dictated per I04 are made as the ROPE is intended to be placed onto the FIELD (i.e. with any knots or loops in place, measure the ROPE end-to-end for I04 B and C)

**Question 10:** Rope materials

Can teams use standard 1" cargo strap webbing as their rope and inter weave cotton fibers into it?

**Answer:** We will not provide rulings on specific designs/materials. There are no rules that prohibit a Team from doing the twisting, tying, braiding, or weaving described in I04-D or that require a ROPE to be made of a single uniform material.

**Question 13:** Rope length clarification

Rule I04 states that ROPE length is "measured end to end". If, for example, a rope had a loop in the middle (like ----o-----), is the length measured as if a measuring tape is placed from one end to the other of the so-configured rope?

**Answer:** We believe 9 answers your question. If it does not, please rephrase your question and resubmit.

**Question 14:** End of Match using your own rope

At the end of the match can a robot with it's team supplied rope be removed together from the field allowing the robot and rope to be separated after leaving the field?

**Answer:** Yes, per the Blue Box beneath R08, "a Team provided ROPE may be removed from the FIELD and is no longer considered a FIELD element once removed from the DAVIT."

**Question 22:** Multiple Rope Materials?

Are ropes allowed to be composed of multiple different materials (each of which comply with I04)? If composed of multiple materials, must those materials be twisted/woven/stitched/braided together to satisfy I04-D, or may they be attached together by other methods? If composed of multiple materials, must each material span the entire length of the rope?

**Answer:** Yes, there are no rules which require a ROPE to be composed of uniform material. Yes, a ROPE must be twisted, tied, woven, or braided, per I04-D. There is no requirement that any component material of a ROPE span the entire length of the ROPE.

# Rules from Steamworks Manual (as of 2/4)

## More on Rope from Q&A

### **Question 57:** Splice = Knot?

Is a splice considered a knot for the purposes of altering the rope?

**Answer:** No, a splice is not a knot. Splicing is defined as "join or connect (a rope or ropes) by interweaving the strands." Thus, a spliced ROPE does consist of fibers woven together (per I04-D), but would need to satisfy the 1 in. maximum width specified in I04-A

### **Question 78:** Can we have multiple ropes inspected at once

May we have more than one rope through inspection or do you need to reinspect for every time we swap out ropes

**Answer:** There is no maximum number of ROPES a given Team may have inspected at a given event. Please keep in mind though that there are limited inspection resources at an event, and we kindly ask that you have a reasonable number of ROPES inspected.

### **Question 89:** Diameter of the rope

Does the diameter of the rope have to be constant throughout the length of the rope or can it vary? Eg a rope that is 1in in diameter at the top, but shrinks to 1/4in diameter at the bottom.

**Answer:** I04 does not require the diameter of the ROPE to be consistent across its length.

### **Question 108:** Detaching Robot from Rope

If the robot has scaled a team-provided rope, may the rope be removed from the davit with the robot still suspended? So, may the robot stay attached to the rope when removing the rope from the field, or must the robot be separated from the rope before both pieces are taken off-field? In question 14, a reference was made to a rule explaining that team-provided rope is not considered a game piece after removal from the davit, but must the robot be detached from the rope before removing the rope?

**Answer:** There is no rule requiring that a ROBOT be removed from a team-provided ROPE before the ROPE is removed from the FIELD.

### **Question 137:** Frayed rope

If the end of an otherwise legal rope becomes frayed, is it still a legal rope?

**Answer:** There is no rule that prohibits a ROPE from being frayed, either intentionally or accidentally. If the fraying (accidental or deliberate) occurs after the ROPE has passed Inspection and it's extensive enough that it could be considered a modification to the ROPE, it must be reInspected per I06.

# Rules from Steamworks Manual (as of 2/4)

## More on Rope from Q&A

### **Question 138:** Knots coming undone

Consider a rope of legal length with a knot. If, during a match, a knot in the rope comes undone such that, if the rope were remeasured, the rope would be longer than 8 ft., would this be a violation of Rule I04c.

**Answer:** Teams should take reasonable steps to ensure knots (or any other portion of their ROPE) does not come undone during a MATCH. That being said, if a knot were to accidentally come undone, it would not violate I04, but would need to be repaired to a legal state (including re-inspection if required) before being used in a future MATCH. Keep in mind that T03 prohibits a knot from coming undone on purpose, or strategically.

### **Question 142:** Rope Retaining Feature continued from Q85 Larks Head Knot around steal ears?

Can the rope pass through the steal ears with a loop and wrap around the ears? The rope knot would look similar to a "Larks Head" Knot.

**Answer:** Second paragraph updated per Team Update 05. We cannot rule absolutely on hypothetical ROBOT or ROPE designs, and the final decision as to legality of a particular ROBOT or ROPE lies with the Lead ROBOT Inspector (LRI) at each event. Generally, loops which wrap around the DAVIT fingers would constitute engaging "securely with the FIELD" per I04-E provided that the ROPE still passes between the fingers (secured by the pin) to ensure that it does not slip off the fingers. Please note that placing any knot used to form loops, as described above, that extends more than 2 in. below the DAVIT fingers would violates I04-F.

### **Question 148:** Loops in rope

**Is there a prohibition from having multiple loops in a rope as long as the other rules are followed? If this is permissible, what about the diameter of the loops? The rule limits the total diameter to 10 inches. Does this mean 5 inches per loop if there are 2 loops, or can each be 10 inches?**

**asked 21 days ago by FRC 433**

**Answer:** There is no rule that prohibits multiple loops in the same ROPE. I04-G applies to the ROPE as a whole, not additive of each component or modification of the ROPE, thus I04-G defines the maximum diameter of a loop.

### **Question 152:** Variable Length Rope

Would a rope with a knot which allowed the overall length of the rope to change during the match (e.g. an adjustable bend) be allowed, provided that both the minimum and maximum length of the rope remains in the allowable range of 63" to 96", and that it meets the other criteria?

**Answer:** There are no rules that prohibit a ROPE changing lengths during the MATCH provided it remains compliant with all specifications.

# Rules from Steamworks Manual (as of 2/4)

## More on Rope from Q&A

### **Question 157:** Moving alliance robots from assigned stations

The answer for Q65 states that "...there is no provision to "trade" stations with other members of an ALLIANCE..." However, on page 40 & 41 the manual seems to say that if the order placement of ROBOTS or ROPES matters to either or both ALLIANCES, the ALLIANCE must notify the Head REFEREE during setup for that MATCH, and that then changes can be made with either ROBOT or ROPE placement. Please clarify.

**Answer:** 4.2: MATCH Setup states "If order placement of ROBOTS or ROPES matters to either or both ALLIANCES the ALLIANCE must notify the Head REFEREE during setup for that MATCH." This refers to placement of ROBOTS or ROPES on the FIELD, not Teams in particular PLAYER STATIONS (those are assigned).

### **Question 159:** Dropping Rope on a Robot

Is it legal to drive your robot under the rope and drop your rope on top of your robot?

#### **Answer:**

Provided all rules are followed (e.g. H11), PILOTS may deploy a ROPE by releasing the ROPE'S retention strap (per Section 3.8) regardless of where ROBOT is.

### **Question 167:** Team supplied rope sticking to hook and loop retaining strap.

If a team uses a fuzzy rope that passes inspection, what would happen should the rope stick to the hook and loop retaining strap on deployment? Would the pilot be allowed to manually disengage the team rope from the airship hook and loop retaining strap or would this be a violation of S07? Assuming the pilot disengaging a rope stuck to the hook and loop retaining strap will be a violation of S07; will the airship hook and loop retaining strap be modified to prevent ropes from sticking to it?

**Answer:** S07 has been updated in Team Update 03 to add clarity regarding unacceptable contact with ROPES.

As long as the PILOT does not contact the DAVIT or the ROPE after it is deployed (below the deck of the AIRSHIP) S07 would not be violated. That being said, we highly recommend you ensure your ROPE is designed/created in such a way as to prevent sticking to the release mechanism (thus lowering the odds of accidentally violating S07 or other rules)

### **Question 168:** Tools on The Field

At the end of the match can a wrench be brought on to the field to remove the robot from the rope?

**Answer:** Bringing a wrench or other non-powered hand tool onto the FIELD at the end of a MATCH is permitted, provided that the process of removal does not violate G02.

# Rules from Steamworks Manual (as of 2/4)

## More on Rope from Q&A

### **Question 174:** Rope With Multiple Sections

Is it permissible for a loop in a ROPE to consist of multiple sections of nonmetallic fibers? For example, could a rope be folded over to create a bite then have a small section of another rope tied between the primary rope's legs, forming a loop?

**Answer:** There are no rules requiring a ROPE to consist of a uniform material; however, note that any tying done to form the ROPE from constituent fibers would be part of the ROPE and must conform to the 1 in. maximum diameter per I04-A.

### **Question 175:** Inspection Policy If Rope Is Untied Then Retied Identically

**If the actions of a ROBOT result in a knot in a ROPE being untied, and the rope is then retied in the same way it originally was, would that rope have to be reinspected?**

**Answer:** If the ROPE were re-tied in an identical manner, it would not need to be re-inspected. If there were any change in knot location, materials, etc, it would require a new inspection.

### **Question 187:** Is a composite rope allowed?

Many ropes are composites made up of a braided outer cover containing a parallel fiber core. These parallel fibers are not braided, twisted or woven together, but are an integral part of the rope, sometimes acting as the primary load-bearing member, and sometimes merely supporting the load-bearing cover. Would such rope be a violation of I04 -D? Examples of ropes of this design include New England Ropes' Sta-Set X, clothesline, cheap hardware store polypropylene ropes, and even bungee cords.

**Answer:** A rope that does not "consist entirely of flexible, non-metallic fibers sewn, twisted, tied, woven, or braided together" does not meet the requirements of a ROPE in FIRST STEAMWORKS. However, if knotted, it is "tied...together," and meets the requirement of I04-D.

### **Question 190:** Figure 9-2 Measurement: With or Without Gravity?

Given the flexibility definition of I04-D's blue box, the possibility of rope stretching a bit under forces, and the pesky nature of gravity, it feels important to ask: Are the measurements of Figure 9-2 to be taken while the rope is laying on the floor, hanging in the air, or in any arbitrary configuration?

**Answer:** The intent of I04 is to regulate the ROPE as it will be used on the FIELD. If there is any question regarding compliance with I04, measurements should be taken with the ROPE as close to the FIELD configuration as possible (i.e. hanging in the air). If the ROPE is elastic, Inspectors are likely to check its two extreme lengths to ensure compliance.

# Rules from Steamworks Manual (as of 2/4)

## More on Rope from Q&A

**Question 311:** Meaning of serialized inspection tag for rope

What exactly is the serialized inspection tag on page 45 in the manual? Is it something we will receive after our rope is inspected at an event or does it have another meaning? Thanks.

**Answer:** After passing Inspection, a serialized inspection tag will be attached to the ROPE near the retaining feature, such that it will not get in the way of a ROBOT interacting with the ROPE.

**Question 403:** About purposefully fraying a ROPE in compliance with I04a:

If a team-supplied ROPE is purposefully frayed in a certain section (in compliance with Q137) and the individual strands from the fray may pull apart to a maximum width of over 1 inch depending on how the ROPE falls during a match, but can be easily compressed by hand to less than 1 inch wide for inspection, would the ROPE still be in compliance with rule I04a? If not, would a loop under 10 inches width made entirely out of frayed rope over 1 inch wide in a standalone setting be legal?

**Answer:** Yes, a 1 in. nominal ROPE whose knotted or frayed diameter is still less than that required in I04, part G (as updated in Team Update 08) is permitted (provided it doesn't violate any other rules, of course).

# Rules from Steamworks Manual (as of 2/4)

## 4.2 MATCH Setup

A DRIVE TEAM may elect to switch one of the ROPES on their AIRSHIP for their own ROPE that meets the criteria defined in I04 of Section 9 Inspection & Eligibility Rules and has a serialized Inspection tag. Once the DRIVE TEAM has installed their ROPE on the AIRSHIP, it is part of the FIELD, but any issues with it will not result in an ARENA FAULT.

If order placement of ROBOTS or ROPES matters to either or both ALLIANCES, the ALLIANCE must notify the Head REFEREE during setup for that MATCH. Upon notification, the Head REFEREE will require ALLIANCES alternate placement of all ROBOTS and then all ROPES, starting with the Red ALLIANCE and in order of PLAYER STATION assigned (i.e. Red Station 1 ROBOT, Blue Station 1 ROBOT, Red Station 2 ROBOT, Blue Station 2 ROBOT...Red Station 1 ROPE, Blue Station 1 ROPE, Red Station 2 ROPE...).

## 5 Safety Rules

S07. Keep your hands “inside” the vehicle at all times. During the MATCH, the PILOT may neither A. contact ROTORS, B. contact DAVITS, C. reach outside any PORT, nor D. contact any part of a deployed (i.e. any part of the ROPE is below the deck of the AIRSHIP) ROPE.

## 7 Game Rules

### 7.1 Before the MATCH

Be prompt/safe when coming to and going from the FIELD. DRIVE TEAMS may not cause significant or repeated delays to the start of a MATCH and/or to the FIELD reset at the conclusion of the MATCH. Violation: If prior to the MATCH, the offending DRIVE TEAM’S ROBOT will be DISABLED. If after the MATCH, YELLOW CARD.

DRIVE TEAMS are expected to stage their ROBOTS for a MATCH, and remove it from the FIELD afterwards, safely and swiftly. Examples include... convoluted installation and removal of TEAM supplied ROPE

# Rules from Steamworks Manual (as of 2/4)

## 7.4 FIELD Interaction

G15. Be careful about what you grab on to. DRIVE TEAMS, ROBOTS, and OPERATOR CONSOLES are prohibited from the following actions with regards to interaction with ARENA elements.

- ...Items A-G exclude ROPES installed on an ALLIANCE'S AIRSHIP.
- Items A-H exclude a ROBOT'S interaction with a Team supplied ROPE that doesn't litter the FIELD.
  - A. Grabbing
  - B. Grasping
  - C. Attaching to (including the use of hook-and-loop tape against the FIELD carpet)
  - D. Grappling
  - E. Hanging
  - F. Deforming
  - G. Becoming entangled
  - H. Damaging

Chrisrin's read on all this:

- Our robot MAY do actions A-H to our team's own rope.
- Our robot may do A-G to our alliance's ropes (unlikely we will).
- If our robot damages (action H) the Touchpad, it's a foul or potentially a yellow card.
- If our robot is clearly damaging the Touchpad and we don't stop it, our robot could be disabled.

Violation: If prior to MATCH, and situation can be corrected quickly, it must be remedied before the MATCH will start. If during a MATCH, FOUL. If during a MATCH and extended or repeated, YELLOW CARD. If offense is via a ROBOT and the Head REFEREE determines that further damage is likely to occur, offending ROBOT will be DISABLED.

Corrective action (such as eliminating sharp edges, removing the damaging MECHANISM, and/or re-Inspection) may be required before the ROBOT will be allowed to compete in subsequent MATCHES.

A ROBOT that has only unseated the TOUCHPAD dome has not damaged the FIELD.

# Rules from Steamworks Manual (as of 2/4)

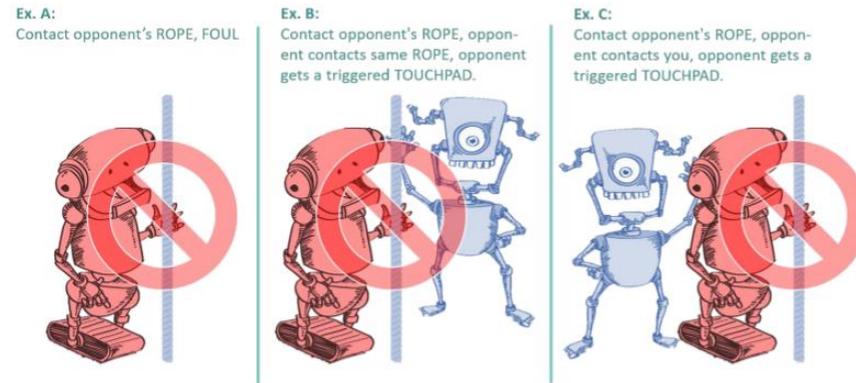
## 7.4 FIELD Interaction (continued)

G18. One ROBOT per ROPE. No more than one (1) ROBOT may be fully supported by a ROPE. Violation: RED CARD.

G19. Only climb on deployed ROPES. A ROBOT may only pull on a ROPE if/once the ROPE is supported only by the DAVIT, the carpet, the ROBOT, or any combination thereof. Violation: RED CARD.

G20. Let 'em climb: don't touch their ROPES. During the final thirty (30) seconds of a MATCH, ROBOTS may not contact an opposing ALLIANCE'S ROPE.

Figure 7-3: Don't touch opponents' ROPES in the final thirty (30) seconds of the MATCH.



Violation: FOUL. If an opposing ROBOT contacts the offending ROBOT or the ROPE, the opposing ROBOT is considered to have triggered an un-triggered TOUCHPAD at the end of the MATCH.

## 7.7 Human Action Rules

H11. Don't release ROPES early. PILOTS may not deploy ROPES (i.e. cause a ROPE to extend below the deck of the AIRSHIP) until there are 30 or fewer seconds left in the MATCH. (The ARENA will sound an alert when thirty (30) seconds remain in TELEOP)

Violation: FOUL. If deployed with more than 35 seconds left in the match, TECH FOUL.

# Rules from Steamworks Manual (as of 2/4)

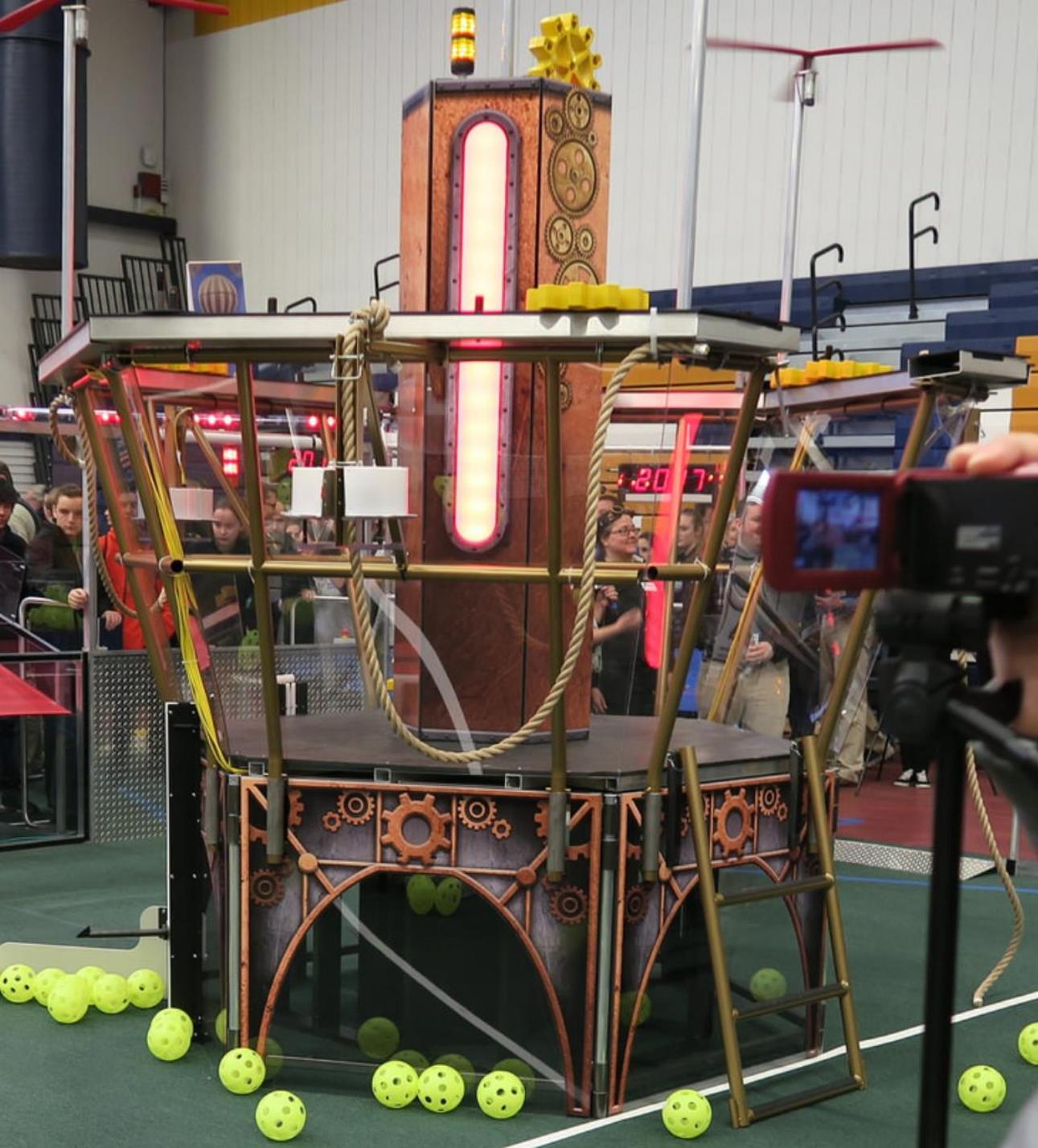
## **8 ROBOT Rules**

### **8.3 ROBOT Safety & Damage Prevention**

R08. ROBOTS must allow removal of GAME PIECES from the ROBOT and the ROBOT from FIELD elements while DISABLED and powered off.

ROBOTS will not be re-enabled after the MATCH, so Teams must be sure that GAME PIECES and ROBOTS can be quickly, simply, and safely removed. Note that a Team provided ROPE may be removed from the FIELD and is no longer considered a FIELD element once removed from the DAVIT.

Pictures from Ligerbots FRC  
2877 ([link to their Flickr](#))





These pics show how much the standard 7'2" rope lays on the floor. Ropes must be between 5'3" and 8' long.

377

+ Follow

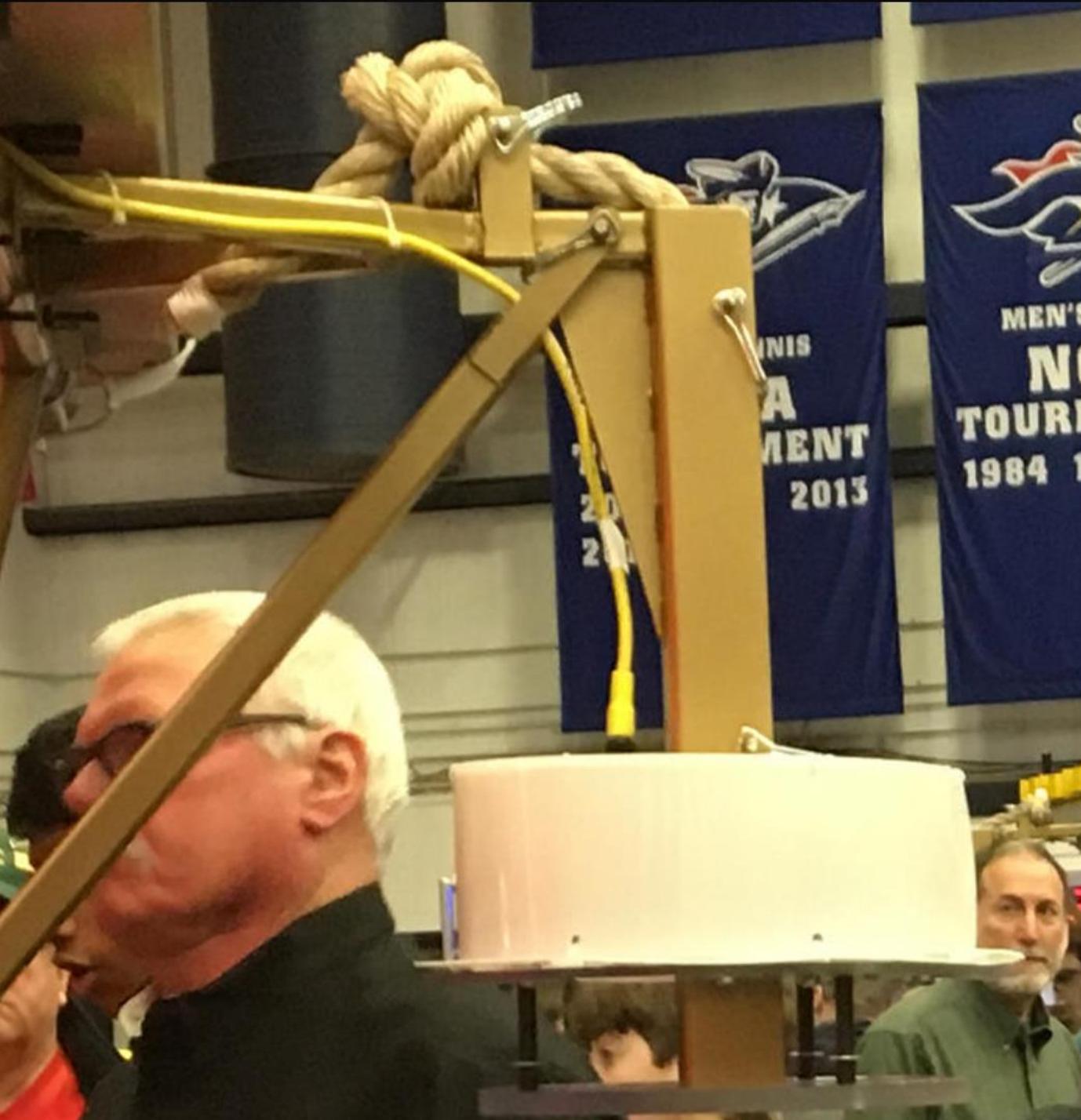














This pic shows that the cylinder alone likely won't press the round plate at the top that is necessary to score, because there is a channel of metal housing the rope that extends lower than the plate. Something else that extends beyond the edge of the cylinder will need to press the plate.

# Appendix

## Climber Concepts

# Climber concept

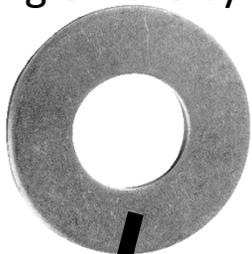
Small ratcheting wrench



May need flanges of some kind to keep the rope from slipping off the cylinder

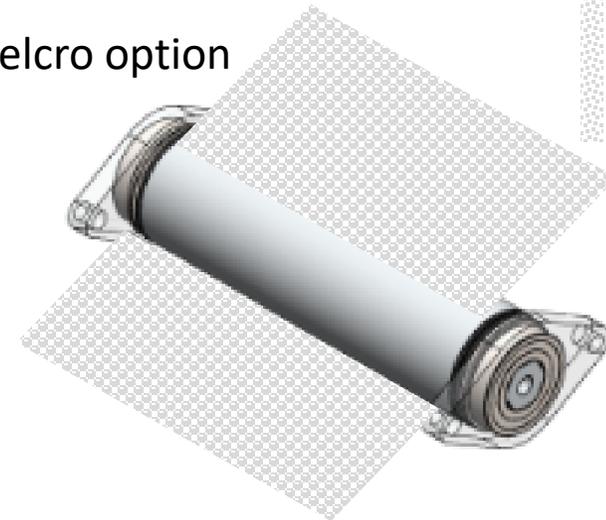
1 1/8" diameter oak dowel (slightly sanded) inside aluminum tube piece leftover from roller. Length TBD depending on available space. Oak dowel reinforces tube and creates material to screw hooks into for the non-Velcro option.

These right-angle mounts are not the right ones, because the hex needs to pass through (at least on the drive side), but you get the idea

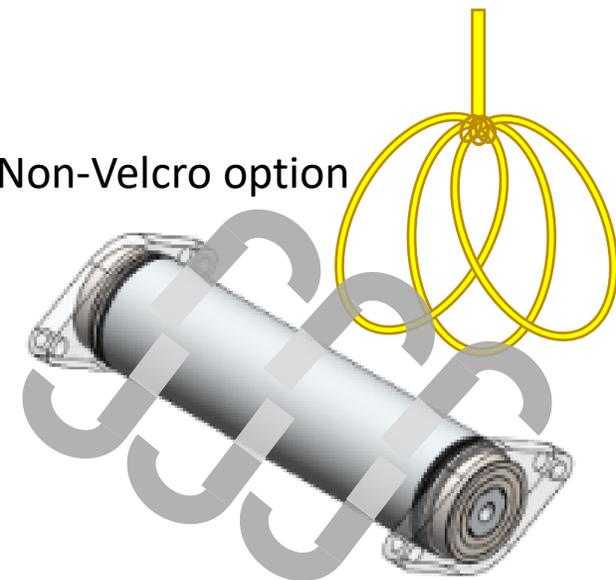


Need something to press the plate at the top. I threw these pictures of coated springs on here, but will need to analyze more how to best do this

Velcro option



Non-Velcro option

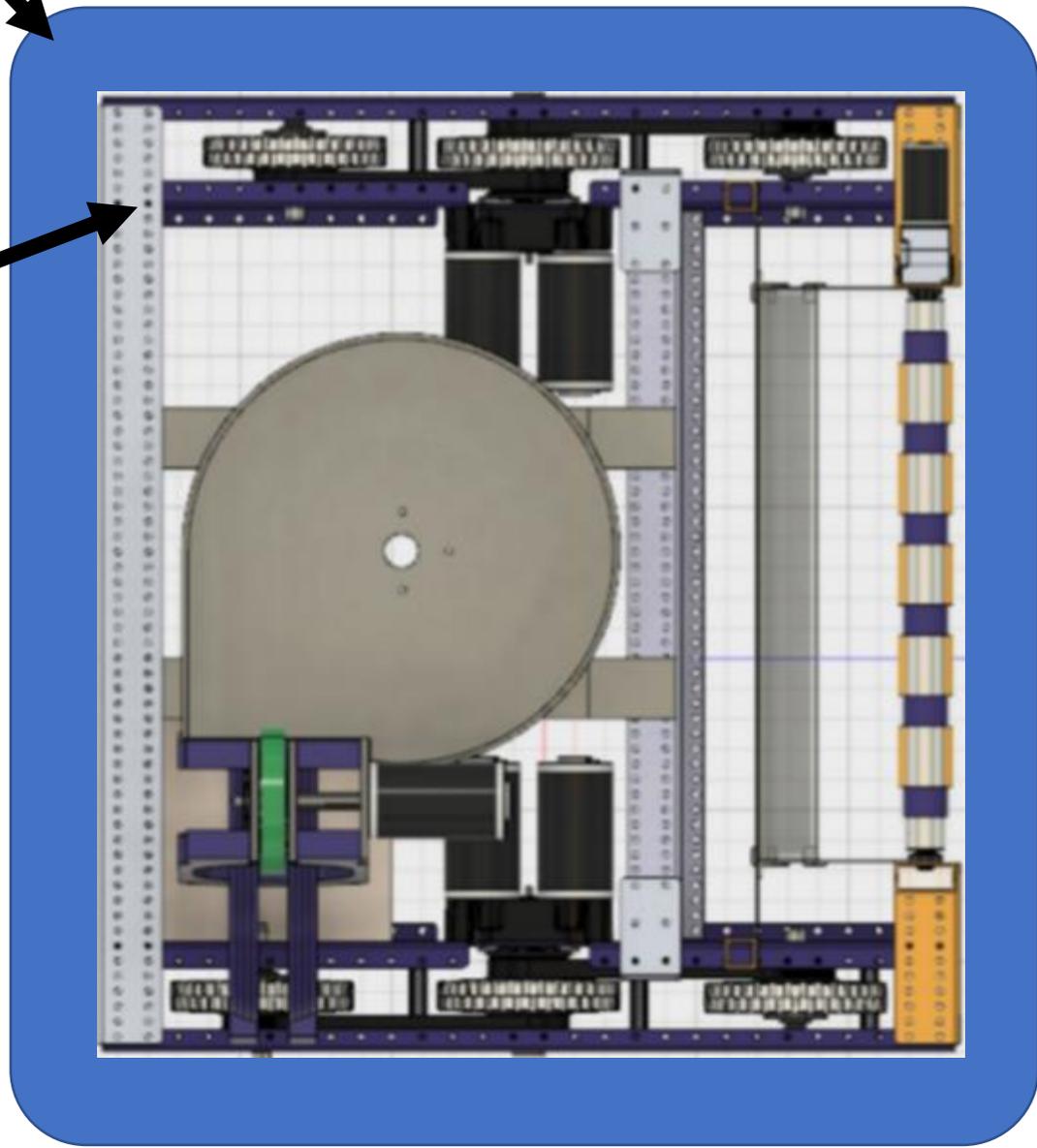


**Climber corner implementation idea**

Corner of robot's bumper would press the trigger plate at the top of rope

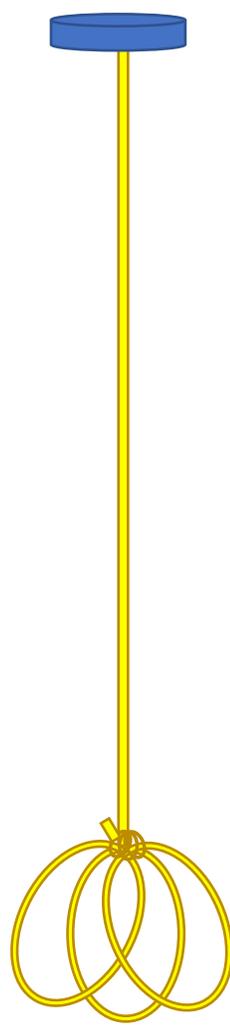
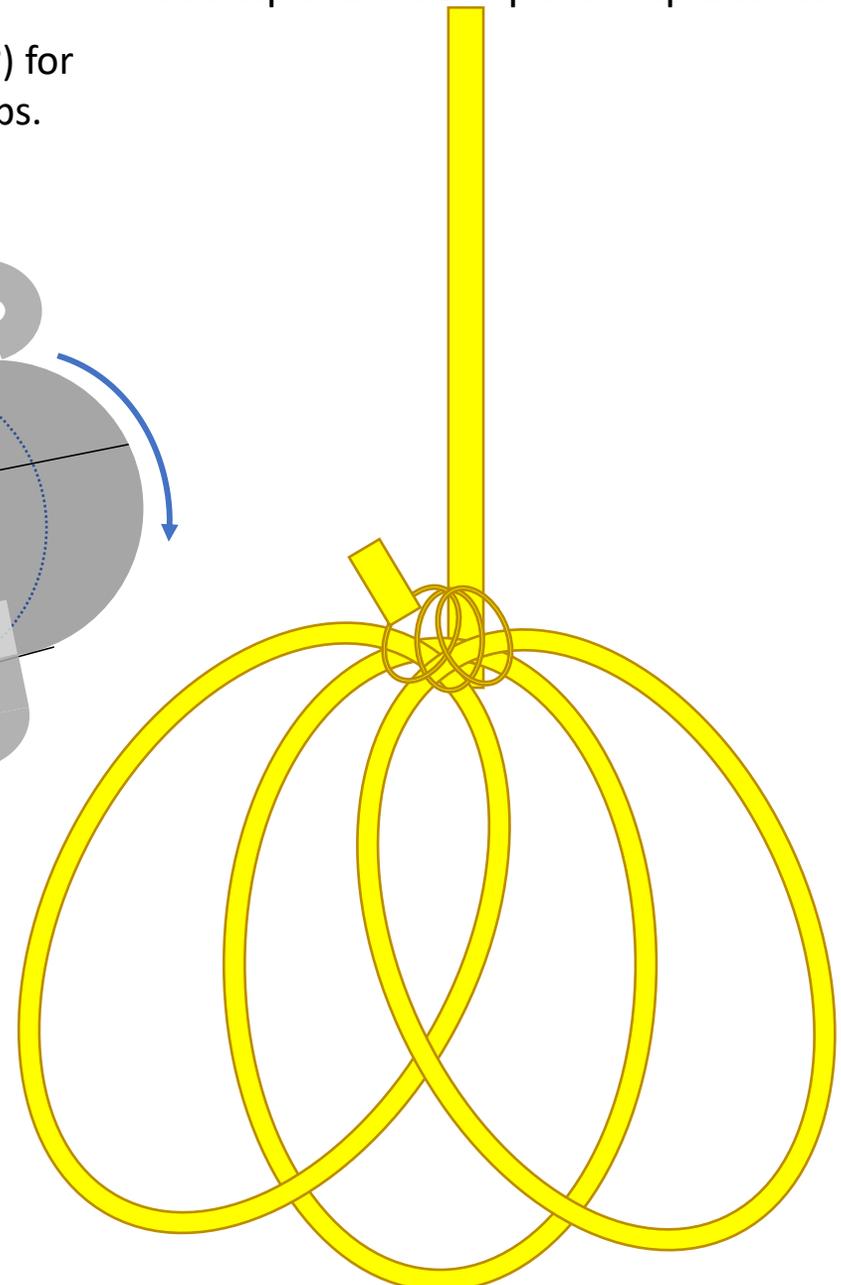
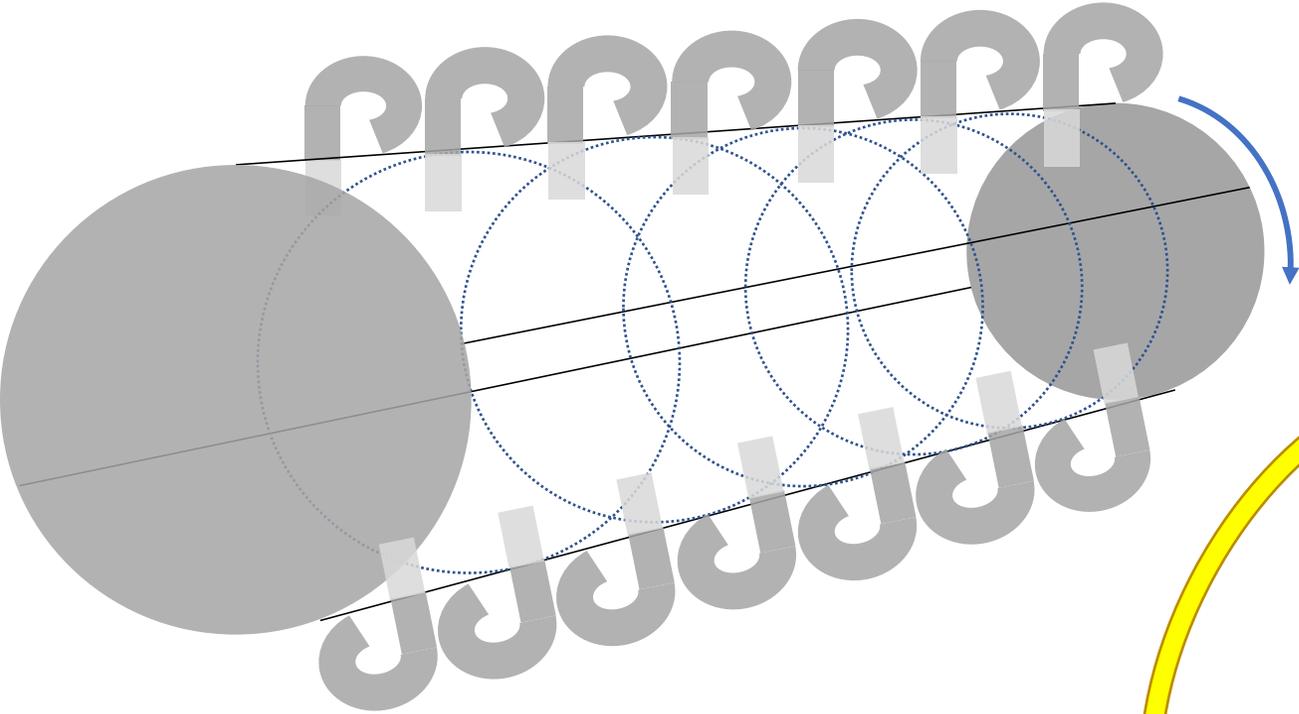
Swivel mount should help keep rope centered on cylinder (in theory). Would need to elevate platform slightly to clear wheel

To make space work, would need a configuration like this probably rather than motor inline with cylinder



Early Climber Idea - using paracord or other strong thin cord should help minimize space requirements

Strong metal cylinder with semi rough surface (corrugated steel?) for purchase & with many strong metal hooks to catch the multi loops. After a revolution or two the majority of the load will be on the cylinder (and the motor, of course).



Multi-looped 550 paracord (much thinner than the 1-inch rope, but still very strong – there are other even stronger small diameter cord options as well that should meet spec)

What knot? There are several multi-loop bowline knot variants that should be strong enough. Yes, I was a boy scout 😊.