SOUTHEASTCON 2017 HARDWARE COMPETITION RULES

Episode MMXVII: The Engineering Force Awakens

A long time ago, in a galaxy far, far away a lot of stuff happened that pitted good against evil in some strange universe. Unfortunately that has nothing to do with this challenge.

Instead, in this robot competition you will build a robot that must discover the unknown, use the Force in a lightsaber duel, bring down the energy shield protecting the enemy base, and then launch a proton torpedo to defeat the enemy.

And your robot must complete these tasks in under four minutes!

The robot

The robot must be completely autonomous and must fit entirely within a 12”x12”x12” cube at the start of each match. The robot must at all times be wholly contained within the playing surface and cannot reach more than 3” beyond the edge of any the arena walls. There is no weight restriction on the robot.

The robot may expand beyond the initial size to any size, and may even split into multiple independent robots during the competition. If multiple independent robots are used, they must start all within the same 12x12x12 space and split after the competition begins. In addition, the independent robots must communicate over a wired link – wireless communication between the various robots is not allowed - this includes radio, light, sound – any non-wired communication channel. This is a safety issue to avoid interference with, and to, other robots that are running at the same time.

You may not tether or control the robot in any way including wired or wireless tethers, two way data transmission, or one way data transmission to or from the robot.

The robot cannot contain any explosives or flammable liquids or gases. Compressed gas is allowed on the robot as long as the pressure is limited to no more than 30 pounds per square inch at any time. Gasses other than air are permitted as long as they do not pose a safety threat if accidentally released.

While multiple switches can exist on the robot for powering up and controlling the various subsystems on the robot, there must be a single clearly visible and labeled start switch. This switch can be either a pushbutton or a toggle switch and will be actuated by the robot team once the judge indicates the start of the match. It is recommended that the robot have an easily reachable emergency cut off switch to allow the robot team to disable the robot if necessary (this is to avoid damage to both the robot and the arena in case a sudden stop is required). If the robot splits into multiple independent robots, the single emergency cut off switch should stop motion of all the robots.

The robot may not present any danger to the judges, spectators, the playing arena or neighboring area around the arena. If at any time the judges deem the robot is causing, or is likely to cause harm, the judge may terminate the match immediately and will have the discretion whether any points are awarded for the match, and if the robot is allowed to complete any remaining matches.

Arena layout

The arena is a single 4' x 8' sheet of smooth sanded ½" (nominal thickness is approximately 15/32") BC grade plywood (B side up) that is surrounded by standard 2x4 'stud' lumber (nominal size is approximately 1.5" x 3.5") walls that form a frame on top of the plywood sheet (the arena inner dimensions will thus be approximately 93" x 45").

(Note that all ½" plywood referenced in the construction of the arena and stages will have a nominal thickness of approximately 15/32" and all 2x4 'stud' lumber will have a nominal size of approximately 1.5" x 3.5", and all 1x2 lumber will have a nominal size of approximately 0.75" x 1.5". Standard building material tolerances are expected).

The arena is divided into five levels, each at a different height. The robot begins in a starting square in the middle of the lowest level. This layer is the largest area, and comprises over half of the playing surface (45" wide by 57" long), and contains the robot starting square and the locations of stages 1, 2 and 3. The starting square is 15"x15" and is located in the center of this space (15" from the inside of the long walls of the arena, and 21" from the inside of the short wall). A 1" wide and 8" long white navigation stripe leads from the middle of the starting area square toward stage 1.

The rest of the arena contains a four tier stepped area consisting of three full-width steps and one smaller step. Each of the full-width steps are 12" deep and 45" wide. The first step is approximately 0.5" high (one thickness of ½" plywood) above the ground/starting floor, followed by a 1" step (two thicknesses of ½" plywood) to the second step and a 1" step (two thicknesses of ½" plywood) to the third step. The fourth step is 1" high (two thicknesses of ½" plywood), or approximately 3.3" above the ground floor) and is only 12"

wide and 12” deep. Each of the steps will have a 1” gloss white ‘warning’ stripe painted on the top edge of the step at the drop-off to the next lowest step.

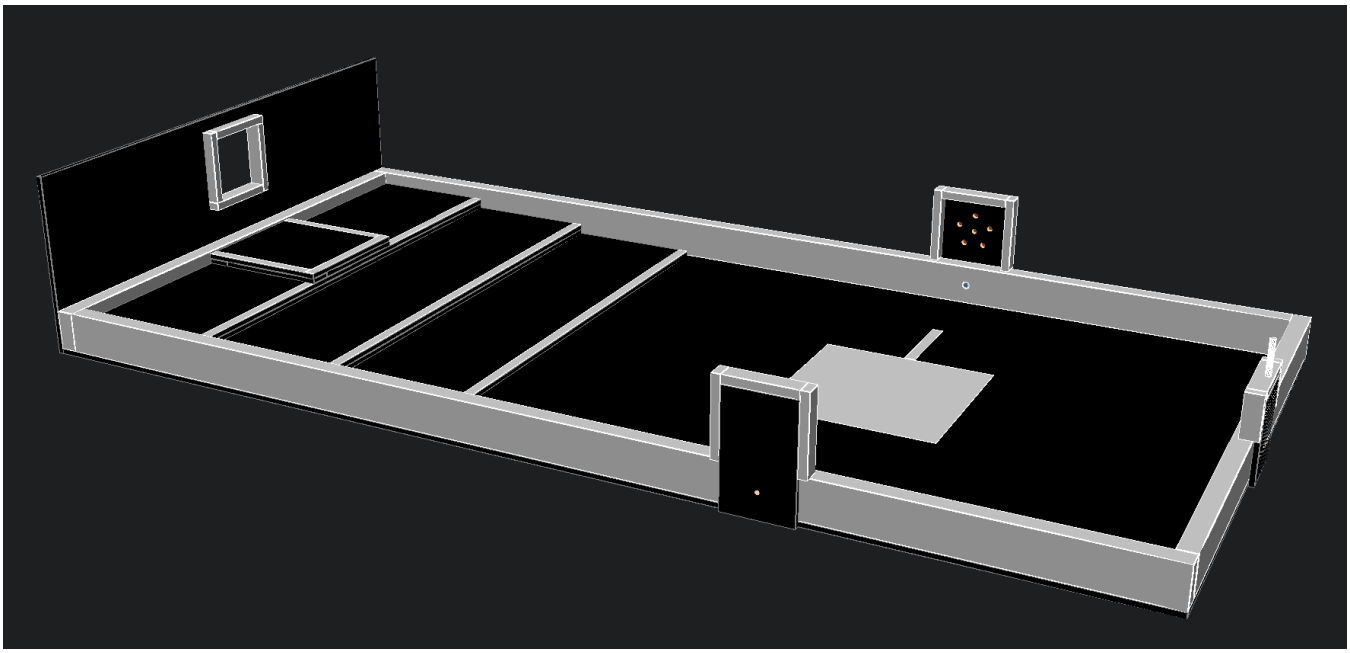


Figure 1 - Arena Diagram

The three staging areas for the competition are located on the three walls surrounding the starting area. They are fixed in position and the center of each staging area aligns with the center of the starting square (the center of stage 1 and stage 3 is 28.5” from the inside wall containing stage 2, and the center of stage 2 is located 22.5” from each of the inside walls containing stages 1 and 3).

Each stage represents a scene from a *Star Wars* movie.

- Stage 1 – Uncovering the Unknown
  This stage represents the scene where R2D2 plugs into the data port of the Death Star to shut down the trash compactor to save Princess Leia. For this contest, your robot must decode the secrets required to shut down the shield that is protecting the enemy base.

- Stage 2 – Lightsaber Duel
  This stage represents one of many scenes where good must battle against evil in a lightsaber duel. Your robot will be required to “use the Force” by sensing an electromagnetic force field to know when to strike the arena’s lightsaber with your own lightsaber.

- Stage 3 – Bring Down the Shields
  Using the secret information you learned in stage 1, your robot must now enter the correct combination code to bring down the energy shield that is protecting the enemy base.

- Final stage – Launch a Proton Torpedo
  Now that the shields are down, you must launch three proton torpedoes through a hole at far end of the arena.

The stages may be completed in any order, with the following exceptions – the information from stage 1 is needed for stage 3, and the firing of the last bullet toward stage 4 ends the match (you are able to fire the first two at any time during the match).

All the plywood surfaces, including each of the layers of the arena, stages 1-4, are painted flat black. All the non-plywood surfaces, including the 2x4 stud wall frames, and the 1x2 frames of each stage are painted gloss white. In addition, gloss white is used in the 15x15" starting square, the 1" line leading from the starting square toward stage 1, the 1" thick frame around the portal hole for the final stage, and the 1" warning line for each step. Note that we will not be providing exact paint vendor names and manufacturing codes for these paints, so your robot should be able to discern between flat black and gloss white without looking for an exact match.

(Note: As past competitors have discovered, colors never look the same under different lighting conditions, so it is never advisable to look for exact colors in a competition. Thus we chose this high contrast paint option as a benefit to you, not as an additional challenge).

Stage 1 Discovering the Unknown

In stage 1, the robot must decode the hidden code required to bring down the shields in stage 3.

This stage consists of six flat conductive copper pads arranged as shown in the diagram below. Each pad is attached to the back of the ½" plywood and is accessible via a 0.5" diameter hole. The pads on the perimeter are arranged in a circle with a 1.5" radius around the center pad. The pads are only numbered in the following description; no number actually exists on the pad or on the stage). Pads begin with 1 at the top 0° position, with the next 4 counting off sequentially in a clockwise manner at 72°, 144°, 216°, and 288°.

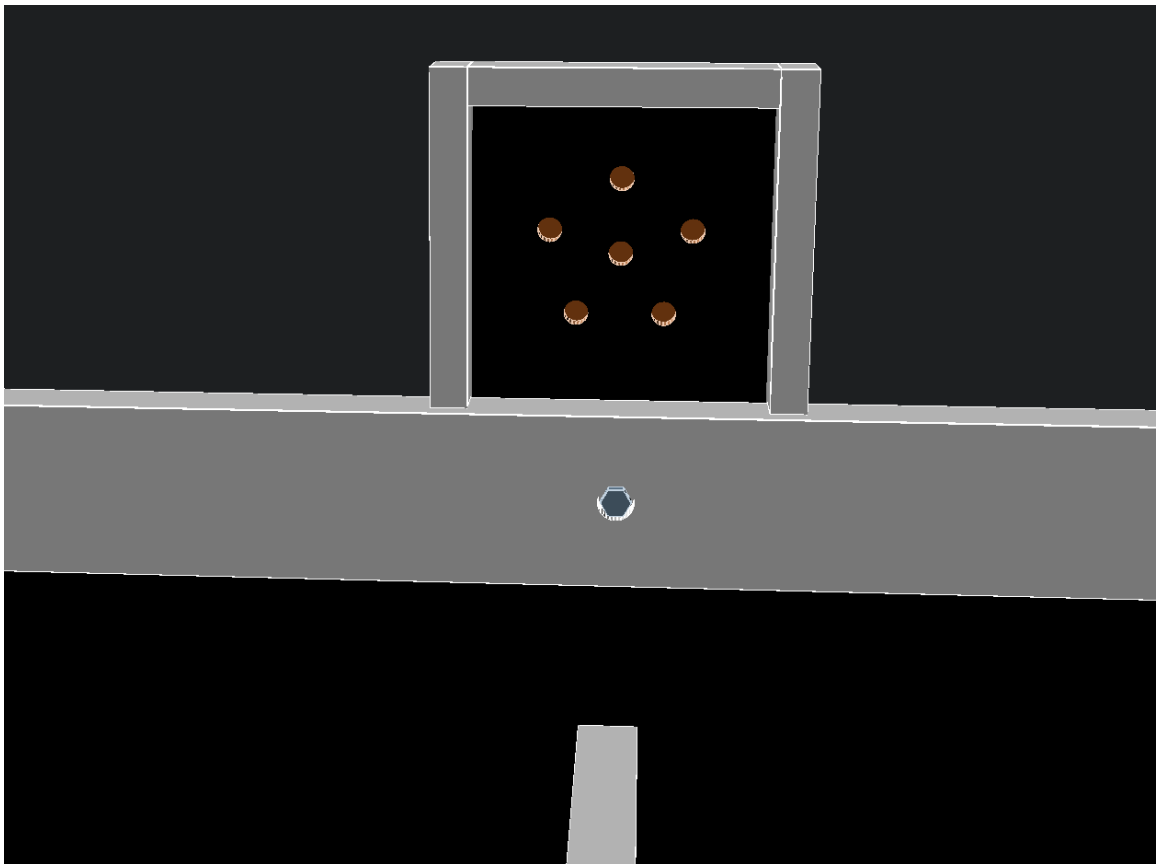


Figure 2: Stage 1 (Discover the Unknown)

Between the common (center) pad and each of the surrounding pads are one of five components arranged in an order that is unknown to the robot when the match begins. Each component will exist once, and only once, but their order will be chosen randomly at the start of each match by a plug-in personality module. The five components are a wire, resistor, capacitor, inductor, and a diode. The message is encoded with each component representing a unique digit code value from as shown in the table below.

Code	Component type	Component value	Suggested vendor / part number
1	Wire	N/A	TBD
2	Resistor	10KΩ, 1/2W, 10% tolerance	Any
3	Capacitor	0.1uF, non polarized	Any
4	Inductor	500mH, 30mA, 736Ω	Digikey, M10176-ND
5	Diode	IN4001–cathode/anode can be oriented in either direction	Any

The robot can access the pads in any order, and with any configuration and/or number of simultaneous connections. For example, the robot can measure only pad 1 to common, and then pad 2 to common, etc, or it can simultaneously connect to all six pads, or any subset number of pads.

The robot should not scratch, dent or modify the copper pads in any way, or leave any visible signs of damage to the pads or the plywood frame in front of the pads. If any damages are visible by the judges, the robot will be disqualified and given 0 points for the match.

The measurement of the component values should not exceed a safety voltage limit of 12v, or a current of 25mA. A single 100mA slow blow fuse will exist between the center common pad and all the components. This fuse will be automatically checked at the beginning and end of each match and if a robot blows a fuse, it will be disqualified and will result in a match score of zero points.

Stage 1 rises above the wall and consists of a 6" tall by 6" wide ½" plywood backboard inside a frame of 1x2 lumber, creating an approximately 1" deep shadow box. The center (common) pad will be located in the middle of the 6x6" plywood backboard. The stage will be attached by a single bolt mid height on the wall so that it can be taken down for easier storage and transportation, or replacement during the competition if a problem is discovered. The bolt head will be countersunk so that it does not protrude beyond the wall edge.

Stage 2 Lightsaber Duel

In stage 2, the robot must use the (electromagnetic) force to sense when a lightsaber is activated. The robot must battle using its own lightsaber to hit the stage 2 lightsaber each time the electromagnetic force field is activated.

The electromagnetic force will be generated by an electromagnet located in the middle of the wall and is located directly behind the stage 2 wall mounting bolt. An immobile lightsaber rises approximately 7" above the stage 2 frame. The lightsaber will consist of a hilt, approximately 3" tall attached directly to the wall and a 4" lightsaber blade. The lightsaber will be lit by an eight element RGB array and will also contain a vibration sensor. The robot should only strike the lightsaber hilt, and NOT the blade directly, to avoid damaging the lightsaber blade and RGB light array.

Each time the magnetic field is energized, the robot should strike the vertical (non-moving) lightsaber. Each time the lightsaber is hit, it will light up for 0.5 seconds - either blue to indicate it was struck while the magnetic force field was activated and points are awarded, or red to indicate the lightsaber was not activated and a penalty will be deducted. Striking

the lightsaber will be detected by the vibration sensor and automatically counted via the arena controller.

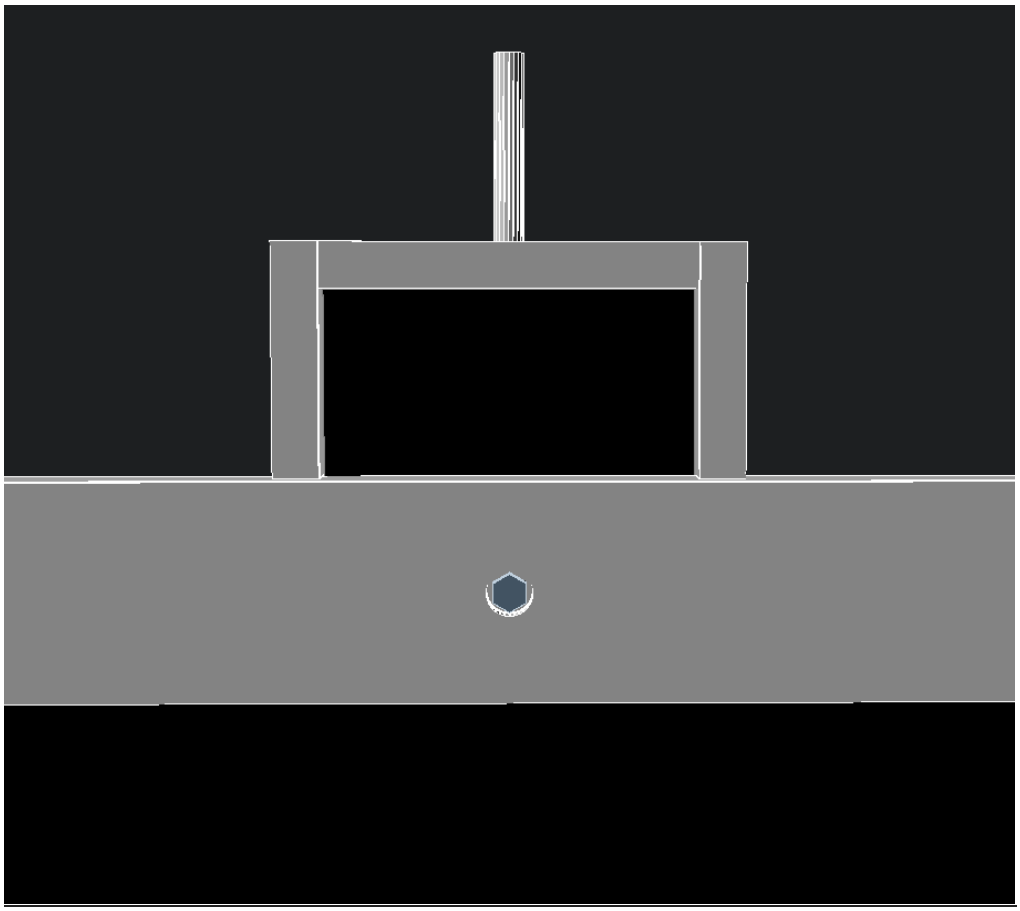


Figure 3: Stage 2 (Lightsaber Duel)

The LED array will be visible along the length of the lightsaber and the vibration sensor will be attached to the lightsaber. The electromagnet will consist of 40 turns of #20 stranded copper wire wound around a 0.5" diameter bobbin and will be energized by one amp. The wire should be wrapped clockwise around the bobbin, as viewed from the robot inside the arena.

Both the lightsaber (mounting bracket, hilt, inner RGB array support and saber blade) and the bobbin form will be a 3D printed PLA part, with the design available on the competition rule website.

The vibration sensor will ignore any vibrations/motion in the first five seconds of the match to avoid any false triggers while the team is starting their robot and stepping away from the arena. Once the five second timeout period is over, the magnetic force field will be

energized. The topmost LED will light green indicating the force field is energized and ready for the first hit.

Part description	Suggested vendor / part number
Lightsaber LED array	Adafruit neopixel stick (https://www.adafruit.com/products/1426)
Vibration sensor	Adafruit medium vibration sensor switch (https://www.adafruit.com/products/2384)

Once the robot strikes the lightsaber the first time, the force field is disabled and a 30-second battle timer begins that indicates the total length of time for the remainder of the lightsaber duel. During the next 30 seconds, the force field will be activated and deactivated a total of four more times.

The starting time for the four additional times will vary from match to match, with the following rules:

- The lightsaber is activated only when the electromagnetic force is on.
- The force field is activated each time for two seconds, or until the lightsaber is hit, whichever occurs first.
- Each deactivation will vary in time, with a minimum set time of 1 second.
- The final (fourth) activation will occur at exactly 28 seconds into the duel. This is to guarantee that each duel can be completed in 30 seconds to ensure fairness from robot to robot so that the final activation does not occur earlier in some matches.
- At most only one hit is counted per active state — the rest will be ignored until the next activation.
- At most only one negative hit penalty is deducted per inactive state — the rest will be ignored until the next deactivation.
- Hits that occur during the first 0.5 seconds of the deactivation do not count for or against the robot – they are neutral points – to avoid assigning a penalty to a hit that arrived just after the field was deactivated.

After the first hit to the lightsaber and the lightsaber duel begins, the lightsaber will light all eight LEDs in a low intensity white and will gradually count down (bottom light goes off last) so it will be completely off at the end of the 30 second duel. The top most LED will light green whenever the electromagnetic field is activated. Each time points are awarded, all eight LEDs will flash blue for 0.5 seconds, and each time points are deducted, all eight LEDs will flash red for 0.5 seconds.

The lightsaber LEDs will also be used as the countdown timer at the start of the match (fully light up at three seconds before match begins and counts down to all off, and then a brief white flash at exactly when the robot team should engage the start button). In addition, all 8 LEDs will flash to indicate the four minute match timer has expired.

Stage 2 rises above the wall and consists of a 3" tall x 6" wide plywood backboard inside a frame of 1x2 lumber, creating a 1" deep shadow box. The lightsaber rises about 7" above the top of the frame. The stage will be attached by a single bolt mid height on the wall so that it can be taken down for easier storage and transportation, or replacement during the competition if a problem is discovered. The bolt head will be countersunk so that it does not protrude beyond the wall edge, but the bolt head will be within ⅛" of the inside wall surface. In addition, this bolt will pass through the magnetic coil bobbin that is used to generate the force field.

Stage 3 Bring Down the Shields

In stage 3, the robot uses the codes from stage 1 to unlock and bring down the force fields by dialing in each digit on a combination lock. The stage 3 combination lock is a quadrature encoder with a built-in RGB LED.

The sequence begins by the robot first turning the combination lock knob a full circle clockwise 'N' number of times for the code value derived from pad 1 (top) of stage 1. The robot then turns the knob counterclockwise 'N' number of complete turns for the code derived from pad 2, and then back clockwise 'N' complete turns for the code value derived from pad 3, counter-clockwise 'N' turns for the code value derived from pad 4, and finally completing with 'N' clockwise turns for the code value derived from pad 5.

A turn is considered a complete turn if it is +/- 15° from a complete 360° turn (ie: 345° to 375° is considered one turn, 705° to 735° is considered two turns, etc). If the robot stops and reverses direction when not within this range, it is not considered a valid digit entry.

If more than five digits are entered (via the alternation of clockwise and counterclockwise turns), only the last five will be counted. This allows a robot to "abort" a sequence by simply starting over at the beginning again. The robot can use this feature as a way to account for any accidental rotation of the knob during initial robot alignment.

Part description	Suggested vendor / part number
Quadrature encoder	Sparkfun rotary encoder – illuminated (RGB) (https://www.sparkfun.com/products/10982)
Quadrature encoder knob	Sparkfun clear plastic knob (https://www.sparkfun.com/products/10597)

The initial state of the stage 3 RGB LED is a 5Hz white flashing beacon. Once the robot engages with the encoder and rotates it more than one fourth of a turn, the RGB LED will stop flashing. The RGB LED will then be lit red while the shaft is rotated clockwise, blue while rotated counterclockwise and white when within the +/- 15° of a complete turn (when moving either direction).

(Note: The control knob LED colors are more for visual verification by the judge that the knob is moving and is not recommended as a signal to the robot, but this is not disallowed and is up to the robot team designer)

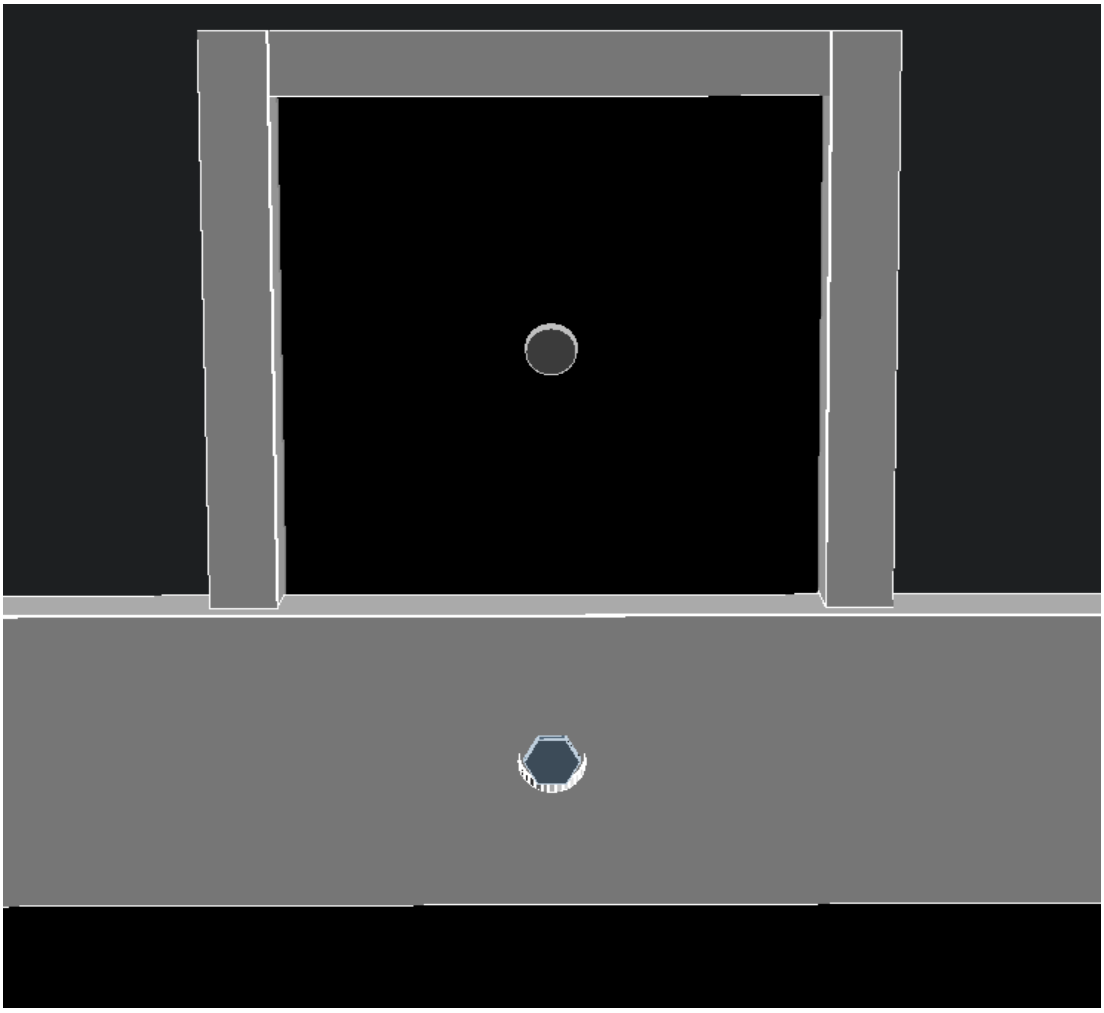


Figure 4: Stage 3 (Bring Down the Shields)

Stage 3 rises above the wall and consists of a 6" tall by 6" high ½" plywood backboard inside a frame of 1x2 lumber, creating a 1" deep shadow box. The quadrature encoder will be located in the middle of the 6x6" plywood backboard. The stage will be attached by a single bolt mid height on the wall so that it can be taken down for easier storage and transportation, or replacement during the competition if a problem is discovered. The bolt head will be countersunk so that it does not protrude beyond the wall edge.

Final stage (Fire the Proton Torpedo)

In the final stage, the robot must launch three missiles (a Nerf N-Strike dart) into the portal at the far end of the arena (farthest from stage 2). The portal is a 6x6" square opening that is located in the backboard. The backboard is constructed of ½" plywood that extends a minimum of 12" above the wall and is 48" wide, extending the full width of the arena. The hole is framed with the same 1x2 gloss white frame as used in stages 1-3. The bottom of the frame is 3.5" from the top step, and it is located midway between the long walls on which stages 1 and 3 are located. The backboard is 48" wide, extending the full width of the arena, and is bolted to the back of the 2x4" wall.

The robot can launch the Nerf missiles from any location within the arena. This means the robot can try for the longer shot from the lower ground stage area, or it can run up directly to the portal and 'dunk' (drop) it in the hole if it chooses to navigate the ever increasing higher platforms leading up the portal.

The robot gets points if at least one Nerf missile is fired (whether it makes its target or not), and points for each Nerf missile that goes through the portal. The match is over once the last Nerf missile is fired and either clears the portal (or is declared a miss). A simple net capture system will exist behind the hole to capture the Nerf missiles for counting (details of how this is attached will be available in the arena build document).

While an occasional errant missile fire is expected, if the judges suspect that a missile is intentionally being fired in a direction other than the portal, the robot will be immediately disqualified and removed from the competition.

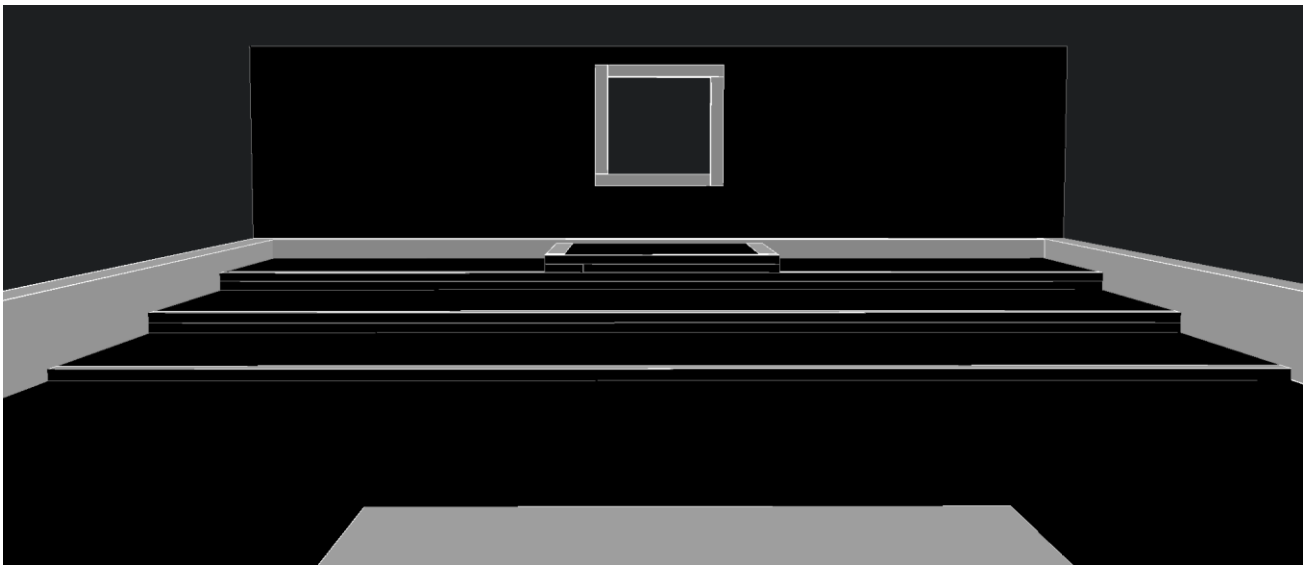


Figure 5: Stage 4 Target Area (and the steps leading to it)

Running the Competition

There is no limit on team size for the participating team, but each team member should be in the same local student chapter, and they must all be IEEE student members.

The competition will consist of two preliminary runs, with an optional third preliminary run if time permits. The total points for each team will be the sum of their match scores for all preliminary runs.

The top four highest scoring teams in the preliminary runs will compete in the final run to be held during the awards banquet. The final competition placement of the four teams will be determined solely on the points in the final run and not dependent on any points earned in the preliminary runs.

Each match will last for at most four minutes and the end of the time will be indicated by all 8 LEDs on the arena lightsaber turning on white. The match for a single robot is over when either the four-minute time limit expires, or the last missile is fired. In addition, the robot team can signal to the judge at any time that they are finished with their match, or the judge can stop the match if the robot is acting in a manner that can cause injury to anyone nearby or damage to the arena or itself.

At the start of each run, the judges will require that all robots be sequestered in a special staging area. Once in the staging area, the robots must remain off and cannot be touched by any students until they are called for their match to begin. The robots also cannot be charging during this time.

For each match, the judges will call the names of the teams to run in that match. Once called, teams will have at most two minutes to retrieve their robot from the sequestration area, place it into the arena, and be ready to start at the judge's command.

When a match is ready to begin, the arena judge will start the time on their arena and the stage 2 LED bar will light up (all white) and count down to zero (over a three second period) and will briefly flash white to indicate the match is to begin. Each team will be responsible for starting their own robot (using the clearly provided and labeled start button), then must back out of the way of the arena. Once the match is over, the robot will be returned to the sequestration area until all the robots in the match have completed. Once that is over, the teams will be instructed to retrieve their robot. Teams will be guaranteed at least 30 minutes between the end of one match and the start of the other match for any changes to the robot necessary for the next match.

While there will be multiple arenas running at the same time, the relative times for the robots within a single run will not matter as the robot times for all of their matches will be tallied and sorted against all other robots.

Constructing the arena

The arena was designed so that it can be constructed from two sheets of 4'x8' ½" BC grade plywood. The actual thickness of the plywood will vary and a more accurate description of the thickness is approximately 15/32", but robots should be built to allow slight variations without affecting their performance.

In addition to the two sheets of plywood, the arena will require three 8' long 2x4 pine studs, and one 8' long 1x2 standard pine lumber.

As stated earlier, the paint colors are flat black and gloss white. Exact vendor and manufacturing numbers for the paint will not be provided.

A separate build document is being prepared that shows photos and build hints from building the initial arena prototype.

Scoring

Points are awarded as follows:

- Starting
    - 10 points are awarded if the robot shows any sign of motion.
    - 30 points are awarded if any part of the robot crosses over the edge of the starting square.
    - The maximum points possible for starting are 40.

- Stage 1: Decoding the Unknown
    - 10 points will be awarded for the robot touching any part of stage 1
    - 15 points will be awarded for correctly decoding 1 pad, 35 for decoding 2 pads, 60 for decoding 3 pads, 90 for decoding 4 pads, and 125 for decoding all five pads.
    - Points for this stage will be awarded by properly decoding stage 3 or by presenting to the judges a display that shows that the stage 1 results were properly decoded. The display must be an electronic display (LED or LCD) on the robot that clearly is visible by the judges at the end of the match that indicates the code values determined for each of the five pads on stage 1. The displayed code should be a five digit number, read left to right, to coincide with stage 1 pad numbers 1..5. Note that the display must be visible on the robot by the judges, and ssh'ing to the robot, or providing the judges a piece of paper with the numbers on it will not count as a valid display. Additionally, the display must be read by the judges before the robot enters the sequestration area, or the points will not qualify.

- The maximum point total possible for stage 1 is 135.

- Stage 2: Lightsaber Duel
  - 10 points will be awarded for the robot touching any part of stage 2
  - 30 points will be awarded for the first hit (to start the duel, as indicated by a the lightsaber flashing blue)
  - 65 points will be awarded if only one additional hit is registered during the magnetic field activation, 110 if two are registered, 170 if three are registered, and 250 if all four are registered. Note that only one hit per magnetic field activation will be counted, so to get more than 2 hits, each must occur during a different magnetic field activation.
  - 50 points will be deducted for a hit that occurs when the force field is not activated (not counting the 0.5 second grace period after the field is deactivated). Note that only one penalty per magnetic field deactivation will be counted (maximum loss is 200).
  - The maximum point total possible for stage 2 is 290.

- Stage 3: Bring Down the Shields
  - 10 points will be awarded for the robot touching any part of stage 2
  - 45 points will be awarded if one digit is dialed in at the correct location in the sequence, 95 if two are dialed in correctly, 155 if three are dialed in correctly, 230 if four are dialed in correctly and 325 if all five are dialed in correctly (for example, if the code is 12345, but 12435 is entered then the 1, 2 and 5 are correct so 155 points are awarded).
  - The maximum point total possible for stage 3 is 325.
  - Since failure at this stage also means no points for stage 1, the team should provide a very clear display on the robot that will show the decoded digits from stage 1. If all the digits are entered correctly at stage 3, it is assumed all digits were decoded correctly from stage 1 correctly. If one or more digits were incorrectly entered at stage 3, and the team can show that the values were decoded successfully at stage 1, they get the full points for the correct digits at stage 1, plus any points for correctly entered digits at stage 3.

- Final stage: Fire the Proton Torpedoes
  - 10 points will be awarded if at least one Nerf missile is fired (regardless of whether it goes through the portal).
  - 50 points bonus will be awarded if only one missile passes through the portal. 120 if two pass through the portal, and 200 if all three pass through the portal.

    - It is not necessary to successfully complete either stages 1, 2 or 3 to be awarded points for the final stage, but once the last Nerf proton torpedo is fired (and either clears the portal or is considered a miss), the match is over and the robot is not allowed to engage with any of the other stages.
    - The maximum point total possible for the final stage is 210.

- Maximum points for a competition:
    - Starting: 40 maximum points
    - Stage 1: 135 maximum points
    - Stage 2: 290 maximum points
    - Stage 3: 325 maximum points
    - Final stage: 210 maximum points
    - Total maximum points: 1000

FAQ

- Where do I find out more about Southeastcon 2017?
  http://sites.ieee.org/southeastcon2017/
- Where is the 2017 Southeastcon Facebook page?
  https://www.facebook.com/groups/SouthEastCon2017HardwareCompetition/
- Where do I find the latest official copy of the rules?
  The latest (and only official copy) will always be posted to the following location:
  http://sites.ieee.org/southeastcon2017/student-program/
  In addition, the rules will also be available in the files section of the 2017 Southeastcon Facebook page. Whenever the rules are updated, they will first be uploaded to the Facebook files section (and a note posted to Facebook), and then followed by an update to the official location a few days later. This allows the ability to rapidly get out a new set of rules, and still have an official place outside of Facebook for the rules. Any rules changes are not official until they appear in the official location on the IEEE page).
- I see the terms match, run and competition used – what does each mean?

  A match refers to a single robot running a single time, with the result of a single score. There is one match per run per robot. A run is the collection of matches for all teams to run once. The first two runs (or optionally three, if time allows a third run before the banquet) are called preliminary runs. The purpose of the preliminary runs is to find the top four teams to compete in the final run. The final run will occur during the awards banquet on Saturday night. During the final run, the only points used to define the final competition placement of the top four teams are the scores from the match in the single final run – no points from the preliminary runs are carried forward.

- If I have a question, can I post it to the 2017 Southeastcon Hardware Competition page?

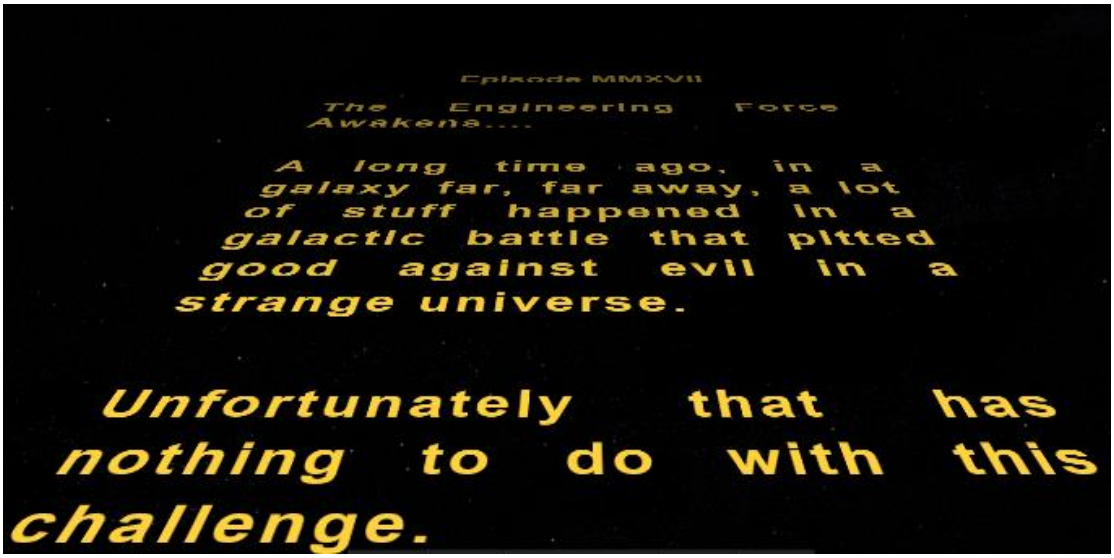
  Yes, you can post the question there and perhaps someone will help you with your answer. However, all official answers must be answered by the 2017 Southeastcon Hardware Rules document and not by a comment on the Facebook page. The page is designed mainly for students to exchange ideas and information, and for quick notices about changes in the official documentation. If a discrepancy exists between what is stated on either of the 2017 Southeastcon Facebook pages and the official website and official rules on the website, the official page and rules will be deemed more correct.

  Please read and follow the Facebook etiquette rules in the Facebook group.

- Where do I send my questions/comments about the 2017 hardware challenge?

Please contact Rodney Radford, the 2017 Southeastcon hardware rules coordinator at rodney.radford.us@ieee.org.

- I really liked that opening Star Wars scroll – where can I see it again?
  Click "Begin" at the link below to see the current scroll, or to edit/create your own scroll (and make sure you have the sound turned on for the full effect!)
  http://www.starwars.com/games-apps/star-wars-crawl-creator/?cid=5700879ee4b03db91956f207



Additional photographs of the arena

This section contains additional diagrams of the arena. These were all created from the official OpenSCAD code files available in the files section of the Southeastcon 2017 Facebook page.

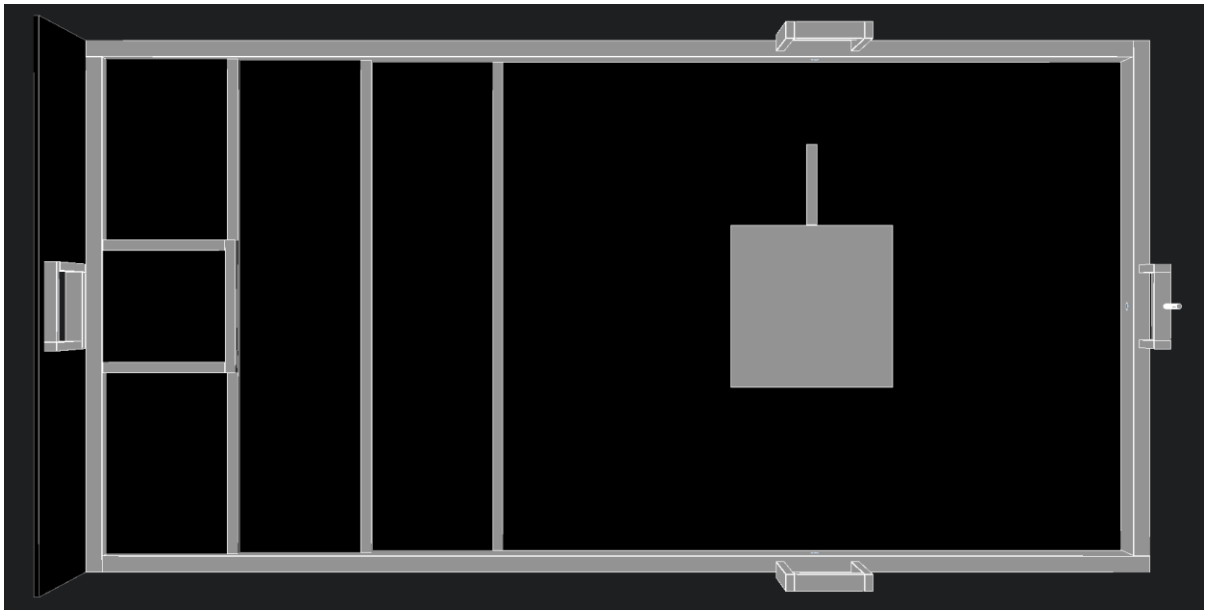


Figure 6: Arena Area (as seen from above)

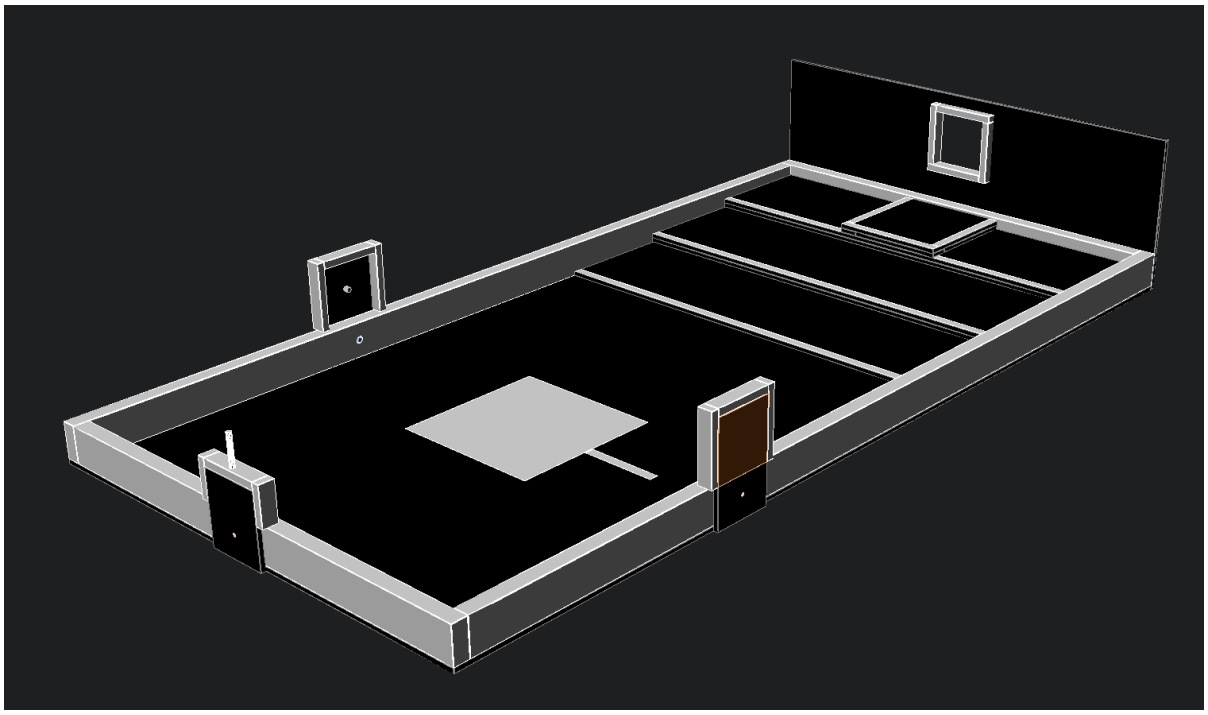


Figure 7: Arena as seen from behind stage 1

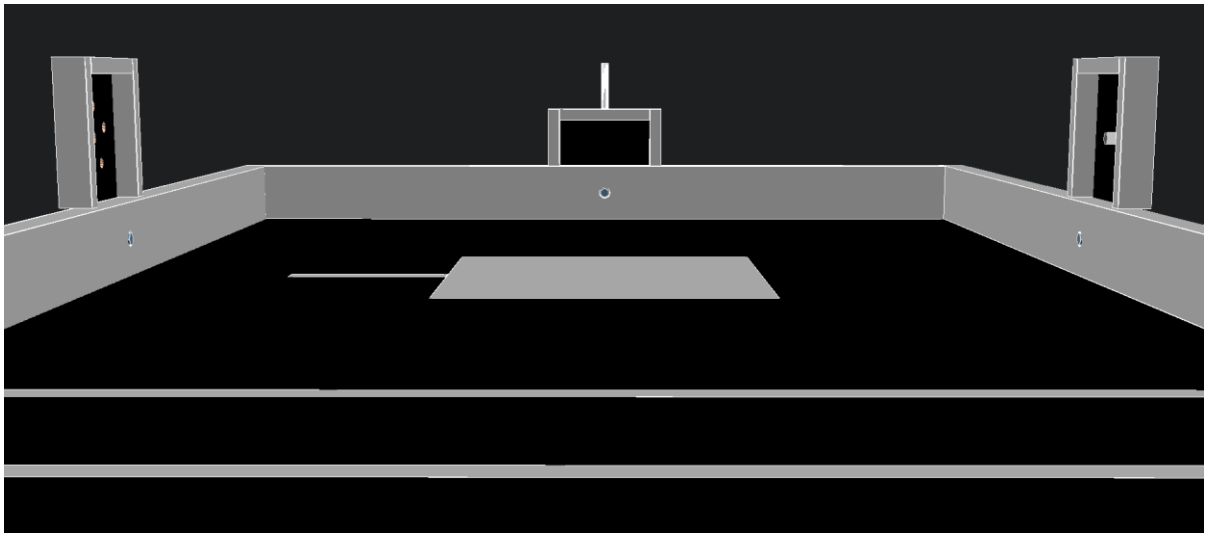


Figure 8: Lower Level and Stages (as seen from the stage 4 steps)

Important dates for the 2017 hardware challenge:

Initially an aggressive schedule was proposed for releasing the schematic diagrams and Arduino code for the arena electronics. While this schedule below has relaxed the deadline of the arena electronics a bit, this should not impact the robot design, building, or testing. Each team can build and test their robot by visually inspecting the robot meets the requirements (as they have done in years past), and the release of the arena electronics is mainly to help debug or uncover any issues in the arena electronics.

The build guide will provide hints on how the stages can be tested without building the full arena electronics – both saving time and money to the students.

The new dates are:

- April 3
    - Deliver the basic set of rules at the Sunday Southeastcon 2016 meeting.
    - 2017 Southeastcon hardware rules Facebook page goes live.

- May 15
    - Release of the OpenSCAD source files used to generate the 3D diagrams.

- July 4
    - Next major release of the rules. The July 4 release included the following changes and updates:
        - Wording clarifications based on questions received before July 4.
        - Correction of some of the arena sizes (to match the OpenSCAD file).
        - Release of the OpenSCAD files for the stage 2 lightsaber and coil spool.
        - Component vendors and part numbers for stage 1 parts.
        - Changed the number of turns (to 40) and increase of current (to 1A) in the coil for stage 2 (this was based on results from the initial prototype build).
        - Changed the colors of the stage 3 RGB quadrature to red/blue to match the theme in the lightsaber.
        - Added the requirement that all team members must be IEEE student members and in the same student chapter. This requirement has always existed for Southeastcon, but listed it specifically in the rules to avoid any confusion.
        - Increased the time between matches from 1 minute to 2 minutes
        - Updated the dates/schedule for next updates.

- July 11
    - Minor update of the rules that included the following changes:
        - Updated vendor information for unknown parts in stage 1 – only the inductor is considered unusual enough that it requires a specific vendor and part number.
        - Changed the max voltage, current and fuse for stage 1 based on the inductor selected for stage 1.
        - Clarified the maximum distance from the bolt surface to the inside of the wall for stage 2.
- August 1
    - Next update of the rules. This is expected to be the final update and only major issues will allow any further update of the rules. Questions on rules clarification will still be answered, and updated in the rules if absolutely needed.
    - Complete test build of an arena and testing of all stages, including release of the build guide showing photographs of the prototype arena, and build hints. Note that the build guide is not required for students to build their own arena as the build guide and photographs will be based on the measurements in this document and the OpenSCAD file.
    - Release the schematic diagrams for the arena electronics.

- January 1
    - Release PCB designs for the arena electronics.
    - Release the first version of the Arduino control code for the arena electronics.

- March 1
    - Release of the final version of the Arduino control code for the arena electronics.

- March 30 – April 2
    - Southeastcon 2017 in Charlotte, NC
    - Full schedule of each of the competitions, and updates on the times for each competition will be posted in advance on both the 2017 Southeastcon Hardware Facebook page and to the 2017 Southeastcon official page