

period.” From the end of the launch period to the end of the competition period, teams may engage in both offensive and defensive behavior, as outlined in more detail below.

4. **Clean-up and Removal Period.** At the end of the competition period, both teams must remove their vehicles and any debris from the competition field within 30 seconds. During this period, the next heat’s contestants will be setting up their devices.

3. Overview of the Contest Arena

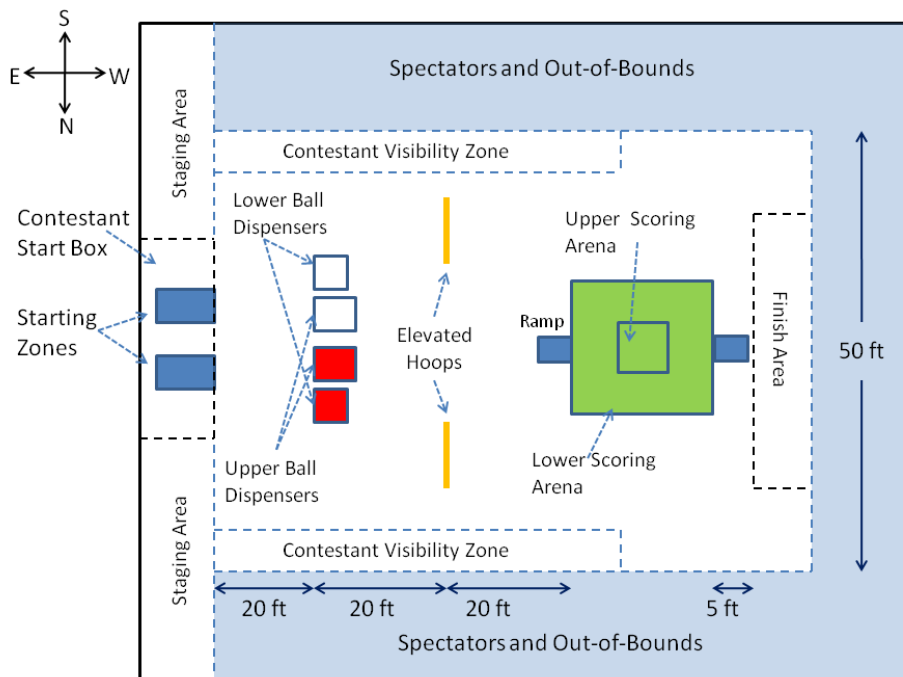


Figure 1: Floor plan of the main contest arena in Brown Gymnasium. Note: the diagram is *not* drawn to scale. Details of key components are given in subsequent figures.

This section describes the overall geometry of the contest arena. The next sections will clarify how to score in this arena, and provide additional details for each key contest arena component.

3.1 Overall Geometry and Physical Limitations of the Contest Arena. The contest arena consists of a subset of the Brown gymnasium floor (Figure 1) and all of the airspace above this region. The gym ceiling is off limits—it cannot be used as a part of a team’s contest strategy. Hence the ceiling cannot be modified, nor can any mechanical components be affixed to the ceiling. Occasional accidental contact with the ceiling is permitted. Similarly, the gymnasium floor cannot be modified or damaged in any way as part of a team’s competitive strategy.

3.2 Starting Zones. Starting zones are located on the east side of the gym. While a team is “on deck,” the team members and their vehicles must be located in the general staging area on the east side of the gym (Figure 1). At the beginning of the set-up period, team members must enter the “Start Box” region, and remain in that region until the beginning of that heat’s competition period (which starts after the vehicles have entirely departed from the starting zone).

3.3 Allowed Movement of Contestants. After the launch period, team members may move within the Start Box, the staging area (without disrupting other contestants), and *contestant visibility zones* along the northern and southern boundaries of the contest arena (see Figure 1). These areas will allow vehicle drivers a better view of their machines so that they can be better monitored and controlled. However, from the beginning of the launch period until the end of the heat, no team member, or any other person, may have contact with their system components. Moreover, no team member, other person, or mechanical device may interfere with the movement or activities of their human competitors during the setup, launch, competition, and clean-up periods. Such interference may lead to disqualification.

3.4 Ping Pong Ball Dispensers. Four ping pong ball dispensers will be placed to the west of the starting zones (see Figures 1, 2). Each dispenser will consist of a clear plexiglass “hopper” containing either white or red colored ping pong balls. White ping pong balls will be associated with the team starting in the southern start zone, and they will be placed in the southernmost lower and upper ball dispensers. Similarly, red balls will be associated with the other (northern) start zone, and preloaded into the lower and upper dispensers on the north side. As described in more detail below (Section 9), the contents of each dispenser will be released by contacting/tripping a switch or lever. The balls will exit the hoppers via shoots whose lower lips will lie at levels of 1.5 feet and 5.5 feet off the ground. Before the start of each heat, twenty balls will be placed in each lower dispenser, and 30 balls will be placed in each upper dispenser. *As described in Section 9, the activation of “trip switches” and “trip levers” will release the ping-pong balls.*

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3.5 Elevated Scoring Hoops. Twenty (20) feet from the eastern edge of the ball dispensers, a pair of hoops, 8 feet in diameter, will be hanging from the ceiling so that the bottom of each hoop will be located 15 feet above the gym floor (see Figure 3). The southern (northern) team can score points by passing one of their team’s vehicles through the southern (northern) hoop.

3.6. Scoring Arena. Further to the west (20 feet from the elevated hoops), a two tiered scoring arena will be placed along the midline of the contest arena (see Figure 4). The bulk of the scoring activity will occur in this arena. The lower tier will contain two scoring bins where teams should deliver their gathered ping pong balls in order to score points. The upper tier of the arena will also contain a scoring bin where teams can deposit their ping pong balls. *The sides of this upper scoring arena will be constructed from plexiglas in order to aid visibility, while the bottom of the bin will be constructed from a light mesh in order to minimize bouncing of ping pong balls dropped into the bin.* As described in Section 5, balls placed in the upper scoring region will be accorded a multiplying factor when determining a team’s final score. Hence, there is an incentive to deposit the gathered balls into the more difficult to reach upper region.

3.7 Finish Area. Teams can score additional points (see Section 5) if their vehicles end up in the finish zone at the end of the competition period.

3.8 Demarcation of Contest Zones. On contest day, all of the boundaries seen in Figure 1 will be clearly marked with tape on the gymnasium floor. *A small border will be placed on the outer boundaries of the contest zone in order to keep stray ping-pong balls from leaving the contest zone. Additionally, to the extent humanly possible, the contest judges will return any ball that wanders out of the arena back into the arena at a point which is closest to the point where the ball first left the arena.*

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3.9. Possible Interactions between Competing Machines and Competing Teams. *You may not interfere in any way with an opponent's devices during the set-up and launch periods. I.e., you may not block your opponent's exit from their starting zone, nor enter the opponent's starting zone.* However, you are allowed to interfere with an opponent's devices once **all** viable competing devices have left the starting zone. *A device will be deemed viable if it makes any movement during the first 5 seconds of the competition period. Devices which have not produced any movement during this period will be automatically unviable. Additionally, a contest judge may declare vehicles unviable at any time. The declaration of unviability is at the sole discretion of the contest judges, but will generally be applied when it is readily apparent that a component or vehicle is disabled, or intentionally left immobile by a team as part of their strategy. After you the end of the launch period (when all vehicles are clearly viable or unviable, you may enter your opponent's starting zone, though there is unlikely to be any advantage in doing so.*

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While you may block, impede, annoy, or otherwise slow down your opponent during the competition period, you may not cause intentional damage to your opponent's system. Pushing, shoving, ramming, blocking, and flipping are allowed strategies. Grabbing a vehicle in a manner which will not cause harm is allowed. However, grabbing operations that may cause perforation or other damage will result in disqualification. The contest judges will disqualify a team for what is deemed intentional damage. *To reiterate, pushing, shoving, and blocking is explicitly allowed even if it results in devices flipping over or falling off from the elevated contest areas. Contestants should design their vehicles to survive such physical actions.* Intentional tearing, stabbing or striking *so as to dislodge components on opposing vehicles* is not allowed. Additionally, devices must avoid creating entanglement hazards such as dangling nets or strings which may ensnare and damage motors, shafts, and propellers.

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You may not modify, or intentionally block, the radio control signals emitted by an opposing teams' transmitter. Intentional damage to any receiver/control module will result in disqualification. Each team's transmitter/receiver pairs will have a different frequency to minimize interference. However, past experience suggests that you should expect *some* sporadic radio interference during the contest. It is your responsibility to avoid damage to the receiver/control modules during the design, fabrication, testing, and contest phases. Competitors should avoid placing their receiver/control modules in a vulnerable position within their devices.

4. Starting Zone and Starting Procedure

- Prior to each heat, a team will be given 45 seconds (beginning with the judge's start command) to place their device(s) within their start zone. All of the team's components that will be used in that heat must be initially placed within starting zone boundaries.
- For sake of efficiency, the contest judges may optionally request teams to set up their entries while another contest round is still taking place. Therefore, the contest judges will notify teams that they are "on deck" for the next heat. Any team "on deck" must be able to start their set-up procedure at a moment's notice.
- Two launching zones (one for each team) will be available for each head-to-head heat of the competition. They will be placed 5 feet apart, symmetrically located about the midline of the competition zone (see Figure 1). Teams will be assigned to their specific starting zone (i.e., the north or the south zone) by the contest judges.
- Each team's launching zone will consist of a virtual box whose sides are 8 feet long in the east-west direction, 4-feet wide in the north-south direction, and 6 feet tall (measured from the gymnasium floor). The horizontal dimensions will be indicated by colored tape on the gym floor (with the permissible area including the tape itself). The vertical height constraint will be checked by the contest judges as necessary at the beginning of the heat.
- During the 45 second set-up period, passive mechanical energy, up to the limits described in Section 7, can be stored in a team's entry. This energy can come from the contest motors and contest battery pack, or from team members' muscle power. NO external electrical, chemical, or other mechanical connection can be made to the system during the setup, launching, or competition phases. I.e., additional sources of energy besides those in the approved contest material list cannot be used.
- At the end of the 45 second setup period, *your devices must be statically stable and self-supporting*. Any lighter-than-air components must be able to stay within the starting zone without human intervention.
- Each system must have a launching procedure that can be simply activated by the press of an electronic or mechanical switch, or by operation of a radio-control system command. From the beginning of the heat (end of the set up period) until the end of the heat, contestants may have no physical contact with their device. Pushing, throwing, or kicking of devices to enable launch is not allowed.
- During the set-up and launching phase, all of the team's contestants must be located within the "starting box" region (see Figure 1). During the set up period, contestants may not interfere with their competitors' devices or their set up procedure.
- Some teams may choose to design and build systems containing multiple components—i.e., different vehicles whose characteristics are optimized to beat different types of opponents. This is permitted as long as: (1) ALL devices do not contain more than the prescribed amount of material (which is summarized elsewhere in these rules), (2) the ensemble of ALL devices respects the contest weight limit and volume limits described in Section 8; (3) and ALL devices can fit simultaneously inside the rectangular box of the launching zone. Any device which will not be used during a particular heat need not be placed in the starting zone at the beginning of that particular heat.
- At the end of the heat, all parts of your system must be removed from the starting zone and contest arena within 30 seconds. Failure to do so can result in a loss for that heat.

- To reiterate, you may not interfere with your opponents or their vehicles at any time during the set up procedure. You may not enter your opponent's starting zone during set up or the subsequent launch period.

5. Scoring

Each team can score points in the following ways.

- **Ping pong ball scoring and collection area difficulty multiplier.** White and red colored ping pong balls have an initial scoring value of 1 point. However, a degree of delivery difficulty factor will multiplicatively adjust the final scoring value of each ball, in recognition that it is more difficult to deposit balls in the upper scoring arena. The degree-of-difficulty factor is 1 for the lower scoring bins and 3 for the upper scoring bin (see Figure 4). Thus, one point will be awarded to the respective team for each ball that ends up within a scoring bin of the lower scoring arena. I.e., for each white ball, the team starting in the southern start zone will receive 1 point, while the northern starting team will receive 1 point for each red ball. Each ball that is deposited in the upper scoring bin will add 3 points to that team's scoring total. Since each team has access to 50 ping pong balls, up to 150 points may be scored if they are all placed in the upper scoring zone. It is perfectly permissible for your scoring balls to be contained within one or more of your vehicles, and for your vehicles to lie within the scoring zone at the end of the regulation competition period. If your vehicle does not lie entirely within the scoring zone, those balls lying entirely within the vertical column above the receptacle boundaries, but below the upper bound of the scoring area, will be scored.
- **Elevated hoop scoring.** Each team can gain an additional 30 points by passing the entire length of a team vehicle through that team's elevated hoop—i.e., the southern (northern) team must pass a vehicle through the southern (northern) hoop to gain these points. The vehicle can move through the hoop in either direction. Note that the elevated hoop score can only be obtained once. Additional passes through the hoop, while certainly allowed, will not contribute additional points to a team's score.
- **Finishing zone.** Each vehicle that lies entirely within the finish zone (and its vertical extent) at the end of the competition period will gain an extra 5 points for that vehicle's team. Vehicles that lie partially in the zone will be awarded 2 points. Note that a vehicle is considered to be a moving device containing a radio receiver and actuators. Thus, vehicles that split apart into multiple parts in the finish zone will not receive additional points. NOTE: at least one scoring ball must be placed in a scoring receptacle during the regulation period in order for a team to be eligible for the finish zone points. That ball need not stay in the scoring zone until the end of the heat.

NOTE: willful damage to the scoring balls or scoring receptacles can result in disqualification.

6. Evaluation

The team with the highest score at the end of a heat's regulation period (and satisfying the constraints outlined above) will be declared the winner of that heat. If the score is tied, the following *tie-breaker* formula will be used. The team receiving the greater proportion of its final

score from *elevated* points (i.e., those points gained by placing balls in the upper scoring area or passing a vehicle through the elevated hoop) will be declared the winner. If this procedure does not resolve the tie, then both teams will be assigned a “win” for that heat. If neither team scores during a heat, then both teams are assigned a loss for that heat. In all cases (particularly those requiring judgment) the judges decide the winning and losing outcomes of a heat.

The overall winner is determined in a double elimination tournament. This is just like a single elimination tournament, except a team must lose twice to be eliminated from the competition. The head-to-head competition and double elimination format is chosen so as to eliminate, as much as possible, the effects of transient conditions (e.g., gusts) and other random factors on contest performance. Your device must be robust enough to survive repeated contest rounds. Basic mechanical repairs to your device are allowed between heats (see Section 8.3). However, “spare” devices cannot be substitute for the original device between contest rounds.

Pairing of teams in each heat will be chosen randomly at the start of each tournament round. Therefore, teams must be able to compete at a moment’s notice once a new round begins.

7. Energy and Actuation Sources

Every team will be provided with the same energy sources and actuators, which will consist of

- 1) Three “small” battery packs that are designed to power radio-control receivers.
- 2) Eight hobbyist servo-motors (four “small” and four “medium” sized).
- 3) Three large battery packs (which are designed to power motors and motor controllers).
- 4) Four “large” brushed D.C. servomotors and four “small” brushed D.C. servomotors. Speed controllers are available for these motors as an option.
- 5) Energy may be stored passively in elastic members or in compressed materials (e.g., compressed air), as long as these energy storage components are made and energized from prescribed contest materials and energy sources. The stored energy must also conform to limits that are described below.

Each team will be provided three standard model-airplane radio-control transmitters, each having 6 channels of control that can be used to remotely control the hobbyist servos and the D.C. servo motors (through the use of an optional D.C. speed controller). These radios and receivers cannot be modified in any way; they must be used in the format as they are provided to you. Note that these transmitters can be reprogrammed in different ways in order to simplify the use of their joystick inputs. Similarly, the battery packs provided cannot be chemically or thermally altered.

Students will have access to an ample number of battery chargers throughout the course and during the contest. However, design teams may choose to purchase additional battery packs if so desired in order to ensure maximum charge during the contest. But no more than three small and three large battery pack may be used by one team in the system design and deployment. Additionally, batteries will be provided during the testing and contest period for the hand-held radio control modules. The battery packs may not be modified in any way at any time (mechanically, chemically, thermally, electrically, etc.); they must be stored and operated at ambient temperature. Depleted radio control module batteries can be recycled in the M.E. Shop.

Passive Energy Storage Limits. There will be limits on the amount of mechanical energy that can be stored in your devices prior to the initiation of the launch sequence. This energy may be obtained by deforming any elements in the prescribed material list, or by compressing air or other contest materials. The limit of such stored energy that prior to the start of the launch sequence will be 20.0 joules (approximately the amount of energy stored by deforming six (6) medium sized rubber bands). Testing and analysis that demonstrates conclusively that these limits have been met must be included in your design notebook, and approval of your analysis must be given by one of the class instructors. Note that gravitational potential energy can be used within the limits of the starting box and system volume constraints (see Section 8).

8. Mass, Volume, and Material Constraints.

8.1 Contest Materials

Each team's device(s) must be constructed entirely from materials supplied in the contest materials list. This "kit list" can be found in a separate document on the course website. It is likely that this list will occasionally updated during the quarter, with those updates announced in classes, and the kit list "version number" indicated on the website. No other materials (either from the M.E. Shop, or elsewhere) can be used or substituted, with exceptions described immediately below. In addition to the standard kit list, each contestant may also use:

- (a) A maximum of 12.0 ounces (dry cured mass) of RTV silicone casting compound. This compound is supplied in bulk. See the M.E. Shop Staff (John Van Deusen or one of the class T.A.s) if you wish to cast one or more parts out of silicone. The intended purpose of this casting compound is for sealing, however, it may be used for molding components.
- (b) A maximum of 6 meters of 2.38 mm [3/32 inch] diameter "Orange-Go" belt material may be used. The M.E. Shop staff can show you how to join the ends of a segment of this material into a continuous belt. The intended purpose of the "Orange-Go" is to construct power transmission belts. However, it may find other purposes.
- (c) Glues and epoxies (including hot glue sticks) that are used only for bonding. Un unlimited quantity may be used for bonding purposes only. A total of 4 ounces of glue or epoxy may also be used (in combination with other materials on the approved contest material list) to create a composite material, with glue as the matrix.
- (d) Paint or Shellac may be used to insulate strands of wire. Similarly, up to 1 m of black electrical tape may be used for electrical insulation, but not for structural purposes.
- (e) Light machine oil, mineral oil, or vegetable oil (depending on the competitor's preference) can be used to lubricate moving parts.
- (f) Up to 1 meter of adhesive tape may be used for sealing. Tears in mylar balloons can typically be repaired quite effectively with scotch tape.
- (g) Non-functional decorations (such as decals and paint) can be used liberally, and are in fact encouraged. Make your devices beautiful to look at, as well as exciting to watch!

Each contestant's final device(s) must be able to have been fabricated from the materials in the kit list, with the exceptions described above. During the construction and testing of your devices, you may use more total materials than are prescribed on the approved material list, but the final device(s) cannot use any more material than is specified by these rules. Some of you may choose to build different type of vehicles so that you can select one that is optimized for a particular type of opponent. This is permitted. However, the total ensemble of your devices must be built within the limitations of the prescribed contest materials, the prescribed mass and volume limitations, and must fit within the limitations of the starting box restrictions.

Replacement supplies and materials are available on a limited basis. If you damage something, or cut it up, and then want to do something different with it, see the M.E. Shop staff. We will do our best to supply replacements, but we cannot guarantee unlimited supplies of all materials. We also cannot guarantee that replacements will be identical to the original. You may want to check availability of replacements prior to conducting a risky experiment with a rare part. In particular, each team member will be supplied with only one set of hobbyist motors and radio control system. If these devices are damaged, it is up to the students to replace them. Sources for these items can be found in the *resources* section of the class web site.

While some glues and epoxies will be available in the M.E. Shop, to ensure an un-interrupted supply, students should go to a (hardware) store, and buy their own.

The approved contest materials may be mechanically modified in any way (disassembled, cut, machined, turned, ground, etc.). However, they may not be altered chemically (except locally by glues, for bonding, or paint for decoration or insulation purposes).

Soldering and brazing are permitted, though not encouraged. Welding is not permitted.

8.2. Contest Entry Size and Weight:

(a) Size: Two days prior to the tournament, each team must demonstrate that, in its immediate pre-launch configuration, all the devices will fit into the starting zone box. Two weeks prior to the contest date, a measuring device will be available in the M.E. Shop to check this constraint.

(b)Weight: Each team's total design must not weigh more than 22 lbs (~10 kg), including the actuators and battery packs (but not including the hand-held radio controller). A flying vehicle's weight will be measured including its stored helium. If a flying vehicle is neutrally buoyant, its weight will be zero. Your devices will be officially weighed in the ME shop in the 2 days prior to the contest. If needed, the contest judges may request a weight spot-check on contest day.

(c) Volume: all "ground vehicles" (i.e., those that cannot float autonomously) must be able to simultaneously fit inside a 80 cm x 80 cm x 80 cm cube. During the competition, the vehicles may unfold or extend components which would result in dimensions larger than this constraint. However, at the beginning of a heat, the vehicles must satisfy this constraint.

It is conceivable that a team may choose to deploy a device that consists of a ground vehicle coupled to a lighter-than-air component (such as a balloon on a tether). If the lighter than air component has its own radio control receiver, and can operate independently, then it will be judged as a vehicle. In this case, the lighter-than-air vehicle must satisfy the starting zone constraints. If the lighter-than-air component is not independently controllable, then the following rules will apply. If the lighter than air portion of the vehicle design can be clearly delineated as a separate “component” (a mechanical assemblage which can easily be separated from the main vehicle, e.g. by cutting or releasing a tether) than the volume constraint which applies to the ground vehicles does not apply to this lighter than air component. However, this lighter than air component cannot qualify for scoring through the elevate hoop. The contest judges have the final authority in interpreting and applying this rule. So it is best to check y

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8.3 Allowed Changes to Design on Competition day. After a device’s initial heat, no major design changes or construction will be allowed. It is inevitable that crashes and damage will be experienced during the competition. Repairs to your devices using materials from the approved materials list will be permitted provided that, in the judges’ opinion, they involve no major design changes to the initial device. Pre-fabricated “spare parts” are only allowed if they have been included in the device weight-in, size restriction, and materials budget. Minor changes, such as angles of propellers axes, placement of balancing weight, etc. will be permitted. These minor corrections must respect the rules on size, mass, and materials described elsewhere.

9. Additional Clarifications of the Contest Arena Geometry

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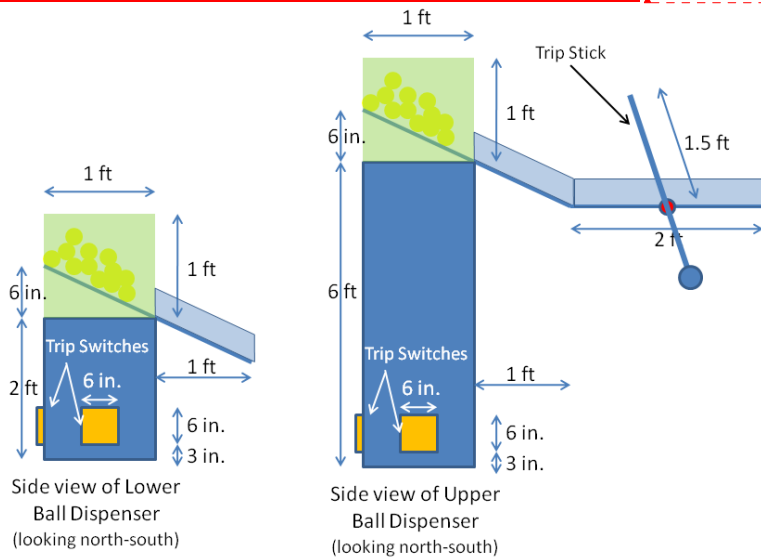


Figure 2: Schematic diagram (not to scale) of the ping pong ball dispensers.

9.1 Ping Pong Ball Dispensers. Figure 2 diagrams the lower and upper ping pong ball dispensers. *The chutes consist of vertical columns which have a 1-foot square cross section. The*

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 9. Additional Clarifications of the Contest Arena Geometry ¶

upper portion of each dispenser will be made of Plexiglas (or similar transparent material) so that the balls can be viewed. The tops of each dispenser will be open. The lower portions of the dispenser will be made from wood. The dispensers will be weighted internally to provide stability. Each chute will also be made from transparent material, and the chutes will similarly be open on their top sides. The chutes will have an overall 1 foot width, and their side panels will be approximately 4 inches wide.

Both dispensers have “trip switches” on their rear and outer sides. I.e., the south (north) dispensers will have a trip switch on the south (north) side. When either switch is pressed on the lower dispenser, these trip switches will release the balls in the dispenser, allowing them to fall down a chute, where they potentially can be gathered. The upper dispenser will have an additional “trip stick” which will work as follows. For the balls to be dispensed from the upper dispenser, both the trip stick must be activated (by rotating the stick through at least a 5 degree angle in either direction) as well as one of the bottom trip switches in order to release the balls. The order of switch activation does not matter. The dispensers will be symmetrically placed around the mid-line of the contest arena (Figure 1), with 2 feet spacing between each dispenser.

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9.2 Elevated Scoring Hoops. The configuration of the elevated scoring hoops is shown in Figure 3. Note that the hoops will be supported by ropes attached to the ceiling of the Brown Gym. These ropes serve as a natural obstacle in the arena, and must be taken into account.

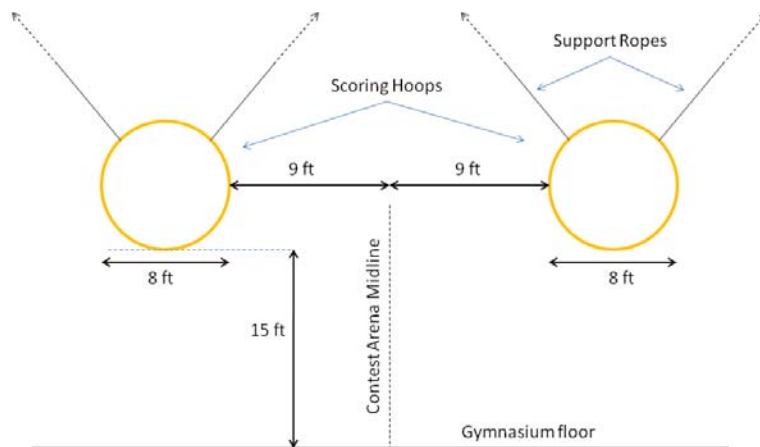


Figure 3: Schematic diagram of the elevated scoring hoops (not drawn to scale)..

9.3 Scoring Arena. A more detailed schematic of the scoring arena geometry is shown in Figure 4. The lower level will consist of a 10 ft x 10 ft platform raised 1 ft off the gymnasium floor. A skirt around the base of the lower scoring level will prevent vehicles from going underneath this platform. The upper scoring region will consist of a simple square bin with 4 ft long sides, a solid flat bottom, and 6 inch high side panels. It will be supported by 4 simple posts such that its bottom is 4ft above the surface of the lower scoring arena

Two scoring zones are located on the lower level. They consist of 2 ft x 2 ft holes cut in the surface of the lower zone. The holes are positioned on the north and south sides of the lower platform, along its midline. The outer edge of the scoring zone is 1 foot from the edge of the arena. Within the scoring zone holes, a recessed floor is located at a depth of 9 inches below the lower platform surface. Sloping walls (at an angle of 45 degrees) will connect the floor of the main scoring arena with the recessed floor of the scoring hole. The sides and bottom of the scoring scoring pit will be made from Plexiglas for improved visibility. In this way, vehicles can drive in and out of the scoring holes.

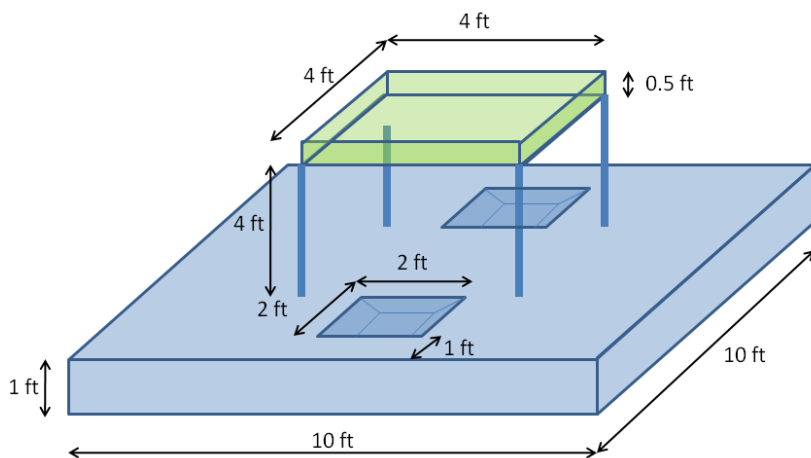


Figure 4: Schematic diagram of the scoring arena. Note: the diagram is *not* drawn to scale. The ramps, not shown in this diagram, would be positioned on the left and right sides.

9.4 Finishing Area. The finish zone dimensions are 8 feet in the east-west direction, and 30 feet in the north-south direction. The zone will be centered on the mid-line of the contest arena, while the eastern edge of the zone will lie 5 feet from the western edge of the scoring arena.

10. Additional Contest Rules

10.1. Safety:

(a) Device which may injure participants or spectators will be disqualified.

10.2. Team Number. Each team will be assigned a 2-digit integer number to identify their team and their contest device(s). Each major component of each team's design must carry an identifying team number. Note that Number 00 is reserved for the contest placebo. While not required, teams are also encouraged to choose a team name, and perhaps a team logo.

10.3. Settling Period. At the end of the competition period, a 5 second "settling period" may be optionally allowed by the contest judges to account for any scoring items that have not stabilized at the end of the competition period. However, all power and control to the contest vehicles must be terminated at the end of the regulation competition period.

10.4 Pre-contest testing. Prior to the final contest, participants are encouraged to test their devices. While we will endeavor to make sufficient testing time available in the Brown gym, we cannot guarantee that the gym will be available for testing on any specific day.

10.5. Other intentional damage. Any intentional damage to Caltech buildings, grounds, or other Caltech infrastructure prior to or during the contest will result in disqualification.

10.6. Set-up and Clean-up Periods:

(a) After the end of the set-up time, but before the “go signal” is given, no action of a team’s device(s) is permitted. I.e., motors cannot work to store energy. Even during the set-up period, only those movements of the team’s mechanisms that are needed to place the devices in the launch region and to store passive mechanical energy (up to the contest limits) are allowed.

(b) A maximum pick-up time of 30seconds (commencing from the end of the regulation competition period) will be allowed for removing all of your device(s) from the contest arena.

10.7. Bye Heats in the Tournament (the “Placebo” rule). If your team gets a bye in any round (because there are an odd number of surviving teams in that round), or your opponent(s) do not show, your team must be prepared to compete against a *placebo device* if so requested by the contest judges. In a placebo round, your vehicle must place at least one scoring ball in one of the scoring receptacles in order to successfully pass the placebo round. This ball need not stay in the scoring receptacle through the remainder of the heat for the round to be successful.

10.8. Authority of the Contest Judges. The course instructors and contest judges will attempt to resolve any disputes or gray areas in the rules using the spirit in which these rules were designed. However, the course instructors and contest judges *have the final authority in all contest matters and decisions*. Just like baseball, unprofessional arguing with contest judges can result in expulsion from the contest.

11. Individual Work

While you will be working in teams, it is expected that each individual will design and fabricate a significant portion of each functional device. It is acknowledged that interaction between teams in the class is highly beneficial. To that end, any conversations, calculations, analyses, ideas and tests may be shared among the teams, but the device design and fabrication must be an individual team effort. Note that this collaboration policy does not extend to replicating others’ ideas. Occasionally two teams will arrive independently at very similar solutions. Sometimes one team will see a great idea in another team’s device, and finding no superior alternative, will want to incorporate it. This duplication is permissible, however, not encouraged. In the past, some competitors have maintained a high level of secrecy around their device, and blindly copying an idea or strategy may be risky. In many respects, you should treat this design project as similar to an ordinary homework set. It is permissible to collaborate with your classmates and seek the advice of the instructor, TA’s, M.E. Shop staff, other class participants, and other students. However, the final product must be your own work. It is vital to document both your own work

and the contributions of others to your ideas by detailing the process of ideation, design, and fabrication in your design notebook. If you are concerned about the acceptable limits to collaboration, discuss the situation with the instructor(s). Do your own work, and as always, it is best if you use your own ideas and concepts.

