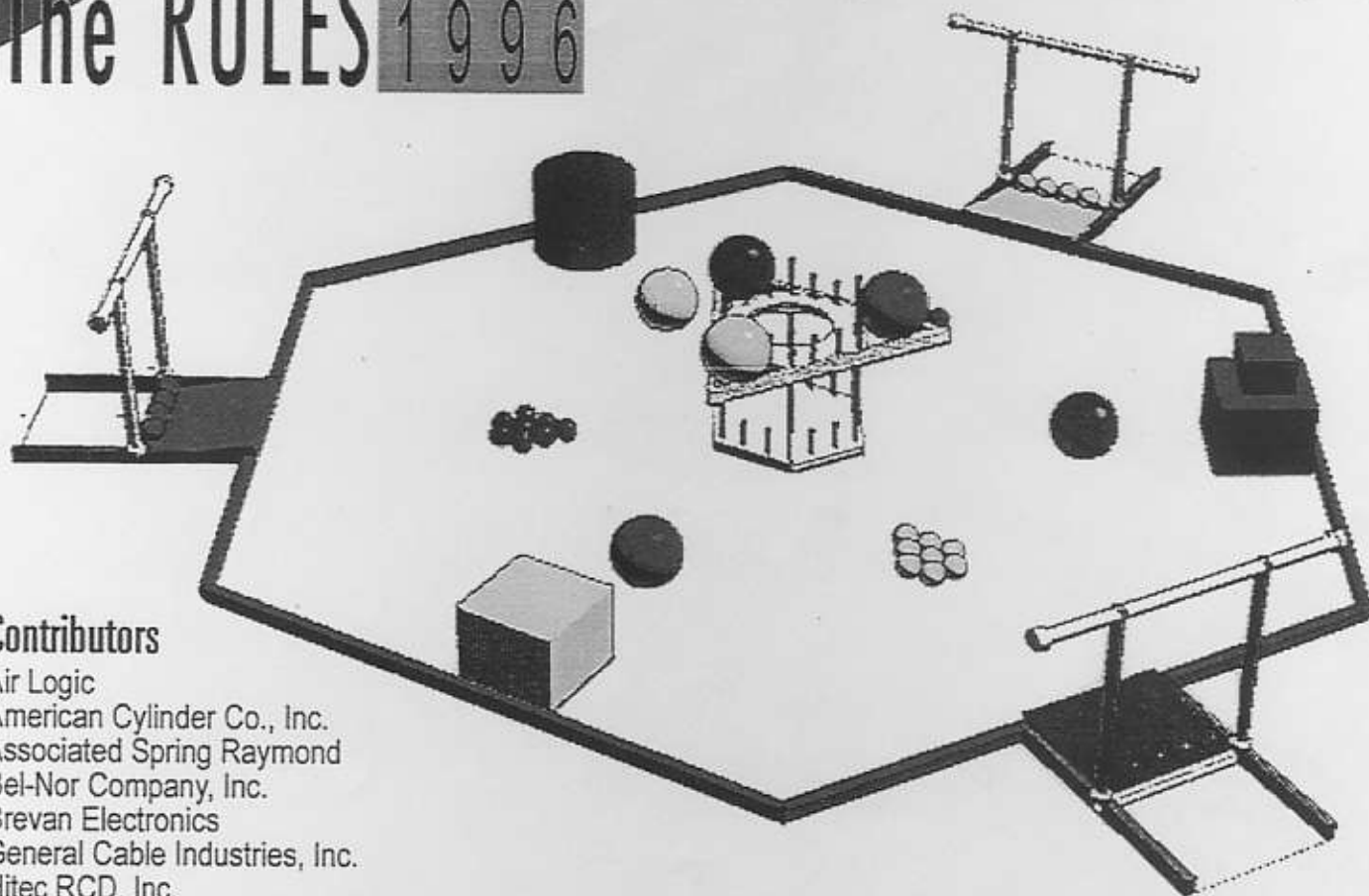


U.S. FIRST THE COMPETITION The RULES 1996

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1. THE GAME

1.1 Game Description

Remotely-controlled robots must be designed and built to collect, transport, and lift 8" and/or 24" diameter balls. There will be 12 small balls and 2 large balls per team. In addition to the robot, each team will be allowed to use a human player, seated at a station on the side of the playing field, to interact with the balls. Points will be awarded for balls located in the central goal at the conclusion of a two minute match. Ball color will be used to identify team ownership. Each small ball in or above the hexagonal portion of the goal will be worth 3 points. Each large ball in or above the hexagonal portion of the goal will be worth 10 points. Each large ball on or over the triangular corners of the goal will be worth 5 points. The geometric center of a ball will be used to determine its position. Starting locations of the balls, robots, and human players are shown in Figures 1 & 2. The winner of each match is the team with the highest score. In the case of a tie, the large ball closest to the center of the field breaks the tie.

1.2 Field Diagrams

The playing field is a carpeted, hexagon-shaped area with a central goal. Around the perimeter of the field are three stations for human players. The perimeter of the field is defined by a curb of 4x4 lumber, resting directly on the carpet. Approximately every 4' around the perimeter, a 1"Ø x 19" tall steel post is inserted into the wooden curb with three 1" size eye loops at 9", 13" and 18" from the field level. At each level, a 3/16"Ø plastic coated steel cable surrounds the field. There is a protective pipe plug on top of each post. The fence is a safety feature and no part of any machine may react against it.

The goal is hexagonal if viewed from above, and has an upper and lower section surrounded by wooden posts. The upper section has a triangular frame which juts out on three sides to provide pockets for the large balls. The upper section also has a 34"Ø hole which allows balls to fall through to the lower section. The goal is constructed of 3/4" plywood sheets, 2x4 beams, and 1-1/2"Ø wooden rods, as shown in Figures 3 and 4.

Each player station is comprised of a ramp, posts, seat belt, and base plate, as shown in Figures 5 and 6. The ramp is 3'-7" wide by 3' deep and consists of a 3/4" piece of plywood with one end on top of the 4x4 field border, and the other end on the carpet, so that it is sloped away from the center of the playing field. The 4x4 field border and wire rope fence extend to the sides of the ramp and base plate, so that there are actually 3 discrete sections of fence per field.

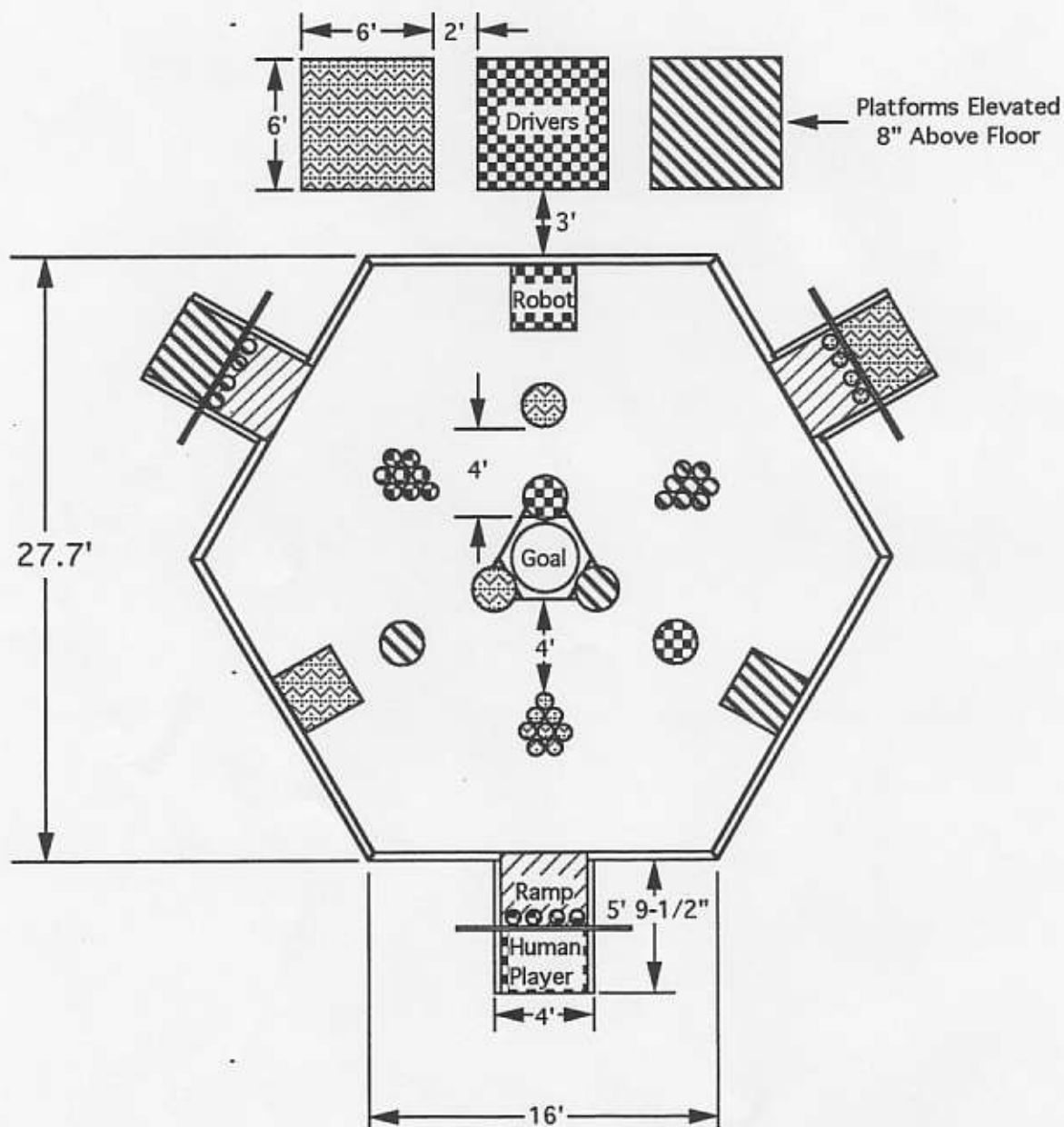
The base plate is a 3'-7" wide by 3' deep piece of 3/4" plywood connected to the lower edge of the ramp. It rests directly on the surface of the carpet. The base plate is used to secure the seat belt, the base of the posts, and indicate the area in which the human player may attempt to contain balls.

Two vertical posts of 2"Ø, schedule 40 PVC pipe are mounted to the base plate by pipe flanges located at the end of the ramp. An 8' long horizontal post of the same type of PVC pipe is mounted across the top of the two horizontal posts via T connectors. The ends of the 8' post are covered with PVC end caps. Each post structure is stabilized by 4 tension cables running from eye-bolts just below the T junction of the posts to eye-bolts mounted at various locations around the 4x4 field border.

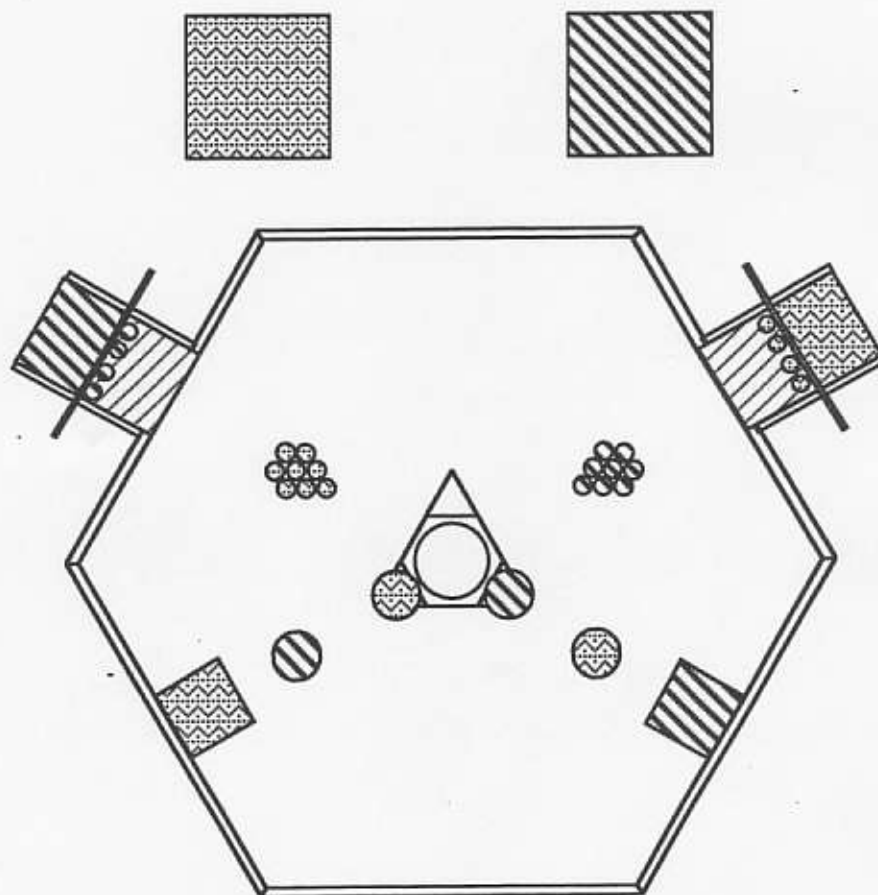
The seat belt is threaded through two slots in the rear center of the base plate.

All field dimensions are $\pm 1"$ non-cumulative. The large balls have a diameter of $24" \pm 2"$. The small balls have a diameter of $8" \pm 1"$. Both types of balls will be inflated to size, not pressure.

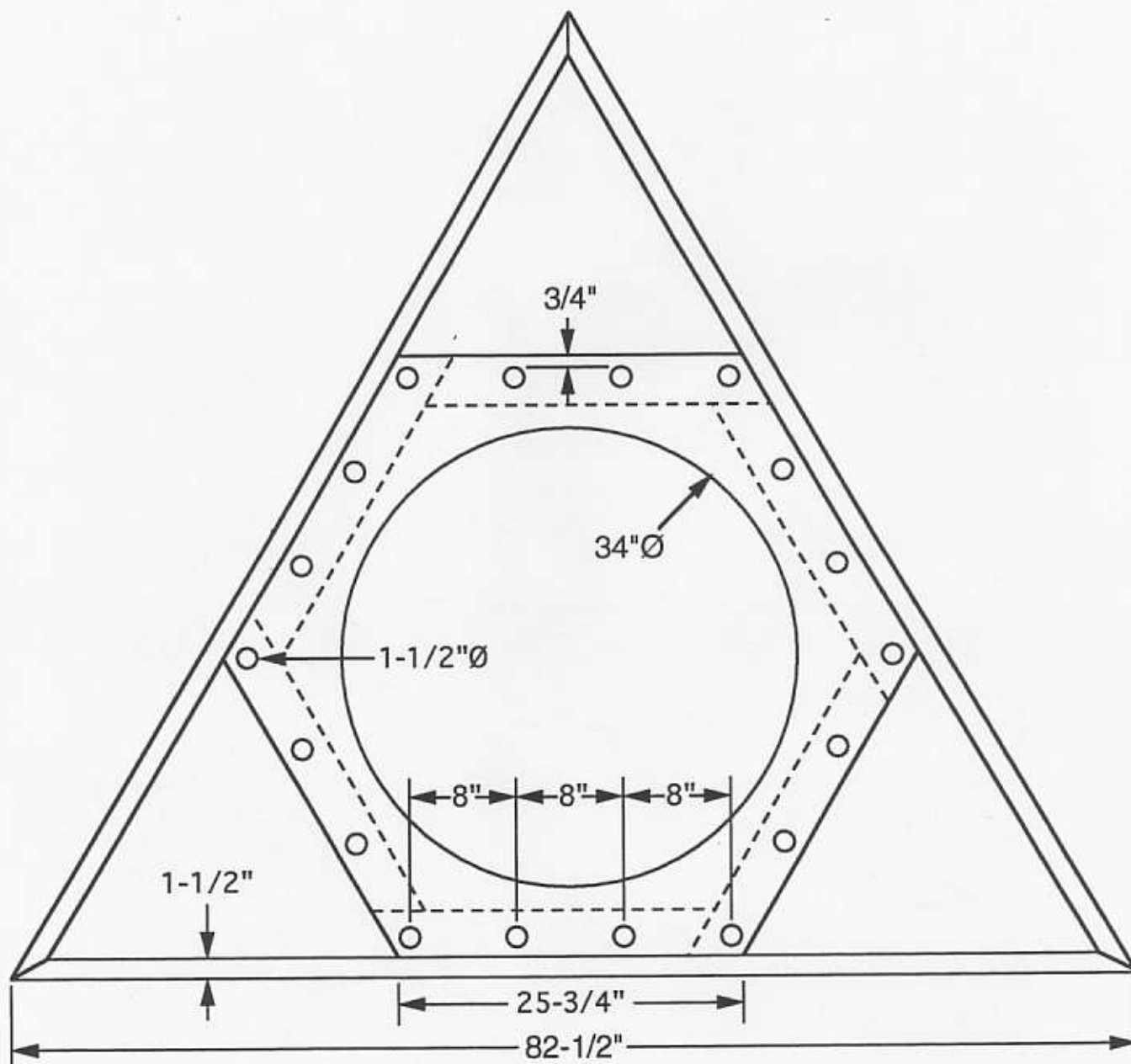
Playing Field - Top View
Seeding/Double Elimination Rounds
Figure 1



Playing Field - Top View
Finals Rounds
Figure 2

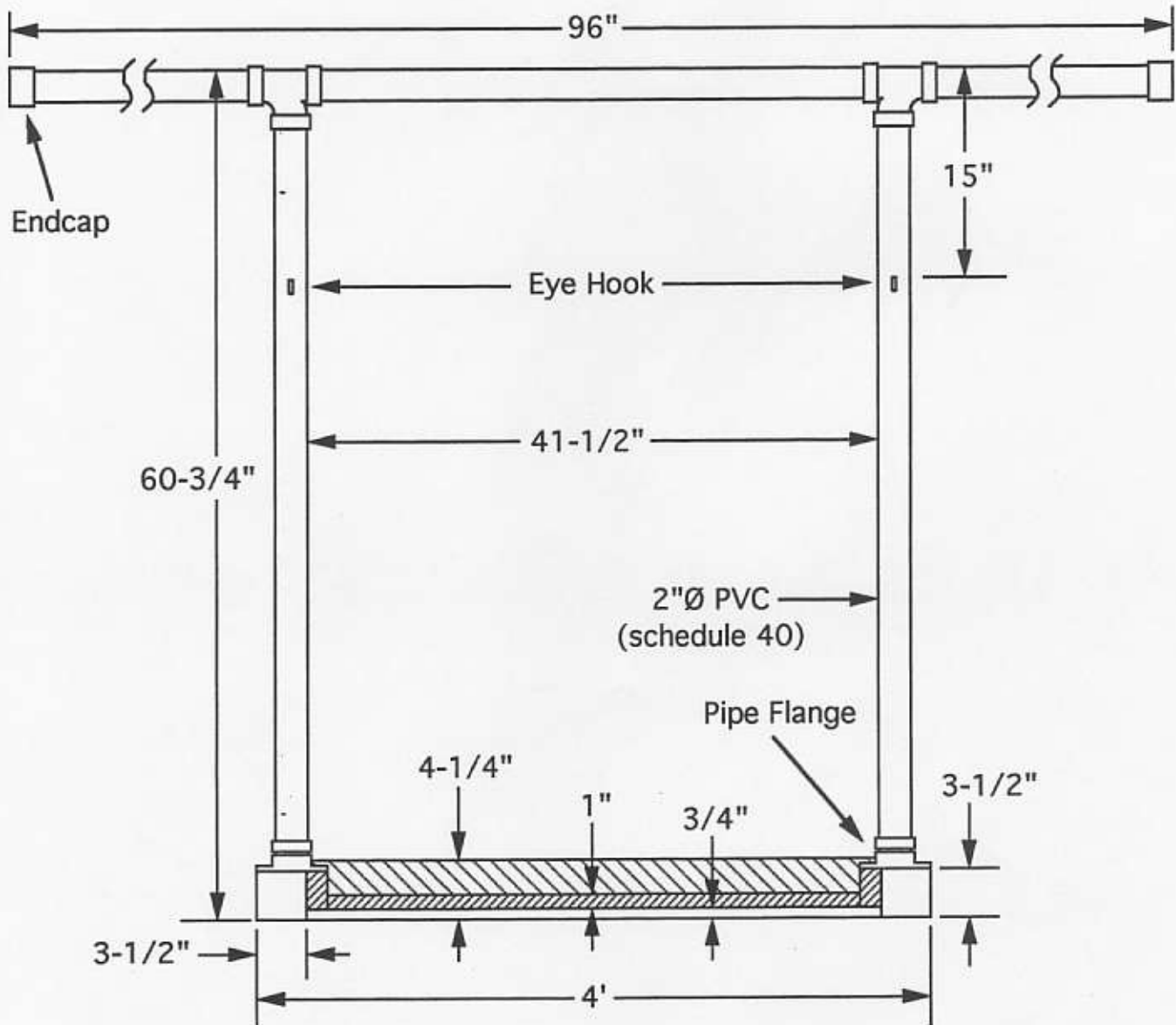


Central Goal - Top View
Figure 4



Notes: 34"Ø Hole and triangular frame exist on upper level only.
Dashed lines indicate presence of 2x4s under 3/4" plywood on both levels.

Player Station - Back View
Figure 5



Notes: Nylon rope and lower eye hooks and omitted for clarity.

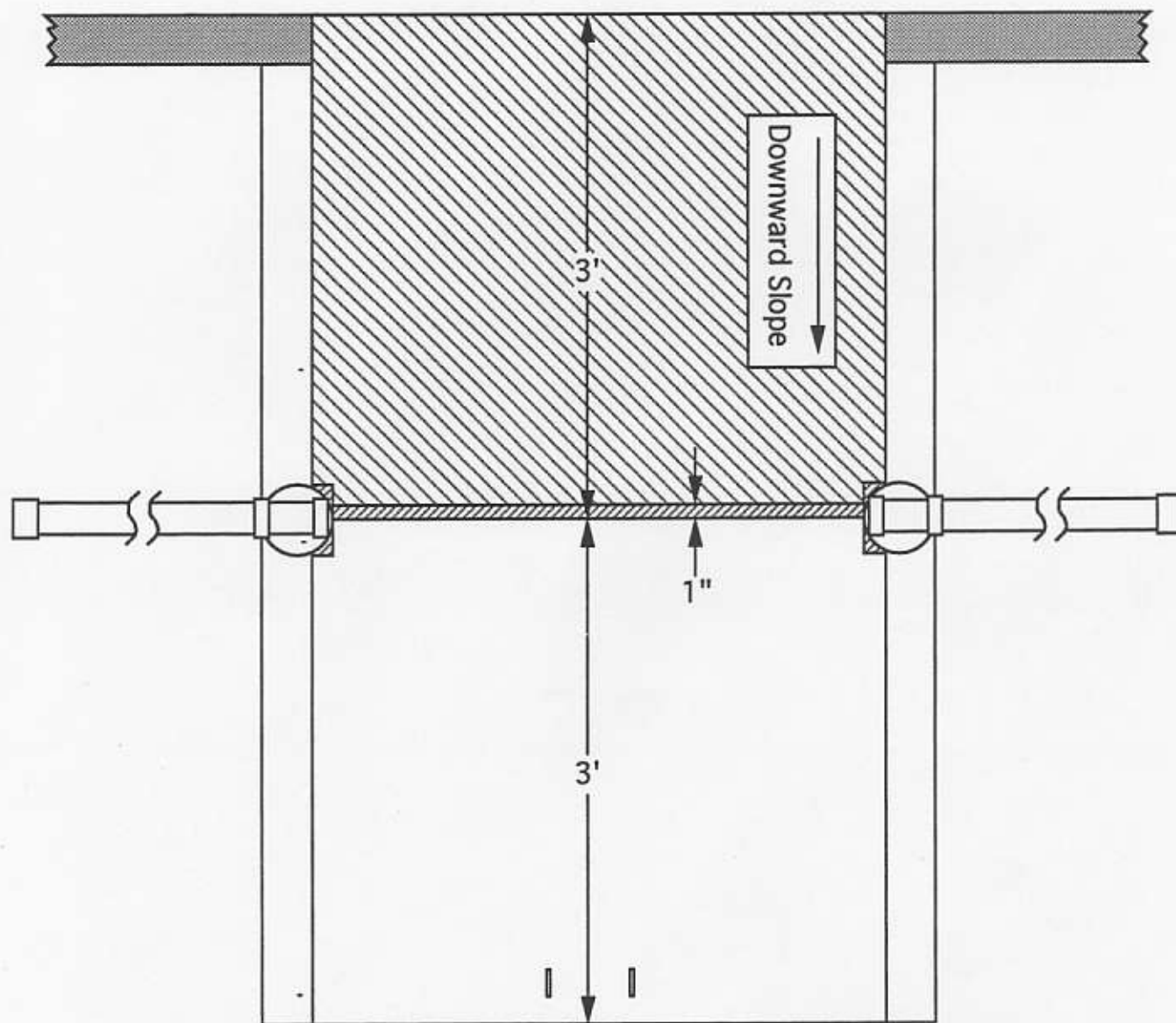


Ramp (3/4" plywood on slope)






Pipe flange supports and ball stop

Player Station - Top View
Figure 6



Notes: Center PVC bar omitted for clarity.

-  Ramp (3/4" plywood on slope)
-  Pipe flange supports and ball stop
-  Field border

1.3 General Tournament Rules

(see complete list of rules in Appendix B)

- T1. Referees have ultimate authority during the competition—their rulings are final.
- T2. If a machine is disqualified by a referee, that machine is turned off for the remainder of the match, and any points scored during that match will be forfeited.
- T3. If a machine is disabled by a referee, that machine is turned off for the remainder of the match, and any points scored during that match will count.
- T4. A machine may not win a match through an advantage gained by breaking a rule, even accidentally. The effect of the infraction on the outcome will be decided by the referees.
- T5. Strategies aimed solely at the destruction, damage, or entanglement of opponents' machines are not in the spirit of the tournament and will not be allowed. Turning over an opponent's machine is not considered damaging and will be allowed, but stabbing, cutting, etc., is illegal. If a breach of this rule occurs the contestant's control system may be disabled by the referees.
- T6. Limited amounts of machine shoving will be allowed; however, if you damage opponents' machines, referees may take action against your team. Possible actions include, but are not limited to; stopping the match to allow the damaged machine to be repaired before resuming play, a complete rematch after repairs have been made, or disqualification of your machine and forfeiture of any points scored.
- T7. If a team's machine is damaged to the point that it cannot complete a round on a fair basis, that team may be eligible for a rematch. This decision will be up to the referees.
- T8. If one team intentionally damages another team's machine, it may result in disqualification. However, if the damaged team's machine is considered too flimsy to begin with, the other team may not be disqualified. The ultimate determination will be with the referees.
- T9. The playing field carpet will be directly on the floor.
- T10. Deliberately damaging the playing field, controls, or balls (using spiked wheels, for example) is strictly illegal and may result in disqualification.
- T11. A machine may not intentionally contaminate the playing field, balls, goal, or another machine with lubricants.
- T12. After a match, team member are not allowed on the playing field until referees have completed the scoring procedure.
- T13. The fence is a safety feature, not part of the playing field. Therefore, no part of any machine may react against it.
- T14. No remote communication devices, such as air phones, walkie-talkies, cellular phones, etc., may be used by teams during a match.
- T15. During the tournament, teams will be notified of their field positions at least two minutes prior to the start of their match in the staging area. Teams will be allowed a maximum of one minute to set up their machines on the field and a maximum of one minute to remove all machine parts from the playing field following a match. You will have at least 4 minutes before your next scheduled match.
- T16. If a team is not ready to setup their machine on the field, and the two minute notification period is about to expire, and they do not wish to forfeit the match, then

they must call a time-out. Each team may take up to 10 minutes (cumulative) of time-outs during the double-elimination rounds. The duration of a single time-out may not exceed 5 minutes. If a machine is still not ready at the end of the time-out period, the team will forfeit the match.

- T17. During the finals matches (quarter-finals on), each team may take up to 10 minute (cumulative) of time-outs which can be used to delay the start of a match if their machine is not ready. The duration of a single time-out may not exceed 5 minutes. Unused time-out time from the double elimination matches is lost.
- T18. At the start of each match, machines may be placed in any orientation within the designated starting area, without touching other machines, the 4x4 boundary, or the fence
- T19. If, in an attempt to remove an opponent's balls from the field, a part of your machine drops out-of-bounds, your machine will be disabled. Any points scored will count.
- T20. If a machines goes out-of-bounds to the point that it has to apply power to any out-of-bounds surface to rejoin play, its control system will be disabled. Any points scored will count.
- T21. If one team intentionally moves another machine out-of-bounds, the machine out-of-bounds will be disabled for the remainder of the match. Points scored will count.
- T22. Balls which are knocked out-of-bounds or popped will be placed back in play next to the fence near the exit point without undue delay. Additional balls will be available for substitution.
- T23. It is not the responsibility of the referees if they damage trapping devices while attempting to retrieve balls. Please design your machine so that balls may be retrieved quickly and easily after a match is over.
- T24. **We strongly encourage you to develop and wear team uniforms, including identifying hats and t-shirts that display company and high school team names and/or logos. This will help the audience, announcers, judges and spectators identify you and your machine.**

1.4 Game Specific Rules

(see complete list of rules in Appendix B)

- P1. Machines will start at equidistant locations, midway along the length of the playing field borders, as shown in Figures 1 & 2.
- P2. Each team will start with 8 small balls on the playing field and 4 small balls on the ramp of the player station. The small balls on the field will be arranged in clusters as shown in Figures 1 & 2. The clusters will be distributed at equidistant locations around the central goal at a distance of 4 feet from the flat side of the base of the goal.
- P3. Each team will start with 1 large ball on the side of the goal and 1 large ball on the playing field. The large balls on the goal will start atop the three triangular frames on the upper portion of the central goal. The large balls on the surface of the playing field will be distributed at equidistant locations around the central goal at a distance of 4 feet from the flat side of the base of the goal, as shown in Figures 1 & 2.
- P4. Each match will last for two minutes. It will begin when the control system is enabled and end when it is disabled, unless whistled dead by the referees.
- P5. Final scoring will begin when all balls come to rest or upon a referees' decision. Students and coaches will not be allowed onto the field until all scoring is complete.

- P6. Upon reaching the scoring stage, each small ball in or above the central hexagonal area of the goal is worth 3 points for the owner. Each large ball in or above the central hexagonal area of the goal is worth 10 points for the owner. Each large ball on or above the triangular frames at the three corners of the goal is worth 5 points for the owner. Ball position will be determined by the geometric center of the ball as estimated by the referees.
- P7. The winner of each match is the team with the highest score. Ties will be won by the team owning the higher large ball in or above the hexagonal portion of the goal. If all teams that are tied have no large ball in or above the hexagonal portion of the goal, the tie will be won by the team with the large ball closer to the center of the field.
- P8. During a match, five members per team (two "drivers", two "coaches", and one "player") are allowed in the designated areas next to the field. Operator badges will be supplied by U.S. FIRST at each event and must be worn by these team members for field access. Of these five team members, at least three must be students from team partner pre-college school(s).
- P9. During a match, machines must be operated from the team operator area next to the field by two students from the pre-college team partner school(s). The coaches must also remain within the team operator area during the match.
- P10. Each team will be allowed to use one human player. Human players will be stationed at equidistant locations just outside the perimeter of the playing field, as shown in Figure 1 & 2.
- P11. The player must be a student from a pre-college team partner school, and must sit at the player station during the match.
- P12. Human players will be secured at each station by a seat-belt-like strap.
- P13. A human player may remove balls from the playing field by passing them over or under the horizontal bar at the player station, or around the outside of the vertical posts. A human player may also catch flying or bouncing balls.
- P14. If a human player returns a ball to the playing field by passing it under the horizontal bar, or after the end of the match, it will result in disqualification for the match, and any points scored by the team will be forfeited.
- P15. A human player may choose not to return balls to the playing field. However, any balls which leave the player's station, such as by rolling off the side, will be returned to the playing field near the player's station without undue delay.
- P16. For safety reasons, the player stations are not considered part of the playing field for the machines. Machines may not drive onto the ramps at the front of any player station, nor may they attempt to retrieve balls from any player station. Any machine which does so will be disabled. Any points scored will count.
- P17. For safety reasons, no part of a machine may pass through, around, or over the PVC posts at each player station or in any way touch the human players. If this occurs due to an intentional act, the machine causing the safety hazard will be disqualified and any points scored will be forfeited. If this occurs by accident, the machine causing the safety hazard will be disabled, and any points scored will count. The referees will decide whether the violation was intentional or an accident.
- P18. For safety reasons, no machine may launch a projectile of any sort, including balls, toward the player station or team drivers and coaches, with the one exception noted below. If this occurs due to an intentional act, the team causing the safety hazard will be disqualified and any points scored will be forfeited. If this occurs by accident, the machine causing the safety hazard will be disabled, and any points

scored will count. The referees will decide whether the violation was intentional or an accident.

- It is acceptable for a machine to launch balls, but no other types of projectiles, toward the player station assigned to the same team as the machine.
- P19. For safety reasons, no player may intentionally touch any machine. If this happens, the player's team will be disqualified and any points scored will be forfeited.
- P20. All field dimensions shown in Figures 1 through 6 are ± 1 " non-cumulative. The large balls have a diameter of $24" \pm 2"$. The small balls have a diameter of $8" \pm 1"$. Both types of balls will be inflated to size, not pressure.

1.5 Competition Structure

Seeding Rounds

Each team will compete in 4 to 6 matches in order to determine the seeding order of the teams. The play order will be pre-determined based on teams registered for the event. A list of the seeding rounds will be distributed to each team on practice day. No team will play another team more than once, and no team will be scheduled to play in two consecutive matches during the seeding rounds.

Seeding order will be determined as follows:

- The winner of a seeding match will receive 3 seed points.
- The runner-up of a seeding match will receive 1 seed point.
- Seeding order will be determined by the total seed points accumulated. The team with the most seed points will be the number 1 seed. The runner-up will be the number 2 seed, and so on.
- Ties will be won by higher total (non-seed) score, higher last match (non-seed) score, or flip of a coin, in that order.

Double-Elimination Rounds

Each team will start off in the double-elimination tree according to their seed. The tree structure will be pre-determined based on the number of teams registered for the event. Copies of the tree will be distributed to each team after the conclusion of the seeding rounds.

The winning team advances to the next round, and the losing teams move to the losing bracket. Every team will be able to lose at least two matches before being eliminated. The double-elimination rounds will end when there are only 8 teams left.

Finals Rounds

The quarter-finals, semi-finals, and finals follow the double elimination rounds. In these rounds, teams will play in 1-on-1, best 2-of-3 matches. At this level, teams which win the 2-of-3 matchup will advance and team which lose will be eliminated.

2. AWARDS

2.1 Chairman's Award

The Chairman's Award is presented to the team which is judged to have created the best partnership effort between team partners: pre-college school(s), universities and/or businesses. All teams participating in the 1996 Competition are eligible for this award. The recipient of this award is decided by an independent panel of judges at the National Championship.

While U.S. FIRST continues to leave this award without specific criteria, there have developed certain themes which seem to best illustrate the partnerships efforts which stand out above others. In 1994, the team efforts continued to progress and develop beyond what we could have predicted so that the judges for the first time named finalists. The entries which were among that group consistently showed the impact that this program had on all team members and their families.

Documentation may consist of any combination of the following:

- Video footage in VHS format, 15 minute maximum length
- Photos
- Written chronicle
- Electronic document (one file only) on 3.5" disk in one of the following formats:
 - Microsoft Word for Windows 2.0
 - Microsoft Word for Macintosh 5.1
 - ASCII Text with no more than 80 characters per line

The computer used to view the electronic documentation may not have any multimedia capabilities, such as digital audio or motion video, or other applications, such as spreadsheets. Do not embed any sound, video, or links to other applications in the document. Embedded images are acceptable.

This material need not be professionally produced, but should clearly convey the effort made to develop a successful school/university or school/business partnership. The recipient will be announced at the National Championship during the Awards Ceremony on Saturday, April 20, 1996.

ALL DOCUMENTATION MUST BE IN U.S. FIRST OFFICES NO LATER THAN 5:00 PM ON WEDNESDAY, MARCH 27, 1996.

The Chairman's Award will be presented at the Awards Celebration on Saturday evening, April 20, 1996. The team carries home a traveling trophy—a high-tech, custom crafted Dean Kamen Clock, which the *New York Times* called "Art That Ticks."

Chairman's Award Materials: Tips

- Avoid going into great detail on the game itself. Use your valuable video time and written space to tell the judges about your partnership.
- If your team submits a video be sure it is of good visual and audio quality. It does not need to be professional but it is imperative that the judges see and hear your message.

2.2 Founder's Award

Each year U.S. FIRST presents this award to honor a company, university or individual that has contributed significantly to the growth of the competition through year-round efforts.

Last year's winner, Walt Disney World, will pass on the trophy clock to the '96 winner at the Awards Celebration in Orlando.

2.3 Judges' Awards

On Saturday evening, April 20, 1995, U.S. FIRST will hold an awards celebration at the Innoventions Fountain at Epcot Center. At this event, a special judging panel will present the following awards:

- Chairman's Award
- 1996 National Champion
- Most Creative Design
- Best Offensive Round
- Outstanding Defense
- Best Play of the Day
- Best Team Spirit Display
- Best Sportsmanship
- Number One Seed
- Most Photogenic
- The Procter & Gamble Creativity Award
- Motorola Quality Award
- Honeywell Leadership in Control Award
- Autodesk Excellence in Engineering Creativity and Communication Award
(Determined by a special Autodesk judging panel prior to the event)
- Rookie All-Stars (3)

A regional series of judges awards is also planned.

2.4 Animation Competition

Information about the Autodesk Animation Competition is located in Appendix C.

3. MACHINE DESIGN, CONSTRUCTION & OPERATION

3.1 Safety Rules

(see complete list of rules in Appendix B)

- S1. Safety first. Due to the nature of the event in which electrical equipment, springs and tools are used, safety will not be compromised.
- S2. Any machine which is determined to be a safety hazard by the referees at any time during the Competition must be sufficiently modified to the referees' satisfaction or it will be disqualified and not allowed to compete.
- S3. No energy stored in a rubber band may be used to launch any projectile. This does not apply to the latex tubing provided in the kit. However, competition balls are the only projectiles the latex tubing may be used to launch.
- S4. Projectiles must have a frontal area greater than or equal to 10 square inches and be shaped to avoid eye injury.
- S5. Do not tamper with the power supply, batteries, chargers, battery boxes, joysticks, or any other control system component except as noted in the control system rules. Tampering could result in failure or malfunction of the control system.
- S6. Safety glasses must be worn by all team members in the team boxes and player stations during matches, and in the pit area when working on machines. They are also highly recommended if your neighbor(s) in the pit are working on their machine.
- S7. Remove batteries from the holders while making adjustments to your machine. Due to the strength of the motors in the kit, it is important to keep fingers away from the gears while your machine is connected to a power supply.
- S8. The batteries may deliver more than 100 Amperes. Do not let the wires come into contact with any metal surfaces. Route wires carefully to avoid damage and short circuits, which may cause serious burns and/or fire.

3.2 Design & Operation Rules

(see complete list of rules in Appendix B)

- M1. The energy used by the machines in the Competition must come solely from:
 - electrical energy derived from the onboard battery packs
 - storage achieved by deformation of springs or the latex tubing provided in the kit
 - compressed air (or vacuum) stored in the air accumulator
 - a change in the altitude of the device's center of gravity.
- M2. Machines must fit, unconstrained, inside a 36" cube with one face of the cube flat on the surface of the playing field. The weight of the machine including batteries may not exceed 120.0 pounds.

Size $\leq 36" \times 36" \times 36"$; Weight ≤ 120.0 pounds

Although UPS offers complimentary shipment of machines to and from competition sites, they will not ship packages as large as a full machine. Many teams have found it helpful to make ease of disassembly and reassembly one of the design goals.

- M3. All machines will be weighed and measured during the practice day at each Competition event and may be re-inspected anytime during an event. If

modifications to your machine are necessary to meet the above requirements, they must be completed before seeding matches begin.

- M4. **Teams are expected to design and build machines to withstand vigorous amounts of interaction with other machines.** (*See also rule T7.*)
- M5. Until the controls are enabled at the beginning of each match, machines and any appendages, extensions or projectiles must remain unconstrained within the 36"x36"x36" starting size. Once a match begins, machines may extend beyond that limit under their own power.
- M6. Machines must be designed to operate by reacting against the surface of the playing field, the innermost face of the curb, the goal, the balls, the other machines, and the air. (*See Section 2.2 for Field Diagrams.*)
- M7. Machines must display their team company and school names and/or logos. The judges, referees, and announcers must be able to identify them by name.
- M8. During a match, machines may be manipulated only by the normal operation of the wireless control system.
- M9. Gaining traction by using adhesives or by damaging the surface of the playing field or the balls is not allowed.
- M10. No substitute machines are permitted; however, functionally identical replacement parts are allowed.
- M11. During any Competition event, any mechanism which will alter the operation of the machine may not be added or removed after the first match of the seeding rounds unless mandated by the judges for rule compliance reasons. (*See also Section 5.3.*)
- M12. Only items listed under the PNEUMATICS section of the kit list may be used to store, generate, or transmit compressed air or vacuum, with the following exceptions:
- Suction cups may be fabricated from legal kit parts, as define in rule K1 below.
 - Pneumatic fittings from Small Parts, Inc. may be used.

Custom-made pneumatic fittings, air cylinders, pumps, air accumulators, and so forth are not allowed, even if they are created from components included in the kits. Also, valves, syringes, tubing, and so forth from SPI or outside sources may not be used for pneumatics.

3.3 Control System Rules

(*see complete list of rules in Appendix B*)

- C1. The control system is provided to allow wireless control of the machines. The transmitter box, receiver/relay box, servos, speed controllers, RNETs, antennas, batteries, battery chargers, battery holders, power supply and joysticks may not be tampered with, modified, adjusted or marked in any way, with the following exceptions:
- the dip switches on the transmitter may be set for custom operation.
 - the speed controllers may be calibrated as described in the Tekin REBEL Owner's Manual.
 - 1/4" bolts may be used (as self-tapping screws) in the recesses of the battery holders.

Tampering includes drilling, cutting, machining, gluing, rewiring, etc. All items listed in Rule C1 must be mounted without alteration. Do not write on or otherwise mark control system components.

- C2. Do not attach tape, stick-on hook & loop fasteners, glue, or other adhesives to control system components. We will re-use many of these components, and these items can be difficult to remove. Instead, use clamps, straps, or existing holes for mounting. The one exception to this rule is:

- Tape may be used to secure the position of the trimmers on the Joysticks in order to prevent accidental changes in calibration.

For mounting control system components, use mechanical fasteners, such as cable ties, straps, or brackets. Do not use tape, stick-on hook & loop fasteners, glue, or other adhesives.

- C3. The black project box is intended to serve as a mounting point for the rocker switches and to enclose the associated wiring. You may modify the black project box in any manner to accommodate your needs. It may not be used on the vehicle.
- C4. All motors and electrical devices connected to the receiver must be connected with the supplied wire and connectors.
- You must use 12 gauge wire for connections from the batteries to the speed controller and from the speed controller to the drill motor.
 - You must use 16 gauge jacketed cable for connections to Delco seat motors, McCord-Winn air pumps and Numatics air valves.
- C5. Do not tamper with the battery holder harness. You may not shorten the battery holder wires.
- C6. The 12V batteries must be inserted directly into the battery holders. You may restrain them in their holders by means of straps, rubber bands, etc.
- C7. RNETs may not be used in the Pit Area at any Competition event. A tether must be used for bench testing.
- C8. The Milwaukee drill motors and Tekin speed controllers, if used on your machine, must be used together as sets. Drill motors may not be powered from the receive/relay boxes. Delco seat motors, McCord-Winn air pumps, Numatics air valves, and the fan may not be powered from the speed controllers.
- C9. Two 0.1 μ F capacitors, included with each speed controller, must be installed in each drill motor as described in the Tekin REBEL Owner's Manual.
- C10. One 20A circuit breaker (provided in the kit) must be installed in series with each drill motor. The circuit breaker must be accessible for inspection at each Competition event.
- C11. Only the 9 volt power supply included with the kit should be used to power the transmit box. If you experience any problems with the 9 volt power supply, contact U.S. FIRST for a replacement. Use of an alternate power supply could damage the transmit box or RNET and is therefore prohibited.
- C12. Do not connect power or any other signals to the switch inputs (P1, P2) on the relay board.

3.4 Materials Usage & Limitations

(see complete list of rules in Appendix B)

- K1. Each machine must be constructed exclusively from materials provided in the Kit of Parts ("the kit") supplied by U.S. FIRST, with the following additions and exceptions:

- 2' x 4' x 1" ROHACELL™ structural foam shipped to each team from the U.S. FIRST.
- Material available from outside sources, as explained below:

Additional Hardware

A specific list of materials and quantities is provided with the List of Components.

Small Parts, Inc. Catalog

Each team receives an account with a \$425 credit balance which will be debited for the actual purchases you make. You may go beyond this dollar limitation for prototyping or to purchase spare parts, but your team is responsible for paying the balance on the account. See Rule K3 and the Appendix for more details on accounting and ordering.

Up to \$425 worth of materials purchased from Small Parts, Inc. may appear on your final machine. You may use any component from the Small Parts catalog up to the \$425 limitation.

Fasteners (rivets, screws, welds, nails, cable ties, etc.), washers, and adhesives are not included in your \$425 limit on Small Parts Inc. equipment on your machine if used as fasteners.

It has been brought to our attention that the actual prices of components purchased from Small Parts, Inc. may not match the prices printed in the catalog. Please use the catalog prices when calculating the cost of machine components from SPI for compliance with the \$425 limit.

If you use only a portion of what you buy from Small Parts, you may prorate the dollar amount used to the smallest quantity listed for purchase in the catalog. For example, if you buy 5' of rod which could have been purchased by the foot, but end up using only 6", you may calculate the amount used as the purchase price for one foot.

- Fasteners, washers and adhesives from outside the kit may be used for joining and fastening purposes only.
- Adhesive tape may be used only as an electrical insulator.
- Lubricants may be used only to reduce friction within your own device.
- The kit container, part packaging, and any documentation in the kit container may not be used to build the device.
- Teams may purchase as much shrink wrap tubing of any diameter as they wish. However, shrink wrap must be used for electrical insulation only. It may not be used as a fastener.

- K2. Many of the materials in the kit are raw materials. They are intended to be used for manufacturing structural or mechanical parts for your machine.

- K3. There is no restriction on the total amount of sprockets/pulleys and chain/belt on your machine, whether bought or machined from official Kit parts. However, there is a restriction on the amount which can be obtained from outside sources—see the *Additional Hardware List* and *Rule K4* for an explanation.

- K4. Due to the high power output of the drill motors, each team may purchase from a source outside of the Official Kit of Parts (such as a bike shop or hardware store) additional sprockets (not gears) and/or pulleys and additional chain and/or belt, with the following conditions:
- On your final machine, you may use no more than a combined total of 4 sprockets and/or pulleys from outside sources.
 - On your final machine, you may use no more than a combined total of 10' of chain and/or belt from outside sources. There are no restrictions regarding pitch or width of chain and/or belt. However, you may not purchase a wide belt, slice it lengthwise, and use more than a 10' length in the final machine.
 - These components must be "commercially available," strictly *off-the-shelf* only. No custom or special orders.
 - These components must be used in a power train. Power train is defined as components transmitting mechanical power to any of the vehicles' mechanisms, including propulsion, arms, projectiles, etc.
- K5. Gears (not sprockets) may be obtained only by machining them from official Kit parts or by purchasing them from Small Parts.
- K6. You may purchase one of the types of wood listed on the *Additional Hardware List*, in a 1/2" thickness with a total area of 4' x 4'. In addition, you may use any or all of the wood samples provided in the kit.
- K7. Fasteners may not be used as structural members or power transmission components except as pins in a linkage or as hinge pins.
- K8. Net material is allowed; however, if it is used to entangle opponents' machines, the referees may disallow it.
- K9. You may only use "off-the-shelf" springs, such as compression, tension, torsion, constant force; spring washers; and, the latex tubing provided in the kit. Springs in addition to those provided in the kit may be purchased only from Small Parts, Inc. You may not fabricate your own.
- K10. Pipe fittings (tees, reducers, elbows, and angles) may be purchased only to join pipe and may be used without limit in linking sections of these materials. Endcaps may also be used.
- K11. A limited number of replacement parts will be made available by U.S. FIRST upon justified request. Otherwise, lost or damaged kit materials may be replaced only with identical components of the same material, dimensions and treatment at the team's cost.
- K12. Materials in the kit may not be changed chemically with the following exceptions:
- rope ends may be singed to prevent loose ends or to bind them together
 - resin and hardener may be mixed to produce epoxy.
- K13. The balls provided in the kit may not be used during any Competition event.
- K14. All unused parts and materials must be returned to U.S. FIRST for proper recycling.
- K15. The control system is the property of U.S. FIRST and certain components must be returned at the conclusion of the competition. The control system is not for sale. Teams wishing to borrow the control system for a limited amount of time after the competition may do so by following the procedures outlined in Section 5.5. For teams that wish to operate their machines after this period, U.S. FIRST can provide

basic instructions on how to refit the machines to use off-the-shelf remote control systems.

3.5 Kit of Parts

The following pages are a detailed packing list for all Components which make up the official Kit of Parts. A checklist has been included in your Kit which you should use as you go through the kit to be sure you have received all parts. This checklist should be signed by a team member and returned to a U.S. FIRST staff member as you leave the Kickoff Workshop. Any materials you did not receive will be shipped to you as soon as possible.

List of Components

Bearings

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
2 Bolt Self-Aligning Flange		Bearing Bag	8	The Torrington Company
Radial Ball Bearing w/Spherical OD	1/2" i.d., self locking collar	Bearing Bag	4	The Torrington Company
Single Row Radial Flanged Ball Bearing	1/4" i.d.	Bearing Bag	4	The Torrington Company
Single Row Radial Flanged Ball Bearing	3/8" i.d.	Bearing Bag	4	The Torrington Company

Control System

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
15 Pin Cable	DB15 Male to Female, 6'	Loose	1	Brevan Electronics
15 Pin Connector	DB15, solder cup, female	Electronics Bag	2	Brevan Electronics
15 Pin Connector	DB15, solder cup, male	Electronics Bag	2	Brevan Electronics
2 Conductor Jacketed Wire	15', #16 AWG	Loose	1	General Cable
2 Conductor Jacketed Wire	#24 AWG	Loose	20'	General Cable
2 Pin Power Connector	Black, European style header	Electronics Bag	2	Augat RDI
2 Pin Power Connector	Green, European style header	Electronics Bag	1	Augat RDI
3 Conductor Shielded Wire	#24 AWG	Loose	20'	General Cable
6 Pin Connector	European style header	Electronics Bag	1	Augat RDI
9 Pin Cable	DB9 Male to Female, 6'	Loose	1	Brevan Electronics
9 Pin Ribbon Cable	12", DB9 Male to Female	Electronics Bag	1	Brevan Electronics
9 Pin Tether Adapter	DB9 F-F, pins: 5->5, 2->3,3->2	Electronics Bag	1	Brevan Electronics
Battery Box	Battery Charger Case	Loose	2	Assembled by Nova Biomedical
Battery Charger		Loose	2	Milwaukee Electric Tool Corp.
Black Project Box		Loose	1	Serco
Circuit Breaker	12 volt, 20 Amp, auto-resetting	Electronics Bag	2	Snap-Action, Inc.
Delco Motor Wiring Harness	5', #16 AWG	Loose	4	Assembled by Nova Biomedical
Diode	1 Amp max	Electronics Bag	2	Brevan Electronics
Flightstick Joystick	7 ft cable with Male DB15	Loose	2	CH Products
Heat Shrink Tubing	3/4"Ø x 1', Black, 2:1 Shrink	Electronics Bag	1	Raychem Corporation
Heat Shrink Tubing	3/8"Ø x 2', Black, 2:1 Shrink	Electronics Bag	1	Raychem Corporation
Jack Screw with Lock Washer	3 screws per bag	Electronics Bag	12	Honeywell - Microswitch Division
Limit Switch	Faint printing on side	Electronics Bag	4	Honeywell - Microswitch Division
Limit Switch	White printing on side	Electronics Bag	4	Honeywell - Microswitch Division
Muffin Fan	12 vdc, 0.90 A	Loose	1	Digital Equipment Corporation
Plastic Hood for 15 Pin Connector	fits DB15	Electronics Bag	3	Brevan Electronics

List of Components

Power Connector for Valves		Pneumatics Bag	3	Numatics
Power Supply	9 Volts DC, 1.2 Amps max	Loose	1	Golden Pacific Electronics, Inc.
Receiver Box		Loose	1	Assembled by Nova Biomedical
Rechargeable Battery	12 Vdc	Loose	4	Milwaukee Electric Tool Corp.
Reed Switch	Normally open	Electronics Bag	4	CP Clare
Relay Box		Loose	1	Assembled by Nova Biomedical
RNET 9600slm + Antenna		Loose	2	Motorola
Rocker Switch		Electronics Bag	4	Honeywell - Microswitch Division
Rocker Switch Cover	Blue	Electronics Bag	1	Honeywell - Microswitch Division
Rocker Switch Cover	Green	Electronics Bag	1	Honeywell - Microswitch Division
Rocker Switch Cover	Red	Electronics Bag	1	Honeywell - Microswitch Division
Rocker Switch Cover	White	Electronics Bag	1	Honeywell - Microswitch Division
Servo	Hitec/JR-style connector, 42	Electronics Bag	2	Hitec RCD, Inc.
Servo Arms & Mounting Hardware	Fits HS300 Servo	Electronics Bag	2	Hitec RCD, Inc.
Servo Extension Cable	Hitec/JR-style, 36" long	Electronics Bag	2	Hitec RCD, Inc.
Servo Y Cable	Hitec/JR-style, 24" long	Electronics Bag	2	Hitec RCD, Inc.
Spade Connector	female, 22-18 AWG	Electronics Bag	20	Thomas & Betts Corp.
Spade Connector	male, 22-18 AWG	Electronics Bag	20	Thomas & Betts Corp.
Speed Controller	7.2 - 12 vdc, Reversing	Loose	2	Tekin Electronics, Inc.
Terminal Strip	6 channel, tubular screw	Electronics Bag	2	Thomas & Betts Corp.
Transmitter Box		Loose	1	Assembled by Nova Biomedical
Wire	#12 AWG, Black	Loose	12'	General Cable
Wire	#12 AWG, Red	Loose	12'	General Cable
Wire Nut	for 12 AWG wire	Electronics Bag	10	Home Depot
Wiring Harness for Air Pumps	fits Textron pumps, 6" leads	Pneumatics Bag	2	McCord Winn Textron

Documentation

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
Kent™ Connect Flyer		Loose	1	Value Plastics, Inc.
Numacalc	manual and software for IBM	Loose	1	Numatics
Numatics Training Manual		Loose	1	Numatics
Small Parts Catalog		Loose	2	Small Parts, Inc.
Spec Sheets for Constant Force Spring		Loose	1	Associated Spring Raymond
Spring Hinge Instructions	comes with Spring Hinge	Hardware Bag	1	Stanley Hardware

List of Components

Fasteners

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
5 Minute Epoxy Gel	resealable 1 oz. dual syringe	Small Parts Bag	1	McMaster-Carr Supply Company
Cable Tie	11.10" x 0.140"	Small Parts Bag	20	Thomas & Betts Corp.
Cable Tie	7.00" x 0.091"	Small Parts Bag	20	Thomas & Betts Corp.
Cable Tie Mounting Base	self-adhesive, holes for #8	Small Parts Bag	25	Thomas & Betts Corp.
Chuck Screw	left handed thread, Torx P20	Drill Bag	2	Milwaukee Electric Tool Corp.
Helical Plastic Wire Wrap	1/4" Ø x 24"	Small Parts Bag	1	McMaster-Carr Supply Company
Hook & Loop Fastener	1" x 2', stick-on	Small Parts Bag	1	McMaster-Carr Supply Company
Mushroom-Head Fastener	1" x 2', stick on	Small Parts Bag	1	McMaster-Carr Supply Company
Rubber Band, Large	3-1/2" x 1/4" wide	Small Parts Bag	5	Alliance Rubber Company
Rubber Band, Small	3-1/2" x 1/8" wide	Small Parts Bag	5	Alliance Rubber Company
Velcro Back Pack Strap		Velcro Bag	1	Velcro USA, Inc.
Velcro Heavy Duty Hold It		Velcro Bag	1	Velcro USA, Inc.
Velcro Pen /Pencil Holders		Velcro Bag	1	Velcro USA, Inc.
Velcro Plant Ties		Velcro Bag	1	Velcro USA, Inc.
Velcro Self Gripping Discs		Velcro Bag	1	Velcro USA, Inc.
Velcro Self Gripping Discs		Velcro Bag	1	Velcro USA, Inc.
Velcro Sticky back Hook & Loop Tape		Velcro Bag	1	Velcro USA, Inc.
Velcro Trunk Strap		Velcro Bag	1	Velcro USA, Inc.

Field Components

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
Inflation Needle for 4-Square Ball	fits bicycle tire pump	Loose	1	Sport Fun, Inc.
U-Bolt Wire Rope Clip	for 3/16" Ø rope, galvanized	Hardware Bag	1	McMaster-Carr Supply Company

Motors & Pumps

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
Delco Seat Motor	12 vdc motor w/ socket for	Loose	4	Delco Electronics Corporation
Drill Gear Shift Link		Drill Bag	2	Milwaukee Electric Tool Corp.
Drill Gearbox	1000/300 RPM transmission	Drill Bag	2	Milwaukee Electric Tool Corp.
Drill Housing, Left Half	Holds motor and gearbox	Loose	2	Milwaukee Electric Tool Corp.
Drill Housing, Right Half	Holds motor and gearbox	Loose	2	Milwaukee Electric Tool Corp.
Drill Motor	12 V DC	Drill Bag	2	Milwaukee Electric Tool Corp.
Drill Shell Screws	5/8" x 4-20 sheet metal screw	Drill Bag	16	U.S. FIRST
Drill Shifter Button		Drill Bag	2	Milwaukee Electric Tool Corp.

List of Components

Drill Shifter Spring	large	Drill Bag	4	Milwaukee Electric Tool Corp.
Drill Shifter Spring	small	Drill Bag	2	Milwaukee Electric Tool Corp.
High Output Lumbar Pump MWT Motor	12 vdc, 22 psi max, 3/16" o.d.	Pneumatics Bag	1	McCord Winn Textron
Low Output Lumbar Pump Johnson	12 vdc, 4 psi max, 3/16" o.d.	Pneumatics Bag	1	McCord Winn Textron

Other

Part Name/Description	Dimensions	Location	Qty /Kit	Product Supplier
Carpet Sample	12" x 12"	Loose	1	
Co-Polymer Gutter Guard	6" x 24"	Loose	1	Home Depot
Fiberglass Matting	4' x 4' x up to 1/8"	Additional	1	TEAM
Kent™ Connect Key Ring Kit		Pneumatics Bag	1	Value Plastics, Inc.

Pneumatics

Part Name/Description	Dimensions	Location	Qty /Kit	Product Supplier
Adapter Fitting	1/4" NPTF male to 1/8" NPTF	Pneumatics Bag	1	Sprague Fluid Connectors
Air Cylinder	1-1/16" bore, 4" stroke	Loose	1	Numatics
Air Cylinder	7/16" bore, 12" stroke	Loose	1	Numatics
Barbed Fitting	1/8" i.d. to 1/8 NPTF	Pneumatics Bag	4	Numatics
Barbed Fitting	1/8" i.d. to 10-32 UNF	Pneumatics Bag	12	Numatics
Barbed T-Connector	1/8" Ø barbs	Pneumatics Bag	2	Value Plastics, Inc.
Check Valve	1/8" Ø barbs	Pneumatics Bag	2	Air Logic
Detachable Barbed Reducing Connector	3/16"Ø to 1/8"Ø	Pneumatics Bag	2	Value Plastics, Inc.
Double Solenoid Valve	12 VDC, 10-32 UNF-3B	Pneumatics Bag	1	Numatics
Numatrol Tubing	1/4" o.d., 1/8" i.d., 15'	Pneumatics Bag	1	Numatics
PIAB Suction Cup	53 mm Ø, 1/8" NPSF	Pneumatics Bag	1	PIAB, U.S.A.
Plug for Air Accumulator	1/4" NPTF	Pneumatics Bag	1	Sprague Fluid Connectors
Plug for Valves	10-32 UNF	Pneumatics Bag	5	Numatics
Polyurethane Tubing	3/16" i.d., 5/16"o.d. x 4'	Pneumatics Bag	1	Value Plastics, Inc.
Pressure Switch	1/8" Ø barb	Pneumatics Bag	2	Numatics
Single Solenoid Valve	12 VDC, 10-32 UNF-3B	Pneumatics Bag	1	Numatics
Syringe	140 cc, Luer Lock Tip	Pneumatics Bag	1	Lowell Medical Instrument
Volume Chamber	approximately 1 liter volume	Loose	1	American Cylinder Company, Inc.

Rods & Shafts

Part Name/Description	Dimensions	Location	Qty /Kit	Product Supplier
Aluminum Rod	1/2" Ø x 12"	Tube	1	McMaster-Carr Supply Company
Aluminum Rod	1/2" Ø x 24"	Tube	1	McMaster-Carr Supply Company

List of Components

Brazing Rod	1/16" Ø x 18"	Tube	6	McMaster-Carr Supply Company
Brazing Rod	1/8" Ø x 18"	Tube	2	McMaster-Carr Supply Company
Delrin (Acetal) Rod	1/4" Ø x 24"	Tube	1	McMaster-Carr Supply Company
Drill Rod	1/2" Ø x 18"	Tube	2	New Hampshire Industrial
Drill Rod	1/4" Ø x 18"	Tube	2	McMaster-Carr Supply Company
Drill Rod	3/8" Ø x 18"	Tube	2	McMaster-Carr Supply Company
Drill Rod	5/16" Ø x 18"	Tube	2	McMaster-Carr Supply Company
Flexible Motor Shaft	13.5" long, Fits Delco Seat	Loose	4	Delco Electronics Corporation
LDPE Rod	1" Ø x 24"	Tube	1	McMaster-Carr Supply Company
Threaded Rod with 8 Hex Nuts	1/4" Ø x 24", 20 pitch coarse	Tube	1	McMaster-Carr Supply Company
Wooden Dowel	1/4" Ø x 12"	Tube	1	McMaster-Carr Supply Company
Wooden Dowel	1/4" Ø x 24"	Tube	1	McMaster-Carr Supply Company

Sheets & Boards

Part Name/Description	Dimensions	Location	Qty /Kit	Product Supplier
Aluminum Plate	1/4" x 3" x 12"	Loose	1	McMaster-Carr Supply Company
Aluminum Sheet	1/16" x 12" x 18"	Loose	1	McMaster-Carr Supply Company
Chipboard - Sample	1/2" x 6" x 12"	Loose	1	Home Depot
HDPE Block	1" x 2" x 6"	Loose	1	McMaster-Carr Supply Company
Masonite Board	12" x 18"	Loose	1	Home Depot
Particle Board - Sample	5/8" x 6" x 12"	Loose	1	Home Depot
Pine Board - Sample	1" x 1-1/2" x 9"	Loose	1	Home Depot
Pine Board - Sample	1" x 2-1/2" x 9"	Loose	1	Home Depot
Pine Board - Sample	1" x 3-1/2" x 9"	Loose	1	Home Depot
Plywood	1/4" x 6" x 12"	Loose	1	Home Depot
Plywood - Sample	1/2" x 6" x 12"	Loose	1	Home Depot
Polycarbonate Sheet	1/16" x 12" x 12"	Loose	1	Plastic Supply Inc.
Rohacell® P170 Structural Foam	1" x 24" x 49"	Loose	1	Richmond Aircraft Products
Rubber Sheet, Black	3/32" x 6" x 18"	Loose	1	McMaster-Carr Supply Company
Rubber Sheet, Red	1/16" x 6" x 18"	Loose	1	McMaster-Carr Supply Company

Small Parts

Part Name/Description	Dimensions	Location	Qty /Kit	Product Supplier
Assorted Brass Screws	comes with Spring Hinge	Hardware Bag	1	Stanley Hardware
Cabinet Catch Magnet w/ Plastic Case		Hardware Bag	1	Stanley Hardware
Double Magnet Cabinet Catch		Hardware Bag	1	Stanley Hardware

List of Components

Flexible Shaft Coupling	Black	Small Parts Bag	4	U.S. FIRST
Folding Table Brace w/ screws	9-1/2"	Hardware Bag	4	Stanley Hardware
Hinged Hasp	3" Strap	Hardware Bag	1	Stanley Hardware
Pivot for Steel Track		Hardware Bag	2	Stanley Hardware
Rectangular Magnet		Small Parts Bag	4	Radio Shack
Roller Guide for Steel Track	7/8" Ø x 1/4" wheel	Hardware Bag	4	Stanley Hardware
Side Release Buckle	Fits 3/4" Strap	Small Parts Bag	1	McMaster-Carr Supply Company
Steel Hinge w/ screws	3-1/2" x 3-1/2"	Hardware Bag	2	Stanley Hardware
Steel Track w/Endstop	2'	Loose	2	Stanley Hardware
Trantorque Coupling	3/8" i.d, 3/4" o.d.	Small Parts Bag	2	Small Parts, Inc.
Utility Draw Pull Latch	1-3/4" high x 3-9/32" wide,	Hardware Bag	1	McMaster-Carr Supply Company
Wheelchair Wheel	6" Ø, 5/16" i.d. bearings, 1-1/2"	Loose	2	Skyway Recreation Products
Wheelchair Wheel	8" Ø, 5/16" i.d. bearings, 1-1/2"	Loose	2	Skyway Recreation Products

Springs

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
Compression Spring	0.600" o.d. x 3" long x 0.059"	Small Parts Bag	1	Associated Spring Raymond
Constant Force Spring, Large	1.02" i.d.	Small Parts Bag	2	Associated Spring Raymond
Constant Force Spring, Medium	0.85" i.d.	Small Parts Bag	1	Associated Spring Raymond
Constant Force Spring, Small	0.51" i.d.	Small Parts Bag	2	Associated Spring Raymond
Latex Tubing	1/4" i.d., 3/8" o.d., 5'	Loose	1	Totalmed
Small Tension Spring	0.650" o.d. x 2.875-3.000"	Small Parts Bag	1	Associated Spring Raymond
Snugger (Spring for Steel Track)		Hardware Bag	4	Stanley Hardware
Spring Loaded Hinge	4" x 4", 30 in/lb max	Hardware Bag	1	Stanley Hardware

Sprockets & Pulleys

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
Pulley with Fixed Eye	1" Ø, for 5/16" Rope	Hardware Bag	3	Stanley Hardware

Tools

<u>Part Name/Description</u>	<u>Dimensions</u>	<u>Location</u>	<u>Qty /Kit</u>	<u>Product Supplier</u>
5/32" Allen Wrench	comes with Spring Hinge	Hardware Bag	1	Stanley Hardware
Torx L-Key	Torx T20 Heads, 3-3/4" Length	Hardware Bag	1	McMaster-Carr Supply Company

3.6 Additional Hardware List

The parts listed on this page may be purchased from Small Parts, Inc. or other sources, and are subject to the limitations mentioned in rule K1.

Fasteners

Hose Clamp	up to 10 of any size
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Other

Fiberglass Resin + Hardner	as needed
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Rods & Shafts

Closët Rod	1 1/4" Ø x 6'
Copper Water Pipe	1/2" Ø x 10'
Electrical Conduit Pipe (EMT)	1" Ø x 10'
Electrical Conduit Pipe (EMT)	1/2" Ø x 10'
Electrical Conduit Pipe (EMT)	3/4" Ø x 10'
Flexible Conduit	1/2" Ø x 10'
PVC Pipe	1" i.d. x 10', schedule 40
PVC Pipe	1-1/2" i.d. x 10', schedule 40
PVC Pipe	1/2" i.d. x 10', schedule 40
PVC Pipe	3/4" i.d. x 10', schedule 40

Sheets & Boards

Aluminum Plate	1' x 2' x 1/4"
Aluminum Plate	4' x 4' x 1/32"
Pine Board	1" x 3-1/2" x 10'
Plywood, Chipboard OR Particle Board	1/2" x 4' x 4'
Polycarbonate Sheet	1/4" x 4' x 4'
Polycarbonate Sheet	3/8" x 2' x 4'

Sprockets & Pulleys

Chain/Belt to match Sprocket/Pulley	up to 10' total, any combo
Sprockets or Pulleys	up to 4 total, any size/combo

Please note that all rooms are first come, first served. The rates quoted here can only be guaranteed until the "cut off date" listed for each facility.

5.4 National Championship

The National Championship will be held at Walt Disney World's Epcot Center. For directions and information about overnight accommodations, please see appendix H.

5.5 Schedule of Events

New England Tournament

- | | |
|-------|---|
| Day 1 | <ul style="list-style-type: none">• team arrival, Registration and Practice, Official Weigh-in• U.S. FIRST final field and technical check |
| Day 2 | <ul style="list-style-type: none">• Seeding Matches• Celebration Party (following seeding matches) |
| Day 3 | <ul style="list-style-type: none">• Double Elimination Tournament & Finals• Awards Ceremony |

National Championship

- | | |
|-------|---|
| Day 1 | team arrival, Registration and Practice, Official Weigh-in
U.S. FIRST final field and technical check |
| Day 2 | Seeding Matches at American Gardens Stage |
| Day 3 | Double Elimination Tournament & Finals
Awards Ceremony at Innoventions Fountain
Wrap Party at Future World West |

Registration

At each event, teams will need to register in the Pit Area by noon on the first day, or Practice Day, of the event. At this time you will:

- surrender both of your RNETs and two of your batteries
- sign-up for your practice times
- receive an orientation packet to the event site and your pit station
- inform U.S. FIRST where the machine will be after the Competition. See Section #, *Administrative Details*, for more details.

Once you have unpacked, a U.S. FIRST staff member will be around to photograph your machine. These photographs will be used by the judges, referees and event staff to identify teams and their machines while on-site at the event.

Practice

In order to make the most of practice time, two fields run at the same time with three teams on a field during an assigned practice slot. It is strongly recommended that each team is respectful of the others sharing the field during this time. Friendly interaction between

machines is acceptable if both/all teams are willing. Unsportsmanlike conduct on the part of a team at any time during the Competition could result in penalty or disqualification.

Everyone will receive at least two half-hour practice slots based on the time you register. The earlier you check-in, the earlier your practice times will be. If additional time is available, an announcement will be made and one additional time slot per team will be assigned on a first-come, first-served basis.

If you need to change a practice slot because of the need for additional prep or repair time, you will be responsible for finding a team with which to switch practice. The staff in the Pit Area will help you locate a team; however, if you cannot arrange the change, that practice slot may be forfeited.

Practice days are:

New England Tournament	afternoon	Thursday, March 28, 1996
National Championship	afternoon	Thursday, April 18, 1996

Official Inspection

Before competing in the Seeding Matches, every machine must pass an inspection for rules compliance. U.S. FIRST staff will be on-site all day to inspect your machine.

Seeding Matches

Each team will compete between 4 and 6 times, and will accumulate points towards its seeding rank. Since these matches are pre-set, lists will be distributed to each team during the practice day. From each match, based on the score the winner will receive 3 seeding points, second place will receive 1 seeding point and the third place will receive no points.

After all matches, teams will be ranked by place totals (not points); ties will be determined by total score, last match score, and flip of a coin, in that order. Results of seeding will determine the first round matches of Saturday's competition.

Seeding matches are on:

New England Tournament	all day	Friday, March 29, 1996
National Championship	all day	Friday, April 19, 1996

Double Elimination Tournament & Finals

Each team will start off in the double-elimination tree according to their seed. The winning team advances to the next round, and the losing teams move to the losing bracket. Every team will be able to lose at least two matches before being eliminated. Competition concludes when there are only four teams left.

The Finals follow the Double Elimination Tournament. The final four will play 1-on-1, best 2-of-3.

Tournament and Final matches are on:

New England Tournament	all day	Saturday, March 30, 1996
National Championship	all day	Saturday, April 20, 1996

Shipping Deadlines

To provide every team, regardless of events in which they participate, approximately the same number of design and build days, the following shipping regulations and dates apply:

New England Tournament (Manchester, NH) Competitors

1. Teams may either ship or bring their machines with them to the tournament.

2. After the tournament, all teams competing in the National Championship will have five days to make repairs and/or changes to their machines, within all rules outlined in this document.
3. **By end-of-business on Friday, April 5**, machines must be picked up by a shipper for transport. This will give all New England teams five additional days to work on their machines.

National Championship participants only

1. Teams must ship their machines by end-of-business on Tuesday, April 2, 1996.
2. This will give all teams competing in only the National Championship an equal number of days to work on their machines as teams competing in both events.

5.6 Submission Deadlines

Team Profiles

U.S. FIRST will publish short profiles on each team in the event programs. By **Friday, March 8, 1996** please send or fax us your profile—you may use the following questions as guidelines when you write your description. Please keep in mind that we are on a deadline and that late submissions run the risk of not being included.

Important: please spell out the following as you would like them printed:

Company/University:

School(s):

Team and/or vehicle nickname:

You may send us a copy of your team logo (black & white, camera-ready if possible, no larger than 8 1/2 x 11)

- 1) How many students and engineers are involved in your effort? How is it organized?
- 2) What is unique about your team?
- 3) Give a brief history of how your team has gone about working on the project.
- 4) Describe any special aspects of your design or intended design that you want the event audience to appreciate (this will remain confidential until the first day of the competition).

This is your team's chance to tell the world who you are and what makes you great. Team profiles should be 200 words or less. Please review pages 11-19 of the 1995 national event program for a look at team submissions for Ramp 'n' Roll.

Chairman's Award Materials

**Must be received at the U.S. FIRST OFFICE NO LATER THAN 5:00 PM
ON WEDNESDAY, MARCH 27, 1996.**

5.7 Shipping & Transportation of Machines

Shipping & Transportation of Machines

UPS is offering complimentary shipping via 2nd Day Air service. Machines shipped to the National Championship must leave your facility by the end-of-business on the dates outlined above. Remember, however, you do not need to go the expense of rush shipments—there are approximately two weeks between events.

1. All machines competing in the National Championship must be shipped to Freeman Decorating, 2300 Principle Row, Orlando, FL 32837-8337, ATTN: U.S. FIRST (Epcot). The phone number is (407) 857-1500.
2. When shipping, batteries must be unplugged and packaged separately from the rest of the machine. A small box inside of your crate is acceptable. This is a federal law.
3. For packages weighing under 70 pounds, corrugated, double wall cardboard of at least 200 pounds bursting strength is required. For packages between 100 and 120 pounds, 275 pound bursting strength is required. For packages between 120 and 150 pounds, 500 pound bursting strength is required. Wood crates should only be utilized if the machine can be bolted to the wood and there are no moving pieces inside the crate. Wood crates should also have handles screwed to the outside to ease lifting. It is recommended that a duplicate address label be placed inside each box before being sealed. Florida is a humid state and moisture could be a concern to moisture sensitive equipment. Please take necessary precautions.
4. The machines may not leave a Competition event site until the conclusion of the that event. If repairs are required, they must be performed on site, unless accompanied by a U.S. FIRST staff member to an off-site designated machine shop.

UPS Packaging Guidelines

1. Weight limit 150 pounds per package
2. Size limit Up to 130 inches in length & girth combined
 Up to 108 inches in length
(*Girth is the perimeter in the plane perpendicular to the longest dimension.*)
3. Follow the guidelines in the "Package With Care" brochure.

You can get your package to UPS in one of several ways:

1. Drop off at any UPS facility.
2. Drop off at a UPS Authorized Shipping Outlet such as Mail Boxes, Etc. or Pak Mail.
3. Call 1-800-PICK-UPS (1-800-742-5877) to arrange for a pick up.
4. Schedule a pick up through on line services such as Prodigy (JUMP UPS) or CompuServe (GO UPS). Visit the UPS home page at: <http://www.ups.com> to track your package and get information on UPS services.

Call 1-800-PICK-UPS for the location of the nearest UPS facility or Authorized Shipping Outlet.

5.8 Before You Come to the Competition

Pit Area

Each team will have a table and power outlet in the pit area. We suggest you bring an extension cord (heavy duty and at least 25') and a power strip to make best use of your power drop. Machines which have been shipped to the Competition site will be delivered to your station; otherwise, you will be responsible for bringing your machine there.

No team displays or team/personal audio systems will be allowed in the Pit Area. U.S. FIRST staff make frequent important announcements which all teams need to hear.

U.S. FIRST reserves the right to limit the number of team members in the pit area. If the pit area may become too crowded for machines and teams to safely and quickly move back and forth to the field, we will request that some team members leave the area. In the event that additional assistance from another team member is necessary, let us know.

Warm Clothing

If your team attends the New England Tournament, please be sure to bring warm clothing. New England weather can be unpredictable and it is often very cold. There may be snow and ice on the ground. It is strongly recommended that you bring warm gloves, boots, hats and jackets.

5.9 Before You Leave the Competition

Return Unused Kit Parts and the Kit Container

Before you leave the Competition for the final time, please return your **unused** kit parts and the kit container to the Pit Registration Area. We must recycle some of these parts and we use the containers from year-to-year. Thanks, in advance, for your help with this.

Take your Machine home

U.S. FIRST encourages teams to take their machines back home with them. U.S. FIRST robots have appeared in pep rallies, parades, corporate annual meetings and even anti-gang assemblies!

Return the Control System

If you would like to take your machine back for educational, display or recruiting purposes, let us know prior to the last event you will be attending. At that time, you will be asked to provide U.S. FIRST with a deposit of \$1,500 which will cover the lending of a remote control system that can be picked up after the Competition (since RNETs will be confiscated). The control system remains the property of U.S. FIRST and the \$1,500 deposit is to cover possible damage to the control system. Your deposit will be returned once we receive the control system back. This deposit can be a check or purchase order which will be held until the return of the system. At that time the deposit will be canceled and returned to you. The U.S. FIRST control systems is not for sale.



1996 Autodesk Judges Award
for Excellence in Engineering Creativity and Communication
(known previously as the U.S. FIRST and Autodesk Image and Animation Celebration)

ENTRY RULES AND GUIDELINES

Competition Objective

To clearly and creatively present design solutions for the 1996 U.S. FIRST Competition problem through computer modeling and animation using industry standard software.

1. Entry Requirements

The Competition is open to all teams participating in the 1996 U.S. FIRST Competition. The Competition period is from February 10, 1996 to March 20, 1996.

All Entries (still image and animation) **MUST** be created using Autodesk software or Autodesk Registered Developer products. Limit one (1) submitted Entry per team. Each Entry (i.e. each image or animation submitted for judging in the contest) **MUST** be accompanied by its own separate and properly completed Official Competition Entry Form, which includes a signed release agreement for the image or animation entered.

Each individual contributor (collectively, the "Entrant") **MUST** be represented on the Official Competition Entry Form, including signing the Archive Consent and Release Authorization Form granting to Autodesk, its subsidiaries, associated companies, successor, assigns, agents and employees the right to use the drawing's, image's or animation's computer code, support files, documents or other electronic media files (collectively, the "Files") listed on the Consent Form.

If Entrant's corporate sponsor or school has any rights or claims to the image or animation in an Entry, the Entry Form also **MUST** be signed by an officer of such employer or parent company and school or the Entry will be disqualified. Entrant and, where applicable, Entrant's corporate sponsor and school represent and warrant that the image and animation in each Entry is owned by the Entrant and/or school and/or corporate sponsor free and clear of any liens or claims of any third party: that they have a legal right to grant the permission given in the Entry Form: and that they indemnify and hold harmless Autodesk, its subsidiaries, associated companies, successors, assigns, agents and employers against liability should any third party claim that the use of the image or animation by the aforementioned violates any right of such third party.

If proprietary information, logos or trademarks appear in an image or animation, Entrant **MUST** enclose written permission for use from the owner of the logos, trademarks or other proprietary material.

2. Responsibility

Autodesk is not responsible for Entries not delivered to Autodesk's San Rafael CA, office by the DEADLINE, March 20, 1996 (per item 5), or for any lost, late, misdirected, illegible, incomplete or damaged Entries.

3. Prizes and Prize Rules

One (1) U.S. FIRST Judges Award trophy will be presented to the team whose animation best represents the objectives of this competition category for Excellence in Engineering Creativity and Communication.

In addition to the Judges Award trophy, a *limited number* of student contributors on the winning team will receive a copy of Autodesk's 3D Studio® Release 4.

Autodesk reserves the right to substitute, at its sole discretion, another prize of equal or greater value for any prize described herein. No part of any prize is transferable. No substitutions of prizes is permitted except as expressly provided above.

The name of the winning team will be announced during the 1996 U.S. FIRST Competition Awards Ceremony. Software awards will be shipped directly to individual contributors following the competition.

4. Judging

Entries will be judged using criteria such as innovative and imaginative use of the software, story telling, uniqueness, composition, complexity, realism, color, proper use of lighting, and motion. Judging will be conducted by employees or consultants of Autodesk, its subsidiaries or associated companies. The judges' decisions are final. Judges are not required to award prizes by default.

5. Deadline: 5 p.m., March 20, 1996

The enclosed Official Competition Entry Form and the Archive Consent and Release Authorization Form **MUST** be completely filled out and accompany your team Entry.

If posted, entry packages **MUST** be postmarked not later than March 15, 1996, and **MUST** be received at the Autodesk office in San Rafael, CA no later than 5 p.m. on March 20, 1996.

If delivered by third-party commercial services, or delivered to Autodesk offices other than San Rafael, entry packages **MUST** be handed over to the third party no later than March 15, 1996, and **MUST** be received at the Autodesk office in San Rafael, CA no later than 5 p.m. on March 20, 1996.

Hand delivered Entries will not be accepted after the deadline of 5 p.m. on March 20, 1996.

Direct all Entries to the following address:

Autodesk, Inc.
Marketing Support Team - Image Archives
111 McInnis Parkway
San Rafael, CA 94903
Attn: U.S. FIRST JUDGES AWARD

6. Entry Specifications

All submissions **MUST** be accompanied by a completed Official Competition Entry Form, including a properly signed Archive Consent and Release Authorization Form. All animation **MUST** also meet the technical specifications outlined below:

- ☒ Each Entry **MUST** include 10-15 seconds of animation.
- ☒ Each Entry **MUST** be accompanied a representative frame rendered at 1024 x 768 (or higher) and in true color (24 or 32 bit color).
- ☒ **MUST** be created using Autodesk or Autodesk Registered Developer software.
- ☒ **MUST** be accompanied by written permission from the owner(s) for use of any proprietary information, logos, or trademarks in your image or animation.
- ☒ Each submission (video, disk or hard-copy print) **MUST** be clearly labeled with the name of the file(s) submitted, the corporate sponsor, the school, and the name, daytime phone, email address and fax number of your school team's primary contact (please specify if student, instructor or corporate team lead).

Note: Entries will remain the property of Autodesk. No hard copies, digital files, video cassettes, or computer diskettes will be returned.

All Still Images:

- ☒ If Line Art, MUST be submitted in an Autodesk CAD file format (DWG, SKD or GCD).
- ☒ If Rendered, MUST be submitted in one of the following file formats: TGA, TIF, JPG. The required resolution is 2048 x 1536 (or higher) with 24 bits (or more) of color.

All Animation:

- ☒ MUST be submitted as video tape, and the animation MUST be one of the following tape formats: BETACAM SP; 3/4 inch; SVHS; Hi-8; or VHS tape in NTSC format.
- ☒ MUST include 10-15 seconds (maximum) 3D animation of the Entrant's competition robot.
- ☒ It is *recommended* that each Entry include the use of background such as scanned images, texture maps, or live video. We're planning to add music to the final video, but if you've already got a soundtrack on yours, please include it.

And:

- ☒ It is requested, *but not required*, that the Entry be accompanied by the source model(s), in DWG, 3DS, and/or PRJ file format, plus ALL texture maps necessary to re-render the model.

If the Entrant decides to accompany the Entry with the source model(s), all copyrighted geometry, textures, and IPAS, POCO or ADS applications that are required to reproduce an image or animation entry should be omitted from the Entry if the Entrant does not have the necessary rights to them or submitting them violates copyright agreements. The Entrant should, however, list all missing elements, describe where they are required in the image or animation and include information about where the elements can be obtained.

- ☒ If submitted in "compressed" format, the data MUST be retrievable using PKUNZIP.
- ☒ If not submitted on standard diskettes, the *requested* data should be submitted on one of the following preferred media:
 - Colorado tape (120 or 250)
 - Syquest (44 or 88)
 - Bernoulli disk (20 or 90)
 - Sun Unix TAR tape
 - CD ROM

Please reference your Autodesk Pre-Kickoff Workshop packet for technical support options available to you as an Autodesk grant recipient.

If you have any questions specifically regarding these Entry requirements, please contact Kaki Leyens, Autodesk, Inc. at (415) 507-6418 or fax (415) 507-6113.

APPENDIX G - CALENDAR OF EVENTS & DEADLINES

Hotel Cut Offs:

New England Tournament

Crowne Plaza	3/1/96
Days Hotel	3/11/96
Highlander Hotel	3/18/96
Nashua Marriott	3/6/96
Sheraton Tara	2/27/96
Suisse Chalet	3/6/96

National Championship

All Star Resort	3/17/96
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Team logos5:00 pm, Friday 3/8/96 at U.S. FIRST
 Team Profiles5:00 pm, Friday 3/8/96 at U.S. FIRST
 Autodesk Award Submission.....5:00 pm, Wednesday 3/20/96 at Autodesk
 Chairman's Award Submission.....5:00 pm, Wednesday 3/27/96 at U.S. FIRST
 New England Tournament.....March 28-30, 1996
 National ChampionshipApril 18-20, 1996

Ship Robots

Teams competing in National Championship only5:00 pm, Tuesday, 4/2/96
 Teams competing in both Tournaments.....5:00 pm, Friday, 4/5/96

Shipping destination for robots to the New England Tournament is still to be determined and will be faxed in a team update by March 15, 1996. **Do not** ship to the same address as last year.

Send Team Profiles, Team Logos and
Chairman's Award submission to:

U.S. FIRST
340 Commercial Street
Manchester, NH 03101

Send Animation Award Submission to:

Autodesk, Inc.
Marketing Support Team-Image Archives
111 McInnis Parkway
San Rafael, CA 94903
Attn: U.S. FIRST JUDGES AWARD

If you are participating the National
Championship ship robot to:

Freeman Decorating
2300 Principal Row
Orlando, FL 32837-8337
ATTN: U.S. FIRST (Epcot)
Phone: 1-407-857-1500