

THE COMPETITION-1998

TEAM UPDATE #1

Date: January 12, 1998

PLEASE DISTRIBUTE THIS TO OTHER TEAM MEMBERS!

FIRST will provide rules updates and other important information to teams exclusively via the "For teams only" portion of the FIRST web site at <http://www.usfirst.org/1998comp/teamonly/updates.html>. Normally, new team updates will be posted every Friday evening. However, urgent information may be posted earlier in the week.

Please check the team updates portion of the web site on a regular basis to insure that your team does not miss critical information about The Competition-1998. FIRST recommends assigning at least one team member the duty of keeping up to date on all team updates. This person or group should be responsible for distributing information contained in team updates to the appropriate team members.

RULES QUESTIONS & ANSWERS

Q1. What will be the ceiling height at the events?

A1. The minimum ceiling height will be 20'.

CORRECTIONS AND UPDATES TO THE MANUAL

Paragraph 3 on page 1 contains several important typos. Below is a corrected version of the paragraph. Changes are highlighted in bold.

"Each ball placed **on** a rail goal will be worth points. ~~but they will not count unless at least 1 ball has been placed into the central goal.~~ The balls placed in the central goal will not score points in themselves but will serve to double points made by balls placed in the rail goals. The position of a ball placed on the rail goals will determine how many points it is worth. Placement of a ball on the outer third of the rail goal will be worth 3 points, on the **middle** third 2 points, and on the inner third 1 point. If a team places balls solely in the central goal and none on the rail goals, no points will be awarded. Since it is probable teams may have tied score points at the end of a match, tie breakers will decide the team placement for the match. The tie break rules are listed in the SC rules section of this manual."

The first part of Rule SC4 on page 82 has been clarified. It now reads:

"1. Each ball placed on any rail goal will be worth points as follows. Balls placed on the outer third of the rail goal (closest to the field border) will be worth 3 points, on the **middle** third 2 points, and on the inner third (closest to the central goal) 1 point. A ball must be contacting both **side** rails of a rail goal, **and the center point of the ball must be above the plane of the upper edge of the rails,** to be counted."

Page 53 contains a typo regarding the SPI Cost. The cost should be \leq \$425.00.

INFORMATION ON BALLS

Balls should be inflated to 0.30 ± 0.05 psig. This should yield a diameter of $20" \pm 1"$.

Contact information for the ball supplier was accidentally omitted from the Supplier Contact List in Appendix C. The supplier is:

Mr. Dave Jackson
Sport Fun, Inc.
4621 Sperry Street
P.O. Box 39150
Los Angeles, CA 90039-0150
800-423-2597

Currently, Sport Fun has balls available in both blue and red. White balls are not available. The red balls are available in limited quantity.

MISSING PARTS

FIRST is aware of several parts missing from all kits, including the Batteries, Drill Bag, and Attenuator. A high priority is being given to these parts and we expect to ship them by 1/16/98.

THE COMPETITION NEEDS A NAME

The Competition-1998 needs a name and we want your suggestions. Names of past Competitions have been "Maize Craze", "Rug Rage", "Tower Power", "Ramp 'N Roll", "Hexagon Havoc", and "Toroid Terror". Please fax your ideas to your team contact (Lori or Geoff) at 603-666-3907.

THE COMPETITION-1998

TEAM UPDATE #2

Date: January 14, 1998

NEW RULE

The following rule has been added for reasons of safety:

- M13. Pneumatic components supplied in the Kit (pump, cylinders, valves, fittings, tubing, etc.) may not be modified except as follows:
- Tubing may be cut
 - The wiring for the pump, valves, and pressure switches may be modified as necessary to interface with the rest of the control system
 - The pressure switch may be calibrated by the normal operation of the adjustment screw
- Mounting and connecting pneumatic components using the pre-existing threads, mounting brackets, etc. is not considered a modification of the components.

RULES QUESTIONS & ANSWERS

- Q2. When a round ends and the power is turned off, if a robot sags so that a ball that was in scoring position no longer is, will that ball be counted as a score or not?
A2. This is covered by rule SC1 in appendix A in the manual. Referees will make the best effort to determine whether the ball is in a scoring position or not. A team should consider trying to design their robot so that it will not sag when the power is turned off in order to prevent the potential loss of points.
- Q3. May a team modify the Seat Recliner Actuator Assembly?
A3. A team may modify this item to any configuration they desire as long as it follows the design criteria specified in the manual.
- Q4. Is heat treating steel considered a chemical modification with respect to Rule K13?
A4. No. Steel parts may be heat treated.
- Q5. May we reuse components from a robot built for a previous competition as long as all the parts are allowed in The Competition-1998?
A5. No. All mechanisms on the robot should be fabricated / assembled by the 1998 team and not reused.
- Q6. May we drive the air pump with the Tekin speed controllers rather than a relay output?
A6. No. See rule C5 and Figures 4.2 and 4.6.
- Q7. May we remove the pump head from the pump and use the motor separately?
A7. No. Rule S9 prohibits the modification of control system components unless explicitly allowed elsewhere. Electric motors are considered control system components. See also Rule M13 above.

Q8. Please clarify Rule SC5, part 3. Does it mean a team with a 3+1 beats team with a 2+2? Does it also mean that 2+2 beats another 2+2 if one of the balls in the 1st 2+2 is higher (vertically) than both of the 2nd 2+2? Does it mean that if the 3pt zones do not break the tie, the 2pt zones will be used and that if the 2pt zones do not break the tie, the 1pt zones will be used?

A8. Yes, yes, and yes.

Q9. Does "no exposed wires", per the robot inspection form, include the capacitor leads on the van door motor?

A9. Good question. Since the part is supplied that way, we will not disqualify teams for using it. However, we do recommend that teams apply some electrical tape to the contacts and exposed leads to prevent any accidental short circuits.

Q10. Are we limited to only 12 volt gel cell batteries of 17.5 amp-hour capacity from Power Sonic, or may we use other brands of the same capacity and physical dimensions, such as Yuasa?

A10. Due to problems with the availability of PowerSonic batteries, FIRST is instead providing CSB brand batteries with very similar specs. You must use the batteries provided in your kit to power the robot at each Competition event. See Rule C23.

Q11. At the kickoff, it was stated that teams were allowed 2 drivers and 3 coaches. The written rules state 2 drivers, 2 coaches, one player. May we assume that the written rules are correct?

A11. Yes, the written rules are correct.

Q12. We are designing a logo for our team and wish to know if we are allowed to use the First logo within ours.

A12. See the last paragraph on page 1. For approval of a team logo incorporating the FIRST logo, please fax the logo to your team representative (Geoff Welcyng or Lori Buckley) at FIRST at 603-666-3907.

Q13. With respect to Rule V25, is replacement of a ball that is popped dependent upon who pops the ball? Does it matter if it is the robot holding the ball that pops it? What if an opponent pops the ball while a robot is holding it?

A13. It does not matter who or what popped the ball. If any team intentionally causes a ball to be popped, then that team will be disqualified.

Q14. May balls be thrown at other balls being held by robots?

A14. Yes.

Q15. Are we allowed to place speakers on the robot?

A15. Yes. See Rule M8. If competing teams consider the sound a distraction, then the speakers may not be used.

Q16. Is it legal to intentionally design a fork that doesn't destroy another robot, but that lifts it out of the field?

A16. No. That is not in the spirit of The Competition.

- Q17. May we use a plug system for a modular electrical system?
 A17. Fully insulated spade connectors may be used, per rule K1, to serve as disconnects. The terminal strips in the kit may also be used as disconnect points. You may not use other sorts of electrical connectors.
- Q18. May we use angle iron in our robot?
 A18. Yes, angle iron may be purchased from Small Parts, Inc. or fabricated from allowed raw materials. See Rule K1 for allowed robot construction materials.
- Q19. May we make a motor have a direct drive by welding something to it?
 A19. Welding is considered a fastener, per Rule K1, and is allowed. As a practical matter, though, it will be very time consuming to repair a drive system problem if the motor is welded in place.
- Q20. Will we receive "bridge" connections for the terminal strip?
 A20. No. See Figure 4.2. Instead of bridging one channel to the next, you should make one large junction of wires that fans out to each channel. This will provide a more reliable connection and reduce voltage drops across the terminal strip.

CORRECTIONS AND UPDATES TO THE MANUAL

There is a typo in the Additional Hardware List. The second line under Sheets & Boards should read:

1/4" Plywood	1 Sheet 4' x 4'
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There is a typo in the last sentence on page 61. It should read:

"Double Elimination concludes when there are only **eight** teams left."

There is a typo in the fourth item of Rule C1. Omit the word "PWM" after "12 AWG".

Rule F2 is superseded by the ball inflation specifications included in Team Update #1.

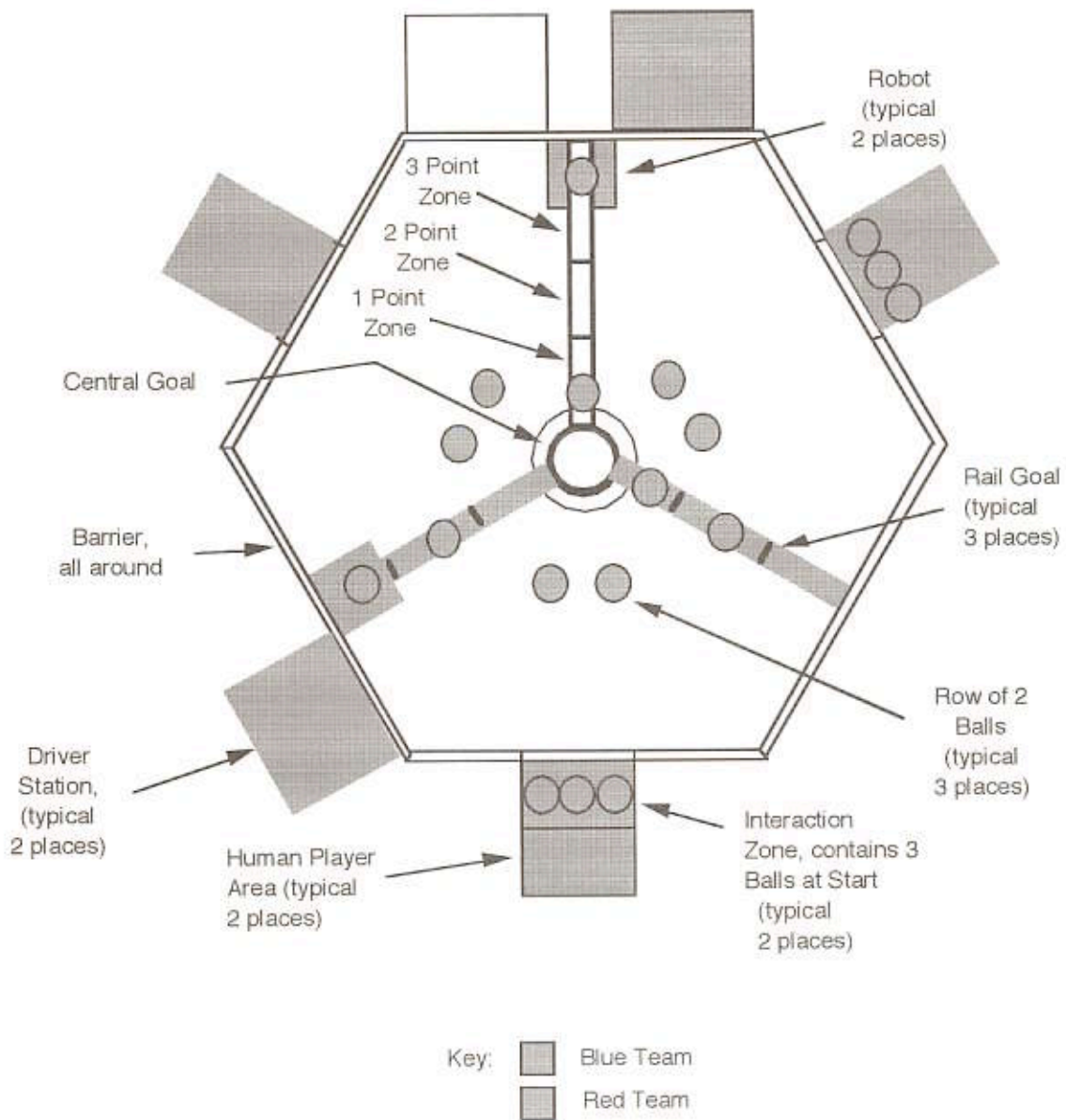
The second paragraph in Section 6.10.3 is updated as follows:

"2. Machines **MUST BE OUT OF TEAM HANDS** by the next Tuesday at 5:00 p.m. The exact dates are listed below."

The second paragraph on page 29 is updated to read:

"To connect the Transmitter to the transmitting RNet, attach the 9 pin end of a 9-15 pin cable to the Data Out port on the Transmitter and the 15 pin end of the cable to the RNet. Next, attach the right angle BNC connector to the BNC connector on the RNet. Attach one end of a BNC coax cable to the right angle BNC connector, and the other end of the cable to the BNC bulkhead connector on the ground plane assembly. Finally, connect the antenna to the other side of the BNC bulkhead connector."

Figure 1.2 is updated as follows:



Playing Field - Top View
Finals Rounds
Figure 1.2

NEW INTERPRETATION OF "CHEMICAL CHANGES"

In past competitions, the melting and recasting of metal and/or plastic parts has been interpreted as a "chemical change" with respect to Rule K13 and was therefore disallowed. This is no longer the case. Melting and recasting materials, such as a block of aluminum, is allowed in The Competition-1998 as long as the basic alloy or chemical composition is not changed. Note, however, that other rules restrict which parts may and may not be modified. For example, the motors or pneumatic cylinders in the kit may not be melted and recast.

REPLACEMENT DRILL PARTS

The Bosch drill model 3310K, mentioned in section 3.4.6, is now obsolete and is no longer available. Teams seeking spare drill parts should instead order Bosch model 3315K.

ADMINISTRATIVE DETAILS

Please note that Team Profiles and Logos are due to FIRST by Tuesday, January 20th. Specific instructions for each of these items can be found on pages 63 and 64 of the rules manual. Also note that any changes on your team confirmation forms must be submitted by Tuesday, January 20th in order to ensure that your team name appears correctly in the event programs.

THE COMPETITION-1998

TEAM UPDATE #3

Date: January 21, 1998

CHAIRMAN'S AWARD DEADLINE EXTENSION

All Documentation for the Chairman's Award must now be in FIRST offices no later than 5:00pm on Tuesday, February 24, 1998. Specific information on the Chairman's Award can be found on pages 71 & 72 on the manual.

FIRST LOGO

The FIRST Logo is a Trade Mark Item and must be treated as such. Teams may use the logo as long as they observe the following guidelines. The following guidelines will replace the last three lines of the 5th paragraph on page 1 of section 1.1:

- The FIRST Logo maybe used by teams for activities, promotions including fundraising, T-shirts, newsletters, identification on their robot, Web Pages, etc.
- The FIRST Logo must be used in a manner that is positive and promotes FIRST.
- The FIRST Logo can not be modified and must be shown in its true form including its trademark colors (black & white are acceptable).
- It is acceptable to personalize the FIRST Logo for team use. However, this form must have the written approval of FIRST.
- Sponsors (corporate, university, etc.) can not use the logo in local or national advertising without the written approval of FIRST.

PROPER BALL INFLATION

As was announced at the Kickoff Workshop, the balls shown on the sample playing field were over inflated. Specifications for proper ball inflation were announced in Team Update #1 and are clarified below.

Team Update #1 specified that balls should be inflated to 0.30 ± 0.05 psig which should yield a diameter of $20'' \pm 1''$. Some teams have observed that not all balls fall within the specified diameter tolerance at 0.30 psig. If a ball inflated to 0.30 psig does not satisfy the diameter tolerance, then the pressure should be adjusted, within the specified tolerances, until the diameter is also acceptable. If a ball is not capable of meeting both specifications, it should be discarded. FIRST will measure both properties of all balls used at Competition events and will not use balls which do not meet the stated specifications.

RULES QUESTIONS & ANSWERS

- Q21. When it comes to human players throwing balls into the playing field, do the rules allow the player to throw the balls as hard as they want to at an opponent's robot or at a ball an opponent's robot is holding onto?
- A21. The rules allow a player to throw balls at the robots holding a ball (see A14 in Team Update #2). If the robot is damaged, the team that threw the ball may be

disqualified. This decision is at the discretion of the referees. Please refer to Rules V5 and V7 of Appendix A.

- Q22. Was the playing field parts list missing pieces on purpose or was it an accident?
A22. Some parts were intentionally left out because FIRST felt the information was not necessary to construct a field. If you have any questions in regards to these missing parts, please feel to ask.
- Q23. Are we allowed to use the FIRST logo in the animation?
A23. The policy on using the FIRST Logo can be found in Team Update #3 in the section titled FIRST Logo.
- Q24. If, while attempting to knock a ball out of another robot's manipulator, the robot is "damaged", who is at fault? Them for poor engineering or our player for the hit?
A24. The rules allow a player to throw balls at the robots holding a ball (see A14 in Team Update #2). If the robot is damaged, the team that threw the ball may be disqualified. This decision is at the discretion of the referees. Please refer to Rules V5 and V7 of Appendix A.
- Q25. Is there a digital Autocad copy of the playing field (dwg format) available?
A25. No.
- Q26. If a robot places a thin object (such as a piece of cloth) on the goal rails and another robot places a ball on that cloth, is the ball considered to be touching the bars, and does it count as points?
A26. The ball would not score because it is not touching the bars. However, the cloth must be attached to the robot and not cause any risk of entanglement. Refer to rules V17 and K10.
- Q27. In rule V27 it states: "No remote communications devices such as air phones, walkie-talkies, cellular phones, etc., may be used by team members at the playing fields." Does this rule apply exclusively to the playing field area, or does it also apply elsewhere? (i.e. the audience, pit area, corridors, etc.)
A27. Remote communications devices are allowed else where at the events. The intent of this rule is to prohibit remote communication between team members on the field and not on the field. Also, this helps eliminates one source of radio interference at the fields.
- Q28. May field components included in the kit of parts, such as the ball, be used in the construction of the robot.
A28. To prevent confusion, the ball may not be used on the robot in it's whole form. However, the ball may be cut into pieces and the vinyl used on the robot.
- Q29. If our robot has a net that holds other team's balls, will the other teams get disqualified if they try to take the ball out by grabbing the net?
A29. An opposing robot may pull a ball out of the net. The opposing robot may be disqualified if the net is damaged. However, if the net is considered to present a risk of entanglement, then it may have to be removed. Both of these decisions are up to the referees. Please refer to rules V5, V7 and K10 in Appendix A.

- Q30. May a robot shake the ramps to dislodge balls?
A30. Yes as long as the playing field is not harmed, loosened, etc.
- Q31. Is the robot allowed to take balls from opponents human player stations?
A31. No. See Rule P10.
- Q32. May our machine blow bubbles??
A32. No. See Rule V10.
- Q33. Is it possible to squeeze the balls through the sides of the goal to score?
A33. With proper inflation, it should be possible.
- Q34. May part of our strategy be to tip an opponent, if we also have scoring capability? (i.e. Is intentional tipping allowed if we also have an offensive component to our strategy?)
A34. No. Intentional tipping is not allowed. See Rule V5.
- Q35. May our robot attach to any of the 1 1/4 inch piping on the Game Court?
A35. Some pipe is off limits. See Rule V12.
- Q36. In regard to rule M12, may suction cups also be fabricated from materials on the Additional Hardware List or purchased from Small Parts, Inc.?
A36. Yes. That is the intent of the reference to Rule K1.
- Q37. In regard to rule C1, does the cutting of the red 24 AWG wire apply to both speed controllers and servos or just to the speed controllers?
A37. No, just speed controllers. The servos will not work if you cut their red PWM wire.
- Q38. May the robot start pointed diagonal at the position shown?
A38. If it can fit within the designated starting area on a diagonal, then yes.
- Q39. In Team Update #2 there was an update to Figure1.2. Some areas appear gray and one cannot distinguish red from blue.
A39. This is a quirk of Adobe Acrobat. It displays gray, but prints correctly.
- Q40. May teams create their own suction cups from parts not in the Small Parts, Inc. catalog? For example, would using a plunger for parts be acceptable?
A40. Teams may fabricate custom suction cups using material in the kit, from the additional hardware list, or from Small Parts. No other materials are allowed.
- Q41. Our team has questions regarding how the score doubling works in The Competition. My interpretation is as follows: If n is the number of balls in the center, then $\text{Score} = 2^n * (\text{Sum of rail points})$. Is this correct?
A41. Yes, exactly.
- Q42. May our robot drive its wheels over the 1 x 6 in front of the player station and into our interaction zone, provided it stays inside the interaction zone and does not climb the railing?
A42. Robots are allowed to drive onto the 1 x 6 in front of the player station. However, the robot is not allowed to drive into the interaction zone as explained

in rule P9 of Appendix A. Also refer to rule V12 of Appendix A for further explanation of interaction with the outer field barrier.

- Q43. May our robot reach into the interaction zone, providing its parts stay within the footprint of the interaction zone?
- A43. A robot is allowed to reach into the interaction zone. Please refer to rule P9 of Appendix A.
- Q44. May our human player pull in a ball that has been wedged underneath the railing in front of the interaction zone, providing that we did not bear on the interaction zone, or touch the railing or a robot?
- A44. Yes.
- Q45. Is it legal to wedge any ball underneath the field boundary railing such that its center is still inside of the railing edge?
- A45. Yes.
- Q46. On page 12 in the manual the ball is listed as 24". In team update #1 it is listed as 20". Is the 20" value the size we should use?
- A46. The ball provided is a 24" (maximum) diameter ball which is to be inflated to a $20" \pm 1"$ diameter. Update #1 is correct.
- Q47. The central goal rests upon carpet laid over a 4' diameter x 3/4" plywood base. What is the edge treatment of the plywood base?
- A47. The base has a 1/2" chamfer all around the edge.
- Q48. What is the surface treatment of the 1-1/4" schedule 40 steel pipes used for the goal construction?
- A48. The surface of the pipe is as manufactured. The pipe is painted flat black. The actual paint has not been specified.
- Q49. Is it possible to fax out to the Teams any drawing(s) of dimensional details on the Bosch 3310K-10 Drill Gearbox (specifically the output shaft detail) and the Drill Housing? We can't get our machinists going until the drills get here.
- A49. The drills and housings were shipped on 1/16 and 1/17. All teams should have received the drill parts by this time.

- Q50. Rule V9 provides a clear, performance-based criterion for Teams to apply in designing for traction at the wheel / carpet interface. Rule V8, however, at least implies that certain design approaches to developing traction will be disallowed at inspection. V8 says, in part: "Deliberately damaging the playing field ... (USING SPIKED WHEELS, FOR EXAMPLE) is strictly illegal ..." Well designed wheels with small scale surface patterns which could be described as "spiked" can effectively eliminate wheel slippage and be less damaging to the carpet than hot, spinning rubber wheels, certainly when combined with suitable torque limitation during operation. Could Rule V8 be revised to simply state: "Deliberately damaging the playing field, controls, or balls is strictly illegal and will result in disqualification." Then V8 would say we can't do deliberate damage, and V9 says we can't do inadvertent damage either. The rules would then limit the outcome we produce rather than the creative content of the machine design.
- A50. FIRST specifically mentions spiked wheels because we have had problems in the past. Teams can develop any traction device as long it does not damage the carpet. The FIRST inspectors, at the events, will ask teams to place their robots on the carpet test platform if they feel it is necessary. FIRST will look into your recommendation for next year. At this time FIRST believes the rule adequately states our intentions.
- Q51. In reference to rule V17, if a mechanism is released from the robot but is tethered in some way, would that break rule V17?
- A51. This does not break rule V17 but it will violate rule K10.
- Q52. In section 2.1.2 it states: "This barrier is just high enough to allow balls to be pushed into the player station without allowing robots in." The clearance between the bottom of the bar and the floor is 17.1 inches according to the goal drawing specifications. Team Update #1 states that the "balls should be inflated to 0.30 ± 0.05 psig. This should yield a diameter of $20" \pm 1$ inch." Therefore, is the measurement for the height of the player station bar (center of the bar 19.5 inches, bottom of the bar 17.1 inches) accurate?
- A52. Yes. Balls can be pushed under the bar. The rules do not state that they will be able to freely roll under the bar.
- Q53. May we purchase more wheel chair wheels from the manufacturer? If so, may we use four of the same sized wheels? For instance, may we use four 6" wheels on our final robot?
- A53. You may purchase additional wheels from Skyway but you are only allowed to use one pair of 6" and one pair of 8" wheels on the robot.
- Q54. Is the 10 second rule on pinning supposed to prevent a team from even attempting to pin another team for the sole purpose of pinning them or is it meant only to limit such attempts to under 10 seconds? If it is the latter, how long must a team back off 3 feet before the clock restarts and another 10 second pinning may take place?
- A54. The intent of the rule is to prevent pinning. It was created to ensure robots are moving. Once a team has backed their robot off by three feet, it can go right back to pinning for an additional 10 seconds. The reason for backing off is to allow the robot being pinned to have a chance to run away.

- Q55. Is there a restriction on the size of custom suction cups?
A55. No.
- Q56. Are there any restrictions on the material used for the suction cups?
A56. Yes. The material must come from the Kit, Small Parts Inc. and/or the additional hardware list. See rule M12 in appendix A.
- Q57. From where may suction cups be ordered?
A57. Small Parts Inc. has available very small suction cups (see page 239 of Small Parts Inc. catalog)
- Q58. May steel sprockets be used instead of another material (e.g. nylon)?
A58. Yes. The Additional Hardware List allows teams to purchase up to 4 sprockets from a vendor other than Small Parts, Inc. Further steel sprockets must be manufactured by the team from allowed raw materials.
- Q59. May the goal be blocked with balls thrown by the human player?
A59. Yes.
- Q60. How many balls are allowed to fit in each section of the arms of the goal? May more be squeezed in than will fit loosely?
A60. As many balls as will fit. However, for balls to count towards the score they must meet the requirements of rule 5C4.
- Q61. May robot parts be left on the goals (as a blocking device) if they remain attached to the robot?
A61. Yes.

CORRECTIONS & UPDATES

Update to A7 (as announced in Team Update #2): It is acceptable to modify the mounting brackets and/or other structural parts of the motors as long as the electrical system is not modified and the mechanical system of the moving parts (pump head, bushings, worm gear output stages, etc.) is not changed or removed. This means that holes may be drilled in the mounting flanges or material removed from the housings as long as the moving parts and/or electronics are not affected. Of course, FIRST will not provide replacement for parts which fail due to modification.

It is acceptable to remove material from the edge of the connector housing on the 9-15 pin cables in order to make a non-interference fit with the BNC right-angle connector.

The robot starting areas on the playing field are 4' x 4' and are located just inside the field boundary, centered under the rail goal.

The 1-1/4" diameter closet rod referred to in the Additional Hardware List assumes a solid wooden rod. Metal or plastic closet rods are not acceptable alternatives.

THE COMPETITION-1998

TEAM UPDATE #4

Date: January 26, 1998

RULES QUESTIONS & ANSWERS

- Q62. May we order parts from Small Parts, Inc. if they are listed in the Bulletin Vol. 5, No.1 - January 1998 addendum from Small Parts?
- A62. Yes. The addendum was included in the kits and it is considered part of the Small Parts catalog.
- Q63. The Basic Stamp Manual contains sections for both the Basic Stamp I and Basic Stamp II. Which processor is used in the Receiver?
- A63. The Basic Stamp II is used in the Receiver. Please ignore the Basic Stamp I section of the Basic Stamp Manual.
- Q64. With respect to the Additional Hardware List, is a belt roller considered a pulley?
- A64. If the roller has flanges at the ends to restrict the belt from sliding off then it is considered a pulley.
- Q65. Rule K1 allows unlimited use of pipe tees, reducers, elbows, angles, and end caps if used with pipe. May we use pipe plugs?
- A65. No.
- Q67. If we purchase a left-hand threaded screw to match the output shaft of the drill gearbox, does it count as a fastener?
- A67. Yes.
- Q68. May we use contact cement to glue two objects together?
- A68. Yes. Adhesive is considered a fastener. See Rule K1.
- Q69. If you have negative points how does that affect your seeding? Do you have to make up the points?
- A69. Actual points scored in seeding matches, as opposed to seeding points, are considered a tie breaker for teams with an equal number of seeding points. Below that is last match points, and so on. Having a negative score simply hurts your seed value, you don't have to make up negative points.
- Q70. If a referee throws a penalty flag does it stop play?
- A70. Penalty flags will not stop the match. However, if a team is disqualified, their robot will be turned off and their player will have to cease throwing or collecting balls.
- Q71. What is the flatness specification of the floor?
- A71. There is no specification. The floor will be either a basketball court or a stage, depending on which event you attend. Both should be quite flat on a scale that matters to a robot. Note, however, that there may be some small ripples in the surface of the carpet due to the fact that it is shipped in a large roll.

- Q72. How will the carpet be attached to the floor area?
A72. It is not attached except for tape at the edges to prevent tripping. The weight of the carpet combined with the weight of the perimeter of the playing field is sufficient to hold the carpet in place.
- Q73. If the operator control components are secured to a board to facilitate setup does the board count as a component of the robot for the purpose of material selection and cost constraints?
A73. Yes. Teams may fabricate devices to hold the control system components on the driver's side. These devices must be fabricated from allowed robot building materials and count against the cost limit on parts from Small Parts, Inc. or against the quantity limits on parts from the Additional Hardware List as appropriate. Weight and size of these devices is not considered.
- Q74. Is it permissible to drill holes in the edge of the ground plane for mounting/ support purposes?
A74. Yes. However, this will not be necessary for Competition events. All teams will connect their Transmitters to power supplies and RNetS pre-wired to the driver stations.
- Q75. What is the maximum torque of the servos?
A75. The servos are rated for 42 oz-in peak torque. However, according to an industry insider, all R/C companies (Futaba, Hitec, etc.) inflate servo torque specs by about 100%. FIRST has not measured the maximum servo torque. Application of large loads is not recommended, though, because the gearing inside the servos is all plastic and is thus fairly delicate.
- Q76. Will balls be checked for compliance at the beginning of each match? Our practice balls become quite deformed during the course of play.
A76. FIRST will check balls at the beginning of each day at each Competition event. We may recheck balls during the day if sizes/ pressures appear to be changing.
- Q77. Regarding rule V17, is it legal to deposit an object outside the playing field if it doesn't hinder other teams if it is just set out of the way? Could such an object be given to a human player.
A77. It is not legal for a robot to intentionally leave parts behind, either in or out of the playing field. The human player may not touch any part of a robot. See Rule V15.
- Q78. May a robot take away a ball being carried by an opponent's robot?
A78. Yes.
- Q79. If a ball bounces out to the human interacting guy, can he just catch them and use them like any other balls from the field. (assuming of course they've got less than 3 balls in the pit with them)?
A79. If it bounces inside the field, then yes. If it bounces outside the field, then no.
- Q80. Are we allowed to purchase extra motors?
A80. No, you may only use the motors supplied in the kit. See Rules C5 and K1.

- Q81. May we use a hydraulic system if we build it using parts from the kit and SPI?
A81. No. Custom pneumatics are prohibited for safety reasons. The same reasoning applies to hydraulics.
- Q82. Even though we only received 1 LED in the kit, may we have more onboard the machine for non-decorative (i.e. useful computer interface) functions?
Q82. No. See Rules C5 & K1. You may, however, customize the behavior of LED D26 on the Receiver by writing a custom control program.
- Q83. Regarding Rules P7 & P8: When a player attempts to pull a ball underneath the railing from the playing field, he/she will inevitably exert some force on the floor (even though they are not directly touching the floor) May the human player lean on a ball for support?
A83. Although it is true that some force will be exerted on the floor during ball retrieval, it was stated at the Kick-off that this was acceptable. Leaning on a ball in the Interaction Zone, such as to be able to get closer to the playing field or to avoid falling over, is a violation of Rule P8 and is not allowed.
- Q84. May the human player touch the railing as a support (w/o reaching inside the field of course)?
A84. No. That would be a violation of Rule P8.
- Q85. We realize Rule V 17 says the robot must remain whole and V9 does not allow damage to the field. However, if a string/line/cable attached to our robot remains attached to anything else that was initially on our robot, is such a string allowed assuming no damage to playing field/ other robots?
A85. The string would not violate Rule V17 or V9. However, it would very likely be judged as presenting a risk of entanglement, which would violate Rule V5.
- Q86. May additional pneumatic tubing from Small Parts be used to transmit a vacuum?
A86. No. That would violate Rule M12.
- Q87. May 8 Tekin speed controllers allowed to be used on the robot?
A87. Yes. You may use the 4 speed controllers supplied in the kit, plus an additional 4 per the Additional Hardware List. You may only use the Tekin Rebel model of speed controller.
- Q88. Which price do we use out of the SPI catalog? SPI offers volume discounts on many parts and the discounts are substantial. For example, stainless steel screws are \$1.35 ea. individually or \$0.42 ea if purchased in a quantity of 100. If a team was wanting to be conservative on the cost of the robot, but was not cost conscious for the entire project, it would be theoretically possible to need one screw, but purchase 100 and not use the remaining 99. This would reduce the cost of the robot itself, but not be an intelligent thing to do.
A88. Part cost should be pro-rated to the cost of the minimum order size that will accommodate the material used on the robot. For example, if you use 11 of part X that is sold in single units, or boxes of 10, 25, or 50, you could use the cost of a box of 25. Similarly, if you use 6" of a 3' rod, but you could have purchased a 1' section, you can account for the cost based on a 1' rod.

Q89. Would it be OK to place a remote camera on the robot and have it transmit the signal to a receiving monitor at the driver's station to view the progress of a match?

A89. No. This is not allowed.

Q90. Is there a small parts machine shop at the competition?

A90. Yes

Q91. Who can work on the robot in the pit area? (students only or also adults)

A91. Students and adults can work on the robot.

Q92. What tools, if any, will be supplied by FIRST, and what tools are we as teams able to bring?

A92. FIRST does not supply any tools at the events for teams. The teams are responsible for their own tools.

Q93. According to P13, the human player may only interact with the balls in the playing area using their bodies, but would the player be allowed to use one ball to help manipulate another ball out of the interaction zone?

A93. Yes

Q94. Can coaches be at the station, and are coaches and/or students allowed to bring notes to the playing field?

A94. Two coaches are allowed in the drivers station. Please refer to rules P3 and P6 in Appendix A. During a match coaches and/or students are not allowed to bring notes to participants at the playing field.

BALL INFLATION TIP

Some teams have found it helpful to pre-stretch the balls in order to achieve the an acceptable diameter within the specified pressure range. If a ball is still too small at the maximum pressure, inflate it to the maximum 24" diameter and let it sit overnight. The following day, release the excess air until the ball is back to an acceptable pressure.

CORRECTIONS AND UPDATES TO THE MANUAL

The third bullet of Rule K4 contains an editing mistake. Omit all but the first two sentences.

The second paragraph on page 67 contains a typo. The date in the last sentence should read "12/11/98".

The header on page 203 should be Appendix M instead of Appendix L.

The following bullet items are added to Rule M12:

- Tubing may be compressed in order to block the flow of air.
- Tubing may not be compressed in order to generate compressed air or vacuum.

The following corrections are to be made to the List of Components in section 3.2:

- Delete Battery Box
- Add 1 Battery Terminal Cover, Black
- Add 1 Battery Terminal Cover, Red
- Add 1 Battery Hold Down Strap
- Change manufacturer of Sealed Lead Acid Battery to CSB Battery of America Corp.
- Add 1 Attenuator
- Change quantity of Capacitor, Drive Motor Noise Suppression to 4 from 6
- Add 1 Window Motor, Left Hand
- Add 1 Window Motor, Right Hand
- Change quantity of Pressure Switch to 1 from 2
- Add 1 BNC Right Angle Connector
- Add 4 Socket Head Screws to attach drill gear box flange to the drill motor

The description of PVC pipe in the Additional Hardware List was incomplete. All sizes of PVC pipe must be schedule 40.

In section 2.1.1 there is an error. Change "1 x 4 boards" in the second line to "1 x 6 boards".

The fax number for the supplier Kee Industrial Products in See Appendix C is incorrect. It should be 716-896-5696.

NEW RULE

K16: Although SPI can special order parts in sizes other than those listed in the catalog, special ordered parts may not be used on the robot unless at least one of the following criteria are met:

- The SPI catalog specifically mentions, on the same page as a given type of parts, that sizes other than those listed are available.
- Within the SPI catalog there are parts with standard cross sections that must be ordered to a custom length. These items may be used and are considered *off-the-shelf*.

One of the reasons for using the SPI catalog is to insure all teams have equal access to parts. Allowing a team to use a part others did not know was available would be unfair.

The following changes are required to Appendix L, Window Lift Mechanism Assembly Procedure:

- Page 197, Step 1: Change 7/16" to 1/2".
- Page 198, Delete steps 7 through 10 and replace with the following:
 - 6A. Install the washer (item 8A) over the flanged bushing (item 3) so it firmly rests against the flange of the bushing.
 7. Install the washer and flanged bushing assembly into the 1/2" hole in the window lift bracket (item 1 and 2).
 8. Remove approximately 0.095" (the thickness of washer item 8A) of the inner circle of the gear (item 6). This will allow proper mating of the gear to the window lift bracket (item 1 and 2).
 9. Install the gear (item 6) into the gear socket located in the window lift bracket (item 1 and 2). Verify the window lift mechanism tape (item 5) is located on the outside of the gear (item 6) Align the tabs on the gear (item 5) with the holes in the window lift mechanism tape (item 5) .
 10. Align the three window motor (item 7 and 8) mounting holes with the three 1/4" through holes on the window lift bracket (item 1 and 2), the window motor (item 7 and 8) gear teeth to the inside teeth of gear (item 6), and the gear shaft of the window motor (item 7 and 8) to the flanged bushing (item 3) in the window lift bracket (item 1 and 2). If alignment is satisfactory push the window motor (item 7 and 8) into the window lift bracket (item 1 and 2) until window motor is firmly against the bracket.

THE COMPETITION-1998

TEAM UPDATE #5

Date: February 4, 1998

NEW TRANSMITTER POWER SUPPLY

Due to control system problems experienced by a number of teams, FIRST is providing all teams with a new power supply for the Transmitter. Teams should receive the new supply by Friday, February 6th at the latest. Teams MUST use the new 7.5 Vdc power supply to power the Transmitter. The 9 Vdc power supply included in the kits does not need to be returned to FIRST.

RULES QUESTIONS & ANSWERS

- Q95. If a robot has a ball and holds it above the interaction zone, does it count toward the 3 balls retained by the human? Specifically, assuming the player station already has 3 balls in it, is it legal to have a robot go to a player station with a ball in hand holding it above the interaction zone, have the player give the robot one ball, and then have the player take the ball from the robot? OR would the robot have to wait to bring the ball above the interaction zone until the human player reduced his/ her ball count to less than 3?
- A95. No. The balls held by the robot over the interaction zone do not count towards the balls being retained the human.
- Q96. Do the drill motors have to be used for the drive system?
- A96. No.
- Q97. May we make as many gears as we need out of raw stock or do we have to buy them from Small Parts? Also, how many may we buy? the rule book is unclear about gears.
- A97. The quantity of gears allowed is unlimited but they must be purchased from Small Parts Inc. or manufactured from raw stock. Please refer to rule K5, page 91, Appendix A in the rule manual.
- Q98. The free materials list indicates PVC pipe. Is it legal for us to use end caps, elbows, tee's etc. as well?
- A98. You are allowed to use fittings as specified in Rule K1, page 90, appendix A of the Manual.
- Q99. Team Update #3 states that we may not remove the worm-drive portion of motors in the kit. May we cut a hole in the drive housing and attach an output shaft to the motor shaft if we do not remove the worm drive?
- A99. No. Attaching an output shaft to bypass the worm drive would be considered a modification of the motor's mechanical system of moving parts which was disallowed.
- Q100. If we use staples to connect together two ends of a belt, are they considered fasteners?
- A100. Yes.

Q101. The rules state that we may fabricate a custom suction cup. May we use more than one custom suction cup on our robot?

A101. Yes. Rule M12 states "suction cups may be fabricated...".

Q102. Rule V12 states that robots should not be designed to interact with the outer field barriers. Are the vertical pipes holding up the outer portion of the rail goals considered part of the outer field barrier?

A102. No, they are not considered part of the outer field barrier.

Q103. Does opening a flap in a suction cup to release its vacuum constitute an illegal pneumatic device, i.e. is this an illegal valve?

A103. Yes it would be considered a valve and disallowed.

Q104. May we purchase a 4-pin DIN connector for the Honeywell photoelectric switch instead of cutting off the existing connector and fishing out the wires?

A104. No. The connector must be cut off.

Q105. There is no wiring harness listed for the van door motor. Are we to remove the connector and splice the wires? May we purchase a wiring harness without penalty?

A105. You must cut off the connector.

Q106. May we fabricate an ergonomic driver interface including the rocker switches, limit switches, and possibly potentiometers if they are not mounted in the project box?

A106. Yes. The materials used in the construction of the interface must be kit parts and count against the cost/quantity limitation on materials used to build the robot, but do not count against robot size/weight constraints.

Q107. Can the Seat Recliner Actuator Assembly be altered to extend the stroke (by extending the metal tube-like covering over the big screw)?

A107. You can add to the tube to increase the stroke.

Q108. Rule P12 indicates a human player may retain a maximum of 3 balls at any one time within the player station. If a human player has 3 balls in his station and the robot delivers a fourth ball to player station as human player is loading one of his 3 balls onto robot; would a team be in violation of this rule?

A108. No.

Q109. Is a key (fits into a keyway) considered a fastener?

A109. No. It is a mechanical shoulder used to position or bear against.

Q110. Is a bearing locking collar considered a fastener?

A110. Yes, as long as it meets the criteria of a fastener defined in rule K1.

Q111. May we use identical parts from outside sources to save time instead of ordering through SPI? (While staying inside the \$425 budget)

A111. No. Parts not in the kit, not on the additional hardware list, and not considered "unlimited quantity items" per rule K1 must come from Small Parts, Inc. Of course, you are welcome to use materials from anywhere for the construction of

prototypes. If Small Parts is out of stock on an item and will not be able to ship quickly, please contact FIRST for permission to obtain the material elsewhere.

Q112. Is it legal to purchase additional power distribution strips?

A112. No. Only control system components provided in the kit may be used to conduct electricity.

Q113. Are we allowed to use rivets to fasten the arm on our robot?

A113. Yes. Rivets are considered fasteners per rule K1.

Q114. May we wire a decorative device to be on whenever the power is turned on?

A114. Yes. See Rule M8.

Q115. May we modify a motor, otherwise illegally, for decorative purposes only?

A115. Yes if the motor serves as a "non-functional decoration" per Rule M8.

Q116. What is the penalty for having more than three balls in the player station?

A116. Unless otherwise stated, rules violations will result in disqualification of the team per rule V2.

Q117. May a human player throw balls into another player's player station?

A117. No. That is not in the spirit of The Competition.

Q118. May a robot push balls into another player's player station?

A118. Yes.

Q119. If the robot is small enough, may it go into the middle of the central goal?

A119. Yes.

Q120. If the robot is small enough, may it go into the interaction zone?

A120. No. Rule P9 implies that it is acceptable to reach over the interaction zone, but not to drive onto it.

Q121. Will use of a gas spring from Small Parts, Inc. violate rule M12?

A121. Assuming that the internal gas pressure system is not modified, no.

Q122. May we modify the drill gearboxes?

A122. Yes. The gearbox is not considered part of the drill motor.

Q123. With respect to Rule S9 and answer A7 as appended in Team Update #3, which of the following is allowed?

1. Shortening the output shaft of the van door motor.
2. Drilling the output shaft of the van door motor to cross pin a gear.
3. Cutting off the worm gear reducer from the seat motor and taking power directly from the motor shaft.
4. Cutting off the handles of the plastic drill motor housing.
5. Modifying the plastic frame for the window lift motor.

A123. 1. Yes, 2. Yes, 3. No, 4. Yes, 5. Yes. In the case of 4 & 5, those components are not considered part of the motor.

Q125. May we manufacture sprockets from raw material purchased from Small Parts?
A125. Yes. Please see Rule K2.

CORRECTIONS AND UPDATES

In the last paragraph of section 4.5.5, the descriptions of D31 and D33 are swapped.

Rule C6 is updated. Changes are highlighted in bold.

- C6. The 10 gauge wire must be used for connections from the battery to the speed controllers, **from the speed controllers to the drill or van door motors**, and from the battery to the Receiver. **The 16 AWG wire may be used to connect seat or window lift motors to the speed controllers.**

Table 4.7 contains errors in the last four rows. Please replace the control program variable names "rx_analog1" through "rx_analog4" with "sensor1" through "sensor4".

SMALL PARTS UPDATE

FIRST is aware that certain catalog items sold by Small Parts, Inc. are on backorder and may not be immediately available to teams. If you order a part which will take more than one week to ship, please contact Ken Lambert, Eric Rasmussen, or Brian Farmer at FIRST for case-by-case permission to obtain an equivalent part from an alternate vendor.

AUTODESK UPDATE

Mechanical Desktop 2.0 Technical Tips

Here are a couple of updates for those of you incorporating your educational grant of the Mechanical Desktop 2.0 into your work on the FIRST Competition 1998 design challenge:

- Preliminary indications show that some users' computers may "hang" when exiting the program in a Windows 95 environment. The current recommendation is to install Windows 95b which is downloadable from the Microsoft Web site.
- A problem manifests itself when accessing the "Help/About" dialog box. This problem seems to be associated with 3D accelerated graphics cards containing the S3 Virge chipset. It is a hardware anomaly, not your software. There is exploration ongoing to determine some workarounds. First and foremost, avoid the "Help/About" dialog box. If problems persist, here are the current recommendations:
 - ◇ Uninstall the graphics card, then...
 - ◇ Start up Windows and reduce resolution to 680 x 480 (VGA resolution), then...
 - ◇ Re-install the graphics card according to the manufacturer's instructions
 - ◇ As an optional workaround you may elect to: Disable the 3D acceleration on your graphics card. Note that in so doing, the card will have to have acceleration turned back on after exiting the program in order to take advantage of hardware acceleration in other programs.

Technical Tips on Hardware Locks

- Before installing your hardware locks label them with tape.
- When installing the locks, place the AutoCAD/Mechanical Desktop 2.0 first, then follow with the 3D Studio MAX 2.0 lock.
- The locks should be as close to the parallel port as possible.
- If your setup requires that the locks be at the end of a cable, make sure the cable is less than 6 feet long.
- If you are installing Mechanical Desktop 2.0 on a computer on which AutoCAD Release 13/Mechanical Desktop 1.2 is already loaded, the oldest lock must be in place before the new ones.
- Again, the closer the locks are to the beginning of the parallel port, the less likely you are to run into problems.

Friendly Advice on Lock Security

- Never leave your hardware locks unsecured! If you lose them, your Autodesk software will not run.
- Protect your locks by building a box to house them or by attaching them to your table with computer security cable.

THE COMPETITION-1998

TEAM UPDATE #6

Date: February 9, 1998

RULES QUESTIONS & ANSWERS

Q126. May we use a motor on the robot to spin up a fly-wheel, and then release energy rapidly from this fly-wheel?

A126. Yes. However, you may not "spin up" the flywheel before the beginning of a match in order to store energy.

Q127. There is a robot trying to score a ball. May our robot go over and give it a stout shove? What if the machine falls over due to a failure of the designers to appreciate the concept of "center of gravity" or due to the "clothesline" effect of the rails? What if the machine takes damage as a result? What if they are trying to remove one of our balls from the goal? Instead of ramming, may we launch a ball with a decent amount of force as a defensive action? What if our human player throws the ball?

A127. Yes your robot may attempt to push another robot away from the goal or launch a ball at it to try to prevent it from performing some action. Be careful when launching balls, however, so as not to violate Rule V16 or A117.

Our objective is not to prevent this sort of interaction. If the robot tips over, then the referees will make an immediate judgment call as to whether or not they think the intent was to tip or merely to push away to prevent scoring or other competitive actions. If they think the sole intent was to tip, then they will levy a penalty. If they think the robot fell as a unintended side-effect of being pushed, then it will be okay. It is true that many robots are top-heavy, but the referees will factor this in when making a judgment. This is the intent of Rules V5 and V6. As for damage, the referees will make a second judgment call, per Rule V7, regarding perceived intent to damage versus quality of design and construction.

Q128. May we change the housing for the Tekin speed controller to be all metal for better thermal conductivity?

A128. No, that would violate Rule C1. With proper gearing, the speed controllers really shouldn't get all that hot. If heat is an issue, use the muffin fan included in the kit to direct forced air over the speed controller heat sinks.

Q129. May we use a ferrite ring around the antenna wire to reduce modulation?

A129. Yes if the ring is from Small Parts, Inc. (SPI) or made from kit materials. (See Rule K1)

Q130. How are you mounting the Antenna ground plane on the transmitter side?

A130. There is no specific mounting procedure for teams to use with the ground plane. FIRST has been using a simple cardboard box with a hole cut in the top (for the cable). Whatever you use, make sure that the antenna is vertical. At the events, FIRST will have power supplies, RNet and ground planes pre-mounted around the playing field. Teams will just plug their transmitter box into the RNet and power supply at whichever driver station they are assigned to during a match.

Q131. May we obtain a matching connector for the connector on the optical sensors or should we cut it off?

A131. Cut the connector off. (Mentioned in Section 4.5.1 of manual)

Q132. What are the differences between the 3310 and 3315 drill motors and are we allowed to use either one during the competition?

A132. They are equivalent. Teams may use either motor on the robot.

Q133. What is the size of the designated starting area for the robot?

A133. 4' x 4'. (See Team Update #3)

Q134. May we modify the drill gearbox?

A134. Yes, the drill gearbox is not considered part of the drill motor.

Q135. May we use 16 AWG Wire to link between channels on the power strips?. If not what size should we use, because two 10 AWG wires won't fit in one channel.

A135. Figure 4.2 shows that power should only be distributed from the battery to the terminal strips via 10 AWG wire. Jumpering the terminal strip from one channel to the next is not recommended because it will cause reliability problems and voltage drops from one end of the strip to the other. If you use the terminal strips, please fan out the 10 AWG wire from a central node, as shown in Figure 4.2. This will reduce failures if a supply wire comes loose and equalize voltage drops to all terminal strip channels. If you really don't want to fan out the 10 AWG wire, consider using a short length of 10 AWG wire as a bus bar on one side of the terminal strip, and run short connector wires into each channel. Just make sure to properly insulate the 10 AWG "bus" when you are finished. Lastly, note that use of the terminal strips is not required as long as proper minimum wire gauges, per Table 4.1, are followed.

Q136. At the start of a match are springs required to be at rest and then activated after the start of the match?

A136. No. Per Rule M1, energy used by the robots may come from storage achieved by the deformation of springs. This means that springs may be pre-loaded prior to the start of a match.

Q137. We have wheels that swivel and in certain locations the wheels swivel out such that they are outside of the allowed width of the robot. The official starting position of our wheels is within the allowed width but during driving they may swivel outside of the allowed width. Will this cause us to be disqualified?

A137. Robots are allowed to exceed the initial size constraints after a match has started. See Rule M5.

Q138. With regard to sprockets from outside sources (additional parts list & rule K4), is it permissible to use a sprocket that comes with a taper lock hub as opposed to a set screw hub? The hub is sold as part of the sprocket and is not a separate line item as sold by the manufacturer.

A138. Yes. The type of hub on the sprocket is not specified in the Additional Hardware List.

Q139. Are U-bolts considered fasteners and thereby unlimited in quantity and exempt from \$ consideration?

A139. It depends on the usage of the U-bolt. If used to securely fasten two objects together, then it is considered a fastener. If used as a bearing surface for a translating or rotating part, then it is not considered a fastener.

Q140. May aluminum parts be made from bar stock in sizes available from SPI without being charged against the 1' X 2' 1/4 aluminum sheet allowed in the additional parts list as long as the cost of the raw bar stock is budgeted within the \$425. limit?

A140. Aluminum bar stock from SPI may be counted against the \$425 limit. Items on the Additional Hardware List may be purchased from any vendor (including SPI) and are not considered part of the \$425 limit.

Q141. Concerning Rule V17, if part of a machine breaks off during a match, either due to another team harming it, a mechanism's weakness, or just rough driving will the team be allowed to complete the match if the robot is still functional? Or will the team be penalized? If so what will be the penalty? And if the machine is allowed to continue, will the broken mechanism be removed from the field?

A141. Good question. The intent of V17 is to prevent robots from being designed to separate into multiple parts on the playing field. If a robot breaks by accident, there will not be any penalty. Unless there is a safety hazard, the match will continue and the broken parts can be retrieved after scoring.

Q142. May we use four 6 inch wheels on the robot to prevent overheating on the motors?

A142. You may not use wheels not supplied in the kit unless they are purchased from SPI or fabricated from allowed raw materials. Thus, you may fabricate your own 6" wheels, but may not use more than two 6" wheels from Skyway.

Q143. Is welding considered a fastener and thereby unlimited? We are specifically inquiring with respect to stick, MIG, TIG and heliarc types of welds.

A143. Welding is considered a fastener, per Rule K1. Just don't abuse it by melting lots of rods into a heap of slag and machining that into a useful part.

Q144. Is it legal to mount motors on the underside of our base as long as they do not damage the carpet?

A144. Yes.

Q145. The additional parts list contains a 12" x 24" x .25" piece of aluminum plate. May we use (4) 12" x 24" x .0625" pieces. Our interpretation of rule "K6" is we could do this. Are we correct?

A145. No. You may use (in addition to your SPI purchases) 1 piece of 1/4" thick aluminum plate which is up to 12" long by up to 24" wide.

Q146. Is it permissible to use carbon fibers?

A146. Only if they are purchased from Small Parts, Inc. See Rule K1.

Q147. Rule M12 states that custom suction cups may be fabricated from legal Kit parts. However, it also says that custom made pneumatic fittings are not allowed. We need a clarification on the intent of the rule. If we construct a custom suction

cup, a fitting would probably have to be constructed in order to create a seal and to form the union between the air line and the suction cup itself.

A147. Excellent question. It is permissible to form a mating thread on a custom suction cup such that it can be connected to one of the pneumatic fittings provided in the kit. The fitting from the kit should then be used to interface with the tubing. The seal around the outer edge of the suction cup is considered part of the suction cup, not a separate fitting.

Q148. May we use wiring in non-electrical situations? For example, as a structural support for the innards of the machine where there is no risk of entanglement to the outside world.

A148. Yes, this is allowed. The wire used must come from the kit or Small Parts, Inc.

Q149. On page 35 of the manual, the diagram of the potentiometer used with the receiver on the robot, shows a three wire connection, the wiper capable of any voltage between 0 and 5 V. On page 31, however, the diagram of a potentiometer connected to the transmitter, shows a two wire (rheostat) connection. Is the transmitter input supposed to be two wire? Will it accept the same (3-wire) input as the receiver?

A149. The potentiometer inputs on the Transmitter use 2 wires only and measure resistance. It is a different circuit than the analog inputs on the Receiver which measure voltage.

Q150. Is it within the spirit of the rules that when we run out of wire for the small motors (16 AWG cable), that we should use spade connectors on 10 AWG wire (mating with similar connectors on the finer wire) to get conductors from the receiver to a point where a shorter length 16 AWG cable is needed?

A150. Yes, that is okay. You may also connect the 10 AWG and 16 AWG wire with solder or wire nuts. You may also extend the 16 AWG motor wiring harnesses with the extra 16 AWG wire provided in the kit. We only specify minimum wire diameter per table 4.1 on page 27. It's always okay to use a larger than necessary wire.

Q151. Is it within the spirit of the rules to either a) substitute a knob with a calibrated skirt for the potentiometer knob on the driver control box or b) make a paper disc to stick under the knob or on the box. Are there any rules for how we label the controls (switches, pots)?

A151. You may fabricate your own knobs from legal kit materials. (See A106 in Team Update #5) Labels are considered non-functional decorations (decals) and are allowed under Rule M8. Rule C2 states that tape, adhesives, etc. should not be applied to control system components. However, since we don't want the project box back, feel free to attach labels to it.

Q152. Do we have to count the shipping and handling charges from Small Parts Inc. in the \$425 budget.

A152. No, shipping and handling charges are not considered in the \$425 limit.

Q153. Just to verify - the wire gauge shown in the drawings in the book is the minimum allowed? If we have enough extra may we use heavier wire, or double up on conductors to lower I^2R losses?

A153. Correct.

Q154. Are trantorque couplings from SPI considered fasteners (per Rule K1)?

A154. No, they are mechanical couplings.

Q155. May we use a shoulder bolt as an axle? Will it count as a fastener (per Rule K1)?

A155. Yes, a shoulder bolt may be used as an axle. No, it will not count as a fastener if used as an axle.

Q156. May we cut up the black project box and use the plastic pieces on the robot?

A156. Yes. Although the project box is intended as a mounting point for driver controls (rocker switches, potentiometers, etc.), it need not be used for that purpose and may be used on the robot.

Q157. Is a turnbuckle considered a fastener (per Rule K1)?

A157. The end attachments are considered fasteners, the adjustable middle section is not.

Q158. May we use high density lubricant tape with an adhesive backing to reduce friction on our robot? Is this a violation of Rule K1?

A158. Teflon coated tape or similar tapes designed to reduce friction are considered lubricants and thus allowed. Rule K1 prohibits adhesive tape except as an electrical insulator in order to avoid the held-together-with-duct-tape look.

CORRECTIONS AND UPDATES

In APPENDIX C- SUPPLIER CONTACT INFO on page 128, there was a typo. It states "S-V Power Tool Company" it should read S-B Power Tool Company. The area code has also changed from (908) to (732).

The Q&A numbering in Team Update #5 accidentally skipped number 124. There is no Q124.

Table 4.7 contains incorrect variable names for the Transmitter switch inputs. The actual variable names are "sw1_fwd, sw1_rev, sw2_fwd, ..., sw8_rev" instead of "tx_sw1, tx_sw2, tx_sw3, ..., tx_sw16".

CONTROL SYSTEM CAUTION

Some teams have experienced failure of fuse F27 in the Receiver after connecting or disconnecting the tether adapter or RNetS while power was still applied to the Receiver. **Please disconnect power to the Receiver before connecting or disconnecting cables to/from it.**

CONTROL SYSTEM TIP #1

Many teams have asked how to use the limit switches on the robot to disable a speed controller output in the same manner that the relay outputs are controlled. This can be done through a custom control program. Below is an example of the code required to do this. The bold text indicates the required addition to an existing line in the control program.

```
Serout SSC, SSCBAUD, [SSC_CMD, PWM5, tx_pot1 MIN (127*rx_sw15) MAX (254-  
(127*rx_sw16))]
```


The above example alters the behavior of PWM output 5 by modifying the minimum and maximum values based on the state of Receiver switch inputs 15 and 16. When switch inputs are open, the corresponding variables (rx_sw15 or rx_sw16) are equal to 0. When switch inputs are closed, the corresponding variables are equal to 1. With a typically calibrated speed controller, a PWM output value of 0 corresponds to full reverse, 127 to off, and 254 to full forward. Thus, closing Receiver switch input 15 will prevent a speed controller connected to PWM output 5 from operating in reverse, but will still allow forward operation. Vice versa for Receiver switch input 16.

When performing the above code modification, be aware that this will not disable the ability of Receiver switch inputs 15 and 16 to affect relay output 8 as in the default control program (see Table 4.7). Additional control program modifications are required to selectively disable Receiver switch control over the relay outputs. Below is an example of the code required to do this. The bold text indicates the required addition to an existing line in the control program.

```
' Use 2nd 8 RX switches (rx_sw9-16) as GO switches for Relays 5-8  
relays.highbyte = relays.highbyte | (rx_sw.highbyte &~ %11000000)
```

The above example omits bits 7 and 8 of rx_sw.highbyte (which are really bits 15 and 16 of the variable "rx_sw" AKA rx_sw15 and rx_sw16) from being passed to relays.highbyte. For more information on binary numbers (%11000000) and operators (&~) please read the BASIC Stamp Manual starting at page 231. For information on variables (relays), variable modifiers (.lowbyte, .highbyte) and aliases (rx_sw15), please read the BASIC Stamp Manual starting at page 221.

CONTROL SYSTEM TIP #2

Many teams have asked how to use a switch input on the Transmitter to control a PWM output on the Receiver. This can be done with a custom control program. Below is an example of the code required to do this. The bold text indicates the required addition to an existing line in the control program.

```
Serout SSC, SSCBAUD, [SSC_CMD, PWM5, (127 + (127*sw5_fwd) - (127*sw5_rev))]
```

The above example alters the behavior of PWM output 5 so that it is controlled by Transmitter switch inputs 9 & 10 (sw5_fwd & sw5_rev). To integrate this function with the limit switch control described in Control System Tip #1, simply insert the above bold text in place of "tx_pot1".

When performing the above code modification, be aware that this will not disable the ability of Transmitter switch inputs 9 and 10 to affect relay output 5 as in the default control program (see Table 4.7). Additional control program modifications are required to selectively disable Transmitter switch control over the relay outputs. Below is an example of the code required to do this. The bold text indicates the required addition to an existing line in the control program.

```
' Set relays to match TX switch inputs  
relays = tx_sw &~ %0000001100000000
```

The above example omits bits 9 and 10 of the variable "tx_sw" (sw5_fwd and sw5_rev) from being passed to the variable "relays".

THE COMPETITION-1998

TEAM UPDATE #7

Date: February 12, 1998

ADMINISTRATIVE UPDATE

Hotel cut-offs:

Friday, February 13, 1998 is the last day to make Disney reservations. Disney rooms that were blocked off are about to be released. If you still need to make reservations for Disney, please call ASAP!

Event Attendees:

In the last few days you have received an Administrative Update that has mentioned limits on "the number of event attendees" at the New England Regional as well as the Mid-Atlantic Regional Competition. We know that the communication of this has created some concerns and we would like to clarify what we're doing and explain why these steps are necessary.

First and foremost - Anyone who would like to attend the 1998 FIRST New England Regional and/or Mid-Atlantic Regional Competition on any of the three days, is encouraged to do so. Teams have worked very hard to build excitement in their communities and the whole magic of FIRST is the tremendous show of enthusiasm for kids working smart in science and technology. We want to make sure everyone has a very positive experience. But at the same time we have to deal with the fact that the New Hampshire College and Rutgers College Avenue Gymnasium can not accommodate all of the fans at one time.

We would like to ensure that everyone has an opportunity to cheer their team on and at the same time to protect everyone's safety. There may be times, especially first thing Saturday morning, when fans without tickets may be asked to view the competition from overflow sites close to the Gymnasiums. They will be equipped with large screen projections of all the action and noise from the playing fields. As fans leave the gymnasium others will be allowed in.

Your cooperation is important and very much appreciated.

Looking to the future, we hope to be either using a larger competition venue or to have spun-off new regionals in these areas. In the meantime, please come and help make the 1998 FIRST New England and Mid-Atlantic Regional Competitions an immensely inspiring and motivating experience for everyone involved.

Thank you very much.

Chairman's Award:

Reminder: The deadline for the Chairman's Award submissions is Tuesday, February 24, 1998.

IMPORTANT CONTROL SYSTEM WARNING

If you need to arc or TIG weld part of your robot, please disconnect and **REMOVE ALL CONTROL SYSTEM COMPONENTS** before performing the welding. Several teams have reported the failure of control system components after arc welding, even when the control system components were mounted on non-conductive parts of the robot chassis and were not connected together.

RULES QUESTIONS & ANSWERS

- Q159. May we use tape or paint on the window of the optical sensor to alter it's detection characteristics?
- A159. Adhesive tape may only be used as an electrical insulator. (See Rule K1) Based on answers to questions in Team Updates, we are also allowing it as a non-functional decoration, but that doesn't qualify in this case. Paint may be used if the paint comes from Small Parts, Inc.
- Q160. A couple of our human players have the ability to shoot the balls from the interaction zone directly into the center goal, but many errant balls just bounce off the superstructure. What if one of these errant balls smacks an enemy robot and part of it breaks? Is it our fault for bad timing or theirs for sub-par engineering?
- A160. Teams will only be penalized for causing damage to robots if the referees view the damage as being caused intentionally. Referees are unlikely to consider such a scenario to be intentional.
- Q161. Are wire ferrules permitted rather than tinning wire at termination points? Ferrules are designed to be sleeved over the conductor and crimped then inserted under the terminal.
- A161. No. The only crimp-on electrical connectors allowed are spade connectors. (See Rule K1) The terminal strips are designed to hold bare wire.
- Q162. May we use a split bolt or a copper splice (similar to butt splice) for power distribution at the secondary of the main fuse?
- A162. Per A112 in Team Update #5, "Only control system components provided in the kit may be used to conduct electricity." The only additions to this are crimp-on spade connectors (per Rule K1), wire nuts, and up to 4 additional speed controllers (per the Additional Hardware List). Please see A135 in Team Update #6 for further comments and suggestions on power distribution. Butt splices are not allowed. Rule K1 specifies (among many other things) that crimp-on connectors other than spade connectors are not allowed.
- Q163. The ring terminals supplied will not fit over the 6 AWG wire on the battery fuse holder. How do we connect the fuse holder to the battery?
- A163. Please use a short section of 10 AWG wire on the battery side of the fuse to fit into the ring terminal.
- Q164. The batteries cannot be removed as quickly as in past competitions. What means of power disconnect may we use?
- A164. For prototyping, you are welcome to install a kill switch in series with the battery. On the final robot, these items are prohibited. Spade connectors make a legal disconnect point. If you are concerned about shutting down the robot

quickly, it is not against the rules to attach a pull cord made of legal robot materials to the fuse for this purpose. Repeated yanking on the fuse, however, will weaken the fuse contacts and may result in robot failure during a match. Pulling the fuse while the robot is drawing significant current may also damage the control system due to inductive spikes. Also, please consider that the act of reaching into the robot to kill power is itself a serious safety hazard. The robot control system is designed to shut down automatically when it stops receiving data from the Transmitter. Thus, excepting extreme control system malfunctions, a robot performing unexpected actions can be safely and remotely disabled by disconnecting the power supply from the Transmitter.

Q165. Are thread inserts considered fasteners when used as intended?

A165. Yes. They are similar to using a nut to fasten.

Q166. With respect to Rule S9, A7, and A123, may we turn down the pinion of the window lift motor to a round shaft and press on a "legal" gear of our own design? Suppose we are able to remove the pinion without damaging it, may we then use that gear elsewhere on the machine?

A166. Yes and yes.

Q167. Are we allowed to attach sandpaper to the robot in any shape or form? It does not damage the ball with the exception of microscopic scratches (the floor delivers the same injury to the ball anyway.) It is low-grit sandpaper that is accessible to all teams. We use it to create friction between the ball and our end-effector. Please respond as soon as possible.

A167. If the sandpaper is available from Small Parts, Inc. then it may be used on the robot. If the referees determine that it is causing damage to the balls or playing field, then it will be disallowed and will have to be removed.

Q168. Are the following considered fasteners (per Rule K1)? A) Shaft collars used to keep a shaft from slipping, B) Retaining rings used for the same purpose, C) Dowel Pins used to keep a shaft in place?

A168. Yes, yes, and yes.

Q169. Is it permissible to route the main battery wire into a solid aluminum block, then run separate wires from the block to the terminal strip for each application?

A169. No. Per A112 in Team Update #5, "Only control system components provided in the kit may be used to conduct electricity." The only additions to this are fully insulated spade connectors (per Rule K1) and the extra speed controllers (per the Additional Hardware List). Please see A135 for comments and suggestions on power distribution.

Q170. On our robot, we used 3" of 1 x 1-1/8" aluminum angle which can be found on page 80 of the Small Parts catalog. Since it can be ordered as a 6" piece, we will use the cost of \$1.79 as the cost basis. For cost-tracking purposes against the \$425 worth of Small Parts purchases that can reside on our robot, do we use: Option A - \$1.79 or Option B -\$0.90 (i.e., 1/2 of \$1.79)?

A170. The cost-tracking should use the full cost of the minimum order quantity (i.e. Option A). Please see the 4th paragraph of the Small Parts, Inc. section of Rule K1 for another example.

Q171. Are we allowed to have on hand more than two drill motors as long as we are only using two on the robot?

A171. Yes. There are no prohibitions on having spare parts.

Q172. May we design our robot to climb up the central goal shaft?

A172. Yes. However, it should be designed not to fall off when the control system is disabled at the end of a match.

Q173. If our robot uses serrated teeth to grip balls, does it pose an excessive risk to the balls or is it allowed?

A173. Based on robots in previous competitions, serrated teeth have caused damage and are not recommended. If a robot exhibits a tendency to pop balls, the referees will require modifications to the offending mechanism(s) in order to prevent further damage.

Q174. We would like to know if we can mount the air pump on the robot and use it?

A174. Yes. Rule M1 only limits energy stored on the robot prior to the start of a match.

Q175. May we purchase surgical tubing from Small Parts and use it as an energy storage device? What are the restrictions to this use?

A175. Yes, see Rule K11. If the use presents a safety hazard, it may be disallowed. (See Rule S5)

Q176. Are we limited to the number of wire nuts provided in the kit or can we obtain more? (In other words, are they considered fasteners or current carrying components?)

A176. Wire nuts are considered acceptable electrical insulators and are allowed. See the paragraph under Table 4.1 on page 27.

Q177. If a shoulder bolt is used to fasten a pulley to our robot, is it considered a fastener or "device" that must be accounted for in the cost of parts from SPI?

A177. Assuming that the pulley rotates about the bolt, such that the bolt is effectively an axle, then the bolt would not be considered a fastener and would need to be purchased from SPI or made from raw materials.

Q178. May we use a rubber grommet to protect wires where they pass through potentially sharp metal edges or surfaces?

A178. Yes. The grommet must be purchased from Small Parts, Inc. or fabricated from allowed raw materials.

Q179. May we buy L-shaped brackets or do we have to manufacture them ourselves?

A179. You may purchase them from Small Parts, Inc. or fabricate them from allowed raw materials. Please see Rule K1.

Q180. In the weight limit rule when they say that the 130 lb. limit includes the control systems, does that mean the joysticks and transmitter?

A180. No. Only the control system components used on the robot. (receiver, 1 RNet, 1 battery, speed controllers, etc.)

Q181. May we make either a venturi or a Hilsch tube (vortex generator) to provide cooling air for our motors, to be supplied with air by the pump?

A181. Rule M12 states that only pneumatic parts in the kit (with a few listed exceptions) can be used to "store, generate, or transmit compressed air or vacuum". There is a venturi-effect vacuum generator included in the kit. You may also connect pneumatic components to the air intake of the pump to get a strong vacuum. Also, don't forget that the muffin fan is a good source of cooling air for the speed controllers, motors, or whatever else you feel needs cooling.

Q182. May we nickel plate or Teflon coat any parts of the robot?

A182. If used merely for decorative purposes, nickel plating or Teflon coating is allowed per Rule M8. Otherwise, nickel plating is allowed if you get the nickel from Small Parts, Inc. Teflon is considered a dry-lubricant and is allowed if used to reduce friction (per Rule K1). Per the rules in Appendix A, some parts may not be modified, which would include coating with nickel or Teflon.

Q183. May we remove the anti-backdrive pins in the drill gearboxes?

A183. Yes.

Q184. If we wish to pre-charge the air accumulator with the pump (per Rule M1), must the pump be mounted on the robot?

A184. No, the pump does not have to be mounted on the robot.

Q185. What happens if a robot delivers a ball to a player area that already contains 3 balls?

A185. A referee will remove an extra ball and return it to the playing field in a timely manner. The referee will not take balls from the player's grasp, so the player has some choice as to which ball is returned to the playing field. If desired, the player has the option of rolling an extra ball out the sides or back of the player area, but may not return an extra ball to the field.

Q186. We can't find a pipe reducer at our local hardware store that will adapt from 1" to 1.5" PVC pipe. May we purchase a 1.5" fitting with an internal thread, bore out the thread to 1", and use it as a reducer (per Rule K1)?

A186. No. Proper reducers should be used. Many plumbing supply stores stock a wide selection of pipe fittings or can obtain them quickly.

Q187. May we take apart one of our batteries and use the acid to make a propellant?

A187. No. It would violate Rules C1, K13, M1, and S5.

Q188. At the Kick-Off, there was a gate mentioned which would ease the delivery of the robot into the playing field. Where will this gate be located in the playing field?

A188 The gate mentioned at the Kick-Off will be comprised of a removable section of pipe located in front of one of the player areas. The gate will not alter the spacing of the field border, but alternate fittings will be used.

CONTROL SYSTEM DEPOSIT

The control system is not for sale. Teams wishing to borrow it until October 2, 1998 must pay a \$500 deposit, preferably before Check-In of their last event. This fee must be in the form of a negotiable check or money order. We are not accepting Purchase Orders this year as we will be cashing all deposits and putting them in an escrow account. We must receive the check or money order and a filled out LOAN AGREEMENT prior to or at each team's last event Check-Out.

To save your team time in processing lines, you may send the deposit to FIRST, attention Thelma. It must arrive at least one week before your last event. Another alternative is to provide it at any competition. There will be a designated staff member in the Pit to receive and process these Control System deposits and its associated paperwork, the LOAN AGREEMENT. Please refer to Section 6.13, Pages 66 - 69 in the manual for more information.

For those of you who have not yet experienced a FIRST Check-Out, especially at EPCOT, **everything you can do to have things prepared ahead of time will make the process go faster.*** You will save time by filling in both pages of the LOAN AGREEMENT prior to Check-In of your first event. Your team must complete this by Check-Out of your last event if your team borrows the system.

***NOTE:** Please watch the Team Updates for an updated, corrected LOAN AGREEMENT. You should fill in this version of the form.

GOOD NEWS: We plan to have two Check-Out lines at all events, one for those teams borrowing systems and receiving back their RNets, and another for those returning FIRST control systems. Please remember to disassemble your hook up when returning your Control System Components. This should make your departure quicker and easier.

THE COMPETITION-1998

TEAM UPDATE #8

Date: February 17, 1998

BALL PLACEMENT INFORMATION

A specification for the placement of the balls on the playing field surface was accidentally omitted from the Manual. Below are ball placement specifications for double-elimination and finals matches.

During double-elimination matches, the 9 balls on the playing field surface will be arranged in three groups of three balls, as shown on Figure 1.1. The center ball in each group will be centered on a point 8 feet away from the playing field border, along a line projecting from the center of the nearest player area to the center of the goal. The side balls in each group will be centered along a line which passes through the center of the center balls and which is parallel to the nearest field border.

During the finals matches, only 6 balls will be on the playing field surface, as shown in Figure 1.2. Placement will be similar to double-elimination matches with respect to distance from the field border and the spacing between balls. However, each ball will be centered on a point located halfway between the center and outer points used for the corresponding three ball group during the double-elimination matches.

In all cases, there will be a six inch space between balls within a group. Please note that, due to variations in ball inflation, the fact that the balls are imperfect spheres, and slight rolling that may occur after balls are placed on the field, actual ball placement and spacing may vary by several inches.

RULES QUESTIONS & ANSWERS

Q189. Is EMT considered pipe with respect to unlimited use of certain pipe fittings listed in Rule K1?

A189. Yes.

Q190. May we use hot glue, which is easily removed, to attach the joysticks and transmitter to our control station board?

A190. No. See Rule C2.

Q191. Why must we wire the muffin fan with 16 AWG wire when the wires in the fan are only 20 or 22 AWG wire? May we use different wire to wire the fan?

A191. The muffin fan wiring is larger than the 22-24 AWG wire in the kit. Thus, you must use the next smallest size (16 AWG) or larger to wire it.

Q192. If PVC connectors and/or endcaps are used in compliance with rule K1 but also perform a secondary function, are they still deemed acceptable?

A192. Yes.

Q193. The manual states a bracket should be made to mount the Receiver Antenna in a vertical orientation. If the robot has existing angle material which can be drilled to mount the antenna, is this acceptable as long as the antenna remains in a vertical orientation and meets the other requirements to avoid shielding or shadowing?

A193. Yes.

Q194. May we add art work if it adds no functionality to the robot at the competition?

A194. Yes. See Rules M8 and M10.

Q195. May we add functionality to the robot in the two days we have the robot after the regionals before it is sent to Florida?

A195. Yes. There are no limits on changes that may be made before shipping deadlines between events.

Q196. We have a question on the interpretation of rule K6 (page 91). Here is the scenario: we cut out four 2" diameter discs out of the 1/4" polycarbonate and glue them together (now have 2" dia. x 1" long billet). May we now cut this billet into any length segments we want?

A196. Yes, that is allowed. The additional hardware list specifies what raw materials you may start with. After that, it's only limited by your creativity and fabrication skills/tooling.

Q197. We want to mount sprockets to our drill motors using plastic. Would this plastic mount count as a fastener (per Rule K1)?

A197. It depends. A plastic adapter, such as to connect a sprocket with a large hub to the smaller diameter gearbox shaft, would not be considered a fastener. A plastic screw or nut used to fasten such an adapter would be considered a fastener.

Q198. With respect to the Additional Parts List (APL), if used in the prescribed amounts, do the parts on the APL count against the total cost of the robot?

A198. No. The APL represents parts you may use above and beyond what is in kit and what may be purchased from SPI. The key word is "Additional".

Q199. Instead of soldering connections to the 25 male solder cup connector, may we take the 25 pin molded cable, cut off one end, and connect to the exposed wires?

A199. No. See Rule C1. See also the 4th paragraph on page 29 and the last paragraph on page 34.

Q200. In rule M1, it states that energy may come from latex tubing and then rule S8 says that latex tubing may be used for launching balls. Are we correct in assuming that latex tubing may be used as an energy source for other purposes than to launch the balls?

A200. Yes. See Rule K11. Latex tubing may not be used to launch projectiles other than balls, though.

Q201. May we turn our battery sideways?

A201. There are no rules governing the orientation of the battery on the robot. Per the CSB battery spec sheet, the batteries are "Nonspillable, usable in any position". However, the spec sheets also state: "Never charge the battery in an inverted position."

THE COMPETITION-1998

TEAM UPDATE #9

Date: February 21, 1998

SAVE THE RNETS

Several teams have encountered wiring problems on their robots which have rendered their receiving RNet permanently non-functional. **Please take extreme caution to prevent the +12 or +5 Vdc power on the robot from coming into contact with the metal housing of the RNet or the BNC bulkhead connector.** This can happen via wires coming loose and contacting the RNet, accidentally energizing the robot chassis to which the BNC bulkhead connector is mounted, or other similar problems.

Although not a requirement of the rules, **FIRST urges teams to mount the BNC bulkhead connector in an electrically non-conductive material** (wood, polycarbonate, etc.) on the robot in order to help reduce the potential for damage if a wiring fault occurs on the robot.

OF SPEED CONTROLLERS, DRILL MOTORS, AND GEAR RATIOS

A number of teams have recently reported strange operation of the speed controllers when used with the drill motors. Two typical scenarios have been observed:

1. The drill motors will operate with full power for a period of time and then slow down to a crawl. If the command is sent to stop and then restart the motors, the problem will temporarily go away.
2. If the drill motors are started at a slow speed and left at that speed for a few seconds, then they will not later accelerate, even if commanded to go full speed. If the command is sent to stop and then jump to full speed, the drill motors will jump right up to full speed and then operate normally.

Research into the problem has revealed both the cause and solutions.

The Cause:

Both of these problems are caused by overly high gear ratios between the drill motors and the drive system contacting the floor.

The actual mechanism causing the slowdowns is a current limiting circuit built into every Rebel speed controller as a safety feature. During startup of the drill motors, the current draw (which is roughly proportional to output torque) is very high. When a motor quickly gets up to speed, or even at low speeds with light loads, the current draw quickly decreases and the speed controllers act as expected. However, if the reflected inertia of the robot is very high (due to a high gear ratio) resulting in continuous high torque requirements, or if the motors are operated slowly with a heavy load (which also causes a sustained high current draw), then the current limiting circuit will cut in and throttle back the output of the speed controller, resulting in slow drill motor operation.

It is important to note that the current limiting circuit built into the speed controllers acts faster than the external 30 Amp auto-resetting breakers and lowers output current

to no more than ~20 Amps when activated. That is why the 30 Amp breakers never trip, even during high current motor operation.

The Solution:

The proper solution to these problems is to use a lower gear ratio so that the drill motors operate at higher speeds and lower torques. This will not only lower the electrical current draw of the drill motors and prevent the above problems from occurring, it will also allow the motors to operate more efficiently and increase overall motor output power.

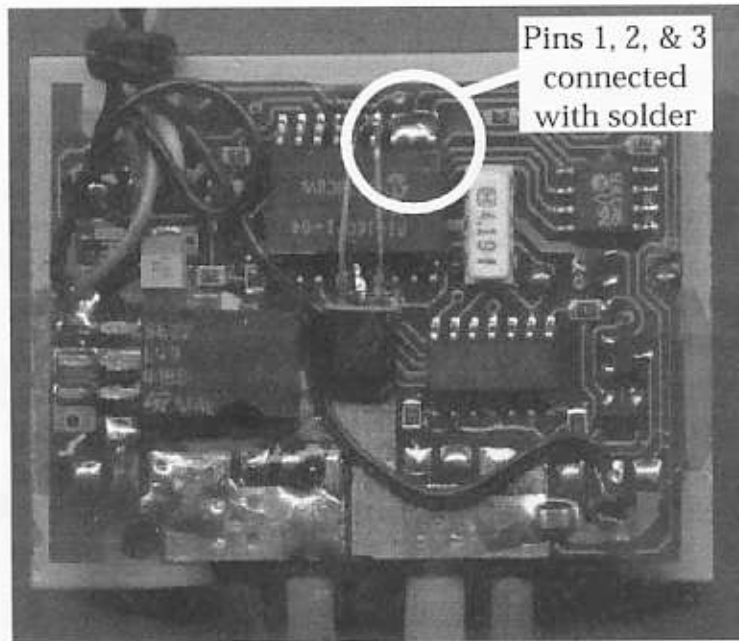
FIRST also recognizes that teams may not be able to change gear ratios before having to ship robots to event sites. Therefore, FIRST has decided to allow teams the option of modifying the speed controllers to bypass the current limiting circuit. Please note that performing this modification will void the warranty on the speed controllers and presents a number of risks.

Teams considering bypassing the current limiting circuit in the speed controllers are strongly urged to consider the following:

- Increased motor output torque introduces increased stresses on mechanical subsystems such as the gearbox, shaft couplings, supports, etc. which increases the chances of drive system failure during a match
- Wiring faults will have a greater chance of causing damage to the speed controllers
- The speed controllers will run much hotter but are still protected by a thermal shutdown circuit and the external 30 Amp breakers
- The drill motors will run much hotter, possibly to the point of damage
- Battery power will be exhausted more quickly
- Excessive current draw will still trip the 30 Amp breakers, so gear ratios may still have to be changed
- Making the modification invalidates the Tekin warranty
- Mistakes when modifying the speed controllers could render them inoperable

Teams still wishing to bypass the speed controller current limits after considering the above should perform the following steps:

1. Disconnect the Rebel from the robot.
2. Using a very small (eyeglass driver size) Phillips-head screwdriver, remove the two black screws from the top of the Rebel. Do not open the unit yet.
3. Turn the Rebel upside-down (this will prevent the red setup button from falling out) and carefully remove the red plastic bottom cover. Try to let the circuit board remain stuck to the heat sink by the heat sink grease rather than coming up with the bottom cover.
4. On the exposed face (bottom) of the circuit board, short together pins 1, 2, & 3 of the 18 pin chip by soldering on a very small piece of wire or using a little excess solder to connect the pins. The corner of the chip with pin 1 is indicated by the small dimple in the top of the chip. Be very careful not to create connections to other pins or to other parts of the circuit board. The picture below shows a properly modified speed controller circuit board.



5. Reassemble the speed controller. Be careful not to overtorque the screws.

RULES QUESTIONS & ANSWERS

Q202. Does a roll pin or dowel used to fasten a pulley to a shaft count as a fastener (per Rule K1)?

A202. Yes.

Q203. If a shoulder bolt is used to fasten two pieces of material acting in a scissor-like manner, is it considered a fastener which is allowed in unlimited quantity?

A203. Yes. Rule K1 specifically allows unlimited use of pins in a linkage. The scissor-like mechanism would be considered a linkage.

Q204. May flat washers be used (in unlimited quantities) as spacers on shafts to ensure proper gear and shaft spacing?

A204. No. Washers may be used to reinforce a part from sliding past the end of a screw/bolt head or nut, or in reasonable quantities (2 or 3 max.) as spacers. It is not in the spirit of Rule K1 to use, for example, 25 washers stacked along a rod as spacers and to still count them as fasteners.

CORRECTIONS AND UPDATES

There is a conflict between rule V22 and Q&A54. Rule V22 states if pinning is a regular occurrence the pinning robot would be disabled by the referee and Q&A54 states a robot can pin another robot on a regular occurrence as long as the 10 second and 3 feet requirements are satisfied. The last sentence of Rule V22 is to be deleted and replaced with the following: "If the referee determines this rule to be violated the violator will be disabled."

Add to rule V17 the following: "If the referee determines a robot has released a part of itself intentionally, the robot will be disabled."

In regards to rule SC1 and Q&A2, the referees will begin scoring approximately 10 seconds after the match ends. This will allow the referees to focus on the balls once the match has ended. Prior to this, the referees may not see all the final positions of the balls and cannot make accurate scoring decisions.

UPDATE ON THE PLAYING FIELD

The bill of materials for the playing field was missing some fittings.

There were three KK19-7 Kee-Klump fittings located at the corners of the field barrier which had no driver stations.

There were also six KK19-7 Kee-Klump fittings added to side B of the playing field at the junction of the player area. These were added to allow a gateway into the playing field arena so teams can wheel their robot into position without lifting their robot over the field barrier.

THE PLACEBO

For teams that may not be aware, FIRST provides a Placebo robot in matches, before the quarter finals, where there are only two competing robots. In years past the Placebo has been remotely controlled and did not interact with the competing robots. For The Competition-1998, FIRST is providing a passive Placebo. The passive Placebo will be a structure that will be on castors and placed in the vacant starting position on the field. The competing robots will be allowed to interact with Placebo and use it as a strategic device during the match. The Placebo will be able to be pushed by the competing robots and placed anywhere on the field.

ADMINISTRATIVE UPDATE

Competition Name:

We are happy to announce the name of the game. The 1998-FIRST Competition will be known as "LADDER LOGIC". FIRST would like to thank all teams that made submissions. We appreciate your input!

Upcoming Deadlines:

Chairman's Award Submissions are due on February 24, 1998 by 5:00pm (EST). If your submission is not received by this date, it will not be considered. **No exceptions!**

Shipping deadline for teams competing in a regional(s) is February 24, 1998 by 5:00pm (EST) (must be out of team hands by this time). Shipping deadline for teams competing in National Championship only: February 27, 1998, by 5:00pm. (EST) These deadlines **WILL NOT** be extended! Absolutely **no exceptions**. If your robot is not out of your hands by this time, you risk your team not being able to compete. Please remember, teams must provide FIRST with documentation proving the robot is out of team hands via fax on or before the above deadline dates.

The deadline for reporting to FIRST the number of team member attendees for all regionals excluding The Southwest Regional is **February 25, 1998 by 5:00pm**. Please phone in your numbers to Geoff or Lori at FIRST (800-871-8326).

Southwest Regional:

There was some confusion regarding the location of the Southwest Regional. The Southwest Regional in Houston, Texas is being held at Space Center Houston located next to Johnson Space Center. There will be signs to direct you.

Mid-Atlantic Competitors:

Due to the anticipated turn out of team members at the Mid-Atlantic Competition, we are asking all teams to designate 2 members to report to the front of the room during the awards ceremony to be available to accept any awards the teams receive. This will eliminate FIRST Staff having to wade through crowds to deliver awards. Just before the awards begin, an announcement will be made calling the designated team members to come forward.

LETTER FROM ANDREW ALLEN

TO: Competitors and Supporters
FROM: The President, FIRST

I want to take a few minutes to address some concerns that we have had some feedback on. First, though, I want to address the fact that we appreciate your feedback. FIRST is growing rapidly and faces many complex challenges, the best way for us to prepare ourselves for the growth is with your inputs. We are not without growing pains, and your support will help us get through them efficiently. Our basic essentials are to keep our growth and costs in control.

Since I came aboard at the end of June of 1997, we have worked to ensure that we can posture ourselves for growth, and not lose the "magic" that FIRST has been so successful in. Some things were changed for a better 1998, and some things were not able to be changed in time. We have raised significant money this year to finance the Foundation itself as well as run 5 regional competitions and the National. Registration fees alone would run FIRST about \$1,000,000 short of our needs for the Robotics Competition in 1998. If our fundraising continues to be successful for 1999, we will not need to raise registration fees.

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We obviously have to look for new sites or other options in 1999. We want our events to be spectator events and it obviously defeats the purpose for team limits to be in place.

Dean Kamen and Woodie Flowers will not be at every event this season. With the schedule that we were forced to work with, and with the expansion that we had, we have some regional competitions scheduled on the same weekends. This was an inevitable occurrence with our expansion, and the only feasible alternative would be to keep the event from expanding anymore from 1997. We don't feel that this results in any major impacts, and are ready, willing, and able to pick up the slack with myself and Greg Hale from Disney.

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The bottom line is that we continue to explore all opportunities to expand and work the financial requirements on all of us. The more "Corporate America" gets involved the more successful we will be. We hope that companies will not only see that FIRST is the right thing to do, but it is also advantageous for the company to be involved with FIRST. Marketing dollars go a lot further than philanthropy dollars, and we want to pursue both.

I hope that I have sufficiently addressed some of the concerns that you all have in 1998. We are about to begin the 1998 Competition, and we are already trying to address the options for a bigger and better 1999. I appreciate any and all comments and suggestions and look forward to seeing you all at The Competition this year.

REVISED CONTROL SYSTEM LOAN AGREEMENT

As stated in Team Update #7, FIRST will be providing a revised Control System Loan Agreement. The revised agreement can be found on the following two pages. Please use this form and not the form provided on pages 68 and 69 in the manual. Also, following the Loan Agreement is a Control System RETURN form. This form is for teams who are not borrowing the Control System and wish to return it at the conclusion of their last competition.

THE COMPETITION-1998

TEAM UPDATE #9

Date: February 21, 1998

SAVE THE RNETS

Several teams have encountered wiring problems on their robots which have rendered their receiving RNet permanently non-functional. **Please take extreme caution to prevent the +12 or +5 Vdc power on the robot from coming into contact with the metal housing of the RNet or the BNC bulkhead connector.** This can happen via wires coming loose and contacting the RNet, accidentally energizing the robot chassis to which the BNC bulkhead connector is mounted, or other similar problems. Although not a requirement of the rules, **FIRST urges teams to mount the BNC bulkhead connector in an electrically non-conductive material** (wood, polycarbonate, etc.) on the robot in order to help reduce the potential for damage if a wiring fault occurs on the robot.

OF SPEED CONTROLLERS, DRILL MOTORS, AND GEAR RATIOS

A number of teams have recently reported strange operation of the speed controllers when used with the drill motors. Two typical scenarios have been observed:

1. The drill motors will operate with full power for a period of time and then slow down to a crawl. If the command is sent to stop and then restart the motors, the problem will temporarily go away.
2. If the drill motors are started at a slow speed and left at that speed for a few seconds, then they will not later accelerate, even if commanded to go full speed. If the command is sent to stop and then jump to full speed, the drill motors will jump right up to full speed and then operate normally.

Research into the problem has revealed both the cause and solutions.

The Cause:

Both of these problems are caused by overly high gear ratios between the drill motors and the drive system contacting the floor.

The actual mechanism causing the slowdowns is a current limiting circuit built into every Rebel speed controller as a safety feature. During startup of the drill motors, the current draw (which is roughly proportional to output torque) is very high. When a motor quickly gets up to speed, or even at low speeds with light loads, the current draw quickly decreases and the speed controllers act as expected. However, if the reflected inertia of the robot is very high (due to a high gear ratio) resulting in continuous high torque requirements, or if the motors are operated slowly with a heavy load (which also causes a sustained high current draw), then the current limiting circuit will cut in and throttle back the output of the speed controller, resulting in slow drill motor operation.

It is important to note that the current limiting circuit built into the speed controllers acts faster than the external 30 Amp auto-resetting breakers and lowers output current

to no more than ~20 Amps when activated. That is why the 30 Amp breakers never trip, even during high current motor operation.

The Solution:

The proper solution to these problems is to use a lower gear ratio so that the drill motors operate at higher speeds and lower torques. This will not only lower the electrical current draw of the drill motors and prevent the above problems from occurring, it will also allow the motors to operate more efficiently and increase overall motor output power.

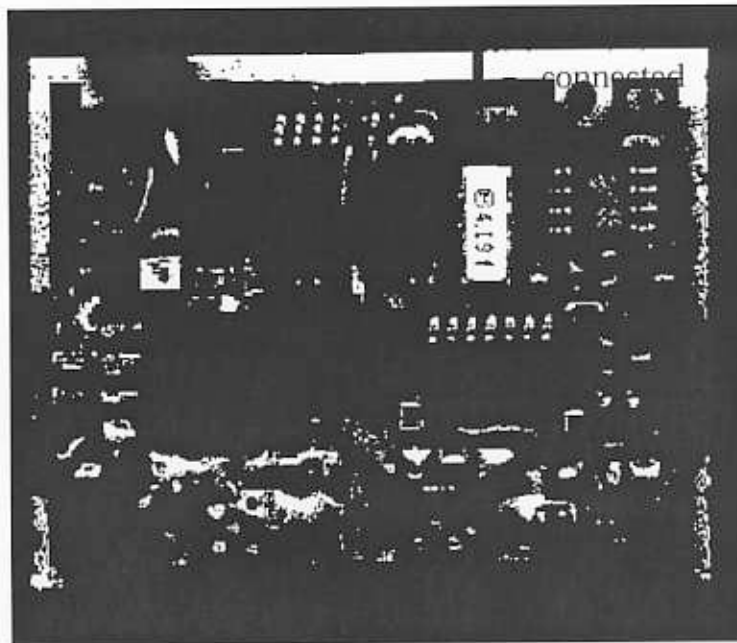
FIRST also recognizes that teams may not be able to change gear ratios before having to ship robots to event sites. Therefore, FIRST has decided to allow teams the option of modifying the speed controllers to bypass the current limiting circuit. Please note that performing this modification will void the warranty on the speed controllers and presents a number of risks.

Teams considering bypassing the current limiting circuit in the speed controllers are strongly urged to consider the following:

- Increased motor output torque introduces increased stresses on mechanical subsystems such as the gearbox, shaft couplings, supports, etc. which increases the chances of drive system failure during a match
- Wiring faults will have a greater chance of causing damage to the speed controllers
- The speed controllers will run much hotter but are still protected by a thermal shutdown circuit and the external 30 Amp breakers
- The drill motors will run much hotter, possibly to the point of damage
- Battery power will be exhausted more quickly
- Excessive current draw will still trip the 30 Amp breakers, so gear ratios may still have to be changed
- Making the modification invalidates the Tekin warranty
- Mistakes when modifying the speed controllers could render them inoperable

Teams still wishing to bypass the speed controller current limits after considering the above should perform the following steps:

1. Disconnect the Rebel from the robot.
2. Using a very small (eyeglass driver size) Phillips-head screwdriver, remove the two black screws from the top of the Rebel. Do not open the unit yet.
3. Turn the Rebel upside-down (this will prevent the red setup button from falling out) and carefully remove the red plastic bottom cover. Try to let the circuit board remain stuck to the heat sink by the heat sink grease rather than coming up with the bottom cover.
4. On the exposed face (bottom) of the circuit board, short together pins 1, 2, & 3 of the 18 pin chip by soldering on a very small piece of wire or using a little excess solder to connect the pins. The corner of the chip with pin 1 is indicated by the small dimple in the top of the chip. Be very careful not to create connections to other pins or to other parts of the circuit board. The picture below shows a properly modified speed controller circuit board.



5. Reassemble the speed controller. Be careful not to overtorque the screws.

RULES QUESTIONS & ANSWERS

Q202. Does a roll pin or dowel used to fasten a pulley to a shaft count as a fastener (per Rule K1)?

A202. Yes.

Q203. If a shoulder bolt is used to fasten two pieces of material acting in a scissor-like manner, is it considered a fastener which is allowed in unlimited quantity?

A203. Yes. Rule K1 specifically allows unlimited use of pins in a linkage. The scissor-like mechanism would be considered a linkage.

Q204. May flat washers be used (in unlimited quantities) as spacers on shafts to ensure proper gear and shaft spacing?

A204. No. Washers may be used to reinforce a part from sliding past the end of a screw/bolt head or nut, or in reasonable quantities (2 or 3 max.) as spacers. It is not in the spirit of Rule K1 to use, for example, 25 washers stacked along a rod as spacers and to still count them as fasteners.

CORRECTIONS AND UPDATES

There is a conflict between rule V22 and Q&A54. Rule V22 states if pinning is a regular occurrence the pinning robot would be disabled by the referee and Q&A54 states a robot can pin another robot on a regular occurrence as long as the 10 second and 3 feet requirements are satisfied. The last sentence of Rule V22 is to be deleted and replaced with the following: "If the referee determines this rule to be violated the violator will be disabled."

Add to rule V17 the following: "If the referee determines a robot has released a part of itself intentionally, the robot will be disabled."

In regards to rule SC1 and Q&A2, the referees will begin scoring approximately 10 seconds after the match ends. This will allow the referees to focus on the balls once the match has ended. Prior to this, the referees may not see all the final positions of the balls and cannot make accurate scoring decisions.

UPDATE ON THE PLAYING FIELD

The bill of materials for the playing field was missing some fittings.

There were three KK19-7 Kee-Klump fittings located at the corners of the field barrier which had no driver stations.

There were also six KK19-7 Kee-Klump fittings added to side B of the playing field at the junction of the player area. These were added to allow a gateway into the playing field arena so teams can wheel their robot into position without lifting their robot over the field barrier.

THE PLACEBO

For teams that may not be aware, FIRST provides a Placebo robot in matches, before the quarter finals, where there are only two competing robots. In years past the Placebo has been remotely controlled and did not interact with the competing robots. For The Competition-1998, FIRST is providing a passive Placebo. The passive Placebo will be a structure that will be on castors and placed in the vacant starting position on the field. The competing robots will be allowed to interact with Placebo and use it as a strategic device during the match. The Placebo will be able to be pushed by the competing robots and placed anywhere on the field.

ADMINISTRATIVE UPDATE

Competition Name:

We are happy to announce the name of the game. The 1998-FIRST Competition will be known as "LADDER LOGIC". FIRST would like to thank all teams that made submissions. We appreciate your input!

Upcoming Deadlines:

Chairman's Award Submissions are due on February 24, 1998 by 5:00pm (EST). If your submission is not received by this date, it will not be considered. **No exceptions!**

Shipping deadline for teams competing in a regional(s) is **February 24, 1998 by 5:00pm (EST)** (must be out of team hands by this time). Shipping deadline for teams competing in National Championship only: **February 27, 1998, by 5:00pm (EST)** These deadlines **WILL NOT** be extended! Absolutely **no exceptions**. If your robot is not out of your hands by this time, you risk your team not being able to compete. Please remember, teams must provide FIRST with documentation proving the robot is out of team hands via fax on or before the above deadline dates.

The deadline for reporting to FIRST the number of team member attendees for all regionals excluding The Southwest Regional is **February 25, 1998 by 5:00pm**. Please phone in your numbers to Geoff or Lori at FIRST (800-871-8326).

Southwest Regional:

There was some confusion regarding the location of the Southwest Regional. The Southwest Regional in Houston, Texas is being held at Space Center Houston located next to Johnson Space Center. There will be signs to direct you.

Mid-Atlantic Competitors:

Due to the anticipated turn out of team members at the Mid-Atlantic Competition, we are asking all teams to designate 2 members to report to the front of the room during the awards ceremony to be available to accept any awards the teams receive. This will eliminate FIRST Staff having to wade through crowds to deliver awards. Just before the awards begin, an announcement will be made calling the designated team members to come forward.

LETTER FROM ANDREW ALLEN

TO: Competitors and Supporters
FROM: The President, FIRST

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THE COMPETITION-1998

TEAM UPDATE #10

Date: February 28, 1998

ADMINISTRATIVE UPDATE

Autodesk Award Entry Specification Update:

An error was made in The Competition 1998 Manual, Appendix E, page 139, with regard to specifications for submitting animation for the Autodesk Award.

Animation may be submitted -EITHER- as VHS videotape in NTSC format -OR- in .AVI format with sound on CD-ROM, JAZ drive (1.0GB capacity), or ZIP disk (Iomega® or 100% compatible). Entries submitted digitally must be fully rendered sequential Targa frames meeting these specifications: 720 X 486 resolution, render to fields, fields order equals odd. Entries submitted digitally must also include sound as a separate .WAV file with start time corresponding to the start time for your animation.

All entries must meet these specifications to qualify for judging in this award category. Please review and follow the complete Entry Specifications list in The Competition Manual.

If you have any questions, please email first@autodesk.com or call Kaki Leyens at 415-507-6418 or Laura London at 415-507-6411.

Shipping Requirements:

Please note that it is the responsibility of each team to inform FIRST via fax, that the **teams robot is out of teams hands by the specified date.** This information should be faxed as soon as possible following the robot being picked up or delivered. For teams competing in more than one event, they have to the Tuesday immediately after their competition to get the robot out of teams hands again. Teams should inform FIRST after each deadline via fax for proof of this.

Event Attendees:

Again, we want to remind everyone that we want you to have the opportunity to cheer on your team, but space has been limited at the New England Regional and the New Jersey Regional. We want to ensure that everyone has the most positive experience possible and we apologize for any inconvenience to you. We are working on alleviate this situation for next year's Competition.

Thursday and Friday both regional events will be open to the public with no limitations. Saturday morning at each of these Regionals will be the time when teams and spectators will not be allowed in the main gymnasium without a ticket. The remainder of spectators will be directed to another gymnasium where there will be a wide screen television so that you can still experience all the noise and excitement from the main gym. As fans leave the main gym, more people will be allowed in.

Thank you for your understanding and your cooperation through these growing pains!

Should you have any questions or concerns, please feel free to call Geoff or Lori at FIRST (800)871-8326.

THE COMPETITION-1998

TEAM UPDATE #11

Date: March 2, 1998

CORRECTIONS AND UPDATES

Due to changes in the control system paragraph 6.13.2 requires revisions. They are as follows:

1. Page 66 delete from list; 1 RNet Adapter
2. Page 66 add to list; 1 Right Angle BNC Connector, 2 9-15 Pin Cable, 1 CAT10 Attenuator
3. Page 67 add to list; 9-15 Pin Cable \$10 \$20, Attenuator \$20 \$20, Right Angle BNC Connector \$5 \$5
4. Page 67 list, modify the cost of the batteries from \$50 and \$300 to \$25 and \$50 respectively
5. Page 67 list, modify the cost of the battery chargers from \$25 and \$75 to \$75 and \$75 respectively
6. Page 67 list, modify the cost of the power supplies from \$10 and \$10 to \$20 and \$20 respectively

Add the following to tie breakers, Rule SC5:

1. As tie breaker number 7. The team with the ball closest to the center of the central goal.
2. As tie breaker number 8. A human player shoot out. The human players will be allowed to shoot 3 balls into the central goal. The ball most enter through the top of the goal. There will be three rounds with each team being allowed one shoot per round. Once all three rounds are complete the team that has put the most balls into the central goal wins the tie. Following each round the central goal will be cleared of any balls. In the event a tie still exists, this tie breaker will be implemented again. Note: Prior to the beginning of this tie breaker the field will be cleared of all robots and balls, and each human player will be given three of their teams balls by the referees.

ADDITIONAL PRACTICE TIME

At the conclusion of the scheduled practice times one playing field will be available for teams to practice/test their robots. In addition to being able to use the robots the human player will be able to practice. This field will be open till the pits close at each regional. A team will be allowed on the field for 10 minutes. Teams are asked to only have required members on the field during this time. There will not be a sign up sheet, teams will be allowed on the field on first come basis.

PIT RULES

1. All team members, when in the Pit, are required to wear safety glasses.
2. Teams are not allowed to accomplish any grinding or painting at their pit stations. There will grinding and painting stations available.
3. Welding and brazing is not allowed at the pit stations. This must be accomplished in the machine shop.
4. No open flames are allowed at the pit stations.
5. Modifying a robot and charging a robot mounted sealed lead acid battery is not allowed. The battery must be removed to be charged.
6. Charge the sealed lead acid battery in an open, well ventilated area.
7. Do not charge the sealed lead acid battery near equipment which may produce sparks.
8. Do not charge the sealed lead acid battery in inverted position.
9. Do not charge the sealed lead acid battery near an open flame.
10. Do not use smoking materials in the sealed lead acid battery charging area.

PEP BANDS

To promote team spirit, FIRST encourages teams to bring small pep bands to the events. They would be allowed to play during any of the three days during practice rounds, seeding rounds, competition rounds, time-outs etc. It would be great to have dueling pep bands.

ENGINEERING STAFF HOURS

During the month of March the engineering staff will be out of the office on the following dates:

- March 3 through 6
- March 10 through 13
- March 17 through 20

Please look for us at the competitions.