

# U.S. FIRST Team Update: 1995 Competition



## Kickoff Workshop

January 7, 1995: Manchester, NH

## Regional Tournaments

- Region 1: Manchester, New Hampshire  
Friday, Saturday ..... February 24, 25, 1995
- Region 2: Charlotte, North Carolina  
Monday, Tuesday .... February 27, 28, 1995
- Region 3: Dallas, Texas  
Friday, Saturday ..... March 3, 4, 1995

## Structure of Event

**Day 1:** Final field set-up, technical testing and team registration and practice. Each team will have at least two assigned half-hour practice sessions.

**Day 2:** Team breakfast banquet, followed by seeding matches. An afternoon break will allow teams to tune their vehicles for the Regional Play-offs that evening and a regional winner will be decided after double-elimination finals.

## National Championship

March 30, 31, April 1, 1995  
EPCOT Center, Orlando, Florida

Walt Disney World's EPCOT Center has asked to host the National Championship! Final negotiations are in progress and we are hoping to confirm this location by month's end. Special packages will be available for participating team members.

## Structure of Event

**Day 1:** Team registration and practice

**Day 2:** Seeding matches—each team will play five or six matches

**Day 3:** Double-elimination tournament with a final four playoff deciding the winner. The *Awards Celebration and Dinner* will follow the entire Competition on Saturday evening.

## 1995 Fees & Deadlines

- Full Participation ..... \$6,000.  
*Regional Tournament & National Championship*
- Regional Tournament Only ..... \$3,000.
- National Championship Only ..... \$3,000.

**Deadline to enter a team:**  
**December 15, 1994**

## 1994 Control Systems

Do you still have control systems or components, such as batteries, chargers, R-nets, or control boxes?

*Please return them ASAP* so we can start preparing for next year. The system is being redesigned, but we need last year's parts to build with. Thanks for your help—if you have a deposit with us, it will be returned once the parts are received.

## 36 Teams Ready To Go!

### 1995 Team List (to date)

Alliant Techsystems Inc. / Kamiak H.S.  
Alliant Techsystems Inc. / Washburn Senior H.S.  
American Power Conversion / School TBA  
Bose Corporation / Assabet Vocational Technical H.S., Framingham H.S.  
Boston Edison Company / Plymouth North H.S.  
Daniel Webster College / School TBA  
Davol Inc. / School TBA  
Delco Electronics Corporation / Kokomo H.S.  
E-Systems, Inc. / Greenville H.S.  
E-Systems ECI Division / School TBA  
Freudenberg-NOK / Memorial H.S.  
GE Elfun Society / Fitchburg H.S.  
Honeywell, Inc. / North Community H.S.  
Honeywell, Inc., Commercial Flight Systems Group / Cortez H.S.  
Ingersoll-Rand Company / Bishop Guertin H.S.  
International Fuel Cells / School TBA  
Johnson & Johnston, Astro Precision Machine, Brooks Automation / Salem Vocational H.S.  
Lockheed Sanders / Nashua H.S.  
Markem Corporation / Keene H.S.  
MICRO SWITCH, A Honeywell Division / Freeport Senior H.S.  
NASA Lewis Research Center / East Technical H.S.  
Navi Dowty & Associates, Inc. / D.C. Everest H.S.  
NYPRO Inc. / Clinton H.S.  
Procter & Gamble Company / Aiken H.S.  
Procter & Gamble Company / Walnut Hills H.S.  
Public Service of New Hampshire / West H.S.  
Raychem Corporation / School TBA  
Rensselaer Polytechnic / School TBA  
SMC Pneumatics, Inc. / Ipswich H.S.  
Southern Methodist University / St. Mark's School of Texas  
Stanley Works / Berlin H.S.  
Texas Instruments, Inc. / School TBA  
University of North Carolina-Charlotte / School TBA  
Womack Machine Supply Co. / Dallas Christian School  
Worcester Polytechnic Institute / Doherty H.S.  
Xerox Corporation / Joseph C. Wilson Magnet H.S.

U.S. FIRST UPDATE: 1/18/94

Below are answers to many of the questions that have been asked. Be sure to read this carefully and reference The Rules you received at the Kickoff Workshop. This will also be posted on the Bulletin Board.

- Reading messages on BBS** Currently, there are only 3 messages addressed to ALL--everyone should be able to read them. There is a glitch in the system preventing us from renumbering the messages; however, this year's messages start with #89. All prior messages have been deleted. You can "cut and paste" messages from the Bulletin Board, if you have the right software.
- Small Parts** You may only use up to \$300 of SPI parts in your final machine. To build prototypes you may exceed this limit, but you will be billed for any amount over the \$300 credit they have provided.
- Switch modifications** No internal modifications are allowed for either the rocker or limit switches. These switches are too small to handle the motor currents, therefore they cannot be used on the machine. They can only be used as part of the controller system. The blue boxes should be used in conjunction with the unmodified switches to make a control box. However, the addition of external levers is okay.
- Timing belt/chain** See Rule K5, page 6. There are no restrictions regarding pitch or width of the timing belt/chain, but you may use no more than 15' total. "Commercially available" means strictly off the shelf only. No custom or special orders.
- Use of Power Drive Train components** See Rule K5, page 6. Timing belt/chain may be used with either motors at any stage of a power train, including the final one (i.e. treads of a Caterpillar-like vehicle). Power train is defined as components transmitting the output of provided motor to any of the vehicle's mechanisms, including propulsion, arms, projectiles, etc.
- Netting** See Rule T5, page 6. Nets are allowed, but if they are used to entangle opponents machines, the referees may disallow them.
- Removing opponents balls** See Rule T6, page 6. If one team's balls are removed from the playing field by an opposing team, those balls are placed back onto the field near the balls' original exit point.
- Disqualification** See Rule T9, page 6. If, in an attempt to remove an opponents balls from the field, a part of your machine drops or is intentionally removed outside of they playing area, then your team's machine is turned off, and any points scored will count. If a machine is disqualified by a referee, any points scored during that match will be forfeited.
- Shipping** See CONSTRAINTS, page 2, and Rule Sh2, page 4. The shipping rule stands as written.
- Springs** In addition to those provided in The Kit, additional springs may be purchased from Small Parts Inc. You may not fabricate your own. The springs may be pre wound prior to power up.
- Fiberglass cloth** You may purchase and use fiberglass cloth, up to 1/8" thick and up to a 4'x4' overall size.
- Goal dimensions** See diagram, page 9. The goal dimensions are as stated on the diagram, with a tolerance of + 1/2".
- Modifying motors** All motors must be controlled through the transmitter/receiver. The motors cannot connect directly to the battery. The Delco motors may not be modified; however, the drill motors may be modified as long as the electrical connections are not changed.
- Design** For anyone interested in trying, flying vehicles are allowed as long as they meet all restrictions outlined in The Rules.
- Projectiles** See Rule S4, page 3. Competition soccer balls are considered safe projectiles.
- Team Communication at Competition** We must prohibit the use of microphones or hand-held radios for team communication at the Competition to avoid interference with the U.S. FIRST staff and event managers internal communications and the control systems.
- Two-part machines** See Rule C9, page 5. Two part machines are okay, however you cannot change the battery holder and you can only use the wires that are provided in the kit to extend power between motors. You MAY NOT use the wires that are in the printer.
- Team Box** See Rule F5, page 4. The Team Box is a 6' x 4' marked area adjacent to the 16" high playing field fence.
- Internet** We do not have direct access to Internet and not all teams have a subscription, so we are currently posting updates via fax and on the Bulletin Board.



U.S. FIRST

BY FAX: 3 PAGES TOTAL  
PLEASE DELIVER IMMEDIATELY

U.S. FIRST  
BILL RAMSEYER  
TOM LEWIS  
OR  
MAX DAVIES

January 13, 1995

To .....All Teams

From .....Eric Rasmussen

Team Update #1 ..... Rule updates and additions to the Control System Manual

We are faxing ONE copy per team today to be sure each team has these updates for meetings they may have this weekend. Please be sure to share this information right away with your team members. We will fax this information to other team members and post it on the bulletin board as soon as possible.

### RULE UPDATES

#### 1. The following are rewrites of rules on page 16.

- P9. If one team intentionally moves another machine out-of-bounds, the machine out-of-bounds will be disabled for the remainder of the match. Points scored will count.
- P10. If a machine is disqualified by a referee, that machine is turned off for the remainder of the match, and any points scored during that match will be forfeited.
- P12. Your machine and/or its mechanisms must be able to sustain its own structure without the use of the field goal. It is acceptable for a machine and/or its mechanisms to come into contact with the field goal; however, resting on or attaching to it is not allowed. Any interaction with the field goal which would be likely to, or does, damage the field goal may result in disqualification from that match. This decision will be up to the referees.

#### 2. On page 14, change the explanation to read:

The parts listed on this page may be purchased from Small Parts, Inc. or other sources, but must be available "off the shelf". You may not purchase "nearly equivalent" parts, special or custom orders.

The quantities shown on this page represent the total quantity which may be used in your device with the following exceptions:

- Samples provided in The Kit do not count toward the total quantities on this list.
- Chain, Belt, Sprockets, and Pulleys purchased from Small Parts, Inc. do not count toward the total quantity, but do count against the \$425 limit.
- Fasteners other than hose clamps may be purchased in unlimited quantity as long as they are used as fasteners. However, any fasteners purchased from Small Parts, Inc. do count against the \$425 limit.

#### 3. Add the following text to the list of bullet items under Materials in the CONSTRAINTS section on page 2:

FOR INSPIRATION AND RECOGNITION OF SCIENCE AND TECHNOLOGY

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- Shrink Wrap Tubing has been added to the kit list. Teams may purchase as much shrink wrap of any diameter as they wish. However, shrink wrap must be used for electrical insulation only. It may not be used as a fastener.
4. All items listed in Rule C1 (page 21) must be mounted without alteration. Use clamps, Velcro, or existing holes for mounting. 1/4" bolts may be used (as self-tapping screws) in the recesses of the battery holders (the marks made by the screws in these recesses will not be considered a violation of Rule C1). Drilling or cutting control system components listed in Rule C1 will result in disqualification.

### KIT LIST CLARIFICATIONS

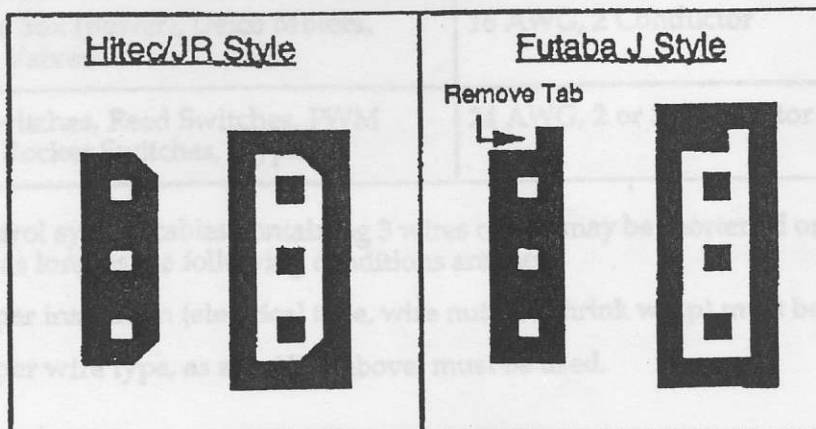
1. Only 6 inches of shrink wrap tubing was included in the kits, not 10 inches as stated in the List of Components.
2. Only 4 feet of Numatrol tubing was included in The Kit. Each team will be shipped an additional 11 feet of Numatrol tubing.
3. The locking screw for the spring hinge is included in the bag of screws with the hinge. It has a Phillips head and not a hex socket head. Some teams were mistakenly told that this screw had a hex head and was missing from their kits.

### ADDITIONAL BALLS

Call Dave Jackson, 800-423-2597, to order additional balls. Please note this number reaches SportFun's offices in California, so call according to Pacific Standard Times business hours.

### ADDITIONS TO THE CONTROL SYSTEM MANUAL

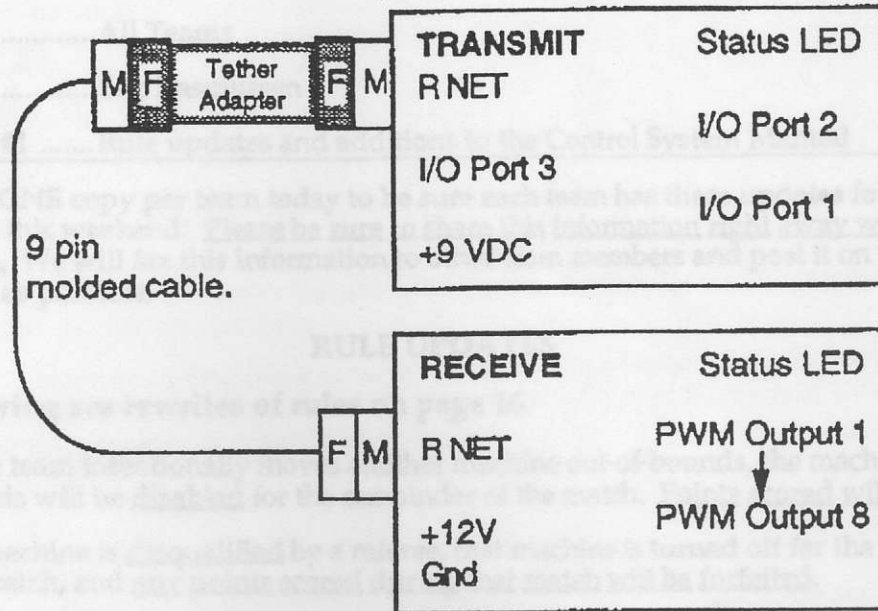
1. Some of the PWM cables in the kits have Hitec/JR style connectors while others have Futaba J-style connectors. The Hitec/JR style cables have yellow, red, and black wires, while the Futaba style cables have white, red, and black wires. The PWM connectors should be plugged into the receiver box with the black wire on the bottom, and the yellow or white wire on top. In order to use the Futaba style connectors, you may need to shave off the external tab to gain a proper fit. See the figure below for details.



Remember: 1 copy faxed today per team. Share with your team members ASAP.

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2. To connect the transmitter to the receiver using the tether adapter, connect one end of the tether adapter to the RNET port on the transmitter box. Connect the other end of the tether adapter to the male end of the 6 foot, 9 pin molded cable. Connect the female end of the 9 pin cable to the RNET port on the receiver box. The figure below illustrates this concept.



3. The wires and cables included in the kits are intended for specific uses.

The table below shows the minimum wire sizes allowed for hookup of the listed devices:

Device	Wire Type
Drill Motors, Battery Boxes, Speed Controllers (power & motor leads), Relay Box (power)	12 AWG Red & Black
Receiver Box (power), Delco Motors, Pumps, Valves	16 AWG, 2 Conductor
Limit Switches, Reed Switches, PWM Cables, Rocker Switches, Joypad	24 AWG, 2 or 3 Conductor

The control system cables containing 3 wires or less may be shortened or lengthened as needed as long as the following conditions are met:

- Proper insulation (electrical tape, wire nuts, or shrink wrap) must be used.
- Proper wire type, as specified above, must be used.

Remember: 1 copy faxed today per team. Share with your team members ASAP.

1995 U.S. FIRST COMPETITION  
TEAM UPDATE #2

Date: January 19, 1995  
From: Eric Rasmussen  
Re: Questions and Answers #1  
Note: 6 pages by fax

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- Q1. May we use fasteners other than hose clamps?  
A1. Yes. Hose clamps are on the additional hardware list only to limit quantity.
- Q2. Netting is mentioned in the rules, but we cannot find it in the additional hardware list or the Small Parts catalog. Where can we get netting?  
A2. Netting can be constructed using parts in the kit, or parts which can be purchased.
- Q3. Is 1/32" the correct thickness of the aluminum plate listed in the additional hardware list?  
A3. Yes. The intention is to allow a metal skin over a composite structure, not to provide another structural component.
- Q4. We called the manufacturer of the balls, and they said that each size only comes in one color. How will balls be differentiated during the competition?  
A4. Sport Fun has agreed to produce a special set of balls for the U.S. FIRST Competition. Both sizes of balls will be available in three different colors. These special balls are not available to teams. For practice purposes, U.S. FIRST recommends marking the balls with an indelible marker. Paint should not be used because it alters the surface of the vinyl.
- Q5. May we use a net to hold balls?  
A5. Yes, but it cannot be loose or left on the field such that it may become entangled in a vehicle or part of the field.
- Q6. May we use a device to block the vision of opposing teams?  
A6. No, this would not be in the spirit of the competition.
- Q7. May devices be attached to parts of the field other than the field goal?  
A7. Yes, but they cannot damage the field and must be easy and quick to remove at the end of a match. Also, remember that the back wall and fence around the field cannot be used for attachment of devices.
- Q8. Please clarify the first sentence on page 24. Could the phrases "both servos and all 6 channels of the relay box, which represents a total of 10 channels," be placed in parenthesis to clarify the meaning of the sentence -- or have we missed it completely?  
A8. The 2 speed controllers, 2 servos, and 6 channel relay box add up to 10 channels worth of output devices. In order to activate all 10 channels with the 8 channel receiver, the two servo Y cables must be used.
- Q9. If a defense mechanism is released from machine A, and machine B throws this mechanism out of bounds, will machine A be disabled?  
A9. No. Machine A would only be disabled if the part of machine A with the control system on board had to react off an out of bounds surface to move back in bounds.
- Q10. Is it legal for a machine to split up into multiple parts which are independently controlled?  
A10. Only if there is a tether made from legal kit components which connects the various parts. No devices other than the receiver box, relay box, muffin fan, and speed controllers may be connected directly to the battery boxes. However, a vehicle may detach a mechanism powered by a non-electrical energy source.
- Q11. Traction appears to be an important factor in this contest. If we were interested in modifying a timing belt, are we allowed to essentially add rubber cleats along the length of the belt?

- A11. Yes, as long as all materials are legal kit components.
- Q12. May we use the air accumulator as an energy storage device?  
A12. Yes. It was accidentally omitted from the list of allowed energy sources on page 2.
- Q13. May we charge the air accumulator before the start of a match?  
A13. Yes, but only with the pumps included in the kit.
- Q14. May we use the pumps to charge the air accumulator if they are not mounted on the vehicle.  
A14. No, the pumps must be mounted on the vehicle if they are used to charge the air cylinder.
- Q15. Where can we get more balls, drill motors, speed controllers, and so on?  
A15. The kit list shows the supplier for each item. The supplier list gives contact information for most suppliers. Both are in the manual. For example, Milwaukee drills can be found in hardware stores such as Home Depot. Bigens balls can be found in toy stores such as Toys R Us. The Tekin speed controllers may be available in R/C hobby stores.
- Q16. What is an "outside source" as mentioned in rule K4 on page 5?  
A16. An outside source is a vendor other than Small Parts, Inc.
- Q17. Is it legal for a machine to lean on or otherwise touch the goal?  
A17. A machine may not be designed to interact with the structure of the goal. Machines which are designed to lean on or otherwise contact the structure of the goal will be disqualified. There are certain conditions where it is and is not legal to touch the goal:  
1) If you happen to bump against the goal while driving, or are pushed against the goal by a competitor, you will not be disqualified. However, you should not plan to "accidentally" bump the goal in order to score. (see rule T8 on page 15)  
2) If another machine attempts to move your machine away from the goal, and there are mechanisms on your machine which would contact the goal in such a way as to try to prevent the your machine from being moved away from the goal, you must retract such mechanisms. It does not matter if such mechanisms were designed to hang onto the goal or for other purposes. If your machine attempts to hang onto the goal, it will be disqualified for the match, and any points scored will be forfeited. This judgment will be up to the referees.
- Q18. Are hovering or flying machines allowed?  
A18. Hovering or flying machines are allowed. However, they must remain over the surface of the playing field.
- Q19. How high are the ceilings at the competition sites?  
A19. Both regional competitions will be conducted in basketball courts with fairly high ceilings (exact height unknown). The national competition will be conducted on a covered stage with a ceiling height of roughly 20 feet. Expect fragile, expensive, and heavy lighting equipment to be suspended from the ceiling of the stage, and design your machine accordingly.
- Q20. May we use slip rings to conduct electricity through a rotating joint?  
A20. No, you may only use the wires provided in the kit to conduct electricity.
- Q21. How tall is the scoring area between the goal posts?  
A21. Infinitely high. However, if, after passing between the goal posts, a ball goes over the back wall without touching part of the field (which includes the goal and back wall for this purpose) or another machine, then the score does not count.
- Q22. May we blockade the speed bump?  
A22. Yes, but not with devices which entangle or take a long time to remove at the end of a match.
- Q23. The output channel pin assignments are described differently in Table 7.2 on page 27, and in the last paragraph on that page. Which is correct?  
A23. The table is correct.

- Q24. Can an arm holding a ball pass the ball back and forth between the two sides of the goal posts and score multiple times?  
A24. Yes, as long as the ball passes fully through the plane of the posts. There is no requirement to release the ball in order to score.
- Q25. May we deploy blocking devices on the field?  
A25. Yes, with two qualifications. First, machines, and any mechanisms they deploy, must be able to be removed from the field at the end of the match in one minute as per rule T3 on page 15. Second, blocking devices should not pose a risk of entanglement. See rule T7 on page 15 for details.
- Q26. May we purchase 10' of 3" wide belt, split it into 20' of 1.5" wide belt, and use all 20' in our vehicle?  
A26. No, 10' is the total quantity of belt (and/or chain) allowed in your machine.
- Q27. May we use a device to link two balls or opponents vehicles?  
A27. Yes, as long as it doesn't provide a risk of entanglement, doesn't damage the balls or vehicles, and can be easily and quickly removed at the end of the match.
- Q28. All the pine boards included in the kit are listed as samples. However, only the 3.5" wide pine board appears in the additional hardware list. Are we allowed to purchase pine board in the other widths?  
A28. No, you may only purchase pine board in a 3.5" width as listed in the additional hardware list. You are free to cut the board to any size you find useful.
- Q29. What surface can we expect on the slopes between the ramps?  
A29. The surface will be painted plywood. Knots will be plugged.
- Q30. What size sprockets and wheels were used on the machine demonstrated at the kickoff workshop?  
A30. The wheels were 12" in diameter, and are not legal kit components. They were used for demonstration purposes only. The ratios between the sprockets demonstrated (not the overall ratio) were approximately 4:1 and 2:1.
- Q31. May we take apart the drill gearbox and modify it?  
A31. Yes, but U.S. FIRST will not supply a replacement if you break it while doing this. It is recommended that, if you wish to explore and possibly modify the inner workings of the gearbox, you purchase a Milwaukee drill from a local hardware store for this purpose.
- Q32. May velcro be used to attach to the surface of the playing field?  
A32. Yes.
- Q33. May a machine grab onto the sides of the ramps?  
A33. Yes, as long as you don't leave marks in the plywood as from spikes or other sharp mechanisms.
- Q34. Small Parts, Inc. sells gas springs on page 300 of their catalog. Do these count as energy storage devices, and can we use them?  
A34. Yes, they are energy storage devices. Yes, you may use any item available from SPI.
- Q35. May PVC pipe be used as an air accumulator?  
A35. No. Only the items listed under the Pneumatics section of the kit list on pages 10 and 11 may be used to carry compressed air or a vacuum.
- Q36. May a machine deploy Styrofoam obstacles?  
A36. No, because the Styrofoam will break down into small particles as vehicles interact with it, and it will leave a mess on the field.
- Q37. May we put nubs on our wheels or treads as long as they don't damage the carpet?  
A37. Yes.



- Q38. May more than one device be powered off of one relay output?  
A38. No. However, the servo Y cables can be used to activate up to three relay outputs from one PWM signal.
- Q39. Is there any restriction on which devices with PWM inputs can be plugged into the different PWM outputs on the receiver box?  
A39. No, there is no restriction. The speed controllers, servos, all 6 channels on the relay box, servo Y cables, and servo extension cables may be attached to any of the PWM outputs on the receiver box.
- Q40. May we use electrical components other than those on the kit list?  
A40. No.
- Q41. What happens if a ball pops?  
A41. It will be replaced by a referee standing on the sidelines.
- Q42. If a ball is popped in the goal area, where is it re-inserted?  
A42. The ball will be re-inserted at the far end as if it had gone over the back wall.
- Q43. Can the ball go under the goal to score?  
A43. No. In order to score, a ball must fully pass through the vertical plane above the horizontal bar and between the vertical bars.
- Q44. May we attach a tether to the ball, shoot it through the goal, and pull it back?  
A44. Yes, that is legal. However, you must make sure that the tether does not pose a risk of entanglement. Also, the tether may not apply force to the goal as the ball is being moved in either direction.
- Q45. Is blocking the goal a legal defense?  
A45. Yes, but you may not attach or lean a device on the goal for such a purpose.
- Q46. Would a net projectile to capture balls be legal?  
A46. No, because a detachable net would pose a risk of entanglement.
- Q47. May we buy different wheels from Skyway or from another company?  
A47. You may only purchase materials shown on the additional hardware list or from Small Parts, Inc. You may not purchase additional wheels from Skyway. However, you are welcome to fabricate custom wheels using materials from the kit, SPI, or the additional hardware list.
- Q48. Is it legal to purposely throw a ball out of bounds, such as into the crowd?  
A48. Yes, it is legal. However, the ball will be replaced. If the ball goes into an inaccessible location, another ball will be substituted in its place.
- Q49. Is it legal for a machine to climb over the 8" high walls on the side of the speed bump?  
A49. Yes.
- Q50. May we use the balls included in the kits in the vehicles?  
A50. Yes, but only as vinyl sheet. You may not use the balls in the kit as balls if they are incorporated into your machine.
- Q51. The additional hardware list states the allowed quantity of resin and hardener as "as needed". Are there any restrictions on the use of resin in the vehicle?  
A51. The additional hardware list allows the use of fiberglass resin and hardener on an "as needed" basis. The intention is to allow the creation of composite structures with the fiberglass matting. This should not be stretched to mean a structure composed largely of epoxy with a small percentage of fiberglass matting. For example, a fiberglass/epoxy wall which is twice as thick as the allowed matting thickness would be considered excessive use of epoxy. Similarly, the use of resin "as needed" is not intended to allow parts cast of pure epoxy. However, use of small regions of cast epoxy, such as for attachment points from the

composite structure to metal bolts, is allowed. The epoxy resin and hardener used should be available "off-the-shelf", and not via special or custom order.

- Q52. May we develop our own transmit interface which uses the RNET modems?  
A52. No, you must use the transmitter box provided in the kit.
- Q53. Is there a limit on the money spent to purchase items from the additional hardware list?  
A53. No. Only items purchased from Small Parts, Inc. are limited by cost.
- Q54. What is the limit to changing our machine during the 5 day period we are permitted to work on it between the regional and national competitions?  
A54. The intent of the 5 day period is to allow teams to repair damage and to work out design flaws in order to improve performance at the national competition. Complete machine redesigns, or mimicking of other designs seen at the regional is not in this spirit.
- Q55. May we keep our control system during the period between the regional and national competitions, so that our drivers may practice using a duplicate machine?  
A55. No. This would be unfair to the teams which do not have the resources to build additional vehicles. However, you may purchase an off-the-shelf R/C radio system, servos, and speed controllers to duplicate as much of the functionality of the original system as possible.

#### Questions and answers from the BBS:

- Q56. Could you please clear up rules k4 & k5? - They seem contradictory to us.  
A56. K4 states that there is no limit to the number of sprockets and/or pulleys that you can use in your machine. It also states that there is a limit, as defined in rule K5, on how many sprockets and/or pulleys that you can purchase from outside sources. The part of K5 to which I believe you are referring simply defines the limit on sprockets and/or pulleys bought from outside vendors as 4. An outside vendor is a vendor other than Small Parts, Inc. Here's an example of a legal machine with 15 pulleys: 4 Pulleys bought from Jim's Hardware Store, 4 pulleys bought from Small Parts, Inc., 7 pulleys machined from kit components.
- Q57. We were told by our teacher and the engineers that attended the workshop that it is illegal to latch onto the goal. What is the deal and why is this not in the rules? What if we just use the goal for stabilization? Can we get a private reply on this so as not to give other teams ideas? If it is illegal could we please have a definition of "latching onto the goal." In addition will the 8 inch barrier on the sides of the speed bump be sturdy enough for a machine to go over it? A private reply on this would help as well.  
A57. All questions and answers are kept public in order to keep all teams on a level playing field. If you wish to ask a question anonymously, then it may be sent to myself or Jessica Forbes as private email, but the substance of the question and answer will be made public in the appropriate message area. Also, questions and answers on the BBS will be regularly faxed to teams so that those teams not using the BBS will be kept up to date. As for using the goal for stabilization and latching onto the goal, the following rules apply: M5 (page 4), & P12 (page 16).  
"M5: Machines must be designed to operate by reacting against the surface of the playing field, the innermost face of the curb, the platform, ramps, slope, the speed bump, the balls, the other machines, and the air." The key word here is "designed". If you come into contact with the goal, such as you might by driving up to it, that is ok. However, if you rely on the structure of the goal in order to score, such as by leaning on the horizontal bar for correct positioning, that is not ok. Similarly, attaching (latching) a device to the goal is not allowed.  
"P12: Any interaction with the field goal which would be likely to, or does, damage the field goal will result in disqualification. This decision will be up to the referees." The reason behind this is that the field goal is a tall, thin structure which is not designed to withstand large applied forces. It is designed to allow teams to score points and to withstand being bumped into at the base by robots, and by flying balls higher up. As for

the speed bump, the 8 inch high sections are made of 3/4 inch thick plywood, and should withstand the forces from vehicles trying to climb over it. If you wish to design your vehicle to do this, it is perfectly legal.

- Q58. Just a few simple questions. In order to score a goal, must our robot release the ball? From our understanding, to obtain a goal, the ball must simply break the plane. Is our robot allowed to remain in contact with the ball and score a goal? Also, are we allowed to employ the use of treads for movement?
- A58. No, you can hold onto the ball as it passes through the goal and still score. However, the ball must pass fully through the plane, not just break the plane, before any points are scored. Treads may be used for movement.
- Q59. Can we react with the bottom 4" of the back wall like we would with the 4x4's surrounding the field?
- A59. Obviously, you may happen to bump into the back wall as you are driving around or get pushed. However, you may not design your machine to react off the back wall. Refer to rules M5 on page 4, T8 on page 16, and P11 on page 16.
- Q60. Is the ball placement for the tournament going to be as it is shown on the field diagram on page 18?
- A60. Yes.
- Q61. What is the last day for clarifications?
- A61. You may ask questions at any time up to and including the national competition.
- Q62. In your reply to another question, you said: "No, you can hold onto the ball as it passes through the goal and still score. However, the ball must pass fully through the plane, not just break the plane, before any points are scored." Is that the ONLY requirement to make a goal, that is, it has to pass through the vertical plane, or are there other requirements? For example, must the ball touch something on the opposite side of the field goal in order for it be considered a goal?
- A62. Under most conditions, that is the only requirement. However, if the ball goes through the vertical plane and over the back wall without touching the playing field, then the score does not count. For example, if the ball hits the goal and goes over the back wall, it still counts. Also, if the ball hits the goal, skims the back wall and goes over the back wall, it also counts.
- Q63. Are we allowed to cut the handle off the drill shell or are we required to use the drill housings in their entirety?
- A63. You may modify the drill housings as you see fit. Just make sure that you can live with the modifications after you make them, because it is hard to uncut a part.
- Q64. What size storage container are we allowed in the pit area? The rules (M12) say that we will be given table space, but I understand that last year many teams had shipping containers which they used as garages to store their items.
- A64. There is no specific limit on the size of storage containers used in the pit area. Page 47 also mentions what to bring to the pit area. Basically, if it can fit on or under a table, it is ok. Typically, there is room on the table for your vehicle and a toolbox, and additional room underneath the table for whatever else.

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #3

Date: January 24, 1995  
From: Eric Rasmussen  
Re: Travel & Disney Reservations, Rule Clarifications and Wheels  
Note: 2 pages by fax

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### Travel Information

**FLIGHTS:** Call 800-664-0272

Our travel agency, Travel Anywhere, located in Manchester, NH, has offered to help teams nationwide find the lowest airfares available for travel to competition sites. *Why should you use them?* They have set up a special 800 number which your Team Travel Coordinator can call to receive an airfare 10% below the lowest possible fare they can find from your departure city. In addition, 5% of their standard commission on these ticket sales will be donated to U.S. FIRST for further development of our organization. Help your team and U.S. FIRST by booking with them!

(Note: this is a new number. It is scheduled for activation on Wednesday, 1/25/94. If you have difficulty making the call, please wait and try once again later before calling us. If you still do not have any luck, let us know. Thanks!)

**DISNEY HOTEL RESERVATIONS** You will be called this week!

Each team should choose one person to handle all team room reservations: a Team Travel Coordinator. A representative from Walt Disney World Sports Special Events will be calling each team this week for the name and number of your Team Travel Coordinator. Once identified, they will send that person an information sheet with instructions and firm rates for staying at one of their All-Star Resorts. Anyone traveling with your team should book through your Team Travel Coordinator to receive the U.S. FIRST package, which includes meals, ground transportation within all parks, and a park-hopping pass for each day.

### Rule Clarifications

#### ADD

- **AIR ACCUMULATOR** to Page 2, "Energy Sources," as an acceptable energy source. It may be pressurized prior to the beginning of a match using the pumps provided in the kit.
- **LATEX TUBING** to the "Springs" section of your "List of Components" (pg. 13). The latex tubing has a 1/4" internal diameter, 3/8" o.d., and is 5' long when not stretched.
- **MILWAUKEE DRILL HOUSINGS** to the "Motors & Pumps" section of your "List of Components" (pg. 10). If you did not receive two left halves and two right halves, call us and we'll send them.
- **PRINTER and RIBBON** to the "Other" section of your "List of Components" (pg. 10). If you did not receive a ribbon in your printer, call us and we'll send one.

#### CORRECTIONS

- **IN THE UNBOUND EDITION OF THE RULES**, Table 7.2 on page 27 is incorrect. Please refer to Table 7.2 on page 27 of the bound manual instead.
- **IN THE RULES**, the second bullet of rule C1 on page 21 should read: "The speed controller Reverse Delay, Throttle, and Neutral potentiometers may be adjusted as described in the Tekin 610-G Owner's Manual."
- **IN THE RULES**, The last paragraph on page 27 should read (note the I/O Port numbers):

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #4

Date: January 26, 1995  
From: Eric Rasmussen  
Re: Corrections and Other Notes, Repair/Replacement Policy, Q & A  
Note: 4 pages by fax

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### Corrections and Other Notes

- Corrections** Since publishing Team Update #2 (1/19/95), it has been decided that teams may completely redesign their machines, within all Rules, during the 5 day period before the deadline for shipment to Epcot. This negates answer A54, and applies only to teams competing in both the regional and national competitions.
- The thickness of the PVC pipe listed in the additional hardware list and on the field diagrams was not specified. In both cases, it should be schedule 40.
- Additions** The air accumulators were shipped to teams via 2nd day UPS on 1/25/95. Included in the shipment were the appropriate fittings for the accumulator, and 4' of red and 4' of black 12 AWG wire. This wire may be used in addition to, and for the same purposes as, the 12 AWG wire originally included in the kits, bringing the total amount of 12 AWG wire to 12' of each color.
- It is a good idea to connect a PWM signal to each channel of the relay box that will be used, even if you only plan to activate the channel with the go switch inputs. If a go switch input is used on a channel without a PWM signal, the output will continue to operate in the appropriate direction even after the go switch input is no longer applied. If you wish to activate a relay channel solely with go switches, simply use the PWM output from a channel on the receiver which is not otherwise being used, and which corresponds to a switch input on the transmit end.
- Amplification** Please do not write on or otherwise mark control system components. See Rule C1 (page 21). Because we will reuse these components, please also do not attach tape, glue, or other adhesives to control system components. For mounting purposes use mechanical fasteners, such as cable ties or brackets.

### U.S. FIRST Policy on Repair and Replacement of Non-functional Control System Components

U.S. FIRST has developed the following policies on the repair and replacement of control system components.

If you experience a failure in any of your control system equipment, please call U.S. FIRST to insure that all components are correctly configured. If this does not resolve the problem, you will be instructed to follow the steps outlined below. Please note the differences in procedure based on the component that is determined to be non-functional.

- If, during examination of the failed components, the failure is determined to be due to misuse or mis-wiring, you will be charged according to the rates below. Please see the first paragraph on page 25 of the Rules.
- If the affected unit(s) failed due to a manufacturing defect, you will not be charged.
- Any team with an outstanding balance will not be allowed to register or compete at the regional and/or national competition until the balance is paid. Teams will be allowed to pay outstanding balances, by check only, at the registration desk at each Competition.

## Procedures and Charges

### Transmit Box, Receive Box, or Relay Box

- 1) Ship the non-functional unit to U.S. FIRST.
- 2) Upon receipt of the unit, it will be examined to determine whether it can be repaired or must be replaced.
- 3) U.S. FIRST will ship the repaired or replacement unit to the team via 2nd day UPS shipment within 1 business day of receipt.

Cost if failure was determined to be a result of misuse or mis-wiring:

Replacement of Transmit Box, Receive Box, or Relay Box:	\$150.00
Repair of Transmit Box, Receive Box, or Relay Box:	\$50.00

### Speed Controllers

The speed controllers have a 90 day warranty. Teams have the option of contacting Tekin for repair/replacement of defective units. Tekin estimates an approximate 3 day turnaround time from receipt of units to shipment of repaired/replacement units.

If teams wish to obtain a replacement speed controller through U.S. FIRST, we will provide a new unit, shipped via 2nd Day UPS, for the list price of \$205.00.

U.S. FIRST is able to provide these replacement speed controllers through a special arrangement with Tekin, and has only a limited number of speed controllers available. This policy is intended to provide teams with failed units a timely method of obtaining replacements. Teams wishing to obtain spare speed controllers must go through regular retail channels.

If you experience do a failure, you should seriously consider the fact that if one speed controller failed with the current vehicle design, a replacement may also fail during the competition. Carefully evaluate the abrupt startup and reversing loads on the motor, the interim and overall gear ratios, and the driving techniques used.

### RNETs

- 1) Ship both RNETs to U.S. FIRST.
- 2) U.S. FIRST will ship a pair of replacement RNETs via 2nd day UPS shipment within 1 business day of receipt.

### Servos & Servo Cables

Replacements can be purchased from U.S. FIRST for \$15. These units will be shipped via 2nd day UPS air. As with speed controllers, U.S. FIRST has a limited number of servos available. Teams wishing to purchase spare servos may purchase equivalent models through regular retail channels.

### Joysticks

The Flightstick joysticks have a 1 year warranty. Teams have the option of contacting CH Products for resolution of problems with defective units. Alternately, Flightstick joysticks are available in most computer stores.

### Joy pads

U.S. FIRST will replace any broken joy pads, but the supply is limited.

### Drill Motors and Gearboxes

All motors are used, but were tested prior to the kickoff workshop. All gearboxes are new. There are only a limited number of replacement motors and gearboxes available.

If you have a burned out motor:

- 1) Ship the non-functional motor to U.S. FIRST.

- 2) U.S. FIRST will ship a replacement motor to the team via 2nd day UPS shipment within 1 business day of receipt.

**Note: If you modify the gearbox, and a failure occurs, U.S. FIRST will not provide a replacement.**

If you have a non-functional gearbox:

- 1) Ship the gearbox to U.S. FIRST.
- 2) Seriously consider the fact that if brand new gearbox failed with the current vehicle design, a replacement may also fail during the competition. Carefully evaluate the shock loading of the gearbox, the interim and overall gear ratios, and the driving techniques used.
- 3) U.S. FIRST will ship a replacement gearbox to the team via 2nd day UPS shipment within 1 business day of receipt.

Alternately, teams may purchase a new Milwaukee 12 volt cordless drill from a standard retail outlet and use the motor and/or gearbox.

#### Delco Motors

- 1) Ship the motor to U.S. FIRST.
- 2) U.S. FIRST will ship a replacement motor to the team via 2nd day UPS shipment within 1 business day of receipt.

As with other components, U.S. FIRST has a limited number of replacement motors available. Teams wishing to purchase spare servos may purchase equivalent models through General Motors parts distributors.

### Questions and Answers

Q65. May we build our own pump?

A65. No. You must use the pumps provided in the kit.

Q66. We are thinking of using different interchangeable mechanisms on our machine in different matches. Each mechanism would have a different function, and would be selected based on the opponents being faced in a given match. Is this legal?

A66. No. Any mechanisms used must be on the machine at the start of all matches. See rule M10 on page 4.

Q67. May we use the wooden dowels in the kit to pickup the balls?

A67. Yes, as long as they are not used as a projectile. However, the dowels should be reinforced to prevent breakage in the event that they are hit by another vehicle.

Q68. Can we fold our vehicle down for measurement and then unfold prior to the start of a match?

A68. No. The vehicle will be measured in the same condition as it will be when it is about to begin a match. This includes having batteries on board for purposes of weight and size measurements. After the beginning of a match, your machine may unfold so that it is larger than the legal starting dimensions.

Q69. Is there a mating connector for the plug on the positive motor output wire on the speed controllers?

A69. No, just chop off the plug.

Q70. May we store compressed air in the Latex tubing?

A70. No, for safety reasons, only items listed under the PNEUMATICS section of the kit list on pages 10 and 11 of the manual may be used to store, generate, or transmit compressed air (or vacuum).

Q71. May we use aluminum sheet from Small Parts, Inc. in sizes not mentioned on the additional hardware list?

A71. Yes.

Q72. May we use bullet, spade, or butt connectors in the vehicle wiring?

A72. No, connections must be soldered and insulated with electrical tape or shrink wrap or twisted together and insulated with a wire nut.

Q73. May we put limit switches in series with the PWM signal wires to interrupt the PWM signals?

A73. No. The only modifications that may be made to the PWM wires are to shorten them or lengthen them using the 3 conductor, 24 AWG wire included in the kit.

Q74. What happens if we can't retract a mechanism that is causing us to hang onto the goal when we are being moved away from the goal by another machine? Will we be disqualified?

A74. This will be up to the discretion of the referees.

Q75. May drivers use binoculars or similar devices to aid vision?

A75. Yes.

Q76. May we hold down a switch on the transmitter prior to the start of a match?

A76. Yes, but the transmitters will not send any signal until the match begins.

Q77. May we remove the switches inside the servos?

A77. No. The servos may not be modified except to change the lever arm on the top.

Q78. May we attach something to another machine to pull them?

A78. Yes, as long as it is not likely to cause damage, get entangled, or take a long time to disconnect at the end of a match.

Q79. Is welding allowed?

A79. Yes. See rule K9 on page 5. Welding, is considered a fastener. You may use a normal amount of welding rod for this purpose. However, you may not use an excessive amount of welding rod to try to create additional structure for your machine.

### U.S. FIRST Policy on Repair and Replacement of Non-functional Control System Components

U.S. FIRST has developed the following policies on the repair and replacement of control system components.

If you experience a failure in any of your control system equipment, please call U.S. FIRST to ensure that all components are correctly configured. If this does not resolve the problem, you will be instructed to follow the steps outlined below. Please note the differences in procedure based on the component that is determined to be non-functional.

- If during examination of the failed components, the failure is determined to be due to misuse or mis-wiring, you will be charged according to the rates below. Please see the first paragraph of page 25 of the Rules.
- If the affected unit failed due to a manufacturing defect, you will not be charged.
- Any team with an outstanding balance will not be allowed to register or compete at the regional and/or national competition until the balance is paid. Teams will be allowed to pay outstanding balances, by check only, at the registration desk at each Competition.



**1995 U.S. FIRST COMPETITION  
TEAM UPDATE #5**

Date: January 27, 1995  
From: Jessica Forbes  
Re: Administrative Deadlines and Bulletins  
Note: 3 pages by fax

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**Item 1-IMPORTANT DEADLINES**

**Team Profiles: February 3, 1995**

U.S. FIRST will publish short profiles on each team in the event programs. Please send or fax your profile by **Friday, February 3, 1995**. See page 47 of the rules for further details.

**Regional Team Breakfasts Attendee List: February 15, 1995**

The Regional events will begin with a team breakfast. Each team is offered up to 30 complimentary breakfasts. Please send or fax your attendee list by **February 15, 1995**. See page 47 of the rules for further details.

**Chairman's Award Materials: February 22, 1995**

Submissions for the Chairman's Award must be in the U.S. FIRST office no later than **5:00 pm on Wednesday, February 22, 1995**. See pages 47-48 and 51 of the rules for further details.

**Item 2-EVENT SCHEDULES**

Times, events and directions for each regional will be available and faxed to each team by **February 15, 1995**.

To: T. Lewis, B. Ramseyer, M. Davies, Delco Electronics Corporat

Fax Phone: 1-1-317-451-7151

From: U.S. FIRST

Fax Phone: 603 666 3907

Volce Phone: 603 666 3906

Date: Tuesday, February 7, 1995 11:54 PM

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #6

Date: February 7, 1995  
From: Eric Rasmussen  
Re: Important RNET Information  
Note: 1 page by fax

### IMPORTANT INFORMATION CONCERNING RNET RADIOS

Please pass this along to other members of the team immediately.

By now, all teams should have received their RNET radios and antennas. As some teams have discovered, not all RNETs are functioning properly. The following instructions apply to everyone, even if your RNETs are working:

Please perform the following procedure ASAP to both RNETs:

- 1) Remove the two screws from the sides of the top of the RNET.
- 2) Gently pull the RNET housing off the RNET. (Hold the antenna connector and pull the circuit section out of the rest of the metal case.)
- 3) Locate the row of DIP switches on one side of the RNET.
- 4) Set switch 6 to ON, and all others to OFF.
- 5) Reassemble the RNET. Make sure to line up the tabs on the RNET with the slots in the bottom of the housing for a proper fit. Don't force anything.

Please take caution to prevent static discharges to the RNET circuitry while the housing is removed.

This should solve any problems you may have encountered with the RNETs. If your control system fails to function properly with the RNETs after performing the above procedure, please call U.S. FIRST.

**1995 U.S. FIRST COMPETITION  
TEAM UPDATE #8**

Date: February 9, 1995  
From: Jessica Forbes  
Re: New England Tournament Schedule & Directions  
Note: 2 pages by fax

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**SCHEDULE**

**Memorial High School, S. Porter Street, Manchester, NH**

Friday, February 24, 1995: Practice Day, Memorial High School

*IMPORTANT NOTE* School will be in session until 11:30 am--please do not arrive any sooner than 9:00 am.

9:00 am - 12:00 noon ..... Team Arrival & Registration (*see page 44 of the Rules*)

12:00 noon - 9:00 pm ..... Practice in half hour time slots (*see page 44 of the Rules*)

When you register, you will have to surrender your Rnets and two (2) batteries, and sign up for practice times. By noon, your machine will have to be weighed, measured and photographed, and your 20 amp circuit breaker installation inspected. U.S. FIRST Staff will be available to assist you.

Saturday, February 25, 1995: Team Breakfast, Center of New Hampshire, Holiday Inn

7:30 am - 8:30 am

Saturday, February 25, 1995: Tournament Day, Memorial High School

*IMPORTANT NOTE* Except for the starting time, all times are approximate. We expect the seeding rounds to go quickly since all matches are pre-assigned and a list is distributed to all teams, making match flow smooth. The double-elimination rounds match-ups depend on how your team finishes each time, so match flow is a bit slower.

9:00 am - 1:00 pm (approx)..... Seeding Matches (*see page 45 of the Rules*)

1:00 pm - 2:00 pm ..... Afternoon break, seeding calculation

2:00 pm - 6:00 pm ..... Double Elimination Tournament

6:00 pm - 7:00 pm ..... Semi-finals and Championship Rounds

7:00 pm - 8:00 pm ..... Presentation of Judges Awards

**REMEMBER**

**Bring an extension cord and power strip for your pit station.**

(continued)

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #9

Date: February 13, 1995  
From: Eric Rasmussen  
Re: Autodesk Reminder, Disney Overview Schedule, Q & A  
Note: 4 pages by fax

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### DEADLINE: February 24, 1995

See your animation on stage during the 1995 National U.S. FIRST Competition at EPCOT at the Autodesk, Inc. Image and Animation Celebration. See pages 69 and 70 of the Rules for details on submissions and shipping addresses. All entries must be received by Autodesk by February 24th! Call Kaki Leyens at Autodesk, Inc. at (415) 507-6418 if you have any questions or comments.

### Disney Schedule

The schedule at Disney will be similar to past U.S. FIRST Competitions. Complete details will be published after the New England Tournament, but here is an overview:

- Thursday: Practice day (team registration from 9-12; practice from 12-9)
- Friday: Seeding matches (9-3 approx)
- Saturday: Double Elimination Tournament and Finals(9-4 approximately).

NOTE: The Awards Ceremony will be after all play and begin at 7:15 with a "Wrap Party" following from 8-10 pm. We hope your team is planning to stay and celebrate with us!!!

### Questions & Answers

- Q80. May we use PVC pipe to construct an air accumulator? May we use syringes or other components from SPI for pneumatics? May we build our own pump?  
A80. No. As was stated in A70, in Team Update #4 sent on 1/26/95: "... for safety reasons, only items listed under the PNEUMATICS section of the kit list on pages 10 and 11 of the manual may be used to store, generate, or transmit compressed air (or vacuum)." The only change since then is that pneumatic fittings, listed on pages 41 & 42 of the Small Parts, Inc. (SPI) catalog may be used. Tubing and other components from SPI may not be used for pneumatics.
- Q81. We noticed that the latex tubing from SPI is not the same as the latex tubing in the kits. Where can we get more of the Latex tubing which was included in the kits?  
A81. U.S. FIRST purchased the Latex tubing from TotalMed in Manchester, NH. TotalMed may be reached at 603-624-0091. The part number for the tubing is TMED-2101.
- Q82. In fax update #2, A26 seems inconsistent with other answers regarding the allowed length of chain/belt allowed in the vehicle. Please clarify.  
A82. A26 was worded incorrectly. It refers to chain/belt purchased from outside sources only.
- Q83. Are bolts or threaded rod considered fasteners?  
A83. Yes, if they are used to fasten two or more items together as allowed in the rules. See rule K10 on page 6. A threaded rod or bolt used as a lead screw, cross bar, or axle would not count as a fastener.
- Q84. Are washers considered fasteners?  
A84. Yes, if used in a normal washer application. See rule K9 on page 5. Washers used for structural purposes, such as welding a stack together to create a support, are not counted as fasteners.
- Q85. May we make our own gears, sprockets, lead screws, pulleys, etc. using materials in the kit?  
A85. Yes. See rules K1 and K6 on page 5.

- Q86. We have a material listed in the SPI catalog available from a local source. May we use the material from the local source and simply count the cost of the equivalent SPI part against our \$425 total?
- A86. No. Parts not included in the kit or listed on the additional hardware list must come from SPI.
- Q87. If we deploy an obstacle, and another vehicle pushes/pulls on it such that the movement of the obstacle results in damage to the carpet, who, if anyone, will be disqualified?
- A87. The team which deployed the obstacle would be disqualified. You should not design a mechanism to attach to the rug or other playing field surfaces in such a manner that the playing field may be damaged.
- Q88. May we add an audio output device, camera, flags, etc. to our vehicle for entertainment reasons?
- A88. Yes. Devices which do not affect the outcome of a match may be used for entertainment reasons. If these devices require power, it must be supplied from an independent source. Devices which transmit RF signals may not be used. Lastly, these devices do count against weight and size constraints.
- Q89. May we purchase extra wire for use in our machine?
- A89. No. You may only use wire included in the kit. See rule C3 on page 21.
- Q90. May we shorten the leads on the battery box, speed controllers, or servos?
- A90. No. See rules C1 and C4 on page 21.
- Q91. May we modify the joysticks either electrically or mechanically?
- A91. No. See rule C1 on page 21.
- Q92. May we take the bearings out of the wheels included in the kit and use them for other purposes?
- A92. Yes.
- Q93. May we use the air cylinders in the kit as air accumulators and start the match with them extended and pressurized?
- A93. Yes.
- Q94. We understand that there may be a platform behind the back wall for the teams to stand on for better viewing of the field. How high will this platform be?
- A94. The platform will be approximately 2 feet high.
- A95. May we construct a harness for our drivers to wear to hold the control system components?
- A95. Yes. Materials used must be legal kit materials, and count against total quantity limits and the \$425 limit if purchased from Small Parts. However, the harness does not count against the weight and size limits for the machine.
- Q96. Will there be a stand or other support for the joysticks behind the back wall?
- A96. Yes.
- Q97. May we use tubing or rubber sheet from SPI as a spring?
- A97. No, only items from SPI specifically listed as springs may be used as springs.
- Q98. Channel 1 on our receiver doesn't seem to give us reverse on our speed controller, and we have already adjusted the trimmer on our joystick all the way. Only channel 2 is working. What should we do?
- A98. You must follow the instructions in the Tekin Owner's Manual to adjust the neutral point on your speed controller. Also, any of the 8 PWM output channels on the receiver can be used to control the speed controllers. However, we strongly recommend using a channel controlled by a proportional input device rather than a switch.

- Q99. The additional hardware list specifies that we may purchase up to 4' x 4' of 1/2" thick plywood, but does not specify the grade. What grade may we use?
- A99. You may use any standard commercial grade of 1/2" plywood. You may not use any custom-made or special order grades.
- Q100. Our speed controllers seem to have different output voltages at full forward. We measured one at 10 volts and the other at 11. Is this normal?
- A100. The output voltage at full forward should be the same if both motors are rotating at the same speed. First, be sure that the joystick trimmers and speed controller settings are set properly. You may wish to connect a servo to the appropriate output channel to verify that it travels over the full range of motion. If so, then the problem lies in the speed controller adjustment, motor, or drive train. If not, then the problem lies in the adjustment of the joystick trimmer. Second, you may want to control both speed controllers from 1 PWM signal by using the Y-connector in order to verify that they are both receiving the same signal. Third, try swapping the drill motors to see if they are the cause of the variation. Fourth, if you still have not determined the cause, call Tekin. Lastly, if you are still having problems, call U.S. FIRST for assistance.
- Q101. May we build, or finish building, a mechanism during the three week period when machines are being stored at Epcot, and attach it to the machine prior to the first seeding match at Epcot?
- A101. No.
- Q102. May we keep our control system during the three week period when machines are being stored at Epcot?
- A102. No.
- Q103. If we machine one of the Skyway wheels included in the kit, and then decide that we didn't want to do so, may we purchase an identical model of wheel from Skyway and use it in the final machine?
- A103. Yes. Team Update #3 includes ordering information for Skyway wheels. The last paragraph of this update should be phrased: "While teams are allowed to purchase *additional* wheels for prototyping work, it should be emphasized that only the *models* of wheels which were shipped in the original kit may be used in the final machine."
- Q104. May we disassemble the gearbox and modify it, including modifying the case or support structure?
- A104. Yes, this is allowed. However, if you break the gearbox while doing this, U.S. FIRST will not be inclined to provide a replacement. Instead, it is recommended that you purchase a spare Milwaukee 12 volt cordless drill for a hardware store for such experiments.
- Q105. Page 15 of the manual defines "out-of-bounds" as anywhere past the plane of the inside edge of the 4x4 boundary. Does this mean that it is only necessary to move a competitor's machine through this plane in order for their machine to be turned off?
- A105. Not exactly. See rule P8 on the same page. A machine could lean out of bounds while still having the base in bounds, and it would not need to be deactivated. The deactivation rule is only in effect to prevent machines from running around loose on the basketball court or stage.
- Q106. May a machine react off the back wall in the same manner as it can interact with the inside surface of the 4x4 boundary? That is, can it deliberately slide against or push off of the back wall surface?
- A106. No. You may not design your machine to react off the back wall. If you happen to bump into it due to driver miscalculation, or get pushed against it by another machine, that is ok.
- Q107. May we use more than one fan?
- A107. You may not purchase another fan. You could take a motor in the kit and make a fan.
- Q108. Is the plywood on the two main edges of the speed bump beveled for a smooth transition to floor height, or is there a step?

- A108. The carpet covering the speed bump extends slightly past the edge of the wood, so that the step-height will be equal to the carpet thickness.
- Q109. May we use a solvent to bond polycarbonate sheets together?  
A109. Yes, the solvent being used as an adhesive is considered a fastener.
- Q110. May we use Helicoil to reinforce threaded holes?  
A110. Yes, the Helicoil would be considered a fastener.
- Q111. What is the proper wiring for the pneumatic valves? Which two terminals should we apply power to?  
A111. Power should be applied to Terminal Power (+) and Terminal Neutral (-). The Ground terminal should not be used.
- Q112. What is the proper wiring for jumpering R13 and R14 on the transmit board?  
A112. One side of R13 should be jumpered to the other side of R13. The same procedure should be performed for R14. There should be no connection between R13 and R14.
- Q113. May we use pagers, beepers, or cellular phones in the pit area or on stage?  
A113. Beepers/Pagers will be allowed in the pit area, but not on stage. No cell phones or other two-way communications devices will be allowed. U.S. FIRST will have at least one cellular phone available for emergency use, and a number will be published for incoming emergency calls.
- Q114. May we modify off-the-shelf springs from SPI?  
A114. No. Rule K12 on page 6 states that you cannot make your own springs or buy those which are not available "off-the-shelf". Modification of springs would be akin to making your own springs.
- Q115. May we use velcro to attach to the carpet?  
A115. Yes.
- Q116. If we use a roll pin to connect a shaft and shaft coupling, is it considered a fastener?  
A116. Yes.
- Q117. Will there be any visible or audible indication when a team has scored? If so, will they be different for each team, or a single signal of some type?  
A117. The scores will be constantly updated on the computer by a referee standing on the side of the playing field. The computer will display the scores on monitors around the playing field.
- Q118. Will the carpet on the speed bump and ramps be one continuous piece with the floor, or separate?  
A118. No, the speed bump and ramps will be covered with separate pieces of carpet which will extend slightly past the ends of the ramp/bump.
- Q119. May we use larger wire nuts than those included in the kits to connected the 12 AWG wire?  
A119. Yes.
- Q120. May we move a motor from one mechanism to another between matches, as long as both mechanisms and the motor are always on the machine? In a similar vein, may we change sprockets between matches in order to select different ratios, as long as all sprockets used are always on the machine?  
A120. Yes, and yes. All configurations used must fit within the initial size constraints, though.

To: J. Davidson or T. Railey, Kokomo High School  
 Fax Phone: 1-1-317-455-8050  
 From: U.S. FIRST  
 Fax Phone: 603 666 3907  
 Voice Phone: 603 666 3906  
 Date: Tuesday, February 14, 1995 6:45 PM

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #10

Date: February 14, 1995  
 From: Eric Rasmussen  
 Re: Corrections, Q & A  
 Note: 1 page by fax

### CORRECTIONS:

In A113 of Team Update #9, all two-way communications devices, including cellular phones, were prohibited at the U.S. FIRST competition. Since making that decision, U.S. FIRST has decided to allow the use of cellular phones in the pit areas, but not in the audience, gym, or on stage.

### Questions & Answers

- Q121. May we build a bigger heat sink for the speed controllers using materials in the kit?  
 A121. Yes, but this may void the warranty on the speed controllers.
- Q122. May we use solderless connectors to attach wires to the switches mounted in the blue project box?  
 A122. Yes, you may use solderless connectors inside the blue switch box. Solderless connectors may not be used on the machine, though.
- Q123. May we use rubber bands as energy storage devices?  
 A123. You may use the rubber bands included in the kit as energy storage devices, though they may not be used to launch projectiles. Rubber bands not included in the kit may only be used as fasteners.
- Q124. If we use a rubber band to pull two items together and then hold them together, does it count as a fastener?  
 A124. No. The rubber band performs work in pulling the items together and is therefore not considered a fastener.
- Q125. If we bend a piece of threaded rod to form a u-bolt, will it be considered a fastener?  
 A125. Yes.
- Q126. We are not able to find schedule 40 PVC pipe fittings at a local supplier. May we use schedule 80 fittings which are available?  
 A126. Yes. You may use schedule 40 or 80 fittings with the schedule 40 pipe.
- Q127. May we use flanges to mount our PVC pipe?  
 A127. No. See rule K13 on page 6 of the manual for a description of allowed PVC fittings.



## 1995 U.S. FIRST COMPETITION TEAM UPDATE #11

Date: February 16, 1995  
From: Jessica Forbes  
Re: New England Tournament Reminders  
Note: 2 pages by fax

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If you have not already done so, please:

1. Pay any outstanding invoices  
All invoices pertaining to the Competition (Registration Fees, Repairs, replacements or spare parts) must be paid by next Friday, February 24, 1995 in order to participate.
2. Call or fax us with the name of your shipping contact person.  
If you are attending the National Championship, your machine must be shipped there. To take advantage of UPS complimentary shipping, they need to know by February 22.. Call us for details.
3. Send us your Team Breakfast List  
We need to know how many people to feed! Send us a list or call us with a number. Additional guests over 30 will cost \$10 per person. Your team will be invoiced.
4. Call us for Bus parking instructions  
Parking for busses will be at a nearby lot since we expect the public to fill up the school lot. Call ahead to make your trip smooth.
5. Sign up for the National Championship!!  
Yes! You can still go to Disney! Teams signed up for only the New England Tournament may sign up for the National Championship at any time up to March 3rd, the date by which your machine would have to be shipped.
6. Check the pressure from your pumps  
It has come to our attention that some of the high output lumbar pumps may not be supplying the rated pressure. If you plan to use this pump in your machine, please verify that it can supply approximately 20 psi maximum pressure. If you discover that it is significantly below this level, U.S. FIRST will provide a replacement pump.
7. Be cautious with your speed controllers  
If you have problems with speed controllers overheating easily, it may be due to excessive friction in your drive system, or an inappropriate gear ratio between the motor and the next stage. Please be careful, it is possible to burn out the speed controllers.

**Note these changes/reminders/updates in preparation for the Tournament NEXT WEEK!!**

1. **Memorial High School**  
REMINDER: The address printed in the Rules is incorrect. The correct address is 403 South Porter Street, Manchester, NH 03103. Directions can be found in Team Update #8.  
REMINDER: School will be in session until 12:00 on Friday. Please help us by staying only in the Pit area or in the Gym, especially when classes are changing. We will post a bell schedule.
2. **Registration: Friday, 2/24, 9 am - 12 pm**  
REMINDER: Please come prepared to surrender your Rnets and two of your batteries.  
CHANGE: Please also bring your Receive box to the Registration area. U.S. FIRST will be making a software change that will not affect the performance of your machine, but will enhance the running of the Competition event. Re-programming will be done on-site and possibly while you wait.

3. **Practice times: Friday, 2/24, 12 - 9 pm**  
REMINDER: Times will be assigned when you register.  
CHANGE: You will still get a full hour of guaranteed pre-assigned practice time; however, in three 20 minute sessions instead of two half hours. This way more teams can practice in an hour as well as waiting time between practice times will be shorter.
4. **Pit Power**  
CHANGE: Because of the configuration of the school cafeteria, there will not be power available at each table. There will be two large work areas available to all teams with ample power for electrically powered tools. You may not use an extension cord to take power back to your table--the Fire Department will not allow it. We encourage you to bring battery-powered hand tools!  
REMINDER: U.S. FIRST will have a battery charging station set up at the entrance to the Pit. We are happy to exchange a charged battery (or two) for a "spent" one (or two). You do not necessarily need to charge your own batteries while at the Tournament.
5. **Pit to Gym Transit**  
UPDATE: The Pit area and the playing fields are between 50-75 yards apart. If you have a cart which you have been using to move your machine around, we suggest your bring it to make transport quick and easy.
6. **Official "Ramp N' Roll" t-shirts**  
UPDATE: Official "Ramp N' Roll" t-shirts will be available for purchase at the tournament for \$12 (cash or check). If you have seen the design for last year, hold on! This year's signature shirt will knock your socks off. Since we cannot sell shirts at Epcot, teams not attending the New England Tournament will receive mail order instructions so they can get their shirts in time to clearly stand out in Florida as official competitors.
7. **Awards Ceremony**  
REMINDER: The presentation of the New England Judges' Awards (Outstanding Design, Number One Seed, etc.) will be done on Saturday, after all play. We hope you will plan to stay with us--besides, you might be one of the award recipients!
8. **Chairman's Award Materials: February 22, 1995**  
REMINDER: Submissions for the Chairman's Award must be in the U.S. FIRST office no later than 5:00 pm on Wednesday, February 22, 1995. See pages 47-48 and 51 of the rules for further details.

### Questions & Answers

- Q128. May we take our 20 feet of Nylon rope and unravel it?  
A128. Yes.
- Q129. One of the items listed on the additional hardware list is "Plywood, Chipboard, or Particle Board". May we mix and match the types of wood as long as the total quantity is not exceeded, or must all wood be of the same type?  
A129. All wood must be of the same type.
- Q130. May we anodize aluminum?  
A130. No, this is a chemical change to the material and is not allowed. See rule K15 on page 6.
- Q131. May we use straight through or 4-way PVC connectors to connect sections of PVC pipe?  
A131. Yes.

To: J. Davidson or T. Railey, Kokomo High School

Fax Phone: 1-1-317-455-8050

From: U.S. FIRST

Fax Phone: 603 666 3907

Voice Phone: 603 666 3906

Date: Monday, February 20, 1995 8:17 PM

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**1995 U.S. FIRST COMPETITION  
TEAM UPDATE #12**

Date: February 20, 1995

From: Jessica Forbes

Re: Notes for teams attending the U.S. FIRST Competition in Manchester

Note: 1 page by fax

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The Pit Stations will have Power!

Previously, it was announced that electricity would be available only in two locations in the pit area, and not at the individual pit stations. We have now found a safe method to route power to each pit station. However, the number of outlets per station will be still be limited. Please bring extension cords and power strips to provide a suitable location and number of outlets for your needs.

\$\$\$!

Teams with outstanding balances for repair or replacement of control system components must pay the full balance in order to compete. Checks or company P.O.s are acceptable forms of payment, and will be accepted during the registration process. If you have questions about your balance, please call Susan Howland at (603)666-3906.

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #14

Date: February 27, 1995  
From: Eric Rasmussen  
Re: Important Updates for National Competitors  
Note: 3 pages by fax

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### **BE SURE YOUR MACHINE DOES NOT VIOLATE THE RULES**

Based on our experience inspecting machines at the Manchester Tournament, the following are the most frequent or most serious rules violations encountered. Machines must be in compliance with the rules in order to compete.

#### Electrical Wiring

- All wire used in the vehicle must come from the original kit of parts. You may not use additional wire from outside sources.
- You must use 12 AWG wire to connect the Relay Box (power input), Speed Controllers, and Drill motors.
- Batteries must be wired in parallel.
- All connections must be soldered or use wire nuts. Solderless connectors (bullet, spade, etc.), terminal strips, etc., are not allowed. The only exception is that solderless lugs may be used inside the switch box to connect wires to the rocker switches.
- Soldered connections, such as on the limit switches and circuit breakers, must be insulated with electrical tape or heat shrink tubing.

#### Pneumatics

Custom-made suction cups, pneumatic fittings, air cylinders, pumps, air accumulators, and so forth are not allowed, even if they are created from components included in the kits. Also, valves, syringes, tubing, and so forth from SPI or outside sources may not be used for pneumatics. As stated in previous rules updates, "...only items listed under the PNEUMATICS section of the kit list on pages 10 and 11 of the manual may be used to store, generate, or transmit compressed air (or vacuum)." The only exception is that pneumatic fittings, listed on pages 41 & 42 of the Small Parts, Inc. (SPI) catalog may also be used.

#### Mounting Controls System Components

Control system components should not be marked, and adhesives such as tape, stick-on velcro, etc, should not be used for mounting. The only exception is that masking tape which may be easily removed may be used to prevent accidental movement of the joystick trimmers. Control system components should be mounted using mechanical fasteners such as clamps, wire ties, or harnesses made of tubing or velcro.

The battery boxes may not be modified. They may not be cut, or drilled. In addition to the fastening methods mentioned above, you may mount the battery boxes using 1/4-20 screws, which will fit tightly into the holes on the bottom of the battery box.

If you have any questions about what is or is not legal, please call Eric Rasmussen at 603-666-3906.

#### **U.S. FIRST BBS BACK ON-LINE**

Due to a power outage on Friday, February 24, the U.S. FIRST BBS was not operational during the weekend. The situation has now been corrected, and teams are welcome to continue to post questions and comments on the BBS.

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #15

Date: February 28, 1995  
From: Eric Rasmussen  
Re: Results from the Manchester Competition & Updates  
Note: 2 pages by fax

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### UPDATE FOR TEAMS ATTENDING THE EPCOT COMPETITION

#### Repairs to vehicles

During the round-robin competition, and early in the double-elimination competition, teams often have 15 minutes or more between matches during which machines may be repaired. As the pace quickens during the later matches of the elimination tournament, the time between matches decreases drastically. Near the end, it is common for a machine to compete in several matches in a row. Please attempt to insure that your machine is sufficiently durable to compete in this fashion.

If a machine must be repaired in order to compete, and the order of matches cannot be rescheduled in order to accommodate these repairs, the affected team will be granted a period of 5 minutes to complete repairs before forfeiting the match. In recognition of the fact that some repairs may reasonably take more than 5 minutes, each team will be allowed one 15 minute timeout which may be used upon reaching the quarter-finals.

#### Spare Parts

U.S. FIRST will have on hand a limited number of kit components to replace those which are damaged during the competition. U.S. FIRST will not supply replacements for parts purchased from Small Parts, Inc. or outside sources. Instead, teams are permitted and encouraged to purchase or manufacture spare machine components and bring them to the competition.

These spare components must be functionally identical (weight, material, dimensions, etc.) to the parts on the machine at the time it is shipped to Epcot, but may be purchased or manufactured after the machine has been shipped. See rule K14 on page 6 of the manual.

### RESULTS OF THE MANCHESTER COMPETITION

U.S. FIRST has received many calls asking for results of the Manchester Competition. We are proud to list the top 10 teams. If you competed in Manchester, do not see your team listed here, and would like to know your ranking, please call U.S. FIRST. Please note that the ranking scheme is based on how close each team was to winning the double-elimination competition, and is not based on seeding or average performance.

1. Osram Sylvania & Manchester Central High School, Manchester, NH
2. Johnson & Johnston/Astro/Brooks & Salem High School, Salem, NH
3. Honeywell Inc. & Cortez High School, Phoenix, AZ
4. R.F. Harris Corporation & Edison Technical High School, Rochester, NY
5. Stratus Computer/The Whiz/Water Instrument Op./ADRA & Assabet Valley Regional High School, Marlboro, MA
6. Procter & Gamble Company & Walnut Hills High School, Cincinnati, OH
7. Public Service of New Hampshire & West High School, Manchester, NH
8. Northeast Util/Coast Guard & New London H.S./Williams, Hartford, CT
9. Carrier Corporation & Canastota High School, Syracuse, NY
10. Navel Undersea Warfare Center/TIMES<sup>2</sup> & Rogers H.S., Providence, RI

To: J. Davidson or T. Railey, Kokomo High School

Fax Phone: 1-1-317-455-8060

From: U.S. FIRST

Fax Phone: 603 666 3907

Voice Phone: 603 666 3906

Date: Friday, March 24, 1995 5:34 PM

## 1995 U.S. FIRST COMPETITION TEAM UPDATE #19

Date: March 24, 1995  
From: Jessica Forbes  
Re: Disney details, #4  
Note: 1 page by fax

### MEAL & PASS PACKAGES

A limited number of packages will be available next Wednesday and Thursday. Here's how to buy the packages:

<b>What is in it?</b>	two meal vouchers per day (breakfast and lunch OR dinner), and a park-hopper pass.
<b>Prices</b>	3 days for \$134.50; 4 days for \$157
<b>Where to buy</b>	Go to the Guest Services window at the front gate of Epcot on Wednesday (3/29) or Thursday (3/30) between 8:00 am - 9:00 pm.
<b>How to pay</b>	Cash, US Traveler's checks, Visa, MasterCard, American Express, Personal Check with major credit card

- If you have told us that you want to purchase packages, they will be set aside for you at the window.
- If you plan to purchase packages and have not told U.S. FIRST, let us know and we can be sure some are put aside for you.

### WRISTBANDS REMINDER

All wristbands will be left at the All-Star Music Resort. Please go there to pick them up. They will be left under your team name and will be handed out all at once. Please arrange to get a wristband to anyone associated with your team who is expecting one. We suggest you meet at the All-Star Music in time to catch one of the busses (6:30 am - 10:45 am) to the backstage door.

### DEAN KAMEN ON CNN

CNN will be repeating its fall broadcast of the half-hour interview with Dean on their show "Pinnacle." It will be broadcast on Sunday, March 26th, on CNN, at 7:00 pm EST. As always check your local listing!

**1995 U.S. FIRST COMPETITION  
TEAM UPDATE #21**

Date: April 28, 1995  
From: Jessica Forbes and Susan Howland  
Re: Important notice on the Chairman's Award Finalists and TV Coverage  
Note: 1 page by fax

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**CHAIRMAN'S AWARD FINALISTS**

We made an error in the Chairman's Award Finalists. While the Nypro/ Clinton team were one of a select group considered in the judges' final decisions, they were not named in the official awards ceremony as a finalist.

The three official Chairman's Award Finalists for 1995 are as follows:

**Honeywell Inc./Cortez High School (AZ)**  
**Delco Electronics/Kokomo High School (IN)**  
**Procter & Gamble/Aiken High School (OH)**

Sorry for any confusion this may have caused. Congratulations once again, to all participants for an outstanding effort this year!

**TELEVISION COVERAGE OF THE COMPETITION**

We will be in touch as we hear of any coverage on the 1995 Competition via fax or postcards. C / NET Central was at EPCOT covering the event and will run their segment on the Competition as follows:

**USA NETWORK**

9:00 am-Saturday, May 6 EST, Central, Mountain, PST  
6:30 am-Sunday, May 7 EST, Central, Mountain, PST  
1:30 am-Monday, May 8 EST, Central, Mountain, PST

**SCIFI CHANNEL**

10:30 am EST, Sunday, May 6, Check local listings for time.  
10:30 pm, EST, Sunday May 6, Check local listings for time.  
2:30 am, EST, Monday, May 7, Check local listings for time.

The USA network feed is set for the same times in each time zone. The SciFi Channel settings are set for EST only. Check local listings for correct times.

**NEWS AT U.S. FIRST**

U.S. FIRST continues to evolve here in the office as well. We expect to add a new Administrative Assistant within one month, allowing Susan to take the lead on managing the Competition. Jessica will now be working on grant funding and administering the 95 survey.. Watch for it. Please call Susan if she may be of any help to you or if you have a team to be recruited!

"Output channels 1 through 4 are fixed. Channel 1 is always A1, which corresponds to the X-axis of the joystick connected to I/O Port 2. Channel 2 is always A2, which corresponds to the Y-axis of the joystick connected to I/O Port 2. Channels 3 and 4 correspond to the X (A5) and Y (A6) axes of the joystick connected to I/O Port 1, respectively. The remaining 4 output channels may be configured by setting DIP switches located inside the transmit box."

- **ON TEAM UPDATE #1 (1/13/95):** We said that fasteners purchased from Small Parts counted against your \$425 limit. That is incorrect. Rule K9 on page 5 of the Rules stands as originally written. Fasteners bought from SPI do not count against the \$425 limit.
- **ON TEAM UPDATE #2 (1/19/95):** Answer A26 should read: "No, 10' is the total quantity of belt (and/or chain) from outside sources allowed in your machine."

### Wheels

Many teams have been asking where additional wheels can be purchased. Skyway Recreation Products, the maker of the wheels in the kits, has agreed to sell wheels directly to teams. Here is the supplier information for Skyway:

Skyway Recreation Products  
4451 Caterpillar Road  
Redding, CA 96003  
800-332-3357 / 916-243-5104 (fax)

Ask for Parrey Cremeans. If he is unavailable, ask for Ken Coster. The part numbers for the wheels included in the kits are:

WHL0000000115 - 6" Ø caster wheel, 5/16" i.d. bearings, 1-1/2" wide flange  
WHL0000000033 - 8" Ø caster wheel, 5/16" i.d. bearings, 1-1/2" wide flange

While teams are allowed to purchase spare wheels for prototyping work, it should be emphasized that only the wheels which were shipped in the original kit may be used in the final machine.

9:00 am - Saturday, May 6 EST, Central Mountain, PST  
6:30 am - Sunday, May 7 EST, Central Mountain, PST  
1:30 am - Monday, May 8 EST, Central Mountain, PST

### SCI-FI CHANNEL

10:30 am EST, Sunday, May 6, Check local listings for time.  
10:30 pm, EST, Sunday May 6, Check local listings for time.  
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