IEEE Southeast Con 2006
<u>Hardware Competition Rules</u>

Ramp:
1. The board is 3/4" plywood, cut into a 4' x 4' square.
2. The board's surface is painted black, while all markings on the board are painted white.
3. There is a starting square 8" x 8" in one corner, into which the robot must fit at the start and finish of each round.
4. Rectangles are painted to represent airplane parking spots, slightly smaller (5" wide by 11-1/2") than the size of the airplanes.
5. Lines lead from the starting square to the package stacking chute and to the planes.
6. There is a "positioning mark" perpendicular to the lines leading past each plane which is aligned with the end of the plane.
7. There is a large unmarked area to the side of the package chute which may be used by a team at its discretion for additional working room.

Planes:
1. Airplanes are represented by cardboard boxes measuring 6" wide by 12" long by 3" high, and can be made by cutting a 6" x 6" x 12" box (such as OfficeMax item #172873) in half.
2. The boxes are left open on top.
3. Although a plain brown cardboard box is described, the actual boxes used may be of any color.
4. The airplanes are numbered 1, 2, and 3 and will be positioned over their corresponding rectangles painted on the ramp. The planes will not be identified in any way with their number.
5. The boxes will not be affixed to the ramp other than by gravity.
6. Airplane 1 leaves three minutes after the start of the round. Airplane 2 leaves four minutes after the start. Airplane 3 leaves five minutes after the start.
7. At the time of departure for each plane, it will be physically removed from the playing field.
8. Planes must be loaded from the "loading zone" side of the plane. This is the side of the plane closest to the starting square side of the board. (This is depicted in the drawing showing the board layout but is not painted on the actual ramp.)

Packages:
1. Packages are cut from a length of dimensioned #2 pine lumber nominally 2" x 4" (approximately 1-1/2" x 3-1/2") cut into twelve blocks each 2-1/8" long. (Save the rest of the board.) Edges may be sanded for smoothness, but will not materially change the overall dimensions of each block.
2. The blocks may be painted any color or left in the natural finish of the wood.
3. Each package will have a barcode label on the top and on the front (side facing the robot) as delivered by the chute. Both labels are oriented parallel to the long edges of the package.
4. Barcode labels will be white with printing in black.

5. The barcode format is Codabar. Registered teams will receive a sheet of actual labels for project development.
6. There are a total of twelve packages in a round, four of which are designed for each plane.

Robot:
1. The robot must be a single autonomous device.
2. It may not separate into multiple units.
3. The maximum starting and ending size of the robot is 8" wide by 8" long by 12" high.
4. Upon starting, the robot may expand to a maximum size of 14" wide by 14" long by 20" high.
5. Upon completion of the round, the robot must again be no larger than 8" wide by 8" long by 12" high.

Package stacking chute:
1. The package stacking chute will consist of a triangular "FedEx Tube" measuring nominally 6" on each side and fastened vertically in one corner of the ramp.
2. Both ends of the tube are open, which requires cutting the flaps off to an even edge on all three sides. Cut the tube to half its length. (This is more easily done before assembling the tube.) (Be careful when gluing the overlapping sides of the tube together so that the finished interior dimension along that side is sufficient for the packages to fit snugly, but with enough tolerance to slide down the chute! Careless assembly can result in inconsistent overlap, causing binding or slop in the completed chute.)
3. The lower end of the chute is between 1-3/4" and 2" above the ramp surface. (To fix the tube in this position, cut the remaining length of 2" x 4" lumber in equal lengths and fasten (staples recommended) onto two sides of the tube. The fasteners should be from the inside of the tube into the wood. (Do this before you glue the tube into its triangular configuration.) Mount the wooden supports to the ramp using four 1-1/2" x 1-1/2" corner brackets and sixteen #8 x 3/4" flat-head wood screws.
4. The chute will be loaded with twelve packages for each round. The order of the packages will be the same for every robot in a round, but it will be different in each round. (The easiest way to load packages into the chute and maintain the same orientation is to insert a stick, longer than the chute is high, against the side that the robot will approach. Insert each package between this stick and the side, pressing down just enough to move the stack of packages a bit farther down the chute. Do not let the packages drop to the bottom on their own. By maintaining pressure against the stack with the stick, you can hold the entire stack of packages in position until the last one is loaded, at which time you ease off the pressure to allow the entire stack to slowly drop to the bottom of the chute.)

Administration:
1. To qualify for the contest, a robot must extract one package from the loading chute, allowing the next package to fall from the shoot onto the ramp. A team will be given up to three rounds to qualify, with each round lasting two minutes.
2. The starting and ending size of the robot will be confirmed for each round by placing a box over the robot. Each team will perform the measurement of its own robot under

the supervision of the Contest Committee. The measuring box must touch the board surface on all sides.

3. All robots competing in a round must be positioned in a holding area prior to the beginning of that round. Electric power will be available. While it may be powered, charging, or turned off while awaiting its run, a robot may not be touched by the team until its allotted start time. It will be returned to the holding area until that round is completed by all robots competing in that round.

4. No programming of the robot will be permitted once the order of the packages has been revealed for a round.

5. An audible signal (the word "GO") will be given by the Contest Committee to start each round. Simultaneously, the timing will begin. Upon this starting signal, each team will manually activate its robot.

6. The robot will return to the required dimensions and turn on a blue LED to signal the completion of its round.

5. Elapsed time will be recorded from the starting signal until
   a. the robot signals completion or
   b. a time limit of 6 minutes has expired.

6. If the robot runs off the board, a time of 6 minutes will be recorded.

7. If a team picks up its robot prior to the completion of its autonomous round, a time of 6 minutes will be recorded.

8. If the robot does not return to the required dimensions at the completion of its round (either by signaling or by elapsed time), a time of 6 minutes will be recorded.

9. The order of competition for each round will be randomly determined.

Scoring:

1. Each robot will compete in three rounds.

2. The maximum number of obtainable points for all three rounds is 300.

3. Points are awarded as follow:
   a. 8 points for each package placed on the correct plane at by its departure time
   b. All packages have the same point value.

4. Points will be deducted as a penalty for each occurrence of the following:
   a. Bump a plane enough to move it out of position (white rectangle visible) – minus 12 points
   b. Package loaded on the wrong plane – minus 2 points

5. Packages must be "on" an airplane at the time of its departure to count. If a package once loaded falls out of the plane, it is considered left on the ramp and is not scored.

6. If the robot leaves the board, its round ends.

7. If a plane is bumped, it will be manually repositioned once the robot leaves the vicinity of the plane.

8. The total time elapsed for each of a robot's three rounds will be used in the event of a tie, with the faster robot winning.

9. If a robot damages a package so that it cannot be re-used, we will be upset. However, any robot that can mangle a block of wood is not one we would want to have mad at us, so no points will be deducted.

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