2007 ASEE MODEL DESIGN COMPETITION

Sponsored by the Two Year College Division of ASEE

Date: September 14, 2006
Dear Colleague,

On behalf of the American Society for Engineering Education (ASEE) - Two Year College Division (TYCD), we invite you to encourage the submission of student design projects for the 9th Annual ASEE Lower Division MODEL DESIGN COMPETITION. This event will be held in conjunction with the 2007 ASEE Annual Convention, Honolulu, HI, June 24 - June 27, 2007. This competition is open to 2nd and 1st year students at four and two year colleges and universities.

In this year's competition student teams will design and build a robot capable of depositing standard ping-pong balls into plastic cups located on opposite ends of a 12' track. The robots must adhere to the guidelines of the model design competition (attached). An oral presentation and written report are included as part of the competition.

The main reason for this competition is for students to gain a better understanding of the design process from start to finish. Designing and building something from an idea is probably why they chose engineering in the first place. Use this design competition as a platform to reinforce their ideas and have some *engineering fun!* We hope to see you and your students' entries in Honolulu.

Please find enclosed the guidelines and registration forms for this event. The interest and registration forms are on the back of this letter.

Sincerely,

Paul E. Gordy
Phone: 757-822-7175
Fax: 757-427-0327
Email: PGordy@tcc.edu

John Wadach
Phone: 585-292-2488
Email: JWADACH@monroecc.edu

Results from the

8th Annual ASEE Model Design Competition

June 19, 2005 - Chicago, Illinois

The ASEE Model Design Competition is a design/build competition for freshmen & sophomore engineering students at 2-year and 4-year colleges. The competition is held each year during the ASEE Annual Convention. The competition typically involves building an autonomous, battery-powered vehicle to navigate some sort of challenging track. The recent competition in Chicago required robots to deposit 12 ping-pong balls sequentially in four corner pockets of an 8' X 8' plywood track in less than two minutes. Scoring for the competition was based on the number of balls deposited sequentially in the pockets, the time to complete the task, and the points earned in the presentation phase of the competition.

Sixteen teams competed and the results were as follows:

1st Place - University of Maryland-Eastern Shore
2nd Place – Monroe Community College, Rochester, NY
3rd Place – Monroe Community College, Rochester, NY

Consider bringing a team from your college to next year's competition on June 25, 2007 in Honolulu, Hawaii. For more information or a copy of next year's rules, please contact Paul Gordy (Pgordy@tcc.edu, 757-822-7175) or John Wadach, Jwadach@monroecc.edu, 585-292-2488).

University of Maryland-Eastern Shore

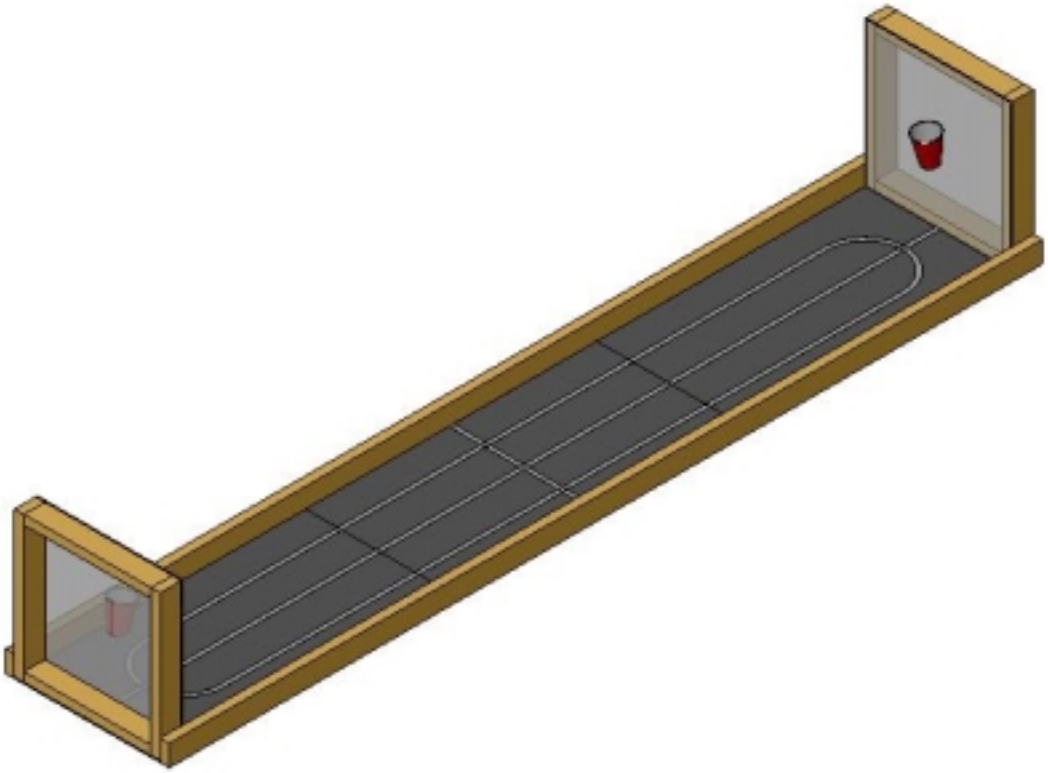
2007 ASEE Design Competition Champions

DESIGN COMPETITION
Honolulu, HI
MODEL COMPETITION GUIDELINES

The American Society for Engineering Education (ASEE) Two-Year College Division (TYCD), Model Design Competition will be held Monday, June 25, 2007 in conjunction with the ASEE Annual Convention in Honolulu, HI.

Objective:
To design and build a zero-emission robot that alternately deposits a total of six ping-pong balls into two 18 ounce Solo Brand plastic drinking cups in less than 120 seconds. An isometric view of the track is shown below.

Figure 1: Isometric View of Track



Track Specifications:

Figure 2: Track Layout (**NOT** to scale due to copy and paste operations)

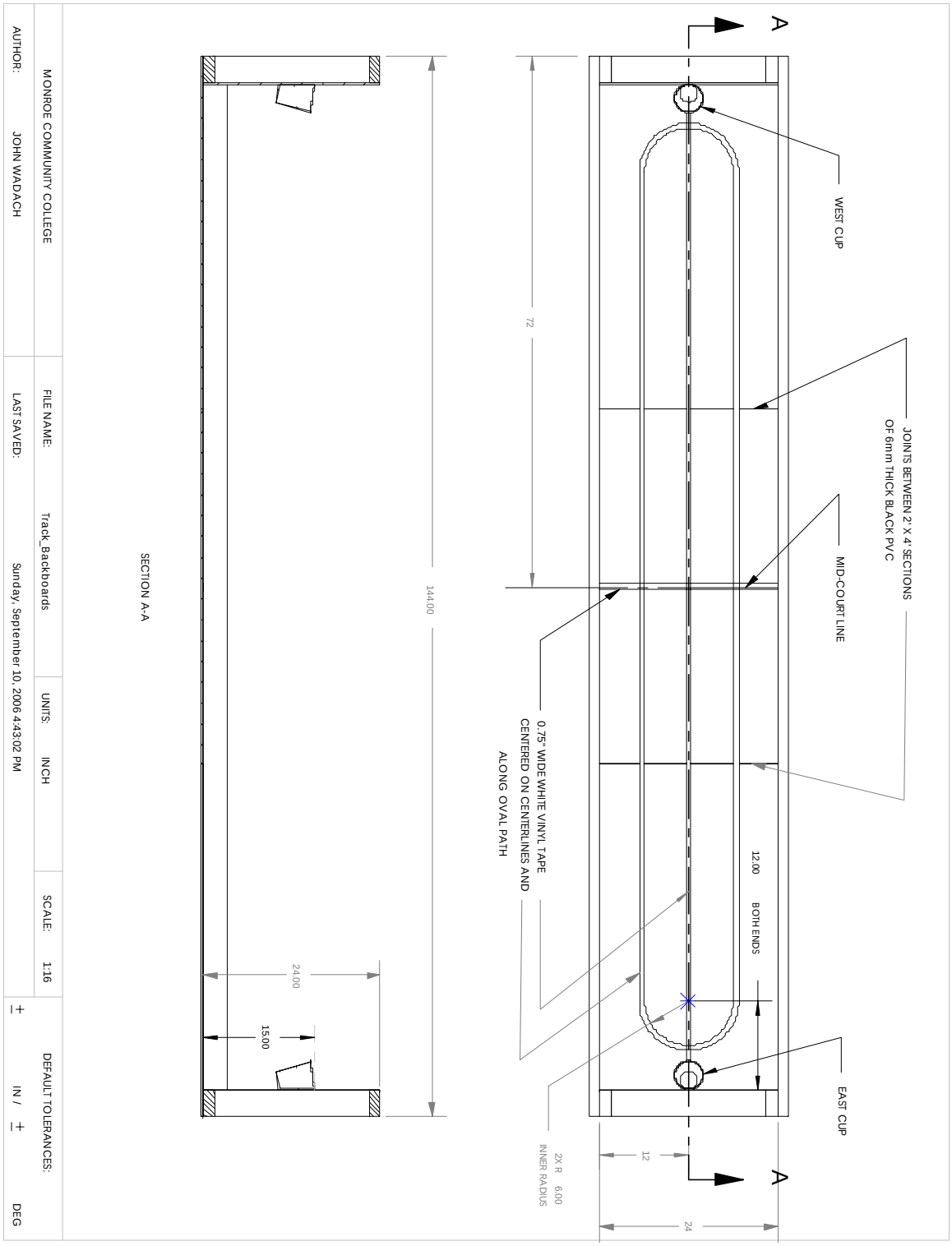
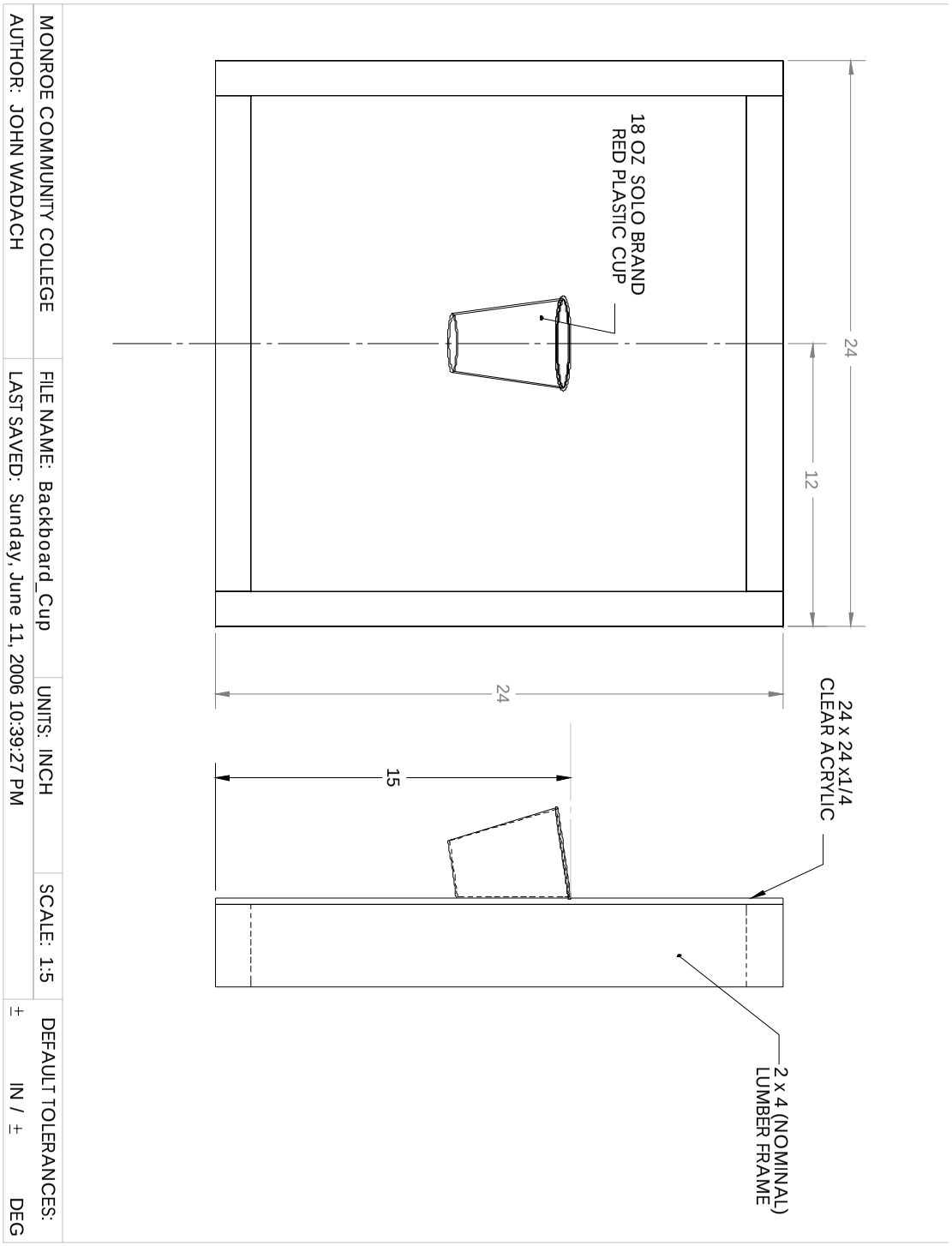


Figure 3: Backboard and Basket (**NOT** to scale due to copy and paste operations)



Track Materials:

1. Two 2” X 4” X 8’ boards (actual dimensions 1.5” X 3.5” X 8’).

2. Two 2” X 4” X 12’ boards (actual dimensions 1.5” X 3.5” X 12’).

3. Two 24" x 24" X 1/4 " Clear Acrylic Sheets available from:
http://www.interstateplastics.com/materials/detail.aspx?ID=AcrylicClearExtruded-SC02

4. Three 24" X 48" X 6mm sheets of black PVC available from:
http://www.interstateplastics.com/materials/detail.aspx?ID=expandedpvc-SBl16

5. One roll of ¾” wide Scotch 35 white vinyl electrical tape available from:
http://www.jameco.com/webapp/wcs/stores/servlet/ProductDisplay?langId=-1&storeId=10001&catalogId=10001&productId=652105

6. Fasteners or adhesive

Construction Procedures:

1. Cut the 2" X 4" boards and fasten them together to create a square box having outside dimensions of 24" X 24".

2. Fasten the 24" X 24" X 1/4" clear acrylic sheet to the front of the square frame using either screws or adhesive.

3. Fasten a red 18-ounce Solo Brand plastic drinking cup to the acrylic sheet in the location defined in figure 3. Metal fasteners or adhesive may be used to affix the cup to the acrylic. If fasteners are used, the heads of the fasteners must not present an obstruction to ping-pong balls.

4. Fasten the backboards to the PVC track using fasteners. Make sure that the head of the fasteners are flush with the bottom surface of the track.

5. Butt the three sheets of black PVC together. Apply duct tape along the joints on the bottom surface of the sheets to hold them together. Flip the sheets over and place the track on a non-carpeted surface. The elevation difference between the sheets along the joints must be less than 1/16”. If an elevation difference of greater than 1/16” is present during the competition the judges will determine a temporary remedy such as standing on the joint without interfering with the robot.

6. Draw lines along the short and long centerlines on the top surface of the track. Apply Scotch 35 white vinyl electrical tape so that the centerline of the tape is coincident with the centerlines on the track. Do not stretch the tape while applying it or it may not stay affixed to the track. The 24" long centerline that is midway between the two "baskets" is defined as the mid-court line.

7. Draw lines along the inside edge of the oval. Apply Scotch 35 white vinyl electrical tape so that the inside edge of the tape is coincident with the line drawn. Do not stretch the tape while applying it or it may not stay affixed to the track.

8. Fasten the 2"x4"X12' long board to the sides of each backboard. The bottom of these side boards should rest on the floor and not on the black PVC surface. In order to decrease shipping costs to Hawaii the side boards may be cut into shorter pieces and fastened together at the competition site.

Vehicle Specifications:

Allowable Energy Sources:
Any energy source is allowed as long as it is completely contained within the robot and does not create or emit any gaseous, liquid, or solid materials. Energy sources must not present any safety hazards to participants or spectators.

Maximum Robot Size at Start:
At the start of a trial the robot and balls must be contained within the following dimensions:

Height: 10.0 inches
Width: 8.0 inches
Length: 12.0 inches

Before each trial the judges may use a measuring template that is placed around the robot to determine if the robot is within the maximum size constraints. Once a trial has begun the robot may unfold into any size.

Components, Fabrication and Cost:
Team members using materials which are commonly available to the general public must perform all fabrication. Use of commercially available vehicles, robots, or entire kits such as RC cars, Legos, K-nex, Fischer-Technics, Parallax or erector sets may not be used. Individual components from these cars, robots or kits may be integrated into a team's robot as long as the majority of the robot's components are not from the same car, robot, or kit source. The cost of purchasing all components must not exceed $350.

Ping-Pong Ball Size:
There is some variation in ping-pong ball sizes. The official diameter of a ping-pong ball changed from 38mm to 40mm in October of 2000. Additionally, even nominal 38mm ping-pong balls may vary somewhat. **For this competition, the size of a ping-pong ball must be at least 37.25mm.** The judges may use a measuring device, such as a metal plate with a 37.25mm hole through which approved ping-pong balls should not be able to pass through. Teams should be ready to present their ping-pong balls for inspection if requested to do so by the judges. Also note that a good source for purchasing ping-pong balls online ($0.95/dozen or $27.90 for 21 dozen with shipping) is:
http://store.rebeccas.com/store/merchant.mvc?Screen=PROD&Product_Code=BLS575&Category_Code=

Robot Navigation:
A trial will be initiated when a team member presses or pulls a button, lever, string, or other starting mechanism on the robot. Energy from the team member's body may not be used to propel the robot or cause components to move on the robot. Once any portion of the robot begins moving the team members may not touch the robot. The robot must be capable of completing the tasks without any input from the team. Team members may not operate radio, infrared, ultrasonic, electrical, or other remote controls once the robot begins moving.

Static Judging:
During the oral presentation session, each team must have their robot on display for the entire session. The judges will inspect the robots for safety and compliance with the rules. If the judges determine that a robot presents a safety hazard, or has the potential to damage any property or the track, the judges will not allow that robot to run in the testing phase of the competition. If the judges decide that a robot is not in compliance with the intent of the rules they will assess a penalty to the team that is proportional to the severity of the violation.

Robot Testing:

1) The robot must begin with some portion of it on or above the mid-court line. The robot including ping-pong balls must begin within the 8" X 12" X 10" maximum size. After a team initiates a trial the robot may change into any size. To score points, all parts of the robot must be completely on the half of the track of the cup that a ball is deposited in. If any part of the robot is on or above the mid-court line, or on the opposite side of the mid-court line, then no points will be awarded for depositing a ball in the cup. A ball is considered to be in a cup if any part of the ball is below a plane coincident with the rim of the cup.

2) The robot may operate for a maximum of 120 seconds after the judge gives the command to start.

3) Each team must provide their own ping-pong balls and the balls may not be modified in any way. Robots may contain a maximum of 6 ping-pong balls at the start of the trial.

4) The ping-pong balls may not be taped, packaged, or bound together in any fashion when they are inside the plastic drinking cups (i.e., the balls must be loose after being placed in the cups). Additionally, no materials other than the ping-pong balls may be left in the cups by the robot or the balls in that cup will not be counted for scoring purposes.

5) The robot may not clamp or hook onto, bore into, or use adhesives or other materials to stick to the track or boards. The robot may not damage, mark, or leave any residue on the track.

6) No part of the robot may touch a cup at anytime. If a robot touches a cup, then no points will be awarded for the balls deposited in that cup while the robot was on the side of the court where the cup was touched. To be able to score points again, the entire robot must travel to the opposite side of the mid-court line. The robot will also be able to score points when it returns to the original side of the court where the touching violation occurred.

7) A robot may deposit the first ball in either the east or west cup. A ball must remain in the cup to earn points for a team.

8) Two points will be awarded for depositing the first ball in a sequence. A sequence is defined as depositing balls one at a time in alternate cups. A perfect run is defined as depositing all six balls one at a time in alternate cups. Scoring for a perfect run is defined below.

Scoring for a Perfect Run

Ball #	1	2	3	4	5	6	Total Pts.
Cup	East	West	East	West	East	West	
Points	2	4	6	8	10	12	42

9) If a robot completes a perfect run then the point total of 42 will be multiplied by a time bonus factor (TBF) as shown below. The TBF is applied only to perfect runs.

Time Bonus Factor (TBF) = (120 seconds / Time to Complete Perfect Run in seconds)

Scoring for a Perfect Run = 42 X TBF

10) Scoring Examples

i. All 6 balls were deposited into the east pocket.

No alternating scoring so each ball earns only 2 points.

Ball #	1	2	3	4	5	6	Total Pts.
Cup	East	East	East	East	East	East	
Points	2	2	2	2	2	2	12

ii. Balls are deposited alternately but ball 4 is shot wide of the cup and falls to the track.

Ball 5 begins a new sequence and therefore earns 2 points.

Ball #	1	2	3	4	5	6	Total Pts.
Cup	East	West	East	Miss	West	East	
Points	2	4	6	0	2	4	18

iii. Balls are deposited alternately but balls 4 and 5 are both deposited in the west cup.

Ball 5 breaks the sequence and begins a new sequence and thus earns 2 points.

Ball #	1	2	3	4	5	6	Total Pts.
Cup	East	West	East	West	West	East	
Points	2	4	6	8	2	4	26

iv. Balls are deposited alternately but 120 seconds elapses before the 6th ball is deposited.

Ball 6 was not in the cup before the time elapsed and therefore earns no points.

Ball #	1	2	3	4	5	6	Total Pts.
Cup	East	West	East	West	East	None	
Points	2	4	6	8	10	0	30

iv. A perfect run is completed in 60 seconds.

The time bonus factor (TBF), is multiplied by the total points to determine the total score.

Ball #	1	2	3	4	5	6	Total Pts.
Cup	East	West	East	West	East	West	
Points	2	4	6	8	10	12	42

Total Score = 42 X (120 s / 60 s) = 84

10) Each team will be allowed to make four trials. The total testing score will be equal to the sum of the points earned in all four trials.

11) The order of testing will be determined by random draw. Each team will have one minute to begin a trial after being called. All teams will be called for a trial in a current round before any teams begin the next round of testing. If time permits, there will be a halftime break of approximately 10 minutes after each team has attempted 2 trials.

11) Teams may not make practice runs during oral presentations, after the start of the robot testing session, or during halftime.

12) Teams may make changes or repairs to their robots between trials.

Oral Presentation:

Prior to the testing of the vehicles, each team shall make an oral presentation that is 10 minutes in duration. The judges may reduce the length of the presentations if the number of entries does not allow the presentation component of the competition to be completed in the allotted time. The oral presentation will be followed by questions from the judges. If time allows, the judges may allow additional questions from the audience.

All participants must be present for all presentations. In addition, each team's robot must remain on display in the presentation room for the entire duration of the presentations. Team members may neither work on, nor test their robots during the oral presentations. The judges will perform their static judging of the robots during the oral presentations.

The objective of the oral presentation is to describe the engineering design process that a team used to arrive at the final solution. The oral presentations should include the components listed below. Each of the 6 topics is worth 5 points. A perfect score for the oral presentation is 30 points.

1. Problem Identification:
   What tasks must the robot perform?
   What constraints were present that limited the design choices?
   What technical problems had to be solved in order for the robot to perform the required tasks?

2. Preliminary Ideas:
   Describe the ideas that were generated for solving the problem.
   Were these ideas adaptations from existing products?
   What criteria were used to narrow the list of possible solutions?

3. Refinement:
   What physical, CAD, and/or analytical models were built in order to evaluate the design alternatives?

4. Analysis:
   What data and results were obtained from the models?
   How did this information help guide the design process toward a final solution?

5. Final Solution:
   Display images of the robot, wiring schematics, and flow charts of programs to describe how it works and how it was fabricated. An itemized cost analysis should also be shown.
6. Presentation Quality:
   The following items will be evaluated by the judges to determine the quality of each presentation: team appearance, organization, vocal quality, visual aids.

Written Report:

Prior to the oral presentation, each team must present the judges with 5 copies of their written report. The written report should include the components listed below. Each of the 3 topics is worth 5 points. A perfect score for the written report is 15 points.

1. Executive Summary:
   This summary should be no more than one page using a 12-point font and single spaced. The summary should succinctly describe the problem that was solved, why the robot is an optimal solution to the problem, results of pre-competition testing, and a summary of the cost of the robot.

2. CAD Images, Circuit Schematics, and Programming Flowcharts:
   CAD images should adequately describe the form and function of the robot.
   Circuit schematics should convey how the circuitry was constructed and how it works.
   If a micro-controller was used, a descriptive flowchart of the programming code should be displayed.

3. Bill of Materials:
   The bill of materials should include the following information for each component of the robot: part name, size or part number, vendor name, quantity used, unit price, and total price. You should also sum all the total prices to display the overall cost of the components of your robot. This cost must be less than $350. For components that you did not have to purchase you must still list a vendor where the item could be purchased along with the unit and total price. These prices must be included in the overall cost of the robot.

Scoring:

The final score for a team will be equal to the sum of the scores for the oral presentation, written report, and robot testing. A team will be disqualified from the competition if they fail to make an oral presentation or do not submit a written report.

Rule Interpretations:

Questions regarding rules prior to the date of the competition should be directed to:

John Wadach
Monroe Community College
1000 E. Henrietta Road
Rochester, NY 14623
Phone: 585-292-2488
Email: JWADACH@monroecc.edu

On the date of the competition:
The judges will interpret the intent of the rules and make all decisions. If the judges determine that a team is in violation of the intent of any rule or specification, they will deduct points in proportion to the severity of the violation. All decisions by the judges are final and may not be appealed.

PROJECT TEAM / ENTRY LIMITATIONS:

Each team must have at least one faculty advisor and at least 2 student members but no more than 10 student members. Each team member must primarily be enrolled in freshmen or sophomore level classes. Each school may have up to three teams entered in the competition unless there is space available for additional teams. If a school has more than one entry then each team must represent a unique solution to the design problem.

Questions regarding teams entries and scheduling should be directed to:

Paul E. Gordy
Tidewater Community College
1700 College Crescent
Virginia Beach, VA 23453
Phone: 757-822-7175
Email: PGordy@tcc.edu

PROJECT INTEREST AND REGISTRATION FORMS:

Please find the entry forms on a separate page. The Interest Form must be received no later than March 1, 2007. A Registration Form for each model design team must be received no later than June 1, 2007.

ASEE ANNUAL CONVENTION PASSES:

It is not required that student team members or faculty advisors be registered for the ASEE Annual Convention. Passes will be provided for all team members and advisors so that they can enter the conference area and exhibition area on the day of the competition. Details for obtaining passes will be made available a couple of weeks prior to the competition.

COMPETITION TIMELINE:

The specific time and location of the oral presentations and robot testing will be sent to all teams and published in the ASEE Final Program and Proceedings booklet. The overall format of the competition is given below.

Morning: **Oral Presentations and Evaluations of Written Reports**

Lunch: **A lunch may be provided for students and faculty advisors. Students are encouraged to sit with students from other teams during lunch.**

Afternoon: **Robot Testing and Awards**

PRACTICE SESSION:

The official track will be available in the Exhibition Hall for teams to practice on prior to and following the oral presentations. Teams should be considerate and only use the track for brief periods if other teams are waiting to use the track. No practice runs may be made during the oral presentations, after the robot testing has begun, or during the halftime period.

AWARDS:

First, second, and third-place teams will receive plaques.

SUNY TYESA COMPETITION

The 2007 State University of New York Two Year Engineering Science Association (SUNY TYESA) will host a design-build competition on or about Friday, May 4, 2007 at one of the SUNY community college campuses. SUNY TYESA will use the same rules and project as the 2007 ASEE Design Competition. Teams interested in participating in the SUNY TYESA competition should contact John Wadach or visit the SUNY TYESA website at: tyesa.org

2007 ASEE Model Design Competition Registration Form

Name of college/university: _____

Team Name: _____

Name of faculty advisor(s): _____

Mailing Address: _____

Phone: _____ Fax: _____

Email (print clearly): _____

Student team captain: _____

Other student team members:

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____

Which students/advisors need badges for the convention center? (Badges are needed if you are not registered for the convention).

Circle one: All need badges. None need badges. Only those listed below need badges.

Please submit this form to :

Paul E. Gordy - ASEE TYCD Chair
Tidewater Community College
1700 College Crescent
Virginia Beach, VA 23453
Phone: 757-822-7175
Fax: 757-822-7334
Email: PGordy@tcc.edu

Return one copy of this form for each team entered by June 1, 2007 (by US mail , fax, or email)

2007 ASEE Model Design Competition Interest Form

Name of college/university: _____

Name of faculty advisor(s): _____

Mailing Address: _____

Phone: _____ Fax: _____

Email (print clearly): _____

Number of model entries expected (maximum of 3): _____

Please submit this form to:

Paul E. Gordy - ASEE TYCD Chair
Tidewater Community College
1700 College Crescent
Virginia Beach, VA 23453
Phone: 757-822-7175
Fax: 757-427-0327
Email: PGordy@tcc.edu

Return this form by March 1, 2007 (by US mail , fax, or email)