

## **EVENT 5: THE WINDMILL**

*(Revised 11/17/09)*

**OBJECTIVE:** Design and build a windmill that can lift a weight of paper clips a vertical distance of 50 centimeters.

### **RULES:**

- a. The team will bring their windmill built or partially built to the competition.
- b. The windmill is to only be constructed from the following materials:
- c. 100 centimeters of quarter inch or less wooden dowel, white glue, 150 centimeters of up to 1 inch wide tape, 4 empty thread spools 2 inches in length or less and outer diameter 1 ½ inches or less, four standard size paper dinner or desert plates, 4 large or smaller paper drinking cups, 150 centimeters of string, a 1 foot square quarter inch thick board and 4 small C-clamps
- d. Not all the material must be used to construct the windmill.
- e. The C-clamps may only be used to attach to windmill to a table or chair.
- f. The windmill may straddle two desk or tables or extend from one side of a desk or table.
- g. Only the air stream produced from a hairdryer of not more than 2000 wattage may power the windmill.
- h. It is the team's responsibility to bring a hairdryer and paper clips.
- i. A mechanical device that modifies the output airflow may be attached to the nozzle of the hairdryer.
- j. No modifications (e.g., electrical or mechanical) may be made to the hairdryer itself.

### **COMPETITION AND SCORING:**

- a. The team will have 10 minutes to assemble their windmill.
- b. The team will be provided with a box of NO. 1 Gem (or similar brand) paper clips, approximately 3.3 cm long. The paper clips may be used. Additional paper clips need to be provided by the team.
- c. Once assembled, the team will attach their paper clips to their windmill.
- d. Using the hairdryer, the team will operate the windmill lifting the paper clips a vertical distance of 50 centimeters.
- e. The team may increase the number of paper clips for a total of three times to determine the maximum mass of paper clips the windmill can lift.
- f. The time limited for each attempt to lift paper clips is 20 seconds.
- g. The distance from and the position of the hair dryer in relation to the windmill may be changed during the trials.
- h. A balance will determine the mass of paper clips lifted by the windmill.
- i. The windmill that lifts the greatest mass of paper clips wins.
- j. Twenty (20) points minimum score for a qualifying windmill that is able to lift 25 grams of paper clips.
- k. In the case of a tie, the windmill that lifts the greatest mass of paper clips in the shortest time wins.

$$\text{SCORE} = \frac{\text{(The mass lifted by your windmill)}}{\text{(Winning mass of paper clips)}} \times 100$$

**Updates to the rules will be posted on the NJAAPT web site at [www.njaapt.org](http://www.njaapt.org). Additionally, frequently asked questions with answer will be available by e-mailing [John\\_Valente@mast.mcvsd.org](mailto:John_Valente@mast.mcvsd.org). It is your team's responsibility to keep the team updated about changes and clarifications to the rules.**