ENGR2110 Mini-Project

During half-time at many basketball games, a contestant from the crowd is brought down to the court to shoot baskets. Your goal is to build a machine to win a half-time shooting contest. You will build a pneumatic-powered catapult that shoots squash balls at a target in order to score points.

By March 1st, you will have completed your pneumatic-powered squash ball catapult and gained sufficient knowledge of the supply kit to compete against other students in your studio to determine who can score the most points with the best combination of accuracy and distance. Figure 2 shows a schematic diagram of the competition setup. You will get three squash balls to shoot at the target which will be placed 18 feet away. You must complete the catapult assembly using the Cradle and Pivot that you constructed in the studio. The objective of the contest is to land the ball inside the center target hole. Each successful shot into the center hole is 27 pts, each shot into the outer hole is 9 pts, hitting the side of the target is 3 pts, and shooting the ball at all is 1 pt. Shots that hit the floor or inanimate surroundings before hitting the target will count.

The launcher system will utilize one catapult this semester. You may re-pressurize the system to 80 PSI after each launch. You will use a switch to activate the pneumatic valve causing the catapult to actuate. You can set the position of the cradle as you need to hit the target. You should practice several times in order to maximize your effectiveness with three shots. Consistent shooting will require you to minimize the variability in your setup. Keep this in mind as you control the re-pressurization, cradle angle, cradle location on the lever arm, and yaw of the launcher system.

Rules

An isometric view of your catapult system is shown in Figure 3. The remaining components, lever arms, screws/fasteners, nuts, washers, base, will be obtained by your team by one or a combination of the following methods: (1) purchase (a max spending budget of $40-reimbursable), (2) fabrication, (3) scrap material (4) modification of existing scrap material. The maximum allowable length of your lever arm is 18”. The maximum height of the base is 4”. All other dimensions are up to your team.
Deliverables

(1) Job Responsibility Matrix, Planning Tree Diagram, Problem Definition, Function Tree, Gantt Chart (due Feb 17)

(2) Solidworks exploded view drawing of system. Exclude piston details and fastener details such as threads or washers. Free body and Kinetic diagrams of lever arm and cradle just before launch (Feb 22)

(3) Fully constructed/assembled working system (March 1)

(4) Mini-Design Report (March 3), 5 pages maximum excluding figures/tables, 11 point font, 1.5” spacing, Times New Romans font, include Bill of Materials

(5) BONUS (10%): Write the dynamic equations needed to determine the velocity at which the projectile is launched for your design configuration, assuming that the force generated by the piston and the distance it travels are known quantities. Ensure you have the same amount of unknowns as equations. Include your equations, any accompanying explanations/assumptions as a separate item in an Appendix.