2015 Air Powered Vehicle (APV)

w/RC Plastic Body

Design Challenge:

The student will design and fabricate a multi functional Air Powered Vehicle that will be able to travel over a long distance, travel over various terrains, drag race or other specified events developed by the instructor.

Objectives:

- Work with tools to process materials and assemble a product
- Demonstrate fastening techniques.
- Incorporate design and engineering techniques.
- Incorporate problem solving techniques.
- Demonstrate skills in accommodating friction and alignment geometry.
- Demonstrate basic understanding of aerodynamics and the effects of rapid acceleration.
- Demonstrate the application of pneumatic power to generate motion.
- Apply mathematical calculations and measurements.
- Work individually and cooperatively.

Constraints:

- Students may use any materials in the fabrication for their APV.
- The vehicle must have at least 4 wheels that touch the ground at the same time.
- The maximum vehicle width, including wheels, cannot exceed 10".
- The maximum vehicle length, including wheels, cannot exceed 20".
- There is no vehicle height requirement.
- The vehicle must contain a Ø1/2" (outside diameter) x 16" copper air tube w/cap for propulsion.
- The copper air tube must be accessible from the rear of vehicle at all times and must fit within the testing mechanism. The decimal measurement from the floor to the centerline of the launching device tube is 1.969". Please refer to the launching device for verification if needed.
- The vehicle must have adjustable wheel alignment. (front wheels, rear wheels or both)
- The vehicle must have an RC Plastic body which will be Reverse Engineered to fit your chassis.
    - No other forms of body material can be used.
- Must only use small CD's for wheels.
- Wheels must be tucked inside the vehicle wheel wells, essentially like a normal car or truck.
- Vehicle must have a reinforced front bumper that protect wheels from breaking. Bumper must be integrated to the chassis and be ecstatically correct to the vehicle type.
    - Vehicle will not be tested without a front bumper.

Safety First:

Be careful and avoid injury when working with all tools. Be especially careful while using the pneumatic firing mechanism and do not point firing rod at other people. Follow all safety procedures and guidelines for each tool as provided for by the instructor and identified in the fabrication lab safety guidelines.

Basic Design, Build and Assembly Information:

- Keep in mind that precision fabrication will result in better performance during vehicle testing.
- Students should keep in mind the size and weight of their APV. Most of the time longer and wider is better. Shorter vehicles tend to veer to one side or the other.
- Identify each of the material components provided and possible purposes they will serve.
- Brainstorm / sketch preliminary ideas for your vehicle design and placement of components.
- Draw refined sketches for your APV showing locations of components and how it will work.
    - ***Note:*** More views makes for an easier build.
- Select the best design from your refined sketches.
- Create a complete set of Detail and Assembly drawings.
- Create a 3D Solid Model Assembly – Inventor .iam and .ipt files
- Create 2D IDW with dimensions for all components to be made by you.
- Adjust body drawing to match chassis specifications. (stretch and scale)
- When designing a body, design the shape of your body in Inventor and covert drawing to 2D (show all views).
- Fabricate or alter parts per drawing dimensions in the Fabrication Lab. (quality and precision of each part will ensure a smooth and functional assembly process)
- Cut out the RC Plastic Body to fit the desired vehicle chassis (wheels tucked).
- Paint RC Plastic Body per instructions
- Assemble vehicle parts.
- Pre-test vehicle and make needed adjustments to the wheel alignment.
- Mount vehicle body to the chassis and provide for quick release if possible.
- Modify if necessary and retest.

Official Testing:

- Vehicle may be unofficially tested as much as needed without penalty.
    - Upon deadline, vehicle MUST be tested.
- Student must state **"*official run*"** before a scored run. This must be witnessed by the instructor.
- Vehicle must complete the entire course for full points. The course surface and terrain will vary somewhat due to running on carpet, tile or concrete. Thus the challenge will be variable and have a range of difficulty.

Distance:

- Students will test their APV using various pressures to maximize the distance traveled over various terrains, i.e. carpet, tile or concrete. Farthest distance wins and will receive the most points, all others will be graded on distance traveled.

Drag Race:

- Students will drag race each other using a common starting and ending point. Instructor will determine distance of race on testing day.

Open Testing

- Instructor will provide a testing scenario or gaming event depending on time left with project.
    - Testing may include: Bowling, Demolition Derby, Ramp Jumps, etc…..

Official Grading:

Individual Grading:

- Points will be earned and calculated based on the entire design and fabrication process and while successfully completing segments of the test track.
    - Students must attempt / complete (3) three distance runs. **100 points** max per event
    - The Sketches and Designs: **300 points** (see drawing checklist)
    - Vehicle Appearance / Build Quality: **100 points**
    - Participation: **100 points**
    - Project Summary and Reflection Paper: **200 points**
    - **Total Points: 1000**

Team Grading:

- Points will be earned and calculated based the entire team w orking process and while successfully completing segments of the test track.
    - Bowling: **50 points**
    - Target Stop: **25 points**
    - Teamwork: **25 points**
    - **Total Points: 100**

Extra Credit:

- Students may earn points above and beyond the normal grade scale based on the performance of their APV. No more than **25 Extra Credit Points** may be earn in each event.
    - Accuracy
    - Racing
    - Cone Prediction
    - Target Stop (if not used in team event)
    - Deal or No Deal

2015 Air Powered Vehicle (APV) Drawing Checklist

Name:_____ Hour:_____ Date:_____

To receive the maximum score turn in the following drawings on "B" Size (11 x 17) paper.

✓	Description	Possible Points	Points
☐	Presentation Isometric Render Drawing w/Body (color) • White background • Vehicle must be large scale to fit paper • No Title Block or Border • Print to Color Laser	**50**	_____
☐	Isometric Render Drawing (color) • Color or Image Background • Vehicle must be large scale to fit paper • No Title Block or Border • Print to Color Laser	**25**	_____
☐	Isometric Assembly Drawing w/Body (B/W) • Border with Title Block • Show 4 Views on one drawing sheet • Cut-outs or removed areas are acceptable • Partial Views acceptable • Print to B/W Laser	**25**	_____
☐	Isometric Assembly w/o Body (B/W) • Border with Title Block • Stock List • Balloons • Notes • Print to B/W Laser	**50**	_____
☐	Complete Set of Detail Drawings (B/W) • Border with Title Block • All necessary information to build your parts • General and Specific Notes • Print to B/W Laser	**100**	_____
☐	Preliminary Sketches • 3 Chassis and 3 Body Ideas • Draw ideas on grid paper • Check your best chassis and body	**50**	_____
		Total Points: **300**	_____
		Letter Grade:	_____

2015 Engineering Design

Air Powered Vehicle Project Summary and Reflection Paper

Objective

Students will develop an Air Powered Vehicle project summary and reflection paper. Students will use their researched results regarding the investigative process and development of their final product. Students may use any information and digital photos taken in class or researched information from the Internet, textbooks and/or reference books to find all relevant information to complete this project.

Report / Portfolio (200 pts)

1. Cover Page - sheet to include:
    - Title of Report
    - Student Name
    - School
    - School Address
    - Hours
    - Class
    - Completion Date
    - Instructor
    - Part Name / Product Name
    - Picture of Project

2. Report Format:
    - Academically written in your own words
    - Arial Font
    - 11 or 12 pt Font
    - 1" Margins
    - Double Spaced

3. Drawings – "A" size paper
    - Two Photo Realistic Drawings w/white background
        - One drawing w/body attached
        - One drawing w/inner mechanical workings – no body
        - Both drawings must be shown in an isometric position

Documentation

Use the list of headings on the next page to assist in writing your report. Add any additional information to your documented report that will help support all of your research findings.
Note: Answering only the questions below will get you partial credit; use your educated opinion and judgment to develop a report that reflects the quality and integrity of your project.

Note: This is an Essay paper not question and answer – introduction, body, and closure.

Containing responses to:

- What was the significance of this project to your education and growth?
- What did you learn about other students during the course of the project including their similarities or differences to you?
- What did you learn during the project that enhanced your learning gained in the core academic classroom?
- What impact might this project have on your lifelong learning process?
- What impact did this project have on your everyday life?
- What insights did you gain through the development and build of this project that might assist you in your career or in selecting a career?
- What did this project teach you about your community involvement, citizenship, and civic responsibility?
- What is the relationship of your project to the "real world"?
- How were you able to contribute to the overall project in the class or group setting?
- What did you do or what about this project made you feel proud?
- What was the most difficult part of your work during this project?
- If you were to start at the beginning of this project again, what would you do differently the second time around?
- What resources are missing from this project and how can you as students remedy this situation? How can the instructor?
- What was the purpose of this project and how can we help people outside of this class better understand the nature of the project and its purpose?
- What cultural influences does this project encourage or discourage, in particular attitudes or something else?
- What part of the project presented you with the greatest challenge?
- What did you enjoy about this project and why?
- What did you not enjoy about this project and why?
- What would you change about the project to make it better and why?
- Would you recommend this project to future students?

Self Evaluation

Evaluate yourself using a scale of 1 to 100, with 100 being the most, in the 3 areas of ***Body Fabrication Quality***, ***Chassis Fabrication Quality*** and overall ***Participation***. Give details as to why you believe you deserve this score based on facts. Be honest with your evaluation and consider the time spent on this project.