EDSGN 100 Section 9
Introduction to Engineering Design

Online Design Portfolio

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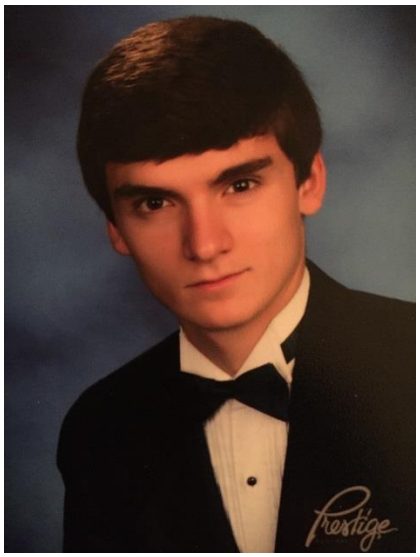

Submitted By: Nick Mahon

Submitted To: Xinli Wu, Ph.D., P.E.

Submitted On: 12/15/15

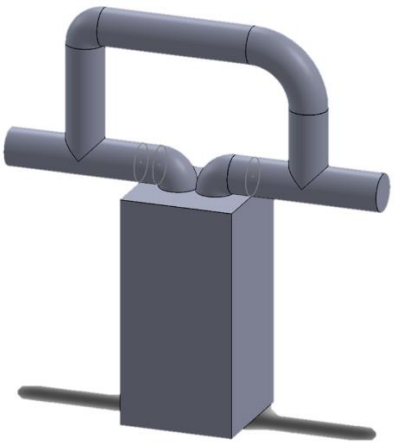

Fig 1. CAD Model

Abstract

This portfolio is designed to compile the work done by Nicholas Mahon during the Fall Semester of 2015 at Penn State University Park in Engineering Design 100. It summarizes Design Project 1 and Design Project 2.

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EDUCATION

Wilson High School, West Lawn, PA (August 2011 – June 2015)

- GPA: 101.8497 / 100 - Summa Cum Laude – Latin Honor System

Pennsylvania State University, University Park, PA (August 2015 – Present)

SCHOOL ACTIVITIES / LEADERSHIP – WILSON HIGH SCHOOL

National Honor Society - Grades: 11,12 (Vice-President)
Student Government - Grades: 9,10,11,12 (Treasurer)
Mini-THON - Grades: 11 (Inaugural Year, Finance Committee Captain), 12 (Treasurer)
Technology Student Association - Grades: 10,11 (Fundraiser Chairman), 12 (Reporter)
STEM (Science, Technology, Engineering, and Mathematics) Academy - Grades: 9,10,11,12

HONORS AND CERTIFICATIONS

The Rotary Club of West Reading - Wyomissing Student of the Month - Grade: 12 (April 2015)
University of Pennsylvania Wharton School of Business Investment Challenge - Grade: 12

- Finished 1st of 325 teams internationally in investment portion of challenge

National Mathematics Competition - Moody's Mega Math Challenge 2014 - Grade: 11; Finished top 200 nationally of 1,152 teams
College Board AP Scholar with Distinction - Grade: 11
Technology Student Association - Grades: 10,11,12; Participated and placed in National, State, and Regional competitions

COMMUNITY SERVICE

Spring Township Science Camp Volunteer – June 2015
Spring Township Community Fall Festival Volunteer - Grades: 9,10,11,12
Mini-THON 2014 - Grades: 11,12
National Honor Society Community Service Volunteer - Grades: 11,12; Wilson Iron Chef Competition & Benefit Auction Volunteer
Student Government - Grades: 9,10,11,12

- **I AM ABLE – Triathlon Relay Team Member** - Grade: 9,10,11,12
- **Berks County Veteran's Appreciation Dinner Dance** - Grades: 9,10,11,12

Camp Swatara Counselor - Grades: 11,12

WORK EXPERIENCE

Wilson High School, West Lawn, PA (June 2014 - August 2014)
Painter. Painted interior / exterior walls, doors, and poles. Supervisor: Ed Darbro Work: (484)256-1953; Home: (610)775-3297
Grace Fellowship Church, Shillington, PA (July 2015-August 2015)

Course Syllabus:

Course overview and objectives:

This is a design-driven course with emphasis placed on skills such as: team-working, communication skills (graphical, oral, and written), and computer-aided design and analysis tools. The course will introduce students to the engineering approach to problem solving with strong references to basic science and math skills, as well as testing and evaluating design ideas by building prototypes. The design projects are the total of at least 30 hours of in-class work (one third of the course). Two design projects will be assigned during the semester. The design projects will require the students to work in a team. **The course grade for the students will reflect their abilities to function effectively as team players.**

Skills acquired by students during the course:

Computing:	Solid Modeling/CAD, EXCEL (spreadsheet), PowerPoint (multimedia presentation)
Internet Skills:	Designing and publishing a basic webpage
Graphics:	Sketching, orthographic projections, multiview drawings, scales, dimensioning, isometric pictorial, oblique pictorial, sections, working drawings
Lab Skills:	experimental methods, data acquisition & analysis, prototype building & testing
Design Methods:	customer needs assessment, concept generation, design selection matrices, design for assembly- disassembly, safety, cost effectiveness, teamwork, and other constraints as need by the project

Grade Distribution:

A	**Design Graphics** Graphics Homework Assignments	15%
B	**Solid Modeling & Conceptual Design Project** Exercises and Quizzes (15%) Project (10%)	25%
C	**Design Modules** Project I (15%) Project II (20%) Online Design Portfolio (5%)	40%

Exam No. 1	10%
Exam No. 2	10%
TOTAL	100%

Grades will be determined based your performance on the activities listed above. Final letter grades will be assigned as follows:

> 93 = A 90-93 = A- 87-89 = B+ 83-86 = B 80-82 = B-

75-79 = C+ 70-74 = C 60-69 = D below 60 = F

Final Design Prototype

Drawings:

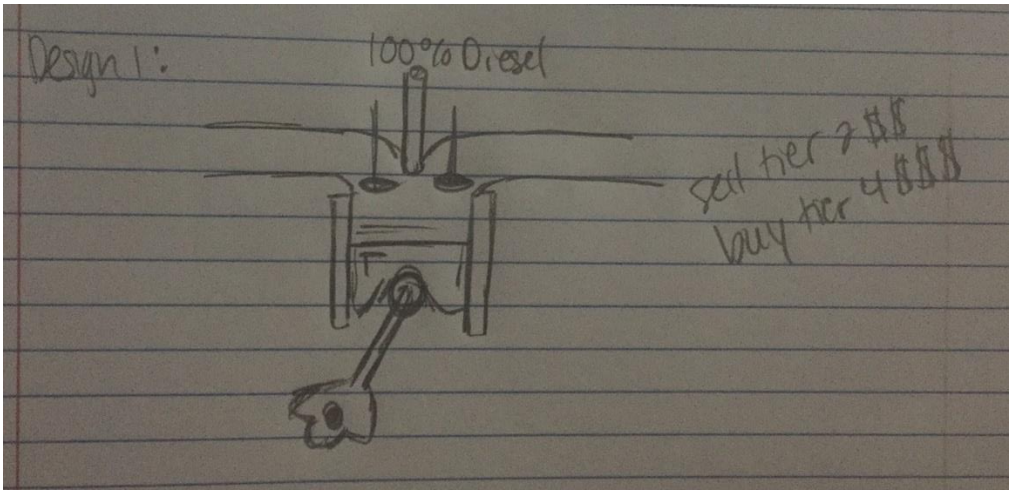


Fig 3. Sketch of a design

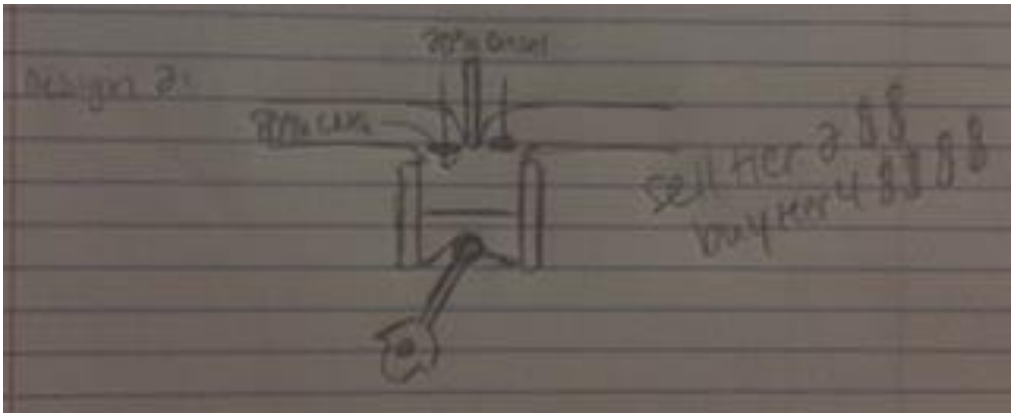


Fig 4. Sketch of a design

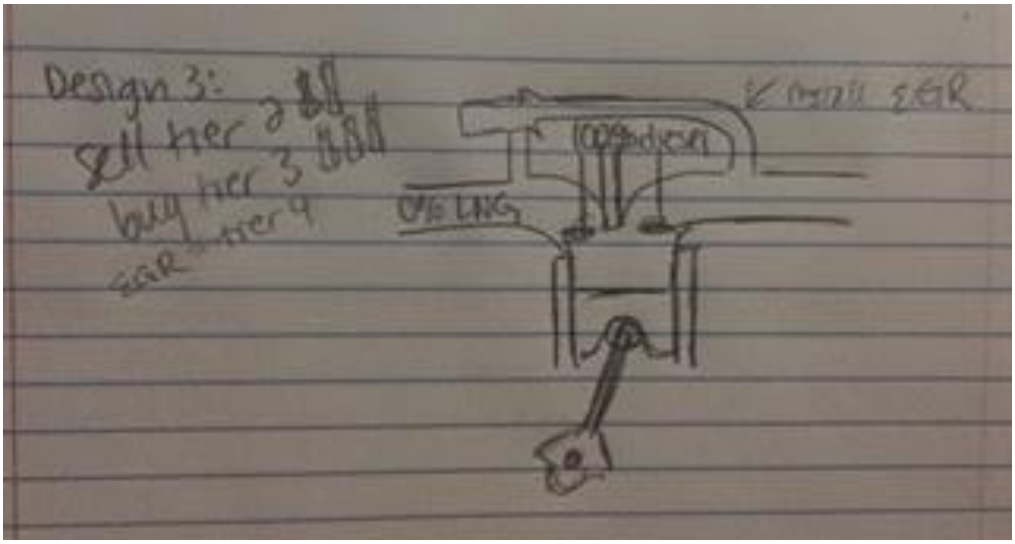


Fig 5. Sketch of a design

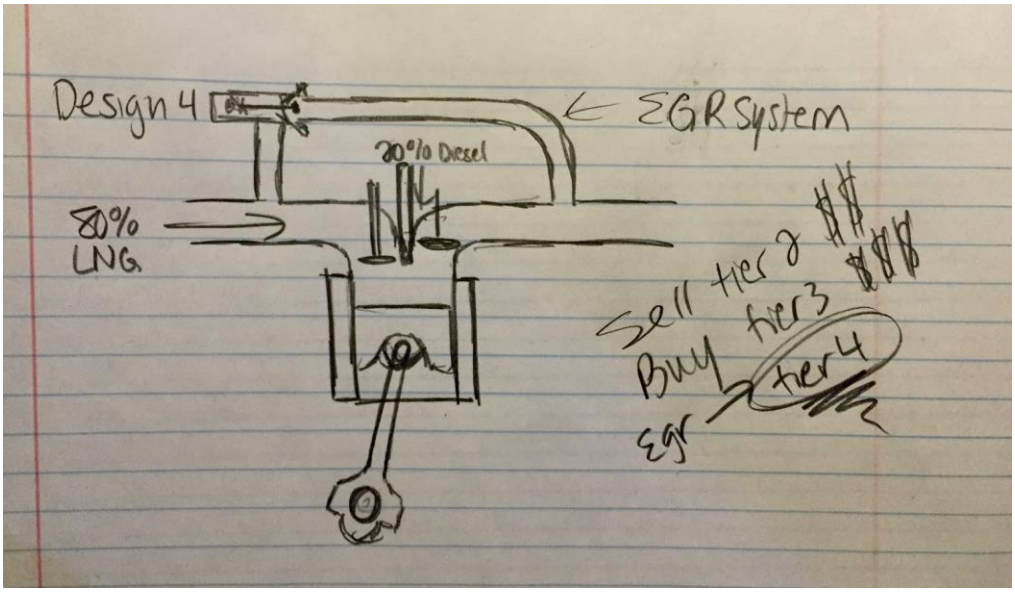


Fig 6. Sketch of a design

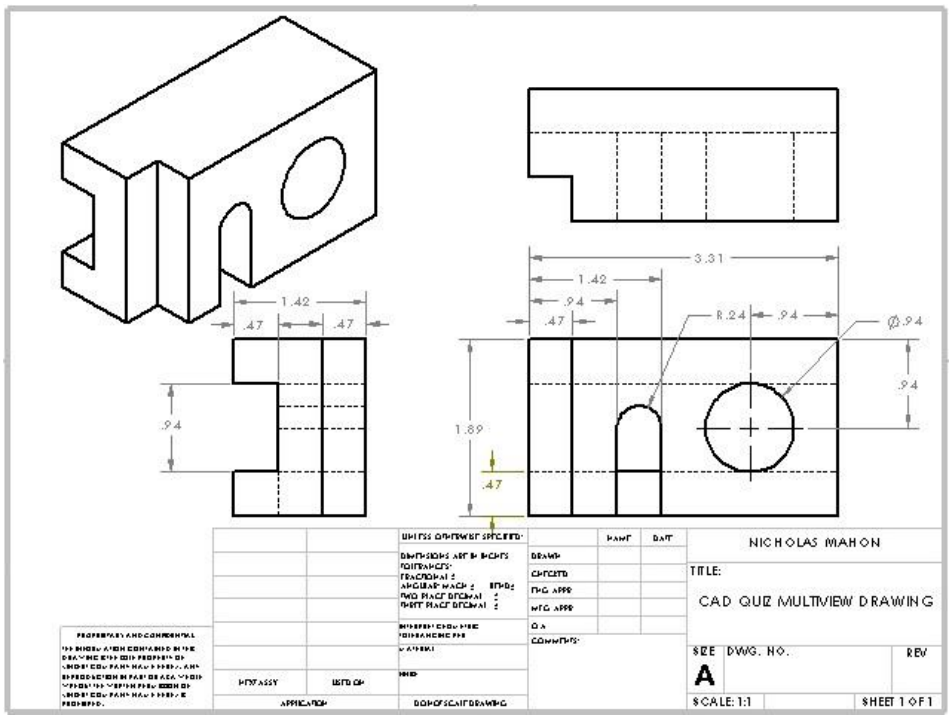


Fig. 7 Students for the CAD Quiz were given a Multiview drawing a told to recreate it in Solidworks. Here is the result.

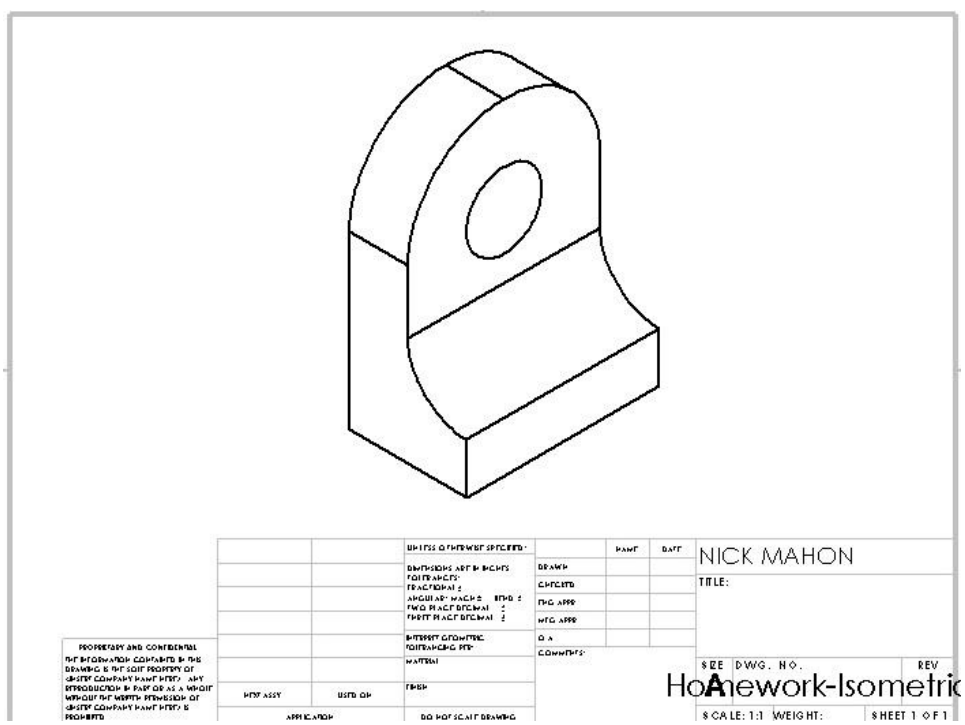
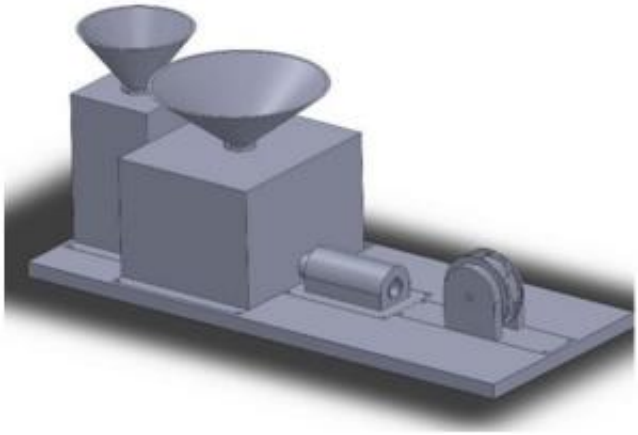


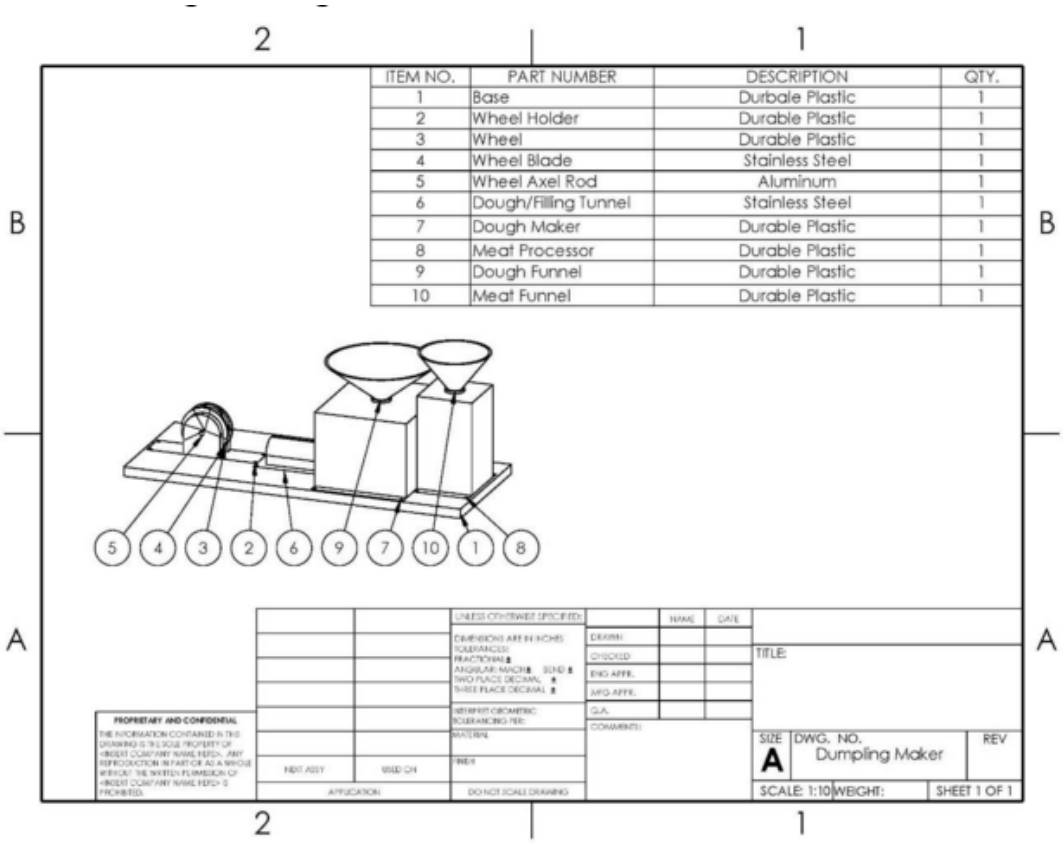
Fig. 8 Students were given a drawing and told to make the appropriate Isometric sketch.

Design Project 1:



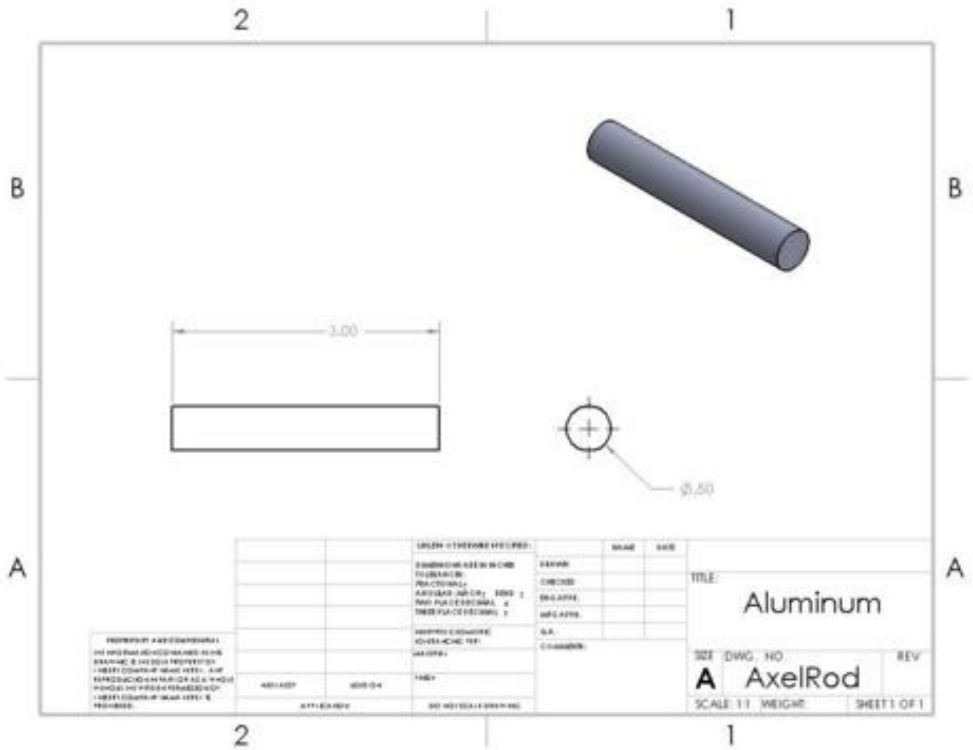
[Project Description Page]

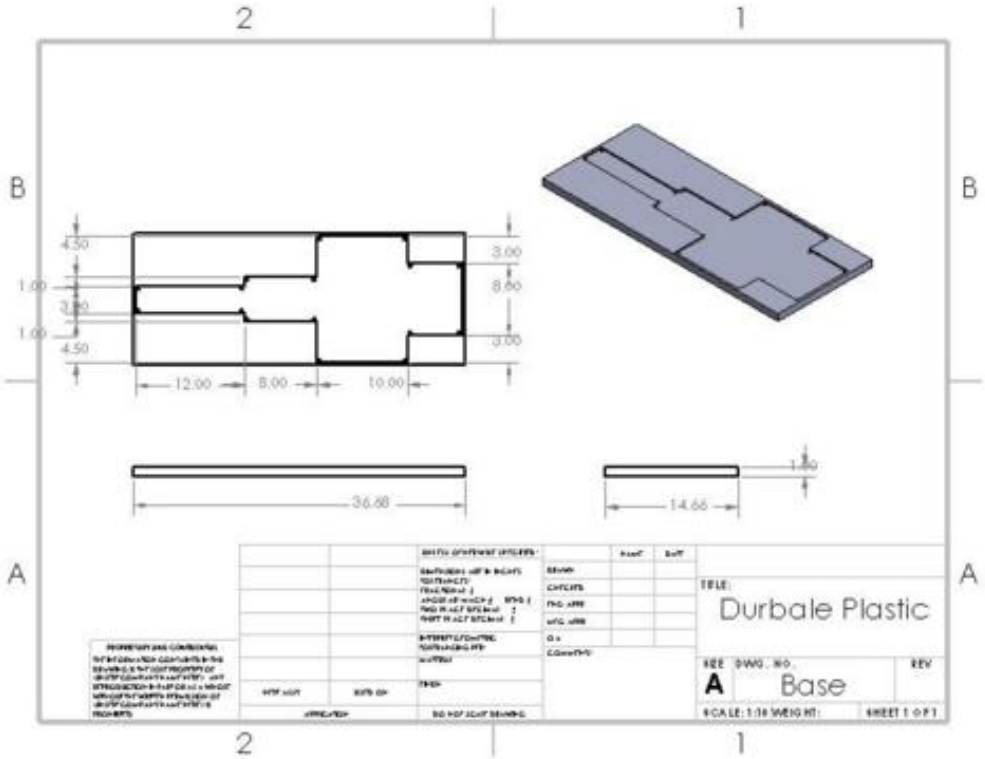
Assembly Drawing:

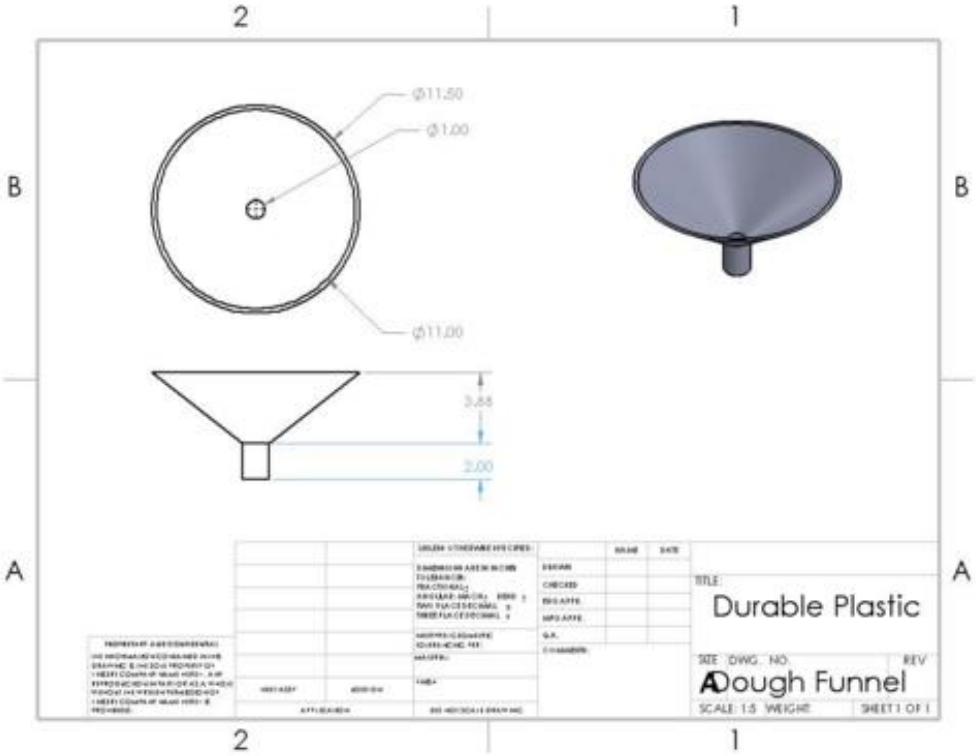


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Base	Durbale Plastic	1
2	Wheel Holder	Durable Plastic	1
3	Wheel	Durable Plastic	1
4	Wheel Blade	Stainless Steel	1
5	Wheel Axel Rod	Aluminum	1
6	Dough/Filling Tunnel	Stainless Steel	1
7	Dough Maker	Durable Plastic	1
8	Meat Processor	Durable Plastic	1
9	Dough Funnel	Durable Plastic	1
10	Meat Funnel	Durable Plastic	1

Three Detail Drawings:



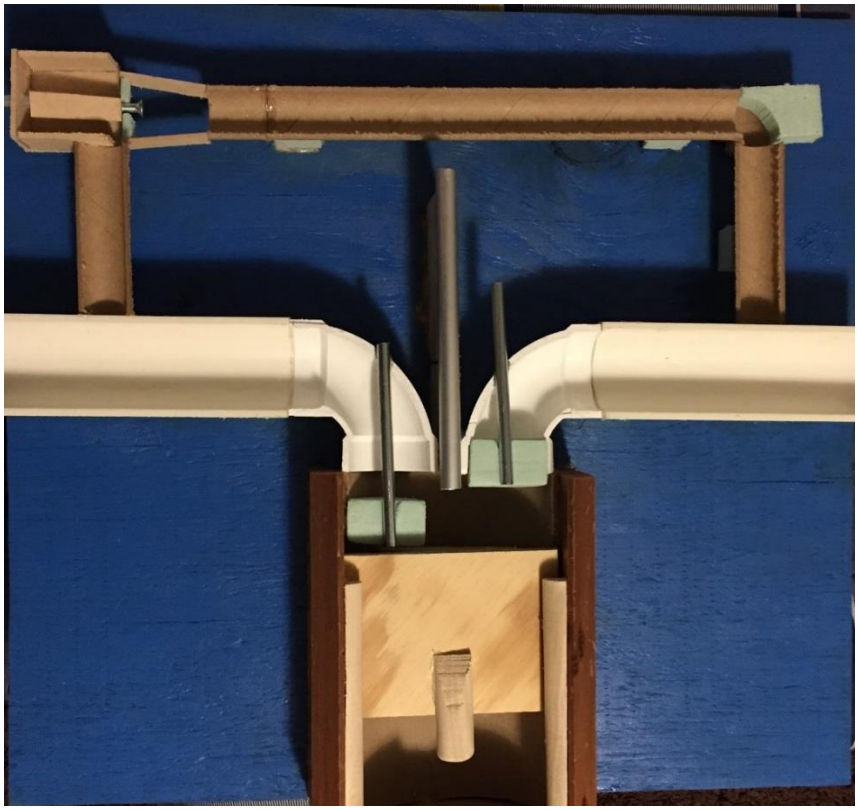




Main Design Features:

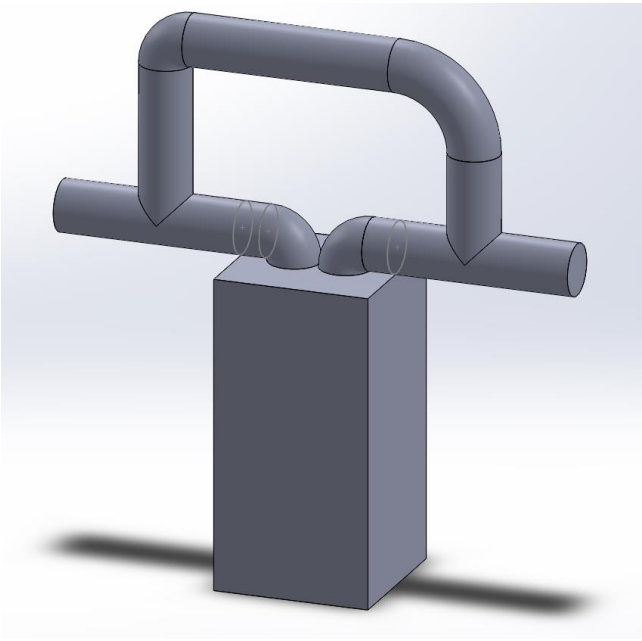
Nick Mahon's Dumpling Maker 1.0 offers many bold and useful feature. First of which is that the entire process is automatic, offering the easiest dumpling making experience possible. The machine prepares the filling and dough for the user based on raw materials that the consumer puts in. All components of the machine including dough maker, filling processor, tubing, etc. is entirely removable and replaceable if program or in need of updating. The key feature of the machine is the speed and efficiency with which it makes dumplings, thanks to the specialty cutting wheel. The cutting wheel presses the dough and filling with no loss into perfectly shaped dumplings.

Design Project 2:



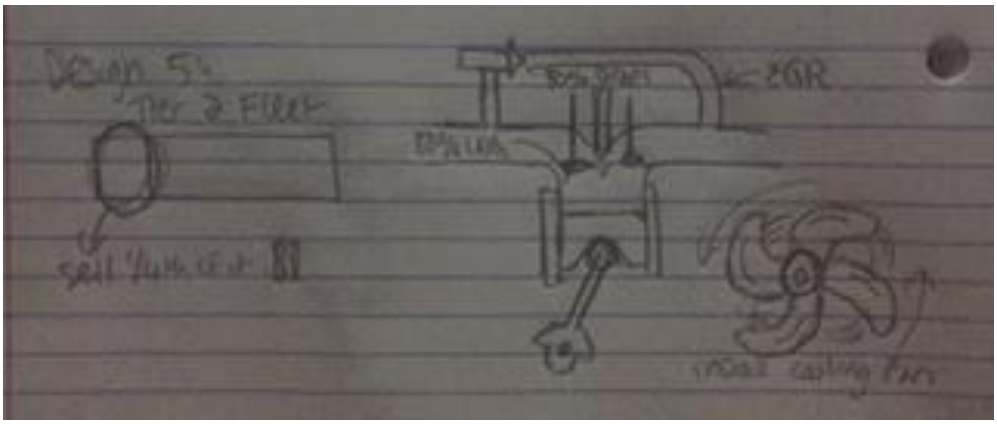
Project Description Page

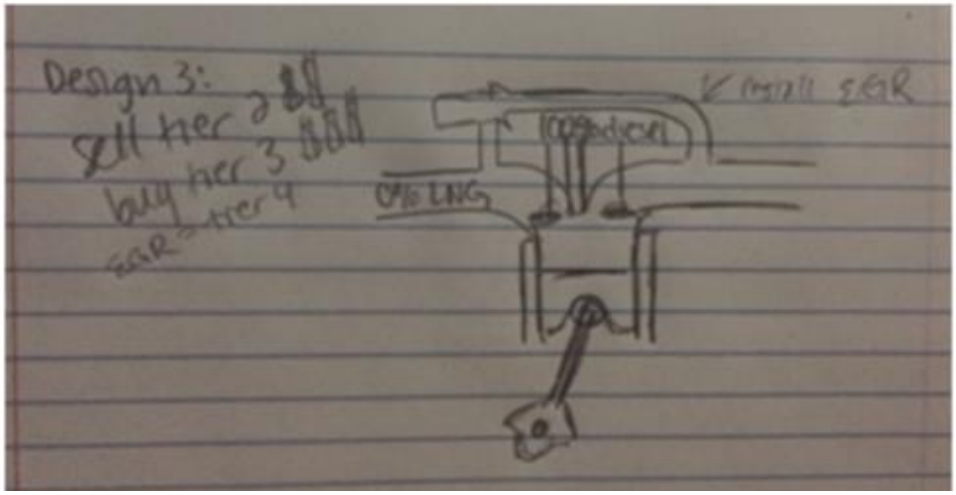
Assembly Drawing:

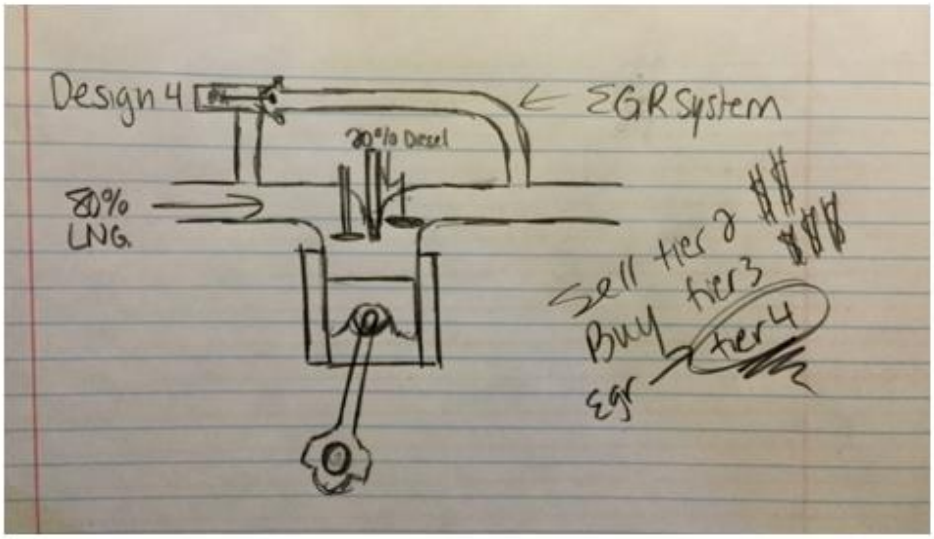


Project Webpage

Sketches:







Main Design Features:

The design consists of selling the tier 2 fleet and buying tier 3 locomotives. Locomotive features will consist of buying NextFuel™ Natural Gas Retrofit Kits. EGR systems will be implemented on all of the engines. Design 4 also features port injection consisting of an 80% liquid natural gas and 20% diesel within the cylinder during combustion.

Summary and Conclusions

For Design Project 1, Nick and his group began the brainstorming by examining each step in the dumpling making process. In this way, the team was able to independently come up with the best way to perform each step and put it all together in one efficient machine. The team also did a small amount of market research by asking various Chinese restaurants a few questions pertaining to the machine. The team was able to confirm the need for this machine and the willingness of the owners to pay a premium price for the machine. The group specified that the machine should not take up too much space, should be fully automatic, and should not require too much difficult maintenance. As such, the three chose the final design that was most efficient given the space allotted and that was incredibly easy to clean. Furthermore, all parts are fully removable for easier cleaning and upgradability. Furthermore, the processor and dough maker can be removed and act as a food processor and dough maker independently of the machine as a whole. The only flaw in the team's design would be the high final cost. It stays within the limitations set by Professor Xinli Wu, but it pushes the boundaries and can be easily cut by removing excess materials in the base and piping. Overall, however, Group 3 is very happy with the final design chosen because of its fully automatic nature, speed, and efficiency. For Design Project 2, Nick Mahon began the process by performing extensive research on engine cooling systems, port injection, Tier 3 vs. Tier 4, EGR vs. non-EGR systems, and diesel vs. natural gas. Then, his team collectively brainstormed and came up with 5 designs to evaluate in a decision matrix. After, designs 4 and 5 tied, the team evaluated them in a runoff weighted matrix where cost and pollution reduction were weighted most heavily. Design 4, a system involving an EGR system and using natural gas instead of diesel, was the winner. This design is the most efficient, because the team still reached Tier 4 standards without having to incur the extra expenses of buying Tier 4 trains straight up. Furthermore, the instillation of an EGR system, as opposed to an after-treatment saved GE an additional $1.5 billion. This design also helps in terms of on-time delivery, because each train can go twice as far after each refueling. The only flaw with Team 3's design is each refueling station is a little more dangerous than others because of the natural gas and liquid nitrogen that must be put into the train. However, because each train goes twice as far on each refuel, the dangers are mitigated in that there are less refueling stations necessary. Ultimately, Nick is very happy with its design, because it stays within the limitations imposed by GE and the city. Also, it offers an ingenuitive solution to the problem and performs up to Tier 4 standards all while remaining extremely cost-efficient.

Acknowledgements

Nick Mahon would like to acknowledge and thank all of GE transportation for providing Penn State's College of Engineering with a design task for eDesign 100 from the opening presentation to the FAQ's on the design project webpage. He would also like to thank Xinli Wu, Ph.D., P.E., for his commitment to not only the whole class of engineers but more specifically to helping Nick learn the process of building and analyzing a prototype and design concept. Nick also thanks People's Choice for selecting the team's design to receive the Best Design Communication Award.

References

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https://en.wikipedia.org/wiki/Selective_catalytic_reduction

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