

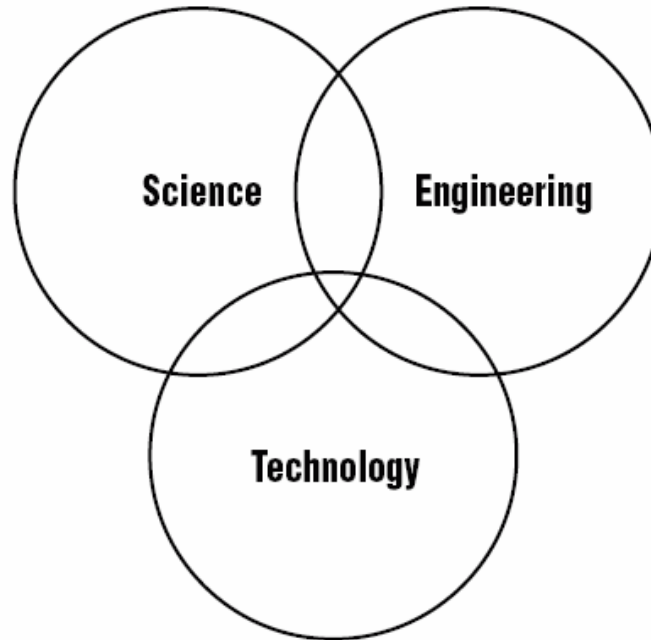
# Designing the Future at Newburyport High School



# From the Massachusetts Science and Technology/Engineering Curriculum Framework

## The Relationship Among Science, Engineering, and Technology

Science seeks to understand the natural world, and often needs new tools to help discover the answers.



Engineers use scientific discoveries to design products and processes that meet society's needs.

Technologies (products and processes) are the result of engineered designs. They are created by technicians to solve societal needs and wants.

# Massachusetts Science and Technology/ Engineering Curriculum Framework Strand 3 - Physical Science

Broad Concept: *Newton's Laws of motion and gravitation describe and predict the motion of most objects.*

At Newburyport High School, physics students use 3D design software when they design, build and test projects that address the concepts of motion and forces.

Examples:

Eggcellerator Cars  
Catapult Project  
Mouse Trap Cars



# Massachusetts Science and Technology/ Engineering Curriculum Framework Strand 4 - Technology Engineering

Broad Concept: *Engineering Design involves practical problem solving, research, development and invention and requires designing, drawing, building, testing and redesigning.*

At Newburyport High School, students use ProDESKTOP to design projects in Robotics and CAD classes.

Examples:

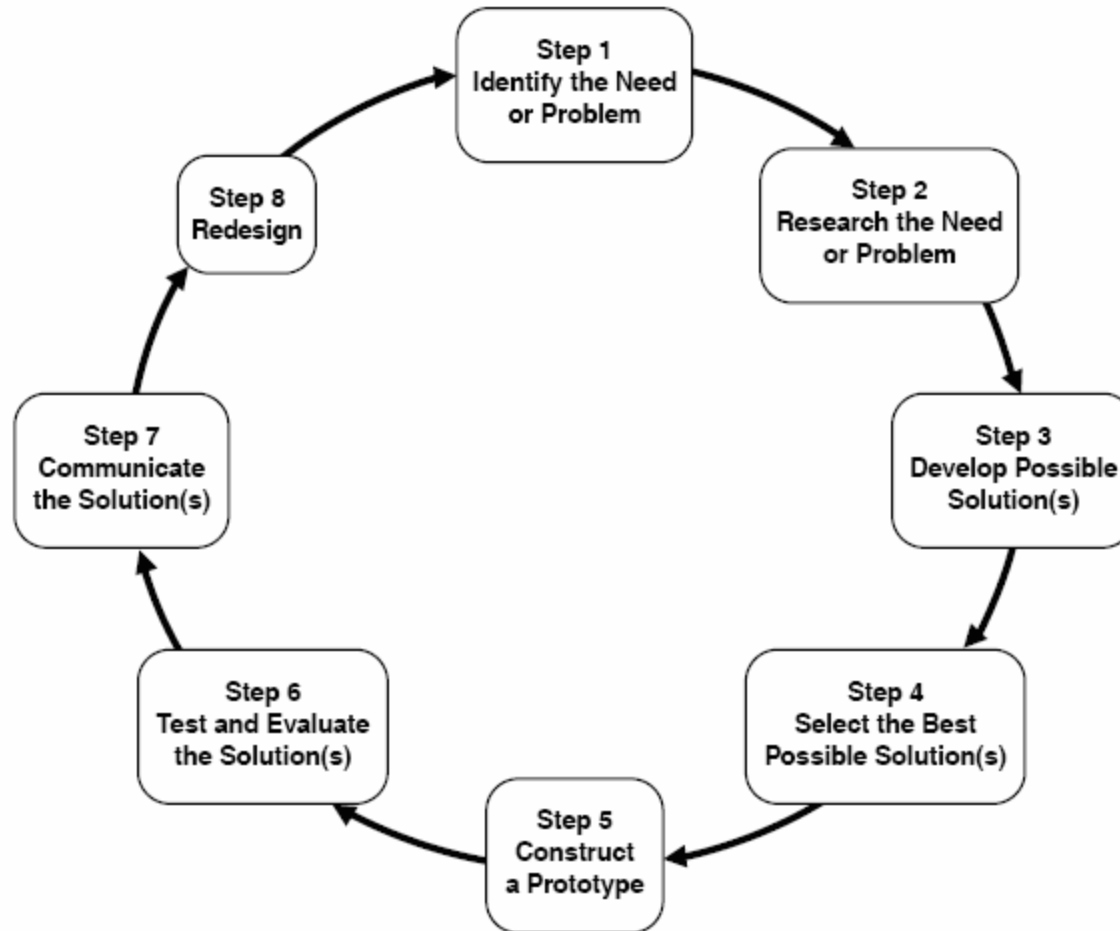
Hacky Sack Robot

Escape Robot



# The Engineering Design Process

Steps of the Engineering Design Process



# Benefits of Making Connections Between Math, Science and Technology/Engineering

- Move Technology/Engineering beyond production-based content to critical thinking and problem solving
- Design and construction activities reinforce abstract math and science concepts
- Highly visual and hands-on experiences motivate students with various learning styles

# Why is 3D Design Software Important?

- Quick way for students to get ideas into a design format
- Promotes collaborative learning
- Quality of work: clean, accurate, does not require artistic talent
- Designs can be exported for use in rapid prototyping and CNC machining operations

# 3D Design Touches 5 Subjects at NHS



Multidisciplinary tool enables students to quickly conceptualize, design and develop working plans for their project ideas in:

Tech/Engineering

CAD/Drafting

Art

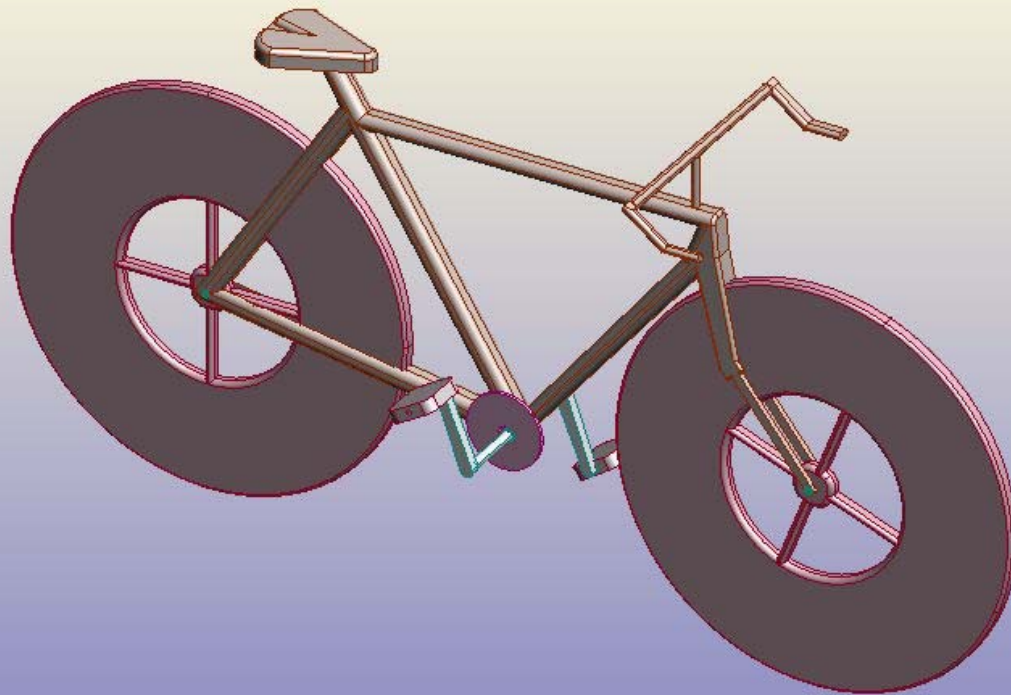
Physics

Math

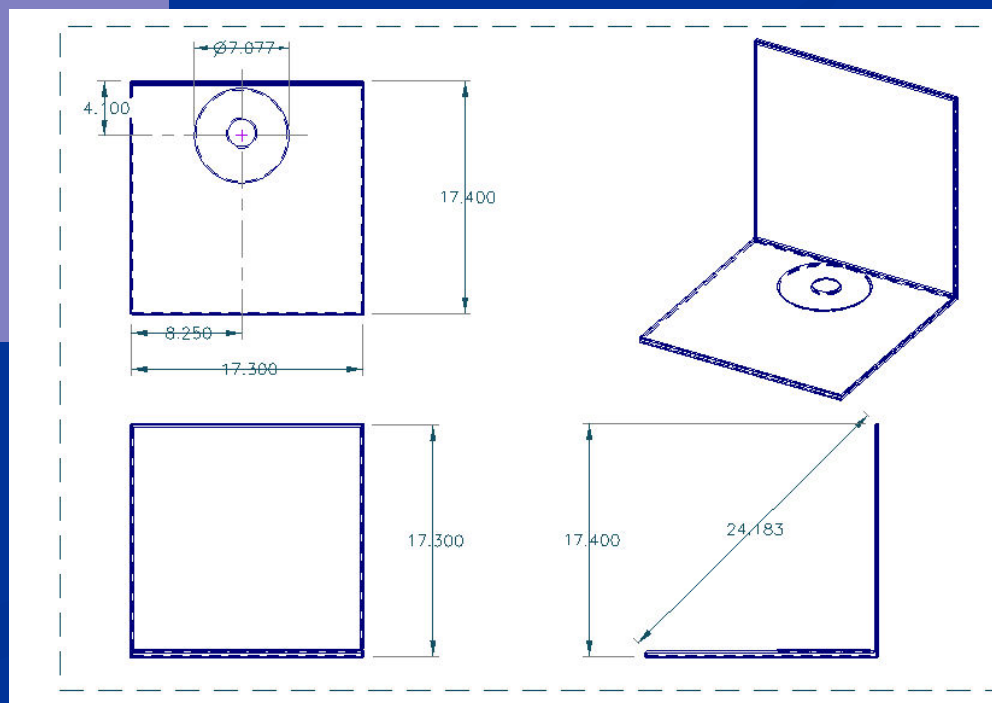
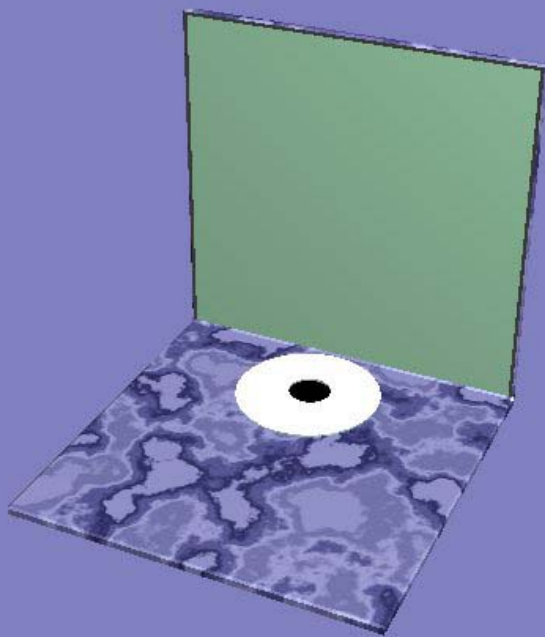
# Gallery of Student Designs

Bike

Joe P.

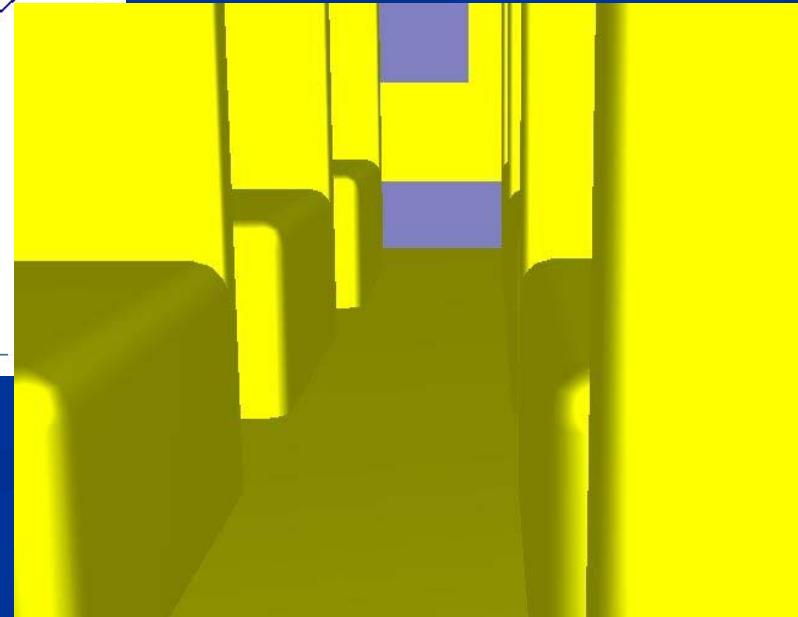
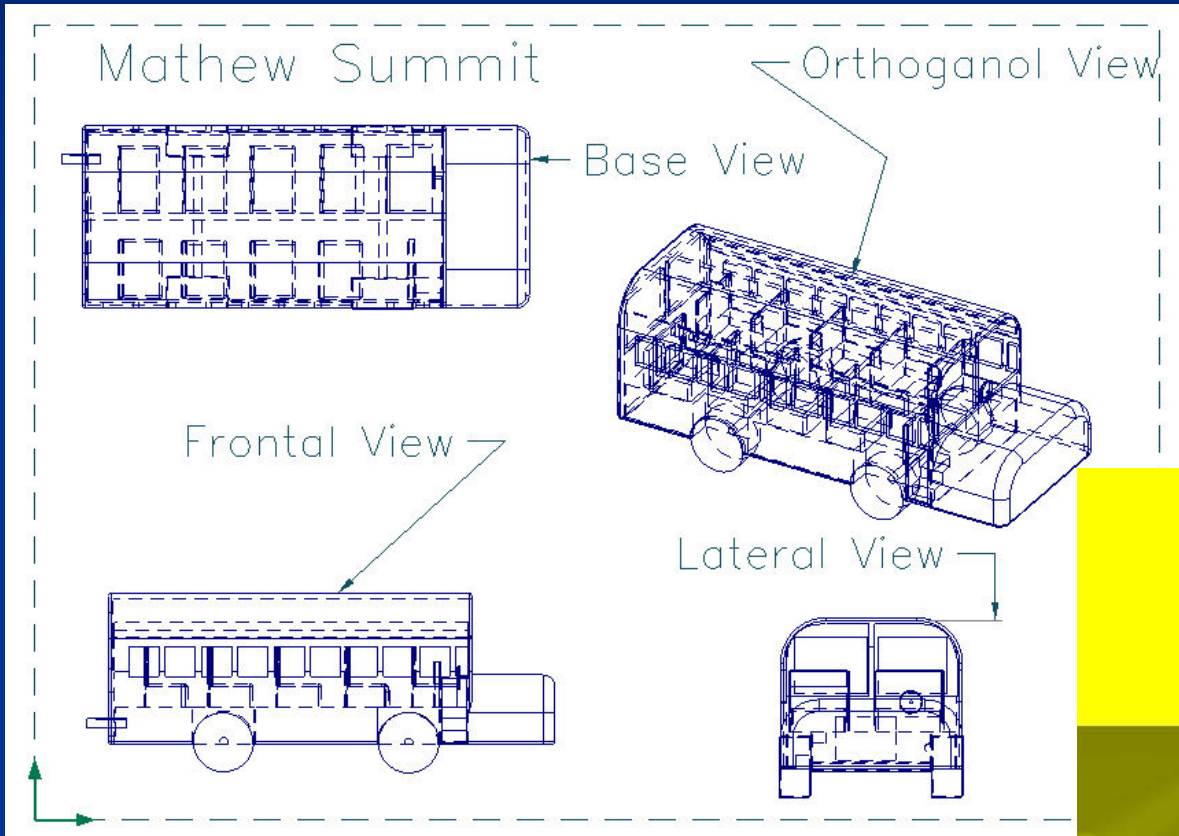


# Laptop Computer



# Bus with Interior View

Matt S.



# Technology/Engineering

**Course:** Robotics

**Teacher:** Steve Smith

**Concepts:** Engineering design process

Extrude, project, sweep, revolve, loft

Prototyping

Manufacturing (CNC)

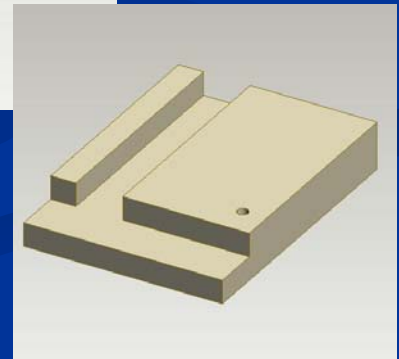
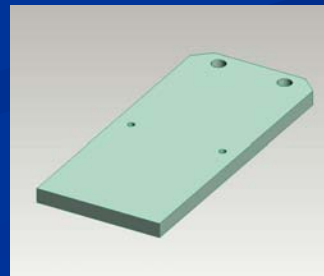
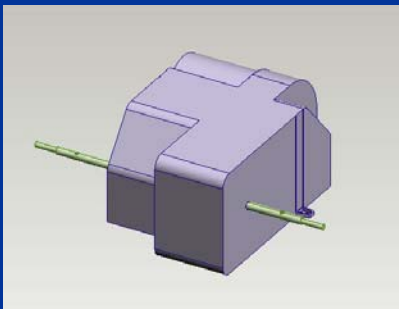
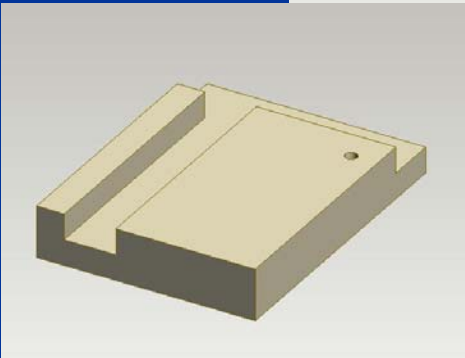
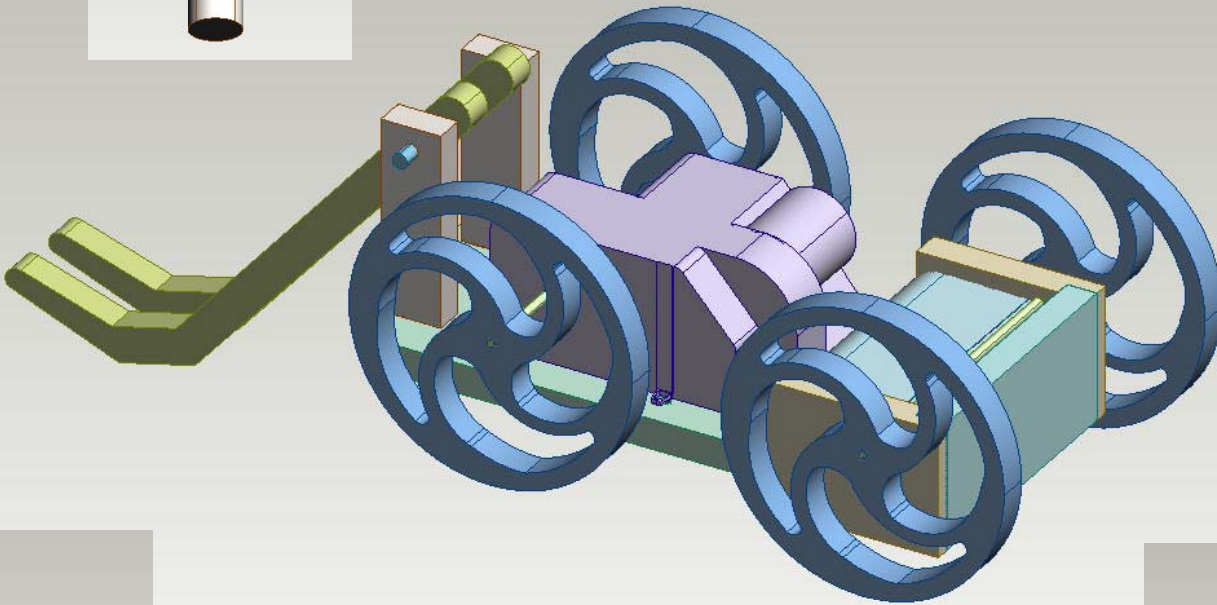
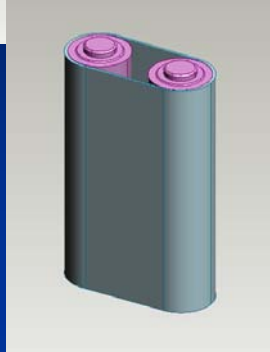
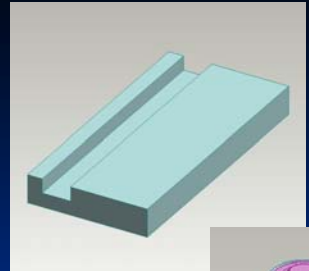
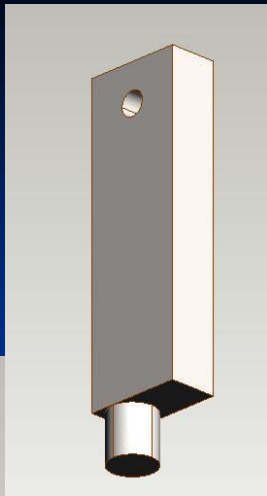
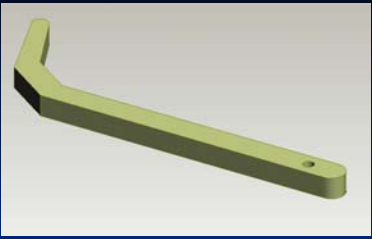
**Projects:** Hacky Sack Robot

Escape Robot



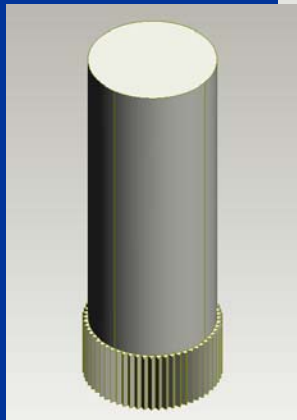
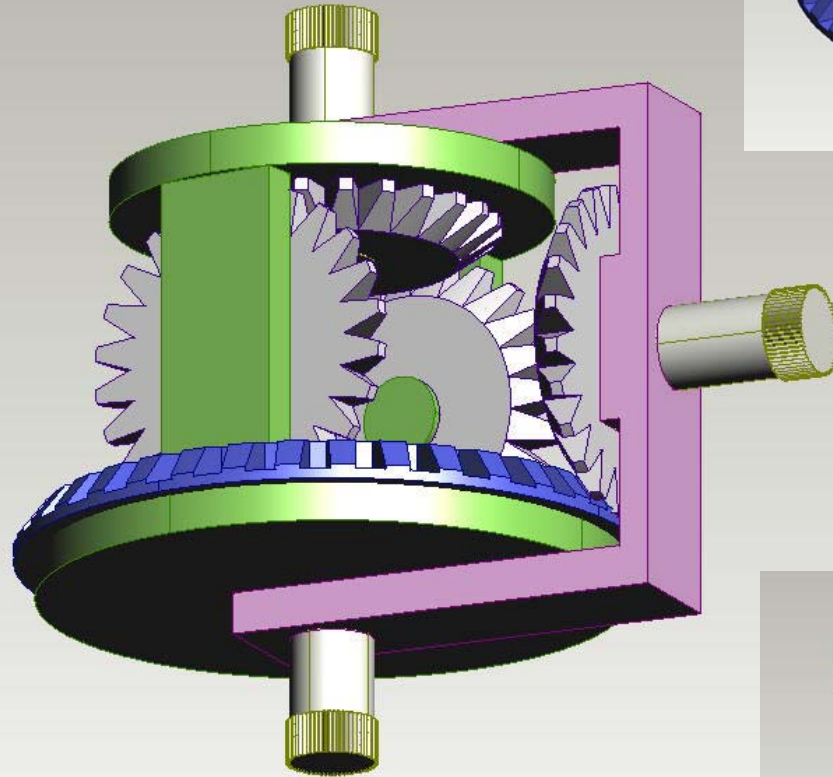
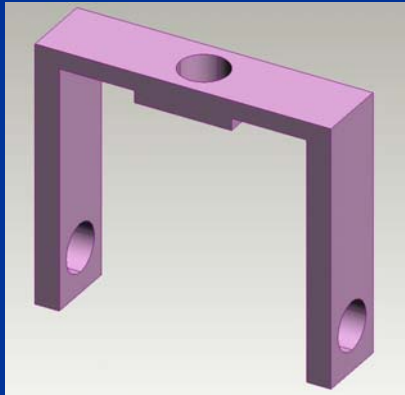
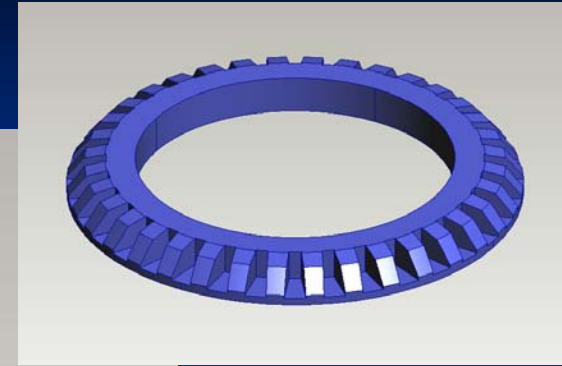
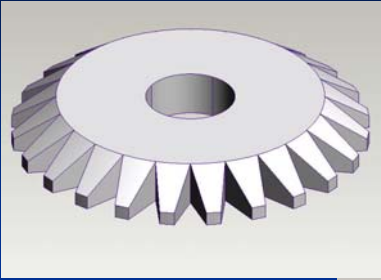
# Robot Car

Conor W.



# Differential Gear Assembly

Bill D.



# Rapid Prototyping



# Ford Partnership for Advanced Studies & Educational Development Center

Students chose an existing product they felt could be improved upon. They surveyed consumers, developed a Customer Needs Statement, Established Benchmark Standards and used Pro/DESKTOP to redesign the product.

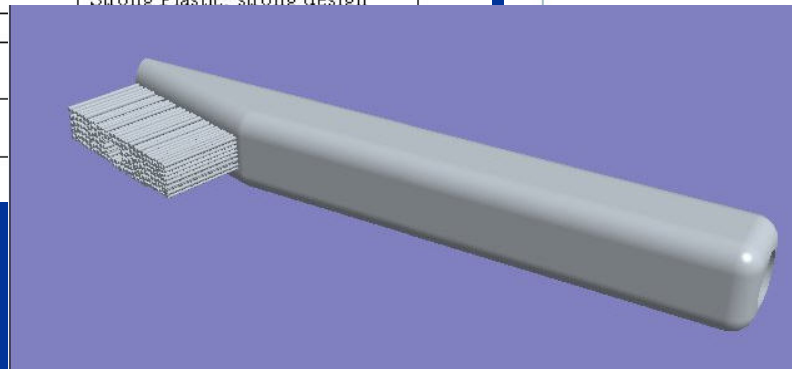
## Customer Need Statement

### *Self Dispensing Toothbrush*

Team #5

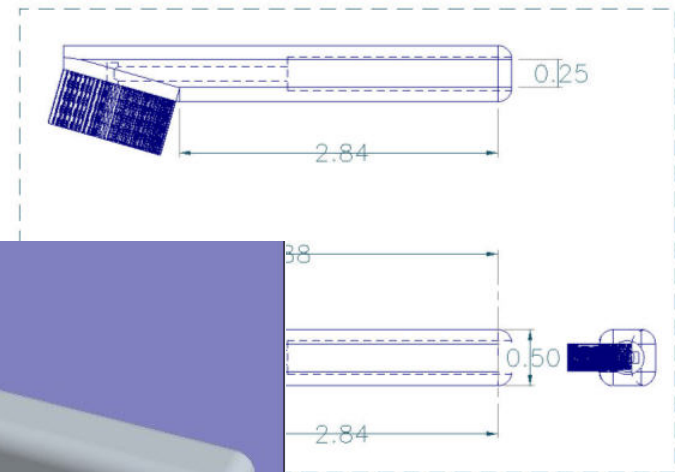
We are making a Self Dispensing Toothbrush that will screw on the top of a toothpaste tube and you can brush with it without putting the toothpaste on.

Customer Needs	Apply Yes/No	Design Needs
1. It needs to be comfortable to hold	Yes	Rubber
2. It needs to be easy to clean	Yes	Comes with a syringe
3. It needs to be simple to use	Yes	Easy to screw on, self explanatory
4. It needs to be durable	Yes	Strong Plastic, strong design
6. It should be flexible but durable	Yes	
7. It should be comfortable to brush with	Yes	
8. Colorful and vibrant	Yes	



## Self Dispensing Toothbrush

*Drawing View*



# Science

**Course:** Physics

**Concepts:**

Force and Motion

Conservation of Energy:

Exchanges between  
Potential and Kinetic  
Energy

Projectile Motion

**Projects:** Eggcellerator Car

Catapult

Mouse Trap Car

**Teachers:**

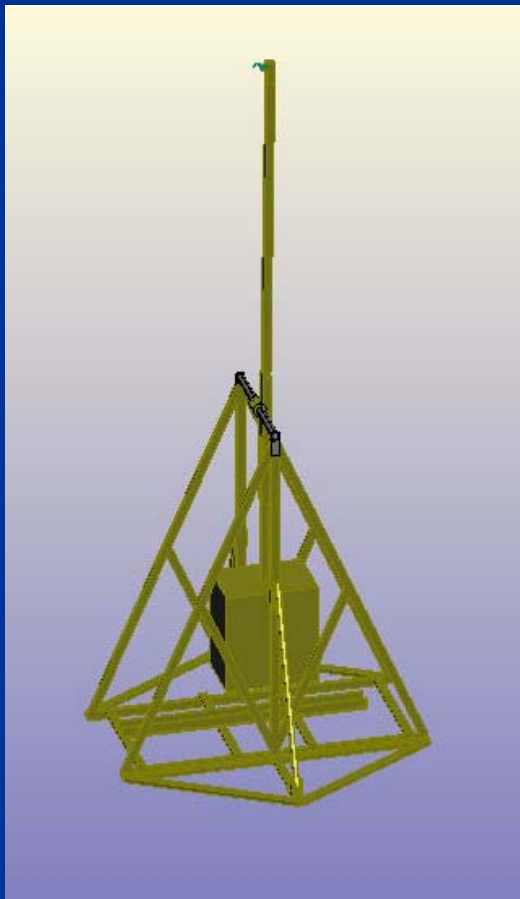
Ken Cole (Physics)

Steve Smith (Robotics)

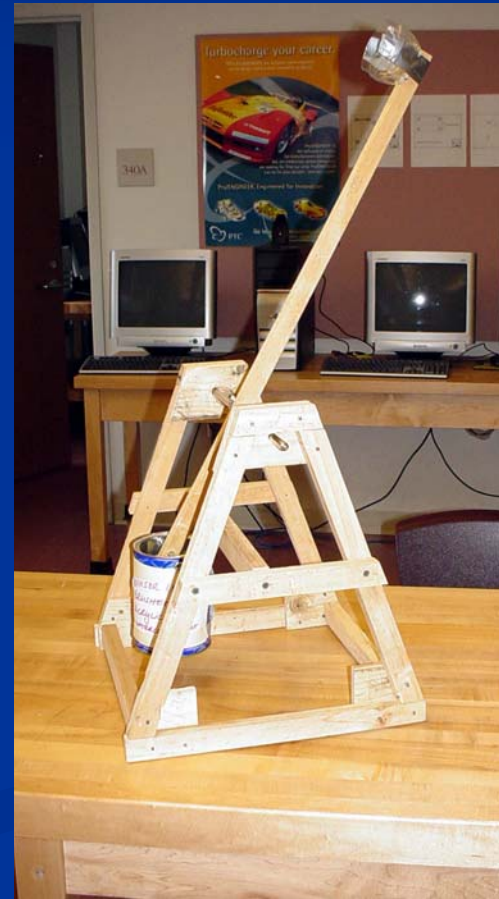


# Catapults

Luke F.



Steve Q.



\*\*\*\*Proposed new course offering\*\*\*\*

\*\*\*awaiting outcome of grant funding\*\*\*

# Integrated Studies

**Course:** Pre-Engineering

**Teachers:** Ken Cole (Physics), Steve Smith (Tech / Engineering) and Mark Littlefield (Math)

**Timeline:** Spring 04 -- grant notification

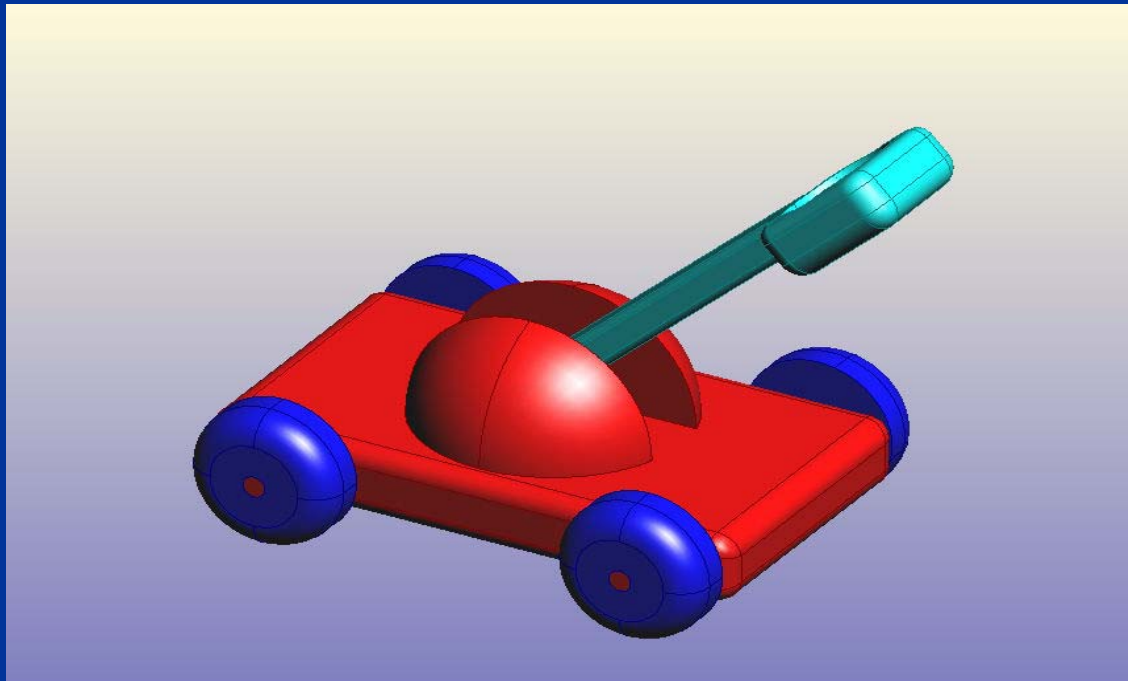
Fall 04 – planning

Spring 05 – course implementation

- The cross-disciplinary course will be taught and developed by teachers from three disciplines
- Using the engineering design process to solve a series of problems, students will experience the connections among math, science and engineering.

# Other Subjects

- Computer-Aided Design / Drafting
- Art



# Training Teachers From Other Districts



# Pro/DESKTOP Benefits

- It's free!
- Students may install on home computers
- Ability to upgrade to Pro/ENGINEER for advanced students
- By teachers, for teachers

# Challenges

- Commitment to change
- Teacher comfort level
- Time constraints
- Computer availability
- Common planning time

# Tips for Success

- Commitment from leadership
- Commitment of colleagues
- Enlist support from outside sources
- Learn side-by-side with your students

**Thank You**