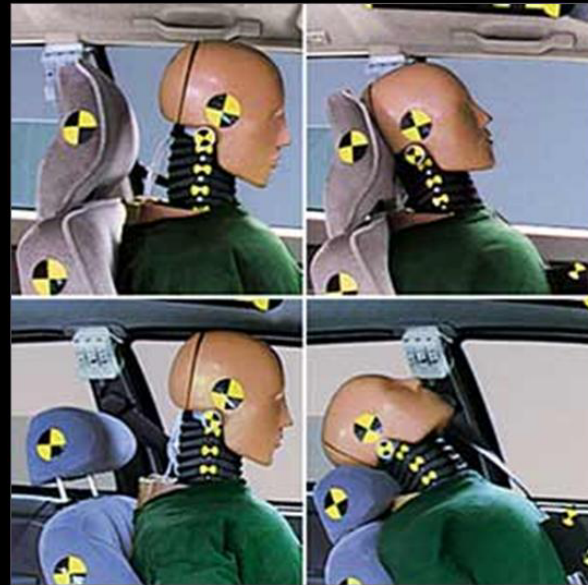




**EGG
CRASH
VEHICLE
DESIGN**



CAREER PREP CENTER

The Problem

You are the newly hired Automotive Engineering Team for JEA Motors Inc, a newly emerging vehicle design company who are planning to build and sell the safest automobiles ever built. The CEO of the company, Mr. Mandl, has hired you to design and build the company's first commercially available vehicle developed to ensure the safety of its passengers during any impact situation. The automotive industry is constantly striving towards a higher level of safety in today's automobiles. Each new model line must pass through rigorous testing and standards. Perhaps the most important testing that occurs is the crash testing. Vehicles are crashed into walls or other cars to determine if the occupants would survive a real life crash, and the types of injuries they could sustain.

Your Challenge

- ☞ Design and construct a vehicle, using appropriate materials, which will safely carry an uncooked egg (driver) over a given distance without causing injury (cracked egg) or death (broken egg) to the driver upon impact with a barricade (cinder block).
- ☞ If the egg (driver) survives the first crash test with no injuries, then the vehicle and driver will be tested on the rollover ramp. If the driver survives the rollover test without injury or death, that student will receive Extra Credit.

Criteria & Rules of the Challenge

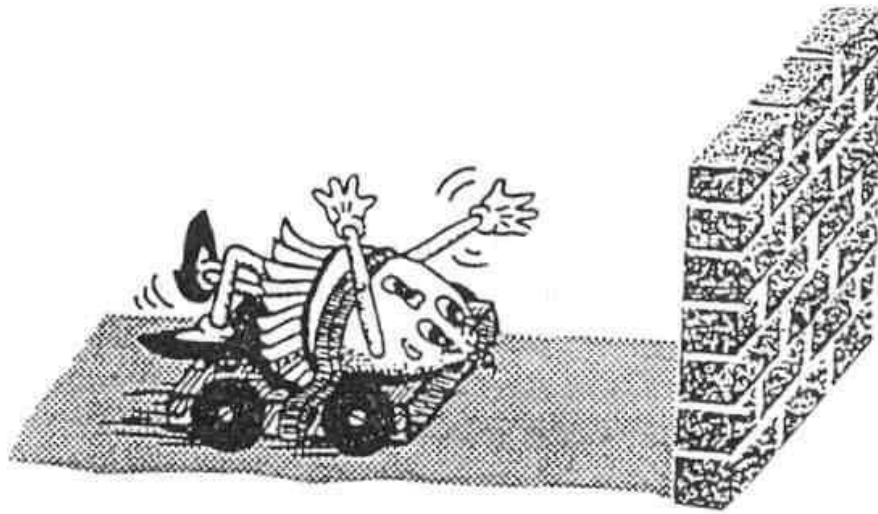
- ☞ Vehicles need to be designed based on your research or real world-automobile safety features.
- ☞ The vehicle must have 3 components to qualify for testing:
 - Wood Frame with bumpers (suspension optional)
 - Interior (seat, seatbelts, protection suit, etc.)
 - Body (hardtop or convertible)
- ☞ The vehicle must be no longer than 12" in length including all bumpers and safety equipment.
- ☞ Vehicle must have some type of a front bumper system.
- ☞ The vehicle must have wheels supplied by instructor. Also the wheels must run on the outer edge of the ramp.
- ☞ The vehicle must fit within the limits of the ramp supplied by the instructor.
- ☞ The vehicle cannot be powered by any means except the incline it rolls off.
- ☞ The vehicle must carry an uncooked egg (driver).
- ☞ The egg must remain securely in the vehicle at all times.
- ☞ Egg will be placed vertically in vehicle.
- ☞ Egg cannot be glued or taped in the vehicle.
- ☞ Egg must be removed from car within 30 seconds after crash.
- ☞ No peanut butter, jelly, or other food items are to be used.
- ☞ The driver/passenger must have an unobstructed 180 degrees field of vision out the front and sides of the vehicle.
- ☞ One-half of the egg must be visible.
- ☞ Egg must be restrained by a seatbelt or seatbelt system.
- ☞ Egg must be removable, interchangeable and not hard-boiled.
- ☞ Remember, the vehicle's condition is not the important factor in assessing its success, as is the case in a real accident. The condition of your passenger, or egg, will be assessed immediately following the impact. NOTE: Students may have no interaction with the vehicle until the instructor has been able to determine the passenger's physical conditions.
- ☞ The teacher will supply eggs at the time of the competition and each egg will be returned to the teacher at the end of the class period. If egg breaks while testing, student must clean up egg before final grade is given. Failure to follow the above rules will result in a letter grade of "F."

Material

Students must use approved materials. Students can use their own material with instructor approval.

The following is a list of appropriate material(s):

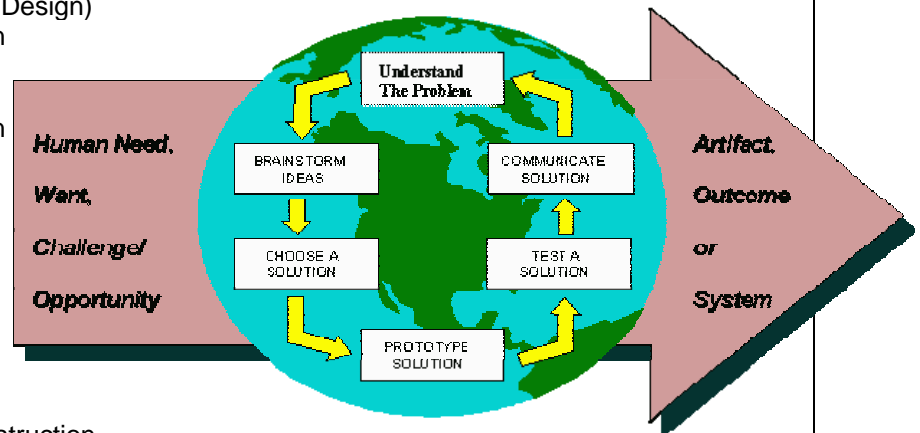
- ☞ Wood (frame rails and suspension components)
- ☞ Matte Board (seats, body, and/or frame components)
- ☞ Thin Clear Plastic Sheets (window material)
- ☞ Rubber Bands (any size or length)
- ☞ String (any size or length)
- ☞ Plastic Wheels (provided by instructor)
- ☞ Cotton or Cotton Balls
- ☞ Straws
- ☞ Springs (purchased or hand-made)
- ☞ Syringes
- ☞ Rubber
- ☞ Styrofoam
- ☞ Plastic
- ☞ Sponge



Daily Requirements

You will be using the Technological Problem Solving Method to complete your task:

- ☞ Day 1 - Independent Work
 - Research (Worksheets)
- ☞ Day 2 - Independent Work
 - Research (Worksheets)
 - Discuss Findings
- ☞ Day 3 - Independent Work
 - Brainstorm (Design Sketches)
- ☞ Day 4 - Independent Work
 - Brainstorm (Prototype Design)
 - Prototype Construction
- ☞ Day 5 - Independent Work
 - Prototype Construction
 - Working Drawings
- ☞ Day 6 - Independent Work
 - Working Drawings
- ☞ Day 7 - Independent Work
 - Working Drawings
- ☞ Day 9 - Independent Work
 - Prototype Design Construction
- ☞ Day 10 - Independent Work
 - Prototype Design Construction
- ☞ Day 11 - Independent Work
 - Prototype Design Construction
- ☞ Day 12 - Independent Work
 - Final Design Construction
- ☞ Day 13 - Classroom Competition
 - Final touch-ups and refinements
 - Competition
- ☞ Day 14 - Classroom Competition
 - Final Competition
- ☞ Day 15 - Project Evaluation Turn-In (With Cover Sheet)
 - Complete set of Working Drawings.
 - Completed Vehicle Design Worksheets.
 - Daily Research & Design Journal.
 - Sketch Worksheets



Vehicle Design Challenge Assessment Rubric

	Excellent	Good	Acceptable	Unacceptable
Design Process	Uses the Problem Solving Method. Has three or more documented resources and a complete set of working drawings within specifications. 40	Evidence of the problem solving with three or more references used and a complete set of working drawings within specifications. 30	Designs discussed with team. Has two or more references and a complete set of working drawings within specifications. 15	Little or no problem solving evident, little or no research and/or drawings. 0
Teamwork	Cooperates and interacts well with team. Workload shared equally. 25	Cooperates and interacts well with the team. Shared the duties. 20	Seldom interacts well with team. Workload not equally divided. 15	Does not interact well with the team and the workload is not evenly distributed. 0
Specifications Craftsmanship	Prototype agrees with neatly prepared drawings, meets criteria, and all assembly and construction done well. 25	Prototype agrees with drawings, meets criteria, and all assembly and construction done well. 20	Prototype agrees with drawings, meets criteria, poor assembly and construction. 15	Prototype disagrees with drawings, meets some criteria, assembly and construction poorly implemented. 0
Test	The egg passenger survives impact with no physical injuries and remains seated securely inside the vehicle. 10	The egg passenger survives with minor or zero injuries, but is no longer seated in its original position. 7	The egg passenger survives the impact with minor or serious injuries and is no longer seated securely inside the vehicle. 4	Our dearly departed egg passenger did not survive the impact. 0

Score _____

Total

(Total Possible – 100)

Vehicle Design Challenge
Automobile Frame Research Worksheet

One of the most important and earliest safety devices of the automotive industry was the design of the automobile body and frame. This should and will be one of the most important features of your vehicle.

In order to research solutions to your problem, please answer the questions below:

1. What is the body shell (or frame) of a car?
2. What three jobs are the parts of the body shell (or frame) designed to do?
1.
2.
3.
Why can "strategic weaknesses" be a strength in vehicle safety?
In a collision, what are bumpers good for?
Why do bumpers have spring-loaded shock absorbers?
What are crumple zones, and what are they good for?
What is Kinetic Energy?

Automobile Frame Research Worksheet Source Sheet

Please list the names of the web site or sites and resources you used to complete the worksheet on the front side of this sheet:

Web Site Name	Web Address

Related Web Sites:

- *Automobile Safety Timeline* - <http://www.allpar.com/ed/safety.html>
- *Automotive Learning Center* - <http://www.innerauto.com/main.html>
- *National Highway Traffic Safety Administration* - <http://www.nhtsa.dot.gov/>

Vehicle Design Challenge
Interior Safety Features Research Worksheet

You may believe that the interior safety features of modern automobiles have no place in your design solutions...NOT TRUE! You are required to use wood for the frame of your vehicle, but may use various other materials to construct the passenger compartment of your vehicle.

To further research your problem, answer the following questions concerning interior automotive safety features:

How does a seatbelt work?
According to the National Highway Traffic and Safety Administration, how many lives a year do seatbelts save?
What is Inertia?
What is the right way to wear a seatbelt?
What are the basic, or 3 main parts, to an airbag? Please BRIEFLY describe them.
1.
2.
3.
By what percent do airbags reduce the risk of dying in a frontal crash?
Why is it important to wear a safety belt (or seatbelt) even if your vehicle has an airbag?

Interior Safety Features

Research Worksheet

Source Sheet

Please list the names of the web site or sites and resources you used to complete the worksheet on the front side of this sheet:

Web Site Name	Web Address

Related Web Sites:

- *Automobile Safety Timeline* - <http://www.allpar.com/ed/safety.html>
- *Automotive Learning Center* - <http://www.innerauto.com/main.html>
- *National Highway Traffic Safety Administration* - <http://www.nhtsa.dot.gov/>

Vehicle Design Challenge
Crash Testing Research Worksheet

Your vehicle will undergo crash testing by your CEO and instructor, Mr. Mandl. The questions below will help to improve your understanding of crash tests, and how to design your car to survive the tests.

To further research your problem, answer the following questions concerning crash tests:

Why have cars been getting safer throughout their history?
What is the "PERFECT" crash?
What are Federal Motor Vehicle Safety Standards?
What are 3 criteria for frontal crashes used in the 5 star rating system?
1.
2.
3.
What are 2 criteria for side impact crashes used in the 5 star rating system?
1.
2.

Crash Testing

Research Worksheet

Source Sheet

Please list the names of the web site or sites and resources you used to complete the worksheet on the front side of this sheet:

Web Site Name	Web Address

Related Web Sites:

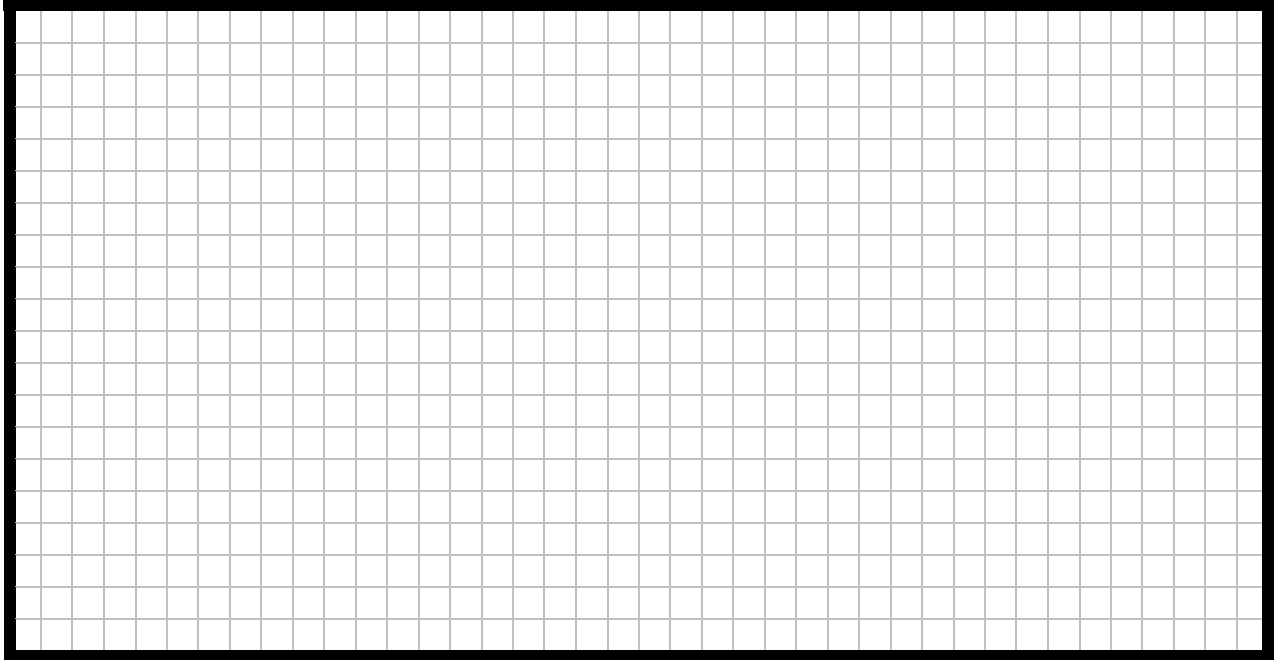
- *Automobile Safety Timeline* - <http://www.allpar.com/ed/safety.html>
- *Automotive Learning Center* - <http://www.innerauto.com/main.html>
- *National Highway Traffic Safety Administration* - <http://www.nhtsa.dot.gov/>

Crash Test Vehicle

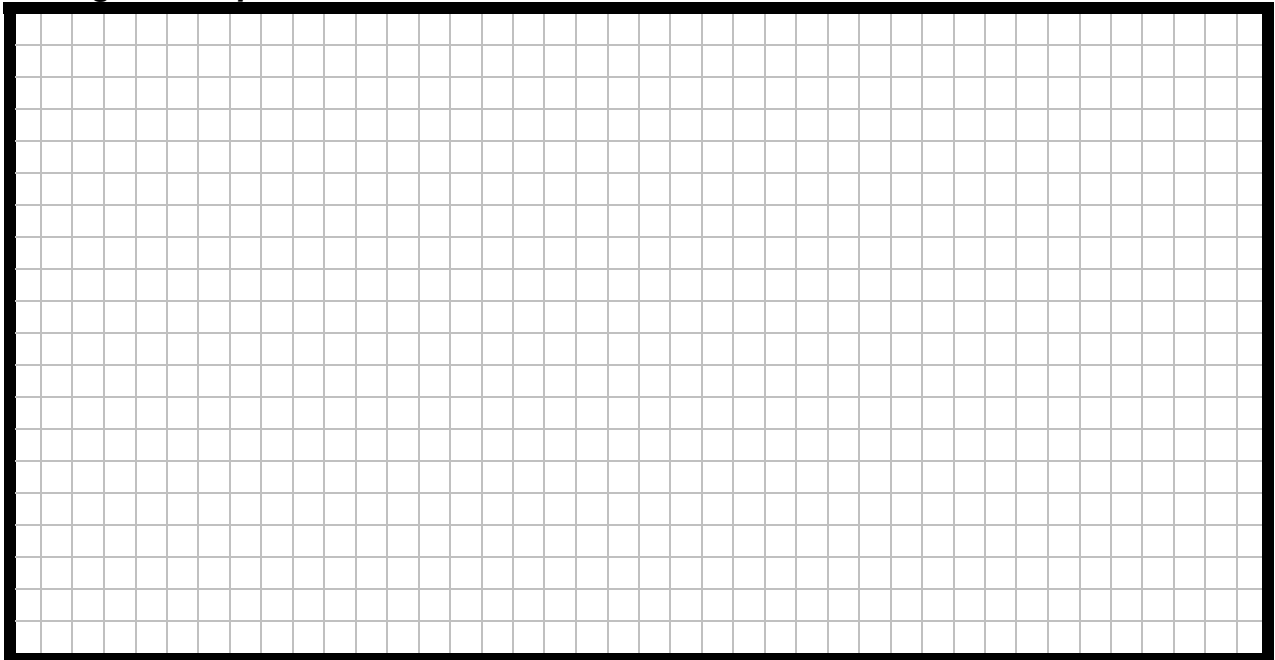
Initial Brainstorming Worksheet

Please provide a minimum of three design concepts using the graph paper blocks below. Please sketch these designs to scale, considering that each block is equal to 1". Also provide 3 views for your design where possible and appropriate.

Design Concept #1



Design Concept #2



Standards Covered in Detail

Academic Standards for Science and Technology

Unifying Themes

- ☞ Discriminate among the concepts of systems, subsystems, feedback, and control in solving technological problems.
- ☞ Describe the concepts of models as a way to predict and understand science and technology.
- ☞ Apply scale as a way of relating concepts and ideas to one another by some measure.
- ☞ Describe patterns of change in nature and man made systems.
- ☞ *Inquiry and Design*
- ☞ Apply process knowledge and organize scientific and technological phenomena in varied ways.
- ☞ Identify and apply the technological design process to solve problems.
- ☞ *Physical Science, Chemistry and Physics*
- ☞ Distinguish among the principles of force and motion.
- ☞ *Technology Education*
- ☞ Apply knowledge of information technologies of encoding, transmitting, receiving, storing, retrieving, and decoding.
- ☞ Apply physical technologies of structural design, analysis and engineering, personnel relations, financial affairs, structural production, marketing, research and design to real world problems.
- ☞ *Technological Devices*
- ☞ Identify and safely use a variety of tools, basic machines, materials, and techniques to solve problems and answer questions
- ☞ Apply appropriate instruments and apparatus to examine a variety of objects and processes.
- ☞ Apply basic computer operations and concepts.
- ☞ Utilize computer software to solve specific problems.

Academic Standards for Reading, Writing, Speaking & Listening

Types of Writing

- ☞ Write complex informational pieces (e.g., research papers, analyses, evaluations, essays).
- ☞ Maintain a written record of activities, course work, experience, honors and interests.

Quality of Writing

- ☞ Write with a sharp, distinct focus.
- ☞ Write using well-developed content appropriate for the topic.
- ☞ Edit writing using the conventions of language.

Speaking & Listening

- ☞ Listen to others.
- ☞ Contribute to discussions.
- ☞ Participate in small and large group discussions and presentations.
- ☞ Use media for learning purposes.

Academic Standards for Health, Safety and Physical Education

Safety and Injury Prevention

- ☞ Analyze the role of individual responsibility for safe practices and injury prevention in the home, school and community