Objective

- Deaths from automobile fires comprise one of the largest causes of death from fire in America. One of every five fires recorded in the US are from vehicular fires. As a result, 3,000 injuries and 500 deaths per year occur.
- There are an estimated 8,000,000 automobiles sold annually in the United States.
- Our product must be built to government regulation specifications and pass all necessary DOT (Department of Transportation) laws, be easy to install and not interfere with existing automobile parts, and have a rapid disconnection to prevent fires.

CTQ Customer Requirements

- Cost
- Serviceability
- Reliability
- User Re-engagement
- System Feedback

CTQ Engineering Characteristics

- Design Complexity
- Ergonomics
- Speed of Reset
- Speed of Re-engagement
- Size

Concept Generation

1. Ball bearing released from supports in housing at impact, breaking battery connection.
2. User pulls down spring-loaded bottom support arm to reset ball, restoring power.

Key Functionality and Innovation

- Precision bearing contacts
- User reset with spring-loaded arm

Design Satisfaction of Customer Requirements

- Aluminum and steel components ensure durability
- Simple design allows for serviceability and low cost
- User reset provides option to restore power if desired

Prototype and Testing

Prototype

- Designed to be placed in circuit with car battery and all electronic components. Due to high g-force loads the new prototype will implement metal casing for added durability.

Testing

- During collision, much larger deceleration is experienced than normal driving. Assume heavy damage could occur to electronics at 30 mph crash.
- Varying crumple zone and speed, device could experience 30 G's.
- Device to be connected to pendulum. When released from a calculated height, device will experience 30 G upon impact of this speed.
- Spring will be used to keep pressure on bearing and restrain the bearing for impacts under 30 G's.

Test Results and Future Work

Summary of Product Design Process

- Customer Surveys showed need for Battery Shutoff Safety system
- CTQ CR’s and EQ’s determined from HOQ
- AHP Process allowed for in depth concept selection from three initial concepts
- Prototype modeling, fabrication, and testing marked end of PDP process with given timeframe

Recommendation for Future Design

- Design mounting brackets between housing and frame
- Optimize surface finish on bearing and bearing contacts
- Design effective electrical insulation on housing to prevent shock

Process Reflection

- PDP Process allowed for effective and efficient product design

Decision Characteristics and Weights

- Speed of Disengagement (0.38)
- Force Durability (0.23)
- Speed of Reset (0.165)
- Design Complexity (0.114)
- Size (0.078)
- Ergonomics (0.034)

Final Decision Matrix Rankings

1) Ball Bearing Design (0.458)
2) Accelerometer Design (0.417)
3) Lead Wire Cutter Design (0.125)