MISSION STATEMENT
The FSAE Aerodynamic development project focuses on the implementation of a drag reduction system (DRS) on the aerodynamic package of RIT’s 2014 Formula SAE competition vehicle.

DESIGN OBJECTIVES
- Meets all requirements of FSAE rules and regulations
- Limit drag on racecars electrical system
- Reduce drag, decrease lap times and decrease fuel used during an endurance or autocross event
- Add no more than 3 pounds of total weight to the car.
- Operate completely independently from the driver.

BACKGROUND
Every year the RIT FSAE Racing team competes in collegiate design competitions with schools across the country. The competition includes both dynamic and static events that challenge both the racecar and the students who designed the car. Each event has its own scoring system and weight. Over the last several years a larger emphasis has been put on fuel economy, increasing it to 10% of the total competition score. The endurance event now not only depends on the total time but the total fuel used for the race. This change in scoring has lead teams to focus on improving performance while maintaining efficiency.

The RIT Formula SAE team over the last 3 years has designed and developed a full aero dynamic package for their racecar. This concept selection was one of the first steps towards a new system has allowed the racecar to become lighter while maintaining performance on the racetrack. A downfall of this system is increased drag during straightaway accelerations. The Formula team had expressed a need for a DRS on their 2014 racecar to decrease lap times and increase fuel efficiency.

CONCEPT SELECTION

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<th>Concept</th>
<th>Linear Actuator with an Arduino controller</th>
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SELECTED CONCEPT
Linear Actuator with an Arduino controller

MECHANICAL DESIGN
The mechanical actuation system consist of a linear actuator that moves a push rod that is connected to two bell cranks that move the second and third wing elements. Separate actuation systems are used for the front and the rear wing.

- The wing elements pivot near the center of pressure to allow for quick actuation times and lower forces.
- A pin connects both sides of the rear wing together so that they can be actuated at the same time.

PNEUMATIC AND ELECTRONIC DESIGN
Control System
- Mini-Arduino
- Throttle Position
- Linear Acceleration
- Steering Angle

Pneumatic System
- CO₂ with a 9oz recreational paintball bottle
- 1/8” tubing
- Front Actuator: (2) 7/16” Bore Bimba Cylinders
- Rear Actuator: 7/8” Bore Bimba Cylinder
- Designed to minimize response time and amount of CO₂ consumed.

RESULTS AND CONCLUSIONS
- Design meets all FSAE rules and regulations.
- Uses pneumatic actuation system with an electric solenoid, minimal use of electrical system.
- Reduced drag while DRS is activated.
- Operated automatically without driver input though steering position, throttle position and accelerometer data.
- Total weight added to system is less than 3 pounds.