In order to sell John Deere tractors in Europe, additional braking safety standards must be met. Currently, to satisfy the stopping distance requirement, the tractor is brought to maximum speed, an operator engages the brakes, and adjusts his braking effort in response to a readout of an onboard load cell to meet a force requirement. The current test is inconsistent and unreliable due to the inability of the operator to apply a constant and accurate load. Our objective is to design and build a brake assist device that delivers a 600 Newton force to the tractor’s brake pedals.

Some requirements for the device to meet include easy deactivation, spatial accommodation of an operator wearing a seatbelt and uninhibited access to the brake pedal in the event of a brake assist malfunction. Additionally, the tractor operator should be able to set a specific load for the device to administer and the device will automatically adjust the applied force.

Since all John Deere compact utility tractors feature onboard hydraulics, our team has decided to employ a hydraulic cylinder actuator for force application. Force and actuator speed are directly controlled by hydraulic pressure and flow rate, respectively. Using a directional control valve, bulk changes in flow rate can be achieved to provide adequate actuator speed for the purpose of simulating the act of slamming on the brakes. This valve can also control when to extend and retract the actuator arm. Additionally, a proportional solenoid control valve can finely adjust fluid pressure to deliver the specific actuator force that the operator desires.

The total development and prototype construction cost was $615. The assignment period of this project is one semester -- a working prototype was completed in mid-March, and all deliverables including a final design report were delivered during the first week of May. This final design report contains background information, customer needs assessment, external search results, engineering specifications, concept generation and selection protocols, system-level and detailed design descriptions.