

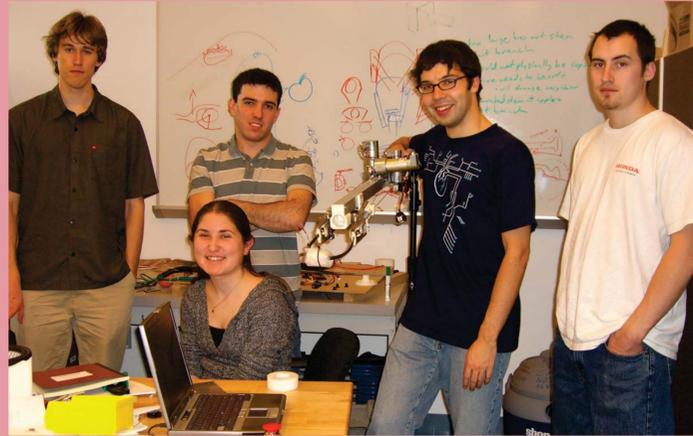


## Project Overview

The goal of this project is to design and prototype an end effector for use in conjunction with an apple and orange harvesting robot. The primary constraints involve ensuring the commercial viability of the design as well as its ability to function within the tolerances of the rest of the robot. The end effector must be able to pick apples and oranges that range in size from  $\varnothing 2"$  to  $\varnothing 5"$ . The end effector must also not damage the fruit it is picking or any nearby fruit, and must be able to pick fruit growing in clumps.

This project is a continuation of a 2007-2008 SCOPE project. At the conclusion of last year, the team has produced a prototype for use in lab testing. The first task for this year's team was to test the existing prototype in the field and determine its strengths and weaknesses. The team brainstormed new mechanisms and constructed a new functional prototype. This prototype was tested in orange groves and further development of key mechanisms was completed based on the testing results.

## Project Team



**Katie Kavett**  
Project Manager

**Michael Boutelle**  
Budget Coordinator

**Scott McClure**  
Electrical Lead

**Gabe Greeley**  
Mechanical Lead

**Will Yarak**  
Safety & Ethics Coordinator

**Dave Anderson**  
Faculty Advisor

**Tony Koselka**  
Sponsor Liaison

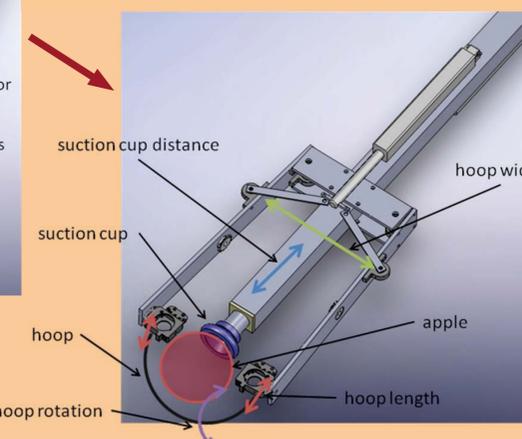
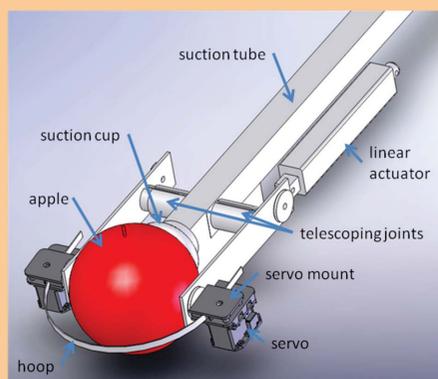
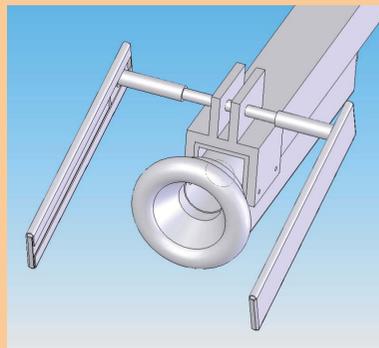
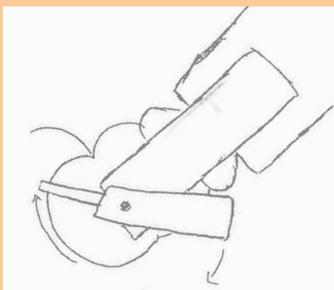
## Field Testing

A number of recurring problems were discovered when testing last year's prototype in apple orchards and testing this year's prototype in orange groves:

- A** | The hoop cannot cut fruit with stems that are too short.
- B** | The hoop cannot fit between fruits that grow in clumps.
- C** | Nearby leaves and twigs are caught between the suction cup and the fruit.
- D** | Apples and oranges are not spherical, so it is difficult to size the hoop correctly.
- E** | Orange stems that are too large in diameter do not fit in the cutter.



## Prototype Evolution



The significant mechanisms designed for the new prototype include:

- A** | Suction cup and vacuum to grab and hold the fruit
- B** | Linear actuator to move the fruit in line with the center of rotation of the hoop
- C** | Linear actuators to control the width of the hoop
- D** | Servos to control the length of the hoop for fruits from 2" to 5" in diameter
- E** | Servos to control the rotation of the hoop concentric with the center of the fruit
- F** | Interchangeable hoop designs:
  - | Reciprocating cutting hoop to shear the fruit stems
  - | Sliding cutter to cut the fruit stems

