Team 15: Tree Limbing and Harvesting ROV

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Objectives

- Design a Remotely Operated Vehicle (ROV) modeled after a total tree harvester head that will climb, de-limb, and section a tree. This project includes:
  - Designing a 3D CAD of the ROV
  - Building a control system skeleton
  - 3D printing a small scale model of the top clamp
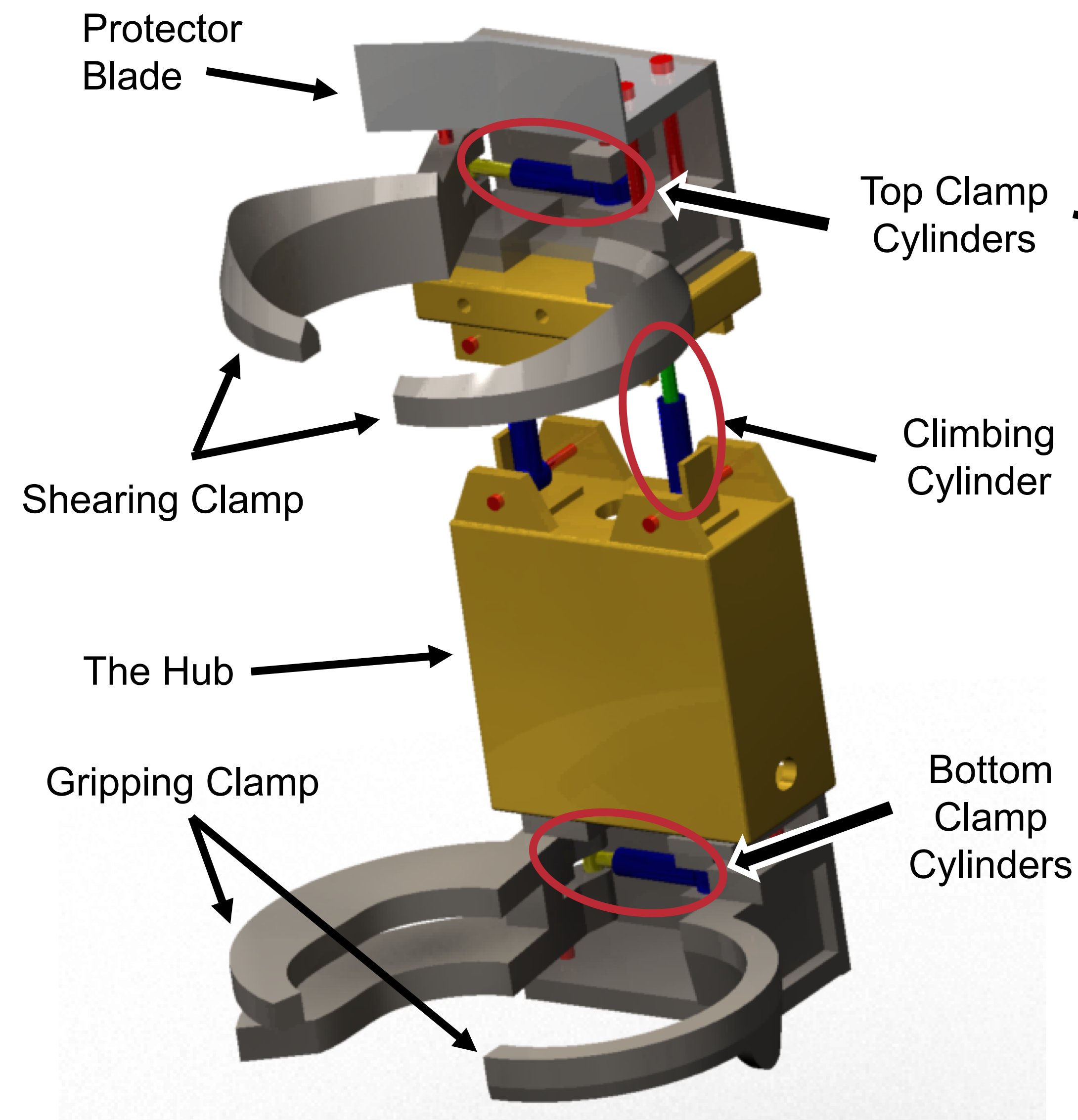

Naarva S23 stroke harvester

Motivation

- Workers in the lumber industry have a 3 times higher fatality rate than the average U.S. worker[1]

- Tree removal methods can cost up to $1,500 using landscaping services
- Although total tree harvesters are safer, they are inconvenient to use in urban environments
- Large trees can be dangerous to private and public infrastructure
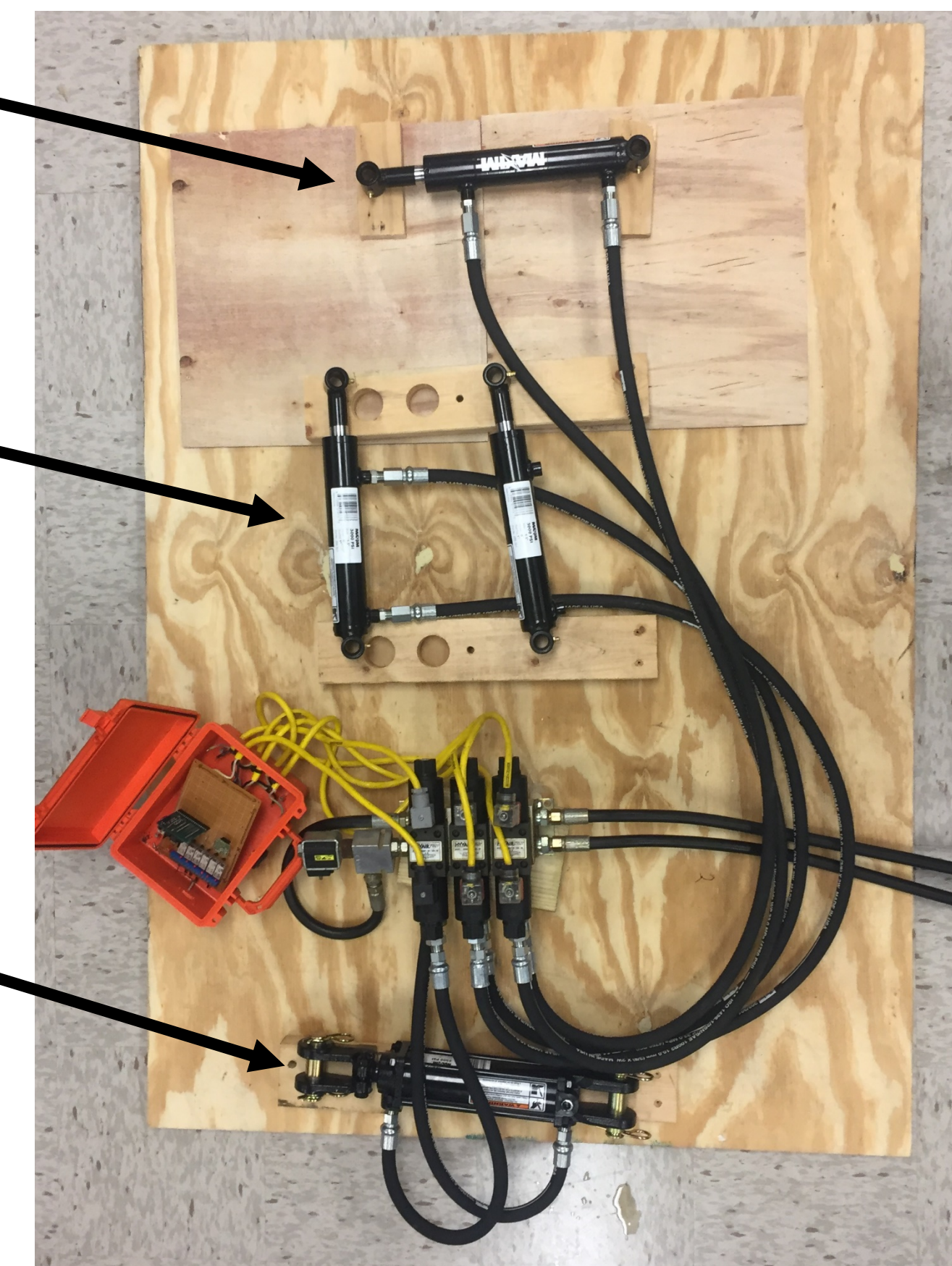

Targets

Maximum tree height	60 ft
Opening width	12-16 in
Maximum weight	70 lbs
Minimum clamping force to climb	100 lbf
Force to shear limbs	1,800 lbf
Minimum holding force to shear limbs	1,900 lbf

The Bear

- Protector Blade
- Top Clamp Cylinders
- Shearing Clamp
- Climbing Cylinder
- The Hub
- Gripping Clamp
- Bottom Clamp Cylinders

Design Description

- Bear hug clamping method used for climbing
- Utilizes a hydraulic clamping system
- Two clamps are connected by two hydraulic cylinders to climb the tree
- The upward hydraulic pressure drives the shearing blade upwards to de-limb the tree
- The microcontroller of the ROV is remotely operated from a safe distance

Hydraulic System

- Open circuit system: continuous flow with a pressure relief valve attached at the manifold.
- Solenoid valves controlled by a wireless controller

- Operating pressure: 2500 psi
- Double acting cylinders
- 3 station manifold
- 3 position solenoid valve
- 3.8 HP motor and pump unit

Conclusion

- Our design decreases the risk factor for users compared to current methods
- The Bear was designed to feature portability and strength
- A control system was developed for a user friendly approach
- While the clamp was designed for various trees, straight pine trees were the control for testing
- Additional control safety feature could be implemented