

# MEASURE PHASE

## PALM HARVESTER

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# PRESENTATION AGENDA

- Introduction
- Background Research
- Recap of the Define Phase
- Process Improvement
- Mechanical Systems Overview
- Budget
- SWOT Analysis
- Design Improvement
- Conclusion

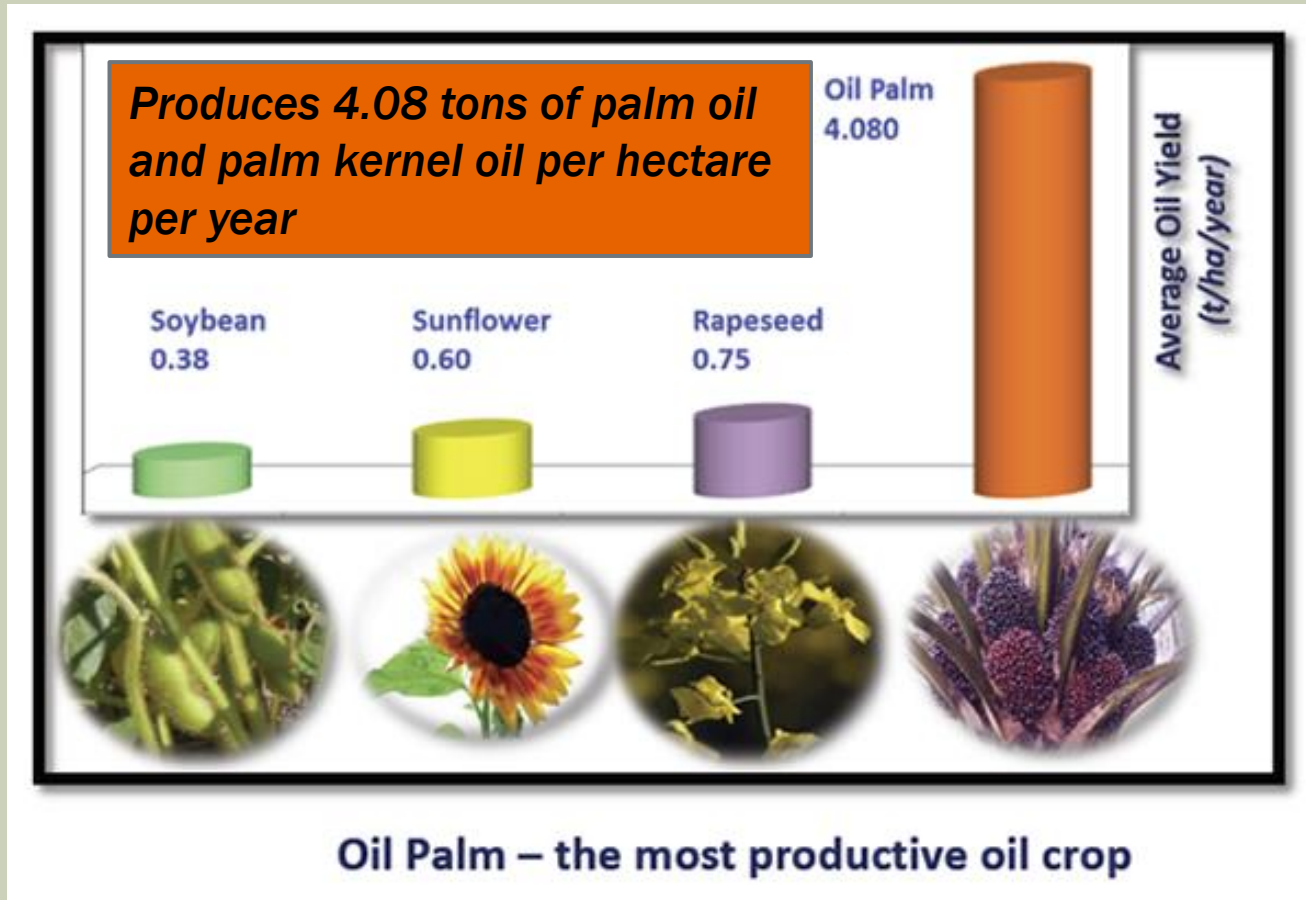
# INTRODUCTION

- Improve working conditions at palm plantations
- Improve last year's mechanism
- **Define Phase:** Gave the areas of improvement
- **Measure Phase:** Tests current mechanism in those areas of improvement

# BACKGROUND RESEARCH

- Palm oil is the 2<sup>nd</sup> most consumed oil in the world after soybean oil
- Malaysia is the 2<sup>nd</sup> largest producer of palm oil after Indonesia
- Malaysia has less strict laws on palm oil plantations than Indonesia

# BACKGROUND RESEARCH



# RECAP OF THE DEFINE PHASE

- **Objective:** Create a safe, reliable, inexpensive and competitive device to retrieve palm fruit.
- **Budget:** \$2,500.00
- **Improvements:**
  - Pulley System
  - Materials
  - Mobility
  - Automation

# PROCESS IMPROVEMENT

## Assembling Cart

Pull wire attached to crank on the cart, approximately 10 feet, and link it to the first pulley located on the telescoping pole.

0:00- 0:39

Lift and place bottom of telescoping through the slot on top of cart.

0:39- 1:00

Stand the pole upright by manually lifting the pole from the top end and attempt to fit the bottom of the pole on the alignment block located in the middle of the cart.

Once the pole is in place, secure it by turning the tightening bolt on the ring.

Manually lift the pole from the alignment block and begin to align it.

Continue until height is adjusted.

**Assembly time: 3:50**

## Disassembling Cart

Lower the telescoping pole by reversing the crank and slowly cranking until all tension from the wire is gone.

0:00- 0:40

After all tension is gone, the telescoping pole can be taken down. The wire won't get caught.

0:40- 1:12

**1:15-2:00**

Manually lift pole from alignment block.

teammates can 'catch' it.

Detach all wires from pulleys to

**Disassembling time:**

**2:20**

Define Phase Recap

Process Improvement

Mechanical Systems Overview

# MECHANICAL SYSTEMS OVERVIEW

Telescoping  
Pole

Cart

Pulley  
System

Automation

Process Improvement

Mechanical Systems Overview

Telescoping Pole



# TELESCOPING POLE

Shape and  
Material

Stress

Deflection

Mechanical Systems Overview

Telescoping Pole

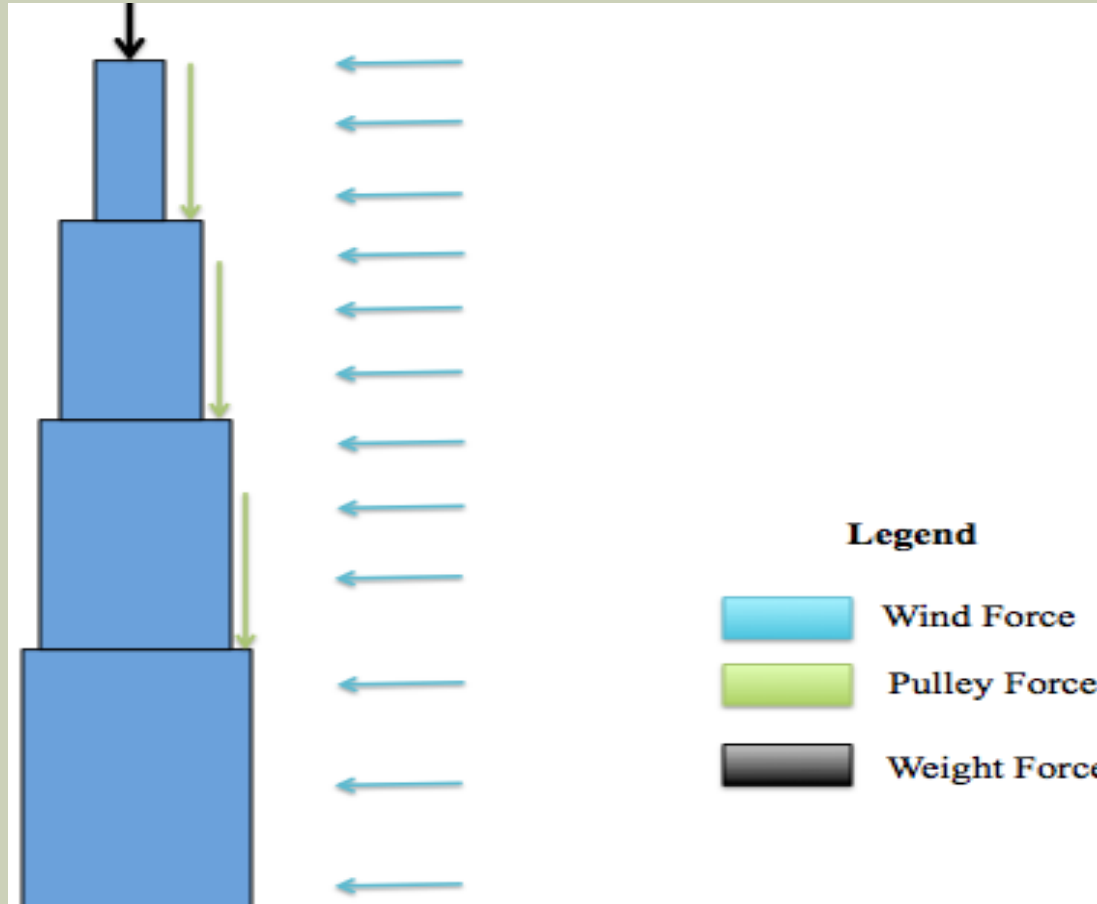
Shape and Material

Presenter: Talya Levin

# CROSS-SECTIONAL SHAPE AND MATERIAL

- Switched from circular to square cross section
- Pole rotation is avoided
- Changed from PVC/Steel to Aluminum
- Improved ductility

# FORCES ON THE POLE

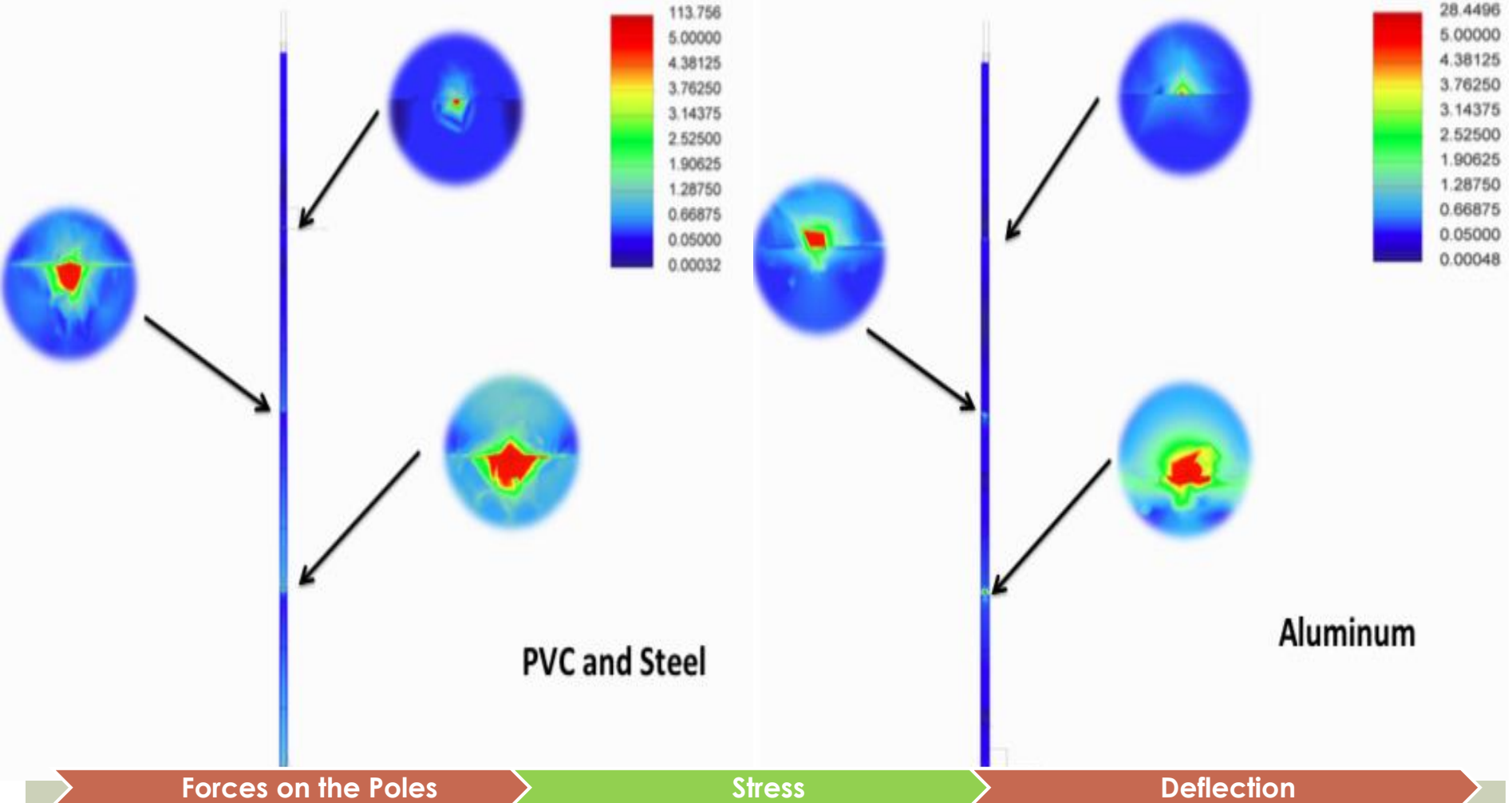


Shape and Material

Forces on the Pole

Stress

# STRESS

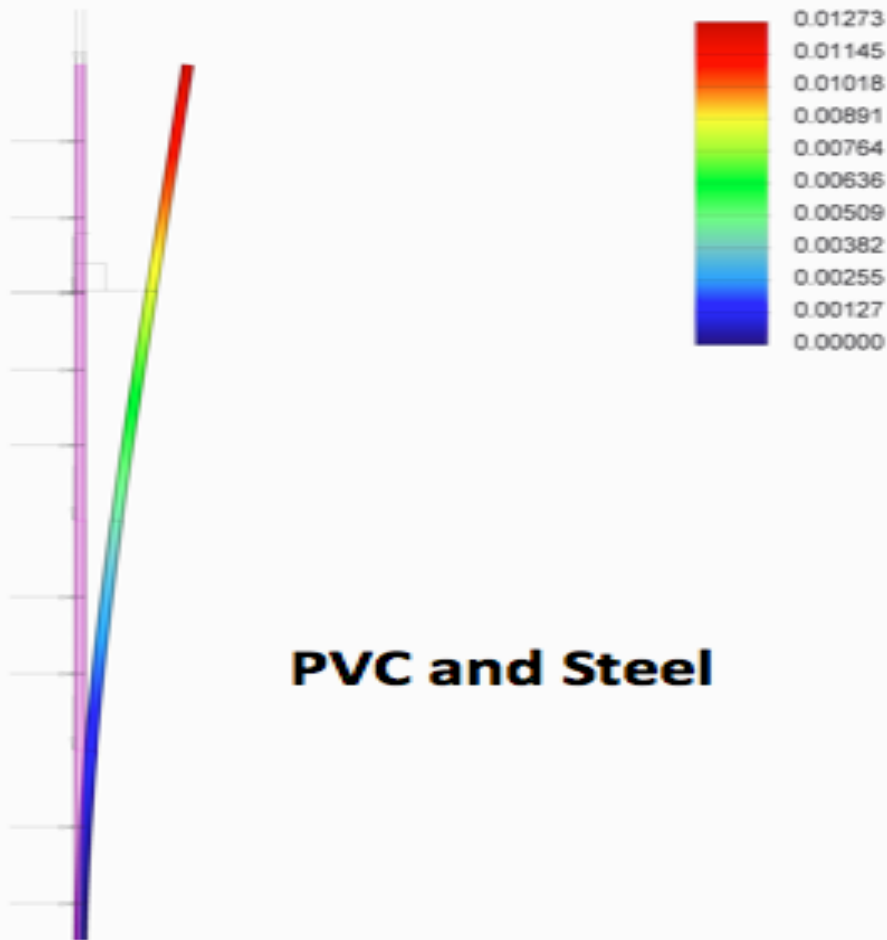


Forces on the Poles

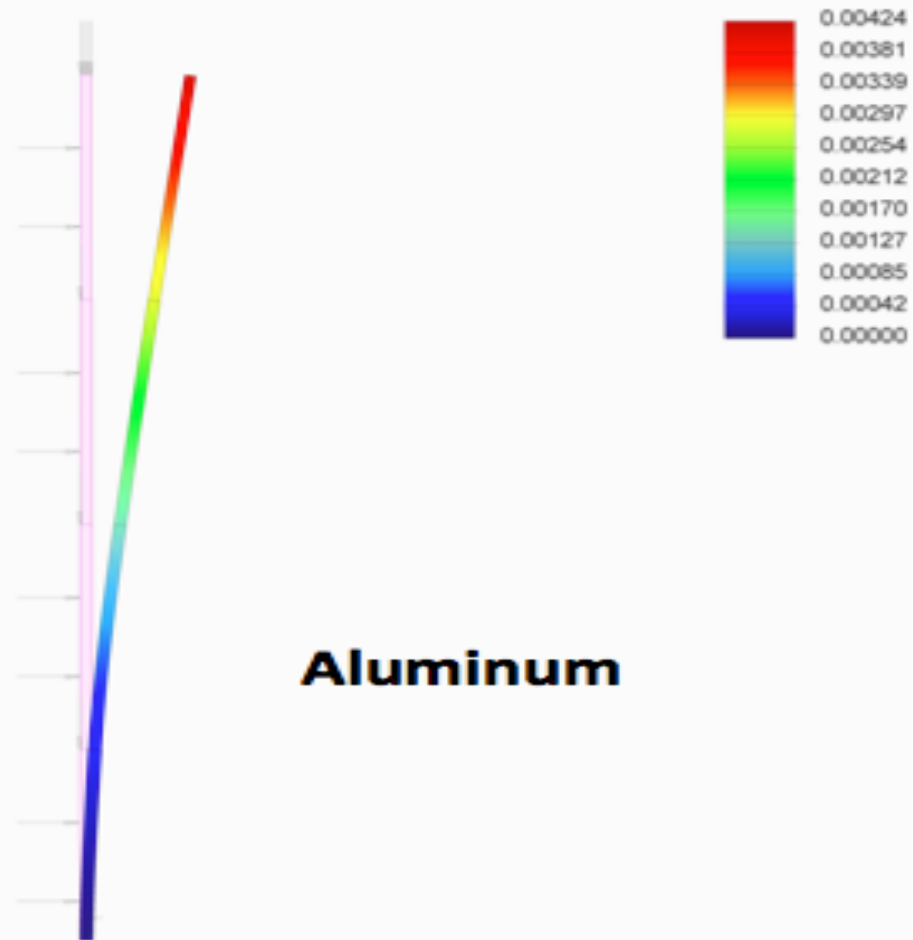
Stress

Deflection

# DEFLECTION



**PVC and Steel**



**Aluminum**

Stress

Deflection

Cart

# CART

Lowering  
the Center  
of Gravity

Wheels

Locking  
Mechanism

Deflection

Cart

Lowering Center of Gravity

# LOWERING CENTER OF GRAVITY

- Pole will rest on the bottom level of the cart
- Height of pole above cart will decrease
- Stability of the mechanism will increase



Cart

Lowering Center of Gravity

Wheels

# WHEELS

Pneumatic Swivel  
Caster Wheels



[3]

No-Flat Replacement  
Turf Tire



[4]

Lowering Center of Gravity

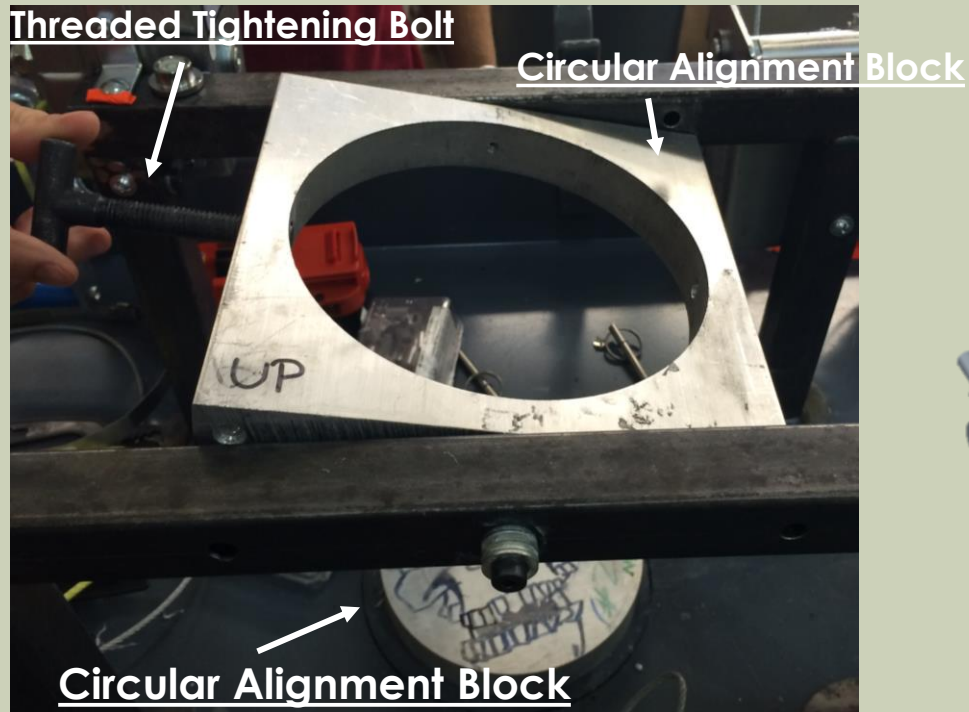
Wheels

Locking Mechanism

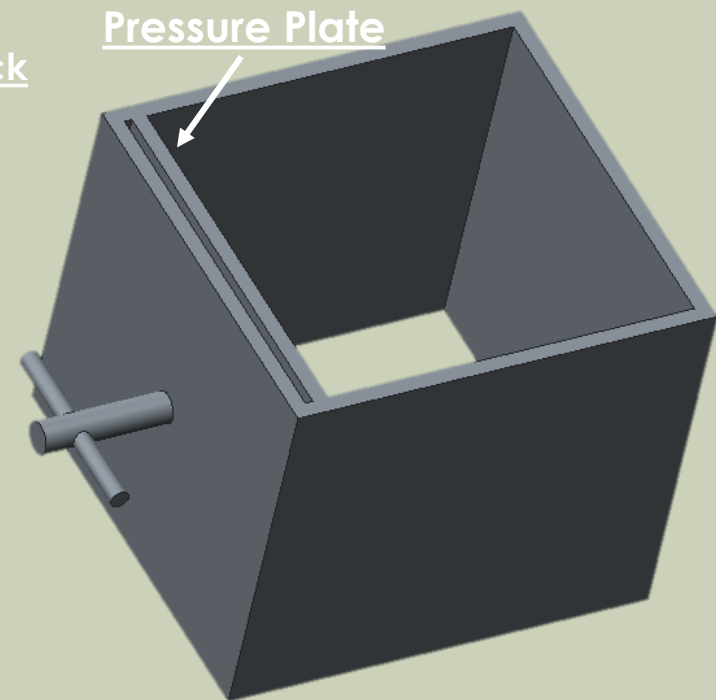


# LOCKING MECHANISM

## Old Pivot Model



## New Pivot Model



Wheels

Locking Mechanism

Pulley System

# PULLEY SYSTEM

## Inner Pulley System

Locking Mechanism

Pulley System

Internal Pulley System

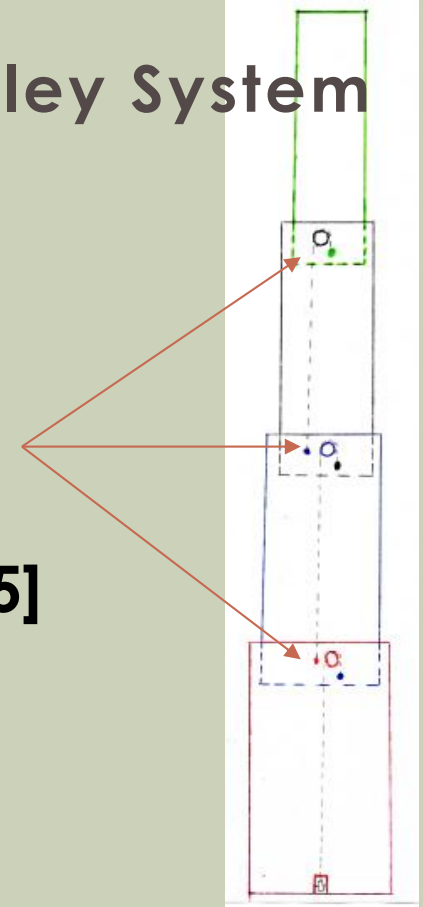
Presenter: Thomas Baker

# INTERNAL PULLEY SYSTEM

## Current Pulley System



## Internal Pulley System



Pulley System

Internal Pulley System

Automation

# AUTOMATION

## DC Gear Motor

Internal Pulley System

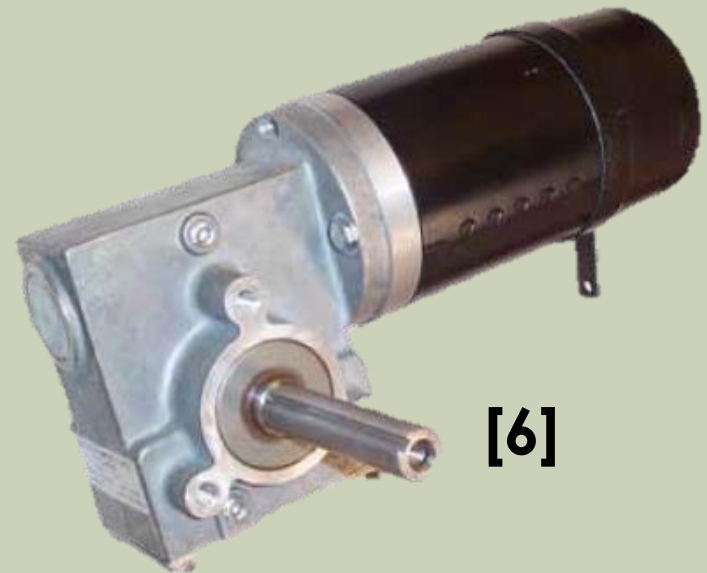
Automation

DC Gear Motor

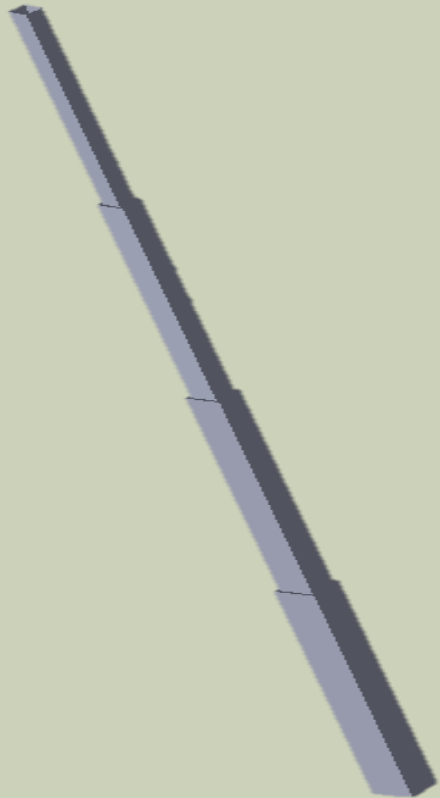
Presenter: Shaneatha Gates

# DC GEAR MOTOR

- Compact
- Light weight
- 36V needed to power
- Built-in worm gear
- Torque Needed: 38.1 N\*m
- Max Torque: 44.8 N\*m



# EXPENSES



DC Gear Motor

Expenses

Budget

# BUDGET

Part	Quantity	Price
Aluminum Square Tubes	4	\$787.07
Pulleys	7	\$34.46
Wheels	4	\$119.96
Motor	1	\$500.00
Miscellaneous (nuts, bolts, etc.)	-	\$30.00
<b>Total</b>		<b>\$1,471.49</b>

Expenses

Budget

Voice of Customer Analysis

# VOICE OF CUSTOMER ANALYSIS

SWOT  
Analysis

Improved  
Designs

Budget

Voice of Customer Analysis

SWOT Analysis

Presenter: Amber Smith



# SWOT ANALYSIS

## Strengths

- Stronger and more wind resistant material
- Automation will simplify controls
- Easier to use over manual method
- Easy to operate

## Opportunities

- Rising demand for palm oil
- Lack of competition
- Reduce labor issues on plantations
- Commercial manufacturing

## Weaknesses

- Large apparatus
- Cutting tool at top is not easily controlled
- Total process may take longer than traditional method so plantation owners may not see a need for it

## Threats

- Future designs that may be more efficient
- No safe fall method for the fruit

Voice of Customer Analysis

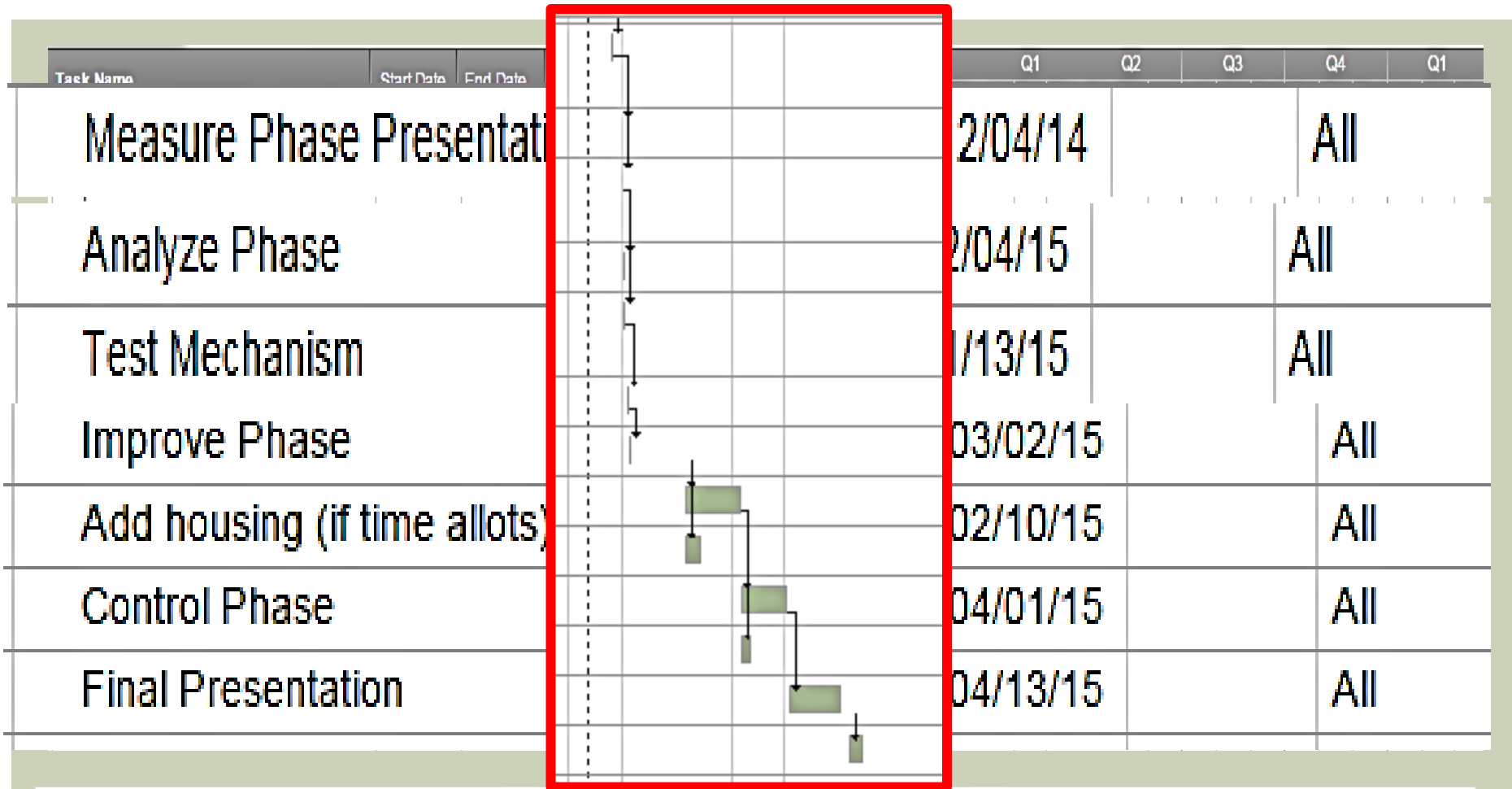
SWOT Analysis

Improved Designs

# IMPROVED DESIGNS

- Automated Telescoping Pole
- Square Cross-Section
- Aluminum Telescoping Pole
- Lowering Center of Gravity
- Internal Pulley System
- Polyurethane Wheels

# GANTT CHART



Improved Designs

Gantt Chart

Conclusion

# CONCLUSION

- **Objective:** Create a safe, reliable, inexpensive and competitive device to retrieve palm fruit.
- **Measure Phase Goals:**
  - Make measureable improvements to last year's mechanism
  - Demonstrate difference between last year's mechanism and current design
  - Create small scale model
- **Next Steps:** Order parts & assemble mechanism

# QUESTIONS



# REFERENCES

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