

# 68K Turbine Blade Handling Interim Design



Team 14

Patrick Filan  
Clint Kainec  
John Kemp



# Advisors

## Industry

### Ashtok Patel

Industrial Engineer  
Environmental Health &  
Safety Manager at **TECT  
Power**  
CSP, CHMM

## Faculty

### Dr. Patrick Hollis

Associate Professor &  
Undergraduate Coordinator  
Department of Mechanical  
Engineering

### Dr. Kamal Amin

Professor  
Department of Mechanical  
Engineering

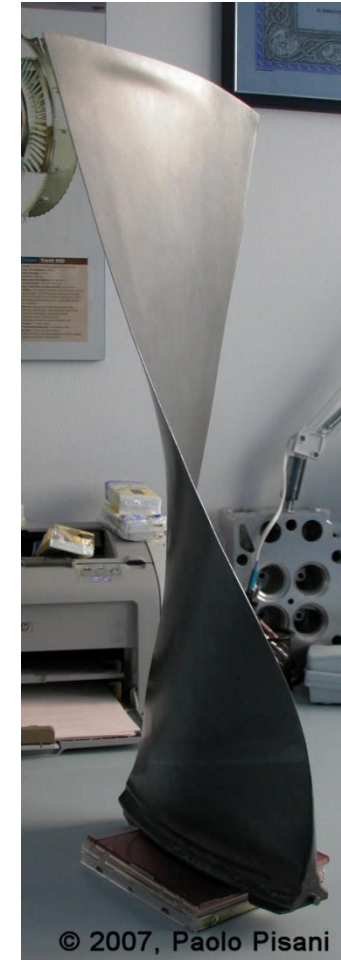
# TECT Power: Thomasville, GA

- A turbine part manufacturing facility
- Currently process a variety of turbine blades
  - Machining, finishing, testing
- Operates both single-axis manual mills and multi-axis automated mills



# The 68K Blade

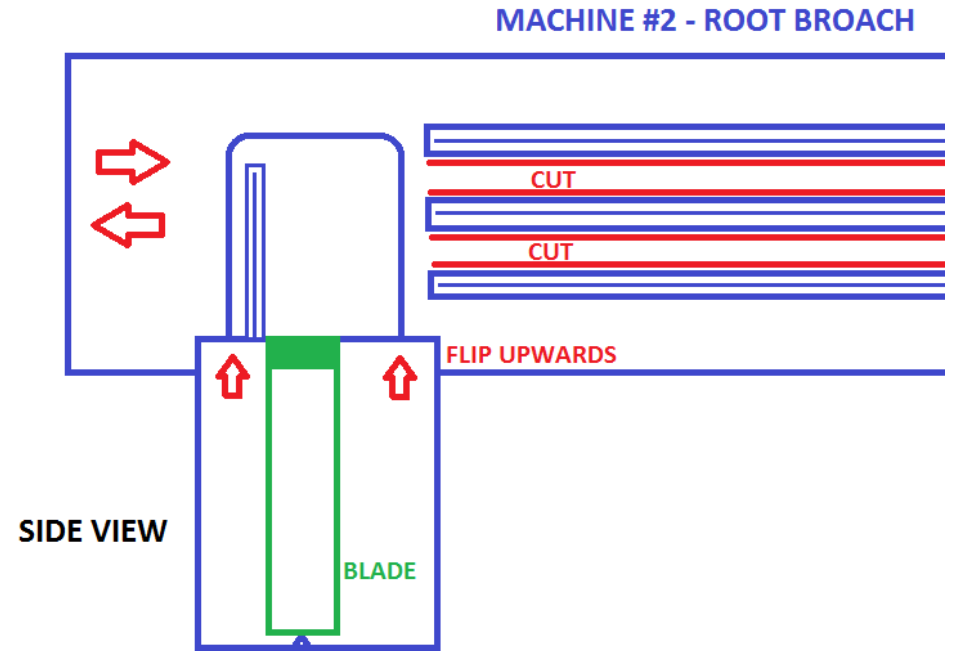
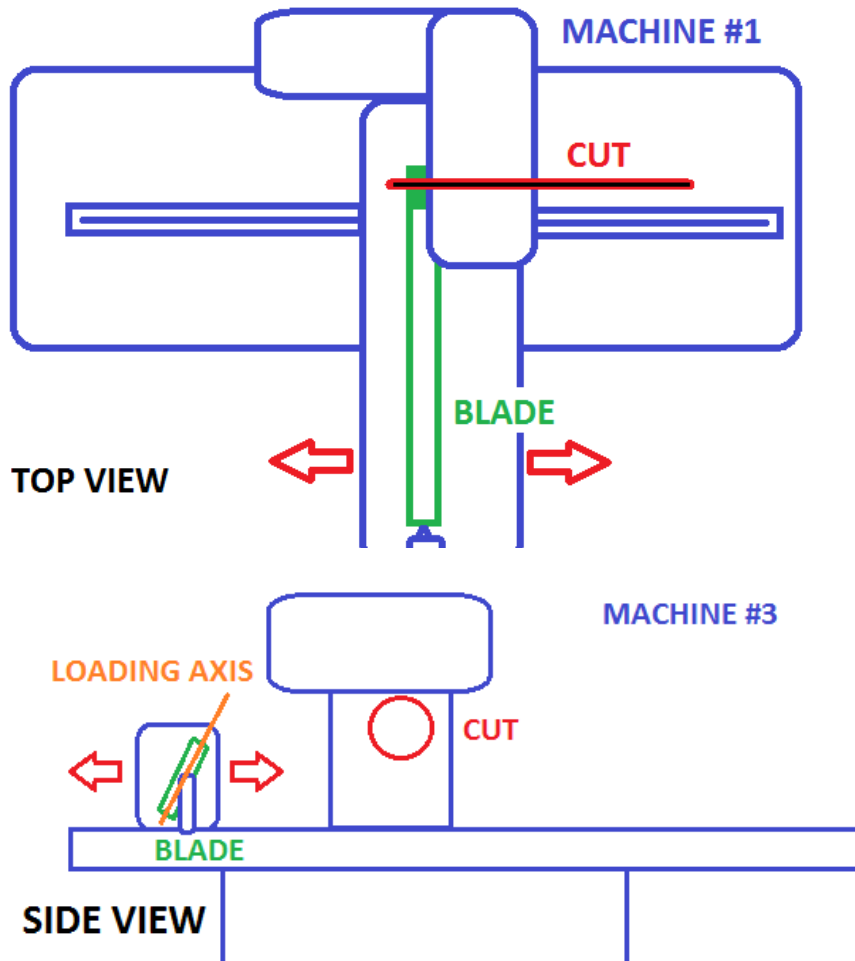
- 45 lb
- 3ft x 1ft x 0.125in
- Titanium aluminide
- Received as a raw forging
  - Only basic geometry
- Geometry
  - Root
  - Tip
  - Twist
  - Midspan
- Used in 68K engines
  - Generate 68,000lbf thrust



# The Problem

- Manual lifting of the 68K turbine blade
  - Risk of injury
  - Straining workers
  - Difficult for new workers
  - Needs to be eliminated
- The blade moves through several machines
  - Each machine unique
    - Obstructions
    - Placement
    - Orientation

# Blade Orientations



Machines 1-3 perform root operations on the blade

# Project Focus

- **Safety**
  - Ergonomics
  - Part-friendly
- Modify current cart
- Orientation and 3D position of the blade
  - Machine-friendly
    - Loading and unloading
  - Time efficiency
  - Cost effectiveness

# Existing Apparatus

## Previous Team

- Cart design
- Transport from storage to machine 1
- Orientated horizontally
- Many machines





# Modifications Necessary

- Removing shelves
  - Adding storage
- Attaching new apparatus
  - Crane
  - Grips
- Housing for apparatus parts
  - Electrical system – If applicable
  - Battery – If applicable

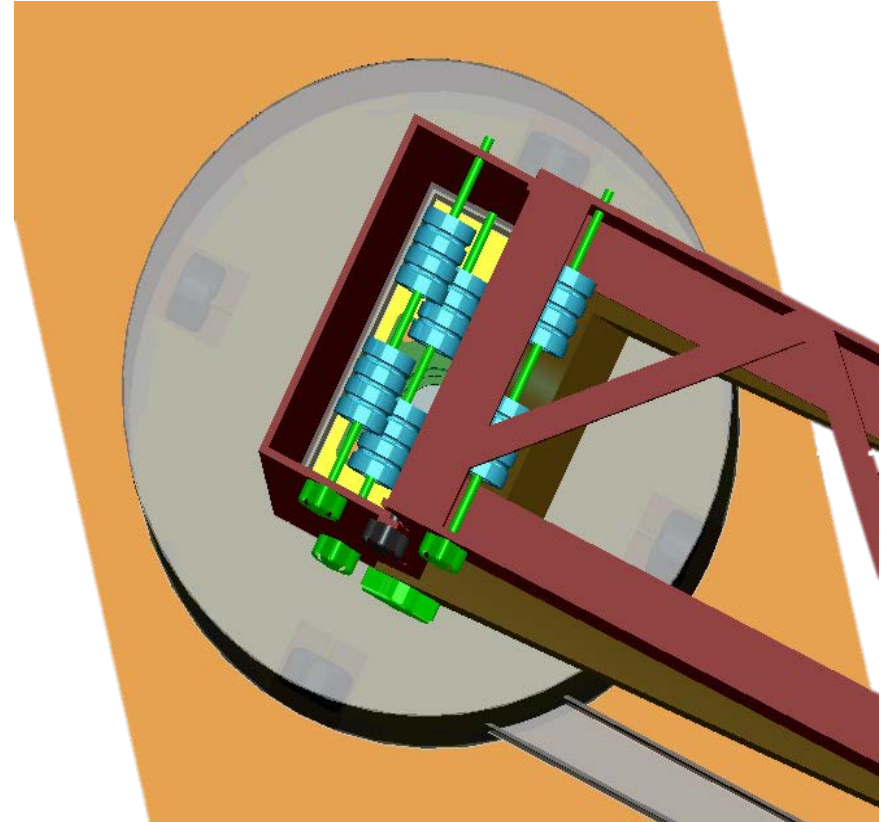
# Crane System

- Mechanical advantage
  - Pulley system
- Crane Motion Ability
- Motor Control
- Support Arms



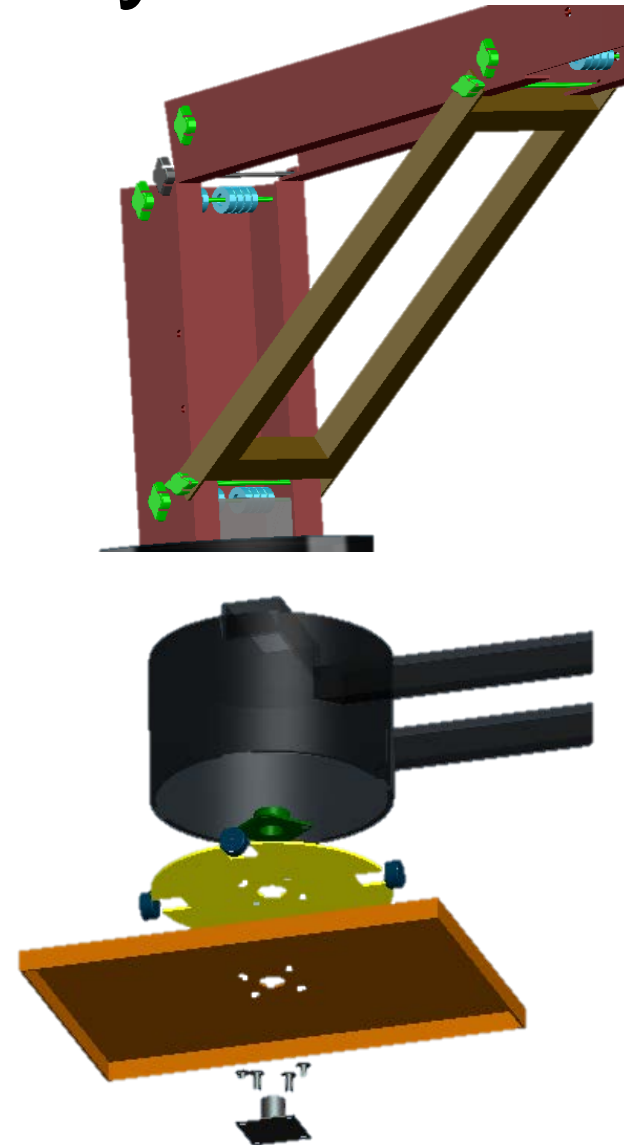
# Crane System

- Pulley system
  - Machined pulley
  - 7/64<sup>th</sup> nylon rope
  - 1,200lbs tensile
- Removable shafts
  - Ease Access
- Bearings
  - High Pressure
  - Concealed
  - No maintenance



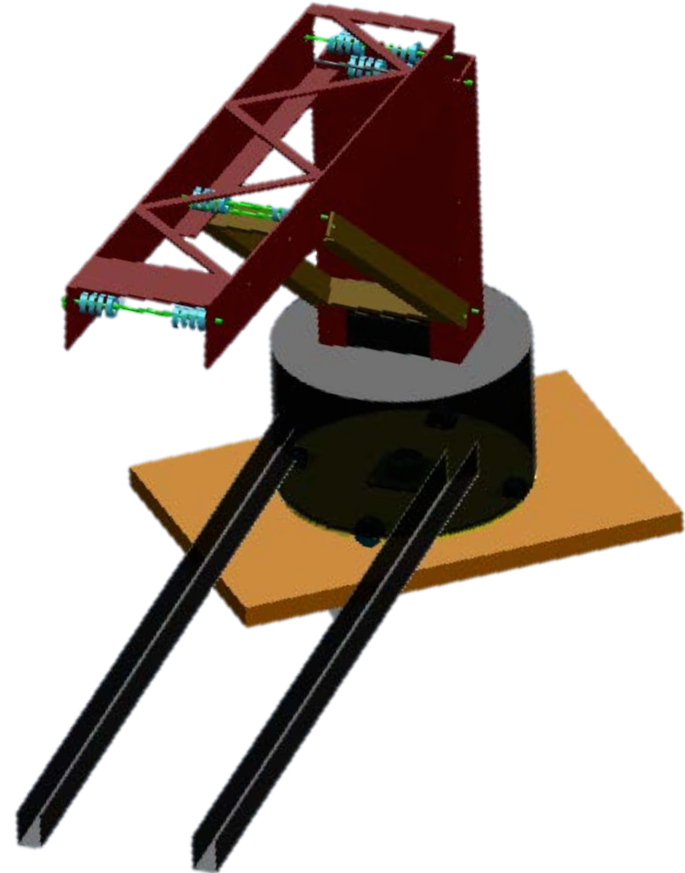
# Mobility

- Cart Motion
  - Vertical motion
  - Planer motion
- Apparatus Motion
  - Rotation
  - Crane motion
- Blade Motion
  - Vertical motion



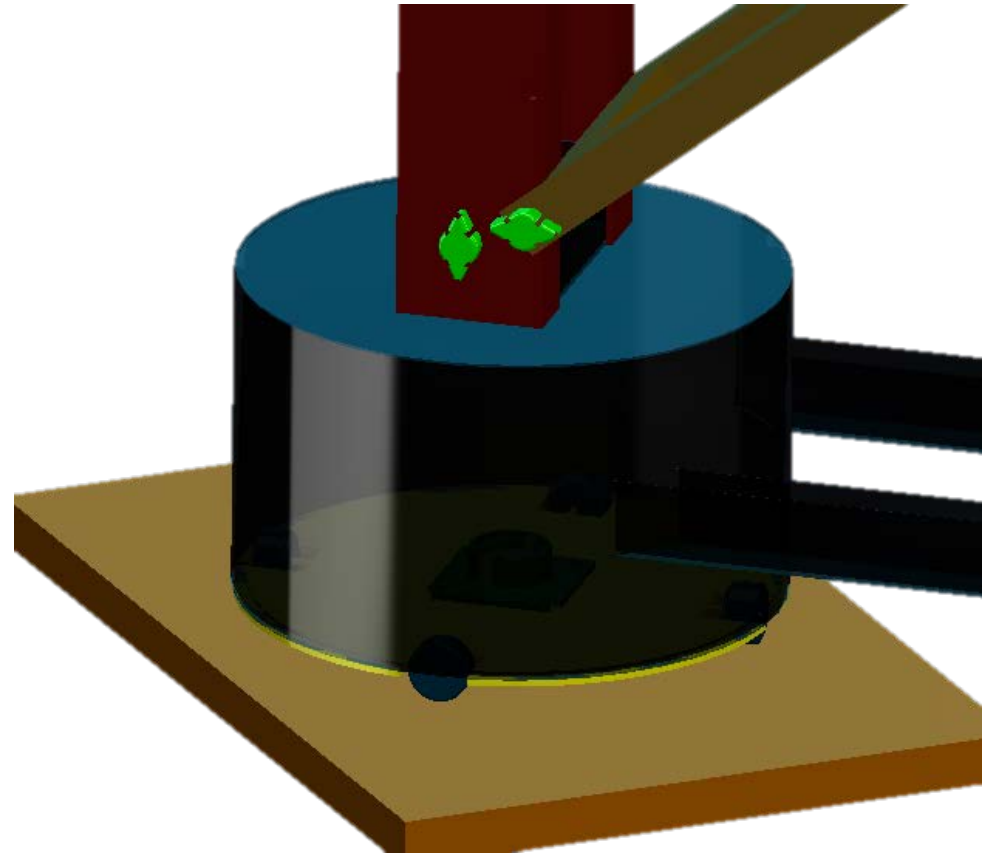
# Support Arms

- Purpose
  - Aide in blade orientation
- Dimensions
  - 5 feet long
  - 15 in apart
- Material
  - Steel
  - Thin, light
  - Durable



# Motor Control

- Two independent systems each equip with
  - 2 0.75hp motor
  - 2 12V batteries
  - 6 Pulleys
  - Spool
- Concealed within a housing



# Design: Electrical

- Need motor driven system
  - Mechanical system too slow
- Need two 12V batteries
- Need controller
- Need power supply
  - Charge and scale voltage
- Motor specifications
  - 0.75hp
  - 12/24VDC
  - Variable speed settings
    - Requested by TECT



# Design: Blade Harness

- Modeled after climbing harness
  - Fits geometry of the blade (midspan)
- Holds the blade
  - Clipping positions
    - Loops and carabineers
- Materials
  - Nylon webbing
  - Heavy thread
  - Leather wear strips





# Safety

## Hazards

- Large structure
  - Movement hazard
  - Difficult to maneuver in tight spaces
  - Heavy

## Resolved issues

- Power supply
  - Battery-powered
    - Detachable cord
- Unattended movement
  - Movement locks
    - Feet on base of cart
    - Locking pins on moving parts
  - Tipping
    - Support struts

# Questions?



# References

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