CISCOR UNMANNED GROUND VEHICLE

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ACKNOWLEDGMENT

Project Sponsor

- Center for Intelligent Systems, Control, and Robotics (CISCOR)

Project Advisors

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- Ryan David-Reyes

PRESENTATION OVERVIEW

- Project Overview
- Vehicle Platform
- Locomotion Overview
- Locomotion Actuation
- Telecommunication
- Field Test
- Summary

PROJECT NEED

- Currently there is no off road vehicle platform for autonomous research and design in CISCOR's inventory

PROJECT GOAL

- Modify an existing all terrain vehicle (ATV) to be capable of full unmanned movement by designing, researching and manufacturing components to allow unmanned locomotion control

PROJECT OBJECTIVES

- Vehicle will be able to turn, accelerate, brake and switch gears without physical user interaction
- Vehicle locomotion controls, mounts and sensors will be durable and able to withstand off road environments
- Vehicle will be able to easily mount multiple sensors
- Vehicle will be able to easily mount multiple onboard computers

PROJECT CONSTRAINTS

- ATV must retain human drivability
- Vehicle must be able to weather off-road conditions
  - Vibration
  - Water and mud
  - Sand and dust
- Vehicle must be retrofitted with all components in a limited mounting area

VEHICLE PLATFORM

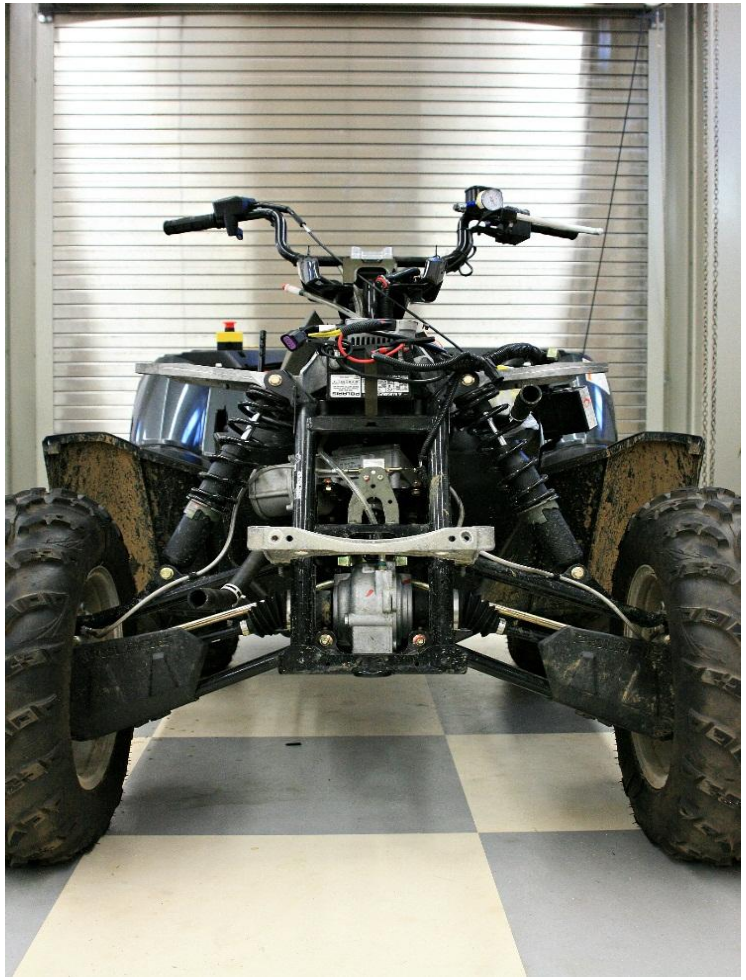
2012 Polaris Sportsman 550 EPS All Terrain Vehicle

- Liquid-cooled
- Power steering
- On Demand All Wheel Drive (4x2, 4x4)
- 42 Horsepower
- Locking Differentials

PROJECT VEHICLE NAME

G. O. L. I. A. T. H.

Gas **O**perated **L**and **I**ntelligent **A**ll **T**errain Ve**H**icle



LOCOMOTION OVERVIEW

Four main locomotion mechanisms on GOLIATH

1) Steering
2) Braking
3) Gear Selection
4) Throttle

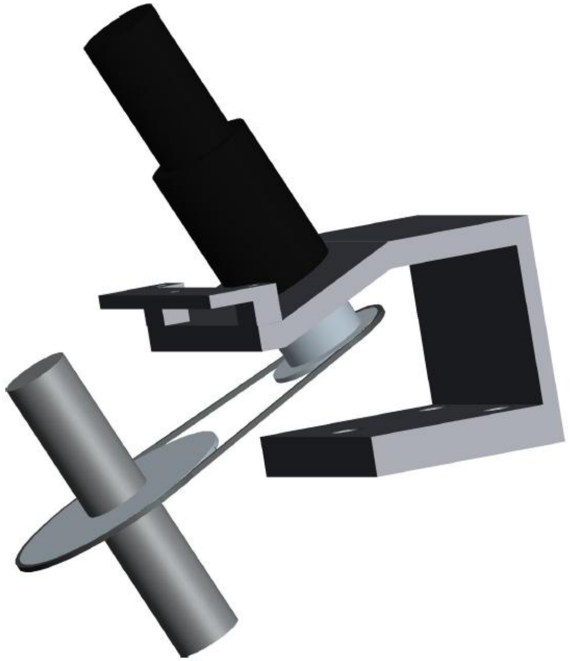
STEERING OVERVIEW

System Objectives

- System will be able to operate with full turning range
- System will be able to withstand feedback from terrain
- System will provide sufficient output power for turning at any speeds and on any terrain

STEERING

- Motor and chain drive mounted
- Maxon Epos3 motor controller mounted
- Fully tested
- READY FOR OPERATION



STEERING VIDEO

THROTTLE OVERVIEW

System Objectives

- System will be precise and responsive
- System will utilize full throttle travel range

THROTTLE

- Permanently mounted
- Fully tested
- READY FOR OPERATION

THROTTLE VIDEO

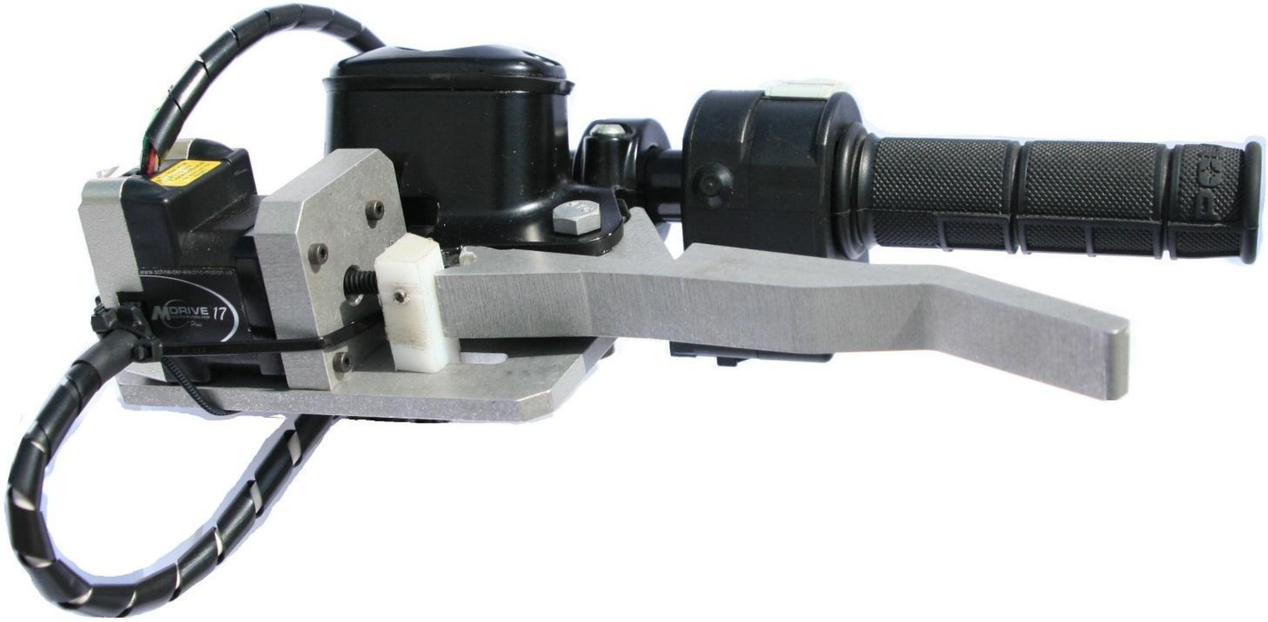
BRAKING OVERVIEW

System Objectives

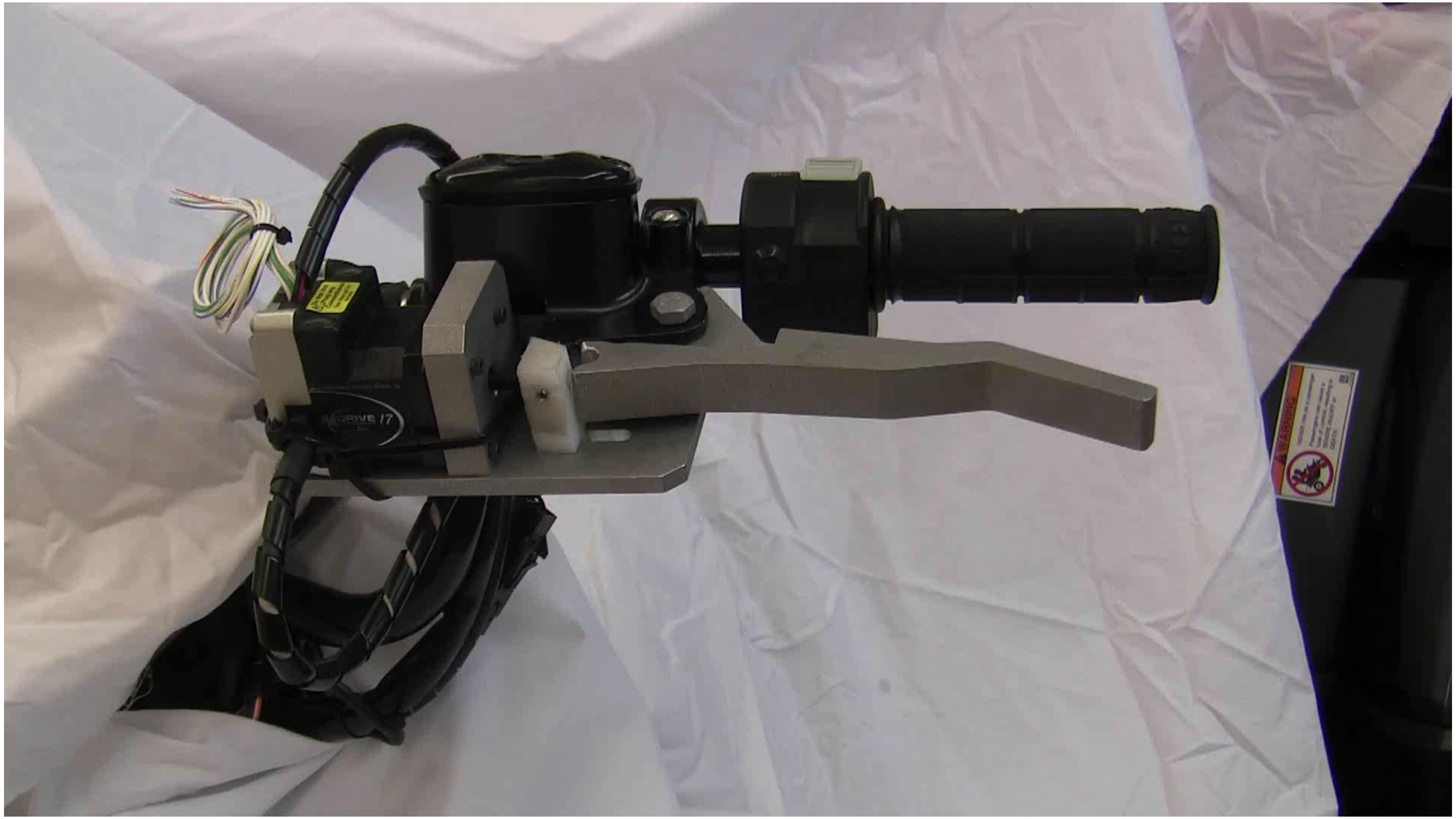
- System will have the same response time for braking as a human would
- System will be able to hold a braking position
- System will be able to utilize full braking range

BRAKING

- Permanently mounted
- Fully tested
- READY FOR OPERATION



BRAKING VIDEO



GEAR SELECT OVERVIEW

System Objective

- System will provide the ability to select all 5 gears

Park, Reverse, Neutral, Low, High

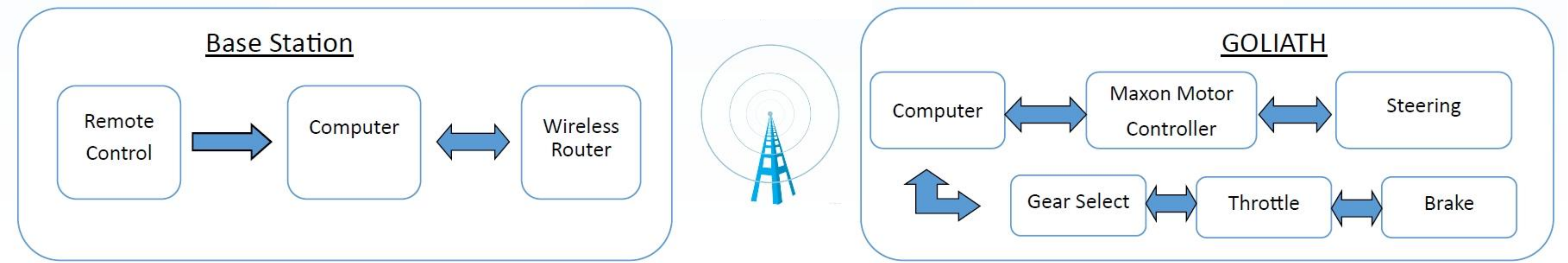
Shift Arm

GEAR SELECT

- Permanently mounted
- Fully tested
- READY FOR OPERATION

GEAR SELECT VIDEO

TELECOMMUNICATION



SUPPLEMENTAL COMPONENTS

- Watertight cargo box
- Logitech Wireless Controller
- Panasonic Toughbook
- High range Wi-Fi transmitter
- Auxiliary Batteries
- Emergency kill switches

ELECTRONIC STORAGE

FIELD TEST VIDEO

FUTURE WORK

- Manufacture weatherproof housings for the locomotion components
- Improve programming
- Mount additional sensors to the vehicle
- Ventilate electronic storage box
- Migrate to Linux platform

PROJECT SUMMARY

- Successfully modified of existing ATV for unmanned use
- Successfully tested all components
- GOLIATH retains the ability to be user operated
- GOLIATH met and exceeded all safety requirements to ensure safe operation
- GOLIATH is READY for delivery to CISCOR

QUESTIONS?

ADDITIONAL SLIDES

CURRENT ATV PLATFORMS

Carnegie Mellon University

University of North Carolina - Chapel Hill

Stanford University

http://www.ri.cmu.edu/

http://www.unc.edu/

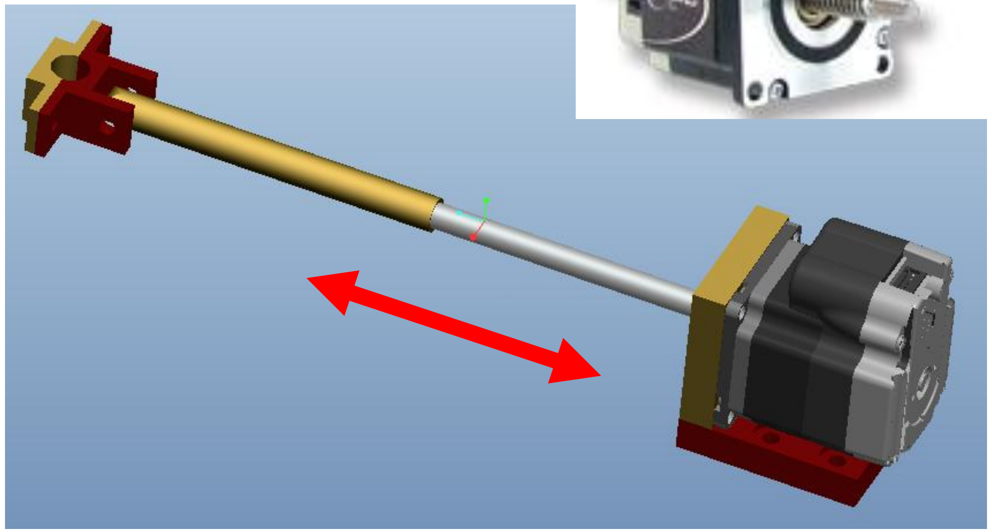
http://cs.stanford.edu/

TESTING OF ACTUATORS

SHIFTING MANIPULATION

Schneider Electric M-drive 23 Hybrid Linear Actuator

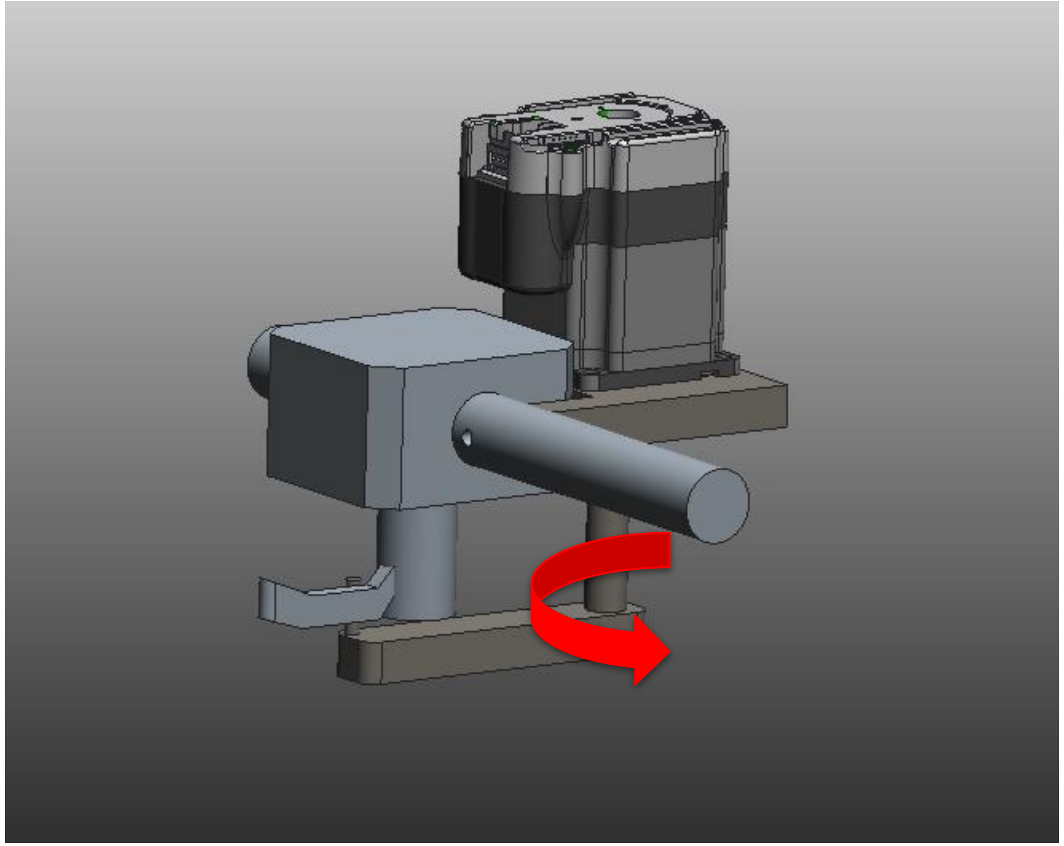
- Non-captive shaft
- Max thrust: 100 lbf
- Accuracy: .005 inches
- Internal magnetic encoder
- Serial communication protocol



THROTTLE MANIPULATION

Schneider Electric M-Drive 23 Stepper Motor

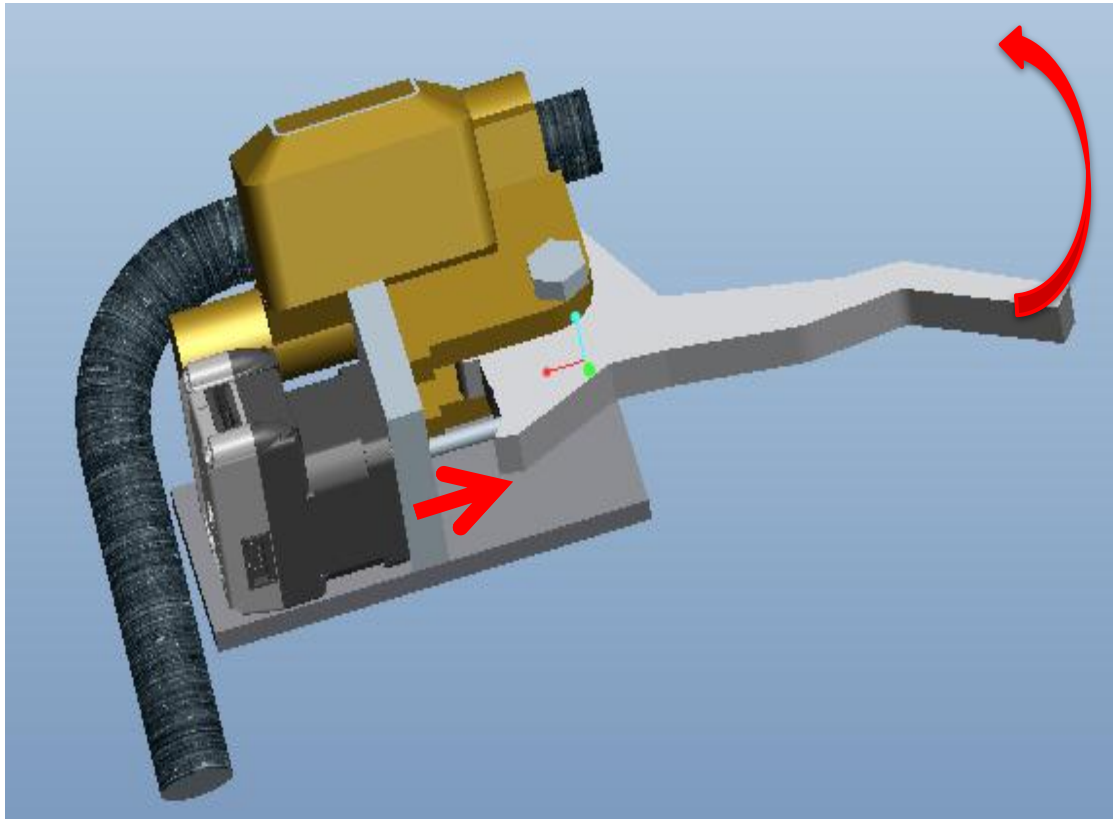
- Holding Torque: 1.60 N*m
- 20 micro step resolution from full steps to 51,200 per revolution
- Integrated motor driver
- Optical encoder
- Serial communication protocol



BRAKING MANIPULATION

Schneider Electric M-Drive 17 Linear Actuator

- Max thrust: 50 lbf
- 3 inches of linear travel
- Accuracy: .005 inches
- Internal magnetic encoder
- Serial communication protocol



ENCODER

- Encoder Products Company: Model 725 - I

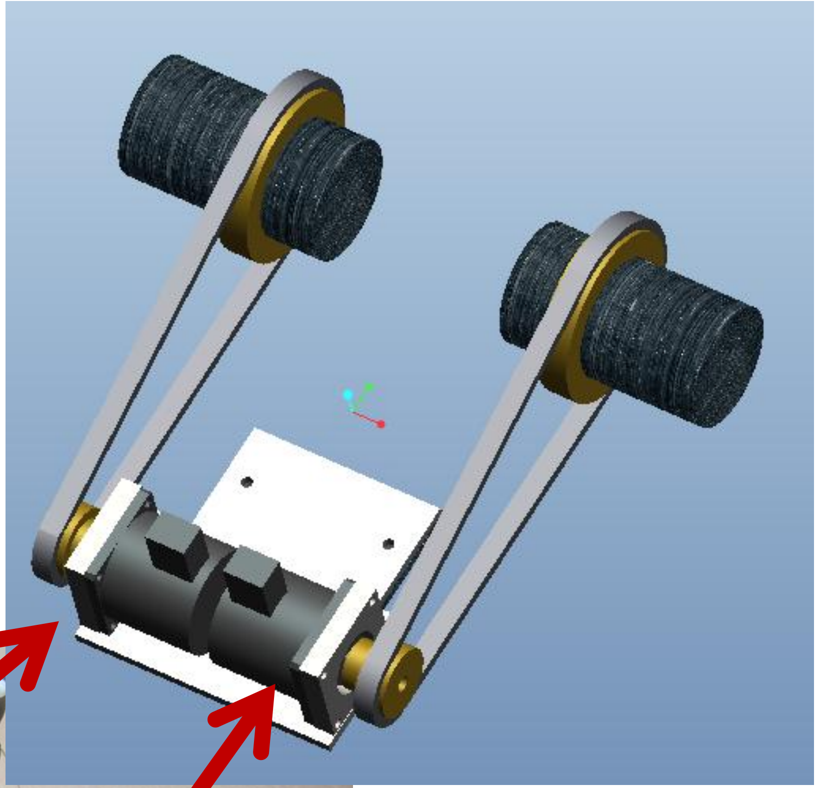
<u>Specifications</u>

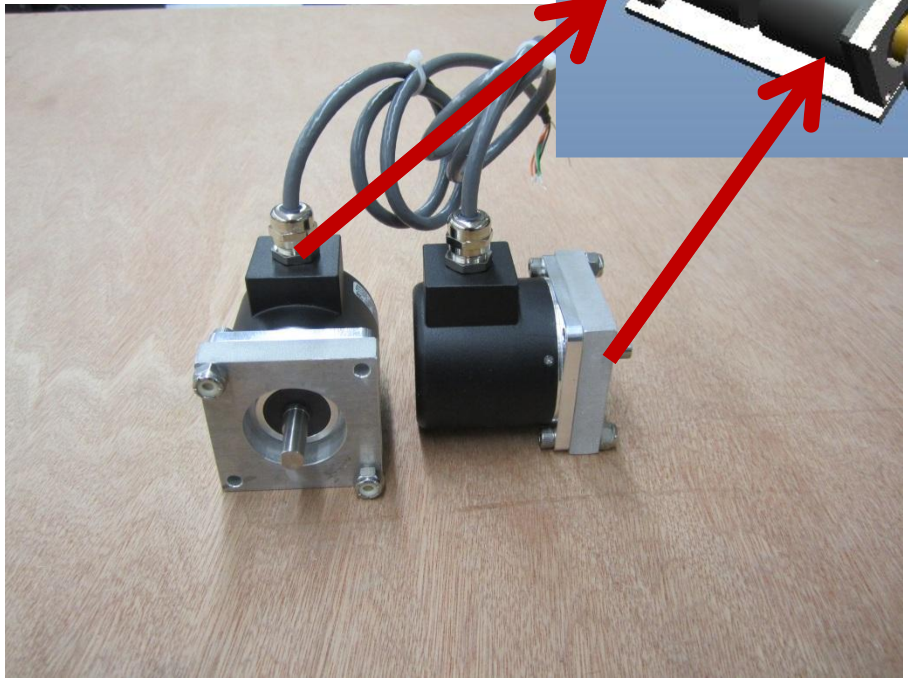
- Industrial Housing
  - Flex Mount Coupler
- IP67 Seal
- Resolution: 30,000 Cycles/Revolution
  - 120,000 Counts/Revolution
  - Speed: Up to 3,000 RPM

SENSOR MOUNTING UPDATE

Current progress:

- Encoders have been purchased
- Encoder mounting manufactured
- Supplement material has been ordered
  - Pulleys
  - Timing Belts





Presented By: Donald Allex