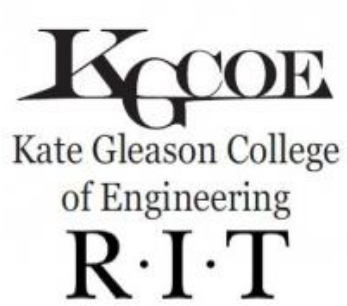
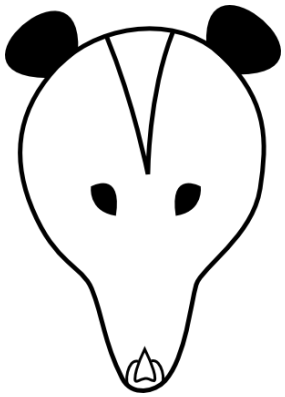


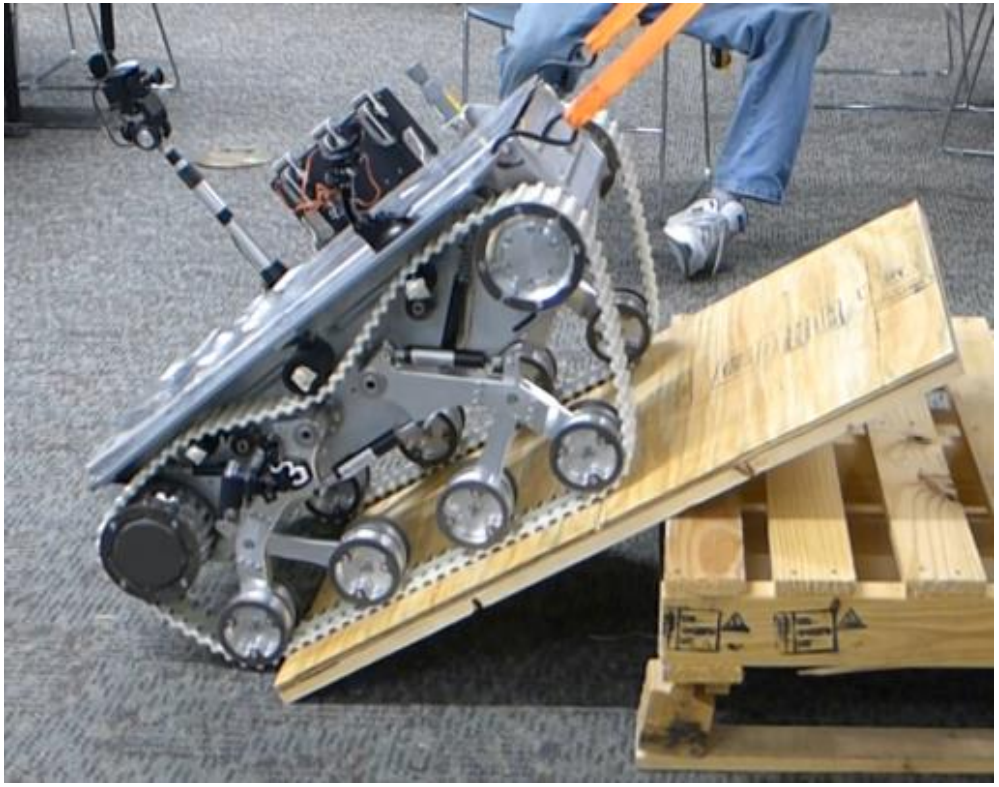


MARSUPIAL MSDII Final Review

Jared Raby
Nico Gallardo
Chris Griffin
Sean Greenslade
Wesly Rice

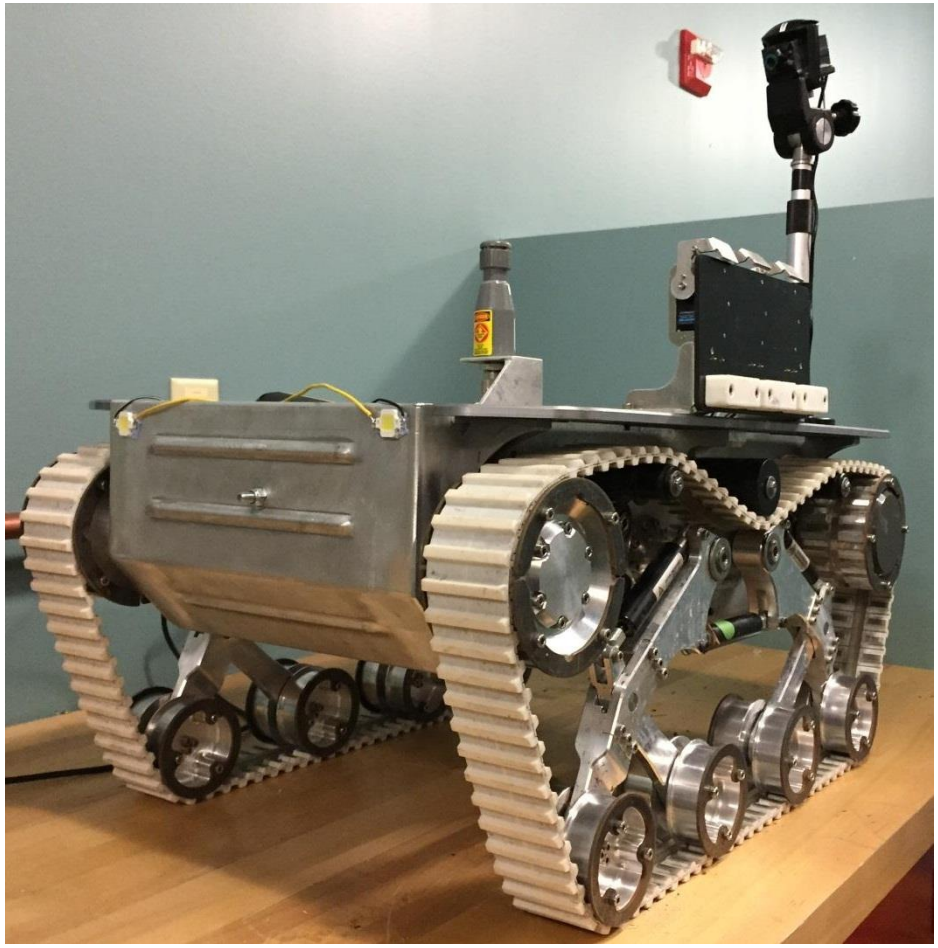
Agenda

- **Overview**
  - → Background
  - → Benchmarking assessment
  - → Engineering requirements traffic light
- **Schedule**
  - → Schedule setbacks
- **Product Presentation**
  - → Demo of vehicle
- **Recommended Improvements**
  - → Mechanical
  - → Electrical
  - → Software
- **Questions**



Introduction

- **Robotics have a multitude of uses**
  - → **Military and civilian applications**
    - – **Search and rescue**
    - – **Bomb defusal**
    - – **Farm field seeding**
- **Existing robots are effective at their respective tasks**
- **Less frequently robot incorporate task versatility into their design**



- **MARSUPIAL Tracked Rover for CRL**
- **Scope**
  - → **Suspended Track System**
  - → **Wireless Node System**
  - → **Electrical Systems**
- **Deliverables**
  - → **Suspended Track System**
  - → **Mesh Network Payload**

Background

- **Carnegie Robotics' Badger Robot**
  - **→Achieves versatility through modular attachment system**
    - **Advantages**
      - Rugged
      - All terrain Chassis
      - Universal mounts
      - Field payloads
    - **Disadvantages**
      - Limited Payload Capacity
      - Excessive Weight
      - Limited Radio Range
      - No included peripherals

Benchmarking Assessment

- **Talon**
  - →Specialized for military only use
  - →Tracked drivetrain
  - →60-100 lb robot weight
  - →1000m Transmitter Range
  - →$230k

- **Packbot**
  - →Used by military and civilian personnel
  - →Tracked drivetrain

- **Husky**
  - → Civilian Use
  - → Four Wheel Drive train
  - → 2.3 mph
  - → 3 Hour Runtime

Engineering Requirements Traffic Light

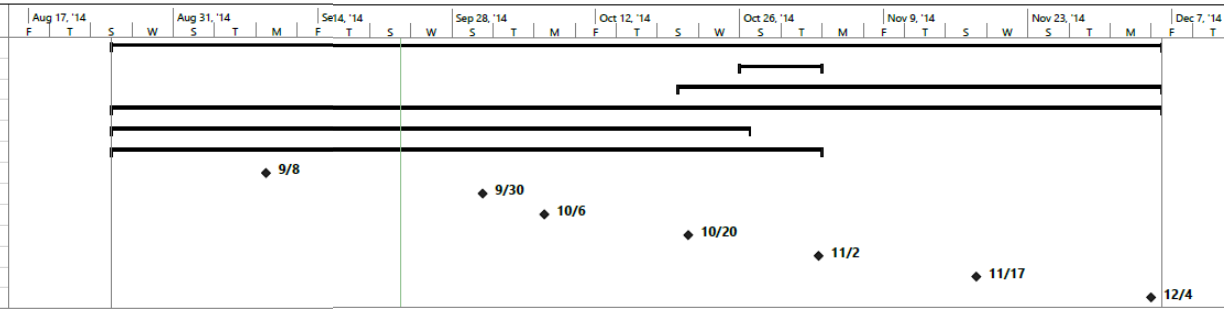
Pass	
Partial Pass	
Not Satisfied	
Not tested	

Engineering Req	Linked Customer Req	Specification	Unit of Measure	Threshold	Objective	Status
E1	CR11	Mean Time Between Failures	Hours	> 400	> 600	N/A
E2	CR2	Quick Change Payloads	Minutes	< 10	< 5	<5
E3	CR3	Safety Standards	N/A	MIL-STD-883-E	Threshold	
E4	CR3	Environmental Standards	N/A	> IP-54	> IP-68	IP-32
E5	CR1	Base Platform Weight	Lbs	< 125	< 75	~85
E6	CR9	Data Transfer Rate over Mesh	Mb/s	> 2	> 3	
E7	CR1	Vehicle Speed	M/s	>2.2	>6.8	>2.2
E8	CR2	Max Payload Weight	Lbs	>50	>100	>50
E9	CR8	Maintain Current Size Envelope	inches	30 x 22	Threshold	
E10	CR9	Video Feed Resolution	Pixels	> 320 x 240	> 1080 x 720	320x240
E11	CR9	Frame Rate	Frames/sec	> 25	> 30	6
E12	CR4	Flat ground incline	Degrees	> 40	> 45	~40
E13	CR4	Stair Incline	Degrees	> 38	> 42	
E14	CR4	Step Obstacle Size	Inches	> 6hx8w	> 8hx6w	~5-6
E15	CR4	Ground pressure exerted by vehicle	PSI	< 4	< 1.5	~0.7
E16	CR6	Mechanical Shock test	g	> 3	> 4	N/A
E17	CR1	Platform Runtime with Payload	Hours	> 3	> 4	>3
E18	CR5	Communication Range	Meters	> 200	> 400	>200
E19	CR7	Computation Benchmarking - FFT 8192K	milli sec	< 500	< 120	
E20	CR10	Communication Packet Loss	%	< 10	0	

Scheduling

- **System Build Complete**
  - → **Mechanical System Delays**
    - **Motor assembly delayed due to shipping complications**
    - **Clock springs used to tension the track delayed due to shipping complication**
    - **Suspension parts slightly delayed due to budget cuts and redesign**
- **System Testing Complete**
  - → **Delayed for mechanical**

ID	Task Mode	Task Name	Duration	Start	Finish
1		Marsupial Launch	103 days?	Mon 8/25/14	Fri 12/5/14
2		System Build Phase	8 days?	Sun 10/26/14	Sun 11/2/14
5		System Test Phase	47 days?	Mon 10/20/14	Fri 12/5/14
8		Mechanical	103 days	Mon 8/25/14	Fri 12/5/14
18		Electrical	63 days?	Mon 8/25/14	Sun 10/26/14
44		Software	70 days	Mon 8/25/14	Sun 11/2/14
60		Checkpoint One	1 day?	Mon 9/8/14	Mon 9/8/14
61		Checkpoint Two	1 day?	Tue 9/30/14	Tue 9/30/14
62		Checkpoint Three	1 day?	Mon 10/6/14	Mon 10/6/14
63		Checkpoint Four	1 day?	Mon 10/20/14	Mon 10/20/14
64		System Build Completed	1 day	Sun 11/2/14	Sun 11/2/14
65		Checkpoint Six	1 day?	Mon 11/17/14	Mon 11/17/14
66		Marsupial Launch	1 day?	Thu 12/4/14	Thu 12/4/14



Project: MSDII_Schedule
Date: Tue 9/23/14

Task, Split, Milestone, Summary, Project Summary, Inactive Task, Inactive Milestone, Inactive Summary, Manual Task, Duration-only, Manual Summary Rollup, Manual Summary, Start-only, Finish-only, External Tasks, External Milestone, Deadline, Progress, Manual Progress

Page 1

Demo Of Vehicle

- **Videos and Live Demo**

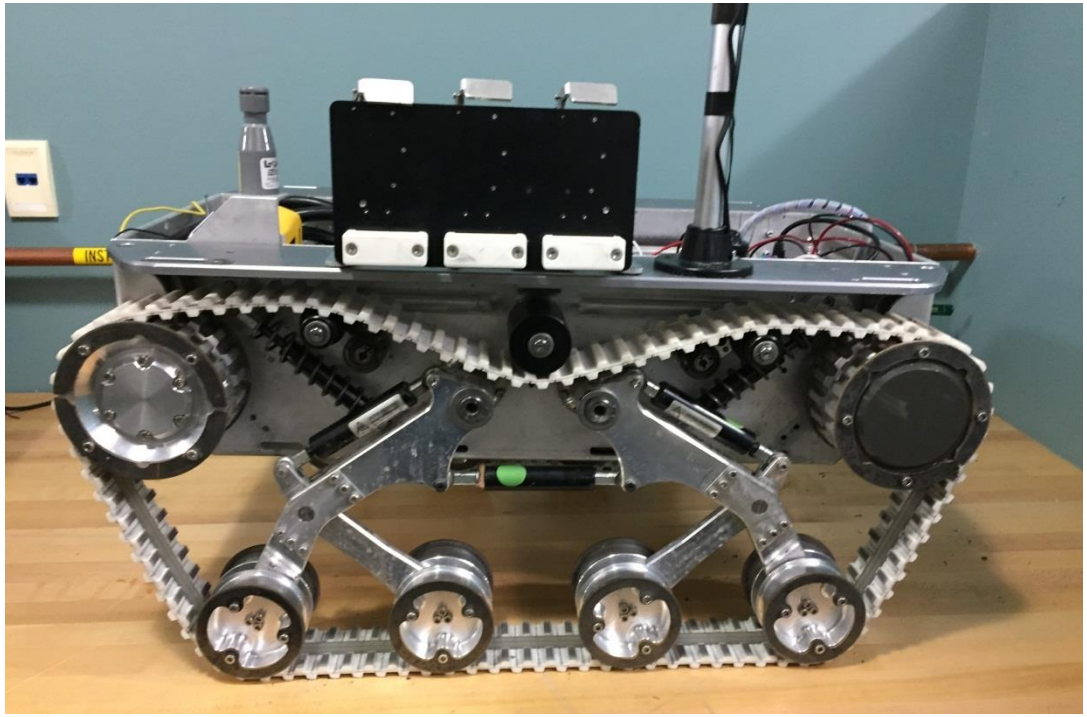
2014-11-20_40DEG INCLINE WITH STEPS AFTER.MTS

2014-11-20_35DEG INCLINE.MTS

2014-11-20_SMALL ITEMS DRIVEOVER.MTS

Recommended Improvements

- **Mechanical**
  - → **Leading Incline is too steep**
  - → **Overall height may be too high**
    - – **Raised CG**
  - → **Self Leveling issues**
  - → **Horizontal spring to stiff**
  - → **Air shocks cant handle the cold**
  - → **Reverse direction of tensioning**
  - → **Track friction**
    - – **Too high inside**
    - – **Too low outside**
  - → **Size of lower idler wheels**



Recommended Improvements

- **Electrical**
  - → Fused battery connectors – better protect the power system
  - → Power Management Board integrated switching – for headlights, power rails
  - → Re-spin of Power Management board
    - – Addition of 12V Regulator
  - → Better battery State-of-Charge sensing
    - – Integrate power management with internal battery SMBus
- **Software**
  - → More functional communication with motor controllers – reading actual speeds, currents, status, etc.
  - → Raw data integrated into RVIZ
  - → Mesh network real-time QoS indicators/statistic
  - → Revise motor control software to be in C++ instead of Python
  - → Fully integrate GPS data and make it useful
  - → Improve IMU GUI in RVIZ
  - → Write complete startup script
  - → Streamline video encoding
  - → Integrate auxiliary encoders on the idlers into software

Questions