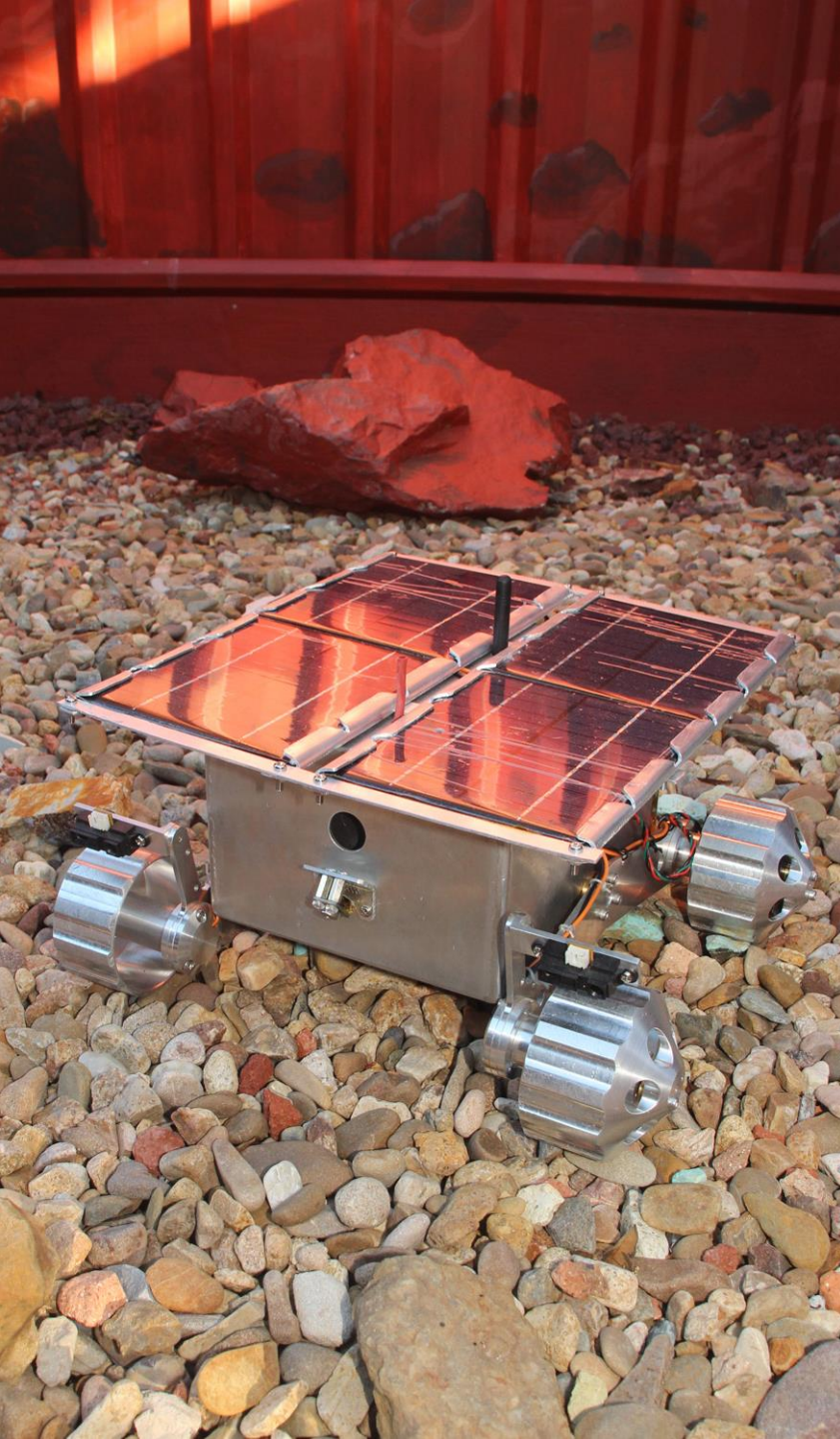# Mobility Testing the A4 Rover for Planetary Science Investigations

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[1]*Mars Society Australia,* [2]*UNSW Canberra*

**Prototype A4 rover for Mars exploration**

Introduction

- Large planetary rovers are heavy and expensive

- MSA is developing a Nanorover suitable for Mars exploration

- Follow-up from 2015-2016 testing

- Engineering testing regime in various field environments

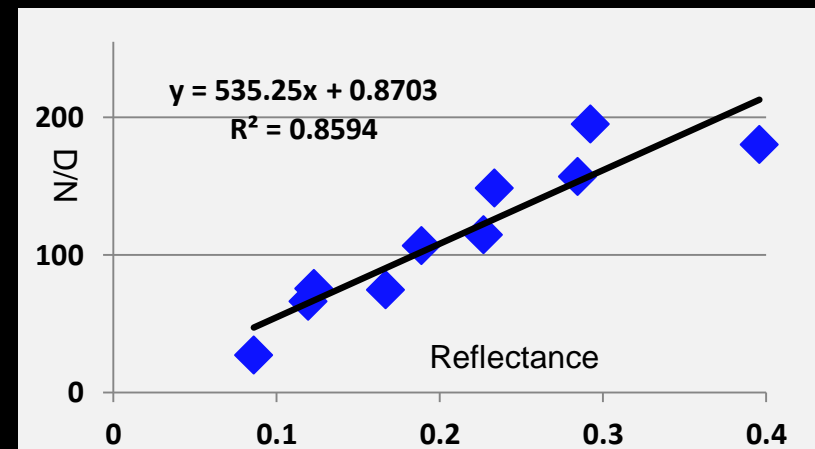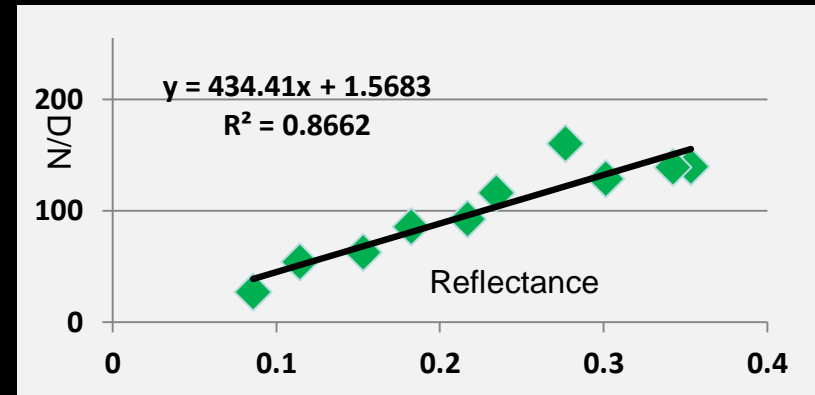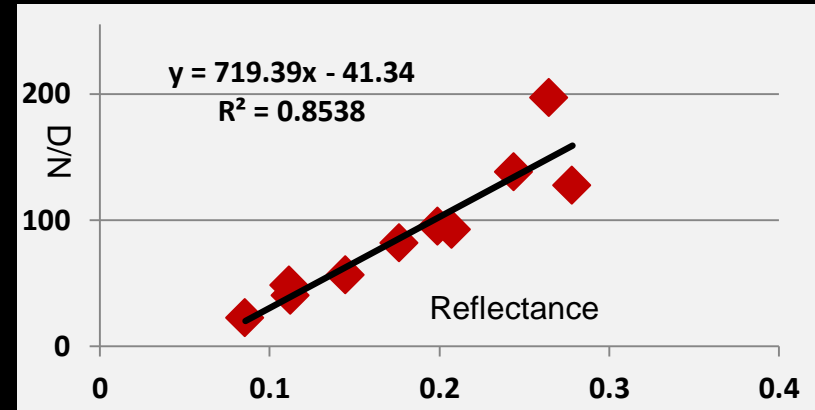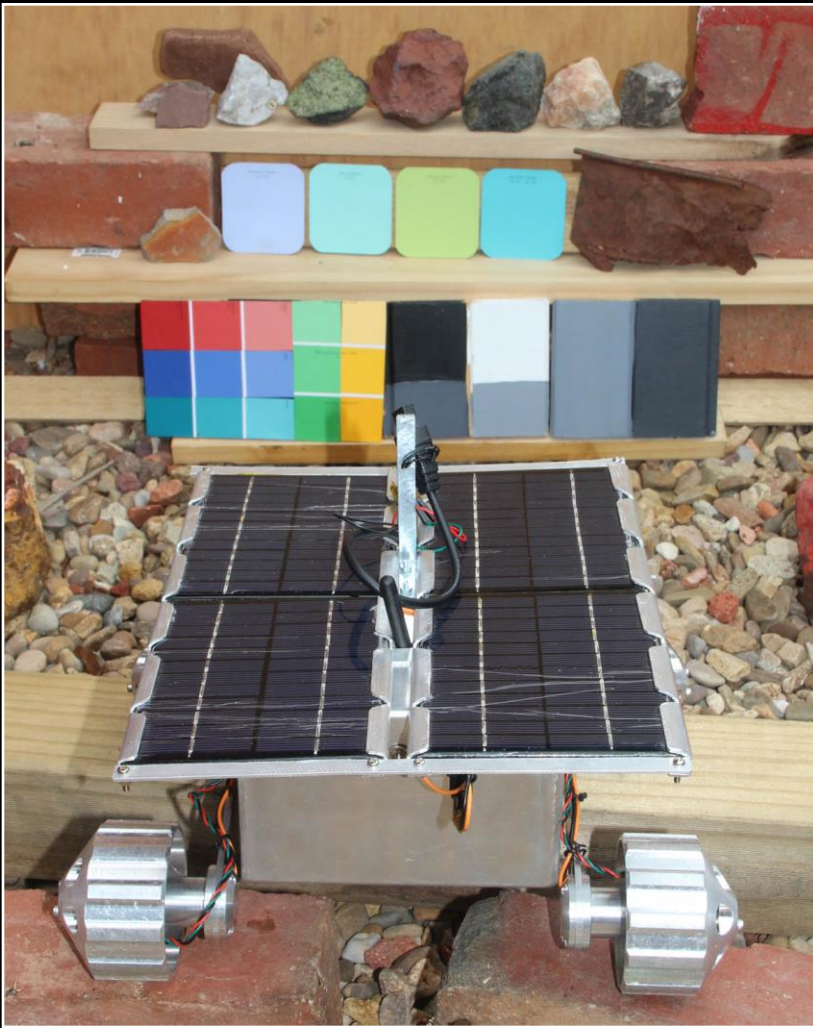- Characterise rover mobility and energy management

A4 Rover Design

- Four wheel skid-steer rover with future IR sensor obstacle avoidance
- Sensors: camera, UV sensor, accelerometers, temp sensors
- Additional sensors return engineering data
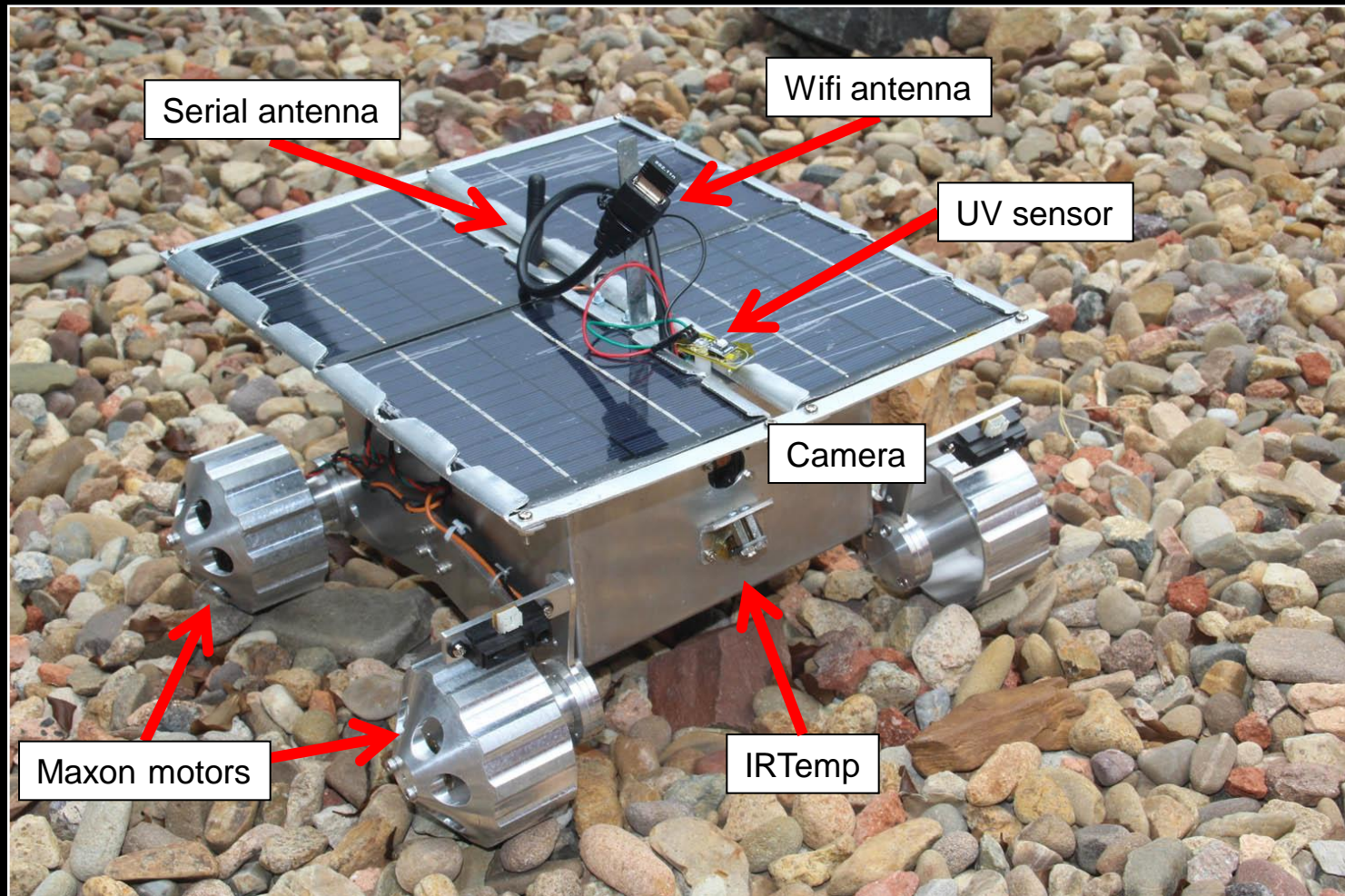
Visual Design and testing

- Crab uses the Raspberry Pi camera
- Calibrated to be used for multispectral imagery
- Custom calibration target developed

$y = 719.39x - 41.34$
$R^2 = 0.8538$

D/N

Reflectance

$y = 434.41x + 1.5683$
$R^2 = 0.8662$

D/N

Reflectance


$y = 535.25x + 0.8703$
$R^2 = 0.8594$

D/N

Reflectance

Engineering Testing

- Current design teleoperated for simplicity
- Rovers tested to determine mobility and power management
- Test surfaces included ramp, sand, pebbles, and rocks
- Custom ramp and Mars-yard built
- Rovers driven on slopes from 0-20 degrees
- Current draw, internal temp and velocity recorded
- Additional tests include obstacle clearance (rocks, gullies)
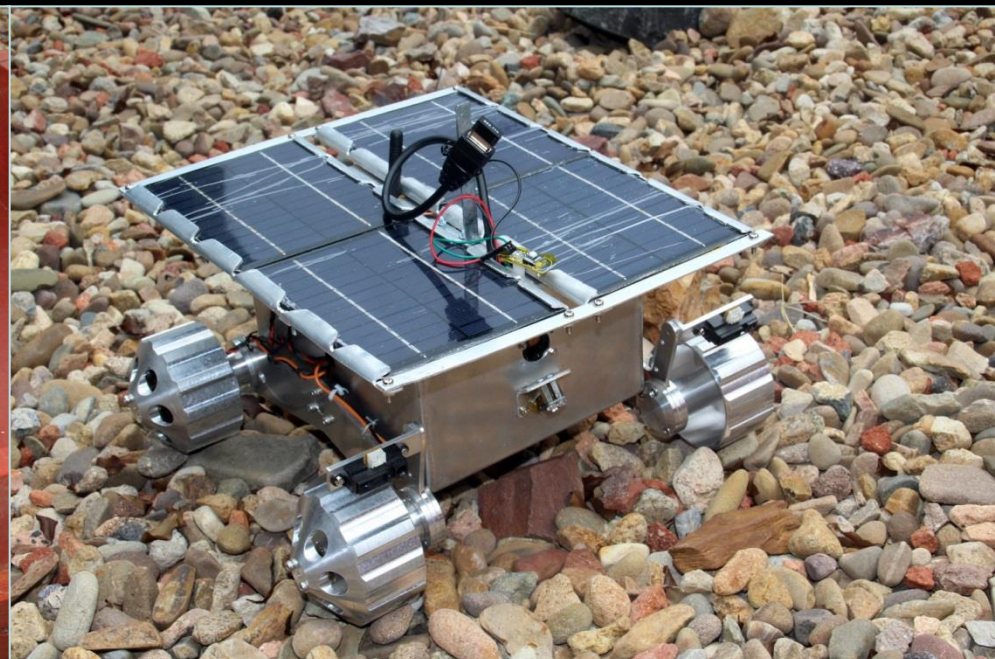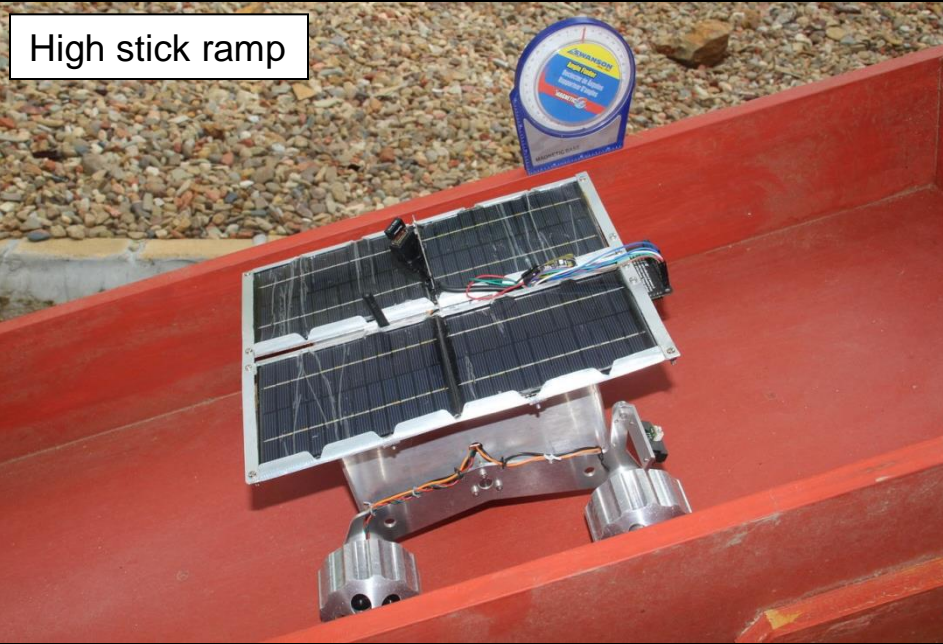
External Environment

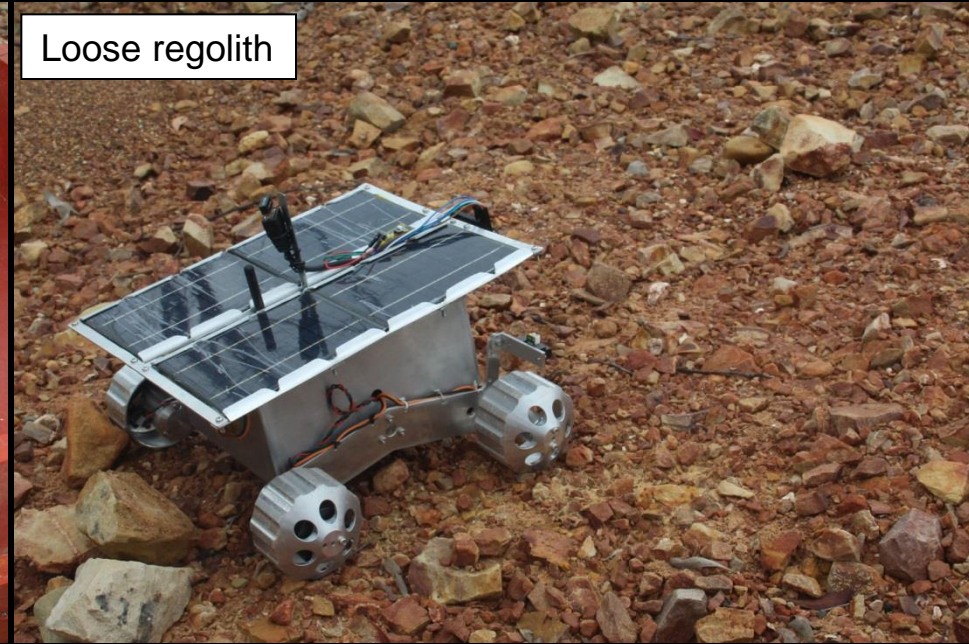- Burra left powered on, sampling battery voltage and temps
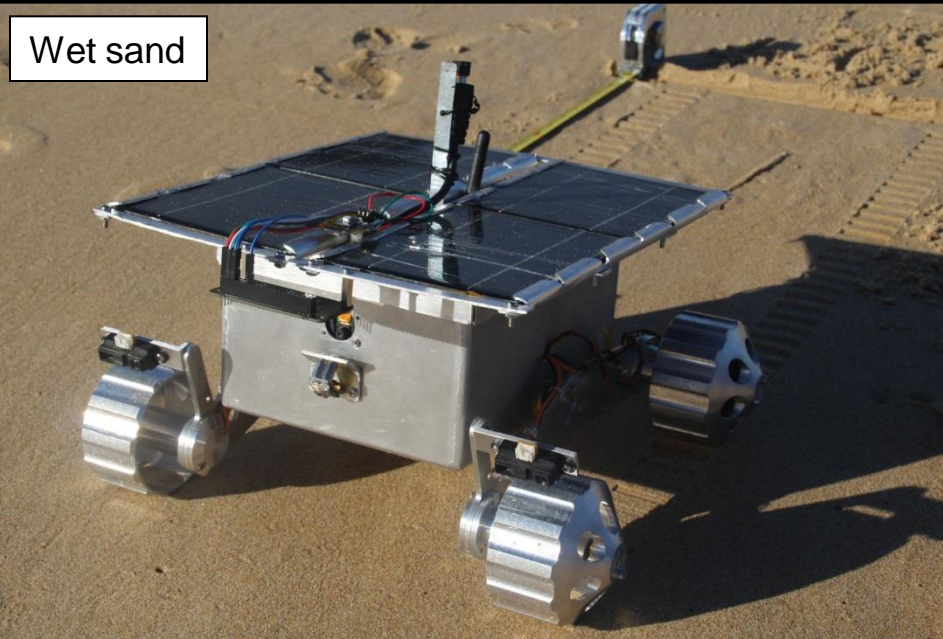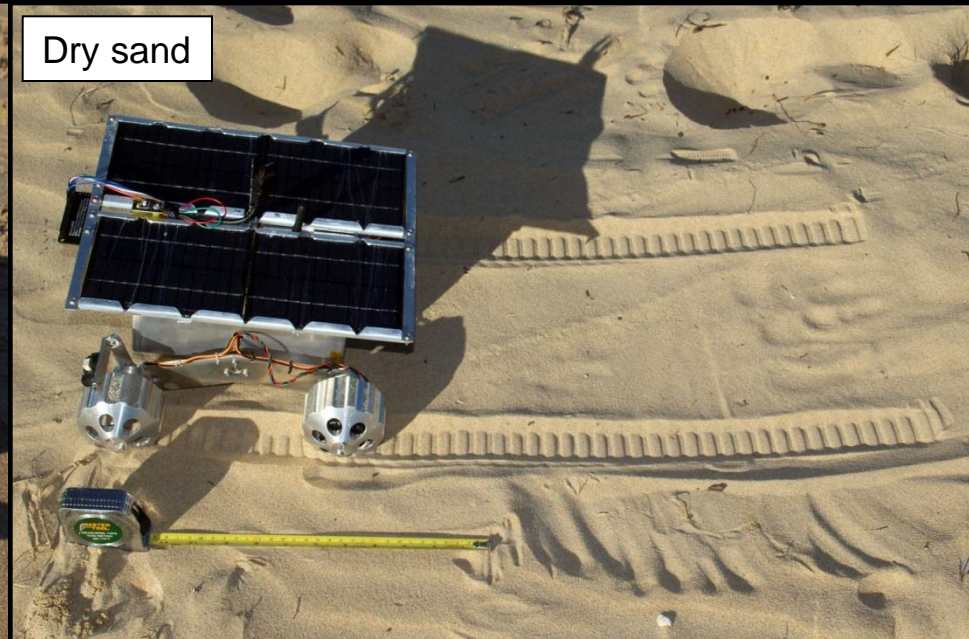- Returned environment and engineering data
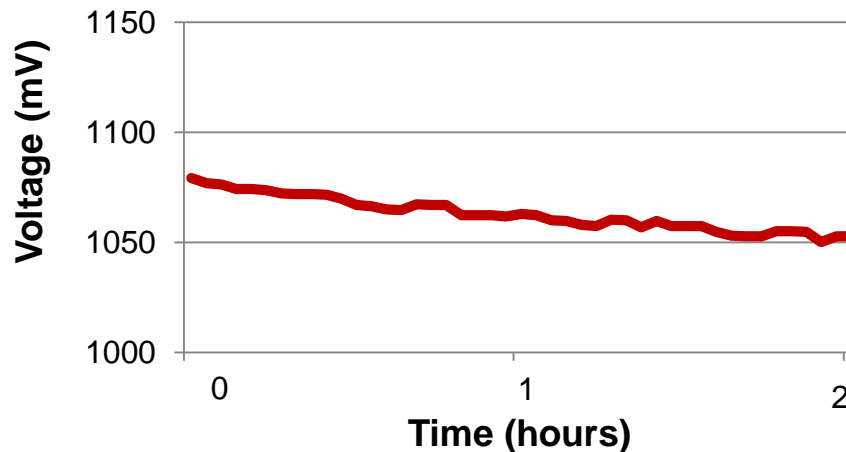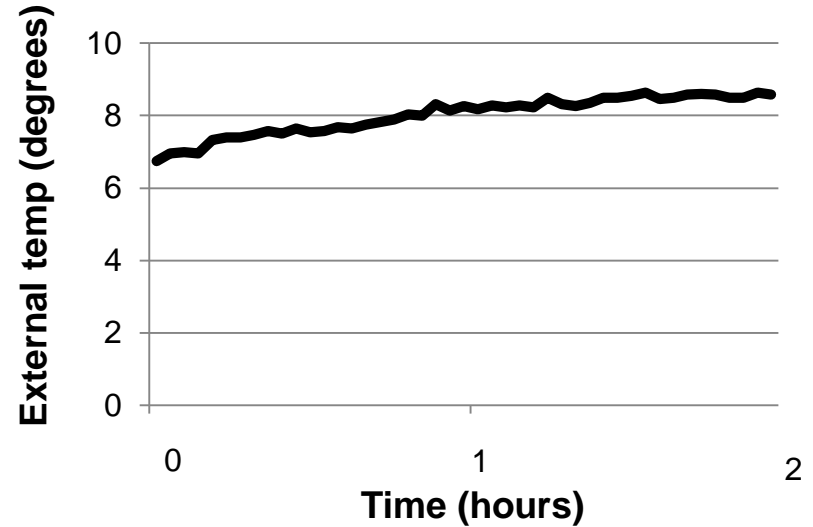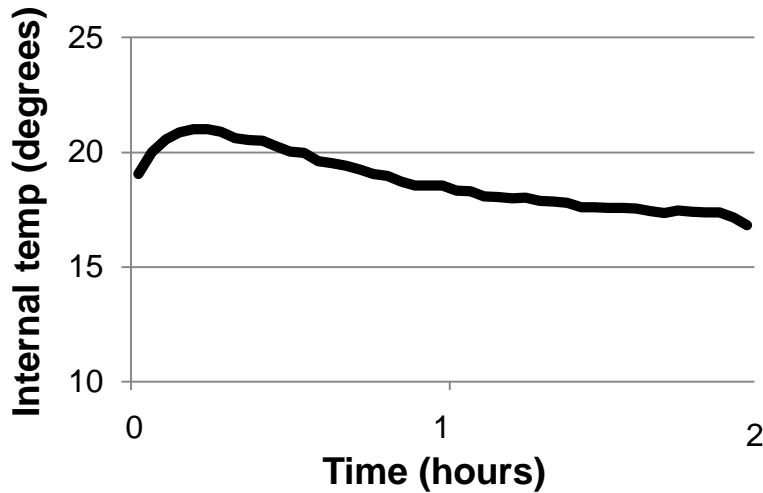
Mobility Trials – "Crab"
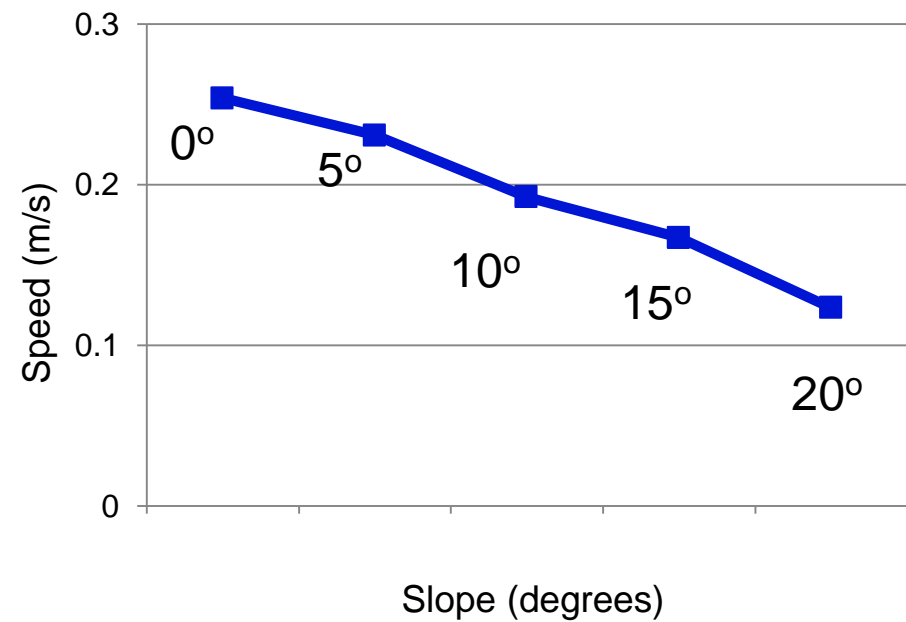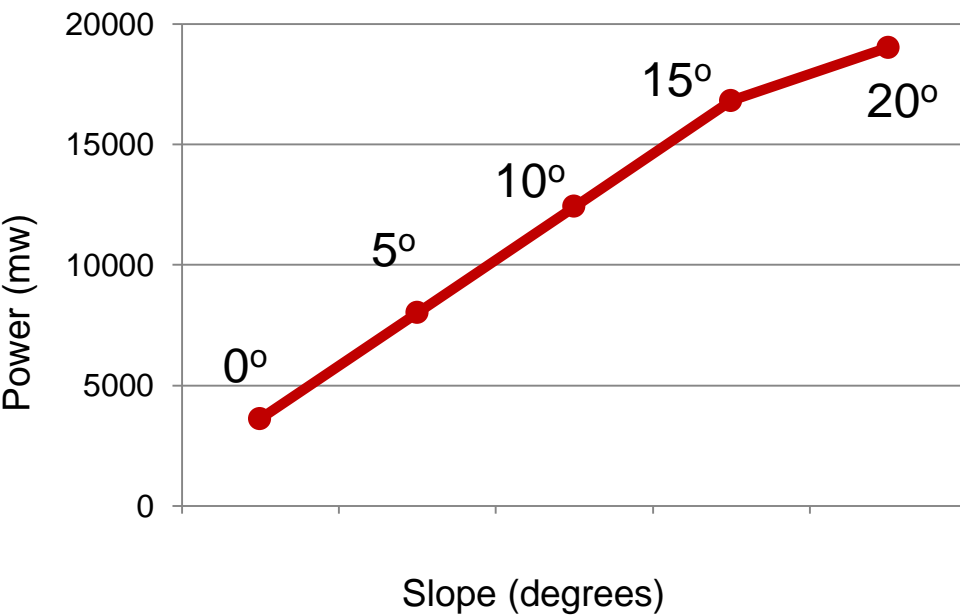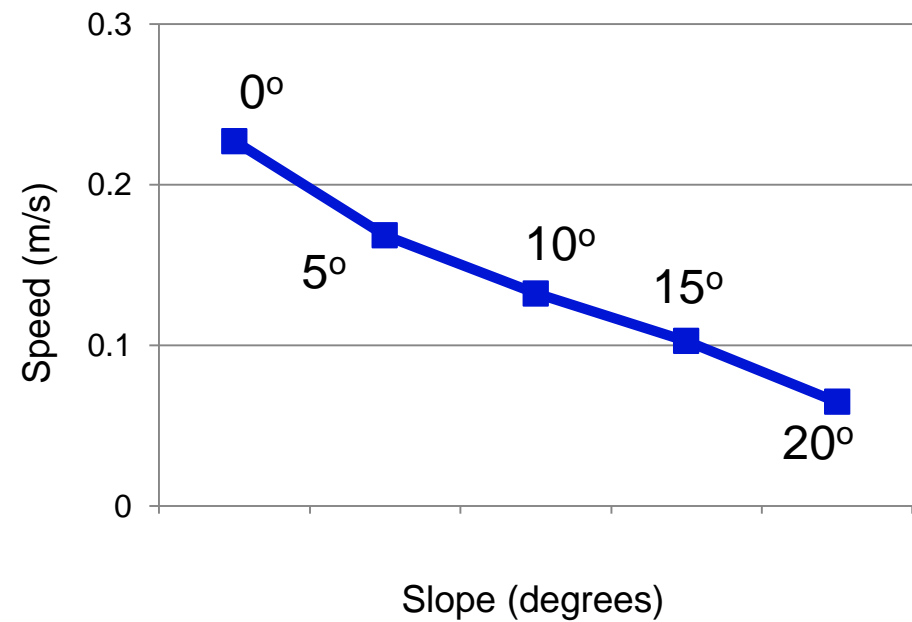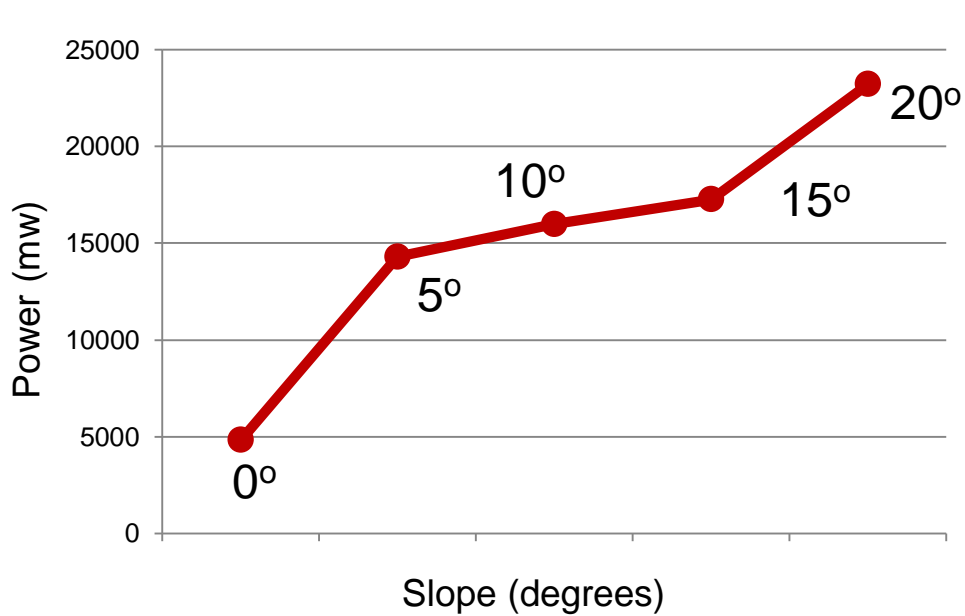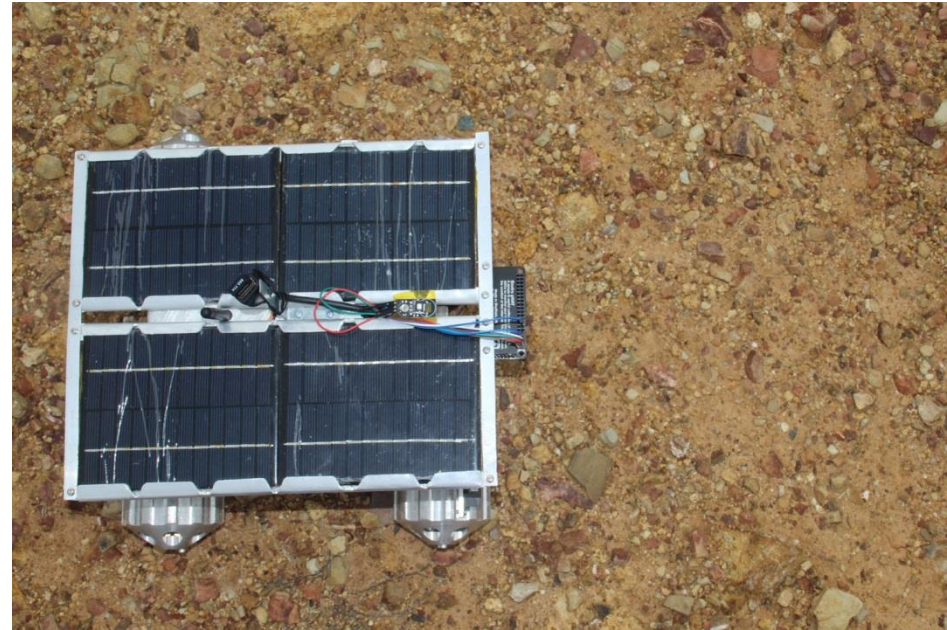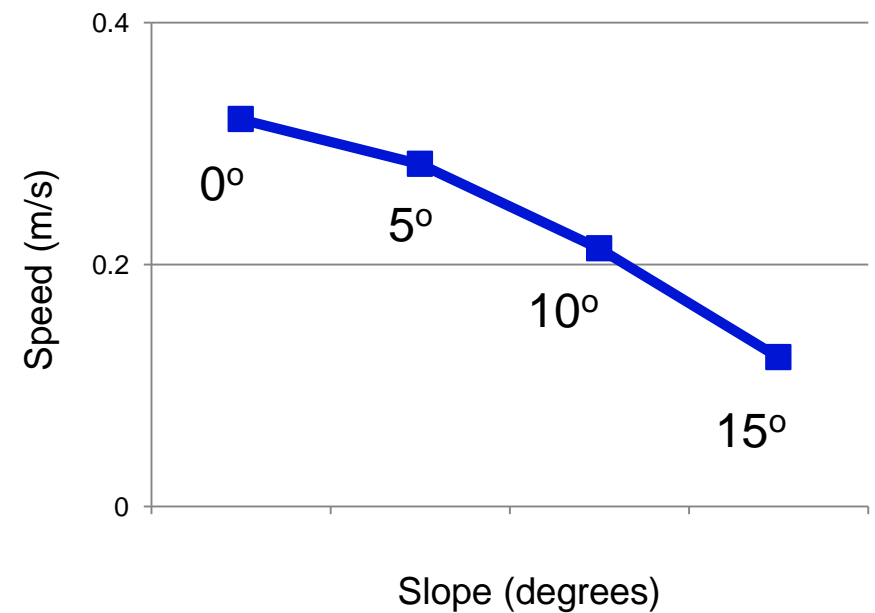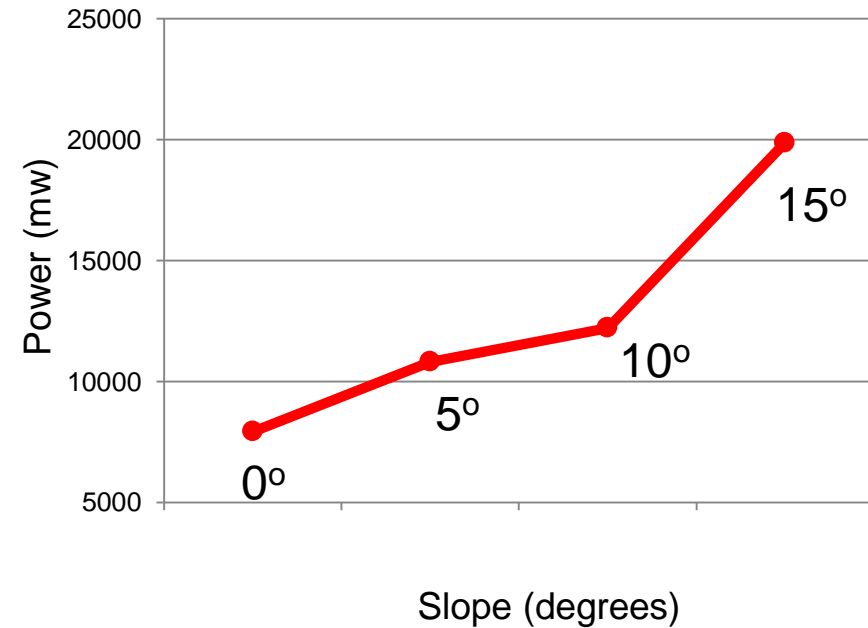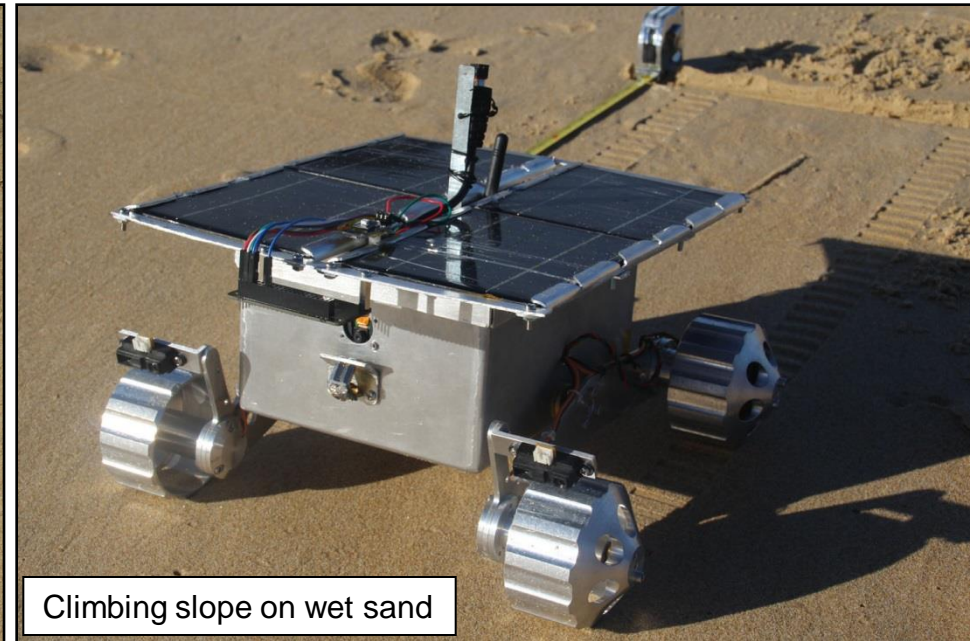

High stick ramp

Loose regolith

Wet sand

Dry sand

Results – High Stick Ramp

Results – Loose Regolith
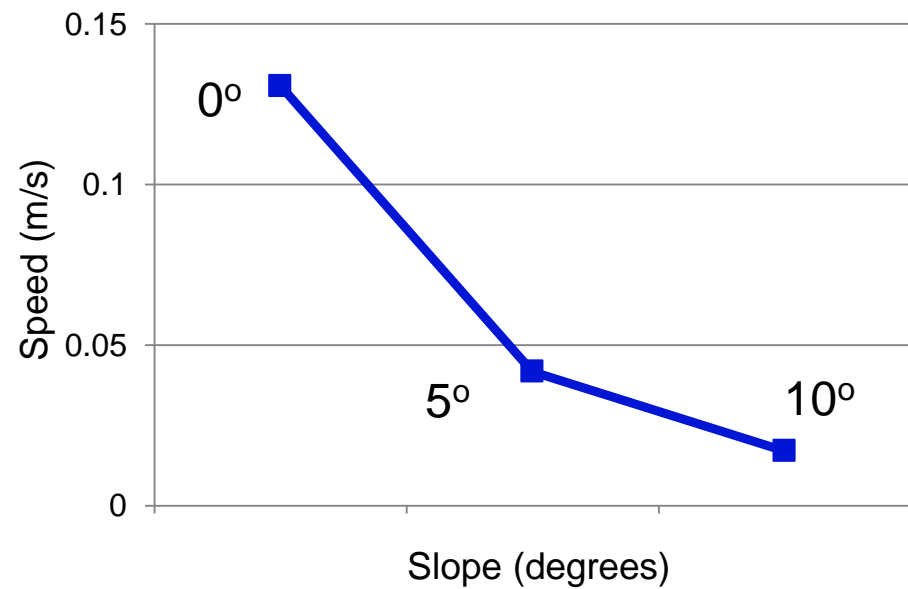
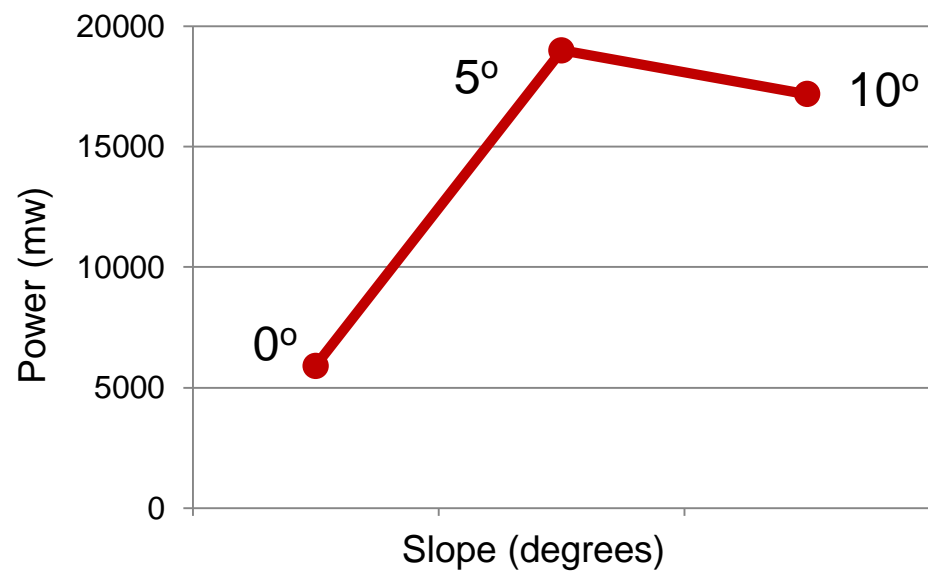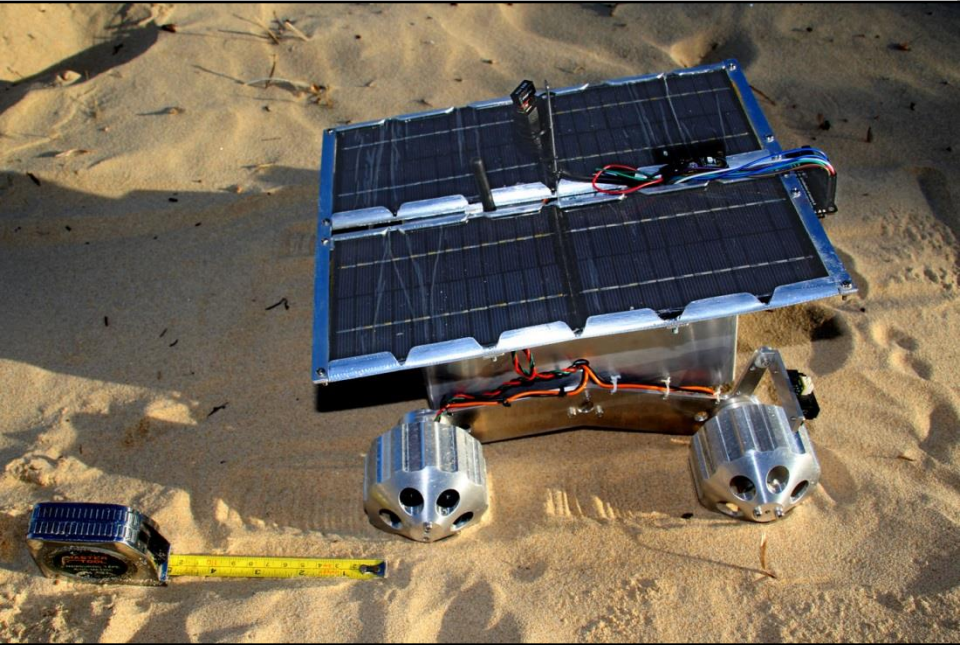# Results – Wet Sand

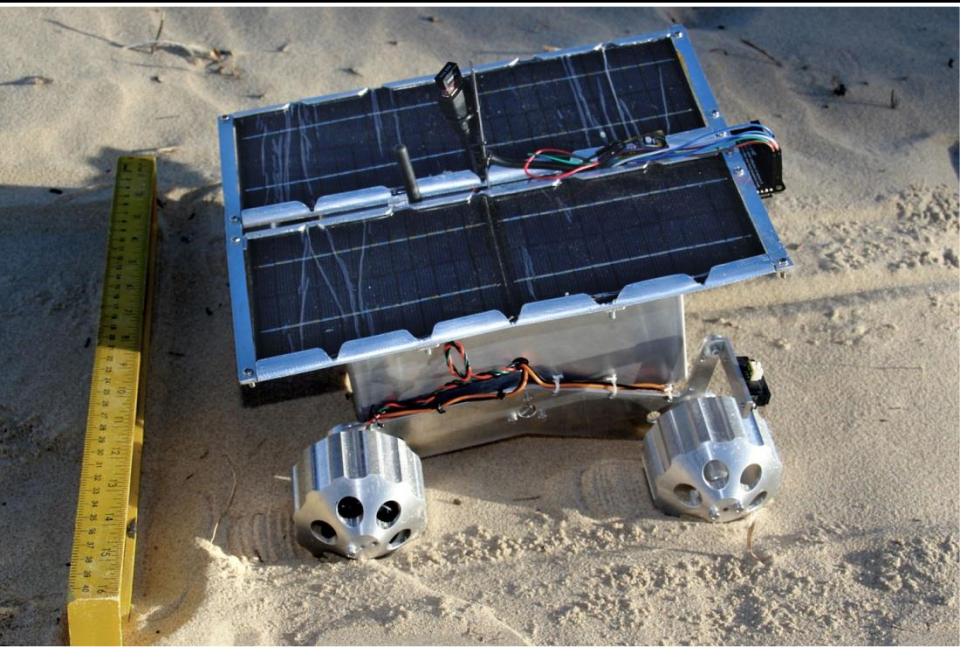Rover tracks on wet sand

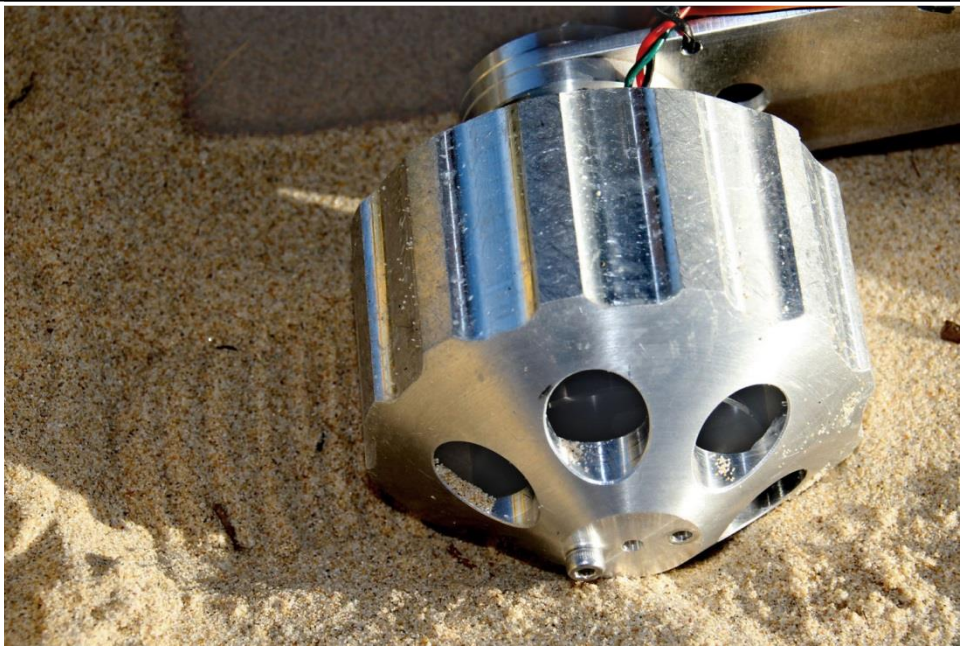Climbing slope on wet sand

Results – Dry Sand

Results – Dry Sand

- More power use except for slipping
- Wheel sink to 3 cm
- Higher wheel slippage
- Vehicle Bogged at 10 degrees
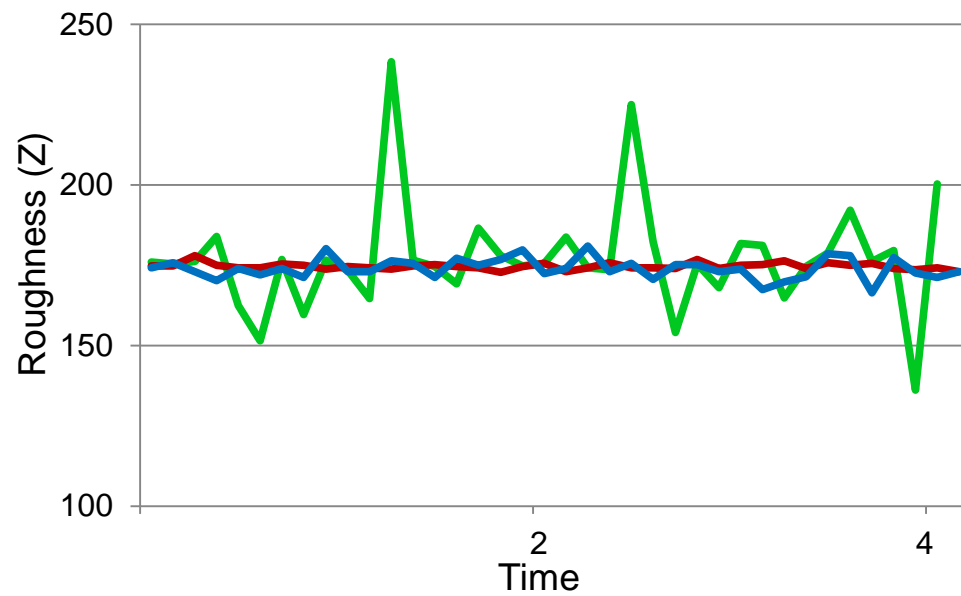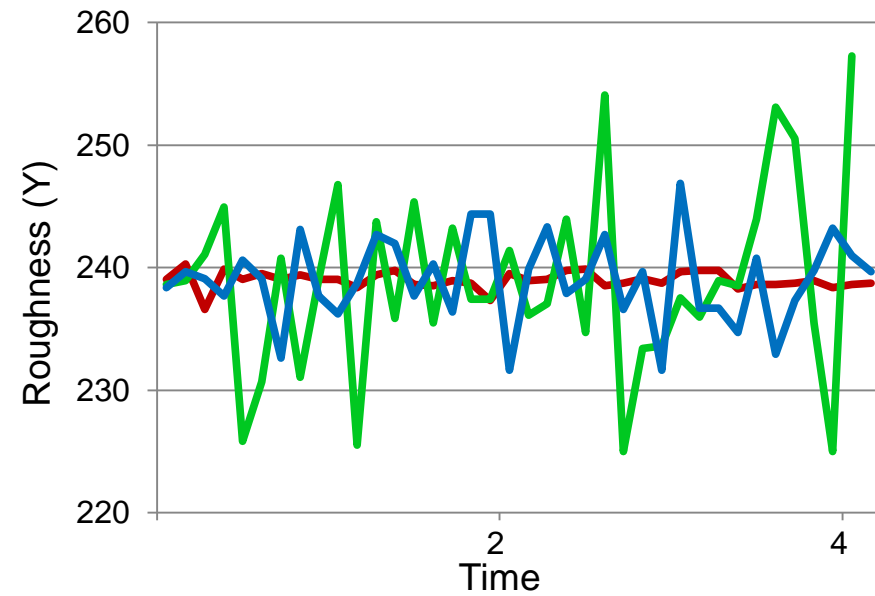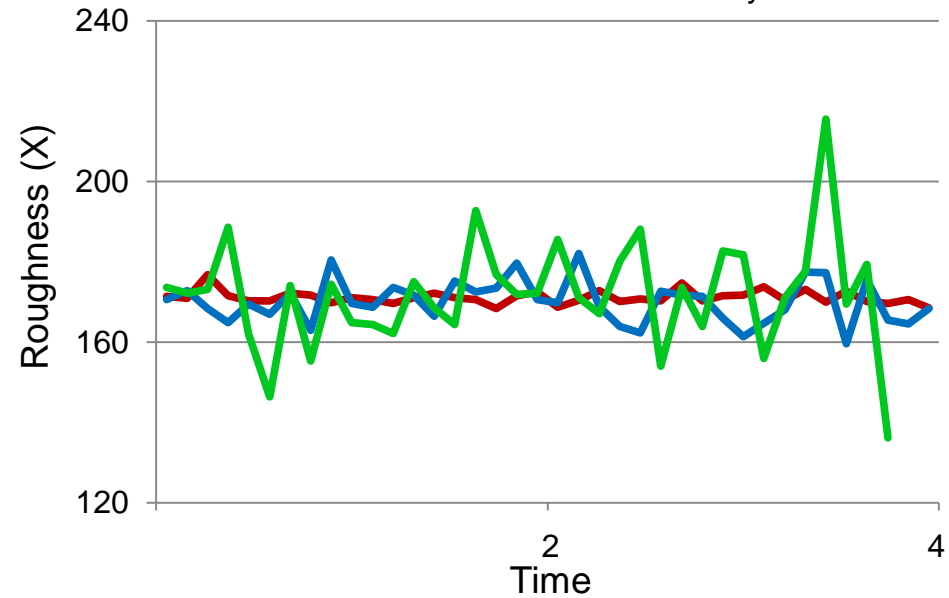- Lower RPM still not effective
- Bigger wheels?

Surface Characterisation

Conclusion

- A4 Rover – develop and test 3 kg nanorover
- Crab able to negotiate terrain types found on Mars
- Need to find more energy efficient image capture solution
- Science and mobility testing is ongoing