



# 2014-2015 NASA Student Launch

## Flight Readiness Review

University of Central Florida

# Launch Vehicle and AGSE design and dimensions

- Length: 79.25 in.
- Diameter: 4 in.
- Weight: 9.26 lbs
- Rover Dimensions: 22 in x 20 in x 22 in
- Electronics Box: 10 in x 14 in x 4 in



# Key design features of the launch vehicle

- LED lighting
- Magnetic latch mechanism
- Arming switch
- Closing mechanism
- Removable bulkhead mechanism for main chute





# Motor description

- Full Scale will use Cesaroni J355 red lightning
- Burn Time: 3.4s
- Propellant Weight: 669gg
- Total Impulse: 267.40 lb\*s
- Max Thrust: 97.63 lb
- Average Thrust: 79.42 lb



# Rocket flight stability in static margin diagram

- ☞ Center of Gravity: 54.194 in.
- ☞ Center of Pressure: 65.66 in.
- ☞ Stability Margin: 2.87 Cal



# Launch thrust-to-weight ratio and rail exit velocity

- Thrust to Weight ratio is 7.35:1
- Rail Exit Velocity is 60.20 ft/s





# Mass statement

- Open Rocket subscale mass prediction: 75oz (4.7lb)
- Actual subscale mass: 101 oz (6.3lb)
- Mass increase of 26 oz (1.6lb)
- Open Rocket fullscale mass prediction: 139 oz (8.7lb)
- Expected mass increase: 30oz (1.9lb)
- Expected total mass: 169 oz (10.6lb)



# Parachute sizes and descent rates

	Mass: slugs	Decent Rate: ft/s	Total Energy: ft*lb	Parachute Size: in.
Drogue Decent 1	0.3478	48.88	830.98	22
Drogue Decent 2	0.2813	43.96	543.607	22
Payload Decent	0.0665	18.80	23.503	30
Main Decent	0.2813	13.82	53.726	70



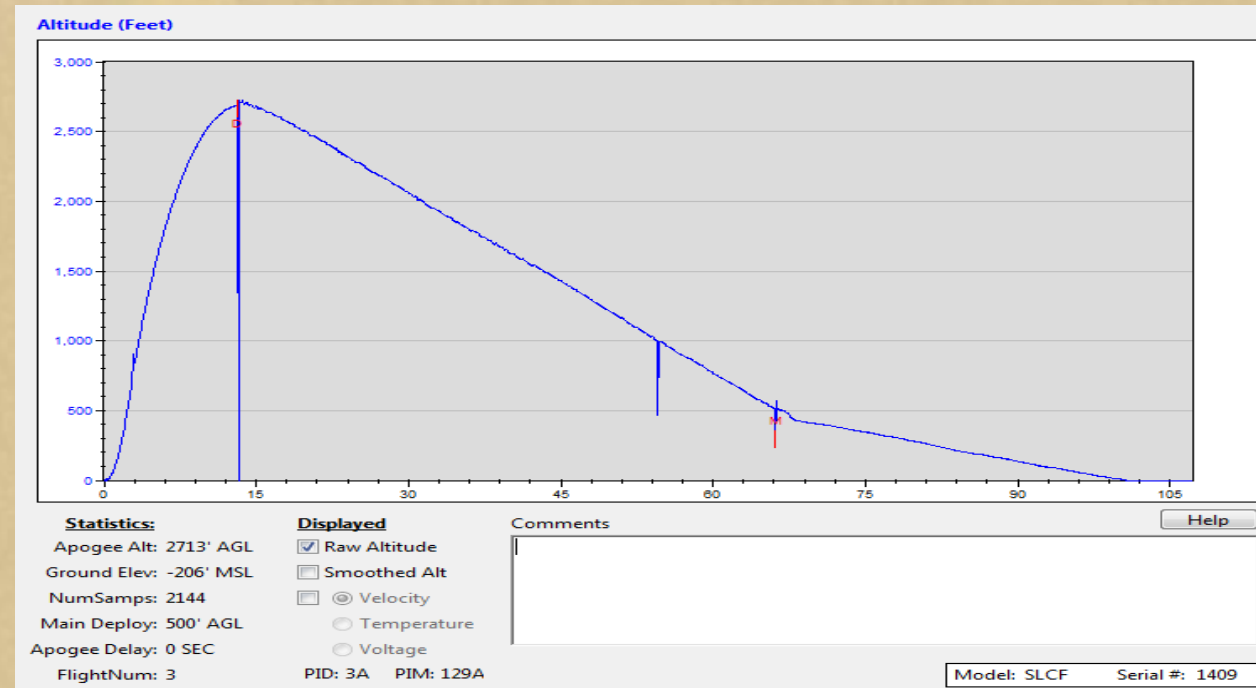


# Kinetic energy at key phases of the mission, especially at landing

- ➡ Kinetic energy determined from previously found velocities.
- ➡ Drogue before payload ejection: 276ft
- ➡ Drogue after payload ejection: 169.6ft
- ➡ Main kinetic energy : 37.9ft
- ➡ Ejected payload kinetic energy : 212.4ft
- ➡ Rail exit kinetic energy 841.8ft



# Predicted altitude of the launch vehicle with a 5-, 10-, 15-, and 20-mph wind



# Predicted drift from the launch pad with a 5-, 10-, 15-, and 20-mph wind

- ➡ Calculated using constant acceleration assumption
- ➡ 5 mph: 675.277 ft
- ➡ 10 mph: 1350.5541 ft
- ➡ 15 mph: 2025.831 ft
- ➡ 20 mph: 2701.108 ft





# Test plans and procedures

- 👉 Ground Testing: test ignition charges through flight computer, green indicator signals continuity
- 👉 Simulations: test through vacuum
- 👉 Actual Launch
- 👉 Outlined in CDR Section 4.1.11



# Full-scale flight test

👉 Approx. AGL

↳ 2,700 ft

👉 Approx. Max Velocity

↳ 450 ft/s



# Recovery system tests

- ☞ Drogue: 36 in. / Main: 76 in. / Drogue: 28 in.
- ☞ Kevlar recovery harnesses
- ☞ Descent rates
- ☞ Drogue before payload ejection: 41ft/s
- ☞ Drogue after payload ejection: 36ft/s
- ☞ Main descent rate: 17ft/s
- ☞ Ejected payload descent rate: 24ft/s
- ☞ Rail exit velocity: 71.5ft/s





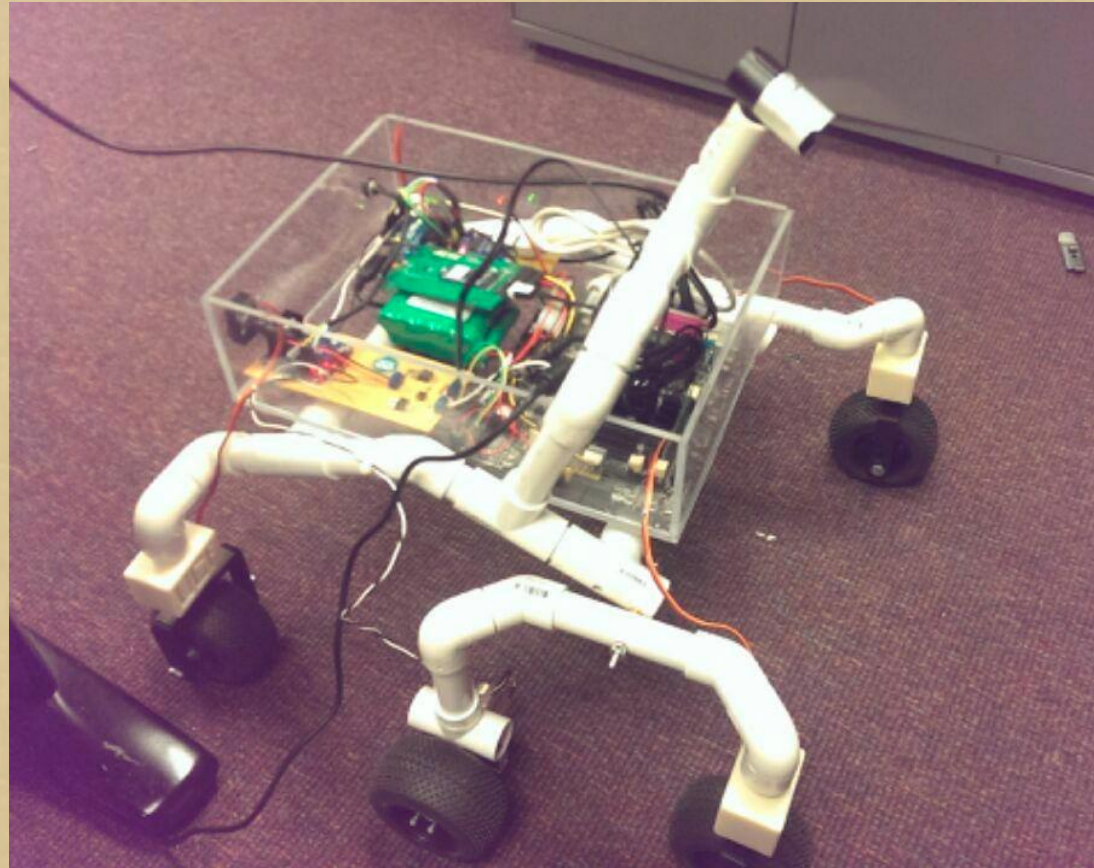
# Summary of Requirements Verification (launch vehicle)

## All Requirements Met

System must be less than \$5000 fair market value at time of flight
Rocket must reliably and accurately achieve apogee of 5280ft
Reliably deploy quadrotor at safe working altitude of 500 ft
Stream telemetry, and video to ground station
Employ video and beacon tracking systems.
Quadrotor must have attitude control within 5 degrees of accuracy during normal operations
Quadrotor must have basic altitude control with 6 feet (2 meters) of accuracy during normal operations
Quadrotor must be able to hover for a minimum of ten minutes and operate for 45 minutes in a low power state (no power supplied to the propulsion system).



# AGSE



# AGSE/payload design and dimensions

## ☞ Chassis

↳ 22 in x 20 in x 22 in

## ☞ Electronics Box

↳ 10 in x 14 in x 4 in





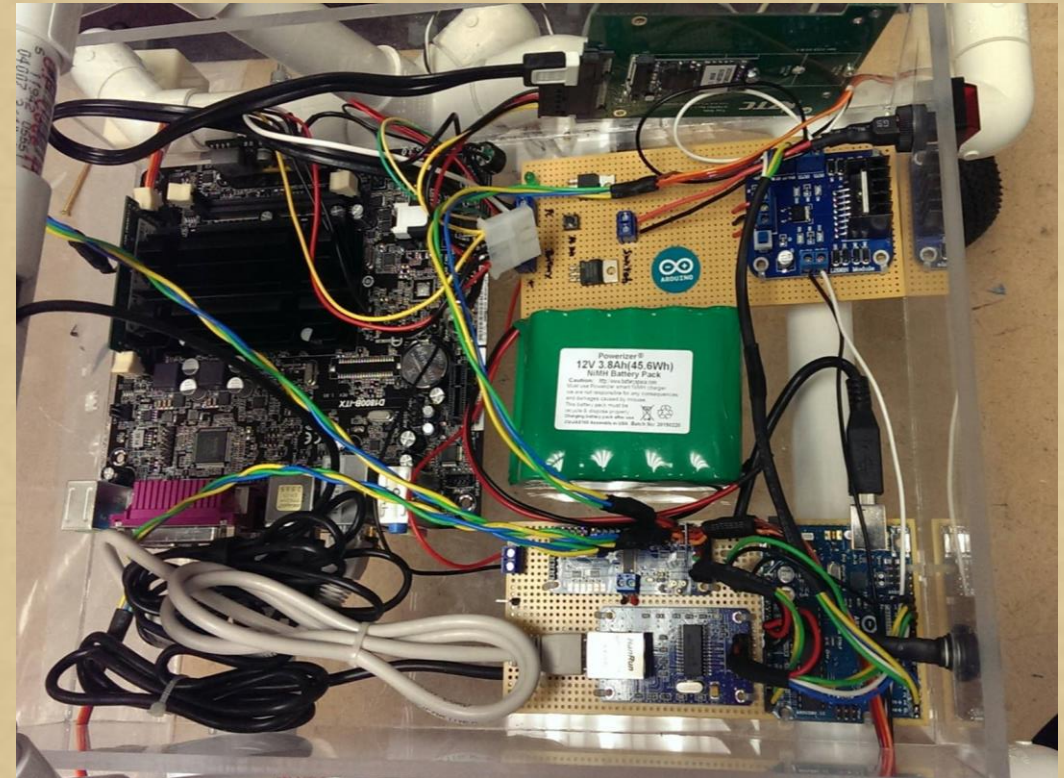
# AGSE/Payload integration

- ➔ Rotating Claw on moving arm
- ➔ Mounted Camera
- ➔ Detect payload in claw



# Interfaces with ground systems

- 👉 Webcams
- 👉 Servos
- 👉 Motors
- 👉 Arduino
- 👉 Motor/Servo Controllers
- 👉 Low Powered PC motherboard





# Summary of requirements verification (AGSE/payload)

- ☞ Power/Kill Switch
- ☞ Start Button to start program
- ☞ Will run all stages autonomously

