High Power Rocketry

Construction, Telemetry and Operations

LSF & ESA CanSat

High school student competition

Build a Can sized “satellite”

Rocket Assembly

Payload Fit check and Comm test

Launch operations

Rocket specifications

1/4-Scale Patriot Missile by Public Missiles

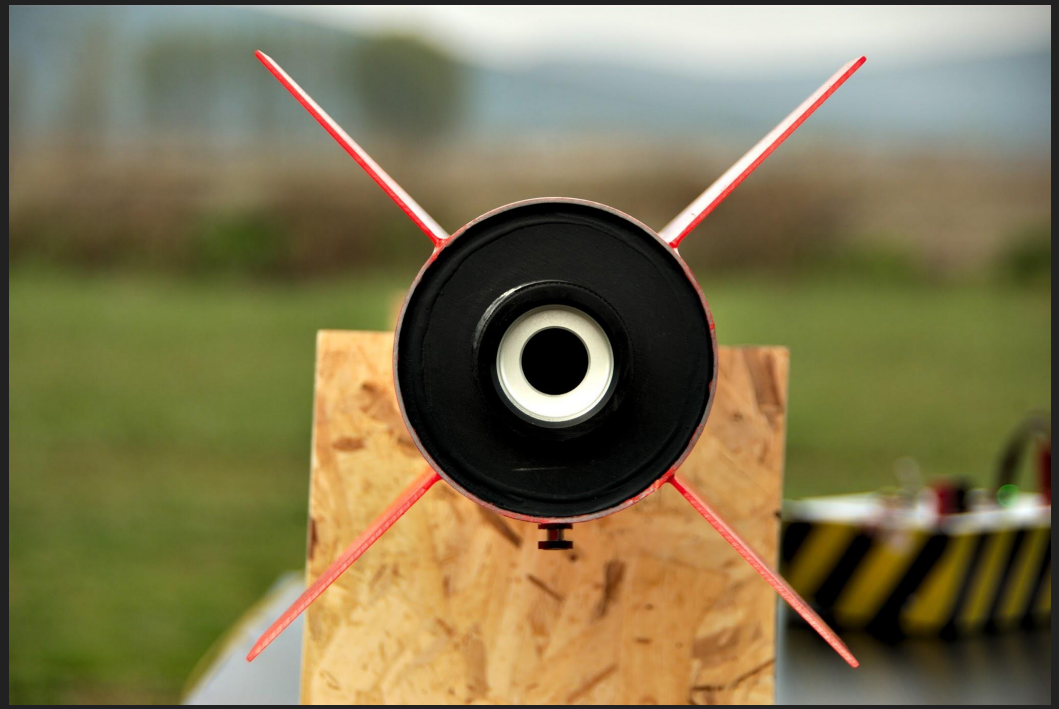
Diameter: 99.06mm

Length: 1371.6mm

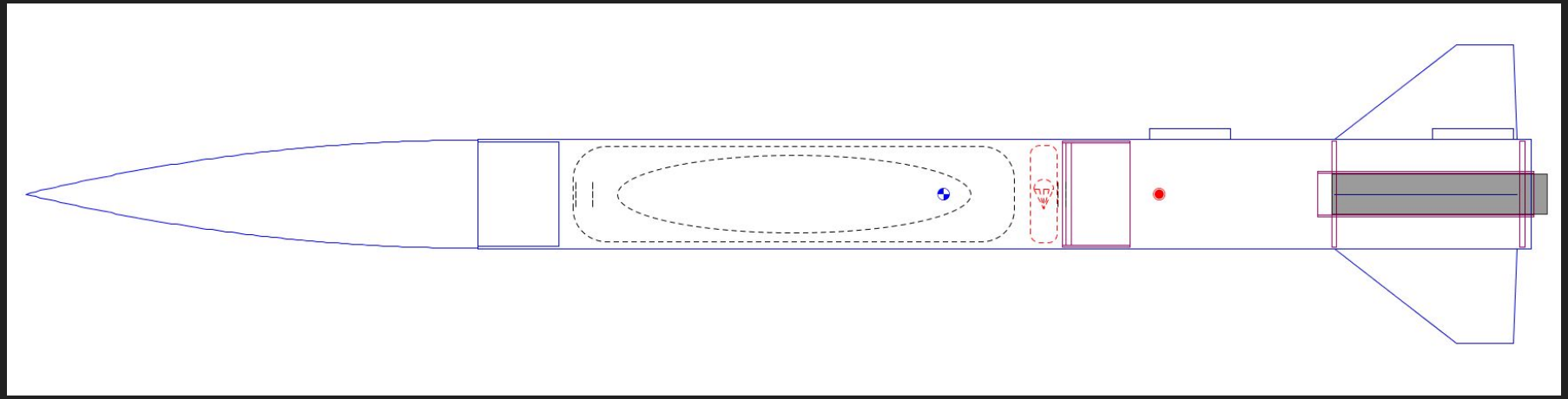
T/O Weight :3.3 kgr

Motor: Aerotech

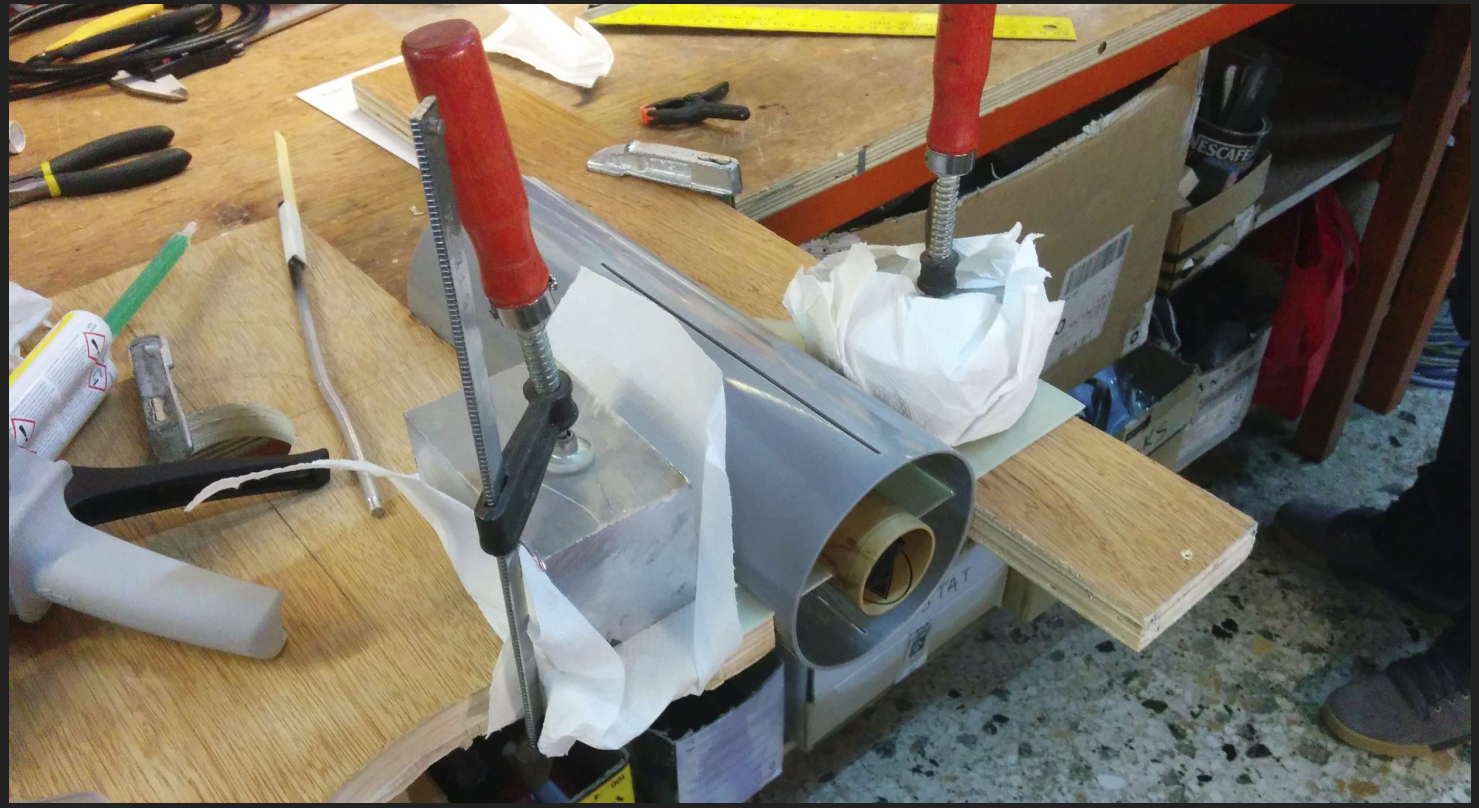
Acceleration: 16-20g



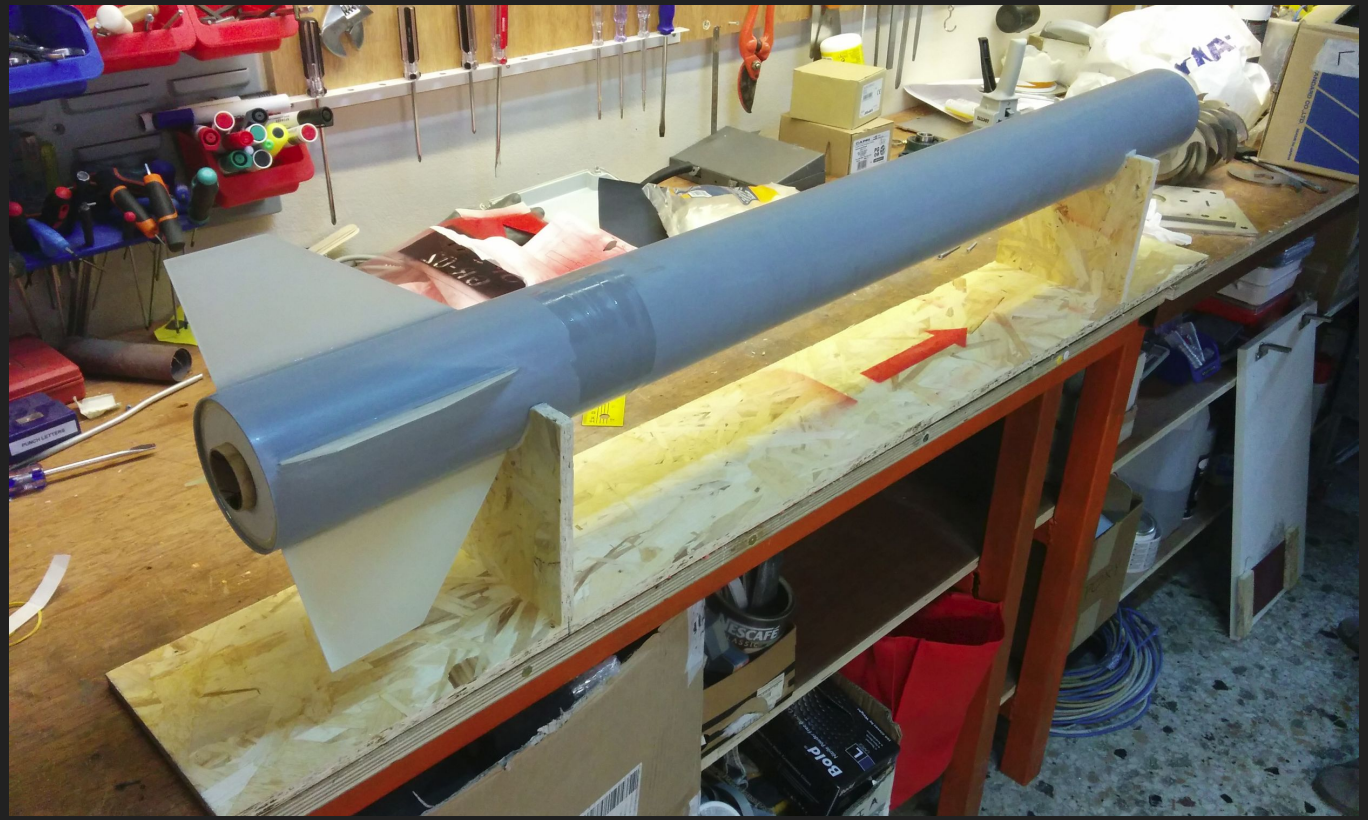
Anatomy



Construction

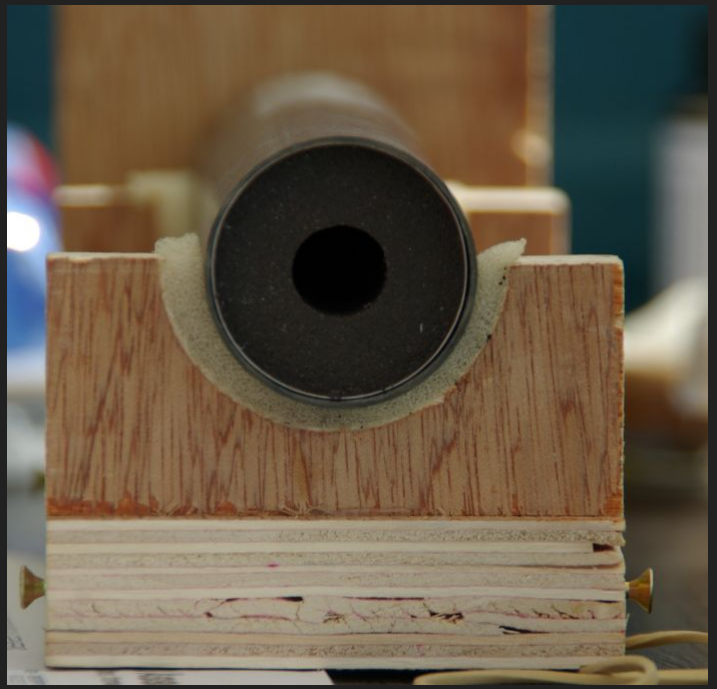


Construction



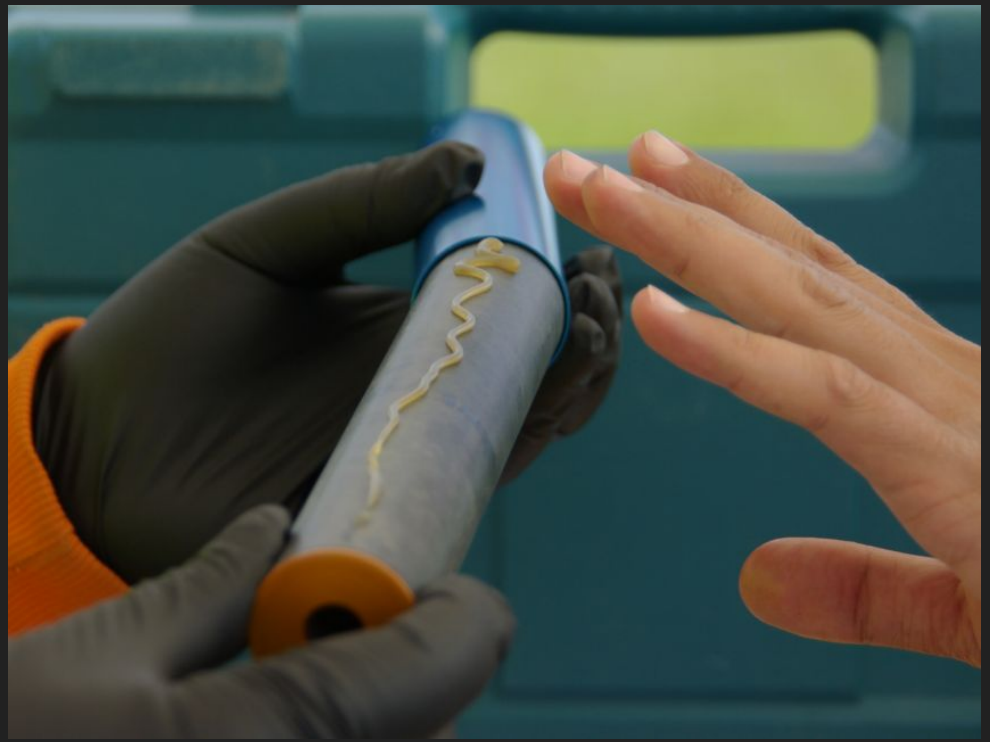
Construction

Motor assembly



Delay charge

Motor assembly



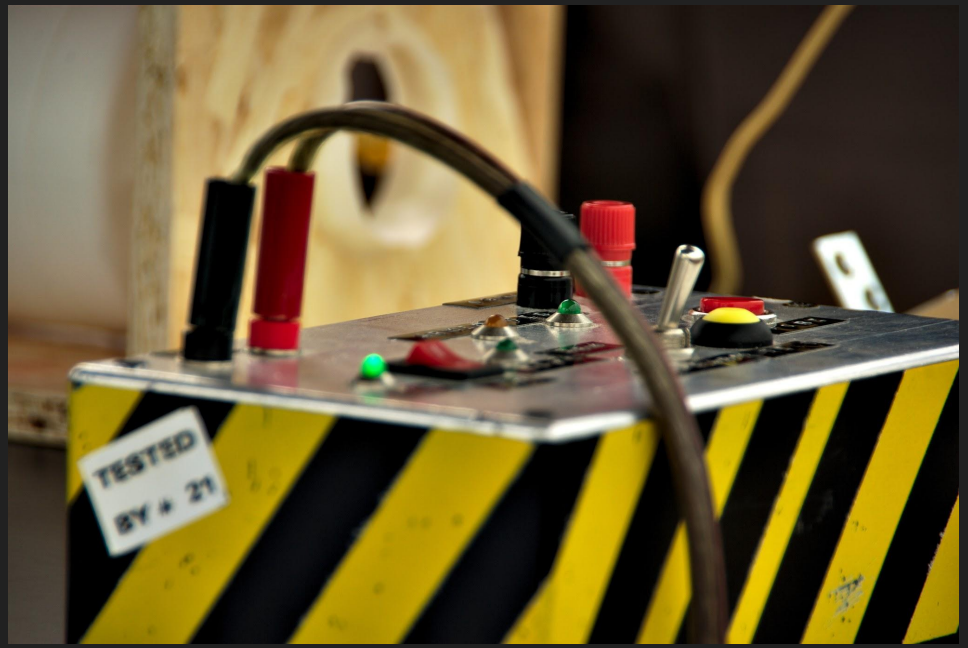
Mission profile

Payload: 10 CanSats 300gr - 350gr

Target AGL Altitude: 1000m

Rocket recovery: Parachute

Payload Recovery: Parachute



Simulation and testing

Mission simulation using OpenRocket

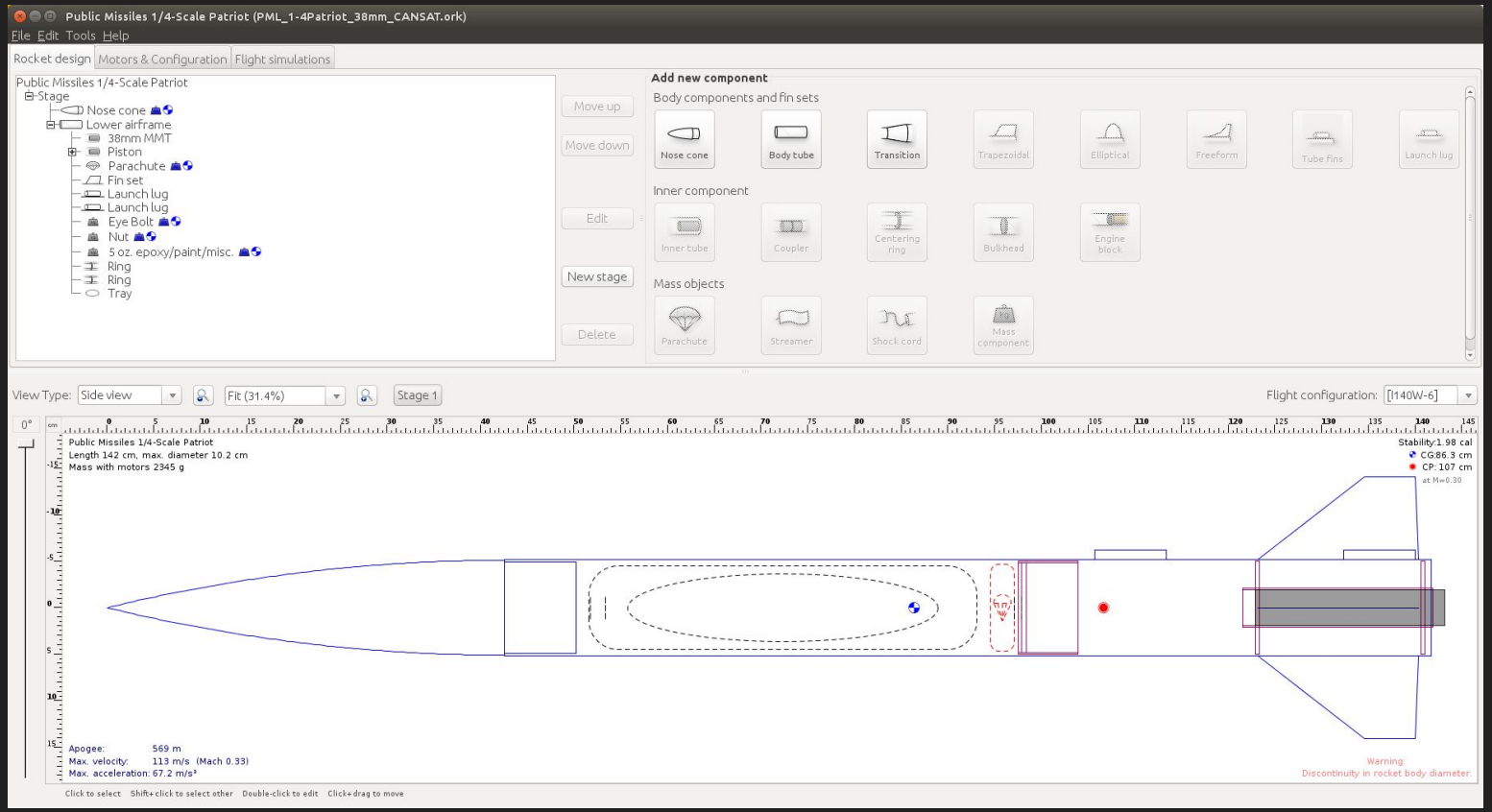
1st test mission:

- Launch test
- Procedures

2nd test mission:

- Telemetry test
- Procedures improvement

Simulation


Public Missiles 1/4-Scale Patriot (PML_1-4Patriot_38mm_CANSAT.ork)
File Edit Tools Help
Rocket design
Motors & Configuration
Flight simulations
Public Missiles 1/4-Scale Patriot
Stage
Nose cone
Lower airframe
38mm MMT
Piston
Parachute
Fin set
Launch lug
Launch lug
Eye Bolt
Nut
5 oz. epoxy/paint/misc.
Ring
Ring
Tray
Move up
Move down
Edit
New stage
Delete
Add new component
Body components and fin sets
Nose cone
Body tube
Transition
Trapezoidal
Elliptical
Freeform
Tube fins
Launch lug
Inner component
Inner tube
Coupler
Centering ring
Bulkhead
Engine block
Mass objects
Parachute
Streamer
Shock cord
Mass component
View Type: Side view
Fit (31.4%)
Stage 1
Flight configuration: [I140W-6]
Public Missiles 1/4-Scale Patriot
Length 142 cm, max. diameter 10.2 cm
Mass with motors 2345 g
Stability:1.98 cal
CG:86.3 cm
CP: 107 cm
at M=0.30
Apogee: 569 m
Max. velocity: 113 m/s (Mach 0.33)
Max. acceleration: 67.2 m/s²
Warning:
Discontinuity in rocket body diameter
Click to select Shift+click to select other Double-click to edit Click+drag to move

Simulation


Simulation 2
Vertical motion vs. time
Altitude; Vertical acceleration
Vertical velocity
Time (s)
Motor ignition
Motor burnout
Ejection charge, Recovery device deployment
Apogee
Altitude (m)
Vertical acceleration (m/s²)
Vertical velocity (m/s)

Stability

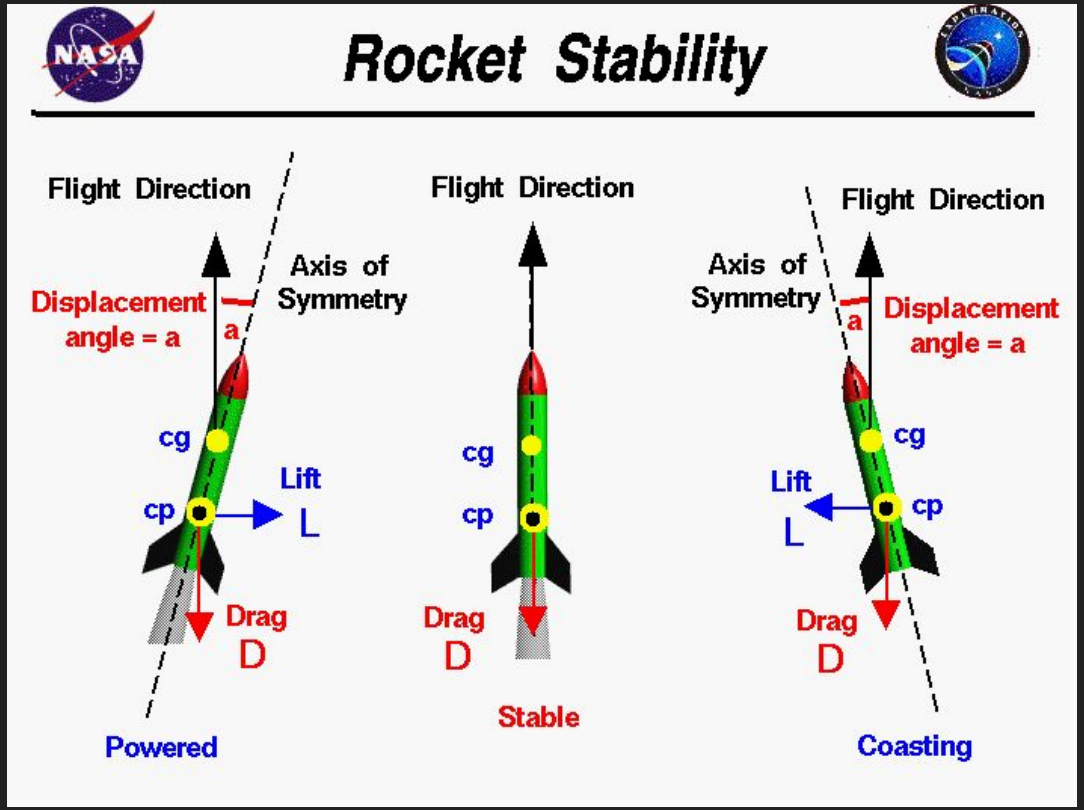
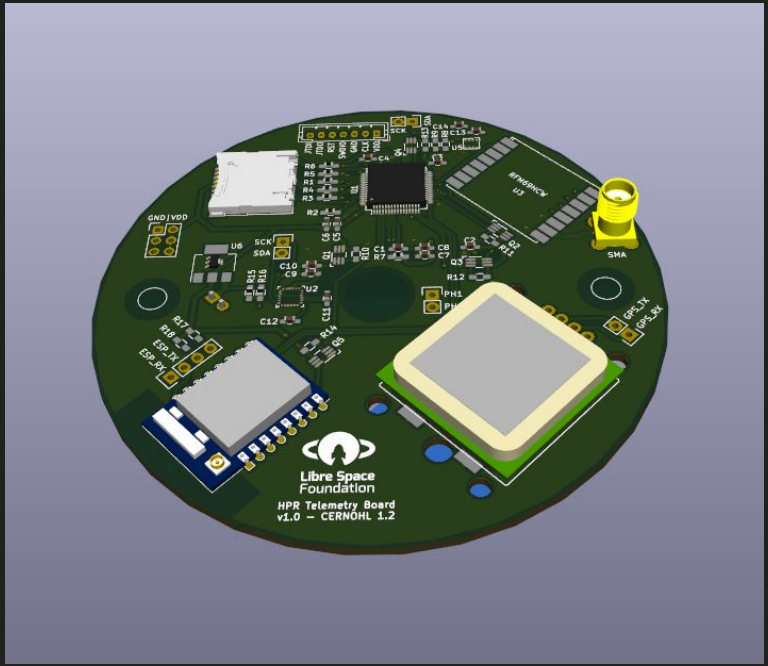
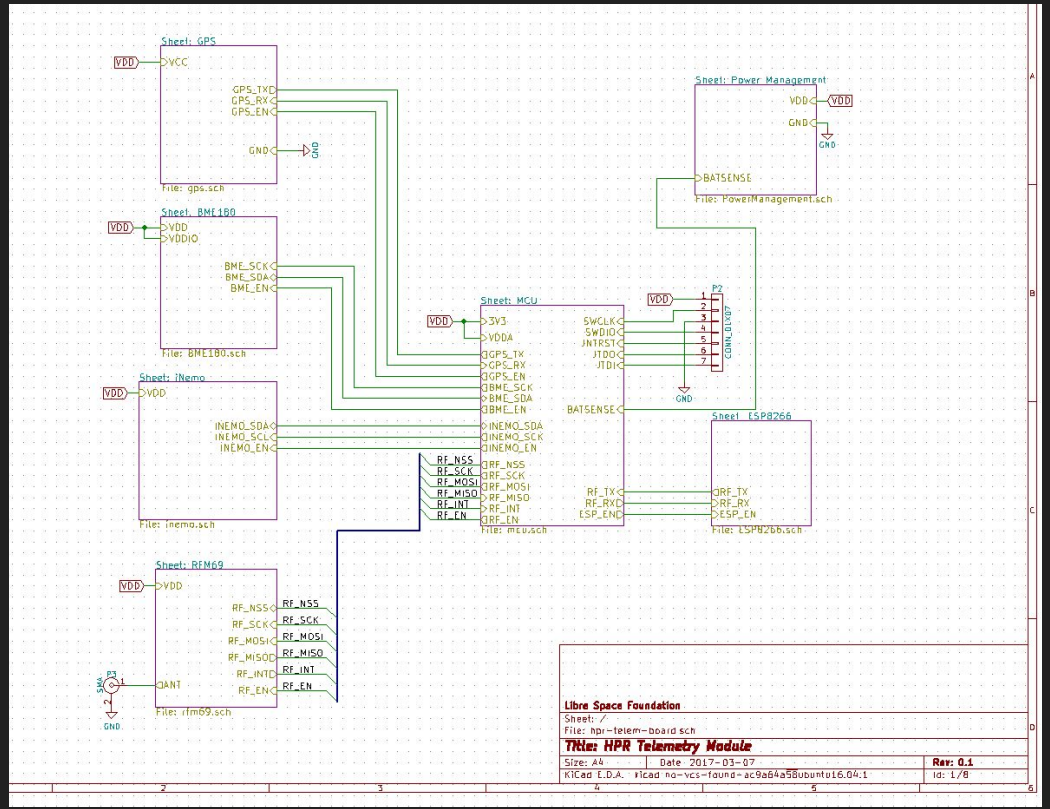


Image by NASA

Telemetry


Libre Space
Foundation
HPR Telemetry Board
v1.0 — CERNOHL 1.2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Sheet: MCU
File: mcu.sch
Sheet: Power Management
File: PowerManagement.sch
Sheet: ESP8266
File: ESP8266.sch
Libre Space Foundation
File: hpr-telem-board.sch
Title: HPR Telemetry Module
Size: A4
Date: 2017-03-07
Rev: 0.1
KiCad E.D.A. kicad no-vcs-found-ac9a64a58ubuntu16.04.1
Id: 1/8

Telemetry

GPS: Position and Altitude

BME280: Barometric pressure & temperature

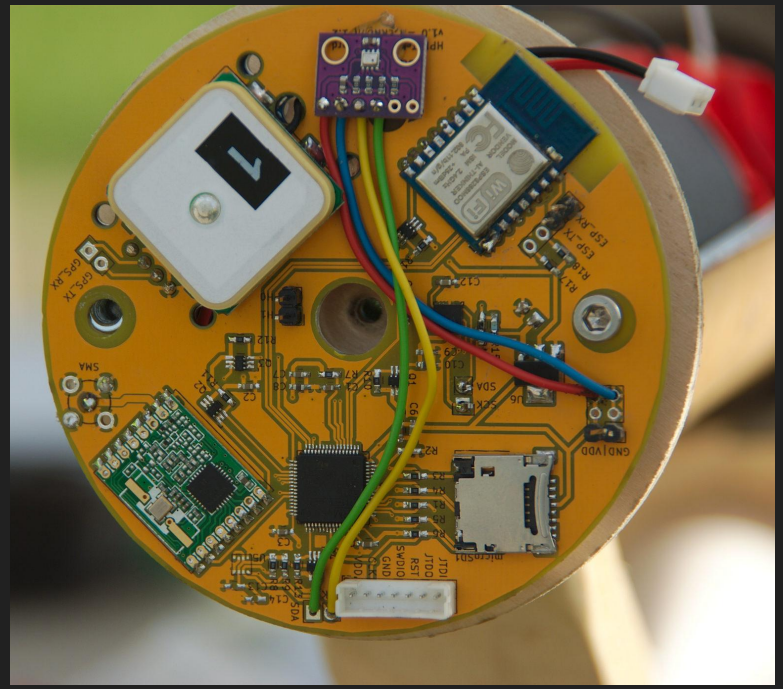
LSM9DS0: Acceleration

RFM69: Long range low power comms

ESP8266: High bandwidth data link

MicroSD: Data storage

MCU: STM32L162 ARM Cortex-M3

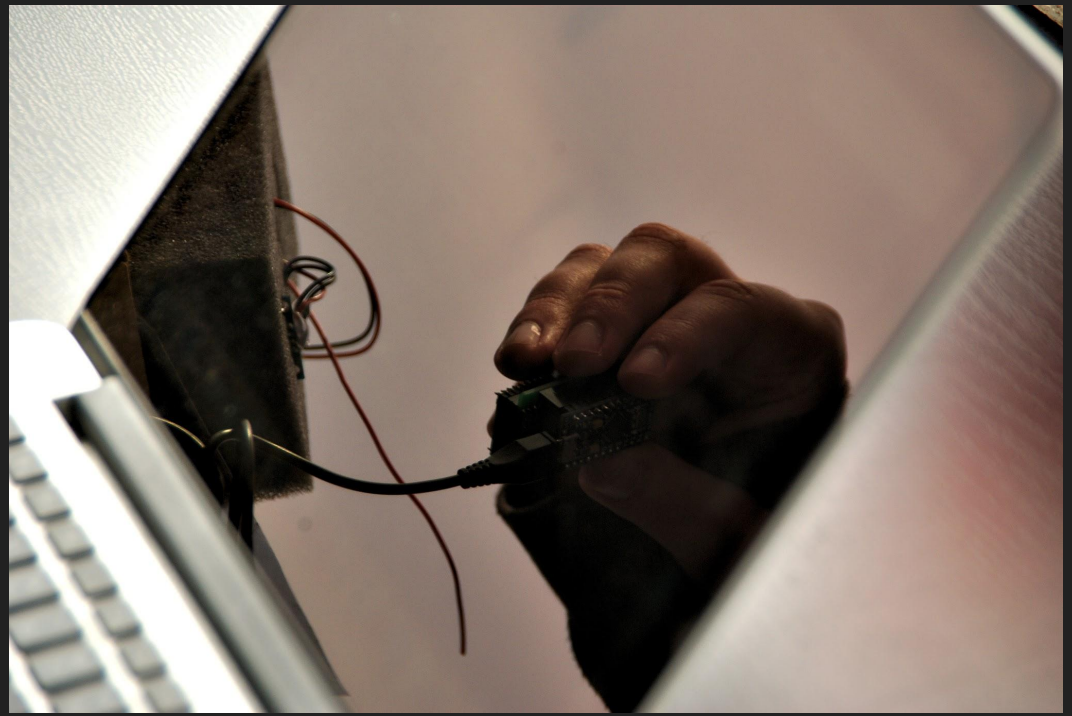


Telemetry

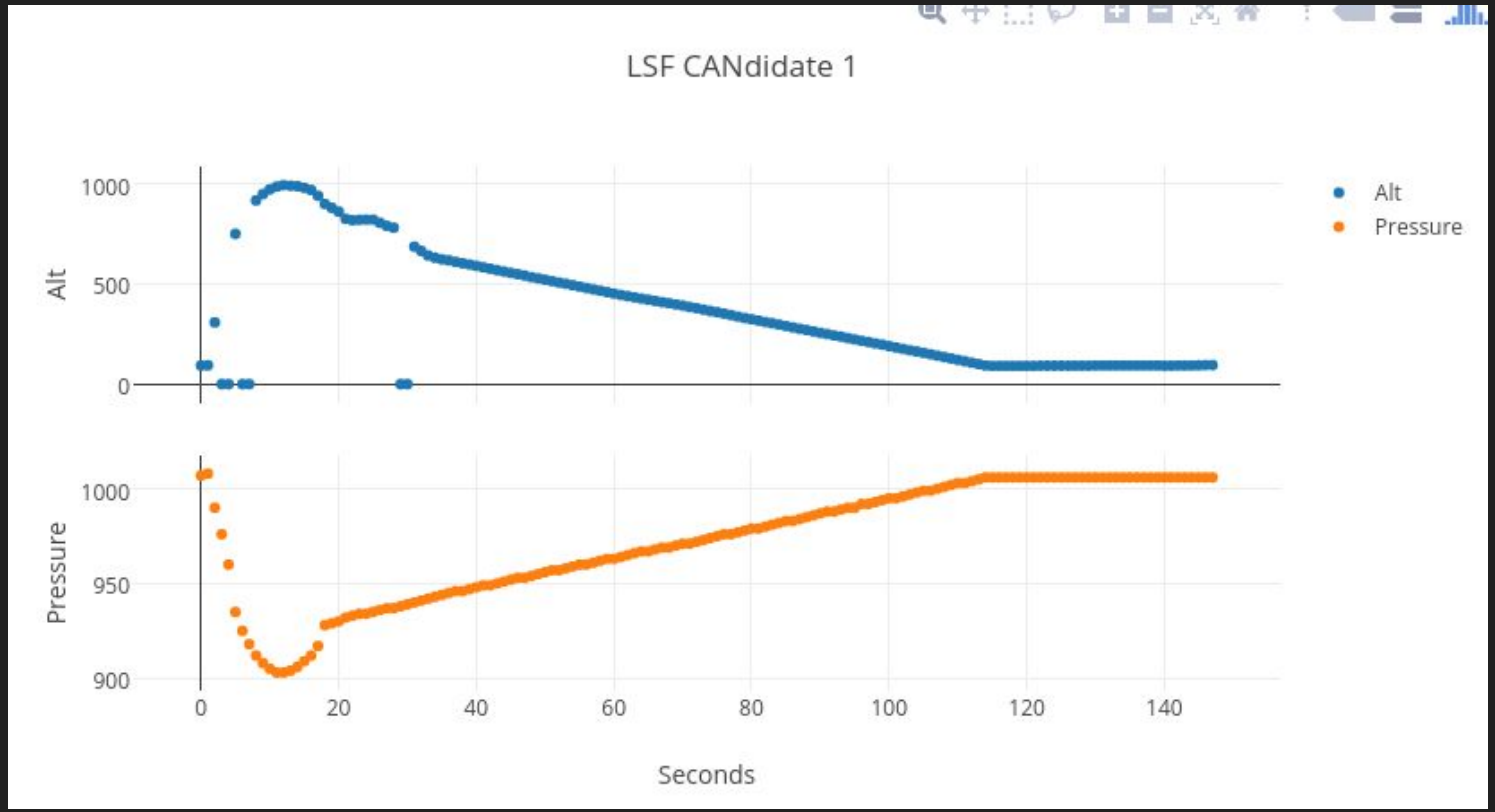
Ground station:

USRP SDR with Yagi antenna

WiFi Access point with panel antenna



Telemetry

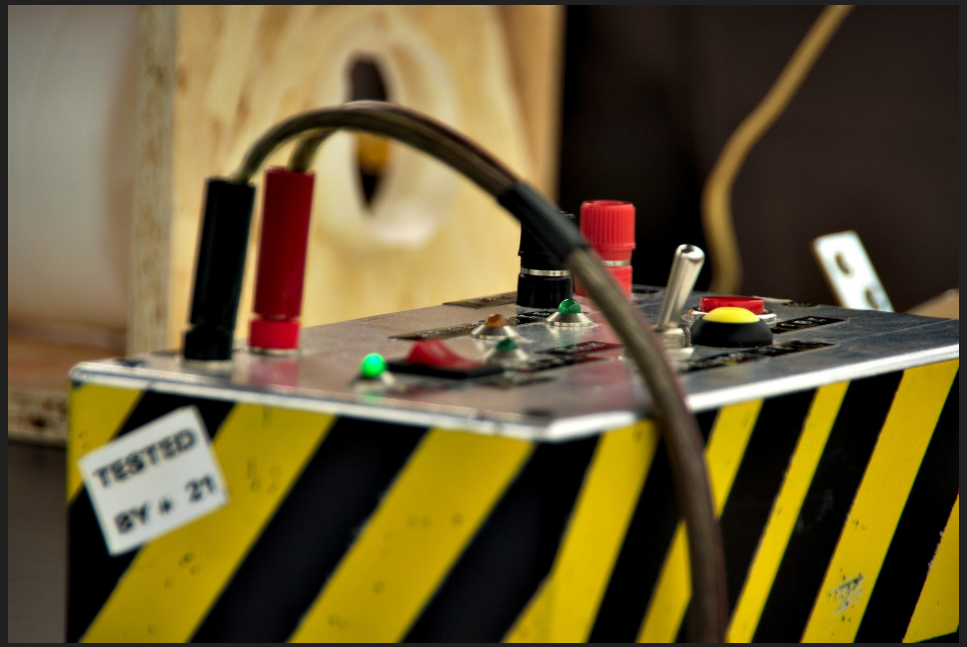

LSF CANdidate 1
Alt
Pressure
1000
500
0
1000
950
900
0
20
40
60
80
100
120
140
Seconds

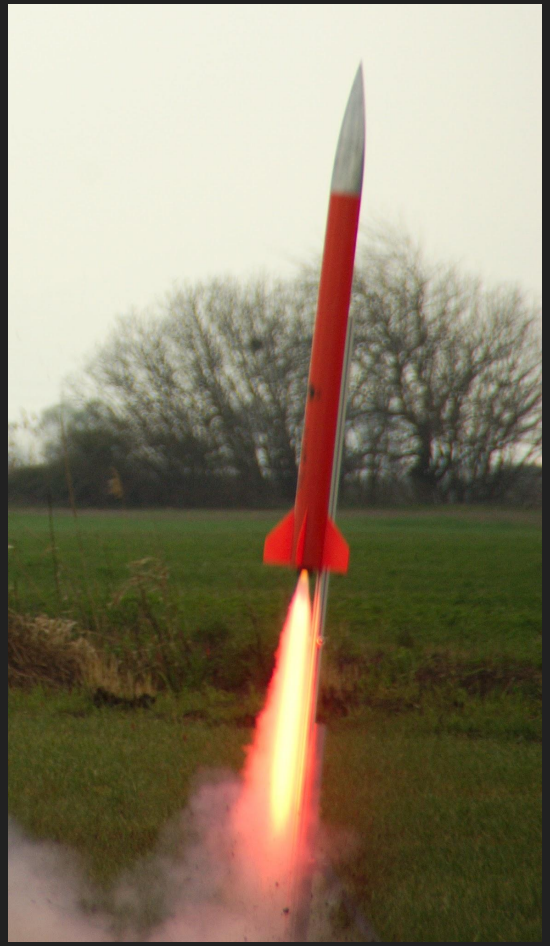
Operations

- Range safety
- Rocket preparation
- Motor assembly
- Payload integration
- Launch and launch abort
- Recovery

Operations

PFFCHHHHHHHHHHhhhh….



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Recovery