

ARES Workshop - OpenRocket Part 2

Ben van der Veer & Hasan al Banna

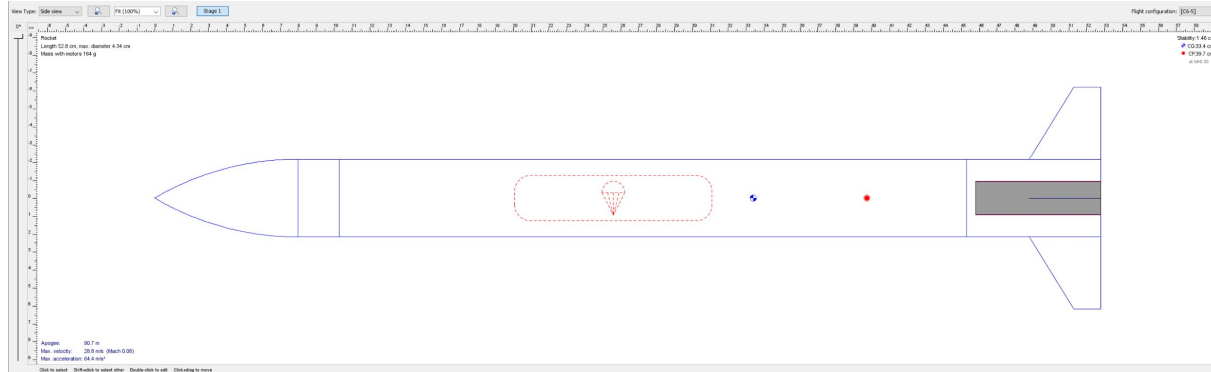


Goal



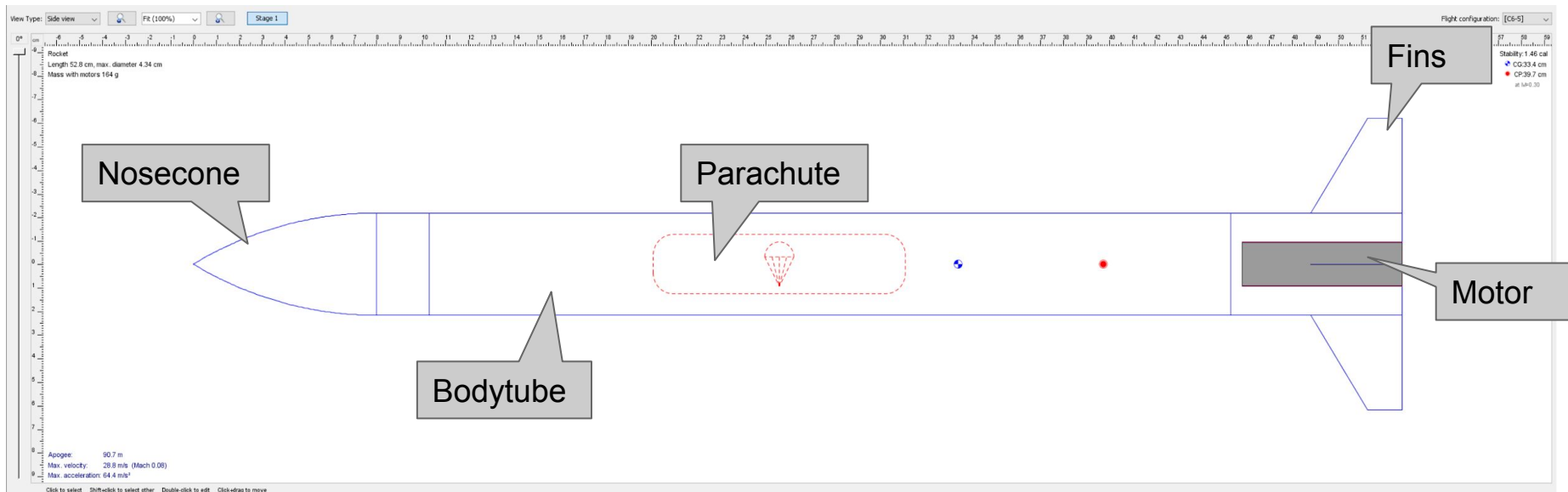
This
workshop

CAD
workshops

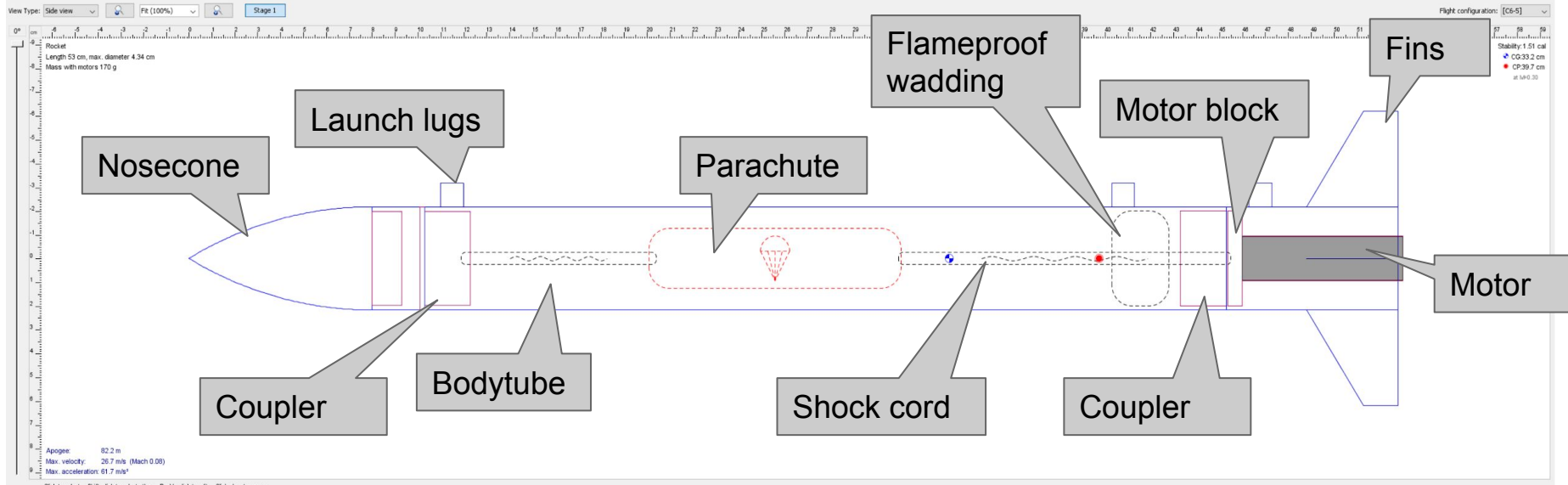




Recap



Reality



Step 1: Start with the motor



$TWR \text{ (thrust to weight ratio)} = \text{Thrust (N)} / \text{Weight (N)}$

$\text{Weight (N)} = \text{Weight (kg)} \times \text{Gravity (m} \cdot \text{s}^{-2}\text{)}$

$TWR > 4$ is desired

Thus for a C6 motor, aim for ~150 grams

Step 2: Decide on structure



Use what you have on hand, get creative

We will go cover 3d printed parts with cardboard body but there are always alternatives

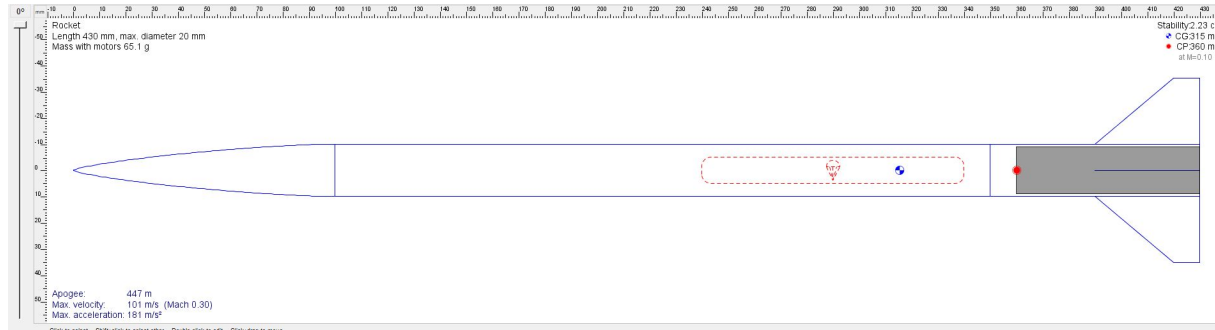


<https://www.instructables.com/Make-Your-Own-Model-Rocket/>

Step 3: Rough Openrocket Design

Create all basic components with estimated masses

- For body tube use the dimensions and weight you measure
- For 3d printed parts start with 1.2mm walls (equivalent to 3 nozzles wide), set material to PVC to approximate mass of PLA
- Parachute use mass of ~20g and length of 15 cm, values based on making my own parachute out of a bin bag



Step 4: Openrocket checklist

Motor ejection timing should be < 2 seconds after apogee

Stability over time (especially off the rod) should be > 1 cal

Velocity at deployment should have no warnings showing

Simulate for higher wind speeds, prior criteria should still be satisfied

Check the altitude your rocket will reach and how far it will drift, consider suitability of different launch sites

Check that ground hit velocity is safe

Vertical motion vs. time

Total motion vs. time

Flight side profile

Ground track

Stability vs. time

Drag coefficients vs. Mach number

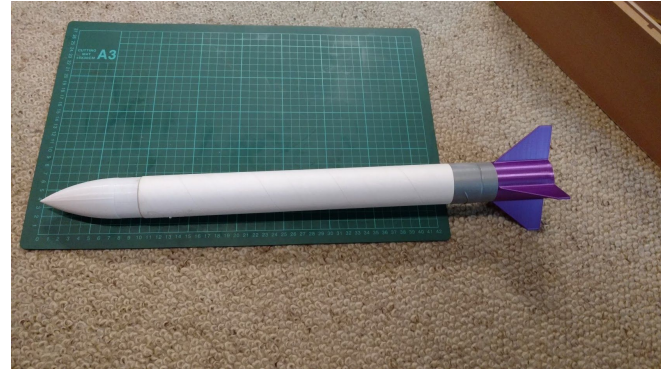
Roll characteristics

Angle of attack and orientation vs. time

Step 5: Troubleshoot

Problem	Observation	Solutions
Motor ejection too late?	Rocket needs to be going up for longer	Reduce drag Reduce weight Reconsider motor suitability
Stability off launch rod too low?	Need to ensure rocket is stable at the velocity it reaches on rod clearance	Change weight distribution Change surface geometry (fins) Longer launch rod
Parachute deployment velocity too high?	Motor ejection timing may be off Weathercocking may be causing sideways flight	See first row for motor timing Lower stability = less weathercocking
Rocket drifts too far?	Rocket needs to come down fast enough to avoid excessive drift	Decrease parachute drag Decrease apogee
Higher wind speed makes rocket unviable?	Rocket should be able to fly safely in common wind speeds (20 km/h = ~6 m/s)	Ensure all previous conditions are okay with various wind speeds
Rocket hits ground too fast?	bad.	Check parachute parameters Check ejection timing

Learning Curve



No Workshop Next Week!!

Week 7 workshop - LaTeX (Lah-Tec)

Have a wonderful break :D
See you in Week 7! :)

