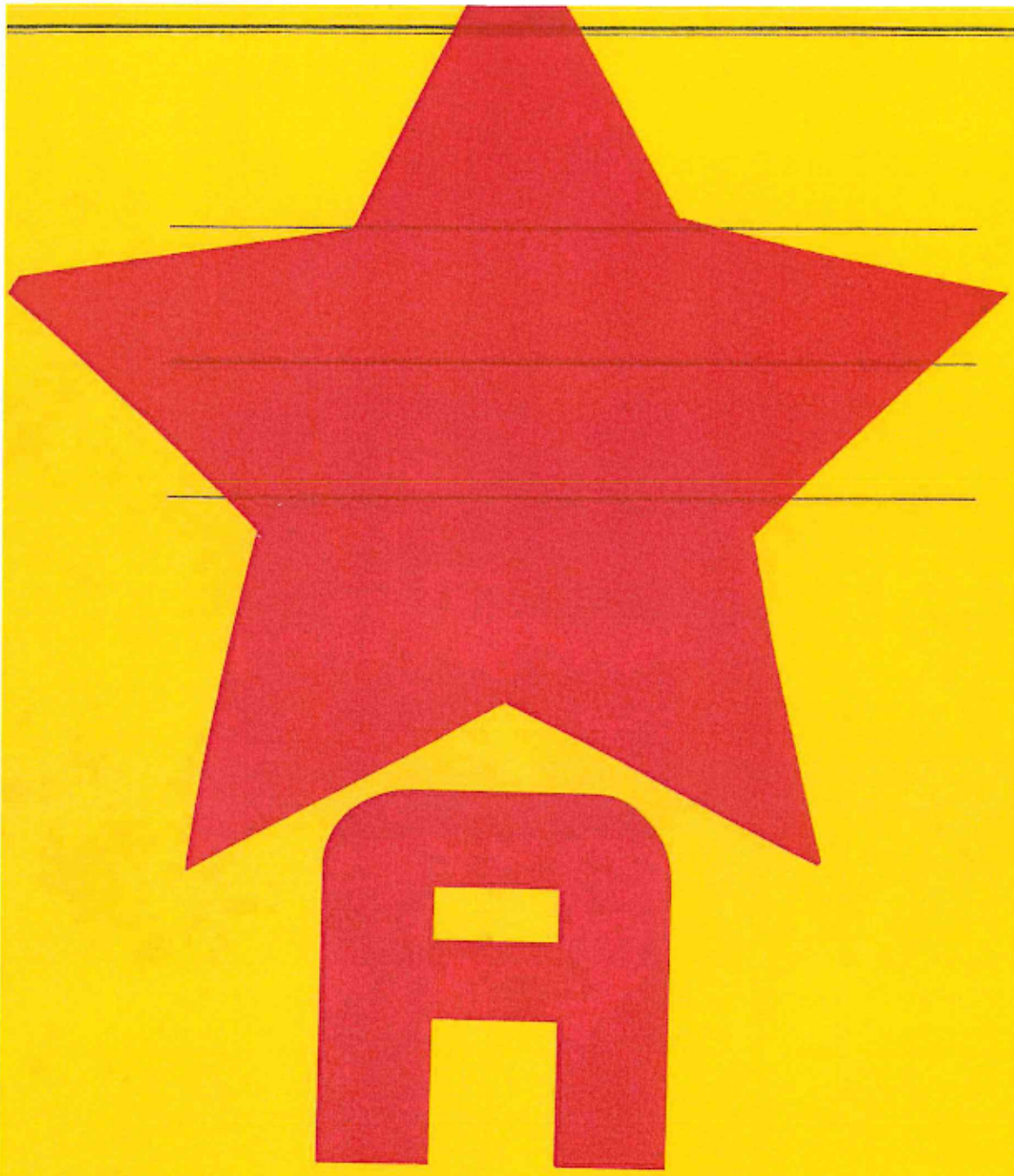


Contents Page:

STEM Club Lent 2019 – UKRoC

Page Num/Tab	Contents
1	Title page
2	Initial Designs
4	Timeline
5	Meeting Point / Research
6	Finalise Designs
7	Test flight
8	Checklist
9	Regional Flight
12	National Flight
14	Cost
16	Rocket theory
Blue tag	Fins
Orange	Egg capsule
Pink	Parachute Testing
Yellow	Design Features
Green	Test Flight

EPSOM
COLLEGE

STEM Club Lent 2019 - UK Youth Rocketry Challenge

Team entry form: Date: 11/01/19

Team name: ASTERIA

Team members (max 6): 1. Gina
2. Kelly
3. Sara
4. ———
5. ———
6. ———

Why do you want to take part in the competition?

As we are doing STEM subjects for A level, we were most passionate in physics and wanted to apply our theoretical knowledge of problem solving to a practical challenge to enhance teamworking skills

Date:

Team signatures: ~~Gina~~ Sara Xu Kuny Gu

Entry successful – Supervisor signature: .....

Good luck.

Mr C.

STEM Club Lent 2019 - UKRoC

Initial design and ideas:

Summarise key criteria of UKRoC :

Max mass : 650g
overall rocket length : min. 650mm
egg payload must separate + come down separately.
minimum 2 parachutes

Initial design of rocket:

(see opposite page)
(see relevant pages)

Resources : Best Practice
Safety in model rocketery
Dr. Philip . Charlesworth

Possible unique design features

- location of ~~the~~ separation
- shape of fins + how many
- size of parachute
- nose cone size
- egg capsule material / shape

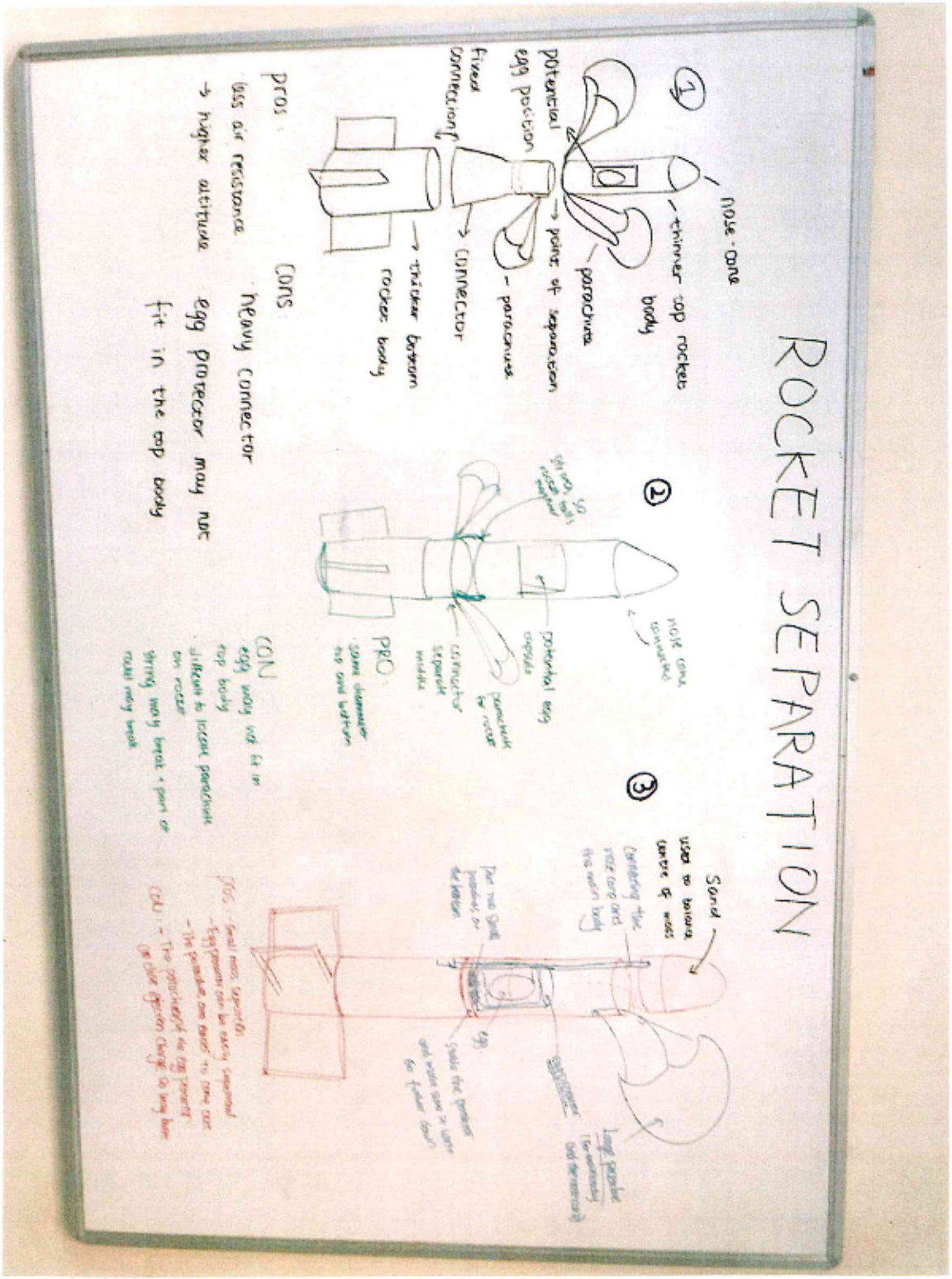
Date: 23/01/19

SMART target:

Gina : 3D printed designs
Sara : design egg capsules

Team signatures:

Gina Preston
Sara Xu.
Kelly Gu



We chose ③ design as it was most suitable for the given criteria. Egg capsule in the most stable location; parachute easy to install.

25 . 01 . 2019

STEM Club Lent 2019 - UKRoC

Timeline proposal

23 · 01 · 19 → initial design meeting
SMART target
→ individual research

24 · 01 · 19 → ~~test~~ meeting discuss designs
egg capsule design finalise
fins design finalise

25 · 01 · 19 → final design meeting for whole group
finalise rocket design

30 · 01 · 19 → meeting with Elliot (mentor)
discuss meeting points
experience from previous year

14 · 02 · 19 → ~~3D print~~ 3D print rocket parts, including
egg capsule + fins

15 · 02 · 19 → assemble rocket
discuss test flight
design exterior of rocket (spray paint)

'6 · 03 · 19 → test flight
meeting of improvements

20 · 03 · 19 → meeting to track progress
fix broken parts of rocket if necessary

28 · 03 · 19 → final test flight
preparation for competition

Date: seen as above

Team signatures:

SMART target:
read best practice safety in model rocketry by Dr. Philip Charlesworth by next meeting

Meeting Record :

23.01.2019

① see page 1 for Smart targets

② clear understand of criteria.

24.01.2019

① see relevant pages for designs

25.01.2019

① see relevant pages for designs

② make sure separate parts of rocket are ready by deadline

30.01.2019

things learnt from Elliot

- read rules carefully - achieve criteria
- time management - stick to deadlines
- egg in upright position with foam
- time of flight longer than expected → test parachute
- use single motor rather than cluster motors.

13.02.2019

① decide exterior design → red spray paint

② parachute testing - relevant pages

③ Decide test flight date

16.02.2019

① Test Flight - egg capsule broken

20.02.2019

① 3D print new capsule

② Schedule next flight

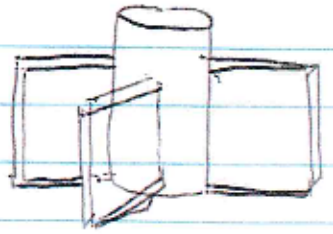
28.02.2019

① Successful test flight !

Fin Design Meeting:

- Research on Fins: Websites: ① https://www.thoughtco.com/fin-1748660.
② https://apogeerockets.com/education/downloads/Newsletter442.pdf
③ https://ourpastimes.com/shape-size-fins-affect-flight-rocket-12026132.h

Final decision =



Four rectangular Fins

Parachute Testing

- tested by dropping from different heights (e.g. stairs in physics department)

Egg Capsule Meeting/ 3D printing

- Resources: ① https://sciencing.com/make-egg-capsule-out-straws-5970369.html
② https://m.wikihow.com/Drop-an-Egg-Without-It-Breaking

Decide to 3D print:

- SolidWorks } software
- tinkercad

- ABS → high tensile strength
high impact resistance
lightweight
available in different colours.

STEM Club Lent 2019 - UKRoC

Test flight: No. ..1..... Date: ..16..03..19.

Height reached: .....897 ft.....

Flight time: .....43 s.....

Feedback: Positives and Negatives

rocket launched successfully

egg capsule did not eject

What have we learnt?

secure egg capsule → potentially locate both at bottom of egg capsule to prevent it moving

Date: 16 · 03 · 19

Team signatures:

Harrietton

Sara Xu

Kenny Qiu

SMART target:
Gina - reprint egg capsule

Supervisor sign off: .....

STEM Club Lent 2019 - UKRoC

Checklist for regional competition:

- prepare rocket
- ejection charge
- check motor
- wading paper
- parachute check (parachute wrap)
- protection foam
- nose cone check

Date: 03·05·19

SMART target:

- improvise parachute + mass at competition.

Team signatures:

STEM Club Lent 2019 - UKRoC

Regional flight: No. ...1.... Date: 04.05.2019

.....

Height reached: 891 ft.

Flight time: 57 s approx.

Feedback: Positives and Negatives

+ve : Successful flight, high reached

low score score 68 approx. safe egg

-ve : flight time too long (17s above)

What have we learnt?

: Reduce parachute size

: Increase mass (add sand to nose cone).

Date: 04.05.2019

Team signatures:

SMART target:

· Keep everthing the same but add a bit mass + cut parachute.

STEM Club Lent 2019 - UKRoC

Regional flight: No. ...2... Date: 04.05.2019

.....

Height reached: 855 Ft

Flight time: 37s

Feedback: Positives and Negatives

very low score 21 approx

very close to target altitude

flight time slightly short

What have we learnt?

reduce mass very slightly

Date: 04.05.19

SMART target:

Well done!

Moving towards finals!

Team signatures:

EPSOM
COLLEGE

Regional Competition:

WWW.EPSOMCOLLEGE.ORG.UK

STEM Club Lent 2019 - UKRoC

National flight: No. 1 Date: .....

Height reached: .....

Flight time: .....

Feedback: Positives and Negatives

.....

.....

.....

.....

What have we learnt?

.....

.....

.....

.....

Date: Team signatures:

SMART target:

STEM Club Lent 2019 - UKRoC

National flight: No. 2 Date: .....

Height reached: .....

Flight time: .....

Feedback: Positives and Negatives

.....

.....

.....

.....

What have we learnt?

.....

.....

.....

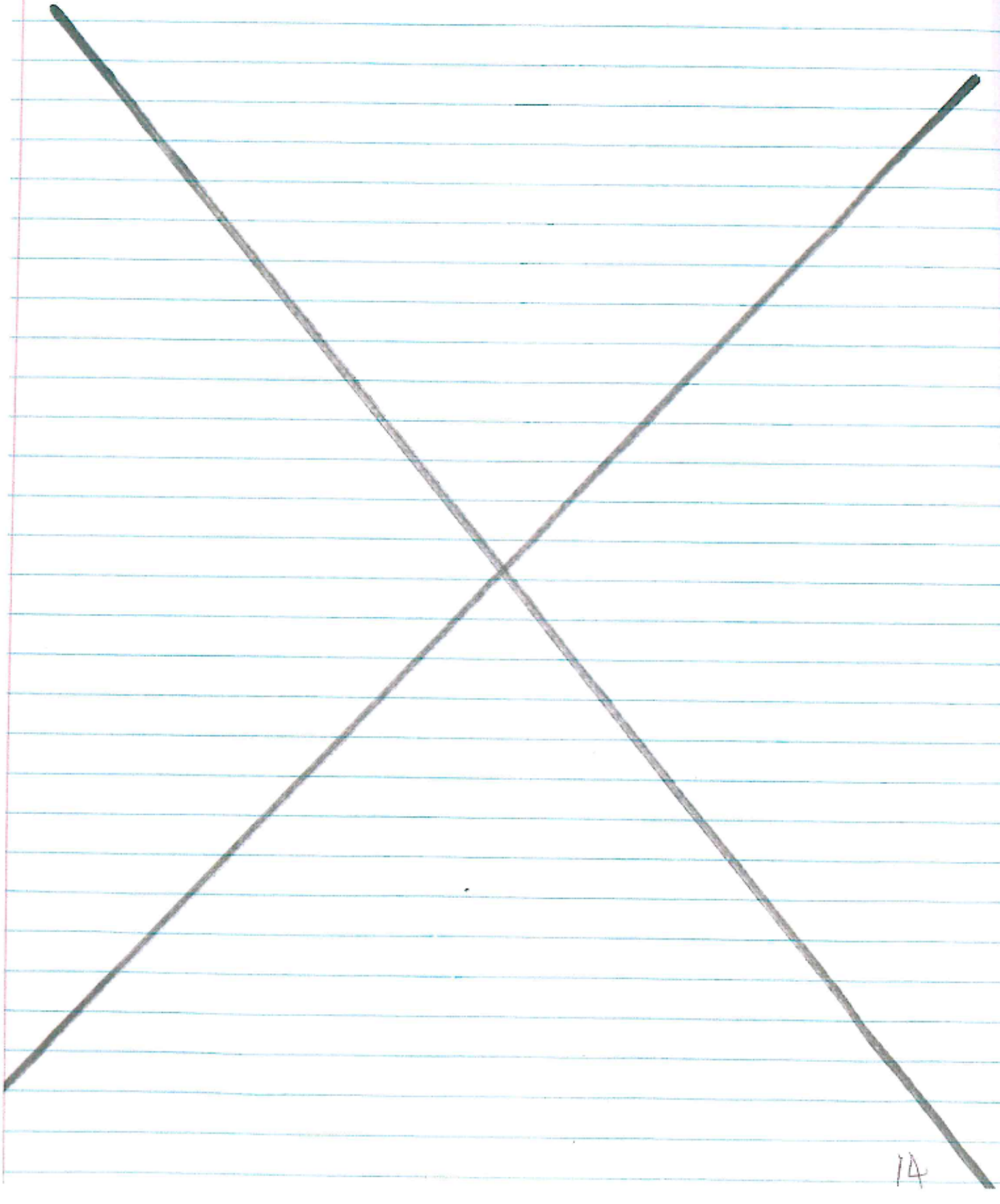
.....

Date: Team signatures:

SMART target:

Cost Analysis

Total Budget : £100
Total Cost : £70.70



LOGIC RC

Custome

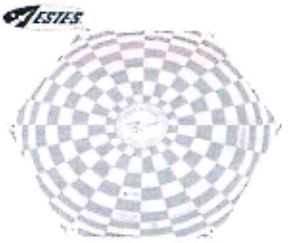
Sort by
Popularity

Rockets › Rocket Accessories ›

D-ES2274 £4.25
Recovery Wadding

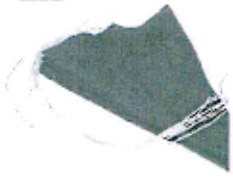
D-ES2302 £3.99
Model Rocket Starters (pk6)

D-ES2264 £3.25
12" Parachute



x4

D-ES2261 £
24" Nylon Parachute



x2

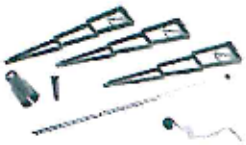
D-ES2230 £24.99
E Launch Controller

D-ES3143 £4.99
Engine Hook Accessory Pack

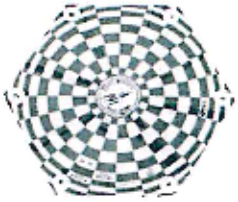
D-ES3089 £7.99
BT-60 Body Tube (Pk3)

D-ES3165 £
NC-60a Nose Cone (

D-ES2215 £17.99
Porta-Pad II Launch Pad



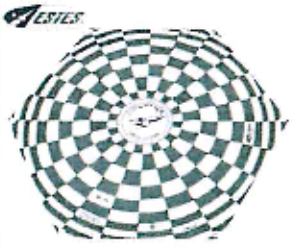
D-ES2262 £2.50
6" Parachute



D-ES3086 £6.99
BT-50 Body Tube (Pk3)

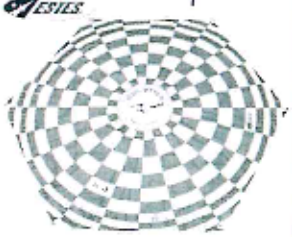
D-ES3087 £
BT-55 Body Tube (Pk

D-ES2267 £4.25
18" Parachute

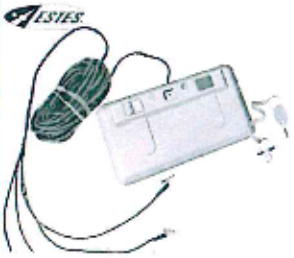


D-ES2271 £4.50
24" Parachute

x2



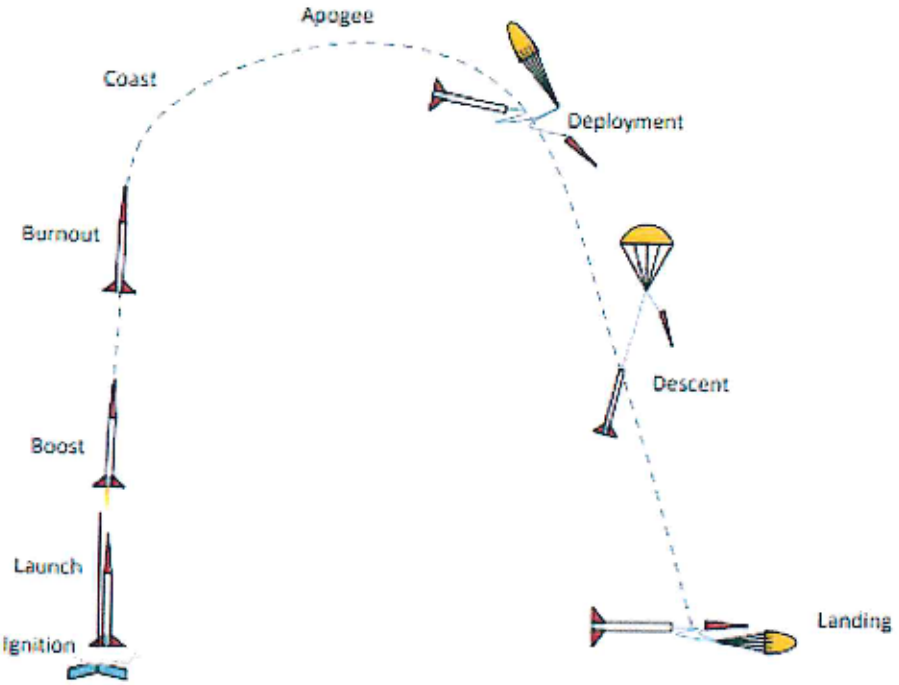
D-ES2240 £34.99
PS II Launch Controller



D-ES2227 £1
Tube Marking Guide

2. Model Rocket Basics

How Model Rockets Work

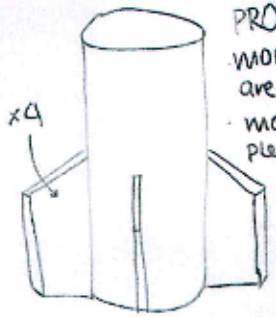


Flight Profile

Figure ?? explains some common rocketry terms for the phases of an ideal flight. At the start of a flight the rocket is mounted on a launch pad. The flight starts with IGNITION, in which the motor is electrically ignited. The rocket accelerates up the launch rod, gaining speed until it leaves the end of the rod. The motor continues

FIN DESIGNS

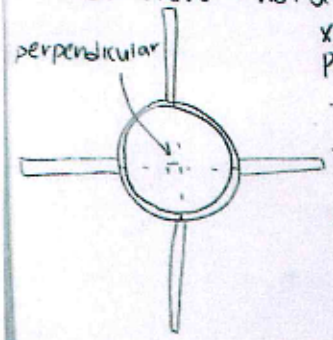
TRAPEZIUM



PRO:
- more surface area → stability
- more aesthetically pleasing

CONS:
- more mass
- less stable than rectangular

TOP VIEW → no. of fins

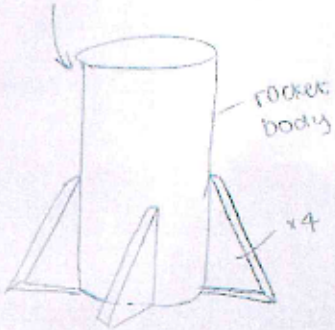


x4

PRO:
- most stable
- angles easier to calculate

CONS
- more mass

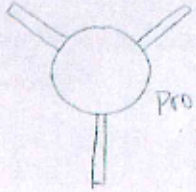
4 x Triangular Fins



PROS:
- less mass than trapezium shaped or rectangular fins

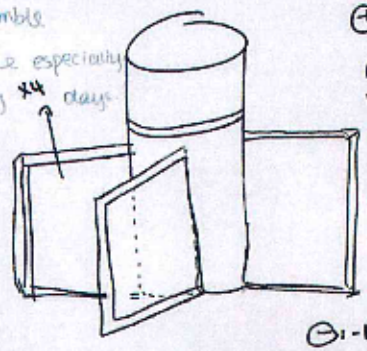
CONS
- less surface area → less stable (rocket may wobble)

– 3 x fins



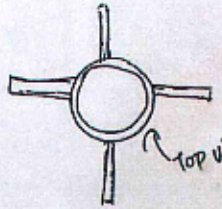
Pro
- can achieve minimum mass

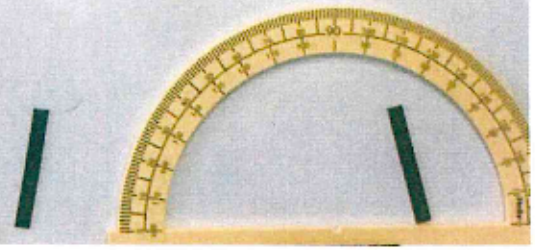
Cons:
- awkard angles to assemble
- unstable especially on windy days

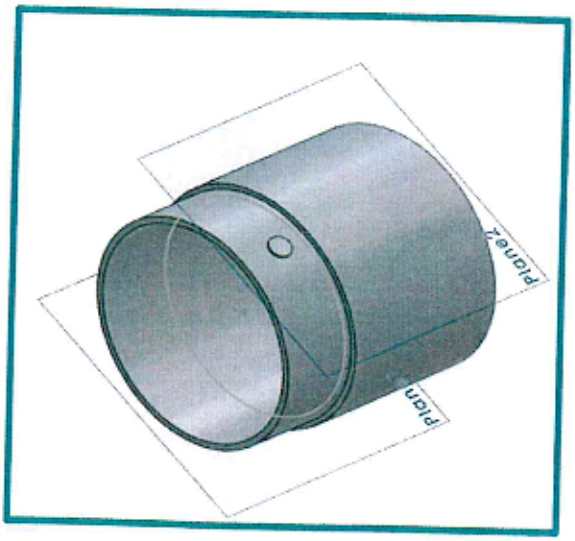


⊕: Largest surface area, make the rocket more stable when the rocket is flying through the air.

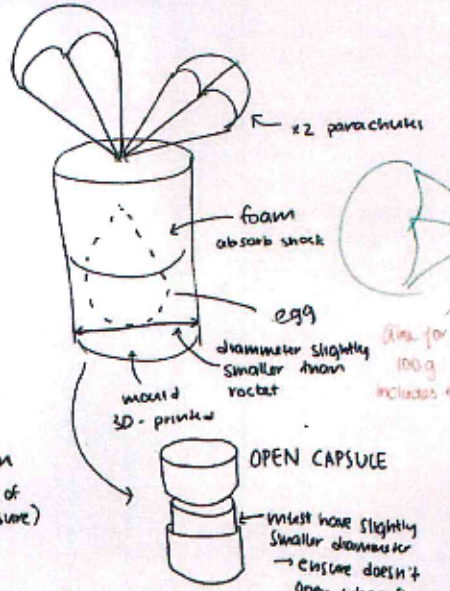
⊖: - Heavy, might make the rocket over the maximum mass
- Make the center of mass too close to the bottom.






plan
plan#2

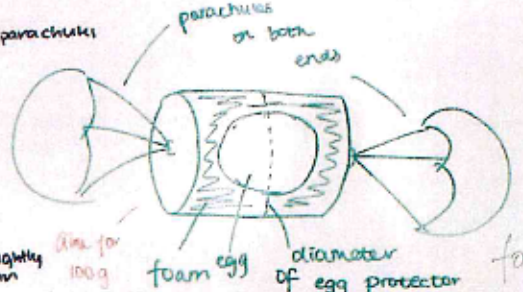
EGG PROTECTOR DEVELOPMENT



PROS:
- ensure that egg lands vertically
- parachute can easily be de-tangled
- come out of rocket vertically, parachute easier to open when launched

CONS
- parachute may tangle with each other
- less surface area when landing → higher chance of egg breaking (more pressure)

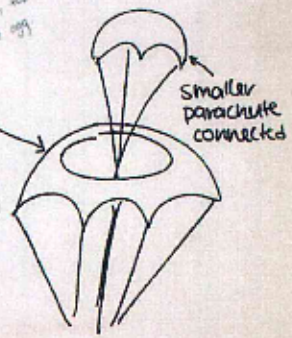
pros
- larger surface area for landing (less) pressure on egg)
- balanced parachutes for landing.



Cons
- must make sure identical parachutes for balanced landing
- if one parachute breaks, egg could break as one parachute is insufficient for safe landing.

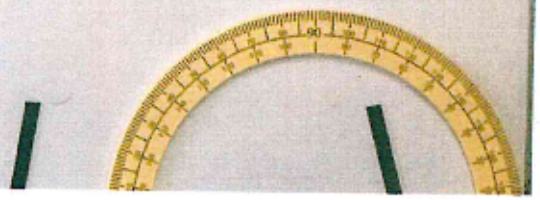
use two different sizes of parachutes
⊕: slower landing, smaller chance to crash the egg
⊖: parachutes easy to get tangled
- error: may not open successfully

Diameter of the pressor should be larger than the diameter of the egg



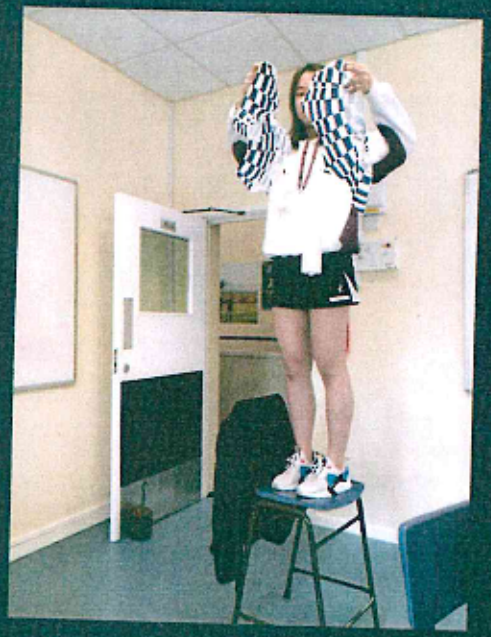
egg mass : 55 - 65 g

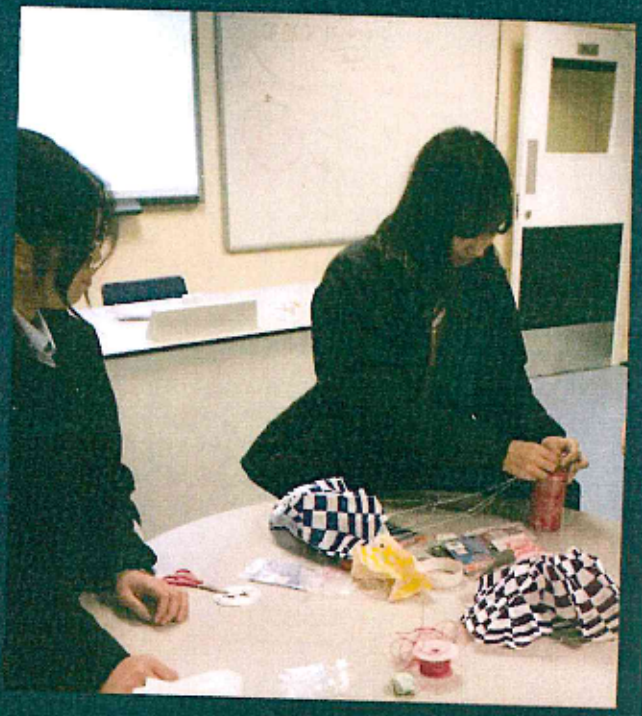
total mass : maximum 650 g



Parachute testing:

EPSOM
COLLEGE



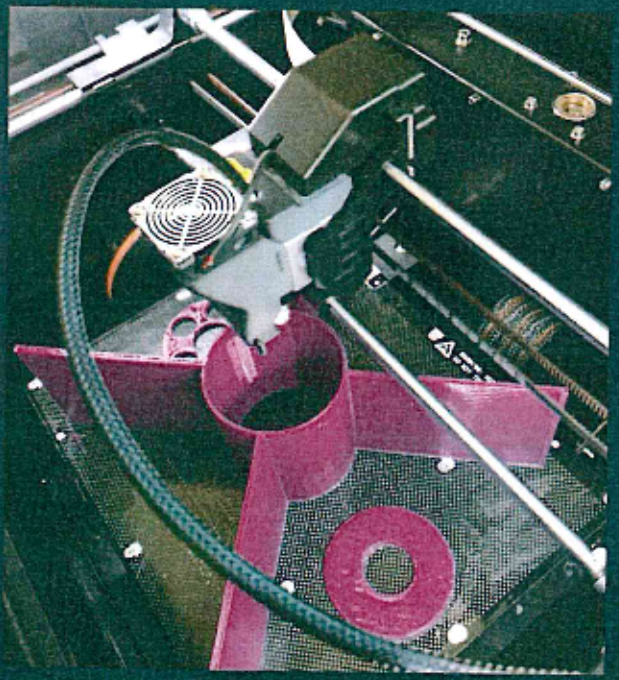


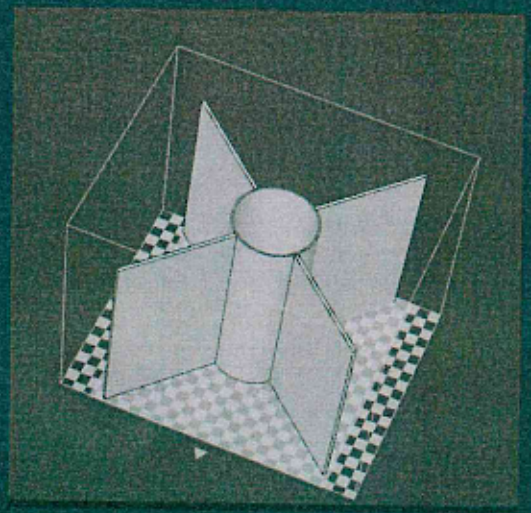
WWW.EPSOMCOLLEGE.ORG.UK

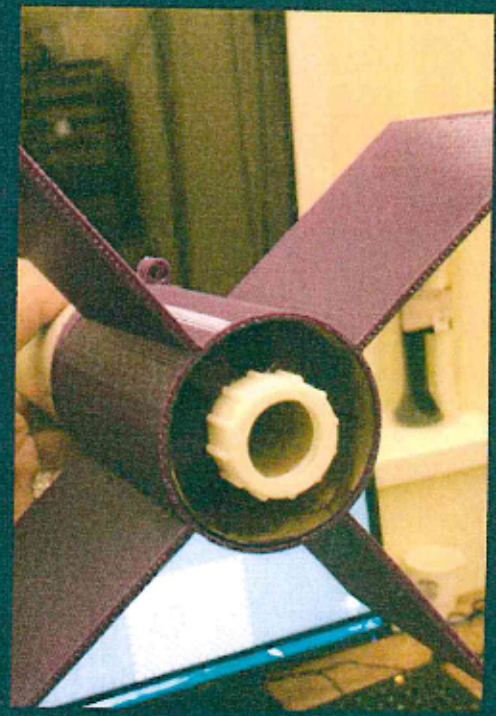
Design features:

EPSOM COLLEGE

Egg capsule, fins and motor holders designed in solid works and 3D printed



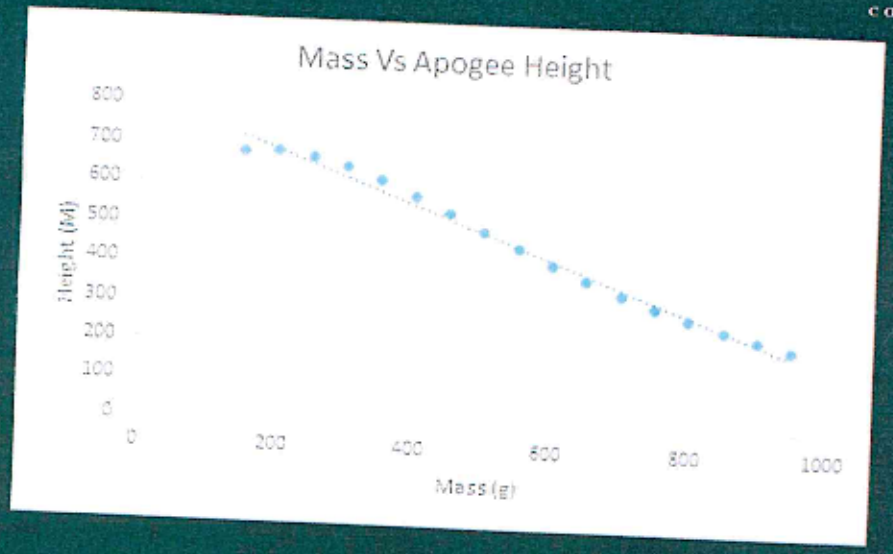




WWW.EPSOMCOLLEGE.ORG.UK

Simulation:

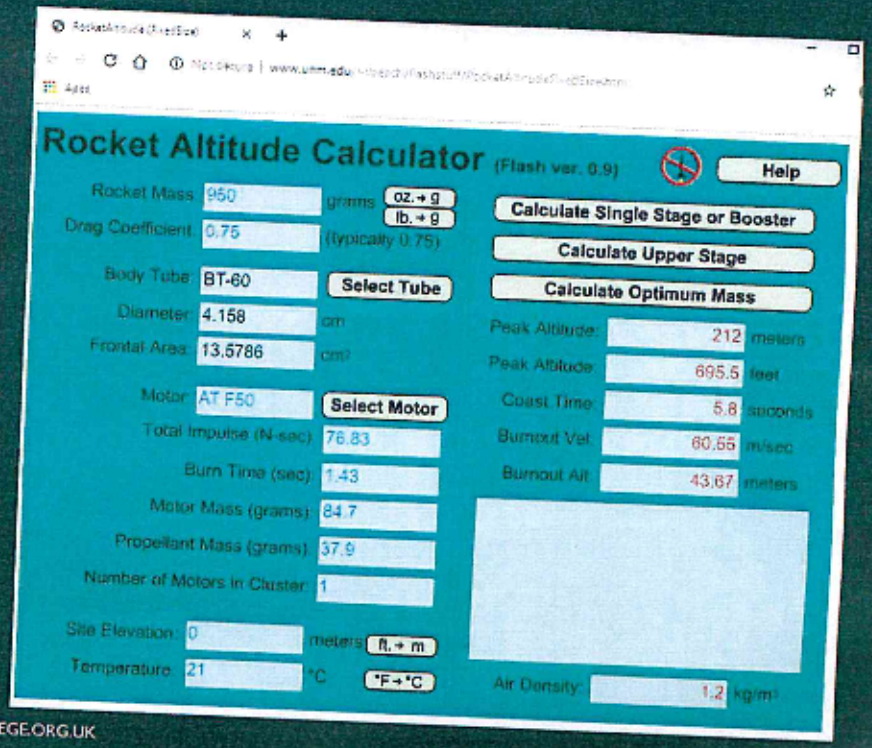
EPSOM COLLEGE



Calibration graph

Launch at max and min

Create a calibration curve



Test flights:

Test flight 1:

- Parachute Failure

Test flight 2:

- Success!!!

EPSOM
COLLEGE

Lessons Learned from test flights:

Test flight 1:

- Houston we have a problem…
- On ignition issue with egg capsule moving – led to rocket not ejecting capsule and parachutes…. = rebuild time

Test flight 2:

- Successful…. Ring in place to stop capsule slipping back
- Egg survived – capsule and foam inserts worked
- Flight time still longer than expected (65 seconds) – reduce parachute sizes

Final Preparations:

EPSOM
COLLEGE

WWW.EPSOMCOLLEGE.ORG.UK

CONGRATULATIONS!
YOU HAVE WON A PLACE AT THE NATIONAL FINALS!

After a busy month of rocket launching and seeing approximately 100 teams compete in Regional Events across the UK - we are very excited to announce that

EPSOM COLLEGE - ASTERIA

have won a place at the National Finals!

Well done everyone... So what next?!
This is where the competition starts to get really heated! Competing in the National Finals is your chance to build and launch a rocket so epic, it wins your team a place at the International finals at PARIS AIRSHOW! So let's start prepping....

Key things to remember:

- Review the rules! **Make sure you build your rocket to correct specifications!**
- Learn from your flights at the Regionals – **is there anything you could do next time to improve your rocket?**
- Keep your logbook updated – **If you have not already done so, you need to keep a logbook detailing your progress. Head to our hints and tips page for further information.**
- Follow our Facebook page **for all the latest news and advice! Post questions and share your pictures!**
- Always ask us if you are not sure on anything! **We are here to help, and have 4 rocketry experts who can help answer any of your rocketry questions.**
- Have fun! **No matter what, this is the most important aspect of the competition. Have fun with your friends and enjoy learning about rocket science!**

Team Details:
Please email rebecca.warwick@adsgroup.org.uk confirming how many students are in the team and how many supervising adults will be attending on the day by **Friday 3 May.**

==========

THE NATIONAL FINALS WILL TAKE PLACE ON WEDNESDAY 8 MAY AT BMFA BUCKMINSTER, GRANTHAM

BMFA Buckminster
Sewstern
Grantham
Lincolnshire, NG33 5RW

Approx times: 09.00 – 15.30

Further details and joining instructions will be circulated to you shortly ...

==========

To infinity and beyond....
Tamsin Thorn and Rebbecca Warwick

DON'T FORGET TO LIKE OUR FACEBOOK PAGE: UKROC

Tamsin Thorn | Event Manager | UKROC@adsgroup.org.uk | +44 (0) 207 091 7800 | +44 (0) 7500 926 923

UKRoC Rules 2019

1. SAFETY: All rockets must be built and flown in accordance with the UKRoC Best Practices document. Rockets flown at the National Finals must have previously flown safely and successfully. Rockets will be inspected before launch and observed during flight by a UKRoC official, whose judgment about the safety of the flight and with these rules will be final. Teams are encouraged to consult with designated UKRoC officials well before the fly-off to resolve any questions about design, safety, or these rules.

2. TEAMS: The application for a team must come from a single school or a single non-profit youth or educational organization. There is no limit to the number of teams that may be entered from any single school or organization, but no more than three teams containing students who attend the same school or who are members of the same organization, regardless of whether the teams are sponsored by that school or organization, can be invited to attend the National Finals. Team members must be students who are aged 11 to 18. Teams may have members from other schools or other organizations and may obtain financing from any source, not limited to their sponsoring organization. Teams must be supervised by an adult approved by the head of the sponsoring school, or by an officially-appointed adult leader of their sponsoring organization. Minimum team size is three students and maximum is ten students. Each student member must make a significant contribution to the designing, building, and/or launching of the team's entry. No part of any of these activities for a rocket used in a qualification flight or at the Finals may be done by any adult, by a company (except by the sale of standard off-the-shelf components available to the general public, but not kits or designs for the event), or by any person not a student on that team. No student may be on more than one team. The supervising teacher/adult may supervise more than one team.

3. ROCKET REQUIREMENTS: Rockets must not exceed 650 grams gross weight at lift off. The egg payload portion of the rocket tube must be large enough to contain an egg of up to 45 millimetres in diameter. The overall length of the rocket must be no less than 650 millimetres as measured from the lowest to the highest points of the airframe structure in launch configuration. The portion of the rocket containing the egg payload and the altimeter must separate from the rest of the rocket in the air and must descend separately under at least two parachutes that are the same shape and are within 50 millimetres (2.0 inches) of the same diameter. The rest of the rocket must recover safely under any deployed recovery system. They must have only one stage. They must be powered only by commercially-made model rocket motors of "F" or lower power class that are listed on the UKRoC Approved Motor List posted on the UKRoC website. Any number of motors may be used, but the motors used must not contain a combined total of more than 80 Newton-seconds of total impulse based on the total impulse ratings in the UKRoC list. Motors must be retained in the rocket during flight and at ejection by a positive mechanical means (clip, hook, screw-on cap, etc.) and not retained simply by friction fit in the motor mounting tube. Rockets must not contain any pyrotechnic charges except those provided as part of the basic commercially-made rocket motor used for the flight, and these must be used only in the manner prescribed in the instructions for that motor.

Product Code: 019778
0139 - 2/18