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UKROC Mentors Guide

By John Jacomb

Notes specifically for Mentors

1. Know your audience! Establish if anyone has prior experience with model rockets.
2. Ensure that a teacher or supervising adult is in attendance at all times ie. you are not left to do everything yourself and they are able to take over the reigns in your absence.
3. If you are proposing to launch a demonstration model (recommended) follow safety guidelines to ensure the site is suitable before you arrive at the venue.
4. If possible ensure the team(s) have read the UKRoC website and in particular the Rules and Mission Statement as they change each year.
5. Make it clear that help is always available.

Introduction

- This is a brief guide only, full details may be found on the UKRoC 2023 webpage
- The winning UK team will compete against the winning national teams from the USA, France and Japan in July
- **Important. Only motors on the UKRoC 2023 'Approved Motor List' and approved Altimeters in the Rules can be used. If in doubt ASK!**
- Details of Regional Final Days can be found on the UKRoC website. The most successful teams, chosen by ADS, will be invited to compete at the National Finals on **17 May**. International Finals take place at the Paris International Air Show on **22 and 23 June**

All Teams must:

- Work together under the guidance of mentors if possible
- Purchase BMFA Group Insurance for your school\Youth Group
- Read and *follow* the Competition Rules and Mission Statement on the UKRoC 2023 website
- See also the 'Top Tips' document on the UKRoC Website

What is a rocket and how to build one

UKRoC ROCKETS ARE NOT TOYS THEY ARE MODELS

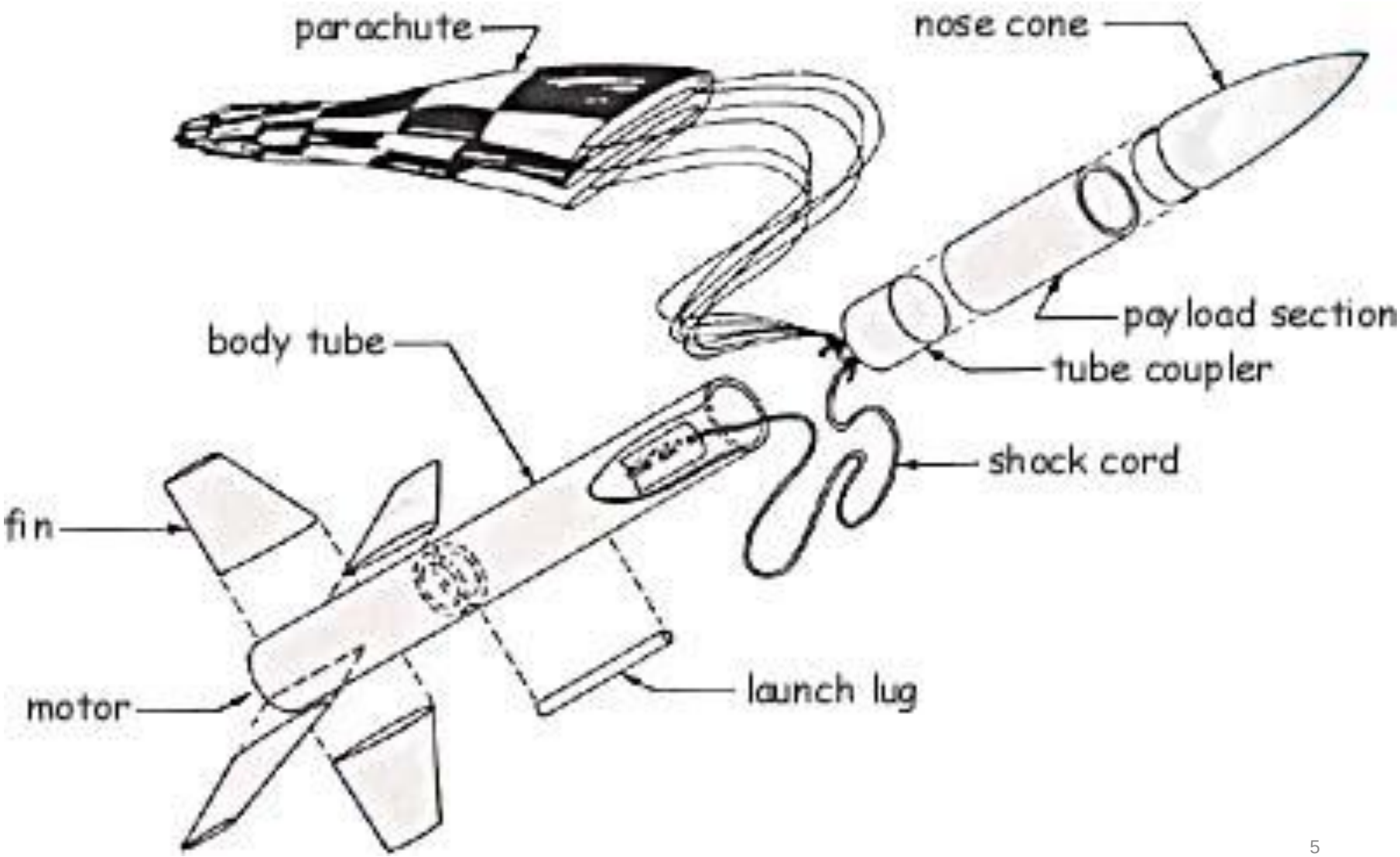
"A **rocket** is a missile, spacecraft, aircraft or other vehicle that obtains thrust from a rocket engine. Rocket engine exhaust is formed entirely from propellants carried within the rocket before use"

…..and now a short video……

How to build a model rocket

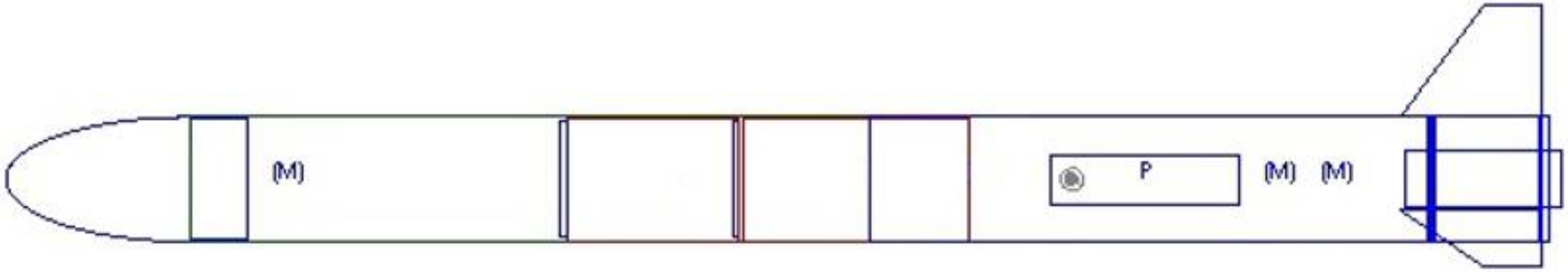
If you are unable to view the video by following the link, simply type "how to build a model rocket aia" into the search bar on www.youtube.com

Standard Parts of a Rocket



Sample Rocket for the 2023 UKRoC competition for schools.

Nb. Do not copy this design as it is not stable in flight



What is the challenge?
UKRoC Rules Precis

- Minimum team size is 3 students and the maximum is 6 students aged 11 to 18 years
- The rocket must not be less than 650mm (25.6”) in length
- Must not exceed 650 grams gross weight at lift-off
- The portion of the rocket containing the egg payload and the altimeter must separate from the motor section (each section must have its own parachute), and must descend safely
- Rockets flown at the finals must have a paint or other decorative coating
- Motors up to ‘F’ power may be used and/or clusters not exceeding 80 newton/seconds (n/s) in total (= x4 ‘D’ motors)
- 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
- Payload to comprise one raw hens egg weighing 55-61 grams, diameter 45mm or less and must return without any cracks or damage.
- Duration score is based on the time from launch to return to earth of the rocket. The target time is 42-45 seconds* in the air.
- Target altitude is 850 feet*

*Slightly different times and altitude apply at the finals if a second flight is required - see the UKRoC website (Rules section) for details.

What will be provided

- Parts must be sourced by teams, see lists.

- There is no charge to enter UKRoC, see the rules for the number allowed on each team

- VERY IMPORTANT

  teams must ensure they have sufficient parts and spares with them at all times i.e. spare motors, igniters, parachutes, wadding & adhesives

  (see next slides)

  Additional supplies *will not* be available on site

Breakdown of Basic Rocket Parts

Nb. this is a suggested list only

- X2 Estes BT80 Body Tubes with a coupling tube
- BT50 Motor Tubes (for rockets with clusters of 3 or 4 motors)
- X1 Estes BT80 Nose Cone
- X2 pairs of 1, 3 or 4 motor centring rings
- Balsa Sheet for fins or ‘light ply’
- Launch Lugs – x2 large Paperclips for a rod or rail guides
- Shock cord for Parachutes
- x2 18” or 24” Nylon Parachutes
- Recovery Wadding
- Kevlar Thread
- x3 or x4 D12-3, 5 or 7 motors - plus igniters & plugs
- Altimeter

Parts List (continued)

- PVA glue, 5 or 10 minute Epoxy (optional), cyanoacrylate (super glue) (optional), (Halfords/Pound Shop/Wickes)
- Sanding sealer + brush to apply for balsa fins (from local hobby shop)
- Glass paper / wet & dry paper (Pound Shop/Wickes)
- Craft knife, scalpel (Pound Shop/Wickes) (optional)
- Solvents to clean brushes (Pound Shop/Wickes)
- If possible use parts left over from previous competitions
- Piano wire or nut, bolt and washer for motor retention
- **NB. 1.** Teams can make their own motor retaining hooks from piano wire. Parts such as tubular launch lugs and motor retaining hooks are not expensive and can be sourced from a supplier (see below). For paint I favour The Range or Halfords spray paint.

*Rocket Parts can be obtained from **Malcolm Jennings of 'Rockets and Things', 01293 517857 (home)/07973 545475 (mob), www.rocketsandthings.com**

IGNITION of ENGINES (MOTORS)

- Clusters of engines can be difficult to ignite properly.
- Extensive testing has identified the most effective and reliable method for igniting clusters using a combination of Tape Fuse and Visco Fuse.
- The UKRoC website has detailed instructions what needs to be done – see Method Two on page 30 in the Best Practice Guide at

https://www.ukayroc.org.uk/…/09/Best-Practise-Guide-2018.pdf

Nb 1.Testing has shown it is important that motor plugs are cut in half to hold the green Visco Fuse in place in the nozzle of the motor. The fuse must be inserted fully into the motor to make contact with the propellant. Cutting the plug in half allows air around the fuse and prevents the spark being snubbed out before it reaches the propellant.

Nb2. Tape Fuse and Visco Fuse can be sourced by teams from Rockets and Things, Klima or Wireless Fireworks.

Possible DESIGNATED ROLES WITHIN TEAMS:

PRE FLIGHT TEAM (*in the classroom or workshop*)
Rocket Design and Construction, divided into 3 sub groups:
1/. *Design* of the rocket including fins, recovery devices and artwork
2/. *Construction*

a) top section incl. nose cone, payload bay and transition
b) motor section including fins, shock cord and motor cluster
c) sanding and sealing, painting and finishing model

3/. *Computer* simulations and Rules e.g. RocSim or Space Cad (to test the design)
Nb. a person should also be designated to create a log documenting the build
LAUNCH TEAM (*at event Preparation Area*)

-rocket preparation i.e. Preparing motors, putting eggs & altimeter into the payload section, folding & packing parachute(s) and weighing model
-checking the integrity and balance of model prior to launch
-at the range head ensuring model prepared correctly, altimeter is set up and running and one person is designated to launch the model

RECOVERY TEAM (*on the field*)

- remainder of team designated to spot and recover model safely

Suggested Construction Techniques

- Fins – use a template & cut balsa so wood grain is at 45 degrees with the motor tube. When cutting balsa several light stokes are best. Use a steel rule. Try to ensure each fin weighs the same
- Joints – DO NOT USE HOT GLUE GUNS, fillet joints with epoxy resin whenever possible for extra strength
- Adhesives – Lightly sand surfaces to be joined, tack part in place with superglue then fillet with PVA or epoxy. Epoxy is stronger than PVA
- Centering Rings (motor mounts) - use light modelling laminate and cut with a laser cutter. Should neither be a tight fit or too loose.
- Shock Cord – use kevlar thread or wire trace at motor end (Kevlar is heat resistant) then elastic. Use a loop for attaching parachute.
- Launch Lugs – either purchase a tube from a supplier or make your own from large paper clips bent 90 degrees. Lugs must fit easily over a 6mm rod and must be firmly fixed in place so use epoxy with a fillet and **must be secured internally within the rocket body tube**.
- Seal all balsa parts using sanding sealer and prime before painting for a smoother more aerodynamic finish. This may add a little weight.

IMPORTANT! Safety is paramount

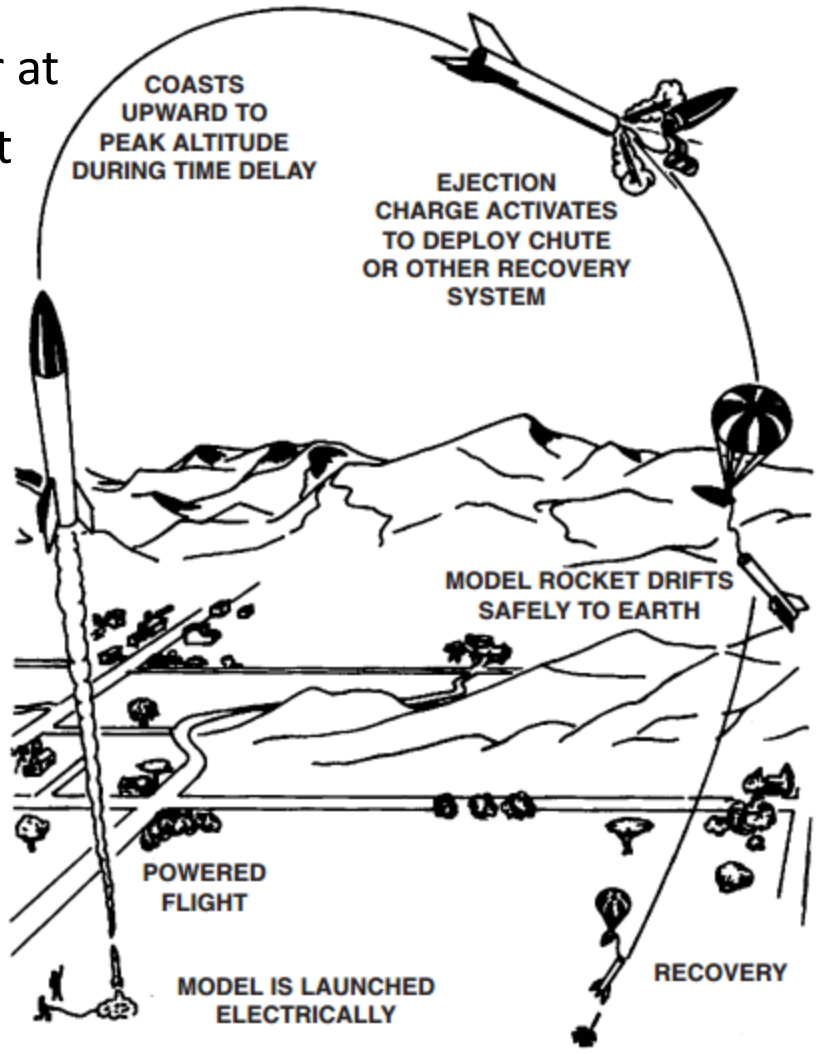
REMEMBER -

There will always be a Range Safety Officer at launches, no launch can take place without one. At Launches the RSO's word is final And MUST be obeyed.

All test launch sites must be deemed suitable and safe by ADS.

LAUNCH SITE DIMENSIONS

Installed Total Impulse (Newton-seconds)	Equivalent Engine Type	Minimum Site Dimension (Feet)	(Meters)
0.00 - 1.25	1/4A & 1/2A	50	15
1.26 - 2.50	A	100	30
2.51 - 5.00	B	200	60
5.01 - 10.00	C	400	120
10.01 - 20.00	D	500	150
20.01 - 40.00	E	1000	300
40.01 - 80.00	F	1000	300
80.01 - 160.00	G	1000	300
160.01 - 320.00	2G	1500	450



To NOTE:

- No spares will be available on site. All teams must therefore ensure they have sufficient items to meet their needs and any unforeseen circumstances before launch. This will include spare items such as motors, igniters, motor casings (where appropriate), parachutes, recovery wadding, altimeters, adhesives, packing etc.
- Teams must be familiar with the Rules as they change each year. In particular see the List of Approved Motors, and approved Altimeters.

- IMPORTANT: all teams should keep a log of their work on the project, the lessons learnt and what adjustments have been made during construction. This is important as it will be marked and used to determine placings if launches are not possible due to bad weather and will be required by all teams reaching the National Fianls.

- Refer to the UKRoC 2020 website for full details and notes.
    - **Any decision of ADS and its' officials is final.**

DON’T GET STUCK!!!

Contact me for technical, practical and other queries

- I don’t know everything about everything but I can get answers!

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Note: see the UKRoC 2023 website for information about insurance arrangements and a draft Risk Assessment etc.

Useful sources of reference:

- www.rocketsandthings.com
- http://www.raketenmodellbau-klima.de/ *
- **UKRoC 2023 website and the 'Hints and Tips' section**
- Estes Educator.com
- TARC website
- www.ApogeeRockets.com
- /Rocksim/Rocksim_information
- www.spacecad.com
- https://wirelessfireworks.co.uk**

***klima engines and rocket parts can be ordered directly from the manufacturer. If you quote your UKRoC registration a 10% discount will be applied**

****** **suppliers of ignition 2mm Visco Fuse and Tape Match Fuse for clustered engines, nb. motors come supplied with plugs and igniters**