

Alpha III Rocket Build

Topic/Subject: Build an Alpha III Rocket using an Estes Rocket Kit

Length of lesson: 60 minutes

Objectives:

Participants will build an entry level, solid propellant, single-stage commercial rocket kit.
Participants will understand and practice safety tips when building rocket.
Participants will name each of the parts of the Alpha III rocket.

National Standards:

MS-PS2-1 Apply Newton's Third Law of to design a solution to a problem involving the motion of two colliding objects.
MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MATERIALS:

Scissors, glue, tape, pencil, sandpaper, Alpha III rocket kit, exacto knife, ruler

BACKGROUND INFORMATION:

To best understand how rockets fly, you must have a basic knowledge of the scientific rules that govern objects on the Earth and in the sky above. A rocket is a machine and it operates according to a set of scientific rules. A rocket sits on a pad (static) until it is launched into motion (dynamic). What it does on the pad, and in flight, can be studied, and to some degree, predicted by scientific laws. If you understand the laws, you will have a greater understanding of the rocket. The basic principles of Sir Isaac Newton's Laws of Motion are stated below:

- 1st Law of Motion: An object at rest will remain at rest unless acted on by an unbalanced force.
- 2nd Law of Motion: Forces equals mass times acceleration.
- 3rd Law of Motion: For every action there is an equal and opposite reaction.

An unbalanced force must be exerted for a rocket to lift off from a launch pad or for a spacecraft to change speed or direction (Newton's First Law). The amount of thrust (force) produced by a rocket engine will be determined by the quantity of propellant that is burned and how fast the gas escapes the rocket (Newton's Second Law). The reaction, or forward motion, is equal to and in the opposite direction of the action, or thrust, from the engine (Newton's Third Law).

The first rockets were used in China around the 1200s for fireworks. By the end of the 19th century, men were beginning to dream of traveling into space and reaching other planets. With the leadership of great scientists such as Konstantin Eduardovich Tsiolkovsky, Hermann Oberth, Robert H. Goddard, and Werner von Braun, the world was able to accomplish this dream.

Lesson Presentation:

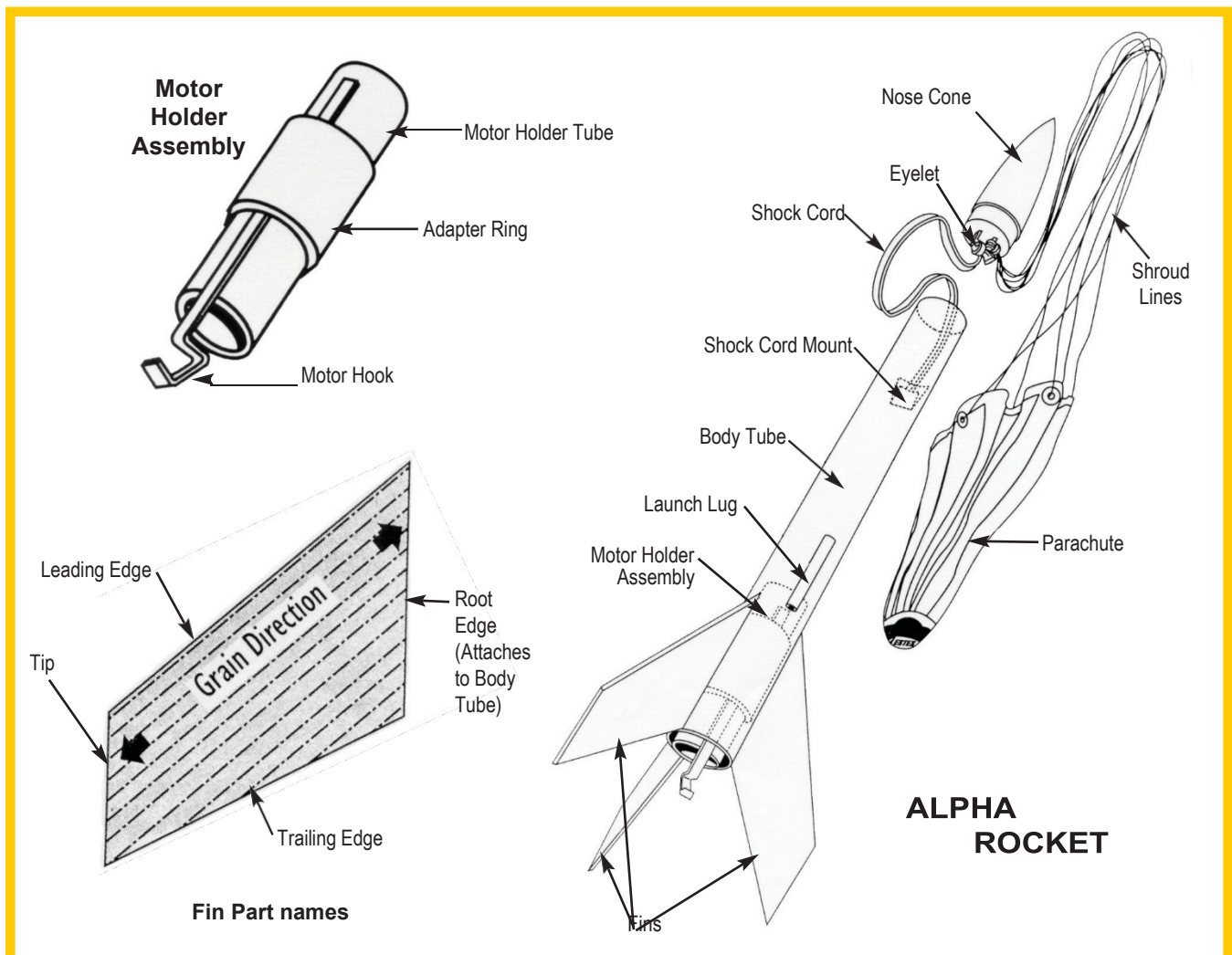
1. Divide participants into groups of two-four
2. Have students empty Alpha III bags and name each of the items in the bag
3. Discuss the importance of each item in whole group setting.
 - Plastic fin
 - Green Split adapter
 - Engine mount tube
 - Mylar retainer ring
 - Green adaptor ring
 - Parachute
 - Nose Cone Screw
 - Launch Lug
 - Body Tube
 - Nose Cone
 - Decal
 - Engine Hook
 - Shock Cord
4. Have cadets and students use the following directions and the directions in the Alpha III rocket kit to build rockets.

Building A Basic, Beginner-Level Model Rocket

To meet the hands-on requirements of this phase, it is necessary for the cadet to build a single-stage, solid-propellant model rocket. The example shown in the illustrations is that of the Estes Alpha model rocket kit. The Alpha is a Skill Level 1 kit, which is considered “beginners” level. Another kit that is very commonly used in the CAP rocketry program is the Alpha III. Its Skill Level is EX2 which is also considered “beginners” level and is even more basic and easier to assemble than Skill Level 1. The differences between the two kits are that the Alpha III comes with a finished nose cone, body tube and fins (no surface preparation or painting required). It also has a single piece, molded fin unit (fins do not have to be individually glued to the body tube). The Alpha does not have these features.

The first illustration shows all the parts required to build the Alpha kit. The Alpha is a good example

because it uses parts that are common to most basic model rockets. Following this is the “Model Rocket Flight Profile,” and it will acquaint the builder with a picture of the launch-to-touchdown sequence of events. Prior to building a first model rocket, it would be helpful to review the illustrated parts list. Then it is recommended that the cadet obtain a model rocket similar to the Alpha in basic construction. Every model rocket kit will come with complete assembly instructions provided by the manufacturer. It is important that these instructions be thoroughly reviewed and understood by the builder prior to beginning assembly. The supplemental instructions provided in this section will give tips on how to achieve a high-quality finish on a model rocket (not applicable to the Alpha III since it is already provided with a high-quality finish).



All too often, cadets get in a hurry and construct a model rocket with very little reference to the instructions. It is highly recommended that the builder go over each step carefully and arrange the parts in the order that they will be used in construction.

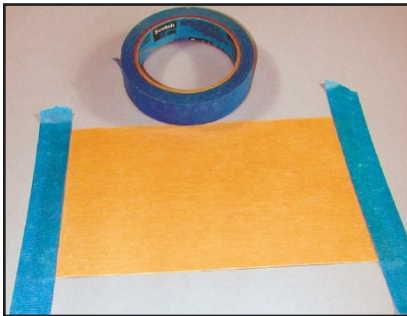


the cadet shown here is following one of the most important rules for building rocket kits: read the instructions!

Grit Guide	
60	Coarse
100	Medium
150	Fine
240	Very Fine
400	Super Fine
600	Ultra Fine
1500	Ultra Micro Fine

Not everybody knows the difference in sandpaper. To be sure, follow this grit guide and purchase a sheet that won't damage the balsa used on model rockets. Something in the range of 150-240 works well for sanding fins.

CONSTRUCTION TIPS



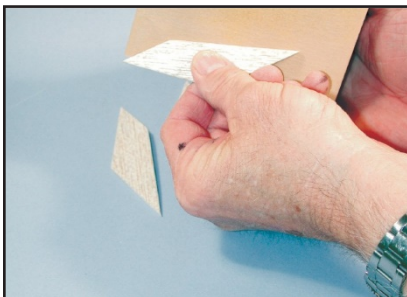
Masking tape can be used to hold sandpaper to a flat surface. This makes a solid base for sanding edges and flat surfaces.



The builder can also use a sanding block. The paper is wrapped around a block for sanding the balsa pieces. This creates a flat surface when sanded.



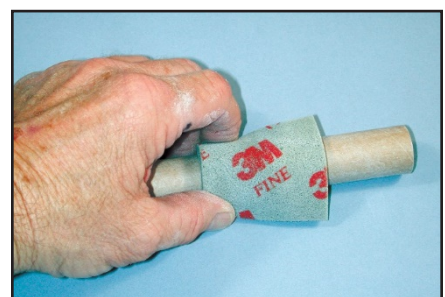
The fins can be held together, and the surfaces sanded. This makes all of the fins uniform.



The leading edges can (and should) be rounded to provide a more aerodynamic surface.



It is highly recommended that the builder use a sanding sealer on the balsa. This seals the surface and makes a more professional looking paint finish.



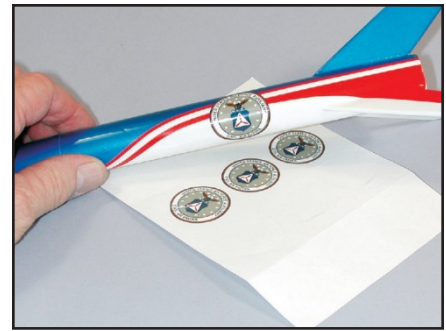
For sanding rounded surfaces, you can purchase a foam sanding pad at most hobby shops and some home supply stores.



White glue can be used to make a nice, rounded fillet between the fins and body. Apply the glue and run your index finger along the length of the joint. The finger provides a nearly perfect form for the fillet. Glue may be easily removed from fingers with water.



Once the rocket is completely assembled and all balsa components sealed, it is ready to be painted. After spraying one or two coats of primer, carefully sand the surface with a finer grade of paper. It is recommended that the builder let the rocket set overnight so the primer has a chance to cure. It is also recommended that very fine sandpaper be used for the final primer coat sanding step.



Depicted here is an example of an elaborate and finely detailed paint finish, requiring meticulous masking and pin striping. If the cadet wishes to spend the time, he or she will be rewarded with a model rocket that is truly exceptional in appearance. NOTE: the finished product is depicted on the first page of this section.

LAUNCH SUPPLIES

To launch your rocket, you will need the following items:

- Electrical Launch Controller and Launch Pad
- Recovery Wadding
- Rocket Motor (appropriately powered for the rocket's first flight). Each kit should be provided with a list of appropriate motors designed to fly the rocket successfully. Select the motor that is recommended for the rocket's first flight.

FLYING YOUR ROCKET

- Choose a large field away from power lines, tall trees, and low flying aircraft. Locate a flying field that meets the minimum site dimensions as outlined in the NAR safety code. Sports fields may provide adequate area for lower altitude flights.
- Launch area must be free of dry weeds and brown grass. Launch only during calm weather with little or no wind and good visibility.
- Don't leave parachute packed more than a minute or so before launch during cold weather [colder than 4° Celsius (40°) Fahrenheit]. Parachute may be dusted with talcum powder to avoid sticking.

MISFIRES

If the igniter functions properly but the propellant does not ignite, keep in mind the following: An igniter will function properly even if the coated tip is chipped. However, if the coated tip is not in direct contact with the propellant, the motor will not ignite.

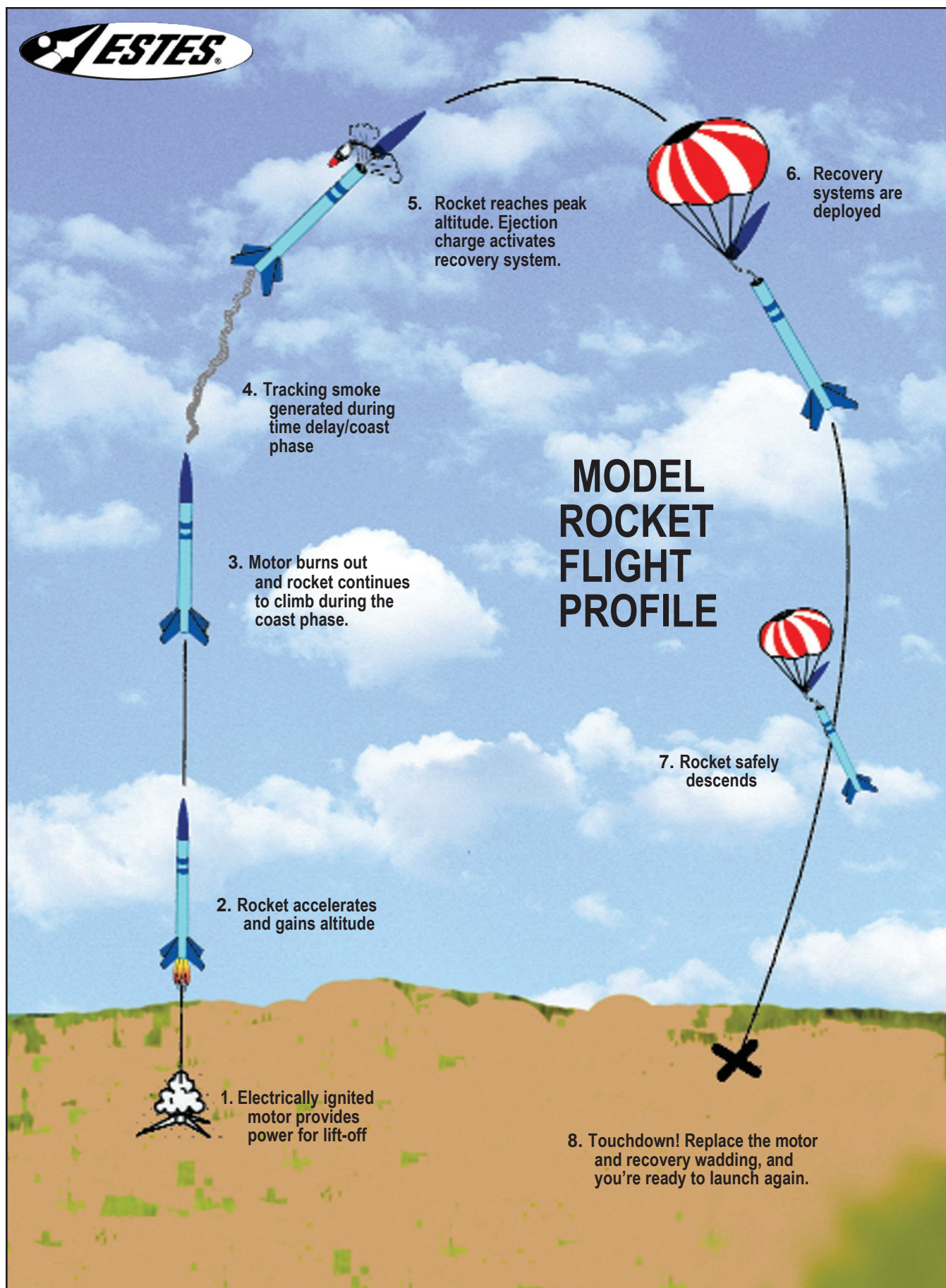
When an ignition failure occurs, remove the safety key from the launch control system and wait one minute before approaching the rocket. Remove the expended igniter and install a new one. Be certain the coated tip is in direct contact with the propellant, then reinstall the igniter plug. Repeat the countdown and launch procedure.

FOR YOUR SAFETY AND ENJOYMENT

Always follow the NAR (National Association of Rocketry) MODEL ROCKETRY SAFETY CODE while participating in any model rocketry activities.

FINAL PREPARATION AND LAUNCH

- Be certain safety key is not in launch controller.
- Remove safety cap and slide launch lug over launch rod to place rocket on launch pad. Make sure the rocket slides freely on the launch rod.
- Attach micro-clips to the igniter wires. Arrange the clips so they do not touch each other or the metal blast deflector. Attach clips as close to
- protective tape on igniter as possible.
- Move back from your rocket as far as launch wire will permit (at least 5 meters - 15 feet).
- INSERT SAFETY KEY to arm the launch controller.
- Give audible countdown 5...4...3...2...1
- PUSH AND HOLD LAUNCH BUTTON UNTIL MOTOR IGNITES.
- REMOVE SAFETY KEY FROM LAUNCH CONTROLLER. KEEP SAFETY KEY WITH YOU OR REPLACE SAFETY KEY AND SAFETY CAP ON LAUNCH ROD.



MODEL ROCKET FLIGHT PROFILE

Closing/Summarization/Career Connection:

This activity is the first step in building and launching Alpha III rockets. Participants will get a true hands-on experience while building rockets to launch later. Alpha III rockets provide participants with experiences in science, engineering, and mathematics. The natural cooperation while building the rockets helps participants learn skills necessary in today's workplace. This activity also allows participants to see careers that are connected to rockets and rocketry.

Assessment:

Students will name the parts of the Alpha III rocket.
Participants will complete Alpha III build successfully.

Extension Activities:

Students will write a How To paper on building the Alpha III rocket.
Students will discuss in small group modifications that could be made using the rocket.