



Civil Air Patrol

United States Air Force Auxiliary
Ohio Wing



Model Rocketry Program

Project Officer: CPT Jim Johnson

The squadron will make arrangements to purchase the rockets each cadet will need for the program. Each cadet will be required to attend all the rocketry sessions to earn the model rocketry badge. Once the rockets are built there will be a launch day all cadets will be required to attend to fulfill the final parts of the model rocket program.

Model Rocket Badge Requirements

1. Attend all classes and labs.
2. Keep a journal and design log for each class, launch, rocket built and "Launch Data Sheets."
3. Attend qualifying launch. This is when you launch your rockets.
4. Diagram neatly on unlined paper a typical launch site. Be sure to label each launch position. You must include a) launcher, b) model rocket, c) igniter, and d) land area requirements.
5. Participate in all launching officer positions (except range officer) and record them in your journal, including the date and the Range Officer signature.
6. Know the Model Rocketry Safety Code. A signed (cadets and seniors) copy should be kept in the journal folder.
7. A signed permission slip for attending the launches shall be kept in the journal folder. This permission slip will be shown to the Range Officer at the beginning of a launch event and retained in the journal folder.

The CAP model rocketry presentation will introduce you to the basics of model rocketry in the following areas:

1. Rocket Systems
2. Model Rocket Construction & Techniques
3. Rocket Operation Phases
4. Launch and Range Operations
5. Model Rocketry References and Sources

The participants of this course will construct a model rocket and then successfully launch this same rocket during the Aerospace Seminar. The course will introduce you to the basics of model rocketry, flight, SAFETY, launch operations, and recovery. The unit(s) you will construct is specially designed for training workshops and can be rapidly built and utilized. You will receive handout material covering each topic presented and a list of model rocketry references and sources as listed in our Model Rocketry Program CAPM 50-20.

MODEL ROCKETRY CLASS OUTLINE

MODEL ROCKET COMPONENTS

Nose Cone (1. stream line 2. payload)
Shock Cord
Recovery Device & Wadding (parachute / streamer)
Launch Tube
Launch Lug
Fins
Rocket Motor

CENTER OF GRAVITY & STABILITY

LAUNCH SEQUENCE

Launch
Powered Flight
Burnout
Coasting Flight
Apogee
Recovery Device Eject
Decent
Landing

PREPARING FOR LAUNCHING: Double-check the recovery system of your model before launching. Parachute and streamer recovered models should have enough wadding between engine and recovery system to prevent scorching the parachute or streamer and assure positive ejection. The wadding should fill the tube for a distance of at least 1-1/2 body tube diameters. Make certain launch panel is disarmed and in proper operating condition. Lower the rocket into position on the launch rod or rail. Clean the micro-clips, and then clip one to each lead of the igniter. The clips must not touch each other, and the igniter leads must not cross. The rocket may be supported with a scrap of wood or an empty engine casing to make it easier to attach the clips and to keep the clips from short-circuiting.

COUNTDOWN: Give a countdown before launching your rocket. First arm the launch panel. Then begin counting: "5-4-3-2-1 -Launch", Press the ignition button at "launch". If the batteries are strong the engine will ignite immediately. As the batteries weaken there will be a short delay before ignition. Disarm the launch panel as soon as the rocket takes off.

MISFIRES: Occasionally the igniter will heat and burn into two pieces without igniting the engine. This is almost always caused by a failure to install it correctly. Disarm the launch panel, wait 1 minute before approaching the rocket, then remove the rocket, clean the igniter residue from the nozzle, and install a new igniter. Follow the launching procedure again.

RANGE RULES (SAFETY)

ALTITUDE DETERMINING DEVICES

PAYLOADS

Passive or Dead Load
Optical
Electronic
Active On-Board
Biological – no mammals
Special

LAUNCH AREA

Field Size (chart)

Wind

Obstacles

Recommended Launch Area:

Engine Type	Maximum Altitude		Site Diameter	
	Feet	Meters	Feet	Meters
1/2A	200	61	50	15
A	400	122	100	30
B	800	244	200	61
C	1600	488	400	122
D	1800	549	500	152

Minimum Launch Site Dimension for Circular Area is Diameter in Feet, and for Rectangular Area is Shortest Side in Feet.

Choose a large field away from power lines, tall trees, and low-flying aircraft. The larger the launch area, the better chances are for recovering your rocket. Football fields, parks, and playgrounds are great areas for a launch. The chart above shows the smallest recommended launch area.

MAKE SURE THE LAUNCH AREA IS FREE OF OBSTRUCTIONS, DRY WEEDS, BROWN GRASS, OR HIGHLY FLAMMABLE MATERIALS.

WORKSHOP TOOLS

Sandpaper (fine) #200 – shaping, #320 - all-round, #400 - smoothing

Modeling Knife Exacto #1 and #11 blade

Tweezers

Sharp Pencil / Ball Point Pen

Scissors

Needle Nose Pliers

Small Screwdriver

12" or 6" Ruler

Spring Clothes Pin

Forceps

Scotch Tape

Box to store your tools and projects (A shoe box will do)

MATERIALS

White Glue (Elmer's / Titebond)

Paint (Spray - enamels / acrylics)

Balsa Wood

CONSTRUCTION AIDS

Spike

Spike Row

Paper Wand

Rotating Spike Fin Alignment Angle

Fin Jig

Q-Tips

Cradle Stand

Rocket Launch Personnel

Range Officers. They are in complete charge of the range. No action is taken without their direction. They give all orders and make all decisions. Their place should be at the control center. They must be recognized as NAR senior members (see paragraph 10 for establishing a NAR section and obtaining NAR senior membership).

Safety Officers. They are responsible for checking all critical points of the operation in advance to make certain that safety regulations are followed. They are responsible for the instruction of all personnel in safety procedures. No launching will take place until the safety officer has given clearance to the range officer. They may be qualified cadets.

Launch Supervisors. They are responsible for assuring that established procedures are followed at the launch site and for supervising the actual launching operation. They certify the launch area to be clear before launching begins.

Spectator Control Officers. They are responsible for clearing the launch area of all personnel not assigned to specific posts. They see that personnel are a safe distance before they give clearance for launching to the range officer. The safety officer may handle this assignment.

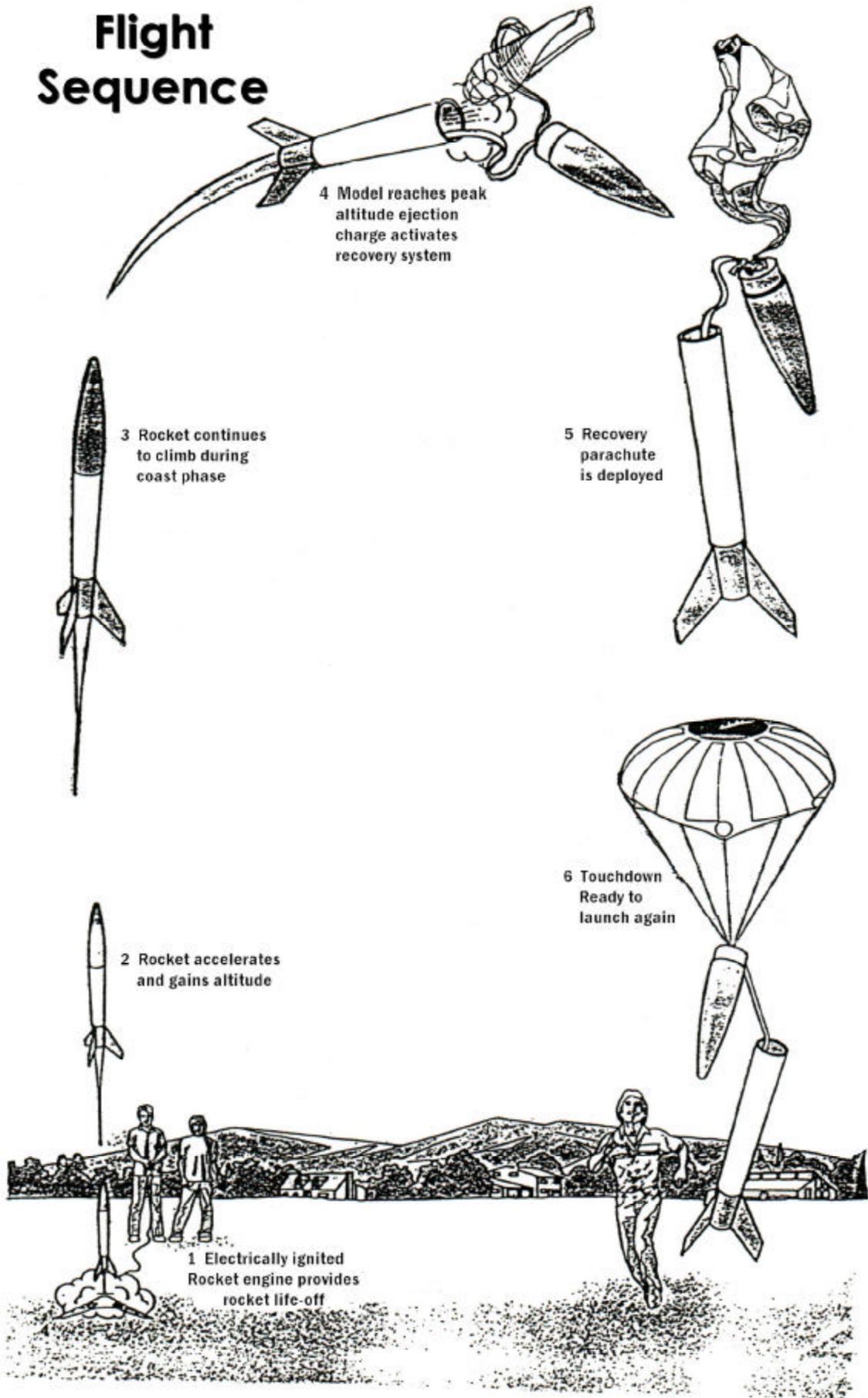
Range Guards. They are responsible for keeping passersby out of the area, scanning the sky for aircraft, and certifying to the range officer that it is safe to launch rockets.

Observers and Trackers. They are responsible for tracking the path of the rocket, taking observations on the azimuth and angle of elevation at the peak of the trajectory, and reporting these data to the control center for plotting.

Public Affairs Officers. They arrange for advance publicity about the meet and provide for newspaper, radio, television, and/or magazine coverage of the activities. They ensure that the rocketry program enjoys favorable public relations.

Rocket Launching Record. All cadets will keep a record of each of their rocket launchings, to include those rockets that are launched on an individual, group, or competitive basis. Records will be maintained on a "CAP Model Rocket Launching Data Sheet," an example of which is included in this manual at attachment 2 and which is authorized for local reproduction.

Model Rocket Flight Sequence



MODEL ROCKETRY SAFETY CODE

1. Construction

My model rockets will be made of lightweight materials such as paper, wood, rubber, and plastic without any metal or other hazardous material as structural parts.

2. Engines

I will use only pre-loaded, factory-made, NAR-certified rocket engines in the manner recommended by the manufacturer. I will not alter or dismantle model rocket engines or their ingredients in any way, nor will I attempt to reload these engines.

3. Recovery

I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again. I will use only flame-resistant recovery wadding in my rockets.

4. Weight Limits

My model rockets will weigh no more than 1500 grams (53 oz) at liftoff and the engines will contain a total of no more than 125 grams (4.4 oz) of propellant. My model rockets will weigh less than the engine manufacturer's recommended maximum liftoff weight for the engine used, or I will use engines recommended by the manufacturer for my rockets.

5. Stability

I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.

6. Payloads

My model rockets will never carry live animals, or payloads intended to be flammable or explosive.

7. Launch Area

I will launch my model rockets outdoors in a cleared area, free of tall trees, power lines, and buildings. I will ensure that people in the launch area are aware of the pending rocket launch and are in a position to see the rocket's liftoff before I begin my audible five-second countdown.

8. Launcher

I will launch my model rockets from a launch rod or other device, which provides rigid guidance until the rocket has reached a speed adequate to ensure a safe flight path. To prevent accidental eye injury, I will always place the launcher so that the end of the rod is above eye level, or I will cover the end of the rod when approaching it. I will cap or disassemble my launch rod when not in use, and will never store it in an upright position. My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly. I will always clear the area around my launch device of brown grass, dry weeds, and other easy-to-burn materials.

9. Ignition System

The system I use to launch my model rockets will be remotely controlled and electrically operated, and will contain a launching switch that will return to "off" when released. The system will contain a removable safety interlock in series with the launching switch. All persons will remain at least 15 feet from the model rocket when I am igniting engines totaling 30 Newtons-seconds or less of total impulse and at least 30 feet from the model rocket when I am igniting engines totaling more than 30 Newtons-seconds total impulse. I will use only electrical igniters that will ignite my rocket engines within one second of actuation of the launching switch.

10. Launch Safety

I will not let anyone approach a model rocket on a launcher until I have made sure that the safety interlock has been removed or the battery has been disconnected from the ignition system. In the event of a misfire, I will wait one minute before allowing anyone to approach the launcher.

11. Flying Conditions

I will launch my model rocket only when the wind is less than 20 miles per hour and under conditions where the model will not fly into clouds, fly near aircraft in flight, or be hazardous to people or property.

12. Pre-Launch Test

When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

13. Launch Angle

I will not launch model rockets so that their flight path will carry them against targets. My launching device will be pointed within 30 degrees of vertical. I will never use model rocket engines to propel any device horizontally.

14. Recovery Hazards

If a model rocket becomes entangled in a power line or other dangerous place, I will not attempt to retrieve it.

Signature

Date

CAP MODEL ROCKET LAUNCHING DATA SHEET				
NAME		GRADE		CAP SERIAL NUMBER
SQUADRON	CHARTER NUMBER		WING	
PERSONNEL PARTICIPATING				
RANGE OFFICER			SAFETY OFFICER	
LAUNCH SUPERVISOR			OTHERS	
WEATHER DATA				
TEMPERATURE	WIND DIRECTION	WIND VELOCITY	VISIBILITY	CEILING
MODEL ROCKET DATA				
NAME AND/OR MODEL NO.		DIMENSIONS		
NUMBER & TYPE OF FINS	MOTOR		TOTAL WEIGHT	
EXPECTED PERFORMANCE				
TOTAL FLIGHT TIME	MAXIMUM ALTITUDE		AVERAGE VELOCITY	
LAUNCHING DATA				
LOCATION OF LAUNCH SITE			TYPE LAUNCHER	
LAUNCHING ANGLE			DATE AND TIME OF LAUNCHING	
MISFIRE	<input type="checkbox"/> YES	<input type="checkbox"/> NO	(IF YES, GIVE REASON AND CORRECTIVE ACTION TAKEN IN REMARKS.)	
SUCCESSFUL FIRING	<input type="checkbox"/> YES	<input type="checkbox"/> NO	(IF NO, EXPLAIN IN REMARKS.)	
TAKEOFF NORMAL	<input type="checkbox"/> YES	<input type="checkbox"/> NO	(IF NO, EXPLAIN IN REMARKS.)	
PART FAILURE	<input type="checkbox"/> YES	<input type="checkbox"/> NO	(IF YES, EXPLAIN IN REMARKS.)	
TOTAL FLIGHT TIME	ESTIMATED MAXIMUM ALTITUDE		ESTIMATED AVERAGE VELOCITY	
IMPACT DISTANCE	FLIGHT BEHAVIOR		OTHER	
REMARKS (USE REVERSE SIDE IF ADDITIONAL SPACE IS NEEDED)				