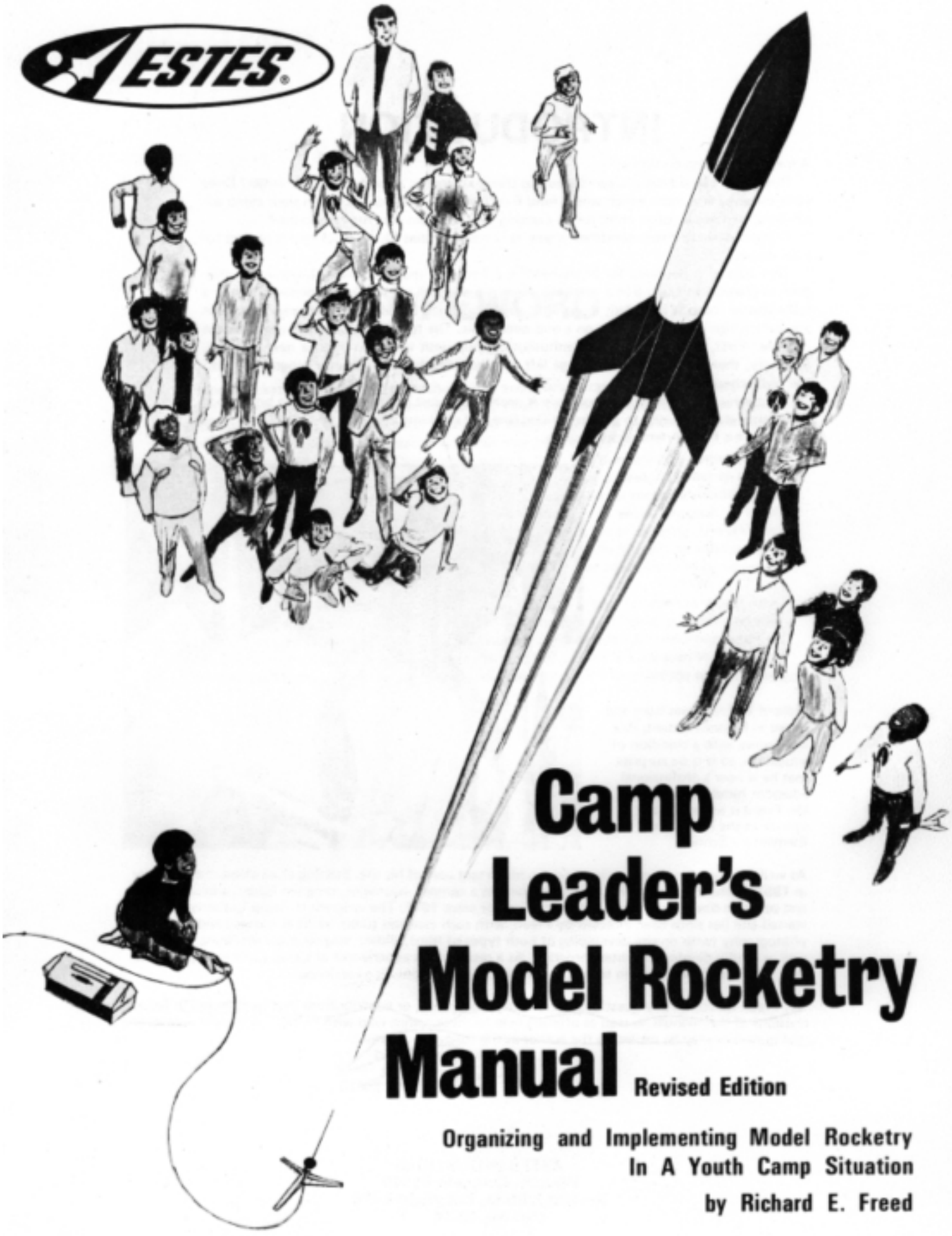

Camp Leader's Model Rocketry Manual

Revised Edition

Organizing and Implementing Model Rocketry In A Youth Camp Situation

by Richard E. Freed

INTRODUCTION

A message to camp directors:

Does your camp have a cleared area (no trees) as large as a football field or larger? Does your camp have a room which would hold 6 or 7 tables and 30 chairs? Does your camp administration have an open mind for an exciting new program idea for your camp? If the answer to these questions is yes, it is possible that model rocketry is perfect for your camp.

This manual is designed for implementing a first-year model rocketry program for youngsters in grades 4 though 6 during a one-week camp. A chapter on implementation in a full-summer camp is included, along with suggestions for second and third year programs and junior high rocket programs on a one-week basis. The fourth to sixth grade age is chosen because, first, they are the most enthusiastic group with which to begin a new program. Secondly, there are plenty of camp-age youngsters left to eventually build a rocketry program up into the high school years.

No previous experience with rocketry is necessary - just a willingness to do a bit of hard planning and an eagerness to see the smiling face and sparkling eyes of a 10-year-old who has just made his first perfect rocket launch.

About the author .....

Richard E. Freed was born and raised in Mount Pleasant, PA in a family with a tradition of education, so it is no surprise that he is now a professional educator himself. At the time he wrote this manual, Mr. Freed was an elementary science teacher in North East, PA.
As well as education, camping has been an important part of his life. Starting as an elementary camper in 1957, Richard has been involved in camping as a camper, counselor, program leader, administrator and program director, as well as rocketry director since 1971. The program at Camp Lutherlyn was started and has since been directed by Freed, with such ventures to his credit as Camroc and Cineroc photography (with on-site developing of both types of film), gliders, staging, scale modeling, etc., as well as a fully developed contest program. As a result of his experiences at Camp Lutherlyn (Prospect, PA), this manual was written to enable others to benefit from his experience.

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FORWARD

Model rocketry has offered many schools and youth organizations an opportunity to update their programs for a space-oriented society. Youth camps have begun to realize the opportunity of merging model rocketry with their earlier objectives. It is the purpose of this manual to acquaint camps with exactly how this can be done.

First, the term Model Rocket Camp means exactly that. The campers who come to camp need to be exposed to and take advantage of a “normal” camping week. Swimming, hiking, fishing, etc. are all-important parts of a camper’s experience. Model rocketry should, therefore, be an addition to the regular camp program and not an entire program in itself.

Model rocketry fits very well with many different types of camping. It works successfully in church camps. It may be used in Scout Camps in fulfillment of various merit badges. Model rocketry can successfully function with whatever adaptations seem necessary in any camp situation.

The scope of this guide is limited mainly to the first year implementation of model rocketry in a camp situation, with suggestions as to how the program could be continued over the second and third years. Suggestions for expanding the program into junior high and into full-summer private camps are included. It is written so that a person need not have previous model rocketry experience to successfully conduct the model rocket camp.

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CHAPTER I
PURPOSE AND OBJECTIVES

Purpose of Model Rocket Camping

Camping can be very beneficial to children of all ages, regardless of where they live. It is especially beneficial to young people who live in a city or suburban area, a situation common to many. The recreational opportunities of a camp alone are invaluable to a city child.
Most camps pride themselves in offering "things that the camper may not normally do at home." Many youngsters who have never been exposed to model rocketry have this environmental handicap. Many youngsters who live in rural areas may not find model rocket products readily available. Model rocketry may blend with camping to provide the campers with a mixture of both the camp's recreational opportunities and an exciting hobby relevant to today's world of space and space travel.

Objectives of Model Rocket Camping

Objectives in a camp situation are very important. Without objectives, a camp has no reason for being, no direction and no purpose. Model rocket camping has its own set of objectives, which should complement the camp's objectives. There should be some common objectives also, to mold the camp's program and the rocketry program into one. The objectives below are stated in a behavioral fashion, so that most can be objectively evaluated at the close of the program to judge success or failure, strengths and weaknesses.

Listed below are the objectives of model rocketry for the first year program. By the close of the program, youngsters should be able to:

1. Construct and successfully launch their rockets.
2. Pack their parachutes and recovery wadding so that the parachute opens when it is supposed to.
3. Understand and follow all safety rules in launching model rockets.
4. Insert igniters properly in the engine nozzle so that it ignites the fuel and does not short out.
5. Make repairs on their rocket, if necessary, and determine the cause of damage so that it does not occur again (learn by his/her mistakes).
6. Understand and be able to repeat the theory through which the launch device, igniters and solid fuel ignition operate.
7. Enjoy a complete camping experience.
8. Common objectives which would relate the camp experience to model rocketry.

a) Church-related camps - Understand how and why man is seeking information about God's celestial creations; to realize that religion and science can complement each other.
b) Scout camps - To fulfill or partially fulfill the requirements for the following merit badges: Space Exploration, Model Building, Model Rocketry (in some states).
c) Other camps - Objectives designed to relate model rocketry to particular program objectives.

CHAPTER II
PRE-CAMP PREPARATION

Publicity

No camp can operate without the campers. The regular brochure sent out by the camp should state the type of program that will be offered, a brief description of the camp, dates and other explanations. Also, a note about the new model rocketry program sent along with any mailed application forms, would help in the publicity. If the camping public is aware of the new camp program, the model rocketry camp is more likely to be filled to capacity well before the camp is to begin so that the proper quantities of material may be ordered.

Leader Preparation

Before the camp begins, the person (or persons) who is to be the leader of the rocketry camp must prepare himself so that he knows what will be going on and can anticipate the problems the campers may face. The best way to achieve this is to "learn by doing". Before the camp begins, the leader should assemble, prepare and test launch the model rocket himself so that he will be familiar with the product and equipment.
Certain manuals are available from Estes to familiarize the leader with model rocket theory. Besides this manual, other Estes publications are "Model Rocketry Technical Manual", "Model Rocket Contest Guide" and "Teacher and Youth Group Leaders Guide".

Necessary Materials for the Camp

Items needed for the camp are listed below. Beside each is a brief explanation of what each is used for. Prices are listed in the current Estes catalog and product can be ordered directly from Estes. Many items may be available from other sources such as hobby shops or the camp itself.

A. Expendable items - must be re-ordered each year of the program.

Notes and Catalog Number

1. Rockets
   The Estes Alpha® Bulk Pack (EST 1756) (12 pack) is recommended because it is simple to construct and launch. This model rocket kit is constructed of balsa and cardboard tubes. The Alpha III® Bulk Pack (EST 1751) is constructed with a cardboard body tube, plastic fin unit and a plastic nose cone. It is even easier to build than the Alpha® and is suitable for younger campers.
2. Engines
   Order enough engines for four launches per camper. It is recommended that you order six engines per camper to allow for varying weather conditions. Engines are also available in bulk packs (24 pack) for greater value.

1/2A6-2 (EST 1593) - one engine per camper. Altitude is 100 feet for an Alpha® model rocket when launched with this engine.

A8-3 (EST 1598) - two engines per camper. Altitude range is from 400 to 500 feet. Use for first launch in practically any wind condition.

B6-4 (EST 1606)- two engines per camper. Range 600 to 800 feet. For use in light wind conditions.

C6-5 (EST 1614)- one engine per camper. Alpha® reaches altitudes up to about 1000 to 1200 feet. For use when it is absolutely still (no wind).

Engines come in packs of three and include three igniters and instructions. Bulk packs of 24 are available in the A8-3 (EST 1781) and the B6-4 (EST 1783).

3. Igniters — Although igniters (EST 302301, six per package) are included in the engine packs, it is best to figure that probably a few youngsters will make mistakes at the launch pad that ruin their igniters. It is suggested that one pack of igniters be ordered for each three campers. It is better to have too many than too few.

4. Recovery Wadding — Recovery wadding (EST 302274) is essential to the proper operation of the parachute recovery system. One package is good for approximately 20 flights. For 50 campers, 4 flights each, 10 packages should be enough.

5. Paint — Any quick-dry spray paint will work, but fluorescent paint is recommended. This allows better visibility in case of wind drift. One can of paint should be enough for about four rockets. Fluorescent colors are brighter when applied over white spray enamel.

6. Glue — Any white glue will work well in construction and repair of rockets.

7. Sandpaper — Assorted sandpaper from fine to extra fine grit is necessary for certain stages of rocket construction.

8. Award Certificates — Camps may order these certificates (EST 2836, EST 2837 and EST 2838) with their rocket order to Estes. These make nice presentations at the close of camp.

9. Misc. Supplies — Supplies such as scissors, pencils, masking tape, rulers and hobby knives are necessary to complete various parts of construction.

10. Emergency Repair Kit — For ease of repairs at the launch pad. Contains shock cord mounts, tape rings, safety key, recovery wadding, 12” parachute kits, shroud line, launch lugs, shock cords and safety cap (EST 302233).

11. Sanding Sealer — For use before painting balsa parts. Available from hobby supply stores.

12. Batteries — The Electron Beam® Launch Controller (EST 302220) requires four AA alkaline batteries (not included). The larger more powerful (and longer lasting) Command Control™ Launch Controller (NCR 2234) requires one or two 6 cell rechargeable NiCad battery packs.

B. Non-expendable materials may be used in future camps as well as with the present year’s camp.

1. Alpha III® Starter Kit — Each kit (#1406) includes one Porta Pad® II Launch Pad, one Electron Beam® Launch Controller, one Alpha III® rocket kit and enough flight supplies for three launches. Comes in a reusable range box with “The Estes Rocketeer’s Guide” included. One kit should be adequate for each 12 campers.

2. Hobby Knives — Used in various stages of rocket construction. A very sharp knife is suggested. Two or three campers can share one knife.

3. Altitrak™
   How high did it really go? Measure altitudes with this easy to use device (EST 302232). Follow the rocket in the sights to apogee and release the trigger to lock the reading. Easy to read display gives altitude in meters along with the elevation angle.

4. Stop Watch
   Parachute duration flight contests are based upon how well the child has packed his parachute and the altitude of the rocket at parachute ejection. Flights are timed from liftoff to recovery.

5. Deck of Playing Cards
   Mark with magic markers the numbers 1 to 50. These can be a valuable aid in determining launch position of campers.

6. Tape Measure
   In spot landing competition, the distance from the selected target or from the launch pad is measured. A knotted rope or a person to pace off the distance is a usable substitute, but a good tape measure is more accurate. The rocket must have landed with its recovery system operating properly.

7. Power Source
   For heavy launch schedules use the ultimate launch controller. The Command Control™ Launch Controller (NCR 2234) uses one or two 6 cell rechargeable NiCad battery packs and comes with 30 feet of heavy-duty launch cable. This launcher provides enough current to ignite engines as fast as you can push the button. Loaded with safety features and designed to last.

Although it may seem that a large amount of money would be involved, most camps charge additional fees for special programs. A moderate charge could more than cover the cost of the materials. In future years, only the expendable materials would have to be re-ordered, thereby saving quite a bit over the initial expenses. Estes offers discounts of 15% and 20% off camp orders with additional savings through bulk packs. Estes model rocket supplies can also be purchased from local hobby shops, usually at discounts for clubs and schools.

Ordering Materials

The key word for ordering is early. The launch pads require assembly. They should be assembled before the camp begins. Materials must be inventoried so that any materials which may be temporarily out of stock may be secured. The order should be placed at least six weeks prior to the first day of camp and even earlier if at all possible.

Staff Orientation

This is a very necessary part of pre-camp preparation. A complete discussion of objectives and schedules with the counselors prepares them to aid with the construction and supervise the launching of the model rockets. Assignment of duties at the launch site and explanation of safety rules are necessary so that the staff and model rocketry leaders work solidly together to achieve the camp objectives and enforce the safety policies consistently for all campers.

CHAPTER III

FIRST DAY OF CAMP (SUNDAY)

Most “one-week” camps run a program from Sunday afternoon to the following Saturday morning. The week’s schedule is described on that basis. The Sunday program is very important in setting the tone for the week’s activities. The following is the suggested schedule for Sunday:

Afternoon

Campers arrive and get situated.
Post-arrival camp activity (swimming, hiking, etc.)
Evening meal.

Evening

Launch site orientation, demonstration launches, safety talk. Campfire, snacks, lights out.

A “regular” camp afternoon schedule should be planned to carry the campers through the evening meal. Then the campers should be taken to the launch site and seated in the spectator’s area for orientation.

During this orientation session, an Alpha® rocket may be launched to demonstrate proper launch procedure and the operation of the equipment at the launch site. After recovery of the Alpha®, prepare it for launch again. Ask the campers to picture some part of their body above the rocket, or a hand under the rocket at the moment of lift-off. Then launch again. Ask the campers to comment on the effects of the rocket on their body in their “pretend” situation. This may be a natural point to introduce launch procedure and safety rules. The campers will then see a reason for following the safety rules. (Note: Safety rules and launch procedure are covered in more detail in Chapter 5 - Third Day of Camp (Tuesday).

The following schedule is suggested for the model rocket camp. It features approximately four hours per day on rocketry and six hours per day in regular activities.

Time	Activity
7:00	Rise
8:00	Breakfast
8:45	Flag raising and cabin cleanup
9:30	Camp activity (study session, merit badge, etc.)
11:00	Rocketry Session Mon. - Tues.: Construction of rocket Wed. - Fri.: Rocket repairs, construct extra rocket, alternate activity.
12:30	Lunch
1:30	Rocketry Session Mon.: Extra construction session so that painting may be done Monday evening (provide an alternate activity for those who are ready to paint by end of A.M. session). Tues.: Pre-launch briefing on igniter installation in engine and launch preparations. Wed. - Fri.: Theory session and engine loading (see Chapter 9 for some suggestions for topics for the theory sessions).
2:30	Camp Activities (swim, boat, fish, hike, etc.)
6:00	Dinner
7:00	Rocketry Mon.: Rocket painting Tues. - Fri.: Launch
8:45	Evening Program (campfire, etc.)
10:15	Lights out

CHAPTER IV

SECOND DAY OF CAMP (MONDAY)

When working with a large group of youngsters, it is very important that all materials and supplies be ready and organized. Many of the children will have never assembled a model rocket before, so the construction of the rocket should be well structured, and supervised by the counselors and leader. Because of the large number of small parts which can easily be misplaced, it is suggested that the operations involving small parts be done first. All operations should be done at the same time in order to keep the best control over the construction and insure that each step is done right before proceeding to the next.

Construction Period (A.M.)

1. Inventory. It is often the nature of children of this age to state that a lost part “wasn’t in my kit to start with”. The purpose of the inventory is to make sure this is not the case. Each child checks his kit for all parts. The parts may be emptied out on the table and placed back in the bag as they are called for. Any missing or damaged parts may be replaced out of the spare kits.

The insertion of the eye screw into the nose cone may be done during the inventory so that the eye screw (which is the smallest and easiest to lose part) is not lost. This is step 1 for the Alpha III® kit.

2. Construction (engine holder, mount shock cord, mount launch lug). Follow the instructions herein with a copy of the actual assembly instruction from a kit. Make sure each camper is done with each step before proceeding to the next. Demonstrate each step with spare kit parts, placing the parts together as instructed and showing anyone who is not sure what to do. Proper construction requires following instructions carefully.

During the A.M. construction period the initial construction steps should be completed. The suggested initial steps for the Alpha III® kit are steps 1, 2,3 and 5. The suggested initial steps for the standard Alpha® kit are steps 1, 2, 3, 5, 6 and 7. Leave materials on the table to dry. The fins for the Alpha® rocket should be attached and reinforced with fillets before painting. Also, the balsa parts of the rocket (Alpha® only) should be sealed with sanding sealer and thoroughly sanded with fine grit sandpaper.

Make sure that scissors, knives, pencils, sandpaper and glue are available at each table. Also, one counselor should be stationed at each table to assist campers who need help.

Construction Period (P.M.)

1. Construction (install engine holder, attach fins, paint). Install the engine holder (steps 4 and 6 for Alpha III®; step 4 for the Alpha® kit).

Painting may be done fairly quickly with the use of spray paint (step 12 for the Alpha® Kit). A stick or twig may be used to hold the tube, but it has been found that youngsters enjoy the operation much more when they use their thumbs to hold the rocket. In addition to more reliable maneuvering of the tube to get all parts of the rocket painted without dropping it on the ground, the campers enjoy showing off the paint marks at the base of their thumbs! The nose cone for the regular Alpha® kit (do not paint nose cone of Alpha III® kit) can be held by a twig. The assembled parts should be left out to dry. At this point the campers have completed all steps except for assembling and attaching the parachute and attaching the nose cone to the body tube.

There will probably be time for an additional activity following completion of construction. (Scavenger hunt, capture the flag, etc)

CHAPTER V

THIRD DAY OF CAMP (TUESDAY)

Construction Period (A.M.)

Additional materials needed for this construction period include coffee cans or some other available container and warm water for use in applying water-soluble decals.

If not completed following the paint operation of the previous evening, the fin assembly may be mounted on the Alpha III® body tube before the decal work is done.

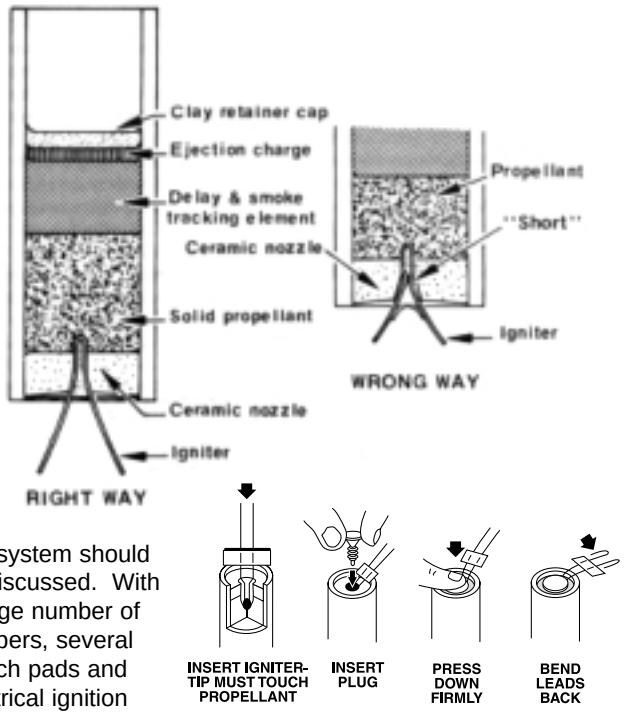
Cut out the parachutes (step 8 for Alpha® III or step 10 for standard Alpha®). Knives work better than scissors. Follow the suggested steps for parachute assembly in Chapter 12: Construction and Repair Hints.

Apply the decals if available (step 10 for Alpha III® kit, optional for Alpha® kit). Use a black felt-tipped pen to mark first initial and last name of the camper on the launch lug to identify each rocket's owner. Leave them out to dry.

Once the rockets have had time to dry, campers with time remaining may wish to "spin-stabilize" their rockets. This is a test, which gives the campers an idea how well their rockets are going to fly. The test is not really necessary for the Alpha® or Alpha III® rockets, but gives the campers valuable training in testing for future rockets built after the close of camp. The stability test is described in "The Estes Rocketeer's Guide", the booklet that comes in the Alpha III® Starter Set.

Pre-Launch Checkout Lecture

Discuss the parts of the engine and how to load the engine into the rocket. These instructions are included in the pack of engines. It is suggested that posters such as those shown may be used to show a cross section of an engine, a shorted-out engine and a properly loaded engine. Once engine loading has been discussed and any questions answered, the electrical ignition system should be discussed. With a large number of campers, several launch pads and electrical ignition systems may be used to speed up launches. Make sure to have plenty of new batteries available for the type of launch controllers used. The campers may hook-up their rockets on the launch pads at the same time, and then move to the launch controllers. Inserting the safety key permits checking for circuit continuity. If a light comes on in the system, then the camper may check for cleared launch area and begin countdown. If there is not continuity, then the key is pulled and the trouble is pinpointed.



Emphasize the various areas campers will go through and that when they are not at the launch pad or preparing to launch, they stay in the spectator's area and observe. The person launching recovers his own rocket.

Explain that when they arrive at the pad they choose a playing card with their launch position number on it and get three sheets of recovery wadding. Explain how to pack the wadding into the body tube and the consequences of packing it too loosely (burnt parachute) and too tightly (no parachute ejection). Drawings can help to explain this.

Pack flame-proof recovery wadding into the body tube from the top. Fill the tube for a distance of 1 1/2", sealing along the sides of the tube. Hold the parachute at its center and pass the other hand down it to form a "spike" shape. Fold this spike into thirds and pack into the tube on top of the wadding. Pack the shroud lines and shock cord in on top of the parachute and slip the nose cone into place.

After theory has been discussed and questions answered, pass out engines, igniters and igniter plugs to the campers. Have them practice putting the igniter into the engine and securing it with the appropriate plug. If they are using regular igniters and plugs, they should be inserted in the engine securely so that the weight of the engine and rocket will be supported. The campers should do this test. If the igniter falls out, probably it would have fallen out at the launch pad. (This little exercise will pay for itself in igniter savings).

After the campers have done this exercise, they might practice parachute packing and wadding placement with their rockets. If they can learn to do most of this on their own before they go to the launch pad, they will be much more independent once they get to the pad for their first launch.

MODEL ROCKET SAFETY CODE

1. Materials - My model rocket will be made of lightweight materials such as paper, wood, rubber, and plastic suitable for the power used and the performance of my model rocket. I will not use any metal for the nose cone, body, or fins of a model rocket.
2. Motors/Engines - I will use only commercially-made NAR certified model rocket engines in the manner recommended by the manufacturer. I will not alter the model rocket engine, its parts, or its ingredients in any way.
3. Recovery - I will always use a recovery system in my model rocket that will return it safely to the ground so it may be flown again. I will use only flame resistant recovery wadding if required.
4. Weight and Power Limits - My model rocket will weigh no more than 1,500 grams (53 ounces) at liftoff, and its rocket engines will produce no more than 320 newton-seconds (4.45 newtons equal 1.0 pound) of total impulse. My model rocket will weigh no more than the engine manufacturer's recommended maximum liftoff weight for the engines used, or I will use engines recommended by the manufacturer for my model rocket.
5. Stability - I will check the stability of my model rocket before its first flight, except when launching a model rocket of already proven stability.
6. Payloads - Except for insects, my model rocket will never carry live animals or a payload that is intended to be flammable, explosive, or harmful.
7. Launch Site - I will launch my model rocket outdoors in a cleared area, free of tall trees, power lines, buildings, and dry brush and grass. My launch site will be at least as large as that recommended in the following table.
8. Launcher - I will launch my model rocket from a stable launch device that provides rigid guidance until the model rocket has reached a speed adequate to ensure a safe flight path. To prevent accidental eye injury, I will always place the launcher so the end of the rod is above eye level or I will cap the end of the rod when approaching it. I will cap or disassemble my launch rod when not in use, and I 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, or other easy-to-burn materials.
9. Ignition System - The system I use to launch my model rocket will be remotely controlled and electrically operated. It will contain a launching switch that will return to "off"" when released. The system will contain a removable safety interlock in series with the launch switch. All persons will remain at least 15 feet (5 meters) from the model rocket when I am igniting model rocket engines totaling more than 30 newton-seconds of total impulse. I will use only electrical igniters recommended by the engine manufacturer that will ignite model rocket engines(s) within one second of actuation of the launching switch.
10. Launch Safety - I will ensure that people in the launch area are aware of the pending model rocket launch and can see the model rocket's liftoff before I begin my audible five-second countdown. I will not launch a model rocket using it as a weapon. If my model rocket suffers a misfire, I will not allow anyone to approach it or the launcher until I have made certain that the safety interlock has been removed or that the battery has been disconnected from the ignition system. I will wait one minute after a misfire 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 (30 kilometers) an hour. I will not launch my model rocket so it flies into clouds, near aircraft in flight, or in a manner that is hazardous to people or property.
12. Pre-Launch Test - When conducting research activities with unproven model rocket designs or methods I will, when possible, determine the reliability of my model rocket by pre-launch tests. I will conduct the launching of an unproven design in complete isolation from persons not participating in the actual launching.
13. Launch Angle - My launch 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 powerline or other dangerous place, I will not attempt to retrieve it.

Emphasize SAFETY FIRST. Campers who refuse to follow safety rules will not be permitted to launch. This may seem drastic, but the camp cannot risk any injuries due to carelessness or it may be the last time the camp will allow the model rocketry program.

Tuesday P.M. - First Launch!

Following dinner, have the campers pick up their rockets at the construction area and proceed to the launch site. The site should be set up before the campers arrive.

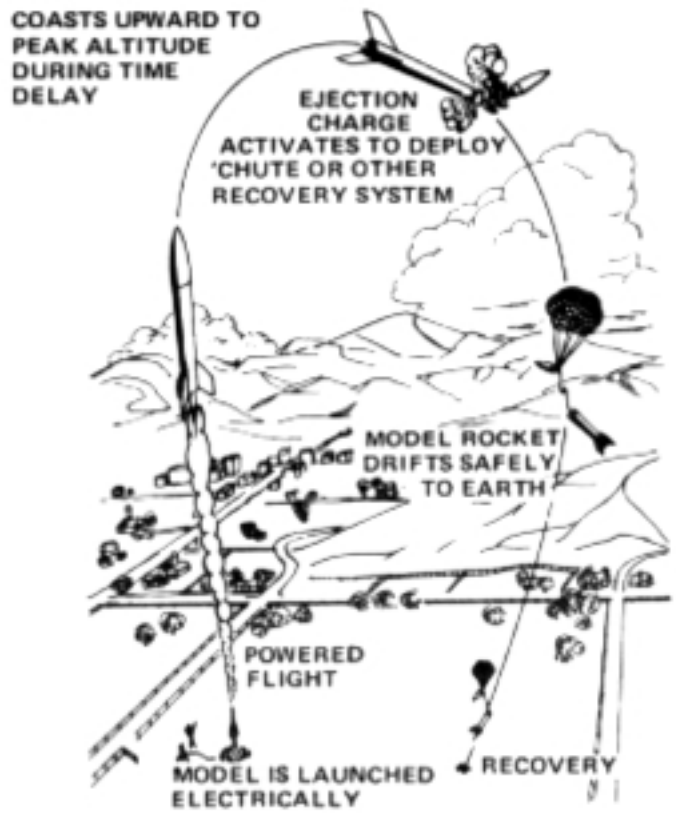
The spectator's area should be roped off and the campers should approach the area so that they stay well back from the launch pad. Under no condition should a camper not preparing or launching his rocket come into the launch area. The launch preparation area should be equipped with all of the igniters, engines and other emergency materials such as scissors, glue, masking tape, extra shroud line and a pair of pliers (preferably needle nose), which may be used to remove stubborn engines from a rocket if necessary. The launch pad area should have two or more Porta-Pads® set up with launch control systems on hand.

The leader must be in a position from which he can supervise and coordinate all launch activities. The leader must authorize each launch. Counselor responsibilities are to supervise the spectator area, making sure that the campers not involved in a launch are seated and not running around the launch site creating a hazard to themselves or others. Counselors also pass out the model rocket engines and igniters to the campers. The campers should be permitted to handle the engines only at the time they are going to use them for obvious safety reasons. Counselors assist the campers in installing the igniters and plugs in the engines and in preparing the rockets for the launch pad.

When youngsters arrive at the launch site they obtain a launch number and three sheets of recovery wadding. They go immediately to the spectator area and can begin packing their parachutes.

Once all campers have arrived and have been seated in the spectator area, have the counselors assume their assigned positions. After a review of the launch procedures, call launch numbers one through eight and instruct these campers to report to the launch preparation area and get their materials. They should line up according to their launch numbers. If two launch pads are being used, have campers line up in pairs. When numbers one and two are ready to proceed to the launch pad, counselors call for three and four to report to the launch preparation area. This should continue so that two campers are on the pad to launch at the same time and eight more are preparing their rockets for launch. The first two campers go onto the pad, slide the rocket onto the launch rod and hook up the micro-clips as described during the pre-launch checkout. If one camper finishes setting up before the other, he goes to his control unit and waits. When the other camper is finished setting up, he also goes to his control unit and each inserts the safety key to check for continuity when told to do so by the leader. If the circuit is complete, the light bulb will glow. If both bulbs glow, the campers continue with the launch sequence. If not - both campers pull their safety keys and the camper with the problem corrects it. The light may not glow if the clips are dirty from previous launches. Sand-papering the contact areas of the clips will solve this problem. Also, rocket engines will not ignite if batteries in the launch controller are weak.

Once continuity has been established on each pad, the campers tell the leader that they are ready. The leader announces to the spectators that launch is about to begin. The launch area should be clear and all eyes should watch the launch in case trouble develops and a rocket goes off course. Countdown!
5 - 4- 3 - 2 - 1 - LAUNCH!!!
If the launch is successful, the camper pulls the safety key from the control unit and goes after his rocket. (It is suggested that the camper try to catch his/her rocket before it lands.) If launch is unsuccessful, the youngster takes his/her rocket back to the preparation area to determine why the “bird” did not lift off. There he/she may re-insert the igniter into the engine and get into line to try to launch a second time.



After one and two have launched, three and four come to the pad, make sure the safety keys are out and then set up their rockets. At this time one of the counselors calls for five and six to move from the spectator section to the preparation area.

After the camper has recovered his/her rocket, the expended engine is removed and thrown in the trash container. Then the camper returns to the spectator area for the remainder of the launch.

If the parachute does not open and becomes damaged or the rocket somehow becomes damaged, it should be taken to the construction building for repairs in the next A.M. period. Otherwise, the rockets may be stored at the construction area until Wednesday P.M. launch. The rockets could be stored with the rest of the materials, but it is suggested that they be put into boxes to avoid breakage.

After the launch has been completed, the launch pad should be dismantled and stored. The electrical ignition systems should be disconnected and stored. The micro-clips should be thoroughly sanded after each launch.

CHAPTER VI

WEDNESDAY, THURSDAY, AND FRIDAY

A.M. Session - Repairs

This time period may be used to repair damage to rockets. The cause of any damage should always be determined and corrected. Once the cause is determined, practice the skill needed (parachute packing, recovery wadding, etc.) so that the camper understands how to achieve a launch without problems.

Since every rocket won’t need repairs, an alternate activity should be planned for this time to occupy those campers who do not need repairs.

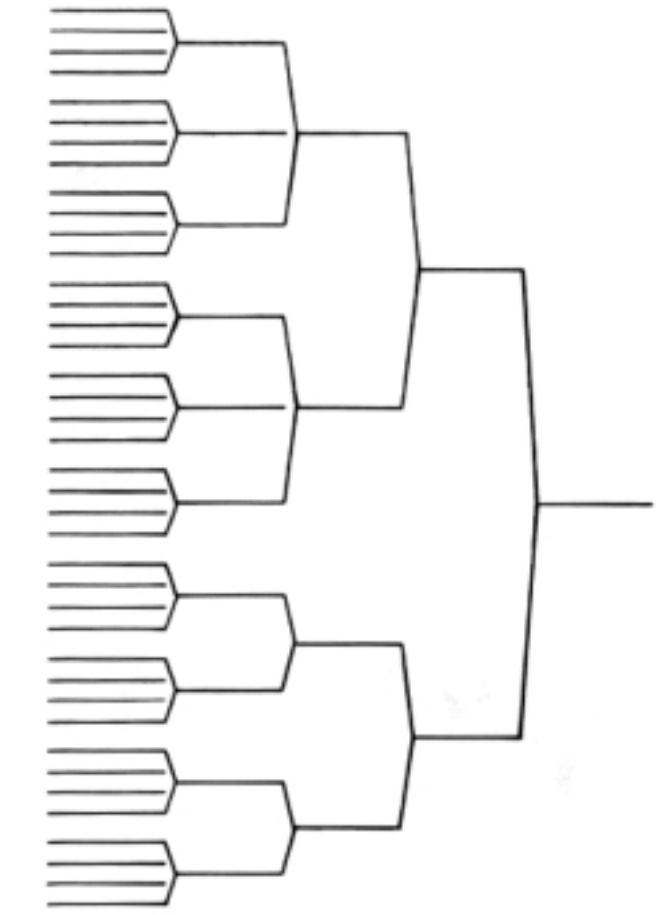
If possible, order a few extra Level One rockets for campers who might wish to buy an extra. Those campers who wish to build another rocket might use this time period. This would be a good alternate activity to the repair session.

Another alternative would be that the campers might visit the crafts area of the camp to work on other projects.

P.M. Rocket Launches

Engine size for the launch may be determined at launch time. Even in higher winds the A8-3 may be used, although it may be wise to use masking tape to tape the shroud lines together part of the way down so the parachute will not open fully. The rocket lands closer to the pad due to less carrying by the wind and returns faster to earth when the parachute is only partially open. This same technique may be used in mild winds with the B6-4 or C6-5 engines, insuring better probability of recovery. If the leader launches his Alpha® with each of these three engines before the camp begins, he should have a good idea of what engine to use for each wind condition.

Possible contests which may be conducted are Altitude (why not do this one Thursday night with one counselor operating the Altitrak™ and someone recording flight numbers and altitudes?), spot landing (distances the rockets land away from a "target" stake measured in meters, yards, or feet), and parachute duration (testing the camper's skill in packing the parachute and wadding so that they will eject and open efficiently and quickly



as well as testing rocket performance). Other contests may be conducted with awards and/or recognition given at the traditional camp closing ceremony to the winners of these contests. A good activity for Friday night launch is a short version of the Drag Race contest. The drag race is set up as an elimination tournament. The winners move on and the losers return to the spectator area. As long as the camper keeps winning, he keeps launching. The leader, after each rocket is set to launch, yells "GO"! The first rocket off the pad is the winner and he moves into the next bracket to compete again. This event encourages correct insertion of the igniter into the rocket, sanding clips before launch, etc. Any rocket which mis-fires is sent to another area where campers are permitted to reload an engine and try again to launch their rocket. Once they have an igniter failure they are out of the competition, but they still are permitted to have their launch for the evening. A sample of the drag race tournament is shown.

Final Closing Ceremony (Friday Night)

The final ceremony of camp on Friday night is most often held in a campfire setting. This ceremony may be used, in addition to the above contest recognitions, as an opportunity to award the campers for their successful completion of the model rocketry camp program.

Other awards might be given at this time too. These should be tailored to the campers and events that have happened during the week. For example, during one particular week, one camper managed to come up with a broken fin every night of the launching. He received an award of a fin that was carefully cut onto about five pieces, glued onto the plaque, labeled "Broken Fin Award" with the camper's name below.

If any of the counselors have tried to launch and failed, everyone can get a good laugh when he receives the "Fizzle Award" at the campfire.

A few of this type of awards can allow for a little lighter mood at the closing ceremony, adding much to the program.

CHAPTER VII

SATURDAY MORNING

A group of campers should go to the launch site to act as the clean up crew. They should police the area and make sure that no wadding, papers, expended engines or other trash is left in the area. They may also search for any stray rockets that were not recovered during the evening launches.

Saturday morning is also an excellent opportunity to clear out any expendable items which might otherwise have to be stored over the winter. The campers will very readily buy materials that are left over. Set up a small store area with posted prices. The store for model rocketry supplies may be run during the entire camp. The camp could possibly offer discount prices on the materials. This way the camper will get a bargain and the camp will not lose money on supplies that remain. The children under the age of 12 should be permitted to buy engines only when accompanied by a parent so that safety rules can be discussed and so that parents can supervise their children in any launches they make.

CHAPTER VIII

POST-CAMP DUTIES

The non-expandable materials should be packed in the range boxes and the boxes should be labeled on the outside as to what is stored in each. Make sure these are stored in a dry location. Otherwise the connections of the electrical ignition systems may corrode and the launch rods and blast deflector plates may rust. In areas where the climate is humid, a thin film of lightweight machine oil can be spread on all launch rods, blast deflector plates, etc., to protect them against rust during storage.

Keep a list of the campers' names and addresses on file. This is necessary for knowing how many second year campers will be involved in the second year of the program. The second year rocket will be a different, more difficult rocket, and Alpha®s will be ordered again for the first year campers.

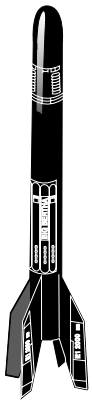
CHAPTER IX

FUTURE YEARS OF THE ROCKET PROGRAM

Second Year of the Program

There will be two levels of experience in the camp in the second year of the rocket program, and the program needs to be expanded to account for this. The theme for first year campers is still simplicity. The first year campers will still build an Alpha® or Alpha III®. The theme for the second year campers might be that of improving construction skills — making a model that is very attractive and works well.

The suggested rocket for this objective is Big Bertha®. This two-foot model is not only good looking, but is also a spectacular model to launch. The same listing should be ordered for the camp as shown in Chapter 2, with the addition of the following:



1. Big Bertha® Rockets
The Big Bertha® (EST 1948) is rated at Skill Level 2 (Beta). It has a cardboard body tube, a plastic nose cone, die-cut balsa fins and decals.

2. Sanding Sealer
Used for smooth surface to paint. Must be used with brush and thoroughly sanded after each application. (Also needed for Alpha® rocket, but not for Alpha III®.) Purchase one bottle for each three rockets at your local hobby store.

3. Paint Brushes
Necessary for applying sanding sealer to fin surfaces of Big Bertha® and Alpha®. May be secured from any department or hobby store.

4. Sanding Sealer Thinner
Needed for cleaning brushes after use of sanding sealer. Regular paint thinner will NOT remove the sanding sealer from the brush.

5. Spray Enamel
Black color available from hobby or discount stores. One can of paint will cover three - four rockets, if used sparingly. (It might be wise to show campers how to paint their rockets or else they might use one can on each rocket and make a mess of their model).

6. Enamel Thinner
Used for removing paint (enamel) from skin, clothing, etc. May be purchased at any department, discount or hardware store.

7. Engines
B6-2 (EST 1605) or C6-5 (EST 1614) engines must be ordered specially for the Big Bertha®.

8. Extra Rockets (optional)
Campers generally have come to camp with the idea of doing a lot of rocketry. At a discount, many campers would appreciate getting an extra rocket. They might purchase this rocket on Wednesday and have time to work on it during the remainder of the week in early time periods of the day. These could be various inexpensive rockets of Skill Levels I, II and III as listed in the Estes catalog.

The schedule for the week's events should be similar to that which was presented in the First Year Implementation Section. The schedule for the week is outlined below and discussed in detail in the earlier chapters of this booklet.

Sunday - Orientation and Demonstration Launch
Monday - A.M. - P.M. Construction
Tuesday - A.M. Construction/P.M. Launch
Wednesday - Launch (higher range engines, weather permitting)
Thursday - Contest Launch (Spot Landing and Altitude Duration)
Friday - Drag Race Contest

The daily schedule should be somewhat modified to allow for two different groups of campers working on different rockets. The following schedule is suggested, but the size of each group will determine the final schedule, as will the daily schedule for your camp.

Time	Activity
7:00	Rise
8:00	Breakfast
9:30	Camp Activity

11:00 Rocket Session
- Mon.: Big Bertha® Group (activity for Alpha® group)
- Tues.: Construction (Alpha® & Big Bertha® Groups)
- Wed.- Fri.: Rocket repairs, construct extra rocket; alternate activity.

12:30 Lunch

1:30 Rocketry Session
- Mon.: Alpha® Group (activity for Big Bertha® Group)
- Tues.- Fri.: Class sessions for both groups

2:30 Camp Activities (swim, boat, fish, hike, etc.)

6:00 Dinner

7:00 Rocketry
- Mon.: Rocket painting (Alpha® & Big Bertha® Groups)
- Tues.- Fri.: Evening Launches

8:30 Evening Program (campfire, etc.)

10:15 Lights out

On Tuesday, both groups should complete their rockets in the morning period. The afternoon period may then be used for pre-launch briefing (as described in Chapter 5). After Tuesday, the morning sessions are used for repair sessions (and construction), and the afternoon sessions may be used as theory sessions. The Wednesday through Friday sessions may be used as follow ups for the theory sessions:

Time	**Activity**
1:30	Tues.: Pre-launch briefing session
	Wed.: Electrical theory: How does the launch control system work? The electrical theory session may be done using the "Model Rocket Launch Systems" manual (EST #2811) leading to suggestions as to how the campers might construct their own launch pads and electrical systems.
1:30	Thurs.: Contest planning: Plan contests for Thursday and Friday night launches. On Thursday, the contests may be the Spot Landing, Altitude and Parachute Duration. Campers adjust launch pad to wind conditions, pack parachutes, etc. in order to have their rocket go the highest, stay up longest and land the closest. Points for each of these events are added together to determine a winner. Friday's contest might be the Drag Race, which is outlined in Chapter 6.
1:30	Fri.: Evaluation session: Ask campers to share what they did and did not like and ask for suggestions on how to improve the future years of the program.

If there is a large group of campers it might be advisable to set up the rockets for launch during these afternoon sessions. Pass out engines, igniters and plugs and get them loaded into the rockets. The wadding insertion and parachute packing should be done later at the launch site, immediately before the launch. Taking care of the engine earlier in the day should save time at the launch site if only an hour or so of daylight is present for launch.

Have the campers check their igniters in the following way. If the igniter is placed into the engine correctly and secured with an igniter plug, the camper should be able, by holding onto the igniter leads, support the weight of the engine and the rocket. The campers should put the plug into the engine carefully so that this is possible. If the weight cannot be supported in this way, then probably the rocket would have "fizzled" at the launch pad. The campers should also be advised to "put the igniter into the engine before the engine is placed into the rocket."

At the close of the second year, the names and addresses should be recorded so the percentage of return campers may be determined in order to place an order for the third season.

Third Year of the Rocket Program

The third year (and subsequent years) of the rocket program for grades 3 - 5 may be run in one of two different ways:

1. Common theme for returning campers. That is to say that the campers are divided into two groups: Beginner and Advanced. The beginners group would build the Alpha® or Alpha III® rocket and the advanced group theme may be one of the following:
   A. Scale models (such as Bullpup 12D™)
   B. Staged models (such as Mongoose™ or Comanche 3™)
   C. Boost Gliders (such as TransWing™ Super Glider)

If two groups are preferred, the same scheduling, ordering, etc. may be used as mentioned previously in this chapter under second year of program.

2. Sequential organization. If a sequence is preferred, it may be set up in the following way:
   Group 1: Beginners (Alpha® or Alpha III®)
   Group 2: Second year campers (Big Bertha®)
   Group 3: Third year campers (one of the A, B or C themes mentioned above)

Separate periods may be set up for the campers in groups 1 and 2, with group 3 attending both periods in order to complete their more difficult rocket. Once they have finished their own rockets,they may help groups 1 and 2 with their rockets.

Any competitions that are run during this week should have separate recognition and separate events for the different types of rockets involved.

NOTE: Chapter 9 is a supplement to previous chapters. For most effective usage in camp, Chapters 3 thorough 6 should be used as a basis upon which to run the camp with Chapter 9 adding information on second and third year programming.

CHAPTER X
JUNIOR HIGH CAMPS

(Grades 6, 7 and 8)

The junior high or middle school age group lends itself to a great many problems for implementation, as well as a great many new opportunities. The problems come with the great range of ability in rocketry, as well as the skill level which the campers have already achieved on their own. Some of the campers come to camp with a high degree of skill and might find a Level I rocket much too easy, even if it is their first time at camp. This wide range of experience places many campers between Skill Levels 1 and 5. This gives rise to the second and third problems. The second is "How can I order for this camp?". One suggestion might be to check the enrollment figure for the camp. For example, for a camp of 20 campers, 10 Skill Level 1 rockets (varied, such as Viking™ or Alpha®), 10 Skill Level 2 rockets (Big Bertha®), 10 Skill Level 3 rockets (such as Mongoose™ and TransWing™ Super Glider and 5 Skill Level 4 rockets (such as SR-71 Blackbird™ or Comanche-3™) should be ordered to accommodate the needs of the camp. It would be hoped that the extra supplies and rockets could be sold at the end of the week. An alternative to this would be to send an inquiry sheet to each camper finding out whether or not the camper is experienced in model rocketry, and if so, to what degree. The inventory might simply ask what Estes rockets the camper has made. The leader can make a judgement based on Skill Levels as listed in the Estes Catalog. Ask specific questions, as some youngsters tend to overrate their skills. This would have to be done well ahead of the camp period to allow time to order supplies and receive them at the camp.

The third problem is minor. It will possibly take extra supervision in construction to supervise and help a number of campers working on their own building different rockets at the same time.

The opportunities are many with the junior high group because older campers are capable of making rockets with clusters of engines, more than one stage, boost gliders, etc. This makes the launches much more interesting as variety of model types is much greater.

A suggested schedule for the junior high camp in model rocketry might be set up as follows:

Time	**Activity**
7:00	Rise
8:00	Breakfast
9:00	Morning activities (should include one to two hours in model rocketry, especially earlier the week).
12:30	Lunch
1:00	Afternoon Activities (should include one to two hours of rocketry, especially early in the week).
6:00	Dinner
7:00	Evening activities (possibly Monday night construction and launches later in the week).

With an older group, it might be advisable for the campers to help in planning their own weekday schedule. They would better know how much time they want to spend on rocket activities and how much on other activities.

It is probable that the rocket will take longer to complete, so it may be necessary to schedule rocket construction through Wednesday afternoon and launches Wednesday evening, Thursday and Friday. This is not to say that they couldn't launch twice on Thursday or Friday.

After the rocket construction is completed, the leader may wish to sell off remaining stock to the campers to work on during the Thursday and Friday periods of construction and repair. This might help to remedy the over-ordering problem.

NOTE: All of the pertinent information on setting up a rocket camp is included earlier in this manual. This chapter is supplemental to Chapters 3 - 6 and should be used in conjunction with them and not alone.

CHAPTER XI

PRIVATE CAMPS AND LONG-TERM CAMPS

(Full Summer or Extended Time Period)

In a private camp, the campers usually are present for more than one week. In this case, model rocketry can be run as an interest group or club in which those campers who are interested may participate by choice. The same basic set up for the rocket launches may be used as described earlier in this manual, along with the ordering and construction procedures. This model rocketry program ordering should be done for 50 campers as per instructions found in the second chapter of this manual.

This writer has spent part of his summers at Camp Akiba, located in the Pocono Mountain region of eastern Pennsylvania. It is assumed that with minor differences, most private camps follow the same basic type of scheduling. Once a week, the campers have a day in which they can choose their own activities. Model Rocketry is included as a possible choice. Once the campers have begun constructing their rockets, free time periods may be offered to allow campers to continue and finish the construction. After a week or two, the campers probably will have finished their rockets on this basis. Then they will be ready for their first launch. The beauty of this type of camp set up is that the campers show up during their activity periods and these smaller groups allow for more individual attention in setting up their rockets and engines and in preparation for launch. Also, less help is needed both at the construction site and at the launch pad. The camp will determine the schedule for each day. Each week the leader should try to accomplish the following.

Week 1: Demonstration launch and promotion of rocketry program.

Week 2: First activity period - Assembly of Skill Level 1 model rockets (Alpha® or Alpha III®). Free time periods may be used for additional construction time during the week.

Week 3: Final construction period, painting and decal work in free time previous to the free activity period day. By this time the rockets should be completed and an inventory of the campers should be made to decide which of the campers wish to continue in the program. Also, a "waiting list" of new campers who wish to begin the program should be included in this inventory. The order for those who have completed an Alpha® should be a Skill Level 2 rocket such as Big Bertha® and those on the "waiting list" should have Alphas® or Alpha IIIs® ordered for them. Be sure sufficient quantities of the appropriate engines are on hand. Also inventory supplies for construction so that items which are needed for the next construction will be on hand. The order form should be mailed or faxed to Estes as soon as possible so the rockets will be received promptly to avoid delay of the programs.

Week 4: This should include a launch for the second time. The campers by this time should understand the launch procedures so that each can now competently pack his parachute, engine and igniter. He/she will be relatively confident of a flawless launch in future weeks.

Week 5: By this time the new order should have arrived. The fifth week should be spent in construction of the Big Bertha® and Alpha®. Working in activity and free time periods, the campers should complete their rockets for launch in the following week. The last order for the year should be sent out during the fifth week. The Big Bertha® group should have an order for a Skill Level 3 rocket (such as Comanche-3™ or SR-71 Blackbird™). Those who built an Alpha® in Week 3 would order a Big Bertha® and those who are on the "waiting list" should begin with the Alpha®.

Week 6: Launch of Big Bertha® and Alpha®. Keep in mind that the Big Bertha® needs at least a B engine with the last number 2 time delay.

Week 7: By this time the new order should have arrived and rocket construction can be done in free time and activity periods.

Week 8: Activity period launch and possible evening activity - "Launch Spectacular" demonstration for the rest of the camp.

Usually during the middle of the camping experience there is a visiting day provided for the parents of the campers. The campers enjoy showing off their model rocketry skills so the schedule for the day might include a short rocketry demonstration. Any camper who may wish to launch his rocket is permitted to do so. Afterwards, parents are invited to go to the construction area for a display of rockets and answering of questions.

NOTE: Methods for launching are included in Chapters 3 - 6 of this manual. It is suggested that this chapter be read in conjunction with the mentioned chapters.

CHAPTER XII

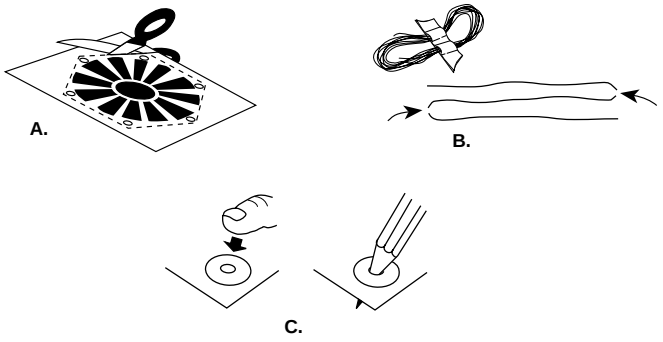
ROCKET CONSTRUCTION AND REPAIR HINTS

Parachutes

The following parachute construction method will avoid many problems and make repairs much simpler.

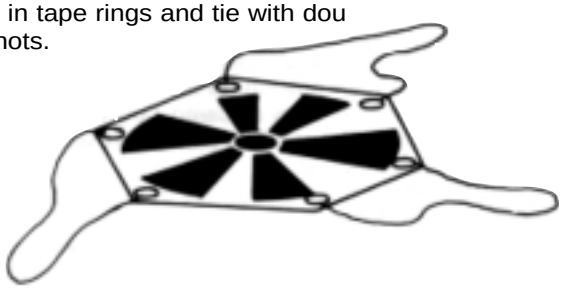
Tape Rings - These rings eliminate most problems where the shroud line comes loose from the parachute.

A. Cut out parachute on printed edge lines.
B. Remove tape from shroud lines, fold and cut into three equal lengths.
C. Attach tape rings to top of parachute and press firmly into place. Punch hole through the parachute material with the point of a sharp pencil.

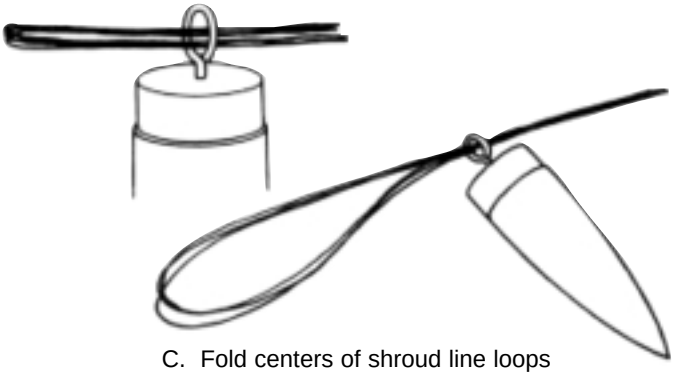


Parachute Assembly

A. Attach shroud lines to parachute as shown. Pass shroud lines trhough holes in tape rings and tie with dou ble knots.



B. Find center of each of the three shroud line loops and bring these points together.



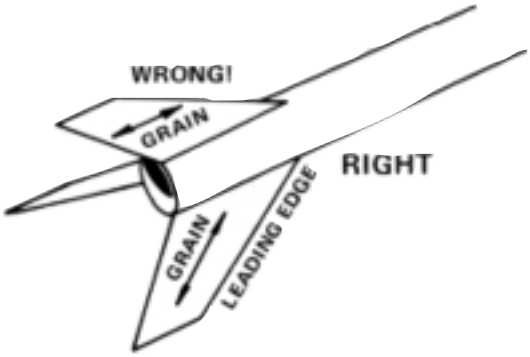
C. Fold centers of shroud line loops together and put through for a distance of four to five inches.

D. Open the loops again and put the nose cone through the loop.

E. Then pull tight. This knot may easily be loosened for shroud line and parachute repair.

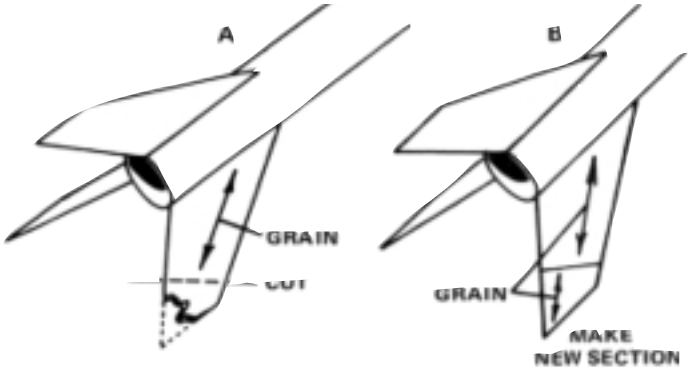
Fin Cutting

Supervise campers to make sure that the fin grain is parallel to the leading edge of the fin. This will eliminate most fin breakage repairs later.



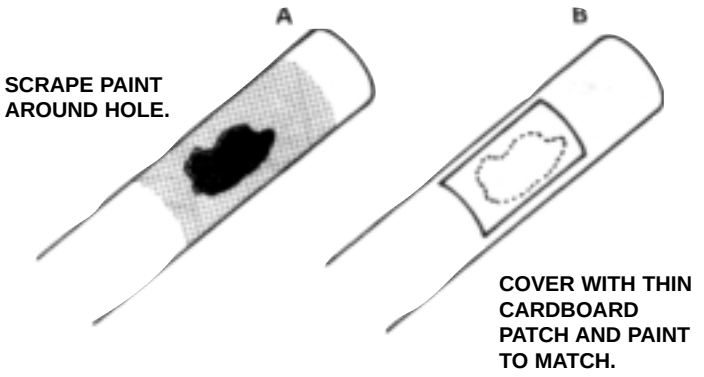
Broken Fin Repair

A. Cut off damaged end to make a straight edge.
B. Cut out section from balsa sheet of proper size to replace damaged section.
C. Glue repair section onto original fin. After original glue is dry, fill crack with glue filler which overlaps both edges to reinforce joint. Seal repaired section with sanding sealer. Paint to match rest of fin.

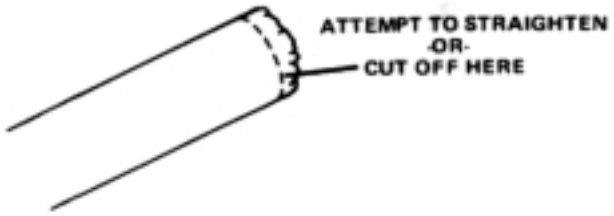


Body Tube Repairs

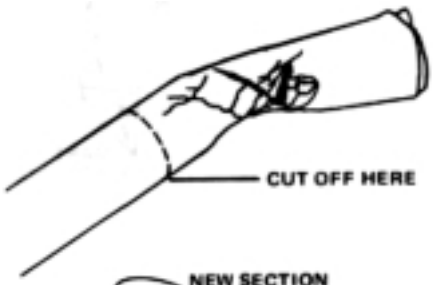
1. Hole in body tube
   A. Scrape paint from area around hole.
   B. Cover hole with cardboard patch. Glue patch into place.
   C. Paint patch with matching color. Add decals, if available to cover patch.

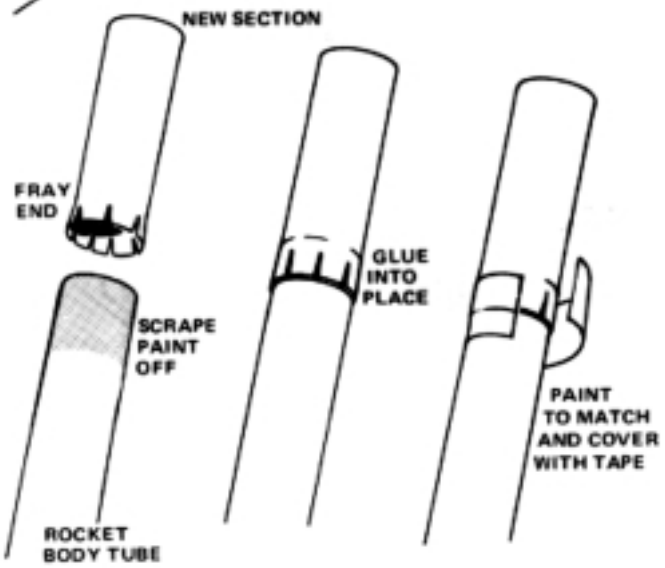


2. Frayed or bent end of body tube.
   A. Attempt to straighten if bent.
   B. If end is frayed or bent so much that the top 1/2 inch or less of the tube is not repairable, cut off the top end of the tube. Do the “spin test” (outlined in “Model Rocketry Technical Manual”) to make sure that the rocket is still stable. If more than this is cut off, it probably would cause the rocket to become unbalanced and therefore unstable. If damage is more than 1/2 inch, proceed to section 3, serious tube damage.



3. Serious tube damage (more than 1/2 inch irreparable). This usually occurs when a rocket has crashed.
   A. Attempt to straighten and reinforce with tape.
   B. If this is not possible, cut off bad section and splice on a new section to match as follows:
      1) Cut new tube section 1/2 inch longer than section that you cut off.
      2) Scrape paint from cut end of rocket body tube for about 1 inch from the cut.
      3) Fray end of new section by cutting slits 1/2 inch into the end.
      4) Glue new section into place with new section sliding over old section. Use rubber bands to hold in place until glue sets.
      5) Paint to match existing paint.
      6) Use plastic black tape strip (electrical tape) to reinforce seam (and to cover the repair job).





CHAPTER XIII

BACKWORD

Since a note at the beginning is called a “Forward”, we’ll call a note at the end a “backword”.

This guide contains procedures that have been used successfully at Camp Lutherlyn for groups of 45 to 80 campers each year.

When Lutherlyn first got the idea of model rocket camping, I was asked to lead and organize it even though I had no previous experience in rocketry. I have, however, worked in camping for over 18 years and have an idea of what this age group likes. My preparation was the “learn-by-doing” method mentioned earlier. These two factors helped me lead what I considered to be an enjoyable program.

I am still not an expert in the field of model rocketry and I doubt if I ever will be. But I believe that this is not necessary. A good background can be obtained in a very short time. (When the first camp started, I had made only a total of three launches in my life!)

At any rate, the main purpose of this guide is to give a few hints as to how one might organize a model rocket camp. If I have given a few ideas or have saved a few problems, I consider my time and effort well worth while.

Richard E. Freed