Estes Industries Technical Report No. TR-8

Model Rocketry Study Guide

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INTRODUCTION

To properly master the field of model rocketry and obtain the most benefit from it an orderly course of study is necessary. This report is an outline of the recommended steps to follow in model rocketry activities. Following such a program not only enhances the value of the rocketeer's activities, but will also make them more enjoyable.

DEVELOP THE BASIC SKILLS

1. Study the Astron Rocket Society Safety Code. Learn the things to do to keep your rocket activities safe and enjoyable.

2. Obtain the basic modeling tools. These include a good modeling knife or single edge razor blade, a ruler, sandpaper, a ball point pen, scissors, white glue, paint, scrap balsa, etc.

3. Practice the principal modeling techniques until they have been mastered. Learn the proper way to hold and cut with a knife, measure with a ruler, glue pieces together, sand rough surfaces and paint rockets.

4. Obtain a model rocket kit employing parachute recovery. Assemble the model carefully, following the kit instructions exactly and using the tools and knowledge gained in previous studies. Launch the rocket with the engine recommended for it by the manufacturer. Use your group's or your own electrical launcher. Practice preparing the rocket for flight as directed in the kit instructions.

5. Study the theory of electrical ignition, including Ohm's law and the generation of electrical energy by chemical reaction.

6. Study the sections of the engine manufacturer's catalog which deal with rocket engine construction and the rocket engine selection chart to learn why the different engines have specific jobs to do and can not be substituted indiscriminately. Learn the principles of rocket engine operation and Newton's three laws of motion.

APPLY YOUR SKILLS

1. Study Technical Report TR-1. Apply the principles outlined in it to designing and building your own single stage model rocket. Test the stability of the rocket following the methods suggested in TR-1. Test fly the model.

2. Investigate the probable effects of too much stability on a rocket. Determine what effect wind will have on the over-stabilized rocket.

ADVANCE TO MULTI-STAGING

1. Study Technical Report TR-2 on multi-staging. Learn the techniques used to obtain reliable stage-to-stage ignition and stage separation. Learn which engines are suitable for the different stages of a multi-stage vehicle.

2. Build and fly a two stage rocket kit such as the Astron Apogee. Follow the assembly and flight instructions carefully.

3. Design and build a multi-stage rocket of your own, being careful to follow the information learned in TR-1 and TR-2. Test fly the model.

ADD MATH TO YOUR SKILLS

1. Study Technical Report TR-3 on altitude tracking. Construct a tracker either from a kit or from home supplies. Study its operation and the associated math. Launch several rockets and use this system to determine the heights they reached.

2. Obtain a slide rule. Learn to use it for multiplying, dividing and finding proportions. Practice calculating rocket altitudes with the slide rule.

3. Study the techniques used in scaling a full size rocket down to model size. Build a scale model using plans and data taken directly from information on large rockets. Paint the model exactly to scale. Check it for stability before launching.

STEP UP TO BOOST-GLIDERS

1. Assemble a rear engine boost-glider such as the Astron Space Plane. Study Technical Report TR-4 on boost-glider construction and theory. Trim out the glider and fly it.

2. Design, build and test your own boost-glider using the methods and theories you have learned.

3. Build and fly a forward engine boost-glider such as the Astron Falcon or the Eagle. Study Technical Report TR-7 to learn the theories involved in forward engine boost-glider operation.

4. Design and build your own front engine boost-glider using the methods and principles you have learned.

PRACTICE SCIENTIFIC RESEARCH

1. Build and launch large, light weight parachute rockets with 24" to 50" 'chutes. Study rocket descent speeds, air currents, winds and thermals. Study the effects of other weather and atmosphere conditions on rocket flight.

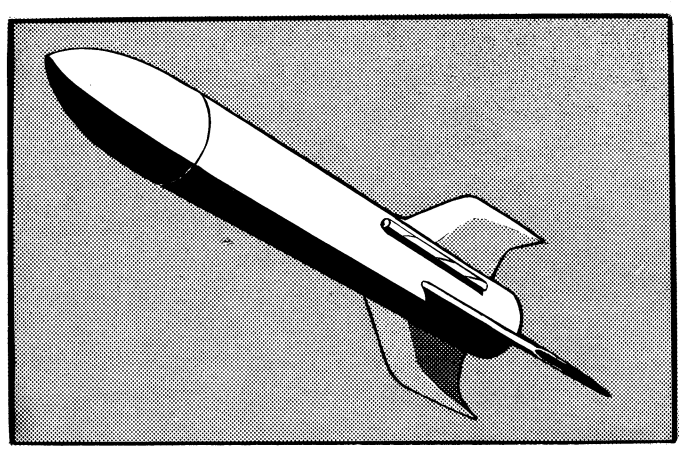
2. Conduct studies in the mathematics of rocket flight, including acceleration, trajectory, drag, etc. Construct a static test stand and learn to interpret test data on rocket engines. Make altitude calculations for theoretical, no drag conditions. Study harmonic motion and the need for damping in static test measurements.

3. Study Technical Report TR-6 on cluster rocket techniques. Build and fly a cluster model. Use the rocket for large payload experiments.

4. Using a rocket of your choice, launch a fresh egg and recover it undamaged to develop skill in payload handling. Then, if desired, advance to launching experimental animals. Launch animals only when a scientific study is involved and take the greatest care for the animal's safety, comfort and well being.

5. Continue payload studies by launching instruments such as cameras and transmitters and learning the fundamentals of other fields associated with rocket instrumentation. Launch a camera rocket and study the interpretation of aerial photographs.

From here the rocketeer can advance in almost any direction, conducting his experiments in the field of research which interests him the most. Many advanced model rocketeers will want to conduct full-fledged research and development programs into previously unexplored areas of rocket science or add to the knowledge in fields such as aerodynamics.



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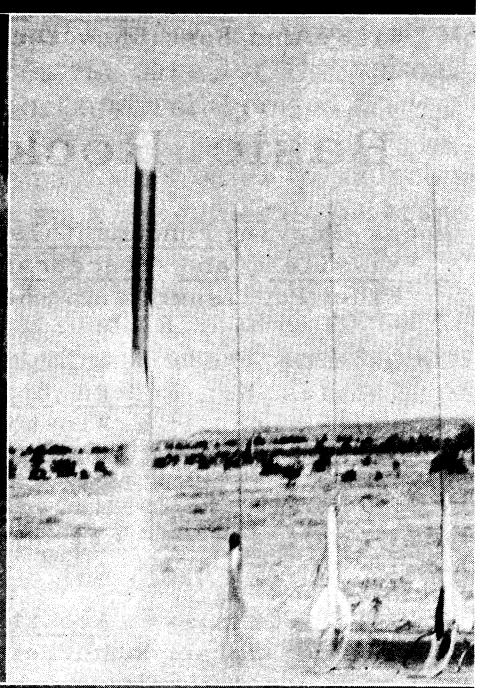

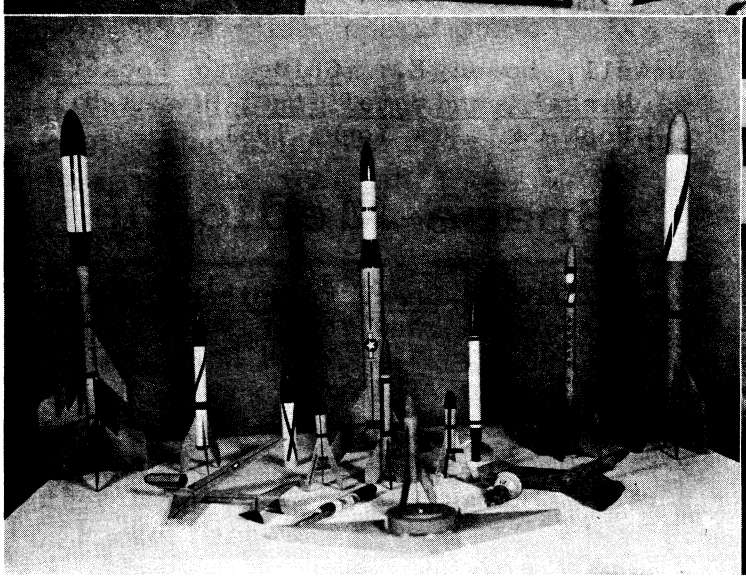

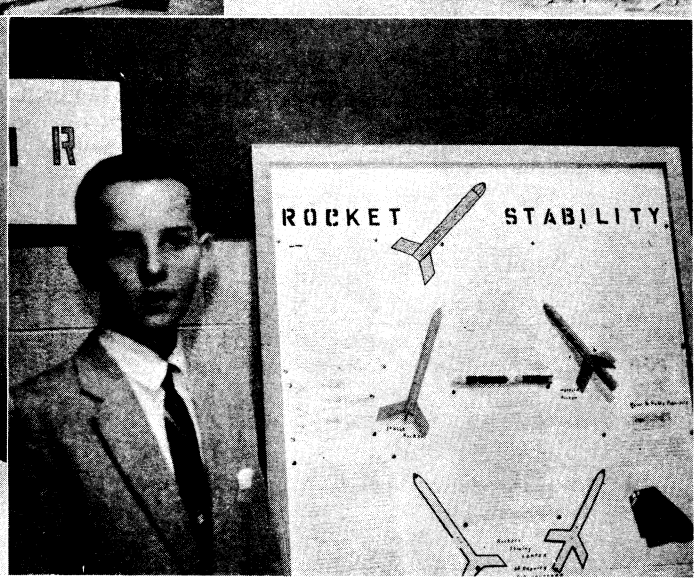
ROCKET STABILITY