MODEL ROCKET NEWS

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Schmidt Project Named Best In Science Fair Contest

"Reducing Drag on an Astrodynamic Vehicle," a science fair project by Roy Schmidt of Denham Springs, La., received first place honors in the recent Science Fair Contest sponsored by Estes Industries. Roy's project was a study of the effect of paint on rocket performance. In the project he measured the performance of a rocket before and after painting, and discovered that the rocket performed considerably better after painting, even though the paint increased its weight. For a picture of Roy's project, see V3, N3 of the Model Rocket News.

Second place in the contest went to "Model Rocketry and the Effects of Acceleration on Mice" by Terry Krumm of Dayton, Ohio. Terry's objects, as he states at the beginning of his report, were to (1) build and fly model rockets capable of lifting payloads in excess of three

This display by Terry Krumm is especially well done, and shows all equipment used in his project.

ounces and (2) to use these rockets to study the effects of acceleration on trained mice. Experimentation in the project included the construction and use of a camera carrying rocket, training a mouse to run a maze, testing the mouse in a home-made centrifuge, and finally testing the mo[illegible] rocket flight.

Continued page 2

Developing a Winning Science Fair Project

What makes a winning science fair project? What can a person do to improve his chances of winning?

A survey of some of the projects entered in Estes Industries' Science Fair Contest shows many of the features which a winning project should have. While it is impossible to predict the choice of the judges, a properly conducted science fair project in almost any of the areas related to model rocketry should have an excellent chance in any fair.

There are three parts to any acceptable science fair project; research, report, and display. A good project has to be good in all three areas.

RESEARCH

The first step in any project is to choose a subject. While this may sound obvious, many people fail here and as a result fail in their projects. Some of the better subjects which have been used include the application of mathematics and aerodynamics to the development of a high performance model rocket, a study of model rockets and the effects of acceleration on mice, a study of the effect of paint in reducing drag, a study of the effect of fin shape on rocket performance, and research on the design requirements of boost gliders.

One of the best projects on basic model rocketry, this display by Bill Bennet shows clearly the construction of typical models.

Continued page 2

Developing - - Continued

In choosing a subject the rocketeer should consider his own interests and capabilities as well as the possibilities for developing an interesting project on the subject. The sooner the subject is chosen, of course, the sooner work can begin on the project, allowing more work to be done, with the result that the rocketeer has a project of which he can really be proud.

With the choice of a subject comes the choice of the objective of the project. The objective may often be the same as the subject, such as "Determining the Effect of Rocket Weight on Rocket Performance," or the one may proceed from the other as in "A Study of Augmenter Principles," with the objective of determining how much, if any, benefit is derived from the use of a jet pump on a model rocket.

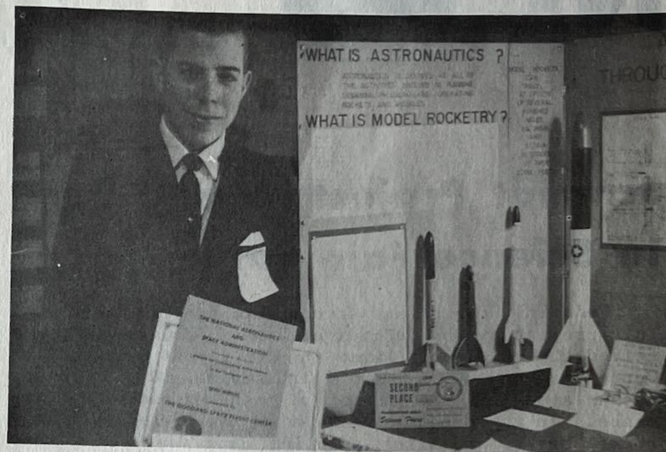
When the objective of the project has been determined it is time to plan the experimentation and gathering of data. The experimentation may consist of launching a rocket several times before painting and then several times after painting, recording the altitude for each flight, as in Roy Schmidt's project on reducing drag, or it may consist of several different experiments, each based on the preceding one.

The nature of the experiments will be determined by the subject which is being studied. It is necessary to sit down and decide what information is needed and how it may be obtained. These experiments must be conducted in such a manner as to determine the truth, not to support a previously formed opinion.

In any project actual research should be conducted if the work is to have any merit at all. Part of the purpose of the science fair is to determine who can do the best job of performing this research. All experiments must be performed carefully; accuracy is very important. Enough tests must be performed to provide reliable data. Everything that can be photographed should be. After the tests have been made the results must be checked carefully to insure their reliability.

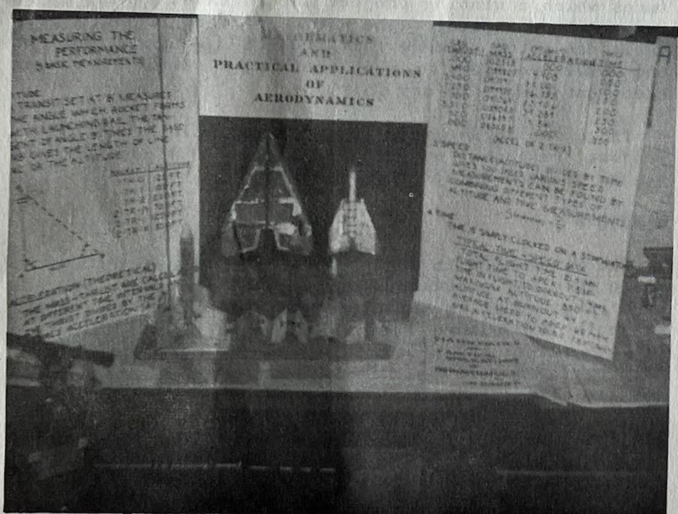
After all data has been collected and a study of all available printed material relating to the subject has been completed, it is time to compile the results. Photographs are developed, graphs and charts are drawn, and all observations are written down in logical order. When all this has been done it is time to draw some preliminary conclusions.

Once these preliminary conclusions have been formed some more tests which will check the validity of the conclusions should be devised and carried out. This



"Astronautics Through Model Rocketry," by Douglas Frost, featuring live payload and camera launchings, was concerned with the use of model rockets in studying astronautics.

Contest - - Continued



Wayne Sumner's display also shows equipment used in his project, and emphasizes the mathematical aspect of the project.

A project by Wayne Sumner of Albert Lea, Minnesota, entitled "Mathematics and Practical Applications of Aerodynamics" was awarded third place. This project consisted of a series of experiments in the use of mathematics and aerodynamic theory to obtain the best performance from a general type of model rocket.

The contest judges commented that all three projects showed considerable thought and care in their preparation, and were outstanding in their various applications of the scientific method. The judges also stated that it was especially hard to pick winners in this contest because there were so many good projects entered, and added that almost all entries deserved the highest praise.

THE MODEL ROCKET NEWS

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The Model Rocket News is published approximately six times annually by Estes Industries, Inc., Penrose, Colorado. It is distributed free of charge to all the company's mail order customers from whom a substantial order has been received within a period of one year. The Model Rocket News is distributed for the purpose of advertising and promoting a safe form of youth rocketry, and for informing customers of new products and services available from Estes Industries. Rocketeers can contribute in several ways towards the publication of the Model Rocket News:

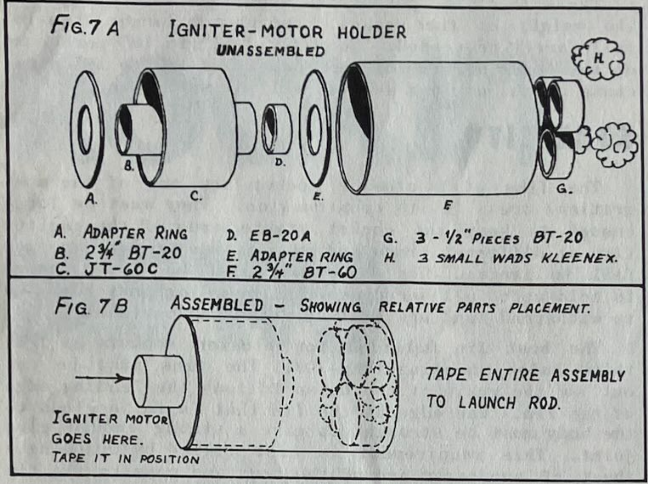
(1) Write to Estes Industries concerning things you and your club are doing in this field which might be of interest to others.

(2) Continue to support the company's development program by purchasing rocket supplies from Estes Industries, as it is only through this support that free services such as the Model Rocket News, rocket plans, etc., can be made available. This support also enables the company to develop new rocket kits, engines, etc.

(3) Write to the company about their products, and tell what you like, what you don't like, new ideas, suggestions, etc. Every letter will be read carefully, and every effort will be made to give a prompt, personal reply.

(4) Participate in the Writer's Program (described in Volume 2, No. 3 of this publication). Not every article submitted will be accepted, but it is through trying that one gains skill, and those which are accepted contribute greatly to the enjoyment of model rocketry by other persons also.

engines can be used in the rocket itself, since the nozzles of other engines are too small to give reliable ignition. It is also important to be sure that the igniter motor and its holder are securely fastened to the launcher.



TYPES OF ENGINES

Since there are so many different engines available to the modeler, the selection of the best one to use in his cluster rocket can become difficult. If maximum performance is desired from a single stage rocket and the Jetex ignition system is used, the proper engine type will generally be the B.8-4. If a 3 engine cluster rocket weighs under 4.5 ounces with engines in place, B.8-6 engines may be used.

To determine whether a particular set of engines is satisfactory for use in your rocket, use the Rocket Engine Selection Chart in the Estes catalog. Maximum thrust and total impulse for one engine are multiplied by the number of engines to provide the figures for the cluster. The same procedure should be followed with the maximum rocket weights.

The use of Series II engines gives certain advantages. The high takeoff acceleration stabilizes the rocket quickly, generally resulting in a straighter and higher flight than is obtained with Series I engines. Payload capability is also increased considerably.

LAUNCHERS

Because of their greater weight and sometimes imbalanced thrust, cluster rockets put considerably more strain on the launcher than do smaller rockets. The standard Electro-Launch is recommended for rockets weighing up to 6 ounces using either the Jetex or the igniter motor systems for ignition. However if the base of the launcher is weighted down with a pair of bricks and the two-piece rod is soldered together, rockets weighing up to 9 ounces may be launched. If, in addition, a 48" length of 1/8" or larger piano wire or other steel rod is substituted for the two piece rod, rockets weighing up to 16 ounces may be launched safely.

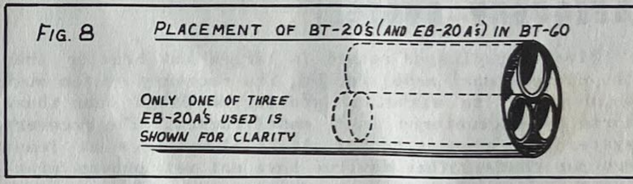
Generally a rod longer and thicker than that needed for single engine rockets is preferable for launching cluster rockets. The thicker rod is less apt to bend or whip as the rocket ascends, and the longer rod will guide the rocket farther, giving the rocket higher speed and greater stability when it leaves the rod. Rockets launched from heavier and longer rods are less apt to veer off course due to imbalanced thrust and will weathercock less due to their greater airspeed when they leave the rod.

ENGINE RETAINING

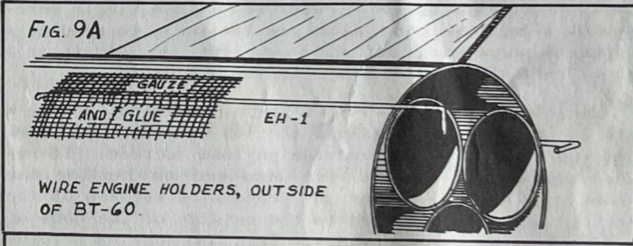
The method of holding the engines is important in any cluster rocket. Not only must the engines be held securely, but they must be aligned with the axis of the rocket so they work as a unit and exert all their thrust in propelling the rocket rather than work against each other. In addition, the engine retaining system must seal the rear of the rocket so the ejection charge or upper stage ignition charge cannot leak out without doing its job.

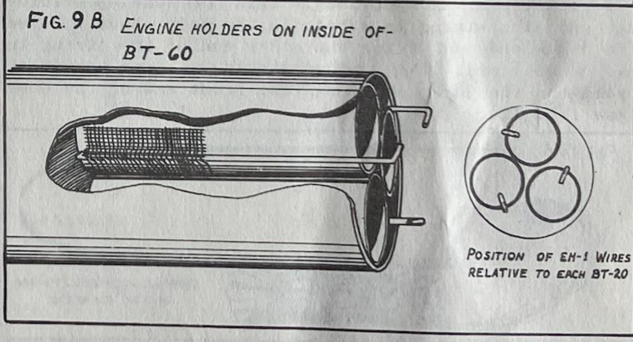
There are two main systems for holding the engines. In the one, the functions of positioning, aligning, and sealing are built into the rocket. In the other, the engines are glued or taped together to align them.

In the first system body tubes just larger than the outside diameter of the engine (BT-20) are glued together and are glued inside the rocket's body (BT-60). These are positioned to handle the alignment of the engines. The spaces between the tubes are then filled with a fillet material such as tissue paper and glue, balsa putty, etc.

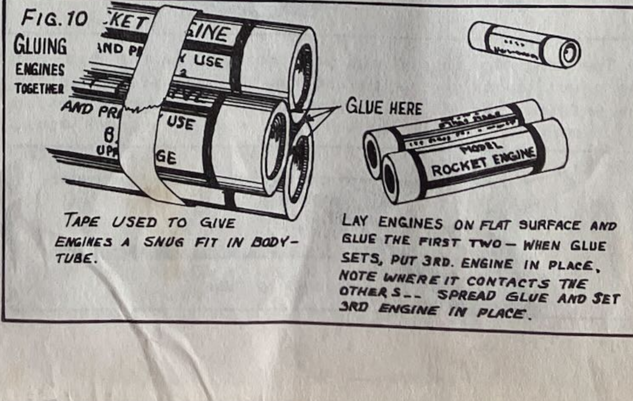


To keep the engines from moving forward during acceleration or backwards at ejection, they must make a tight friction fit in the holder tubes. This may be accomplished by wrapping the engine with tape until it takes considerable effort to push it into position. The other alternative is to use wire engine holders as shown in fig. 9. These make the replacement of engines considerably easier. They must, however, be positioned carefully so they do not interfere with the fins.



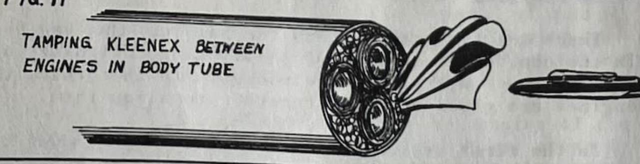


In the second system the engines are first glued or taped together, and then inserted into the rocket body. It is usually easier to obtain and maintain correct alignment by gluing the engines together than by taping them together. Enough tape is then wrapped around the outside of this group of engines to give a very tight



friction fit inside the rocket body. Finally, facial tissue or similar paper is tamped tightly into all holes around and between the engines to seal the rear of the rocket and control the ejection gases. (See fig. 11.)

FIG. 11



Some experiments with mounting engines in cluster rockets at an angle to create spin have been tried. However, it appears that spin fins are more effective and more reliable.

RECOVERY SYSTEM

Since the cluster rocket is larger and heavier than the conventional model rocket, its recovery system must be designed to withstand greater stresses than those normally encountered in a model rocket. The recovery system in a cluster rocket almost always uses at least one parachute; other devices have not yet proven practical. Generally two parachutes are used on rockets with large payload sections, one parachute on rockets with no payload section or just a small one.

On rockets with large payload sections two parachutes give more reliable recovery, since there is no possibility of the heavy payload section breaking the shock cord at ejection and no possibility of its snapping back and tangling in the parachute of the lower section if it is completely separate. Cluster rockets without payload sections are best recovered with a single parachute. The nose cone alone is too small to require a separate parachute, and will not put the strain on a shock cord that a 4 oz. payload section would.

Parachutes are normally attached directly to a screw eye in the base of a payload section with no shock cord between the parachute and the payload section. To reduce the possibility of fin breakage on landing the shock cord on the lower or propulsion section of the rocket is often attached to the outside of the body of the rocket near the engines. This is done by gluing one end of a string in a hole in the body about 1" from the rear end and tying the other end of the string to the shock cord. The string should be long enough to reach up the body and into the front end of the tube (see fig. 12).

FIG. 12 A

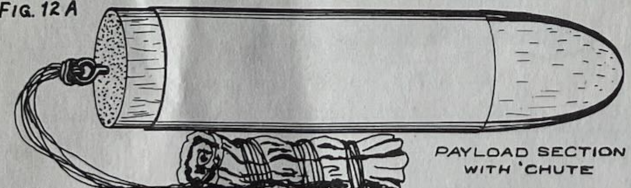
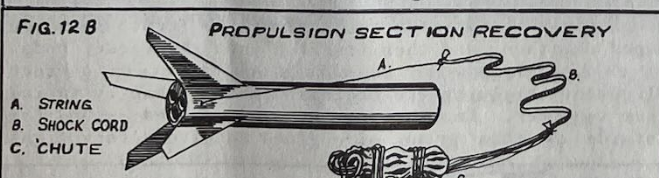
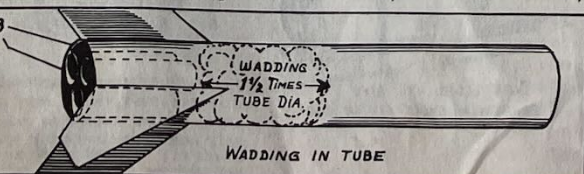


FIG. 12 B



The best way to protect parachutes from the heat of the ejection charge is to use wadding and plenty of it. The wadding should be flameproofed. Flameproof cotton or flameproof tissue paper will work, but rock wool, available from most lumber yards, gives the best results. Pack enough wadding into the rocket to fill it for a distance equal to at least 1-1/2 times the diameter of the body. The wadding whould be fairly tight against the sides of the tube to give an effective seal.

FIG. 13



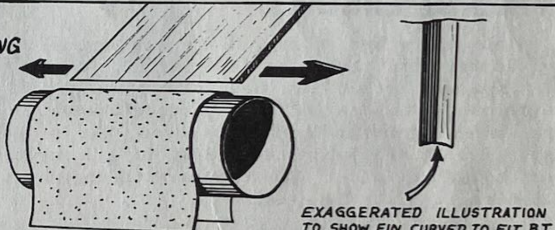
The size of the parachutes should be in keeping with the weight of the rocket. Parachutes larger than 18" will rarely be needed. Normally a 16" to 18" parachute on the lower section of the rocket and 12" to 16" parachute on the payload section will be sufficient.

STABILITY

The fins of a cluster rocket are one of the most critical areas in its construction. They must be large enough to keep the rocket stable even if the engines fire at different times and even if one or more engines fail to ignite. The fins must also be strong enough to hold up to all aerodynamic stresses against them and to withstand landings against rocks and pavement.

The best fin material for cluster rockets is 1/8" thick balsa sheeting (BFS-40). The fins must be cut out so the grain of the balsa follows the leading edge of the fin. The edge of the fin that is to be glued to the body must be straight to give a strong enough glue joint. This requirement is best filled by wrapping a sheet of sandpaper around the body and passing the fin forward and back on the sandpaper several times.

FIG. 14



When the fin positions have been marked on the body tube and the fins sanded, they can be glued in place. For best results, apply only a very thin line of glue along the inside edge of the fin. Press the fin into position against the body, and hold it in place for a couple of minutes. Then repeat this procedure with the other fins. After the glue has dried, reinforce each joint by applying a fillet of glue in the corner between fin and body as in fig. 15. The rocket should be balanced on its side (but no pressure should be put on the fins themselves) while the glue dries so it will not flow out of position.

FIG. 15A

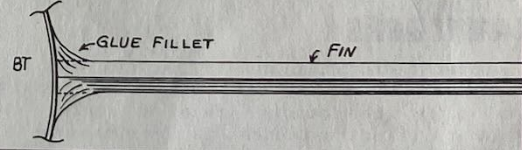
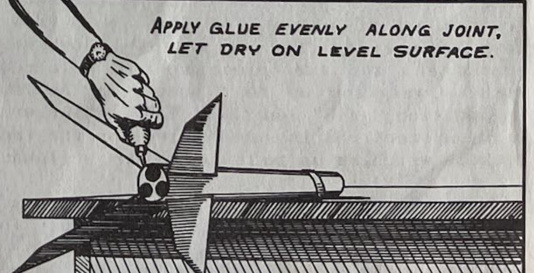


FIG. 15 B



Stability in a model rocket depends on many things, including location of center of gravity, body diameter, nose cone shape, positioning of fins, shape of fins, and surface smoothness. To obtain proper stability in a cluster rocket it is best to make the fins larger than would appear necessary. The center of pressure of a cluster rocket must be at least 1/2 the body diameter behind the rocket's center of gravity (see Technical Report TR-1). If the rocket's stability is tested by the string method described in TR-1, it is best to have at least a 20° margin of stability.