MODEL ROCKET NEWS

VOL. 12, NO. 3
July 1972

"When is Estes coming out with an X-15?" The answer to all of you rocketeers who have been asking the question is in the photo above. This X-15 *(Cat. No. 0705. Retail: $3.95)* is one of three rugged, all-plastic, ready-to-fly models in the brand new Estes Firing Line. The other two models are the Banshee *(Cat. No. 0703. Retail: $2.95)* and the Vampire *(Cat. No. 0704. Retail: $2.95)*.

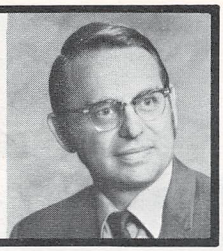
Also in the Firing Line, Estes offers a Starter Outfit *(Cat. No. 0701. Retail: $9.95)*, which includes the Vampire, Mini-Pad Launch System, three engines, igniters, and recovery wadding. The Mini-Pad Launch System *(Cat. No. 0702)* is available as a separate item for $5.95, and there is a Relaunching Package *(Cat. No. 0709. Retail: 99¢)* containing three engines, igniters, and wadding.

Truly a historical model, the Estes X-15 is a scale model of the famous stub-winged, rocket-powered U.S. research airplane. It was designed at Estes from plans supplied by North American Rockwell (formerly North American Aviation), which built the only three X-15 aircraft ever flown.

Designed for manned flight research at speeds up to 4,000 miles per hour and altitudes of 50 miles, the X-15 made its first flight on June 8, 1959, after being air-launched from a B-52 at 45,000 feet. By the end of the joint USAF-NASA-Navy program, in 1969, the three X-15's had made 199 flights, setting two unofficial world records: 354,200 feet (67 + miles) and 4,520 miles per hour, or 6.7 times the speed of sound. Among those who flew the X-15 was Neil Armstrong, later to become the first man on the Moon. One of the vital functions performed by the three X-15 aircraft was to serve as reusable manned platforms for a wide range of experiments that helped accelerate the Mercury, Gemini, and Apollo spaceflight programs.

X-15 No. 1 is now on permanent display at the Smithsonian Institution in Washington, D.C.; and No. 2, at the Air Force Museum at Wright-Patterson Air Force Base, Ohio. (No. 3 was destroyed in a crash in November 1967.)

NOTES FROM VERN



Back in '58 if you wanted to design a rocket you had to start from scratch – I mean really from scratch. You couldn't just order a nose cone and body tube that fit nicely together. To make a nose cone you had to first go down to your local hobby shop and buy a piece of balsa lumber (they usually came 36'' long which meant you had a lot of waste or a very long cone). Then you carefully turned it to the shape you desired using sanding boards, sandpaper, etc. Then for the body tube you took a piece of heavy manila paper (the kind file folders are made from); spread glue all over it and wrapped it around a proper sized mandrel (everyone has one of those). After the tube was thoroughly dried, you then proceeded to trim the ends and wondered how you were going to fill along the edge made by the last wrap of heavy paper against the tube.

When these ''good old days'' disappeared, as pre-manufactured body tubes and nose cones became readily available, some of those skilled in the art of making their own everything cried out, ''The hobby is being ruined by so much being done for the rocketeer!'' And today some of these purists are still enjoying the hobby in its native state of everything being done by the rocketeer except growing his own balsa tree. And that's all right – if it's your way of doing things – but the field of model rocketry was expanded several-fold when we began making pre-manufactured parts available to the rocket designer and builder.

Now, Estes is introducing a new step in rocketry – the ready-to-fly bird. This rocket is not intended to replace the conventional type of construction we've used for the past 10 years or so. Instead, it's designed for the rocketeer who enjoys flying rockets but doesn't like to build them, or wants to fly a rocket but doesn't have the time to build it, or doesn't believe he'd be able to build a rocket. We figure it's a good way for many new people to get acquainted with model rocketry. Then, as the rocket bug really bites hard, many of these new rocketeers will also start enjoying the even greater satisfaction which comes from having built the rocket which zooms skyward at the press of a launch button.

● ● ●

During the school year most of your time is associated with school activities (you know, things like recess, parties, science clubs, sports, rocket clubs, occasional classes, etc.). But summer comes along and unless you're lucky enough to find a job, you soon find yourself wondering what to do next. A couple of suggestions:

(1) When you're on the family vacation, stop by Penrose to visit us at the Model Rocket Capital of the World. The plant is open for tours from 8:30 a.m. to 4:30 p.m., Monday through Friday, and is located just 1-1/2 miles east of Highway 115 on U.S. 50 (about 25 miles west of Pueblo). There's a big new rocket out front to help you spot the place as you drive by.

(2) When you're not traveling, get a few of your neighborhood friends together and start a rocket club. If you need help starting a club, write to our Club Director, Dane Boles. He'll send you a Club Guide telling you all the right things to do to have a first class organization. Most rocketeers find it makes their hobby a lot more rewarding to be able to share their experiences with friends.

CONTRIBUTORS WANTED FOR MODEL ROCKET NEWS!

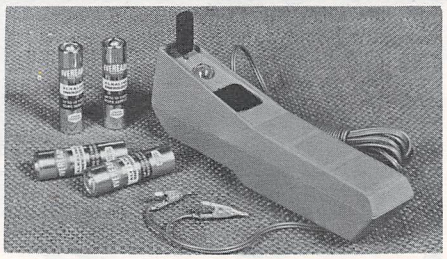
Got any good ideas for MODEL ROCKET NEWS articles – technical information, cartoons, anecdotes, club news of unusual interest, etc? Then why not submit them to us for possible publication? Our constant aim is to make MRN a better, more interesting magazine, and you might just be the type of contributor we are looking for.

Unless you have it ready, don't send us a finished article – just an outline, and we'll let you know if your proposed story meets our editorial requirements. If you send us photos, please make sure that you pack them between cardboard sheets so that they won't get creased in the mail. Also tell us in your letter if you want your material returned. Address all material to: Editor, MRN, Estes Industries, Penrose, Colorado 81240.

Should your article or photos be used in MRN, we'll reward your efforts and talent with an Estes merchandise certificate, the amount of which will be determined by the MRN editorial staff.

Hope to hear from you soon!

WIN A SOLAR LAUNCHER!



by Robert Cannon, Education Director

Here is your chance to win a new Estes *Solar Launch Control System,* a custom-designed, injection-molded plastic launcher that works on four 1.5-volt AA pen cells and uses the new Estes Solar igniters.

Our problem is patterned after one of the most popular contests. This contest involves predicting the exact altitude which a model rocket will reach with a specific engine. One way to practice for this event is to repeatedly launch a model with the same type of engine and carefully track each flight. Sometimes a specific height is assigned as the ''altitude objective.''

Here is our problem: Can you select the engine which will launch an Estes *Astron Sprint* the closest to an altitude of 1,200 feet? The engine must be one of those recommended in the kit instructions for flying this model.

The first correct answer from each state will receive a free Estes *Solar Launch Control System* (retail value: $2.95 – batteries not included).

Send your entries to: Sprint Contest, Estes Industries, Penrose, Colorado 81240. Be sure to include your name and address (with Zip code) with your answer. No entries will be returned. Employees of Estes Industries or members of their immediate families are not eligible.

MODEL ROCKET NEWS

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The MODEL ROCKET NEWS is published by Estes Industries, Inc., Penrose, Colorado. This publication is written for America's model rocketeers to promote safe youth rocketry, distribute current technical information, and make model rocketry more enjoyable and educational. Current issues of the MRN are distributed free of charge to all active Estes customers.

Vernon Estes .....Publisher
Francois Genty .....Editor

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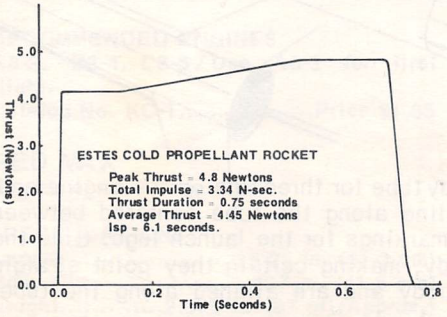
COLD-PROPELLANT MODEL ROCKETRY

(As Estes Industries introduces its new "convertible" Green Line of cold-propellant model rockets, the question, "What are cold-propellant rockets and how do they work?" will no doubt come up. The following article, written to supply the answers, was prepared by Alan Forsythe, of Vashon Industries, the company that developed cold-propellant model rocketry in 1968 and is now a part of Estes Industries.)

The differences between solid-propellant and cold-propellant model rockets are significant – and the main difference is in the propellant. RP-100, the power source for cold-propellant rockets, is a liquified gas refrigerant technically known as "difluorodicholoromethane" or "Freon 12" (DuPont trademark). It is virtually as inert as water; it cannot burn or explode, and has no odor.

Normally a gas at room temperature, RP-100 is packed in aerosol cans under pressure, in liquid form. The liquid produces a vapor pressure of about 70 pounds per square inch (gauge) at room temperature, providing the motive force for expelling the liquid from the can or the rocket engine. Being a refrigerant, it almost instantly vaporizes upon being released. The rush of combined liquid and gas escaping from the nozzle of the rocket engine generates thrust.

Just before flight, the cold-propellant rocket engine is loaded with RP-100 through a hose extending from the aerosol can. As loading proceeds, some air is blown out of the engine to make room for the liquid. A white spray coming out of the air vent at the rear of the engine tells the rocketeer when the engine is fully loaded.



To launch the rocket, the nozzle is released from its fueling adapter and the rocket lifts off. Thrust lasts for about 0.75 second, followed by an upward coasting, and parachute ejection at the top of the flight.

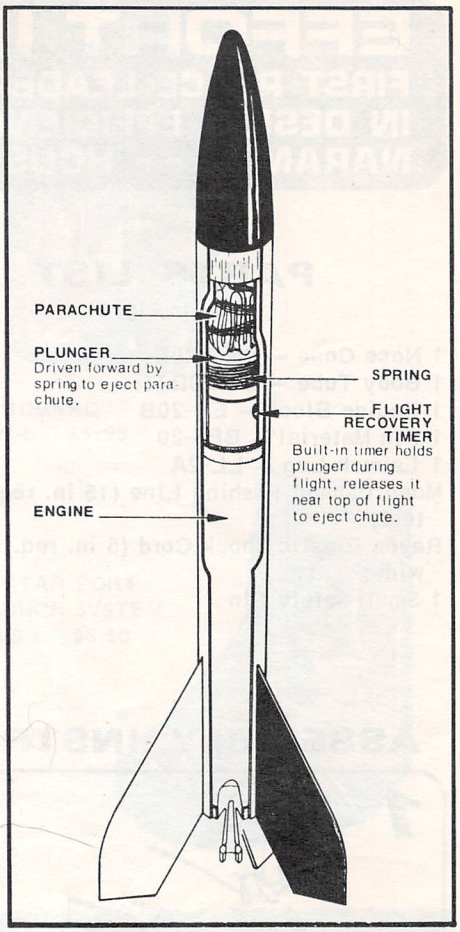
Spring ejection

Parachute release is triggered by an unusual device built into the upper section of the engine. When the engine is loaded with RP-100 propellant, pressure from the propellant passes into a small forward chamber and causes a rubber diaphragm to expand through three holes in the engine wall and press against the inside of a piston tube. This holds the piston in place through powered flight, and also during coasting. Once the propellant has been expelled, the pressure is relieved and the diaphragm shrinks back, allowing the piston to spring forward and drive the parachute out of the rocket body.

The time delay from "burnout" (when the engine runs out of propellant) to peak altitude is achieved by restricting the escape of pressure from the engine's small chamber with porous material. Pressure in the chamber therefore takes an extra 1 to 3 seconds to escape through this material before the diaphragm can shrink back and release the parachute.

Normally, the specific impulse of RP-100 propellant is about 6.1 seconds, much less than solid propellants can achieve. Specific impulse and thrust are also strongly influenced by temperature.

At 70°F, the new Estes Green Line cold-propellant rocket engine produces about 1.0 pound of thrust, but at 40°F the thrust is only about half of that, or roughly 0.5 pound. At -20°F it would produce no thrust at all – and no thrust means no flight for the brave, but frigid, rocketeer! However, RP-100 itself is a refrigerant, and if allowed to boil or vaporize it will cool right down to -20°F, even on a warm day. The result would be a very disappointing rocket performance, so avoid letting RP-100 boil or vaporize. In short, the rocket must be full of warm, liquid (not gaseous) propellant to get total performance.



One basic difference between solid-propellant rockets and cold-propellant rockets is the amount of fuel needed to supply power.

Solid propellants have relatively high specific impulse (performance per pound of propellant), therefore not much propellant is required to provide a good flight. As a result, the proportion of total vehicle weight that is solid propellant is quite small, and overall vehicle weight doesn't change much as propellant is consumed.

Low impulse

On the other hand, cold-propellant rockets use a low-impulse propellant. To make up for this factor, a relatively large weight of propellant is used. At liftoff, the rockets are over half propellant by weight, that is, the mass ratio (liftoff weight divided by burn-out weight) is quite high – more than 2.

(continued on Page 8)

EFFORT III

FIRST PLACE LEADER DIVISION IN DESIGN EFFICIENCY AT NARAM 12 - - HOUSTON, TEXAS

DESIGNED BY
RICHARD J. RYNEARSON
N.A.R. NO. 16924
COLLEGE STATION, TEXAS

ESTES INDUSTRIES ROCKET PLAN NO. 75

PARTS LIST

(Refer to Fig. 8)

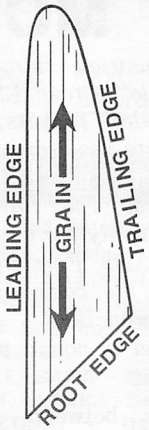
1 Nose Cone – BNC-20B
1 Body Tube – BT-20D
1 Engine Block – EB-20B
1 Fin Material – BFS-20
1 Launch Lug – LL-2A
Monofilament Fishing Line (15 in. req., 15 lb. test)
Rayon Elastic Shock Cord (5 in. req., 1/8 in. wide)
1 Small Safety Pin

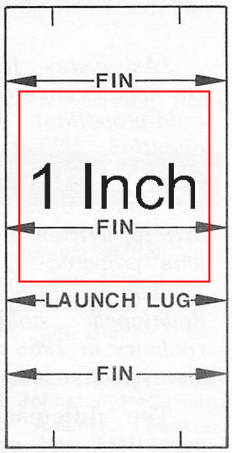
ADDITIONAL MATERIALS

Hobby Knife
White Glue
Ruler
320 Grit Mylar Sanding Material
Sanding Sealer
Color Enamel (Spray)
Paint Brush
Rubbing Compound
Sharp Pencil

RECOMMENDED ENGINES

1/4A3-4S 1/2A6-4S

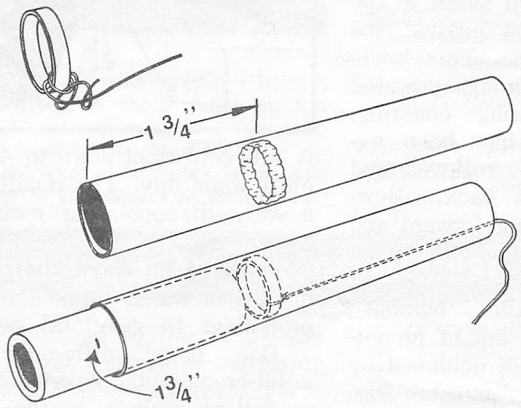




FIN MARKING GUIDE

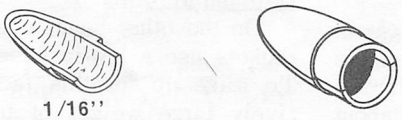
ASSEMBLY INSTRUCTIONS

1



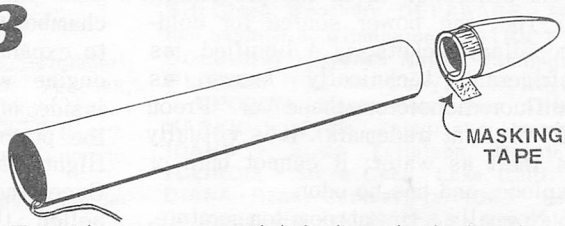
Cut a body tube that is 4'' long. Take a 15'' length of fishing line and tie one end securely to the engine block. Spread a thin ring of glue around the inside of the body tube 1-3/4'' from one end. Insert the engine block inside the tube, feeding the fishing line in ahead of it. Using a regular engine casing marked at 1-3/4'', slide in the engine block, stopping at the mark. Immediately remove the engine casing.

2



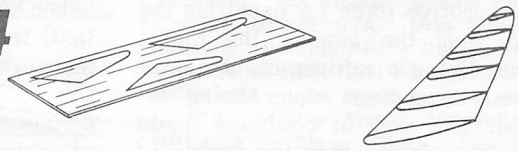
Split the nose cone in half with a modeling knife. Hollow out both halves until the wood thickness is 1/16''. Glue the halves together and set aside to dry.

3



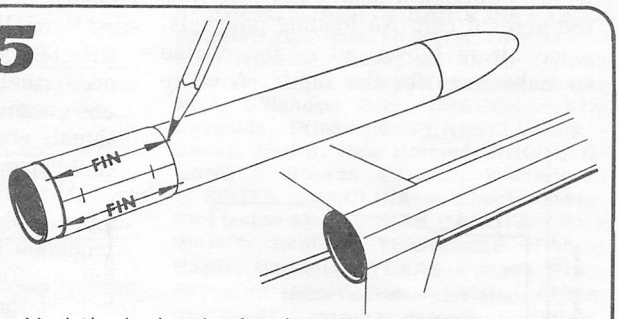
Tape the nose cone tightly into the body tube on the end away from the engine. Feed the fishing line back down the body tube so it does not get in your way. Refer to Fig. 8.

4



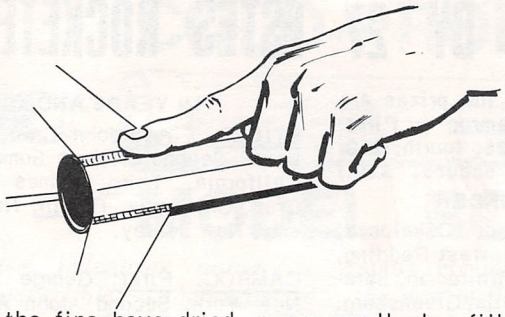
Cut the fins from 1/16'' fin stock using the fin pattern shown on plans. Sand carefully to an airfoil shape.

5



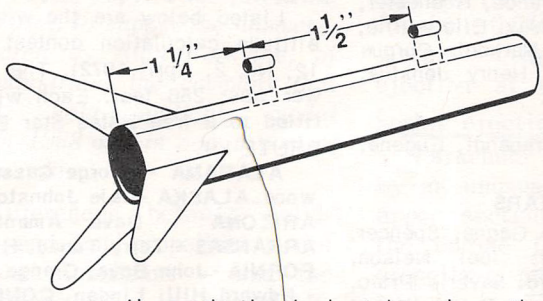
Mark the body tube for three fins on the engine end. Also, draw a line along the tube centered between two of the fin markings for the launch lugs. Glue the fins to the body, making certain they point straight out from the body and are aligned along the tube.

6



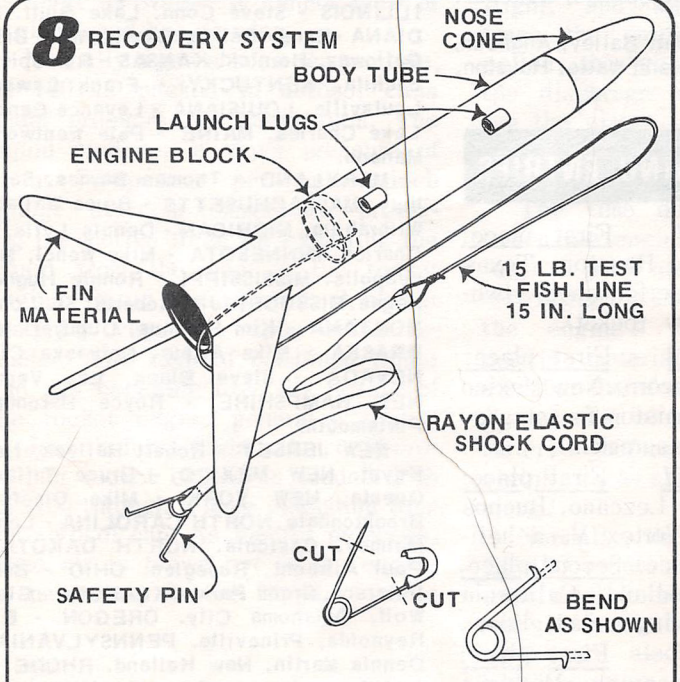
When the fins have dried, run a small glue fillet along the base of each fin.

7



Using a pencil, mark the body tube along the launch lug line 1-1/4'' and 2-3/4'' from the end of the tube. Glue a 1/4'' long launch lug to each position. Be careful to align each lug so the model will slide smoothly on the launch rod.

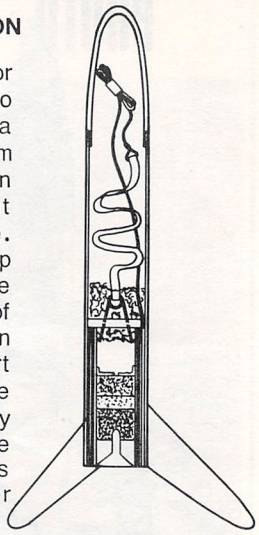
8 RECOVERY SYSTEM



Spray the model with one coat of colored enamel AFTER completing the finishing procedures in Step 10. Orange is a high visibility color. (The original model was painted orange with black numerals for the NAR number.) Let the paint dry completely, and then rub down the entire model lightly with rubbing compound.

Rig the recovery system as shown. The rear ejection clip is made from a small safety pin as shown in the illustration.

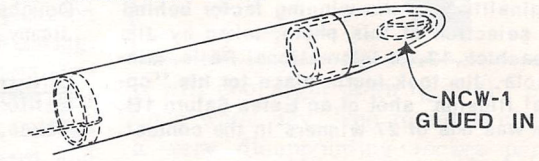
9 LAUNCH CONFIGURATION



When preparing the model for flight, form the fishing line into a coil by wrapping it around a finger. A small sleeve made from a 1/8'' diameter soda straw can be used to hold the coil when it is inserted into the body tube. Press the rear ejection clip firmly into the front end of the engine. Place two squares of recovery wadding (crumpled) on top of the engine as you insert it into the rocket. If the engine tends to slip out of the body tube, wrap some masking tape around it. Make sure the fit is not too tight to insure proper ejection.

10

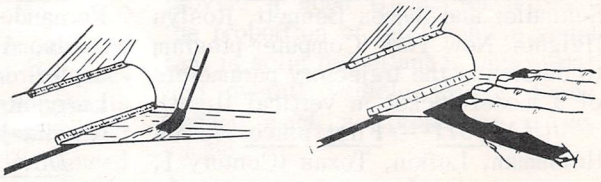
The Effort III was designed with minimum weight and drag in mind. Therefore the margin of stability is also at a minimum. The model you build might tend to be slightly unstable on its first flight (in that it might oscillate on the ascent), but you can correct this by adding a small amount of weight inside the hollow nose cone.



If the rocket is not stable, bend one lead weight (NCW-1) and glue it inside the nose cone as far as it will go. Relaunch. You can also use 0.12 oz. of balancing weights (NCW-3) or the equivalent weight in modeling clay. The model will only be stable with short 1/4A or 1/2A engines. However, you'll find the maximum design efficiency can be obtained with these small engines. The original national contest winner achieved an unofficial altitude of 204 meters and an overall efficiency of 81% with a 1/2A6-4S.

Once the model has been tested and is stable, glue in the nose cone.

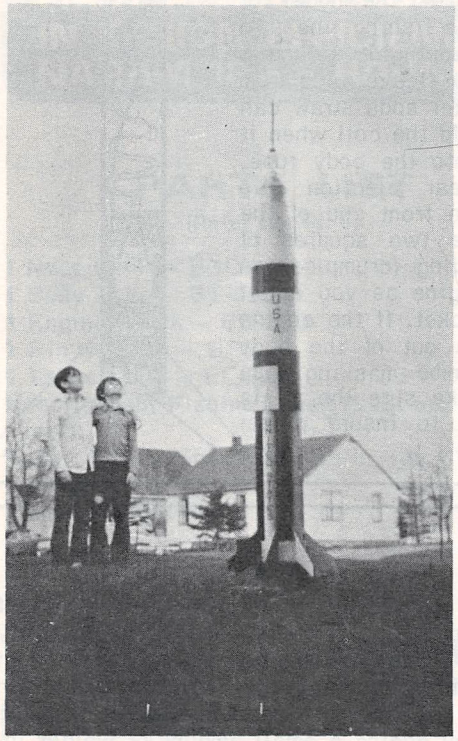
FINISHING PROCEDURES



Begin the finish on the model by sanding it lightly with 320 grit, mylar-backed sanding material. Pay special attention to the nose cone, the nose-body joint, and the fins. Cover the entire model (body tube included) with a light coat of sanding sealer. Allow to dry completely.

Repeat the sanding and sanding sealer process on the nose cone, nose-body joint, and the fins until the entire outside surface of the model is smooth.

PHOTO CONTEST PRIZES SHARED BY 27 ESTES ROCKETEERS



Originality was the winning factor behind the selection of this photo, taken by Jim Lucachick, 12, of International Falls, Minnesota. Jim took fourth place for his "optical illusion" shot of an Estes Saturn 1B. Jim was one of 27 winners in the contest.

(In all age categories, the prizes are as follows: Stills and Camroc – First: $50; second: $40; third: $25; fourth: $10. Cineroc – First: $75; second: $50.)

14 YEARS AND UNDER

STILLS. First: Jeff Auld, Oskaloosa, Iowa. Second: Mel Isaacoff, West Redding, Connecticut. Third: Chris Whiteman, Sarasota, Florida; and Mark Wells, Greensburg, Kentucky. Fourth: Dave Winchell, Mt. Kisco, New York; and James Lucachick, International Falls, Minnesota.

CAMROC. First: Steve Pence, Rochester, Michigan. Second: Vince May, Ellettsville, Indiana. Third: Ronald Merkord, Corpus Christi, Texas. Fourth: Henry Jenkins, Little Falls, New Jersey.

CINEROC. First: Earl Brabandt, Eugene, Oregon.

15 TO 18 YEARS

STILLS. First: Michael Gagne, Spencer, Massachusetts. Second: Joel Nelson, Princeton, Illinois. Third: Saverio Prato, Agincourt, Ontario, Canada. Fourth: David Brown, Cohocton, New York.

CAMROC. First: Frank Osborn, Bethlehem, Pennsylvania. Second: Nick Yuschak, Whitestone, New York. Third: Wayne Dougherty, Pennsville, New Jersey. Fourth: Jimmy Pattee, Colorado Springs, Colorado.

CINEROC. First: Barrett Bailey, Anaheim, California. Second: Glenn Watts, Houston, Texas.

19 YEARS AND OLDER

STILLS. First: John Cato, Auburn, Alabama. Second: Robert Somers, Berkeley, California. Third: James Baker, Santa Cruz, California. Fourth: Ned Hood, Beverly, New Jersey.

CAMROC. First: George Helser, Troy, New York. Second: John Andrews, Portland, Oregon.

DOM JUDGING STAFF SELECT 12 MORE WINNING ENTRIES

We are pleased to list below the names of recent winners in the Estes Design of the Month contest. There were ten first-place designs, each qualifying for a $50 Estes merchandise certificate, and two second-place designs, each worth a $25 certificate;

The winners were:

JUNE 1971 – First place: Rafe Schindler and James Bennett, Roslyn Heights, New York (Computer program to determine the trajectory parameters of a model rocket in vertical flight).

JULY 1971 – First place: James Heishman, Lufkin, Texas (Century 1, a square rocket with "hatch recovery.").

AUGUST 1971 – First place: David M. Austin, White Plains, N.Y. (CINEROC boost-glider). Second place: Allan Williams, Bowie, Maryland (Bandit-3 sounding rocket).

SEPTEMBER 1971 – First place: Daniel Weimer, Jackson, Michigan (Nuclear Explorer, made with styrofoam ball).

OCTOBER 1971 – First place: Ronald D. Madsen, Houston, Texas (Twister, a high-performance, two-stage, gyro-recovery rocket).

NOVEMBER 1971 – First place: Gary W. Schwede, Socorro, New Mexico (Nose-mounted thermistor for stagnation-temperature measurement).

DECEMBER 1971 – First place: Fernando P. Lopez Lezcano, Buenos Aires, Argentina (Vortex V, a helicopter-recovery device). Second place: Larry Rollins, Woodland, California (Cardinal, a swing-wing rocket glider).

JANUARY 1972 – First place: Ted Parshall, Chesaning, Michigan (Baffle recovery system).

FEBRUARY 1972 – First place: Jon Fischer, Paris, Texas (Heliroc).

Any type of model rocketry design can be entered in the Estes DOM contest (rockets, boost-gliders, launching and recovery devices, etc.). Designs should be sent to the Design of the Month Editor, Estes Industries, Penrose, Colorado 81240.

Did you win a Star Blazer?

Listed below are the winners in our altitude calculation contest (MRN Vol. 12, No. 2, April 1972). The correct answer was: 256 feet. Each winner is entitled to a free Estes Star Blazer MINI-BRUTE kit.

ALABAMA - George Gassaway, Homewood. ALASKA - Dale Johnston, Peterburg. ARIZONA - Dave Amenta, Tucson. ARKANSAS - Terry Tuney, Higden. CALIFORNIA - John Bova, Orange. COLORADO - Edward Hill, Linden. CONNECTICUT - Bill Green, Woodbury. DELAWARE - Stephen Sashihara, Wilmington. DISTRICT OF COLUMBIA - Upenda Naidu, Washington. FLORIDA - John Curry, Fort Myers. GEORGIA - Steven Hutcherson, Athens. HAWAII - Eddie Salsgiver, Honolulu. IDAHO - Bruce Tellatson, Pocatello. ILLINOIS - Steve Conn, Lake Bluff. INDIANA - Randy Csikos, Dyer. IOWA - Brian Galloway, Hornick. KANSAS - Ron Spicer, Wichita. KENTUCKY - Frank Lawson, Louisville. LOUISIANA - Levance Gentry, Lake Charles. MAINE - Pete Wentworth, Manson.

MARYLAND - Thomas Barnes, Salisbury. MASSACHUSETTS - Bruce Wallace, Wilbraham. MICHIGAN - Dennis Lytle, St. Charles. MINNESOTA - Mike Wencl, Minneapolis. MISSISSIPPI - Ronnie Hughes, Magee. MISSOURI - Jim Roberts, St. Louis. MONTANA - Kim Resihus, Dupuyer. NEBRASKA - Mike Arthur, Nebraska City. NEVADA - Steve Black, Las Vegas. NEW HAMPSHIRE - Royce Barondes, Portsmouth.

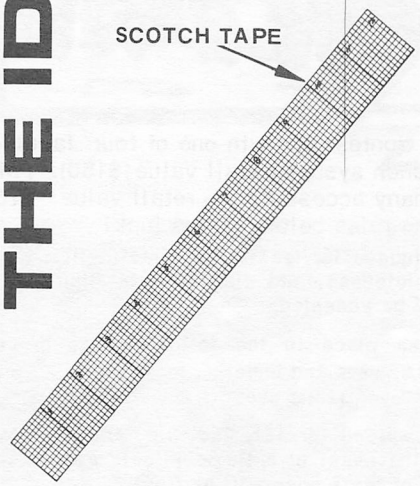
NEW JERSEY - Robert Hallock, New Egypt. NEW MEXICO - Bruce Tiffany, Questa. NEW YORK - Mike Olsefski, Brooktondale. NORTH CAROLINA - Lamar Mauney, Gastonia. NORTH DAKOTA - Paul Allrecht, Roseglen. OHIO - Brian Peterson, Brook Park. OKLAHOMA - Glenn Wolf, Oklahoma City. OREGON - Elly Reynolds, Prineville. PENNSYLVANIA - Dennis Martin, New Holland. RHODE ISLAND - Joseph Caranci, Middletown.

SOUTH CAROLINA - Chuck Owens, Charleston AFB. SOUTH DAKOTA - Rick Marlette, Redfield. TENNESSEE - Ronnie Belitz, Maryville. TEXAS - James Firth, Beaumont. UTAH - Robert Lindley, Ogden. VERMONT - Jonathan Spencer, Northfield. VIRGINIA - Thomas Strother, Falls Church. WASHINGTON - Karl Jahns, Allyn. WEST VIRGINIA - Robert D'Amico, Weirton. WISCONSIN - Mark Payne, Menomonee Falls. WYOMING - Marvin Hendricks, Burlington. PUERTO RICO - Daniel Lopez, Fajardo.

THE IDEA BOX

HANDY RULER

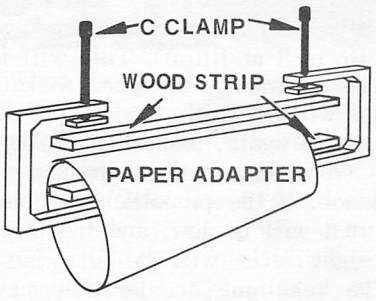
To make the ruler 12" long you will have to tape on an extra 2" piece.



Since many of the measurements used in rocketry are in tenths of an inch, it would be handy to have such a ruler around. One way to make one is to get a sheet of graph paper, cut it to width and length of your 12" ruler, mark off the inches and tape or glue it to the back of your ruler.

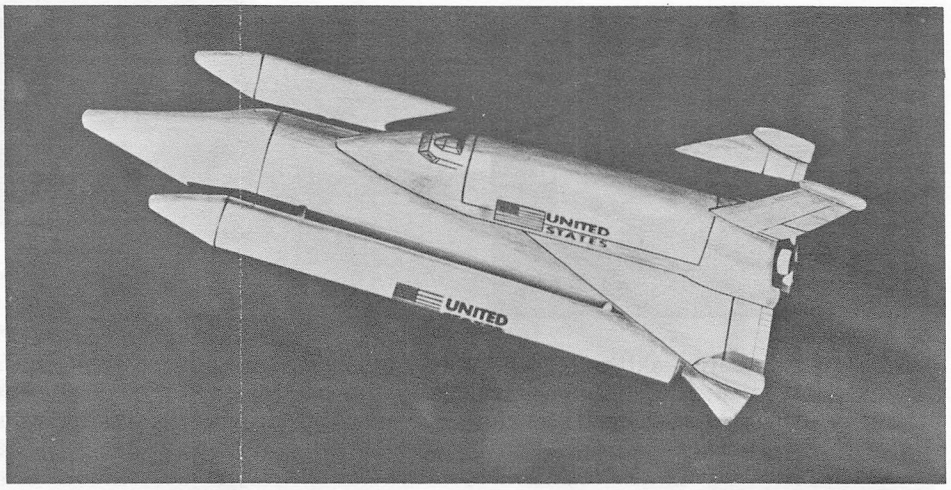
by Danny Lia
89 Hudson St.
Schenectady, N.Y. 12303

PAPER ADAPTER CLAMP



Take 2 small strips of wood placing one on the inside, and one on the outside of the ends of the paper adapter after gluing. Seal them together with C clamps. Be sure to place wax paper under each strip of wood to prevent the paper sticking to the wood.

by Thomas Weiser
79 Bakerdale Road
Rochester, N.Y. 14616



SHUTTLE: the future in space

Next December, an era in space exploration will come to an end with Apollo 17, the last of the U.S. manned lunar landings. Seven years from now, a new era will open as NASA (the National Aeronautics and Space Administration) launches its first Space Shuttle – a vehicle that will, as President Nixon said recently, "transform the space frontier of the 1970's into familiar territory."

The Space Shuttle is nothing new to the thousands of model rocketeers who, for the past three years, have built and flown the Estes *Orbital Transport* (Cat. No. K-42. Retail: $3.75). Just like the real thing, the Estes *Orbital Transport* lifts off under rocket power, then, at ejection, the re-entry vehicle separates and glides back to earth after completing its mission. The booster returns by parachute.

What makes the Estes *Orbital Transport* even more realistic is the fact that the Space Shuttle booster stage will use solid propellant, rather than liquid propellant, just like the miniature Estes version. Up to now, all U.S. manned space flights have been powered by liquid-fuel rocket systems. (The cartoon on the cover of the November 1968 issue of Model Rocket News – Volume 8, Number 2 – showing technicians fitting the nozzles on a space vehicle booster with Estes solid-propellant engines was not so far out after all!)

In its present design, the Space Shuttle will not only take unmanned applications and scientific spacecraft into Earth orbit, but will also enable its crew of four (pilot, co-pilot, and two technicians) to repair or refurbish, or even retrieve, such satellites and bring them back to Earth for extensive overhaul.

The recoverable booster stage will be two large solid-propellant rocket motors mounted in parallel and having a thrust output of more than 5,000,000 pounds – more powerful than any other U.S. launch vehicle except the Saturn V – and making the spacecraft capable of carrying as much as 65,000 pounds of payload.

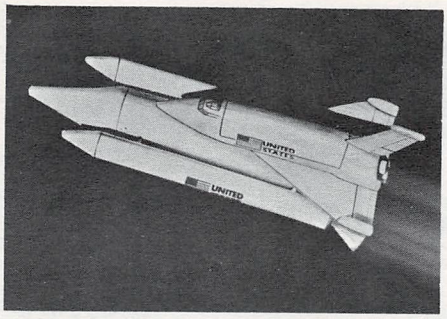
The 70-ton spacecraft, called the Orbiter, is a winged vehicle closely resembling a jet transport aircraft. Its design will make it possible to return to Earth after completion of a mission and land on a runway like a conventional jetliner.

Vertical launch of the Space Shuttle will be accomplished by a combination of the solid booster stage and the Orbiter's three liquid-propellant engines which provide a total thrust of 1,400,000 pounds. At an altitude of about 25 miles, the booster stage separates and descends by parachute for recovery in the ocean. Then the Orbiter flies farther into space under its own power; its rear-mounted engines draw their propellant from a large external tank which is jettisoned when the spacecraft enters its orbit.

At re-entry, the Orbiter is protected by a new form of heat shielding which will last through 100 missions, in contrast with the insulation which burned off during re-entry of earlier recoverable spacecraft.

**ENTER SPACE SHUTTLE DESIGN CONTEST!
SEE RULES ON PAGE 8**

Vol. 12, No. 3



PRIZES...PRIZES...PRIZES...PRIZES...PRIZES...PRIZES...PRIZES...PRIZ

ENTER FABULOUS ESTES SPACE SHUTTLE DESIGN CONTEST!

Test your creative skills in Estes Industries' challenging Space Shuttle Design Contest and win one of four fabulous prizes! First prize: $250 Estes merchandise certificate. Second prize: Multi-Pad launch system (retail value: $150). Third prize: deluxe TRANSROC outfit (includes TRANSROC kit, two walkie-talkies, and many accessories – retail value: $75). Fourth prize: deluxe CINEROC outfit (retail value: $50). To enter, simply follow the rules below. Good luck!

1) All design entries must be for a Space Shuttle vehicle. Plans must consist of booster vehicle which can be recovered safely, and a shuttle craft which separates from the booster at apogee and glides back to earth. Actual design, method of operation, appearance, etc., are up to you.

2) Please send only your plans. Do not send actual models, as they cannot be returned.

3) Please use only Estes parts in planning your design. Be sure to include a parts list with your plans, plus instructions or diagrams you feel would be helpful.

4) All designs must be original. No current kit designs will be accepted.

5) Photos are not required, but pictures of your completed design will be appreciated.

6) All entries will become the property of Estes Industries.

7) You may enter as many plans as you like.

8) Employees of Estes Industries or members of their immediate families are not eligible.

9) Entries will be judged for feasibility, practicality, originality, neatness, completeness, and clarity. Only flight-tested and proven designs will be accepted.

10) Judging will take place in the following age groups:
16 years and under
17 years and over

11) Prizes will be awarded for 1st, 2nd, 3rd, and 4th place in each age group. In the event of a tie, duplicate awards will be given. The decision of the judges will be final.

12) Entries should be sent to:
Space Shuttle Design Contest
Estes Industries
Penrose, Colorado 81240

13) Be sure to include your name, age, address, city, state, and Zip code with each entry.

14) Deadline for entries is September 1, 1972.

15) Winners will be announced in the October 1972 issue of Model Rocket News.

COLD-PROPELLANT MODEL ROCKETRY

(continued from Page 3)

The fundamental effect of high mass ratio is high performance – i.e., higher altitude. There is a very noticeable increase in acceleration from liftoff to burnout. Since thrust is essentially constant, and the weight decreases drastically, the acceleration increases proportionally. For example, acceleration at liftoff is about 4 g's, but just before burnout the rocket is accelerating at nearly 8 g's. The effect is a somewhat slow liftoff followed by what seems like an increasing "kick in the pants" just before the rocket runs out of propellant.

Thrust-to-weight ratio is the third performance factor for model rockets (after specific impulse and mass ratio). This factor is important because model rockets are normally launched vertically against the pull of gravity. The thrust therefore must be considerably greater than the weight, or the rocket simply won't move upward. For instance, if the thrust-to-weight ratio is 2, one-half of the thrust is consumed counteracting gravity, and the other one-half accelerates the rocket upward. If, instead, the ratio were 10, only one-tenth of the thrust would be needed to counteract gravity, and the remaining 90% would be available to accelerate the rocket.

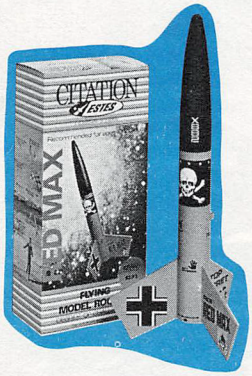
Because of the mass change during powered flight, the thrust-to-weight ratio changes. Cold-propellant rockets undergo a considerable change in thrust-to-weight ratio. At liftoff, this ratio is usually smaller than for solid-propellant rockets, because of the large mass of propellant in a cold-propellant rocket. Later in powered flight, when the propellant is nearly used up, the ratio may be as large as, or larger than, for solid-propellant rockets, not because thrust has changed, but because weight had drastically decreased. Thus it is clear that if thrust-to-weight ratio is adequate at liftoff, it will improve later in the flight.

The question may be asked, "Will the rocket be moving fast enough to be stable in flight by the time it leaves the guidance of the launch rod?" The answer: whether the rocket's velocity is high enough for fin stabilization depends upon acceleration at launch – and the accelerating force depends upon the thrust-to-weight ratio. Thrust at liftoff should be about three times the weight of the fully loaded rocket (thrust-to-weight ratio of 3 at liftoff). This will insure that a normally designed rocket with fins will be stable.

Here again, propellant temperature is very important to rocket performance. If the propellant is cold, the thrust will be low, and the thrust-to-weight ratio will be likewise low. The resultant acceleration may not be enough to attain a stable flight velocity before the rocket leaves the pad. Warm propellant in the rocket engine will make all the difference.

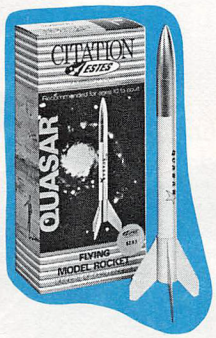
Like any other modern devices, cold-propellant rockets require care, skill, and attention to details to gain the best results, and they offer an interesting challenge to the rocketeer. Proper assembly, testing, and loading will increase the chances of a perfect, thrilling flight.

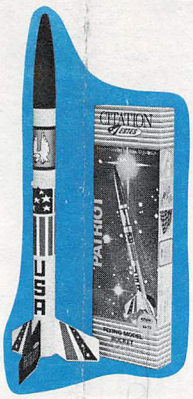
STARTER KIT
MKS-1 $11.95



RED MAX
KC-2 $2.75

QUASAR
KC-1 $1.85

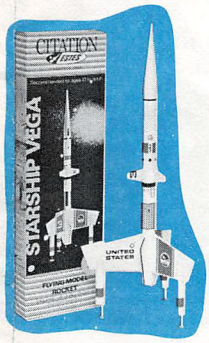




PATRIOT
KC-3 $3.75

BOMARC
KC-5 $5.95

STARSHIP VEGA
KC-4 $4.75



STAR PORT
LAUNCH SYSTEM
LS-1 $8.50

Please note that the CITATION rocket kit catalog identification "MK" has been changed to "KC". Identification for the Starter Kit and the Star Port Launch System remains the same.

CITATION

MODEL ROCKETRY'S FINEST LINE – – NOW AVAILABLE DIRECTLY FROM ESTES

STARTER KIT

Complete in reusable four-color Field Operations Box. Includes Quasar Flying Model Rocket, metallized Star Port Launch Pad, Rocket Positioning Spring, Launch Control System, Glue Packet, Number One X-acto Knife, 3 engines, igniters, tape discs, recovery wadding.
Catalog No. MKS-1 .....Retail $11.95

QUASAR

Degree of Challenge: One

SPECIFICATIONS:
Length .....14 in. (35.6 cm)
Body Dia. .....0.976 in. (24.8 mm)
Weight.....1.5 oz. (42 gr)

RECOMMENDED ENGINES
A8-3, B6-4, C6-5 / Use A8-3 for first flight.
Catalog No. KC-1.....Price $1.85

RED MAX

Degree of Challenge: Two

SPECIFICATIONS:
Length .....16.25 in. (41.3 cm)
Body Dia. .....1.637 in. (41.6 mm)
Weight.....2.375 oz. (67 gr) (Approx.)

RECOMMENDED ENGINES
B4-2, B6-2, C6-5 / Use B4-2 for first flight.
Catalog No. KC-2.....Price $2.75

PATRIOT

Degree of Challenge: Two

SPECIFICATIONS:
Length.....26 in. (66 cm)
Body Dia. .....1.637 in. (41.6 mm)
Weight.....3.3 oz. (94 gr)

RECOMMENDED ENGINES
B4-2, B6-2, C6-5 / Use B4-2 for first flight.
Catalog No. KC-3.....Price $3.75

STARSHIP VEGA

Degree of Challenge: Three

SPECIFICATIONS:
Length.....19.5 in. (49.5 cm)
Body Dia. .....0.976 in. (24.8 mm)
Weight .....1.88 oz. (53 gr)

RECOMMENDED ENGINES
B4-2, B6-4, C6-5 / Use B4-2 for first flight.
Catalog No. KC-4.....Price $4.75

BOMARC – Model Rocketry's first scale boost glider.

Degree of Challenge: Four

SPECIFICATIONS:
Length .....23 in. (58.4 cm)
Body Dia. .....1.325 in. (33.6 mm)
Weight.....3.8 oz. (108 gr)

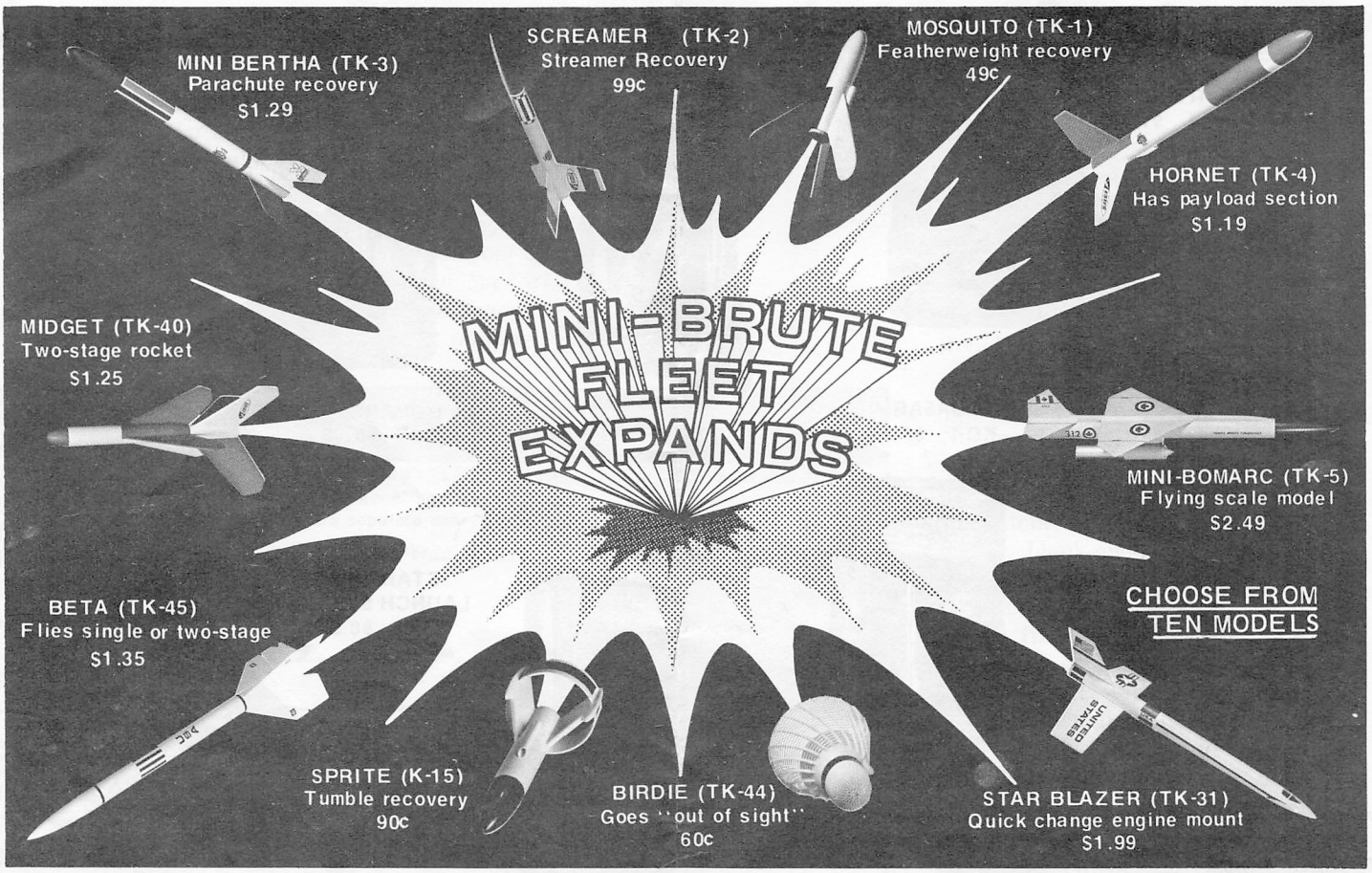
RECOMMENDED ENGINES
B6-2, C6-3 / Use B6-2 for first flight.
Catalog No. KC-5.....Price $5.95

STAR PORT LAUNCH SYSTEM

A space-age designed, ruggedly constructed, complete system. Bright, vaccum metallized finished launching platform features: authentic girder design, tilt adjustment for different launch angles and snap together construction for quick field assembly and compact storage. The launch controller completes the system . . . advanced engineering features include a safety interlock key and continuity check light. Complete with 18 feet of cord, micro-clips, battery clips and assembly instructions.

Use with either 6- or 12-volt power source.

Catalog No. LS-1 .....Price $8.50



SPECIAL FREE ESTES ENGINES OFFER

Buy a CITATION *Starship Vega* (Cat. No. KC-4 – shown in this MRN issue) or a *Saturn V* (Cat. No. K-36 – shown at right) and receive a free tube of Estes engines.

Simply send us *both* box ends from either kit and we will mail you a free tube of appropriate engines to launch your model. Both the *Starship Vega* and the *Saturn V* are available directly from Estes Industries or from your local Estes dealer.

This offer starts April 1, 1972, and ends June 30, 1972.

● ● ●

Show your support in the United States space program by participating in Estes' Follow Apollo 16 Project Support (*details at right*).

Launch the magnificent *Saturn V* (Degree of challenge: Five), a 43-1/2" tall scale model of our nation's mightiest rocket on April 16 in honor of our Apollo 16 astronauts.

Scaled to 1/100th of its actual size, this model features precision molded plastic Apollo escape tower and authentic detailed engine nozzles. The kit includes the Estes Tech Report on engine clustering.

SATURN V

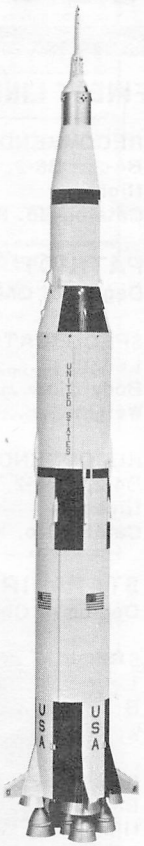
Specifications

Length	43.5" (110cm)
Body Dia.	3.938" (100mm)
Weight	9.9 oz. (280 gr)
Shipping wt.	3 lbs., 5 oz.

Recommended Engines

May be flown as 3 engine cluster or single stage.
Cluster Power:
(3 required) C6-3
"D" Power: D12-3
(1 required)

Cat. No. 701-K-36
$16.95



SUPPORT APOLLO 16; WIN A SPACE CERTIFICATE

Launch a *Saturn V* or other fine Estes kit, such as the CITATION *Starship Vega*, on April 16 in honor of our Apollo 16 astronauts! Carry out your own miniature space shot just before or immediately after the launch of Apollo 16.

For your symbolic support of our nation's space program, we will send you a special Follow Apollo 16 Space Certificate signed by Vern Estes, president of Estes Industries.

FOLLOW APOLLO 16 SPACE CERTIFICATE APPLICATION

My Estes rocket followed Apollo 16. Please send my Space Certificate.

Name _____

Address _____

City _____ **State** _____ **ZIP** _____

Time launched _____ **(a.m. or p.m.)**

Rocket _____

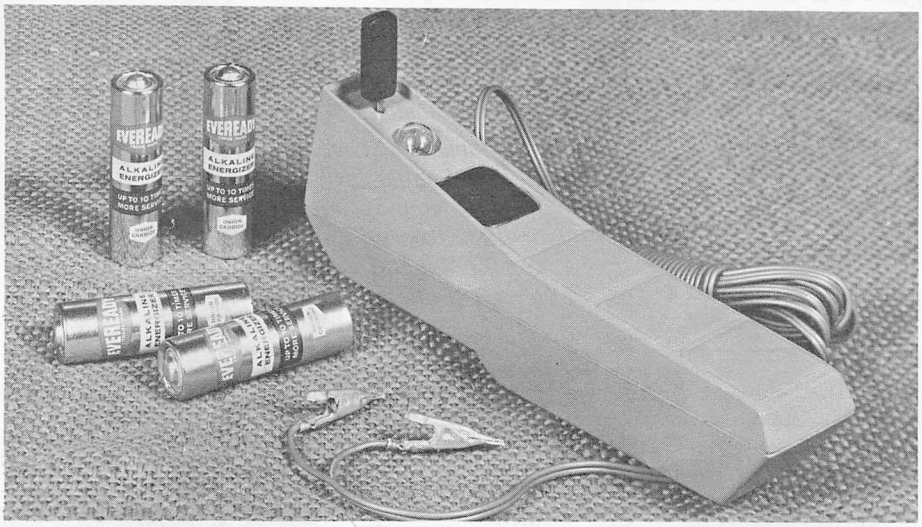
Mail to:

Estes Industries
Box 227
Penrose, Colorado 81240

NEW SOLAR LAUNCH SYSTEM AVAILABLE IN MAY

Model rocketry enthusiasts will soon be introduced to Estes Industries' Solar Launch Control System, the result of extensive research to produce the ultimate in model rocket launch controllers.

Scheduled to be placed on the market May 1, the Estes Solar launcher (Cat. No. 721-FS-10) represents a totally new concept in model rocketry and combines many technical advances that can make the hobby that much more enjoyable for the model rocketeer.



New Igniters, Too

The new launcher is custom-designed to fit snuggly in the rocketeer's hand. Made of durable, "non-breakable" injection-molded plastic, it operates on four 1.5-volt AA pen cells that are good for some 60 launches and is engineered to work exclusively with the new Estes Solar igniters (Cat. No. 721-NWI-2), which will also be available after May 1. The Solar igniters require only a 6-volt power source.

In addition to advanced styling, the futuristic-looking Estes Solar launcher offers ease of construction: the wiring harness is pre-assembled and no special tools are needed to put the kit together. Built-in safety features include a recessed launch button – an added safeguard that backs up the interlock key and the continuity light.

With its 15-foot lightweight launch cable, which comes with pre-soldered micro-clips, the launcher weighs a mere 5 ounces. And it is only 6 inches long – it won't take much room in the rocketeer's range box.

Retail price of the new Estes Solar launcher will be $2.95 (batteries not included). The Solar igniters will retail for 30¢ for six.

BONUS KITS NO LONGER AVAILABLE

The Estes bonus kit program has been discontinued. Look for bigger and better rocketeer specials from Estes! Take advantage of our current super-fantastic special offers:

Hawkeye Instamatic II Camera
Starship Vega Engine Offer
Free Engines for your Saturn V
Range Box Special
Parachute Special
Project Support (Follow Apollo 16)

ORDER FORM

TYPE OR PRINT PLAINLY IN INK
(If additional space is needed use a separate sheet of paper.)

effective 2-15-72

ENCLOSED IS $_____ DATE:_____

PLEASE RUSH THESE ITEMS TO:

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Address _____

City _____ State _____ ZIP CODE _____

Age _____

For Office Use Only

Amt. Recd. _____
Checked By _____
No. Labels _____
No. Pkgs. _____
P _____
N/F _____

Is this your first order? ☐ Yes ☐ No Was your last order more than one year ago? ☐ Yes ☐ No

PLEASE TYPE OR PRINT PLAINLY IN INK

	Quan.	Cat. No.	Product Description	Unit Price	Total
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2					
3					
4					
5					
6					
7					
8					

Please do not write in this space.

AMOUNT THIS ORDER
State Sales Tax 3% (Colo. Residents Only)
Orders under $6.00 add 45¢ additional handling .45
Balance Due Estes Industries from Previous Order
Priority Postage (if desired)
TOTAL ENCLOSED

YOUR ORDER WILL REACH YOU FASTER IF YOU INCLUDE YOUR CORRECT ZIP CODE ON ORDER.

MOVED RECENTLY?

If you have moved since your last order please write your old address below.

NAME _____
ADDRESS _____
CITY _____
STATE _____ ZIP _____

CATALOG REQUEST

Do you have a friend who is interested in model rocketry? Fill in his name and address below and we will send a catalog free.

Friend's Name _____
Address _____
City _____
State _____ Zip _____

1708-72

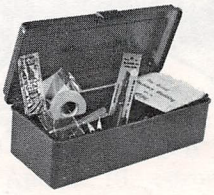
ESTES®
A SUBSIDIARY OF DAMON

ESTES INDUSTRIES
BOX 227, PENROSE, COLO. 81240

CAMERA SPECIAL OFFER

Kodak Hawkeye Instamatic II Camera . . . just aim and shoot! Only $5.95 . . . Regular $12.95 Value. (Catalog Number P56 MP.) Perfect for model rocketry photography! Take advantage of this Kodak value and enter Estes Rocketeer Photo Contest! Takes quality black-and-white or color snapshots or color slides. No settings or threadings necessary – just drop in the film cartridge, aim and shoot. For night or indoor photos pop on a flashcube and take four flash photos without changing bulbs. Easy film advance. Large, bright viewfinder. No double exposures.
Hurry . . . supplies are limited!!!

RANGE BOX SPECIAL



Ideal for the serious rocketeer. Rugged plastic range box includes built-in 10'' rule, two supply shelves, igniters, recovery wadding, masking tape, utility knife, micro-clips, white glue, emery boards, and two pre-assembled parachutes. Perfect for the beginner. (Cat. No. RB-4).
Only $1.99 Regular $4.95 value

FAR OUT 'CHUTE VALUE

High-visibility 10'' orange-and-white Apollo canopy parachutes. Absolutely no assembly required! Parachutes are precut and the shroud lines are already taped to the 'chutes. Each parachute is packed in its own protective plastic bag. Great for your own MINI-BRUTES or for those exciting multiple-chute recoveries! Take advantage now of this super-offer! (Cat. No. 721-PK-10.)

Ten 'chutes for only 99¢