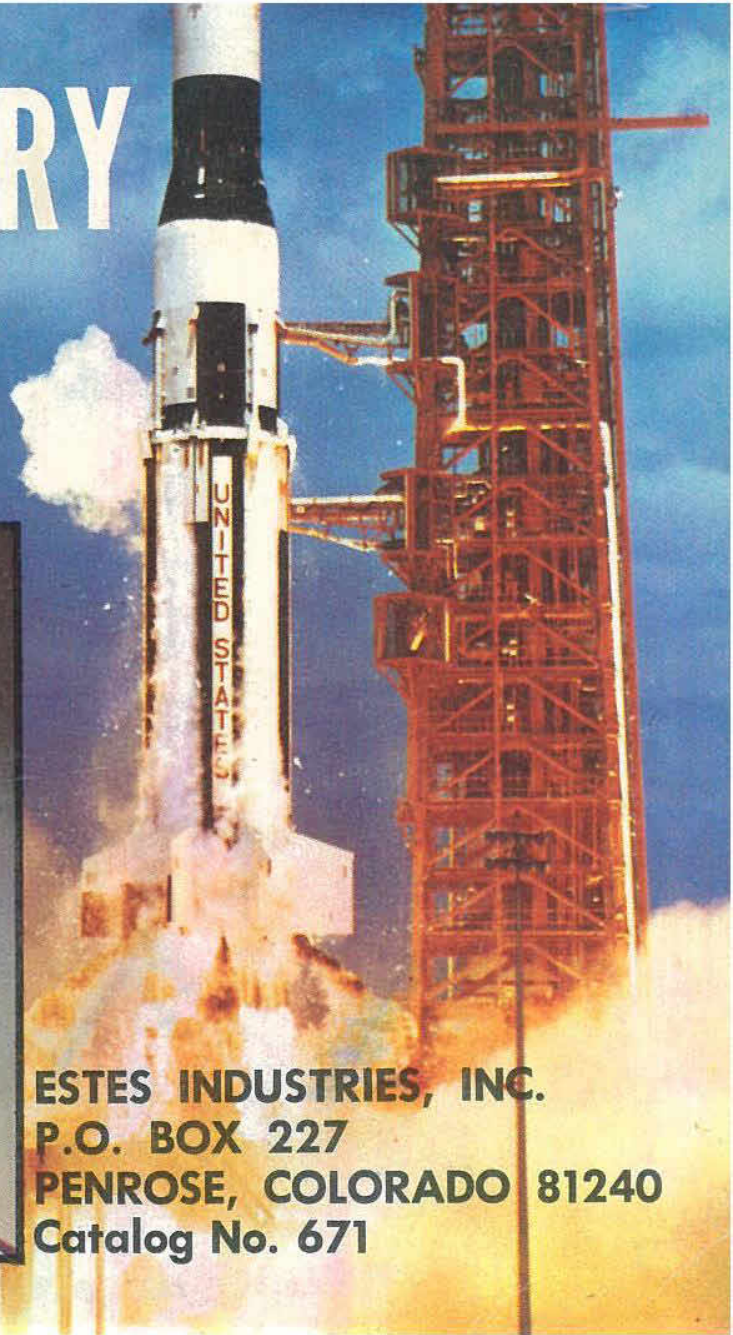


# MODEL ROCKETRY

SUPPLY  
CATALOG



**ESTES INDUSTRIES, INC.**  
**P.O. BOX 227**  
**PENROSE, COLORADO 81240**  
**Catalog No. 671**





## what is **Model Rocketry?**

There are many answers to that question, as any Estes Rocketeer can tell you . . . Model Rocketry is the thrill and excitement of the count-down . . . It is pressing the launch control switch. It is watching your rocket streak skyward . . . It is following the vapor trail as your "bird" shrinks to just a speck . . . and waiting out the recovery until the parachute blossoms out for a safe return of the rocket you've built, ready for many more flights.

But launching is only half the fun. This space age hobby is more than just the thrill of launching a rocket to a thousand feet in seconds. It's a challenge to experiment and explore man's newest science. The more models you build and fly, the more you learn, the more you feel a part of the space age.

What better opportunity to begin studying for a career dedicated to pushing man's frontiers farther and farther toward the stars?

Scores of young men and women are discovering the value of model rocketry in school and science fair projects, and in their own private research projects.

Designing, building and launching a rocket puts to use principles of physics, math, aerodynamics, optics, biology, astronautics, electronics and photography. Science studies are made more interesting and easier to understand.

The space age also increases interest in such related subjects as space medicine and psychology, and leads into studies in the non-science fields of language, history, arts and literature.

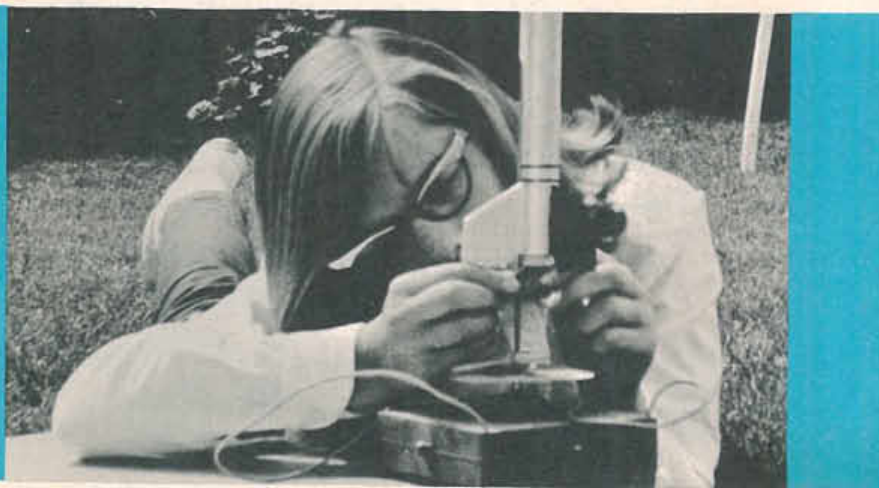
This is the direction which model rocketry leads the people who will, perhaps soon, explore the planets.

## THE SPACE AGE HOBBY WHICH PRESENTS A WAY FOR TODAY'S YOUNG PEOPLE TO EXPLORE THE EXCITING CHALLENGE OF THE SPACE AGE

How does model rocketry accomplish this? A model rocket itself is a highly specialized mechanism, light in weight, utilizing nonmetallic materials such as paper, plastic, and balsa. Standard modeling tools are used to assemble the rockets. By using these materials, the model rocketeer gains the highest performance from a prepackaged commercial engine, and is able to launch accelerometers, biological specimens, electronic instruments, and many other objects inexpensively, reliably and above all, without the dangers often associated with non-professional rocketry.

The model rocketeer does not make his own engines or mix his own propellants, for he realizes that he does not have the facilities and background to do so either efficiently or safely. Instead, he makes use of propellant devices which are pre-made, providing him with a reliable power package which is consistent from one unit to the next. This introduces an element of control into his experiments and enables him to reduce and correlate his data more readily and accurately. He can now draw conclusions from his experiments which would otherwise have been only conjecture.

The type of youth science study provided by model rocketry has no equal for developing active minds which can explore new concepts and principles. Practical experience, gained from working with the same principles, theories and ideas which will be used in his profession, is necessary if today's young person is to be motivated to study for a vital career in the space sciences. When motivated he becomes a pioneer, a pioneer of the greatest frontier man has ever faced.





*WELCOME to  
the exciting world  
of rocketry*

Vernon Estes, president of Estes Industries, explains cluster ignition techniques to local rocketeers.

Welcome . . .

to Estes Industries and to model rocketry, America's fastest growing scientific hobby. Your participation in the Estes program of model rocketry means more than just finding a place to purchase rockets.

As an Estes customer, you will not only have the advantage of obtaining the best materials at the lowest price, but you will also be kept informed of the latest developments as you receive the "Model Rocket News". You will find our Technical Reports (TR's) a helping hand when it comes to designing your own rockets and an invaluable aid to learning the scientific principles of rocket construction and flight. In addition our Customer Service department is always ready to help you.

We invite you to send us your own rocket designs, project ideas and safety suggestions. Each one will be carefully studied and many put to use. Thus you will play an important part in helping establish and maintain the safest and most educational rocket program in the world.

If you have the opportunity, please stop in and see us. We will be pleased to show you around.

Sincerely,

*Vern*

## COMPLETE OUTFIT FOR GETTING STARTED IN MODEL ROCKETRY

**STARTER OUTFIT**  
Just \$6.50 ppd.

Astron Alpha Kit. #K-25    4 Batteries . . . . . #PFB-1  
Electro-Launch Kit #FS-4    1 Engine . . . . . #1/2A. 8-2  
Design Manual . . . #P-1    1 Engine . . . . . #A. 8-3

Here is everything you'll need to build and launch your first rocket. The Alpha is easy to build and has outstanding flight characteristics. Comes with complete instructions to build and fly . . . The Electro-launch included is one of the finest launchers available — one you can use throughout your rocketry career. Also included is a comprehensive manual of rocketry information to get you off to a good start.

Cat. No. 671-DSK-65 Shipping wt. 2 lb., 8oz. **\$6.50**



For building and finishing supplies see pages 62-63

### Also Available \$2.00 BEGINNERS SPECIAL

Includes Alpha kit and all items above except launcher and batteries. Ideal if you already have a launcher or wish to build one of your own design. (Instructions included).  
Shipping Wt. 11.5 oz.

Cat. No. 671-DSK-20

**\$2.00**

For deluxe starter special including building and finishing material, see page 10



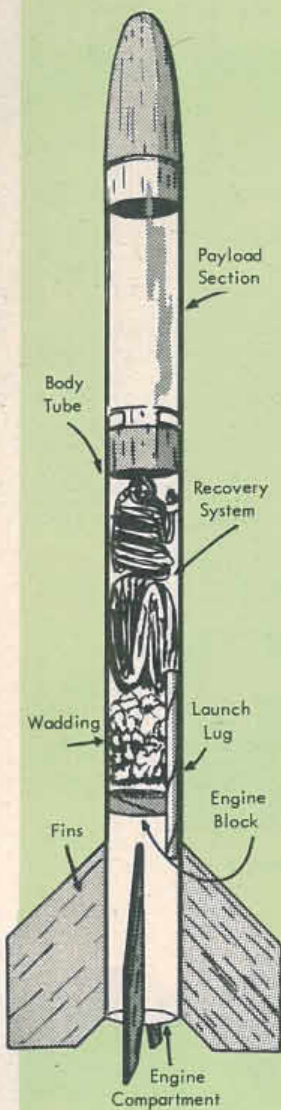


## DESIGN AND CONSTRUCTION

Most model rockets, though varying greatly in appearance and purpose, use certain basic components. These include the nose cone or payload section, body tube, engine retainer, fins, launch lug, and recovery system. The arrangement of these parts in a working model rocket is shown in the plan. The functions of the various parts are explained on the next page.

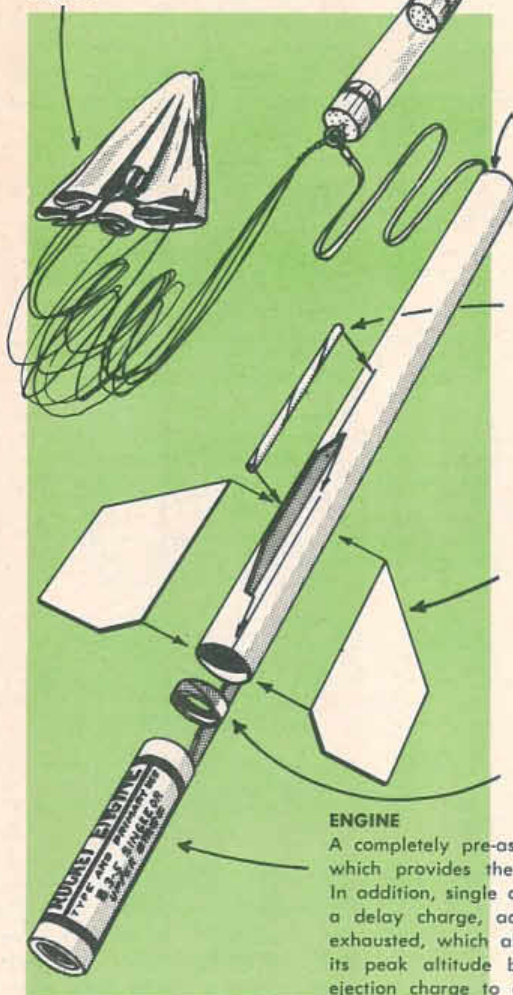
While the range of possible sizes for model rockets is quite great, three body diameters have become the most popular. These are the .710" i.d. (BT-20), .950" i.d. (BT-50) and 1.595" i.d. (BT-60). Parts which fit these tubes are identified by their numbers. For example, a BNC-20N fits a BT-20, a BNC-60L fits a BT-60 and a TA-2050 adapter mates a BT-20 to a BT-50. The other tube sizes available follow the same system. Thus the EB-30 engine block, the BNC-30E nose cone, the PS-30B payload section and the NB-30 nose block all fit the BT-30 body tube.

All parts are manufactured to close tolerances, assuring the builder a precision fit and good appearance. When, after building several kits, the rocketeer is ready to begin designing his own models, he will find that the complete range of precision mating parts makes construction both easier and more satisfying for him.



### RECOVERY SYSTEM

Slows the rocket's descent from peak altitude to bring it back to earth undamaged and in reusable condition. This model uses a parachute which is deployed by the ejection charge built into the engine.



### PAYLOAD SECTION

Accommodates small biological specimens, instruments, etc. On models designed purely for sport or high performance, the payload section is often omitted and the recovery system is attached directly to the nose cone.

### BODY TUBE

Serves as the basic airframe of the model. Generally all other parts of the rocket are attached in some manner to the body.

### LAUNCH LUG

A tube which fits over the launch rod to guide the model along the rod for the first few feet of its flight, keeping it going straight until it is moving fast enough for the fins to guide it.

### FINS

Act like the feathers on an arrow, guiding the rocket in the air by providing lift in a direction opposite any turning force.

### ENGINE RETAINER

In this model, an engine block which positions the engine in the body tube.

### ENGINE

A completely pre-assembled solid propellant device which provides the motive power for the model. In addition, single and upper stage engines contain a delay charge, activated when the propellant is exhausted, which allows the model to coast up to its peak altitude before it in turn activates the ejection charge to deploy the recovery system.



## Get The Most From Model Rocketry

...by following a carefully planned course of study and experiments. By starting out with simple models and working up to the more complex ones, you'll have more successful flights, enjoy your studies more and learn more. By studying technical reports and other available literature you'll gain a solid knowledge of model rocketry that will serve you well in other areas of science.

To help you plan your own studies in model rocketry, here's a suggested program. With this program you tackle more advanced subjects after mastering the basic ones.

1. Build and fly the Astron Alpha. Study the rocket's design and read the included technical report, TR-1, to gain a thorough understanding of principles of rocket stability which are so very important to proper rocket performance.
2. Extend your knowledge of stability by building and flying the Astron Scout.
3. Study Technical Report TR-9. Apply the principles described in it in designing, building and flying your own single stage model.
4. Build and fly the Astron Apogee. Study TR-2 (included with the kit) to master the principles of multi-staging.
5. Build and fly the Astron Farside to gain further experience in multi-staging and gain a broader knowledge in the field.
6. Design, build and fly your own multi-stage model, practicing the techniques you learned with the Apogee and the Farside.
7. Learn the principles of rear engine boost-gliders by building and flying the Astron Space Plane and studying the included report, TR-4.
8. Build the Astron Falcon and study TR-7 (included with the kit) to learn the principles of front engine boost gliders and gain further experience in the art of balancing for maximum performance.
9. Design, build and fly your own boost-glider, applying the principles you have studied while working with the Space Plane and the Falcon.
10. Get started in clustering by building and flying the Astron Cobra and studying TR-6 (included with the kit).
11. Practice what you've learned by designing, building and flying your own cluster rocket.
12. Start your own special research program. Aerial photography, space medicine, electronics, meteorology, physics and aerodynamics are but a few of the fields open to the ambitious model rocketeer.

Once you've started, don't stop. The whole universe is yours to explore. As you train yourself to be a competent scientist, you'll find more and more new fields opening for you. Don't be afraid to be curious. Curiosity gave us the electric light, the radio, the automobile and the airplane. Your curiosity may well give man things he has never dreamed of.

## MODEL ROCKET FLIGHT

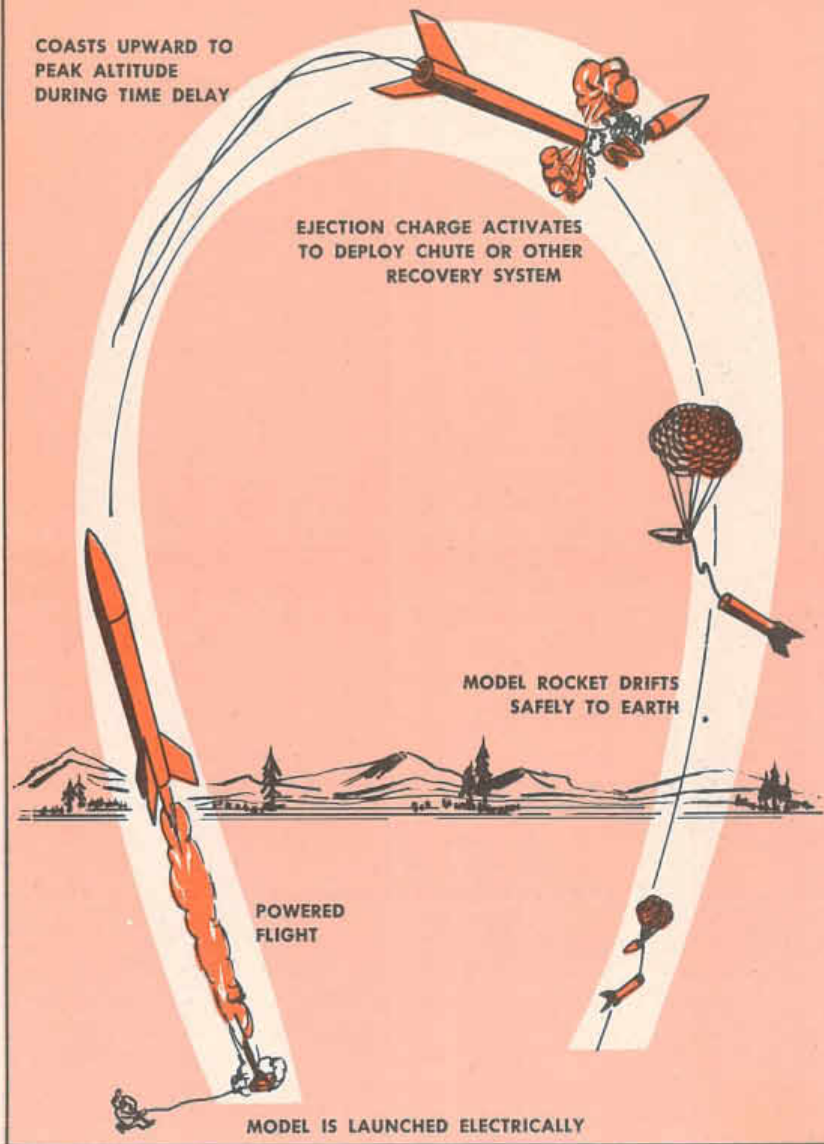
COASTS UPWARD TO  
PEAK ALTITUDE  
DURING TIME DELAY

EJECTION CHARGE ACTIVATES  
TO DEPLOY CHUTE OR OTHER  
RECOVERY SYSTEM

MODEL ROCKET DRIFTS  
SAFELY TO EARTH

POWERED  
FLIGHT

MODEL IS LAUNCHED ELECTRICALLY





## MODEL ROCKET PERFORMANCE

### HOW HIGH WILL YOUR MODEL GO?

The altitude capabilities of different model rockets vary greatly. There are several things that affect the performance of a model. The first of these is engine size. The greater the **total impulse** of an engine, the higher it will boost a model. The chart below shows the approximate altitudes that can be achieved with single stage rockets.

Engine Size	Altitude Range	Approximate Altitude in a typical 1 oz. model
¼A.8-2	50' to 250'	100'
½A.8-2	100' to 450'	300'
A.8-3	200' to 900'	650'
B.8-4	300' to 1200'	1000'

(Some high performance models will reach higher altitudes than shown above.)

The second thing that affects rocket performance is weight. The heavier a rocket is, the less altitude it will reach. A baseball can be tossed higher than an 8 pound cannon ball — and the same holds true for model rockets. In addition, heavier rockets are more apt to tilt at an angle as they leave the launcher, reducing altitude even more.

Weights listed for rocket kits in the catalog do not include engines. To determine the lift-off weight of a model, add the engine weight, shown in the engine selection chart, to the kit weight.

Drag, or wind resistance, is the third item which affects performance. The more drag on a rocket, the less altitude it will reach. A number of factors determine the amount of drag on a rocket. The more frontal area the rocket has, the greater its drag will be. As a result, large diameter model rockets will generally not reach as great an altitude as smaller diameter rockets with the same engine power. Rough surfaces create turbulence in the air as it flows past the rocket, increasing drag. Smooth finishes will increase the altitude capability of the model. The stability of the rocket also affects drag — if it wobbles in flight, it will have greater drag. Careful attention to reducing drag can sometimes double a rocket's altitude capability.

The kits, components and engines in this catalog have been designed to cover the entire performance range from low altitude sport and demonstration models to high altitude, high performance payload and competition rockets. By choosing his kits, materials and engines carefully, the rocketeer can fill his performance needs exactly. Complete specifications are given on all items to make this selection easy.

For a complete discussion of rocket performance, read Estes Industries technical report, TR-10 (see page 79).

## ROCKET SAFETY . . .

### . . . an enviable safety record with model rockets

Since 1960 model rocketeers across the country have flown more than 6 million model rockets. During this time they have established one of the best safety records of any sport or hobby. While no exact data is available, it is known that model rocketry is considerably safer than most "common" sports such as hunting, swimming, bicycling, football and baseball.

Several things contribute to this safety record. Such hazardous operations as mixing and loading propellants are eliminated by the use of a pre-manufactured engine. The model rocket itself has a great margin of safety built into it. Model rockets are built of lightweight balsa and paper so that they absorb any impact rather than the object struck. The model rocket spends very little of its flight near the ground — most of its flight is several hundred feet away from **anything**. Finally, model rocketeers themselves have contributed greatly by following a recognized safety code such as the one reprinted below. The newcomer to model rocketry will do well to follow this safety code too. Not only will it add to the safety of his activities, but will make model rocketry more enjoyable and more valuable also.

**SAFETY CODE:** As a model rocketeer I will act in a mature manner with safety foremost in my mind in all my model rocket activities and will obey this safety code at all times.

1. I will not attempt to compound propellants or other combustible chemicals or tamper with pre-manufactured rocket engines. I will not use model rocket engines for purposes other than those for which they are recommended by the manufacturer. I will inspect each rocket engine before use and never use an engine which shows signs of physical damage, remembering that any rocket propellant can be explosive under certain conditions.
2. I will not smoke near rocket engines, launch my rockets in the presence of highly combustible materials, use flammable recovery wadding or engage in any activity which would present a fire hazard.
3. I will never use any metallic rocket engines, will not construct my model rockets with substantial metal parts in the area of the engine, and will not launch any rocket over 16 ounces in weight or containing more than 4 ounces of propellant in compliance with Federal regulations.
4. My model rockets will be electrically ignited, using a launch system with either a switch protector or a safety interlock to prevent accidental ignition of the rocket engine, and I will remain at least 10 feet away from any rocket which is being launched. I will use only igniters of the type recommended by the engine manufacturer.
5. I will launch my model rockets using a launching rail or other suitable guide means aimed within 25 degrees of the vertical to assure a safe and predictable flight path, and will launch only rockets whose stability characteristics have been predetermined.
6. I will not fly model rockets in high winds, conditions of low visibility, in the vicinity of low flying aircraft, near tall buildings, near people not aware of the launching, or under any conditions which might endanger property or persons.
7. I will not launch rockets so that their ballistic trajectory will carry them against targets on the ground, and will never use an explosive warhead or other pyrotechnic payload in a rocket.
8. My model rockets will contain recovery devices which will deploy at an altitude of at least 50 feet to return the rocket safely and undamaged. To insure proper operation of my rocket's recovery system I will make a careful pre-launch inspection of all the recovery components with special attention to tightness of the engine and nose cone.
9. To prevent accidental eye injury I will always either place the launcher so the end of the rod is above eye level or cap the end of the rod with my hand when approaching it. I will not place my head or body over the launching rod.
10. When conducting research activities with unproven designs or methods I will, when technically possible, determine their reliability through pre-launch static tests, and I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.



## DELUXE STARTER SPECIAL

This is the most complete outfit ever offered for people who have done no previous model building. At the low price of \$7.75 you get everything needed to get off the pad: rocket, engines, launcher, tools and paints. As a special bonus an authoritative manual on rocketry is included.



- Astron Alpha kit ..... #K-25
- Electro-Launch kit ..... #FS-4
- 4 Batteries ..... #PFB-1
- 1 Engine ..... #1/2A.8-2
- 1 Engine ..... #A.8-3

### PLUS

a knife, glue, paints, brush, brush cleaner, sandpaper—supplies which can be used in building several more rockets.

Cat. No. 671-DSK-77 ..... \$7.75  
Shipping wt. 3 lb., 11 oz.

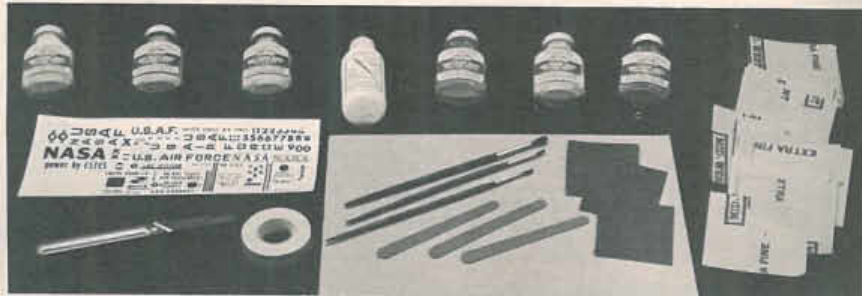
## ASSEMBLY SPECIAL

A Complete Construction and Finishing set

- |                                   |                                      |                             |
|-----------------------------------|--------------------------------------|-----------------------------|
| 1 Bottle White Glue #WG-1         | 1 Bottle Dope Thinner #BDT-1         | 1 Knife #KNS-3              |
| 3 Emery Boards #BE-1              | 1 Bottle White Dope #BRD-1           | 18 Sheets Sandpaper #SPA-2  |
| 1 Bottle Sanding Sealer #SS-1     | 1 Roll Masking Tape #MT-1            | 3 Paint Brushes #PB-3       |
| 1 Bottle Silver Dope #BRD-1       | 1 Bottle Black Dope #BRD-1           | 1 Bottle Orange Dope #BRD-1 |
| 3 Sheets Sanding Material #SP-320 | 1 Gold Mine Special Decal Sheet #D-5 |                             |

One convenient package, containing all the tools and supplies recommended for assembling, painting, and decorating most model rockets. Ideal for the beginner who doesn't already have modeling equipment. This set helps you build the best models right from the start.

Cat. No. 651-CK-3A, shipping wt. 1.5 lb. .... \$3.00



## Astron ALPHA

A High Performance  
"first"

... great "first" rocket for you to build and fly



Specifications: Length — 12.25";  
Body Dia. — .976; Fin Span — 4"; Weight — .76 oz.  
Recommended engines: 1/4A.8-2; 1/2A.8-2; A.8-3; B.8-4

### PARACHUTE RECOVERY/QUICK ENGINE CHANGE

An exciting rocket to fly. From "lift-off" to recovery, it demonstrates superior flight characteristics. The easiest parachute model to "prep" and fly. With its low weight and streamlined design, the Alpha will reach high altitudes consistently. An excellent model to have in your rocket fleet. The choice of experienced modelers because of its high performance and dependability.

Kit includes technical report, TR-1

Cat. No. 671-K-25, shipping wt. 8 oz. .... \$1.50

(Engines not included in kit)





**4 ENGINE  
POWER**

**\$9.50**

**Specifications**

Length.....37"  
Body Dia.....3.53"  
Weight.....9.86 oz.

Recommended Engines (All four must be the same.)  
A.8-3; B.8-4

# SATURN 1-B

**SPECTACULAR  
FLYING SCALE  
MODEL**

### 3 Parachute Recovery

A thrilling scale model for even the most advanced rocketeer, this bird will be a real challenge to your building and flying skill. A four engine cluster lifts the Saturn 1-B model into the air. Two 24" parachutes on the main body and a 12" parachute on the command-escape structure return it gently. A real beauty, both in the air and on display. A 12 volt car battery and launch control system (such as the Estes 12 volt Launch Control System) is required for ignition. Kit comes complete with all parts, decals, detailed instructions and a copy of Technical Report No. TR-6 (but no engines). Shipping weight 4 lbs.

**Cat. No. 671-K-29 . . \$9.50**



**U.S. Army's  
Surface-to-Surface  
Ballistic Missile**

# HONEST JOHN

*Decals for authentic  
markings to give you a  
historic model to  
display and fly*

**SPECIFICATIONS**  
Weight 1.19 oz.  
Length 13.75"  
Fin Span 4.4"  
Body Tube  
Dia. .976"

Engines not included



Flying Scale Model  
Scale Detail by G. Harry Stine

## PARACHUTE RECOVERY FOR MANY LAUNCHINGS

A beautiful scale model that performs with brilliance. Lifts off the launch pad fast and streaks skyward straight and true. Recommended for experienced modelers, the kit comes complete. An exciting flight model and a historic one for your display shelf.

Recommended Engines: B.8-4, A.8-3, 1/2A.8-2

Cat. No. 671-K-27, shipping wt. 14 oz.



**\$2.00**



# GEMINI-TITAN GT-3

SEMI-SCALE MODEL  
SPECTACULAR FLIGHTS  
PARACHUTE RECOVERY  
TWO ENGINE POWER

\$400  
EACH

Spectacular on the ground and in the air, the Gemini-Titan is a model for the expert rocketeer, a model that is a challenge to build and fly. Requires experience to build, but the GT-3 is a rocket that the modeler can point to with real pride when he's finished it. Features clear plastic fins to stabilize it in flight without detracting from its appearance, full 24" parachute for soft landings. Requires 24 volt Electro-Launch or 12 volt car battery power supply for launching. Kit is complete with all parts and detailed instructions (but no engines). Shipping weight 16 oz.

Cat. No. 651-K-21 .....\$4.00 each

#### Specifications

		Recommended Engines
Length	24.4 in.	
Body Dia.	2.22 in.	A.8-3
Weight	3.8 oz.	B.8-4

Kit includes technical report, TR-6



EASY-TO-BUILD  
**WAC**   
CORPORAL

*Great for Flying and Display*

HISTORICAL FLYING SCALE MODEL

High-flying scale model of the famous sounding rocket! Easy enough for the novice to build, yet interesting enough for the experienced rocketeer, the WAC CORPORAL gives top performance for a scale model. Parachute recovery gives gentle landings flight after flight. Comes in easy to assemble kit form. (Engines not included.) Shipping wt. 5 oz.

Cat. No. 651-K-11 .....\$1.50 each

Body Dia.	.....736 in	Recommended Engines	
Length	.....11.8 in	1/4 A.8-2	1/2 A.8-2
Weight	......65 oz	A.8-3	B.8-4
(Use 1/2 A.8-2 engines for first flights.)			

Kit includes technical report, TR-1



# AEROBEE 300



## Flying Scale Model

Easy to build scale model of a great sounding rocket. Gives top performance in flight after flight. Features parachute recovery for gentle landings, payload section for small specimens. Kit is complete with all parts and easy-to-follow instructions (but no engines). Shipping weight 14 oz.

Cat. No. 651-K-17 ..... \$2.00 each



Recommended Engines	Specifications	
1/2 A.8-2	Length	20 in.
A.8-3	Body Dia.	0.98 in.
B.8-4	Weight	0.85 oz.

# V-2

## Flying Scale Model



High performance scale model of the rocket that started the space age. Easy but interesting to build, the V-2 features reliable parachute recovery for gentle landings. Detailed instructions provide full information on assembly and finishing. Kit comes complete with all parts (but no engines). Shipping weight 7 oz.

**PARACHUTE  
RECOVERY  
EASY-TO-BUILD  
KIT**

Cat. No. 651-K-22 ..... \$1.75 each

Specifications	Recommended Engines
Length 11.2 in.	1/2 A.8-2
Body Dia. 1.325 in.	A.8-3
Weight 1.4 oz.	B.8-4
	B.3-5





FLYING  
SCALE  
MODEL

## Sleek and Slender ARCAS®

for exciting probes  
into the  
atmosphere

**\$2.00**

### Parachute Recovery

Precise scale model of the famous ARCAS® sounding rocket. A handsome model to display, an exciting one to launch. Zooms hundreds of feet into the sky; returns gently by its 18" multi-color parachute ready for a fresh engine and another flight. Easily assembled, kit comes complete with all parts, decal and instructions. Shipping wt. 14 oz.

RECOMMENDED ENGINES (not included)  
B.8-4, A.8-3, 1/2A. B-2

#### SPECIFICATIONS

Length ..... 22.82"    Body Dia. .... 1.325"  
Fin Span .... 3.82"    Weight ..... 1.44 oz.

Cat. No. 671-K-26 ..... \$2.00

® Registered Trademark of the Atlantic Research Corp., Alexandria, Va.

Launch vehicle for the Discoverer program

# THOR AGENA-B

**\$2.50**  
ppd.

### Flying Scale Model

Actual scale model of the famed N.A.S.A. booster that lofted such satellites as Aloette (Canada's first satellite), Nimbus (the U.S. weather satellite) and many more. Colorful 18" chute brings it back gently. Features clear plastic fins to stabilize model in flight without detracting from its appearance. Easy to build, comes complete with all parts and easy-to-follow instructions (but no engines). Shipping wt. 13 oz.

Cat. No. 671 - K-28 ..... \$2.50

#### RECOMMENDED ENGINES

1/2.8-2    B.8-2  
A.8-3    B.8-4

#### SPECIFICATIONS

Body Dia. 1.637 in.  
Length 17.25 in.  
Weight 2.16 oz.





# Astron DRIFTER

GREAT FOR  
COMPETITION AND  
SPORT FLYING

## 2 BIG CHUTES

ONLY  
\$1.75

Spectacular in upward flight and recovery, the Astron Drifter combines low weight with large chute capacity. Perfect in any competition with its 24" chute, the Astron Drifter is a great performer with its 12" chute for test and sport flying too! Parachutes are easily interchanged.

Cat. No. 651-K-14 ..... \$1.75 each  
Shipping weight ..... 8 oz.

**Recommended  
engines are:**

1/2A.8-2    A.8-3  
B.8-2      B.8-4  
Engines not included

Body Dia. ... 0.98 in.  
Length ..... 14.3 in.  
Weight ..... 1 oz.



- SINGLE STAGE
- PARACHUTE RECOVERY

# Astron X-RAY

*Visible Payload*



An easy-to-build high performance single stage payload rocket, the Astron X-Ray features parachute recovery and a large see-through payload compartment. Perfect for research work and sport flying too. Kit comes complete (less engines).

Shipping wt. 6 oz.  
Cat. No. 651-K-18 ..... \$1.75

**RECOMMENDED  
ENGINES:**

1/2A.8-2  
A.8-3  
B.8-4  
B.3-5

Length ..... 16 3/4"  
Body Dia. .... 0.736"  
Payload  
Sec. Dia. .... 0.950"  
Weight ..... 0.7 oz.



## MULTI-STAGING TECHNIQUES

By studying staging techniques developed by Estes Industries (see technical report TR-2) young rocketeers can learn much about the principles of 2 and 3 stage propulsion systems which boost our nation's rockets into orbit and outer space. Though the methods of operation for professional and model rocketry are different, the principles are quite similar.

At launch the lower or first stage of a multi-stage rocket is always ignited by standard electrical means. The second stage ignition is accomplished automatically at burnout of the first stage engine, etc.

In model rocketry, as in space launches, booster sections are automatically separated from the following section as the thrust from each engine is spent. Model rocket booster sections are returned safely by tumble recovery, and the final section is returned by parachute or any other standard system.

We recommend that a rocketeer become thoroughly familiar with single stage rockets before advancing to multi-stage models.

## Astron DELTA

**TWO STAGES • FLIES OVER 2000 FEET • MULTI-PURPOSE  
ADVANCED DESIGN • PARACHUTE RECOVERY**

Reliable workhorse booster for payload research. The Astron Delta accommodates all BT-50 size payload sections. May be flown either as a single or two stage vehicle, features advanced stage coupling for top dependability. Kit is complete with all parts and easy-to-follow instructions (nose section and engines not included). Shipping weight 8 oz.

**Cat. No. 651-K-16 ..... \$1.50 each**  
Kit includes technical report, TR-2

Specifications	Recommended Engines	
	Booster	Upper Stage
Length 13.6 in.	Multi-Stage Flights	
Body Dia. 1 in.	B3-0	B.8-6
Weight 1.45 oz.		B 3-6
		B 3-7
	Single Stage Flights	
	A.8-3	B.8-4
	B 3-5	B 3-6

The basic system used on most multi-stage model rockets today is covered by Estes patent number 3,292,302

Pat. No.  
3,292,302

# Astron FARSIDE

## 3 STAGES

A sophisticated ultra-high altitude probe or a workhorse vehicle for high altitude studies with large payloads — take your choice with the Astron Farside. Advanced stage coupling gives dependable ignition and stage separation. Perfect for your advanced research programs. Top stage flies to well over 2500', returns gently by parachute. Available with standard 1" payload section (No. 651-K-12) or with extra large 1½" dia. capsule for large payloads (No. 651-K-12X). Be sure to specify model type when ordering. Kit comes complete with all parts and assembly instructions (but no engines). Includes technical report, TR-2. Shipping weight 8 oz. . .

**STANDARD MODEL:**  
Cat. No. 651-K-12 \$2.75 each

**LARGE PAYLOAD MODEL:**  
Cat. No. 651-K-12X \$3.00 each

	K-12	K-12X
Length	21.5 in	25 in
Weight	2.0 oz.	2.5 oz
Diameter	0.98 in	1.6 in

### RECOMMENDED ENGINES

First Stage	Second Stage	Top Stage
¼ A.8-0	¼ A.8-0	¼ A.8-4
½ A.8-0	½ A.8-0	½ A.8-4
B 3-0	A.8-0	A.8-4
	B.8-0	B.8-6
	C.8-0	B 3-5
	B 3-0	

**NOTE:** Other booster engines may be used if there is no wind.

Pat. No. 3,292,302



Astron

# APOGEE II

IN ORBIT...

...THE HIGHEST

OR FARTHEST POINT FROM EARTH IS CALLED

The ability of this rocket to reach extreme altitudes consistently makes "APOGEE" a natural name choice.

The ultimate in two stage performance and dependability. The new, improved Astron Apogee II incorporates revolutionary discoveries in multi-stage methods, features a transparent, see-through payload capsule — lets you observe specimens without removing them from the rocket. Parachute recovered for soft landings. Complete with all parts and instructions (but no engines). Shipping weight 6 ounces.

Cat. No. 651-K-5 .....\$2.00 each

### Recommended Engines

Booster	Upper Stage
1/4 A.8-0	1/4 A.8-4
1/2 A.8-0	1/2 A.8-4
A.8-0	A.8-4
B.8-0	B.8-6
C.8-0	B.3-5
B.3-0	



Kit includes technical report TR-2

"APOGEE."

Pat. No.  
3,292,302

Weight ..... .60 oz  
Length ..... 14.75 in  
Body Dia. ... .736 in

# MARS SNOOPER

- FASCINATING DESIGN
- PARACHUTE RECOVERY
- IDEAL FOR DEMONSTRATION FLIGHTS

A truly different model rocket, the Mars Snooper combines interesting appearance with reliable performance — makes an excellent model for demonstration flying and display. Features payload section, 18" parachute and precut fins for easier assembly. Recommended for the careful modeler, the Mars Snooper kit comes complete with all parts and detailed instructions (but no engines). Shipping wt. 12 oz.

Cat. No. 651-K-20 .....\$3.00 each

### Specifications

Length	21.7 in.
Body Dia.	0.98 in.
Weight	2.2 oz.

### Recommended Engines

1/2 A.8-2
A.8-3
B.8-4







# BIG BERTHA

**SIMPLE — RELIABLE**  
**PARACHUTE RECOVERY**  
**PERFECT FOR**  
**DEMONSTRATIONS**  
**SINGLE ENGINE OPERATION**

Easy-to-build, reliable and impressive in flight, Big Bertha is an ideal model for demonstration flights. Features a slow, realistic takeoff that fascinates spectators. This is the model shown in action on the inside front and back covers. Big 18" 'chute gives slow descent and gentle landings. Kit comes complete with all parts and easy to follow instructions (but no engines). Shipping weight 16 oz.

**Cat. No. 651-K-23** ..... **\$2.00**

Specifications		Recommended
Length	24 in.	Engine
Body Dia.	1.6 in.	B.8-2
Weight	2.25 oz.	



Weight ... .72 oz  
 Body Dia. .736 in  
 Length ... 8.7 in

# Astron PHANTOM

*Complete Cutaway Rocket*

**DEMONSTRATES BASIC BUILDING RULES.**  
**Great for classroom or science fair!**

This bird will never fly, but it will certainly help get your science fair project or special demonstration off the ground! The Astron Phantom has a transparent body to show all the insides of a model rocket — plus a special dummy engine cut in half to show its insides. A great help in answering questions on model rocketry, the Astron Phantom kit comes complete with all parts and instructions (but no fins). Shipping weight 5 oz.

**Cat. No. 651-K-7** ..... **\$1.75**



# Astron SPACEMAN

The most controversial model rocket yet. Some feel he's a disgrace to the sport, others say he does an important job in showing that a rocket doesn't have to look like a rocket to fly well. Requires patience and a bit of artistic ability to build. Uses the featherweight recovery system. Kit comes complete with all parts and instructions (but no engines). Shipping weight 7 oz.

**Cat. No. 651-K-9** ..... **\$ .75**

4" wide, 7.25" long,  
 weighs .45 oz.

**Recommended Engines**  
 1/4 A.8-2      1/2 A.8-2  
 A.8-3      B.8-4  
 (Use 1/4 A.8-2 engines  
 for first flights.)



# Astron

## SKY HOOK



• PARACHUTE RECOVERY

• EASY TO BUILD

You'll really enjoy building and flying your Astron Sky Hook. Easy to build and durable, parachute recovery brings it back gently for flight after flight. Kit comes complete with all parts and instructions (but no engines). Shipping weight 5 oz.

Cat. No. 651-K-8 .....\$1.35

• TERRIFIC PERFORMER

Body Dia. .765 in  
Length ... 12 in  
Weight ... .65 oz

Recommended Engines  
1/4 A.8-2 B.8-4  
1/2 A.8-2 B.3-5  
A.8-3

ONLY  
\$1.35

(For first flights use 1/2 A.8-2 engines.)

# Astron COBRA

The ideal bird for getting started in clustering, yet challenging to the experienced rocketeer; the Astron Cobra gives you top performance. Medium size payloads (up to 4 ounces) get a real ride in the Cobra's 1" diameter capsule. Kit comes complete with all parts, instructions, and a copy of technical report TR-6 on cluster techniques. (Engines not included.) Shipping weight 13 ounces.

Cat. No. 651-K-10 .....\$2.50 each

Body Dia. .... 1.6 in  
Length ..... 22.25 in  
Weight ..... 2.5 oz

Recommended Engines  
A.8-3 B.8-4

BIG BOOST  
FOR COMPACT  
PAYLOADS

3 ENGINE  
POWER



EXTRA  
LARGE  
PAYLOAD

3 ENGINE  
WALLOP

2 - CHUTES

# Astron RANGER

IDEAL FOR PAYLOAD EXPERIMENTS!

Specially designed for big payloads — you can demonstrate your skill by launching and recovering an egg with this rocket! Carries payloads up to 3½ ounces to high altitudes. The perfect vehicle for your special instruments and specimens. The Astron Ranger kit comes complete with all necessary parts, assembly and flight instructions, plus a copy of TR-6 on cluster techniques. (Engines not included.) Shipping wt. 13 oz.

Cat. No. 651-K-6 .....\$2.75 each

Body Dia. .... 1.6 in  
Length ..... 24 in  
Weight ..... 3.35 oz

Recommended Engines  
A.8-3 B.8-4



# Astron SPACE PLANE



Patent No. 3,157,960

**ALWAYS A WINNER!**

## AMERICA'S NO. 1 CONTEST WINNER AND RECORD HOLDER!

Rocket powered glider — ascends vertically, then glides to a gentle landing. The most successful boost-glider ever developed, the Space Plane wins duration contests with amazing regularity. The Space Plane features easy and accurate adjustment of glide characteristics, plus a payload compartment large enough to handle small biological specimens and other scientific objects. The Astron Space Plane is easy to launch and with proper care will give you unlimited flying enjoyment. This kit is recommended for the experienced modeler, and must be assembled with precision and care. (Engines not included.) Shipping weight 5 oz.

Body Dia. .... .765 in  
Length ..... 10 in  
Wing Span ..... 9 in  
Weight ..... .5 oz

Kit includes technical report, TR-4

### Recommended Engines

1/4 A.8-2	1/2 A.8-2
A.8-3	B.8-4
B.8-2	

(Use 1/4 A or 1/2 A engines for first flights.)

Cat. No. 651-K-3 ..... **\$1.80 each**

# Astron FALCON

## ROCKET GLIDER



Patent No. 3,114,317

Kit includes technical report, TR-7

## CLIMBS STRAIGHT UP! FLAT GLIDE — LONG DURATION!

Get sky-high performance with the new Astron Falcon boost-glider. Beautiful climb — glide durations up to and over 1 1/2 minutes on 1/4 A engines, even more with larger engines. A great bird for the experienced rocketeer. Glide recovery brings it back gently, ready for a fresh engine and another flight. Kit comes complete with all parts and instructions (engines not included). Shipping wt. 5 ounces.

Cat. No. 651-K-13 ..... **\$1.00 P.P.**

Length ..... 12 in  
Wing Span ..... 10 in  
Weight ..... .40 oz

### Recommended Engines

1/4 A.8-2	1/2 A.8-2
A.8-3	B.8-4
B.8-2	

For normal flying only 1/4 A and 1/2 A engines are recommended — the Astron Falcon can easily glide out of sight with larger engines if it is built and balanced carefully.





Astron

# SCOUT

- EASY TO BUILD
- TUMBLE RECOVERY
- EDUCATIONAL

Get valuable experience building and flying the Astron Scout. Kit teaches rocket balance principles. A must for the rocketeer who wishes to learn to design his own models. Kit comes complete with all parts, instructions, and a copy of technical report TR-1 (but no engines). Shipping weight 2 oz.

Cat. No. 651-K-1 .....\$ .70 each

#### Recommended Engines

1/4 A.8-2 1/2 A.8-2 A.8-3 B.8-4  
(Use 1/4 A.8-2 for first flights.)

Length .. 7 in  
Body Dia. .765 in  
Weight ... .28 oz

Patent No.  
3,114,317



Astron

# MARK

STREAMER  
RECOVERY

THE NEXT STEP FOR THE BEGINNER  
IDEAL FOR SPORT AND  
DEMONSTRATION FLYING

An excellent bird for novice or experienced rocketeer. Easy to build, ideal for sport and demonstration flying, the Astron Mark gives top notch performance. Kit comes complete with all parts and instructions (but no engines). Shipping weight 5 oz.

Cat. No. 651-K-2 .....\$1.25

#### Recommended Engines

1/4 A.8-2 1/2 A.8-2  
A.8-3 B.3-5 B.8-4  
(Use 1/2 A.8-2 for first flights.)

Length ..... 9.12 in  
Body Dia. . . .765 in  
Weight ..... .65 oz



Astron

# SPRITE

HIGH PERFORMANCE  
TUMBLE RECOVERY

The perfect model for small fields and sport or demonstration flying. The Astron Sprite is easy to build, with tumble recovery to teach principles of rocket balance and bring the model back safely — close to the launcher. Uses lightweight Series III engines only, gives top performance for its size. Kit comes complete with instructions and a copy of TR-1 (but no engines). Shipping weight 5 oz.

Cat. No. 651-K-15 .....\$ .75 each

#### Specifications

Length 5.3 in.  
Body Dia. .765 in.  
Weight 0.3 oz.

#### Recommended Engines

1/4 A.8-2S  
1/2 A.8-2S  
1/2 A.8-4S

*Ideal for small  
field sport and  
demonstration flying*

Patent No.  
3,114,317



Astron

# STREAK

2,000 ft. flights Featherweight  
Recovery

Low weight and wind cheating design give the Astron Streak fantastic performance. Uses mylar body tube for high strength and low weight — only 1/8 ounce without engine. Ideal for contests and records. Recommended engine for normal flying is the 1/4 A.8-4. Kit comes complete with all parts and instructions (but no engines). Shipping weight 4 oz.

Cat. No. 651-K-4 .....\$ .50

Body Dia. .... .72 in  
Length ..... 5.6 in  
Weight ..... .125 oz

Recommended Engines  
1/4 A.8-4 1/2 A.8-4  
A.8-4 B.8-6

*Spectacular Single  
Engine Performance*



PHOTO  
TECHNIQUES  
AND  
PROCESSING  
INFORMATION  
PAGE 36



Lens speed — F-11  
Shutter speed — 1/1600  
Focal Length 3" (76 mm)

Cat. No. 651-C-1

**\$4.00**

Shipping Weight 7.5 oz.

## ROCKET Photography

**NOW YOU CAN TAKE  
AERIAL PICTURES FROM  
YOUR OWN ROCKETS**

An ingenious space age camera which automatically takes pictures of the earth from your rocket hundreds of feet in the air — almost like being there yourself.

## CAMROC ROCKET CAMERA

### Specifications

Diameter 1.6"  
Length 5.3"  
Wt. 1.26 oz.

**Recommended Booster  
Vehicle is the Astron Delta**  
Other models  
can be adapted

**Recommended Engines**  
Multi-Stage Flights  
Booster Upper Stage  
B 3-0 B 3-6 B 3-7  
Single Stage Flights  
B 3-5 B 3-6

PRINT SIZE  
3 INCHES

ACTUAL SIZE  
NEGATIVE 1½"

## Estes Industries research adds new dimensions to model rocketry

The Camroc is an important piece of equipment for your rocket activities. This amazing camera opens an entirely new field to rocketeers. Study space science reconnaissance techniques the practical way — over familiar terrain, with known objects. Learn principles of camera construction and operation.

Build your own rocket aerial camera that can be launched to high altitudes by light weight model rockets for many space type photo missions. As it follows the flight sequence illustrated at the right, the Camroc automatically takes its picture and returns safely by parachute.

Film used is a single exposure film disc mounted in a detachable, light-tight holder for quick and easy replacement in the field.

Kit contains: all parts; complete instructions for assembly and operation; 1 film holder loaded with unexposed film; an exposed film disc and 1 empty film holder for loading and experimenting.

Fits body tube BT-50

Save 50¢

## SPECIAL OFFER

Complete Camroc kit plus the Astron Delta kit, shown on page 22. This gives you the best basic outfit for taking aerial photos. Engines not incl. Cat. No. 651-RC-1 . . . \$5.00

Shipping weight 10 oz.

**NOTE:** While the camera system is quite easily operated, we recommend that you first learn rocketry building and launching in preparation for camera work.





## EXPERIMENTAL AERIAL PHOTOGRAPHY WITH THE CAMROC

By using various launch rod angles and engine delay times it is possible to cover a wide range of aerial photography, from high obliques to verticals. As an example, look at the reproduction of the print and the negative on the preceding pages. The print is a vertical shot; the negative is an oblique shot showing perspective and a wider expanse of land below. Instructions included with the Camroc Kit explain the various techniques used.

The Camroc produces a round negative of 1½" diameter. Prints produced at the Estes Industries photo lab are enlarged 2 times (to 3" dia.) Rocketeers who do their own photo processing can make contact prints or enlargements.

## PROCESSING AND SUPPLIES

Rocketeers who have access to a photographic darkroom can develop and print negatives from the Camroc with no difficulty. For those who would rather not do their own processing, Estes Industries offers developing and printing service. Prints produced are enlarged to twice the negative size. Recommended film is Estes Industries Astropan 400 or identical Kodak Tri-X. Both films are rated at A.S.A. 400 but pushed to A.S.A. 1200 in development.

ALL PROCESSED NEGATIVES AND PRINTS ARE RETURNED BY AIR MAIL WHEN DISTANCE IS OVER 400 MILES.

### LOADED FILM HOLDERS

Extra film holders for in-the-field changing are available for the Camroc. They come 4 to an order, each pre-loaded with a fresh Astro-pan 400 film disc. These film holders must be returned with the film for processing. They are re-usable and a discount of \$.25 is allowed for each holder returned when re-ordering. (Credit applies only when re-ordering loaded film holders). Shipping Wt. 2 oz.

Cat. No. 651-FFH-4..... 4 for \$2.00

### FILM ONLY

Precision cut Astropan 400 film discs to fit Camroc film holder. Packaged in light-proof double envelope. Envelope should be opened ONLY IN TOTAL DARKNESS to avoid ruining the film. Handling and loading instructions included. Shipping weight 1.5 oz.

Cat. No. 651-NF-6..... 6 for \$.75

### CHANGING BAG

Light-tight "portable darkroom". Fits over operators arms, provides total darkness for changing film in the field or re-loading your own film holders. Shipping weight 8 oz.

Cat. No. 651-FCB-1.....\$1.00 each

### DEVELOPING-PRINTING

Film is developed under controlled conditions. One glossy print is made at 2 times enlargement (3" dia. image). A refund of \$.20 will be made on any negative which does not meet the requirements for a satisfactory print. This can be caused by incorrect exposure or improper handling. In this case, negative returned unprinted. We recommend returning film in its original container or other totally light-tight container.

Cat. No. 651-FDP-1...\$.75 ea. 4 for \$2.00

### EXTRA PRINTS

You can order additional prints of negatives which have been previously developed. The negative(s) must be enclosed in a suitable protective package with the order. (Please do not order extra prints without first checking the negative and original print to determine if it is suitable for extra prints.

Cat. No. 651-NP-1...\$.40 ea. 4 for \$1.00



## Rocket Launch

- SUPPLIES • SYSTEMS
- EQUIPMENT

The following pages offer tested and proven items for perfect "lift-off"

## Electro-Launch

### Complete Launcher Assembly

All parts and instructions for a completely self contained launching system with high impact plastic base and extra large blast deflector. Features push button ignition control from a hand held panel with safety interlock and check light to prevent misfiring. Requires 4 size D photoflash cells for 6 volt operation. Easily converts to 12 volts for extended battery life and heavy duty use by adding 4 extra batteries and changing to a 12 volt pilot bulb. Use it for rockets weighing up to 6 oz., or anchor the base to the ground for heavier models. For launching cluster engine models, add extra battery pack (page 40) or use LAUNCH CONTROL SYSTEM FS-5 (page 39) with 12 volt car battery.

- electrical ignition
- hand held control panel
- safety interlock
- continuity check light
- adjustable launch angle
- collapsible 2-piece launch rod
- easy to assemble kit with instructions

Cat. No. 651-FS-4

**\$3.50**

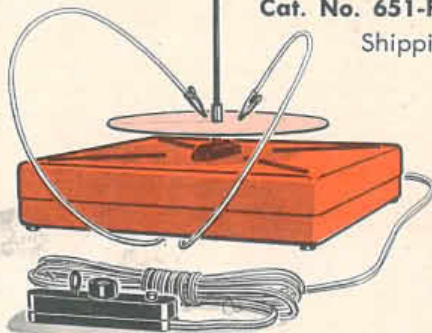
Shipping wt. 30 oz.

Same kit, but batteries for 6 volt operation included.

Cat. No. 651-FS-4B....\$4.50

Shipping wt. 46 oz.

*The biggest little launcher in the world*





# Launching Your Rocket

Complete instructions for launching model rockets are included with all engines sold by Estes Industries. The first step is to install the igniter which is included with each engine. This is a simple two-step process:

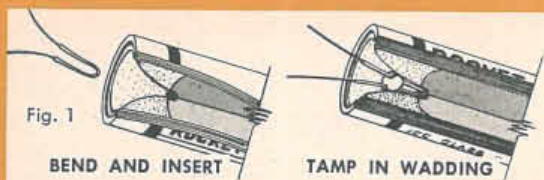
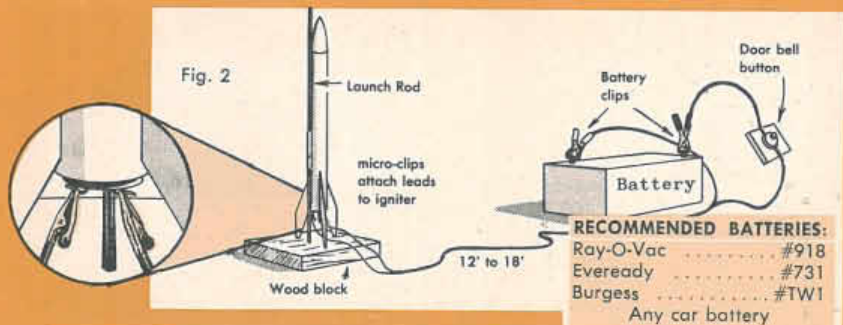


Fig. 1

Next the rocket is placed on the guide rod on the launcher and connected to the electrical system as shown. This system may be the simple home-made unit in Fig. 2 or one of the more complete systems sold by Estes Industries (the Electro-Launch or the Launch Control System). A word of caution for your home made unit: for safety, the launch button must be a spring return type for automatic disconnect.



All of these systems work by passing enough electrical current through the high-resistance igniter to heat it to 1000°F. This ignites the coating on the igniter which in turn ignites the engine.

All single engine and multi-stage models in this catalog can be launched with any launch system sold by Estes Industries or a home made system like the one shown. Cluster rockets such as the Gemini-Titan, Cobra and Saturn should be launched using a heavy duty system such as the LAUNCH CONTROL SYSTEM (Cat. No. 651-FS-5) with a TILT-A-PAD launcher and 12 volt car battery. A complete technical report on clustering which explains ignition methods is included with each cluster rocket kit sold by Estes Industries.



## LAUNCH CONTROLLER SWITCH

Designed for a perfect countdown and launch sequence. Same as in Electro-Launch, it features safety interlock, continuity check light and push button controlled launching. Comes in kit form with 6 or 12 volt (specify when ordering) pilot light and instructions for wiring into your system or portable launcher. Shipping weight 6-oz.

Cat. No. 671-FSS-4.....\$1.50



## Complete LAUNCH CONTROL SYSTEM



The perfect system to modernize and add flexibility to your launching program. Use with a 12 volt car battery for 2, 3, and 4 engine cluster models. Kit includes the above launch controller panel, 18 ft. of No. 18-2 zip cord, micro clips, battery clips, and assembly instructions. Available for use with either 6 or 12 volt power supplies. Specify voltage when ordering. Shipping weight 12-oz.

Cat. No. 651-FS-5  
\$3.00

## TILT-A-PAD LAUNCHER

Unbeatable for flexibility and gives you the very best in launch control and convenience. Tripod stand permits launching of rockets up to 12-oz. and adjusts to fit any terrain. Tilts to compensate for wind direction and speed. Legs fold down for compact storage. Use it with almost any electrical ignition system. Comes in easy to assemble kit form with complete instructions.

Cat. No. 651-RL-3.....\$1.50 Shipping weight 2-lbs.

**EXTRA INTERLOCK KEY, Cat. No. 651-FSK-4.....\$ .10 ea.**  
for Electro-Launch and above systems

These systems usable with auto battery or other heavy duty power supply.



More launching supplies on following pages



## LAUNCHING SUPPLIES



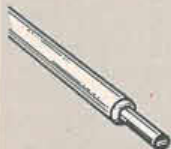
**BATTERY PACK:** Durable plastic cased 12 volt battery pack, ideal for use as a booster for the Electro-Launch, a power supply for other launchers, phone systems or any other range power application. Can be set up to deliver 3, 6, 9, or 12 volts, requires 2, 4, 6, or 8 size D cells (not included) depending on voltage desired. Comes in kit form with complete instructions. Shipping weight 1 pound.

Cat. No. 651-BP-2 ..... \$1.50 each



**TWO PIECE ROD:** Handy collapsible two piece rod for portable launchers. Pieces slip together to make a 36" long rod. Base rod has a diameter of 1/8". Shipping weight 6 oz.

Cat. No. 651-RLR-1 ..... \$ .35 each



**ADD ON ROD:** Sturdy 1/8" diameter, 18" long launch rod section expands two piece rod (see above) to 53" length, gives extra control of flight path — especially with heavier models. To assemble, separate two piece rod, insert tapered end of add-on rod into hole in lower rod, insert upper rod into hole in add-on section. For a constant 1/8" diameter launch rod, join two or three add-on sections together. Shipping weight 6 oz.

Cat. No. 651-RLR-3 ..... \$ .20 per section



**DELUXE BLAST DEFLECTOR:** Durable pressed steel plate deflects engine blast out and away from launcher. Two inches wide, five inches long. Ideal for launchers that receive extensive use. Shipping weight 5 oz.

Cat. No. 651-BD-1 ..... \$ .60 each



**BLAST DEFLECTOR PLATE:** Slip-on metal deflector plate fits any launcher using 1/8" rod, protects launcher base from rocket blast. Four inch diameter. Shipping weight 5 oz.

Cat. No. 651-BD-2 ..... \$ .35 each



**PIVOT:** Adjustable launch rod mounting pivots up to 25° to compensate for tilt of launcher base, windage, etc. Easy-to-assemble, mounts to launcher base with 2 #4 screws. (Rod not included.) Shipping weight 2 oz.

Cat. No. 651-LP-1 ..... \$ .35 each



**IGNITERS:** Easy-to-use, extra reliable igniters — the same type as supplied with all Estes engines. Suitable for ignition systems using 6 volts or more, see engine instructions for installation procedure. (Patent pending.) Shipping weight 1 oz.

Cat. No. 651-NWI-1 ..... 6 for \$ .15

**NICHROME WIRE:** Electrical heating wire for model rocket ignition. #30 recommended for use with car batteries, #32 for use with other power supplies. Shipping weight 1 oz.

#30, 15 FOOT ROLL: Cat. No. 651-NW-30A ..... \$ .50 each

#32, 15 FOOT ROLL: Cat. No. 651-NW-32A ..... \$ .50 each



**BATTERIES:** Extra powerful size D photoflash batteries pack the energy needed for rocket launching. These are the type specified for the Electro-Launch, deliver up to 16 amperes of current on a complete short when fresh. Shipping weight 4 oz. each.

Cat. No. 651-PFB-1 ..... \$ .30 each



**MASKING TAPE:** Use to secure engines in models, mask for painting, etc. Strong, flexible 1/2" wide tape comes in 30' rolls. Shipping weight 5 oz.

Cat. No. 651-MT-1 ..... \$ .30 each



**MICRO-CLIPS:** Equip your launcher with the best. Spring-loaded solid copper clips attach lead wires to igniters. Easy to clean and highly conductive with flat contact surfaces. Only 1.1 inches long, attach to leads with or without solder. Shipping weight 1 oz.

Cat. No. 651-MC-1 ..... 2 for \$ .25



**GIANT BATTERY CLIPS:** Heavy duty clips connect to battery terminals up to 1" in dia. Clips are 3" long, available with red or black insulators. Specify color when ordering. Shipping weight 5 oz.

Cat. No. 651-BC-1 ..... \$ .40 each



Second insulator outlined to show construction.

**BATTERY CONTACTS:** Spring brass battery clips for special battery installations, replacement part for the Electro-Launch. Fit size D cells, can be trimmed to fit smaller batteries. Shipping weight 1 oz.

Cat. No. 651-BC-2 ..... 2 for \$ .20



**LEAD WIRE:** Flexible, durable size 18 two conductor insulated wire. Ideal as a lead from firing panel to launcher, zip the conductors apart for wiring inside the panel. In 12 foot lengths. Shipping weight 5 oz.

Cat. No. 651-LW-12 ..... \$ .70 each



**TERMINAL LUGS:** Tiny 1/2" long solderless lugs make electrical connections a snap — insert bare wire into the end of the lug and crimp in place with pliers. 1/8" hole for terminal. Shipping weight 1 oz.

Cat. No. 651-TL-1 ..... \$ .05 each





## Electrical EQUIPMENT



**PILOT LIGHT HOLDER:** Add visual control to your launch panel by wiring in an arm or continuity check pilot light. Holder is steel with 1/2" red plastic jewel, mounts in 7/16" hole. Takes either 6 or 12 volt bulbs, bulb not included. Shipping weight 4 oz.

Cat. No. 651-LH-1 ..... \$ .45 each



**6 VOLT BULB:** Fits holder No. LH-1. Shipping weight 1 oz. (Type 51.)

Cat. No. 651-AL-6 ..... \$ .20 each



**12 VOLT BULB:** Fits holder No. LH-1. Shipping weight 1 oz. (Type 53.)

Cat. No. 651-AL-12 ..... \$ .20 each



**KEY SAFETY SWITCH:** A must for every control panel. Prevents accidental launching of rockets. SPST, turns on with key, must be turned off to remove key. Mounts in 1/2" hole. One key included with switch. Shipping weight 4 oz.

Cat. No. 651-KSW-1 ..... \$2.05 each

**EXTRA KEY:** Cat. No. 651-KSW-1K ..... \$ .25 each



**PUSH BUTTON SWITCH:** Heavy duty construction momentary type, SPST, normally open. Excellent for use as a firing switch. Mounts in 1/2" hole. Shipping weight 4 oz.

Cat. No. 651-SWM-1 ..... \$ .90 each



**ROTARY SWITCH:** Twelve position single pole rotary switch — just right for use as a selector switch with firing systems using more than one launcher. With twelve positions, this switch should handle almost any need. Non-shorting, mounts in 3/8" hole. Shipping weight 5 oz.

Cat. No. 651-SWR-1 ..... \$1.35 each



**DIAL PLATE:** Numbered 12 position plate for use with rotary switch No. SWR-1. Mounts on panel with same nut used to hold switch. Etched aluminum on black background. Shipping weight 1 oz.

Cat. No. 651-DP-1 ..... \$ .25 each



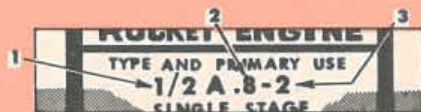
**SOLDERING IRON:** 25 watt, top quality tool for making good connections in launchers and other electrical circuits. Does the work of irons of higher wattage. Develops up to 720° F. Handle remains cool. Replaceable, pre-tinned nickel-plated tip gives extra long life. Use with ROSIN core solder. Shipping wt., one pound.

Cat. No. 671-SI-1 ..... \$4.00

## ROCKET ENGINE TYPES & CLASSIFICATION

All engines sold by Estes Industries are stamped with a code designation which, when understood, will give the rocketeer important and useful data on the engine's performance capabilities. Here's how to read this coding:

1. This portion gives you the "total impulse" or total power produced by the engine as in the chart below.



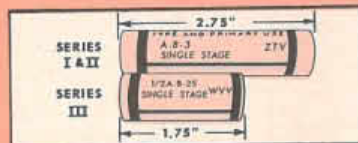
2. This portion is the engine's average thrust in pounds. Series I and Series III engines are rated at .8 lb. average, Series II engines at 3 pounds. Series I and Series III engines are for normal flying, Series II engines are for lifting larger payloads and for high acceleration studies.

3. This number gives you the delay in seconds between burnout and ejection charge activation. Engines with "0" have no delay charge, no ejection charge, and are for use in booster stages only.

Series III engines are identical in performance to the corresponding Series I engines. Series III engines have a final "S" in their code.

### TOTAL IMPULSE CLASSIFICATION

Code	Total Impulse
1/4 A	0-.175 lb-sec
1/2 A	.176-.350 lb-sec
A	.351-.700 lb-sec
B	.701-1.20 lb sec
C	1.21-2.00 lb-sec



**QUALITY CONTROL:** Three out of every hundred engines made by Estes Industries is static tested on a recording type of test stand which graphically records the maximum thrust, thrust variations, minimum thrust, overall thrust duration, length of time delay, and the strength of the ejection charge. Any batch of engines which does not meet rigid standards is discarded. In addition, the engine production machine automatically rejects all engines which do not contain the correct amount of propellant. Tolerances are kept as small as possible so that these engines make excellent propulsion units for contests and exhibitions.

### SAFETY:

Rocket engines are not toys, but scientific devices. With common sense and close adherence to safety rules, model rocketry is as safe as any other sport, hobby or scientific study: Carelessness can make it dangerous, as with model airplanes, baseball or swimming. If you are hit by a model rocket traveling 300 or more miles per hour, you will be hurt. Don't spoil model rocketry's excellent record of safety.



# ROCKET ENGINE SELECTION CHART

Cat. No. and Engine Type	Total Impulse	Thrust Duration	Maximum Thrust	Time Delay	Engine Length	Initial Weight	Propellant Weight	Label Color	Maximum Rocket Weight***		PRICES		
									Single Stage	Multi-Stage	Each	3 for	12 or more
<b>SINGLE STAGE ENGINES</b>													
1/4A.8-2	0.17 lb-sec	0.17 sec	23 oz.	2-2½ sec	2.75 in.	0.50 oz.	0.00211 lb.	Green	2.0 oz.	- - -	\$ .25	\$ .65	\$ .21 each
1/4A.8-25**	0.17 lb-sec	0.17 sec	23 oz.	2-2½ sec	1.75 in.	0.38 oz.	0.00211 lb.	Green	2.0 oz.	- - -	\$ .25	\$ .65	\$ .21 each
1/2A.8-2	0.35 lb-sec	0.40 sec	23 oz.	2-2½ sec	2.75 in.	0.54 oz.	0.00422 lb.	Blue	2.5 oz.	- - -	\$ .30	\$ .70	\$ .23 each
1/2A.8-25**	0.35 lb-sec	0.40 sec	23 oz.	2-2½ sec	1.75 in.	0.42 oz.	0.00422 lb.	Blue	2.5 oz.	- - -	\$ .30	\$ .70	\$ .23 each
A.8-3	0.70 lb-sec	0.82 sec	23 oz.	3-3½ sec	2.75 in.	0.60 oz.	0.00844 lb.	Purple	3.0 oz.	- - -	\$ .35	\$ .80	\$ .26 each
B.8-4	1.15 lb-sec	1.40 sec	23 oz.	4-4½ sec	2.75 in.	0.71 oz.	0.0139 lb.	Red	3.5 oz.	- - -	\$ .40	\$ .90	\$ .30 each
B 3-5*	1.15 lb-sec	0.35 sec	9.0 lb.	5-5½ sec	2.75 in.	0.69 oz.	0.0139 lb.	Red	5.0 oz.	- - -	\$ .50	\$ 1.00	\$ .33 each
B 3-6*	1.15 lb-sec	0.35 sec	9.0 lb.	6-6½ sec	2.75 in.	0.69 oz.	0.0139 lb.	Red	4.0 oz.	- - -	\$ .50	\$ 1.00	\$ .33 each
<b>UPPER STAGE ENGINES (OR SINGLE STAGE ENGINES IF USED IN VERY LIGHT ROCKETS)</b>													
1/4A.8-4	0.17 lb-sec	0.17 sec	23 oz.	4-4½ sec	2.75 in.	0.51 oz.	0.00211 lb.	Green	1.0 oz.	- - -	\$ .25	\$ .65	\$ .21 each
1/4A.8-45**	0.17 lb-sec	0.17 sec	23 oz.	4-4½ sec	1.75 in.	0.39 oz.	0.00211 lb.	Green	1.0 oz.	- - -	\$ .25	\$ .65	\$ .21 each
1/2A.8-4	0.35 lb-sec	0.40 sec	23 oz.	4-4½ sec	2.75 in.	0.55 oz.	0.00422 lb.	Blue	1.5 oz.	- - -	\$ .30	\$ .70	\$ .23 each
1/2A.8-45**	0.35 lb-sec	0.40 sec	23 oz.	4-4½ sec	1.75 in.	0.43 oz.	0.00422 lb.	Blue	1.5 oz.	- - -	\$ .30	\$ .70	\$ .23 each
A.8-4	0.70 lb-sec	0.82 sec	23 oz.	4-4½ sec	2.75 in.	0.63 oz.	0.00844 lb.	Purple	1.5 oz.	- - -	\$ .35	\$ .80	\$ .26 each
B.8-6	1.15 lb-sec	1.40 sec	23 oz.	6-6½ sec	2.75 in.	0.73 oz.	0.0139 lb.	Red	1.5 oz.	- - -	\$ .40	\$ .90	\$ .30 each
B 3-7*	1.15 lb-sec	0.35 sec	9.0 lb.	7-7½ sec	2.75 in.	0.73 oz.	0.0139 lb.	Red	3.0 oz.	- - -	\$ .50	\$ 1.00	\$ .33 each
<b>BOOSTER ENGINES</b>													
1/4A.8-0	0.17 lb-sec	0.17 sec	23 oz.	none	2.75 in.	0.46 oz.	0.00211 lb.	Green	Don't Use	4.0 oz.	\$ .25	\$ .65	\$ .21 each
1/4A.8-05**	0.17 lb-sec	0.17 sec	23 oz.	none	1.75 in.	0.34 oz.	0.00211 lb.	Green	Don't Use	4.0 oz.	\$ .25	\$ .65	\$ .21 each
1/2A.8-0	0.35 lb-sec	0.40 sec	23 oz.	none	2.75 in.	0.49 oz.	0.00422 lb.	Blue	Don't Use	3.5 oz.	\$ .30	\$ .70	\$ .23 each
1/2A.8-05**	0.35 lb-sec	0.40 sec	23 oz.	none	1.75 in.	0.37 oz.	0.00422 lb.	Blue	Don't Use	3.5 oz.	\$ .30	\$ .70	\$ .23 each
A.8-0	0.70 lb-sec	0.82 sec	23 oz.	none	2.75 in.	0.56 oz.	0.00844 lb.	Purple	Don't Use	3.5 oz.	\$ .35	\$ .80	\$ .26 each
B.8-0	1.15 lb-sec	1.40 sec	23 oz.	none	2.75 in.	0.64 oz.	0.0139 lb.	Red	Don't Use	3.0 oz.	\$ .40	\$ .90	\$ .30 each
B 3-0*	1.15 lb-sec	0.35 sec	9.0 lb.	none	2.75 in.	0.64 oz.	0.0139 lb.	Red	Don't Use	6.0 oz.	\$ .50	\$ 1.00	\$ .33 each
C.8-0	1.50 lb-sec	2.00 sec	23 oz.	none	2.75 in.	0.71 oz.	0.0181 lb.	Black	Don't Use	3.0 oz.	\$ .45	\$ .95	\$ .31 each
<b>SPECIAL PURPOSE ENGINES</b>													
B.8-2	1.15 lb-sec	1.40 sec	23 oz.	2-3 sec	2.75 in.	0.68 oz.	0.0139 lb.	Red	Gliders & Special Designs ****		\$ .40	\$ .90	\$ .30 each
B.8-0(P)	1.15 lb-sec	1.40 sec	23 oz.	none	2.75 in.	0.66 oz.	0.0139 lb.	Red	Static Test Engine		\$ .45	\$ .95	\$ .31 each

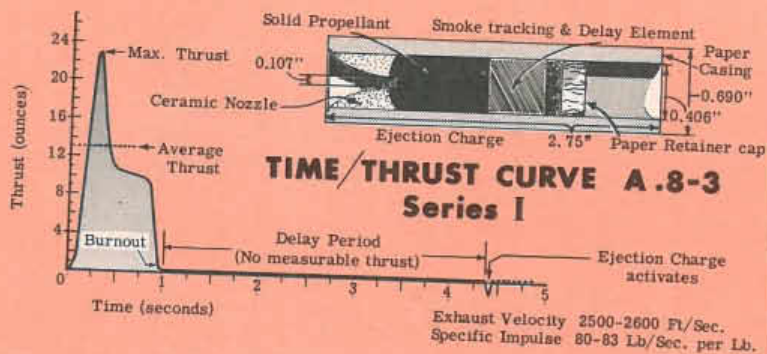
NOTES: \*Series II engine. \*\*Series III engine. \*\*\*With engine(s). (P) Denotes plug to prevent blow-through. Empty casing weight (with propellant, delay and ejection charges expended) on all Series I and Series II engines is .42 oz., on all Series III engines, .30 oz. Sufficient ignition material and instructions are included with each rocket engine (any quantity) ordered from Estes Industries. Shipping weight of each engine is 1 ounce. \*\*\*\* Use on larger and heavier rockets such as the Big Bertha. For complete information on rocket performance with various engines, study technical report TR-10, listed on page 79.



# ROCKET ENGINE DESIGN

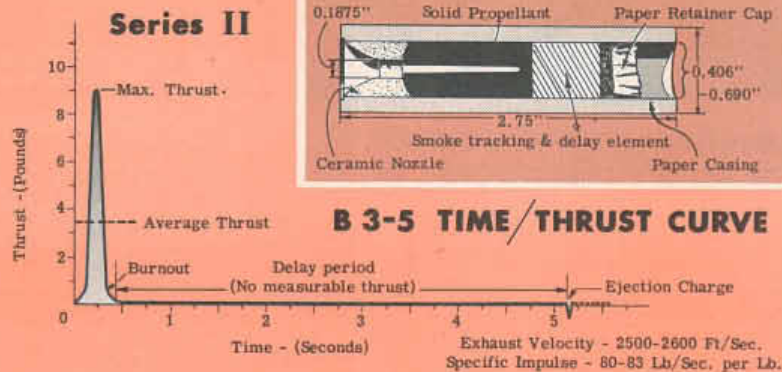
This rocket engine design and performance information is given for educational purposes only. We believe that if you understand how your rocket engine works you are in a better position to gain scientific knowledge from your activities and to design your rockets for specific purposes such as payload experimentation, altitude studies, drag racing, etc. We **DO NOT** grant permission for you to attempt to copy our design nor do we recommend that you attempt to build your own rocket engines.

The Series I and Series III engines are a solid propellant type with a dual thrust level design. There is a slight center bore at the very tip of the nozzle end of the grain which serves two purposes. First, it provides for easy ignition. Second, as you will note from the Series I graph, this special design produces a high initial thrust of 23 oz., thus stabilizing your rocket more quickly. This is because the slight center bore provides a relatively large burning area, resulting in faster consumption of the fuel. After this initial high thrust, a transition to



an end burning grain is made, and the thrust drops to a sustaining level of 10 oz. Data from wind tunnel tests shows this dual thrust level to be the most effective design for rocket engines which are used to propel lightweight model rockets at sub-sonic speeds.

The slow burning delay and tracking charge is ignited at the burnout of the propellant grain. This slow burning, smoke producing charge provides no thrust, but permits the rocket to coast upward to its peak altitude. At the burnout of the delay charge a recovery system ejection charge is ignited which pressurizes the forward end of the rocket body tube, activating the recovery system. For further information, see the Series I performance graph and cutaway drawing.



The Series II engine is a solid propellant type with a center burning grain. This provides a greater propellant burning area, resulting in a higher thrust level than the Series I engines, but with a shorter thrust duration. The total thrust duration of a Series II engine is slightly under .35 sec. This makes the thrust characteristics of the engine somewhat like a sledge hammer blow — thrust rises to over 9 pounds in a fraction of a second, then drops off again, as shown in the Series II performance graph. The average thrust of the Series II engine is 3.4 pounds. The result is that the Series II engine is ideal for acceleration studies, as a booster on heavy multi-stage rockets, and for drag racing. Delay charge and ejection charge operation are the same in the Series I and Series II engines.

## MAKING ROCKET ENGINES

At our plant rocket engines are made automatically, under controlled conditions, with limited amounts of propellant being measured by explosion proof metering devices. If you wish to attempt to build your own engines "safely," we would recommend that you have in reserve a few thousand dollars in cash for special equipment, a college degree, a safe place to work (not in a garage or basement), protective clothing and some specialized training. If you build rocket engines with less than the above you may find as some chemistry teachers, students and many others have, that through the rest of your life you will be without a finger, hand, arm, eye, ear, face, or you may well be badly burned or even killed. Our country needs live rocket scientists and engineers who have all their fingers and hands. We are looking forward to fellows like you to fulfill this need.



## Tips for Flying Model Rockets

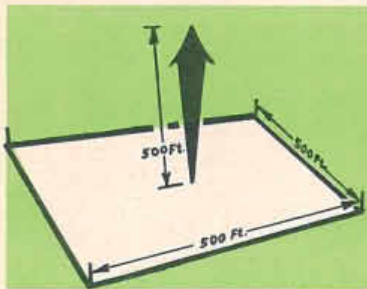
### SUGGESTIONS FOR BEGINNERS:

Most beginners start their rocket studies and experiments with single stage rockets because they are easier to build and are generally more dependable. We suggest that you use single stage designs for your first half dozen rockets. There are five primary rocket engines for single stage flying, the 1/4A.8-2 for general testing, the 1/2A.8-2 for low altitude flights, the A.8-3 for medium altitude flights, the B.8-4 for high altitude flights, and the B.3-5 for high acceleration, high altitude flights. These are the most popular for the first test flight. A well designed high performance rocket can exceed an altitude of 500 feet when powered by a 1/2A engine.

### FIRST TESTS:

It is best to use the smallest engine(s) possible for the first tests on a new rocket design. If the design is bad and the rocket is not stable it presents less hazard. If you have a high performance rocket and use the largest engines first, you are likely to see it soar off into the wild blue yonder, never to be seen again — quite a disappointment if you spent hours building it. For most designs 1/4A and 1/2A engines are best for the first test flights. A well designed high performance rocket can approach an altitude of 1,000 feet when powered by a 1/2A engine.

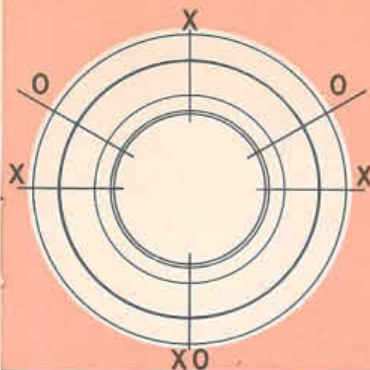
### RECOVERY FIELD:



The altitude to which you fly a rocket should not be greater than is practical for the size of the flying area. In a town or city, flying in a limited area, 1/4A and 1/2A engines are best. In large open park areas A engines are all right, and in open rural areas B engines and two or three stage rockets are okay. A general rule to follow is that the field should be at least as large as the altitude to which you intend to fly the model. When flying a rocket to 500', you should launch it from the center of a 500' by 500' field.

### SERIES II ENGINES:

The wallop packed by Series II engines (B 3-) makes them more difficult to handle than Series I engines. Extra care should be exercised to be sure the rocket is stable. Extra caution must be taken to be sure fins are extra durable and well secured to the rocket body. A Series II engine must be mounted against a secure bulkhead so a sudden force of 10 pounds will not force it forward in the rocket body. With a Series II engine, a light weight model will be traveling about 400 miles per hour in just 70 feet from the launcher. Use extra caution.



## CONSTRUCTION TIPS

This Fin Spacing Guide will space equally three or four fins on all body tubes sold by Estes Industries. To space the fins, center the end of the tube in the circles, then mark at the "X" lines for four fins or on the "O" lines for three fins. Draw lines from these marks as shown in the bottom drawing.

BT-10 is an ultra-light mylar tube for use with the featherweight recovery system. It will withstand the heat of an ejection charge only when the engine is ejected from the rocket body by the charge. Paper reinforcing material must be used to glue parts to the tube, as ordinary glue will not stick to the mylar tube.

Apply PRM-1 smoothly  
eliminate bubbles

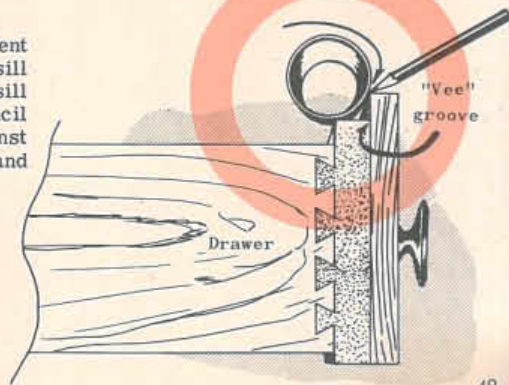


After fins are dry flow  
in a good fillet of white  
glue or plastic putty.



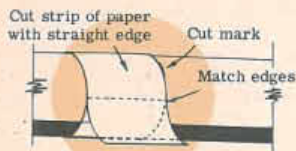
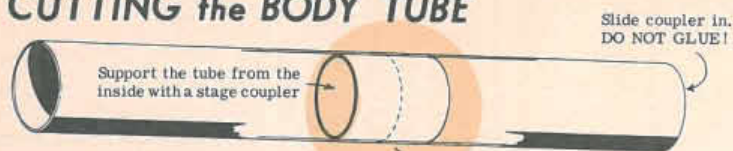
Strips of PRM-1  
Where balsa must be glued to plastic surface

Mark the body tube for fin alignment using the "V" notch of a drawer sill as shown. Match the edge of the sill with a spacing mark and run a pencil along the top of the drawer against the tube. Glue the fin on the line and it will be parallel to the body.





## CUTTING the BODY TUBE



Wrap paper around tube and align edge with cut location mark. Draw a line completely around the tube.

Proposed cut area



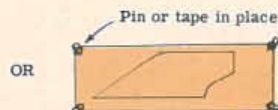
USE A SHARP BLADE...but don't try to cut through the tube on the first turn. Follow the line cutting very little more than the surface layer. One or two more turns keeping the same knife pressure should give a clean square cut.

## Layout...



Where all sides of fin are straight, the pin-hole method is easiest. Just lay the pattern over the balsa with the grain direction aligned properly and push a straight pin through each corner of the pattern. Remove the pattern and draw connecting lines between the pin holes.

## FINS



Carefully trace a more complex design onto stiff paper or cardboard. Cut out and align on the fin-stock and trace around this template.

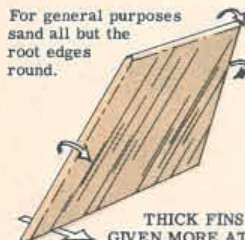
## Cutting...



Use a metal straightedge wherever possible. Hold knife or saw blade at 90° angle from the surface being cut and hold the handle about a 45° angle for a clean cut. Soft balsa tends to tear if blade is dull or held at too high an angle.

## Sanding...

For general purposes sand all but the root edges round.

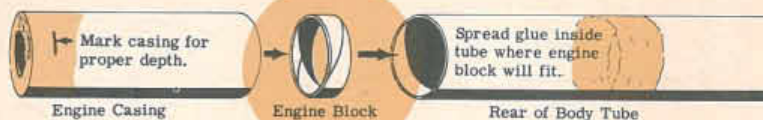


THICK FINs MUST BE GIVEN MORE ATTENTION

Sand to rough airfoil shape with medium sandpaper and block. The final shape is reached with extra-fine sandpaper and a gentle touch.



## ENGINE BLOCK INSTALLATION

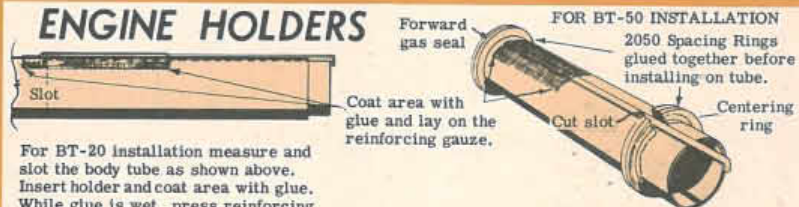


For easy installation, use an engine casing to press the engine block into position. After applying glue to the inside of the tube, place the engine block just inside the rear of the body. Push the block forward into position with the engine casing in one smooth

motion so the glue will not freeze the block in the wrong place.

When the mark on the engine casing is even with the rear of the body tube the block will then be in the correct position. Remove the engine casing immediately.

## ENGINE HOLDERS



For BT-20 installation measure and slot the body tube as shown above. Insert holder and coat area with glue. While glue is wet, press reinforcing gauze into place as shown. Let dry.

Coat area with glue and lay on the reinforcing gauze.

ENGINE HOLDERS PROVIDE FOR QUICK, EASY AND RELIABLE POSITIONING AND RETAINING OF THE ENGINE

## FINISHING

Apply two or more coats of sanding sealer sanding lightly between each coat.



Sealer is exaggerated here but emphasizes that the wood grain should be filled and the surface smooth for the application of the color coat.

REMEMBER - FINAL FINISH IS ONLY AS GOOD AS THE BASE PREPARED FOR IT

## Brush

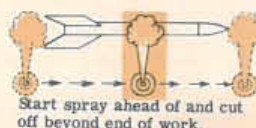
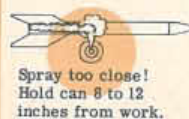
Make sure the brush is clean. Old dope will mix with and dis-



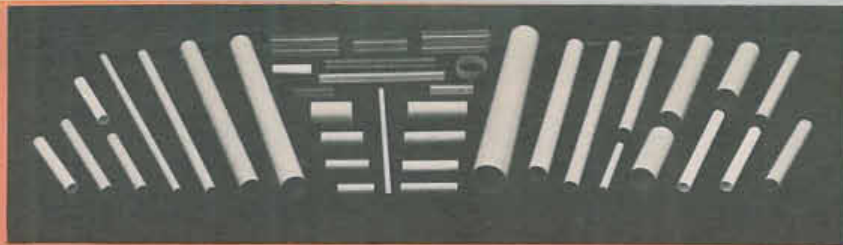
color fresh dope. Dope can be thinned 50% for a smoother finish. Avoid "brushing over" as the surface sets rapidly. Unnecessary brushing can produce an uneven finish. Lighter colors are more difficult to apply.

## Spraying

A better than average finish for the beginner...an excellent finish when you've got the "hang" of it.







## FOR BUILDING ROCKETS OF YOUR OWN DESIGN

Cat. No.	Length	Inside Diameter	Outside Diameter	Wall Thickness	Weight in Ounces			Price	
					Net	Per in.	Ship.	Each	3 For
<b>BT-5, Spiral-Wound Paper Tube, for nose sections and strap-on payloads</b>									
651-BT-5	18"	0.515"	0.541"	0.013"	.219	.012	11	\$ .30	\$ .65
651-BT-5P	5.1"	0.515"	0.541"	0.013"	.062	.012	4	\$ .15	\$ .30
<b>BT-10, Mylar Plastic Tube, for featherweight models</b>									
651-BT-10	9"	0.710"	0.720"	0.005"	.088	.0098	4	\$ .25	\$ .50
651-BT-10H	3.062"	0.710"	0.720"	0.005"	.029	.0098	1	\$ .10	\$ .25
<b>BT-20, Spiral-Wound Paper Tube, for competition and sport models</b>									
651-BT-20	18"	0.710"	0.736"	0.013"	.288	.016	11	\$ .30	\$ .65
651-BT-20B	8.65"	0.710"	0.736"	0.013"	.138	.016	4	\$ .15	\$ .35
651-BT-20D	6.5"	0.710"	0.736"	0.013"	.104	.016	4	\$ .15	\$ .30
651-BT-20G	3.5"	0.710"	0.736"	0.013"	.056	.016	4	\$ .10	\$ .20
651-BT-20J	2.75"	0.710"	0.736"	0.013"	.044	.016	4	\$ .10	\$ .20
651-BT-20M	2.25"	0.710"	0.736"	0.013"	.036	.016	4	\$ .10	\$ .20
<b>BT-30, Parallel-Wound Paper Tube, for sport models</b>									
651-BT-30	9"	0.725"	0.767"	0.021"	.270	.030	4	\$ .25	\$ .50
651-BT-30F	7"	0.725"	0.767"	0.021"	.210	.030	4	\$ .25	\$ .50
651-BT-30B	6.125"	0.725"	0.767"	0.021"	.184	.030	4	\$ .20	\$ .45
651-BT-30C	5.5"	0.725"	0.767"	0.021"	.165	.030	4	\$ .20	\$ .40
651-BT-30A*	3.5"	0.725"	0.767"	0.021"	.105	.030	4	\$ .30	---
651-BT-30J	2.75"	0.725"	0.767"	0.021"	.082	.030	4	\$ .10	\$ .25
<b>BT-50, Spiral-Wound Paper Tube, for sport and high performance payload models</b>									
651-BT-50	18"	0.950"	0.976"	0.013"	.378	.021	11	\$ .40	\$ .90
651-BT-50L	12.7"	0.950"	0.976"	0.013"	.242	.021	5	\$ .30	\$ .60
651-BT-50H	7.75"	0.950"	0.976"	0.013"	.163	.021	4	\$ .25	\$ .50
651-BT-50S	4"	0.950"	0.976"	0.013"	.084	.021	4	\$ .15	\$ .30
651-BT-50J	2.75"	0.950"	0.976"	0.013"	.058	.021	4	\$ .15	\$ .30
671-BT-50W	9.5"	0.950"	0.976"	0.013"	.200	.021	5	\$ .25	\$ .50
<b>BT-55, Spiral-Wound Paper Tube, for sport and demonstration models</b>									
651-BT-55	18"	1.283"	1.325"	0.021"	.672	.042	11	\$ .50	\$1.10
651-BT-55S	4"	1.283"	1.325"	0.021"	.268	.042	4	\$ .20	\$ .40
671-BT-55V	16.35"	1.283"	1.325"	0.021"	.687	.042	11	\$ .50	\$1.10
<b>BT-60, Spiral-Wound Paper Tube, for sport and demonstration models</b>									
651-BT-60	18"	1.595"	1.637"	0.021"	.960	.053	11	\$ .60	\$1.40
651-BT-60D	11"	1.595"	1.637"	0.021"	.583	.053	11	\$ .45	\$1.10
651-BT-60K	7"	1.595"	1.637"	0.021"	.371	.053	6	\$ .35	\$ .70
651-BT-60R	5"	1.595"	1.637"	0.021"	.265	.053	6	\$ .25	\$ .50
651-BT-60J	2.75"	1.595"	1.637"	0.021"	.146	.053	6	\$ .15	\$ .30
<b>BT-70, Spiral-Wound Paper Tube, for monster models and tail rings</b>									
651-BT-70	17.5"	2.175"	2.217"	0.021"	1.30	.072	14	\$ .85	\$1.70
<b>BT-70, Spiral-Wound Paper Tube for tail rings</b>									
671-BT-70A	0.7"	2.175"	2.217"	0.021"	.050	.072	4	\$ .15	\$ .30
<b>Clear Plastic Tubes — for payload sections</b>									
651-PST-20	8"	0.710"	0.736"	0.013"	.168	.021	4	\$ .30	\$ .60
651-PST-20J	2.75"	0.710"	0.736"	0.013"	.058	.021	4	\$ .15	\$ .30
651-PST-50S	4"	0.950"	0.976"	0.013"	.110	.027	4	\$ .20	\$ .40
651-PST-60R	5"	1.595"	1.637"	0.021"	.350	.070	6	\$ .35	\$ .80
651-PST-65R	5"	1.750"	1.796"	0.023"	.450	.090	6	\$ .45	\$ .90

Be sure to give correct catalog number and length when ordering body tubes.

\* Replacement part for the Astron Stout, with holes punched.

## PAYLOAD SECTIONS



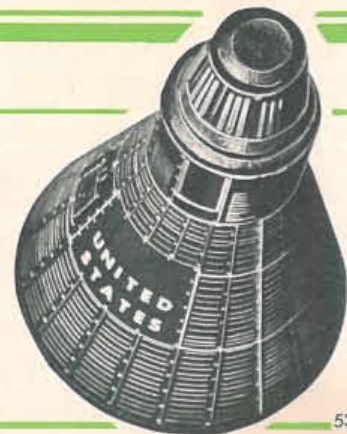
Ideal for payload launchings! Carry instruments, biological specimens, etc., in these lightweight, high capacity payload sections. These capsules come complete with all needed parts, including nose cone, body tube, nose block or adapter and screw eye.

Cat. No.	Body Mat'l.	Weight oz.		Fits	Inside Dia.	Inside Length	Overall Length	Price Each
		Net	Ship.					
651-PS-20A	Clear Plastic	.16	1	BT-20	.710"	2"	4"	\$ .80
651-PS-20C	Clear Plastic	.40	4	BT-20	.950"	3"	7"	\$ .85
651-PS-30B	Regular Tube	.24	1	BT-30	.725"	2"	3.75"	\$ .65
651-PS-50A	Clear Plastic	.39	4	BT-50	.950"	3"	6.50"	\$ .90
651-PS-50B	Regular Tube	.36	4	BT-50	.950"	3"	6.50"	\$ .85
651-PS-50C	Clear Plastic	1.0	11	BT-50	1.59"	4"	10.5"	\$1.30
651-PS-50D	Regular Tube	.95	11	BT-50	1.59"	4"	10.5"	\$1.25
651-PS-50E	Clear Plastic	1.1	11	BT-50	1.75"	4"	10.5"	\$1.35
671-PS-55B	Regular Tube	.53	11	BT-55	1.28"	3"	7.63"	\$1.10
651-PS-60A	Clear Plastic	.98	11	BT-60	1.59"	4"	9.50"	\$1.30
651-PS-60B	Regular Tube	.90	11	BT-60	1.59"	6"	10.5"	\$1.25
651-PS-60C	Clear Plastic	1.0	11	BT-60	1.75"	4"	9.50"	\$1.35

MERCURY CAPSULE  
PERFECT FOR PAYLOADS

Add a special touch to your rockets. Get this model Mercury Capsule. A big 1.8 inches in diameter and 3.2 inches high, this capsule is equipped with a removable base for easy payload access. Comes in easy to assemble kit form with a full set of adapters to fit the capsule to all Estes body tubes. Makes an ideal display model too. Shipping weight 3 ounces.

Cat. No. 651-PSM-1 ..... \$1.00 each





# NOSE CONES

Precision made for finer performance

Catalog No.	Dimensions				Material	Ill.	Average Weight	Ship. Weight	Price	
	1	2	3	4					Each	3 for

### LIGHTWEIGHT GEMS FOR BT-5

651-BNC-5E	0.515"	0.541"	1/4"	1-5/8"	Balsa	E	.020 oz.	1 oz.	\$ .25	\$ .50
651-BNC-5W	0.515"	0.541"	1/4"	3-1/8"	Balsa	W	.039 oz.	2 oz.	\$ .40	\$ .80
651-BNC-5S	0.515"	0.541"	1/4"	1-3/4"	Balsa	S	.016 oz.	1 oz.	\$ .25	\$ .50
651-BNC-5V	0.515"	0.541"	1/4"	1"	Balsa	V	.013 oz.	1 oz.	\$ .25	\$ .50

### PERFECT FOR BT-10

651-BNC-10A	0.702"	0.728"	1/4"	1-1/16"	Balsa	A	.03 oz.	1 oz.	\$ .25	\$ .50
651-BNC-10B	0.702"	0.728"	5/16"	2"	Balsa	B	.05 oz.	1 oz.	\$ .25	\$ .50

### VARIETY FOR A BT-20

651-BNC-20A	0.710"	0.736"	1/4"	1-1/16"	Balsa	A	.03 oz.	1 oz.	\$ .25	\$ .50
651-BNC-20B	0.710"	0.736"	5/16"	2"	Balsa	B	.05 oz.	1 oz.	\$ .25	\$ .50
651-BNC-20N	0.710"	0.736"	1/2"	3-1/4"	Balsa	N	.08 oz.	2 oz.	\$ .45	\$ .90
651-BNC-20P	0.710"	0.900"	7/16"	1-3/4"	Balsa	P	.07 oz.	4 oz.	\$ .25	\$ .50
651-BNC-20R	0.710"	0.736"	3/8"	3-1/8"	Balsa	R	.07 oz.	2 oz.	\$ .40	\$ .80

### BALSA BEAUTIES FOR BT-30

651-BNC-30C	0.725"	0.767"	3/8"	3-1/8"	Balsa	C	.04 oz.	1 oz.	\$ .30	\$ .60
651-BNC-30D	0.725"	0.767"	3/8"	1-7/8"	Balsa	D	.06 oz.	1 oz.	\$ .30	\$ .60
651-BNC-30E	0.725"	0.767"	7/16"	2-5/8"	Balsa	E	.07 oz.	1 oz.	\$ .40	\$ .80
651-BNC-30M	0.725"	0.767"	1/2"	2"	Balsa	M	.06 oz.	1 oz.	\$ .40	\$ .80
651-BNC-30N	0.725"	0.767"	1/2"	3-1/4"	Balsa	N	.08 oz.	2 oz.	\$ .45	\$ .90

### DESIGNED FOR THE BT-50

671-BNC-50AD	0.950"	1.300"	1/2"	4-9/16"	Balsa	AD	25 oz.	6 oz.	\$ .75	\$ 1.50
651-BNC-50J	0.950"	0.976"	1/2"	1-7/8"	Balsa	J	.08 oz.	4 oz.	\$ .40	\$ .80
651-BNC-50K	0.950"	0.976"	1/2"	3-1/4"	Balsa	K	.13 oz.	4 oz.	\$ .45	\$ .90
651-BNC-50X	0.950"	0.976"	1/2"	3-3/4"	Balsa	X	.15 oz.	4 oz.	\$ .50	\$ 1.00
651-BNC-50Y	0.950"	0.976"	3/8"	4-3/4"	Balsa	Y	.16 oz.	6 oz.	\$ .75	\$ 1.50

### JUST RIGHT FOR THE BT-55

671-BNC-55AC	1.283"	1.325"	3/8"	5-3/4"	Balsa	AC	.32 oz.	6 oz.	\$ .80	\$ 1.60
651-BNC-55F	1.283"	1.325"	1/2"	4-3/8"	Balsa	F	.19 oz.	4 oz.	\$ .75	\$ 1.50
651-BNC-55AA	1.283"	1.325"	1/2"	3-5/8"	Balsa	AA	.15 oz.	4 oz.	\$ .75	\$ 1.50

### EXCLUSIVELY FOR THE BT-60

671-BNC-60AB	1.595"	1.637"	3/8"	3"	Balsa	AB	.23 oz.	4 oz.	\$ .70	\$ 1.40
651-BNC-60L	1.595"	1.637"	5/8"	3-3/4"	Balsa	L	.34 oz.	4 oz.	\$ .75	\$ 1.50
651-BNC-60T	1.595"	1.637"	1/2"	3-3/8"	Balsa	T	.17 oz.	4 oz.	\$ .75	\$ 1.50

### IDEAL FOR THE PST-65

651-BNC-65L	1.750"	1.796"	1/2"	3-3/4"	Balsa	L	.41 oz.	4 oz.	\$ .75	\$ 1.50
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### ESPECIALLY FOR OUR ENGINE MAILING TUBE

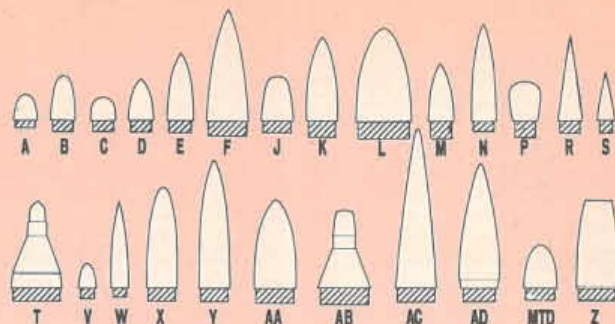
651-BNC-MTD	0.937"	1.002"	3/8"	1-7/8"	Balsa	D	.06 oz.	4 oz.	\$ .30	\$ .60
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### AND A TAIL CONE FOR BT-55 (with pre-drilled hole)

651-BTC-55Z	1.283"	1.325"	1/2"	3-1/2"	Balsa	Z	.25 oz.	4 oz.	\$ .75	\$ 1.50
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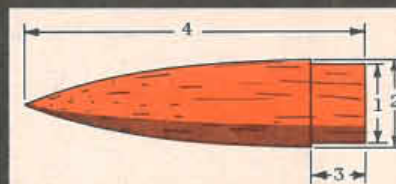
Nose cone shapes are shown at top of opposite page. Compare letter in column "Ill" with cone having corresponding letter in illustration.

Dimensions may vary slightly



Nose cone dimensions listed on opposite page.

**CAUTION:** When designing rockets using lightweight nose cones, be sure to follow procedures in TR-1 on rocket balance and stability. Don't forget to order screw eyes and nose cone weights: See pages 59 and 76



REFERENCE DETAIL FOR NOSE CONE DIMENSIONS ON CHART OPPOSITE, UNDER COLUMNS 1, 2, 3, 4

## NOSE CONE STOCK AVAILABLE FOR MAKING NOSE CONES OF YOUR OWN DESIGN

You can order 4" to 6" lengths of balsa blocks for making your own nose cones. These are cut-off pieces from our manufacturing process. Slightly damaged corners will not interfere with their usability.

1" x 1" blocks, shipping wt. 1 oz.

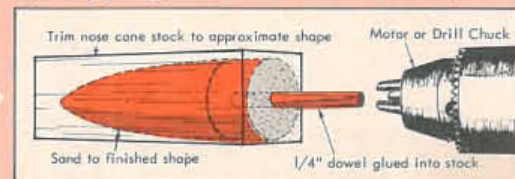
Cat. No. 651-NCS-1 .....ea. \$ .15

2" x 2" blocks, shipping wt. 3 oz.

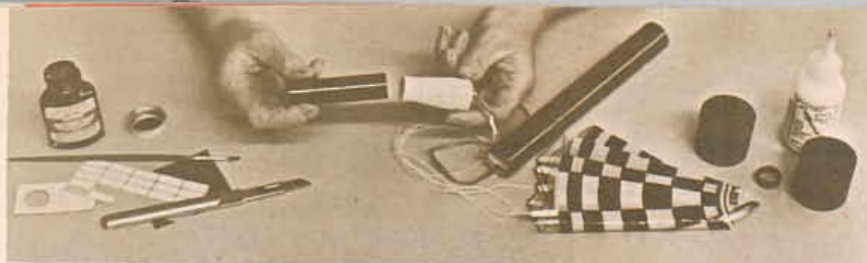
Cat. No. 651-NCS-2 .....ea. \$ .20

## NOSE CONE DOWELS: 1/4" dia. x 2" long, hardwood Cat. No. 651-NCD-2, shipping wt. 2 oz. .... 3 for \$ .10

USE DOWELS AS SHOWN IN DRAWING FOR MAKING NOSE CONES







## NOSE BLOCKS

Use these top quality, featherweight balsa nose blocks in payload sections and anywhere else a solid bulkhead is required. Precision turned for exact fit in body tubes.

Cat. No.	Dimensions		Fits	Weight oz.		Price	
	O. D.	Length		Net	Ship.	Each	3 for
651-NB-20	.710"	3/4"	BT-20	.014	1	\$ .30	\$ .60
651-NB-30	.725"	3/4"	BT-30	.014	1	\$ .30	\$ .60
651-NB-50	.950"	1"	BT-50	.040	4	\$ .35	\$ .70
671-NB-55	1.283"	1 1/4"	BT-55	.115	4	\$ .45	\$ .90
651-NB-60	1.595"	1 1/2"	BT-60	.190	4	\$ .50	\$1.00
651-NB-1MT	.937"	1"	Mailing Tube	.040	4	\$ .35	\$ .70

## ENGINE BLOCKS

Get light weight, precision fitting engine blocks for the best internal construction on your models. These hollow bulkheads position the engine, allow gases to pass forward unobstructed for normal ejection or upper stage ignition.

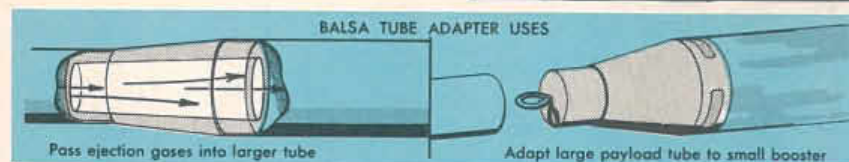
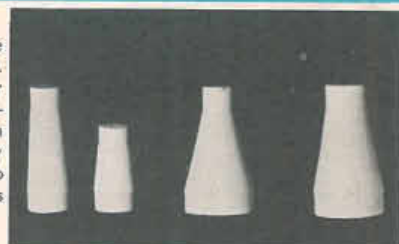
Cat. No.	Dimensions			Fits	Weight oz.		Price	
	O. D.	I. D.	Length		Net	Ship.	Each	3 for
<b>PAPER ENGINE BLOCKS</b>								
651-EB-20A	.708"	.65"	1/4"	BT-20	.009	1	\$ .10	\$ .20
651-EB-20B	.708"	.65"	1/8"	BT-20	.005	1	\$ .10	\$ .20
651-EB-30A	.724"	.65"	1/4"	BT-30	.010	1	\$ .10	\$ .20

Engine blocks are used to precisely position the engine when preparing the rocket for flight, and to provide a solid bulkhead against which the engine pushes as it develops its thrust. These units are of a size which can be used directly in rockets designed using BT-20 or BT-30 bodies. They can also be used in special designs using larger bodies or cluster engines. For additional information see construction tips on page 51.



## BALSA ADAPTERS

Super light, precision made balsa adapters give unlimited flexibility for model rocket design. Switch from one size body tube to another for payload capsules, parachute compartments, propulsion sections, etc. Adapters fitting BT-20 can be built up with masking tape to fit BT-30. Any adapter can be hollowed with a knife or drill to make a passage for ejection gases. All adapters have a 1/2" mating surface on each end.



Catalog No.	Mates	Length	Taper Length	Weight oz. Net Ship.	Price Each
651-TA-520	BT- 5 to BT-20	1.75"	0.75"	.04 1	\$ .30
651-TA-550	BT- 5 to BT-50	2.2"	1"	.06 4	\$ .35
651-TA-2050	BT-20 to BT-50	3"	2"	.15 4	\$ .40
651-TA-2050A	BT-20 to BT-50	2"	1"	.11 4	\$ .35
651-TA-2060	BT-20 to BT-60	3"	2"	.20 4	\$ .60
651-TA-5060	BT-50 to BT-60	3"	2"	.23 4	\$ .60
651-TA-5065	BT-50 to PST-65	3"	2"	.26 4	\$ .60
651-TA-6065	BT-60 to PST-65	2"	0.5"	.23 4	\$ .50

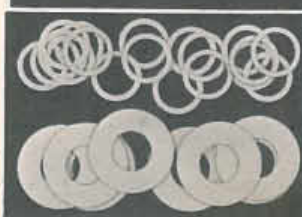
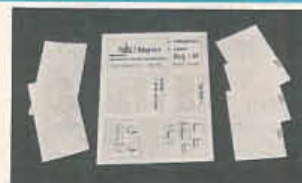
## PAPER ADAPTERS

Add still another dimension to rocket design. Easy to use paper adapters are perfect for making transitions between tube sizes for countless designs. Set includes a total of 20 rings for positioning BT-5 in BT-20; BT-5, BT-20, BT-30 in BT-50; and BT-5, BT-20, BT-30 and BT-50 in BT-60. Also three universal tapered shrouds and instructions. Shipping wt. 2 oz. Cat. No. 651-TA-1 ..... \$ .35 each

**20-50 RINGS** — Set of 20 rings for centering and mounting BT-20 in BT-50. Shipping weight 2 oz. Cat. No. 651-RA-2050 ..... \$ .30 per set

**20-55 RINGS** — Set of 10 rings for centering and mounting BT-20 in BT-55. Shipping wt. 2 oz. Cat. No. 671-RA-2055 ..... \$ .30 per set

**20-60 RINGS** — Set of 10 rings for centering and mounting BT-20 in BT-60. Shipping weight 2 oz. Cat. No. 651-RA-2060 ..... \$ .30 per set







## ENGINE MOUNTS

Get a precision engine fit in large body tubes without adding unnecessary weight. Engine mount sets come complete with instructions — just assemble and glue in place in your model.

**EH-2050** Fits BT-50, includes BT-20J, EB-20A, 2 rings for centering holder tube, and JT-50C for positioning rings. Net weight 0.1 oz. Shipping weight 5 oz.  
Cat. No. 651-EH-2050 ..... \$ .35 each

**EH-2055** Fits BT-55, includes BT-20J, EB-20A, 2 rings for centering holder tube, and JT-55C for positioning rings. Net weight 0.14 oz. Shipping weight 5 oz.  
Cat. No. 651-EH-2055 ..... \$ .35 each

**EH-2060** Fits BT-60, includes BT-20J, EB-20A, 2 rings for centering holder tube, and JT-60C for positioning rings. Net weight 0.17 oz. Shipping weight 5 oz.  
Cat. No. 651-EH-2060 ..... \$ .35 each

## STAGE COUPLERS

Little tubes with many uses, stage couplers exactly fit the inside of the tube designated. Great for multi-staging, joining body tubes, positioning adapter rings, etc. Make perfect guides for cutting body tubes and sanding cut edges of body tubes, too. Extra durable, lightweight. Shipping weight for all stage couplers is 3 oz. each.

Cat. No.	Dimensions			Fits	Average Weight	Price	
	O. D.	I. D.	Length			Each	3 for
651-JT-5C	.513"	.455"	3/4"	BT-5	.020 oz.	\$ .10	\$ .20
651-JT-20C	.708"	.650"	3/4"	BT-20	.027 oz.	\$ .10	\$ .20
651-JT-30C	.724"	.650"	3/4"	BT-30	.030 oz.	\$ .10	\$ .20
651-JT-50C	.949"	.920"	1"	BT-50	.051 oz.	\$ .15	\$ .30
651-JT-55C	1.28"	1.25"	1.3"	BT-55	.088 oz.	\$ .15	\$ .30
651-JT-60C	1.59"	1.55"	1 1/2"	BT-60	.124 oz.	\$ .15	\$ .30
671-JT-70A	2.175"	2.115"	1 1/4"	BT-70	.140 oz.	\$ .20	\$ .40

## FIN STOCK

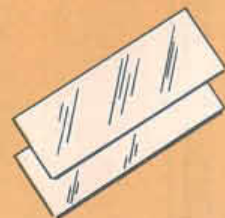
Top quality balsa sheeting for making fins for model rockets. For maximum strength, grain of wood should follow the leading edge of fin. Read **FINS** in Vol. 3, No. 3 of the **MODEL ROCKET NEWS** for more information.

Catalog No.	Dimensions (In Inches)	Weight oz.		Major Use	Price
		Net	Ship.		
651-BFS-10	1/32 x 3 x 9	.065	4	High Performance	3 for \$ .35
651-BFS-20	1/16 x 3 x 9	.130	4	High Performance	3 for \$ .40
651-BFS-20L	1/16 x 3 x 12	.173	6	High Performance	3 for \$ .55
651-BFS-20B	1/16 x 1/2 x 6	.015	2	Glider Elevon	2 for \$ .10
651-BFS-30	3/32 x 3 x 9	.150	4	Sport Models	3 for \$ .45
651-BFS-30L	3/32 x 3 x 12	.200	6	Sport Models	3 for \$ .60
651-BFS-40	1/8 x 3 x 9	.200	4	Cluster Rockets	3 for \$ .50
651-BFS-40L	1/8 x 3 x 12	.265	6	Glider Wings	3 for \$ .65
651-BFS-60S	3/16 x 1/2 x 3.7	.020	2	Scout Fin Replacement	3 for \$ .15
651-BFS-80	1/4 x 2 x 17	1.00	12	Sky Slash Body	\$ .30 each 3 for \$ .60

**CLEAR PLASTIC FIN STOCK:** Build flyable models of finless space boosters and retain scale appearance. Clear plastic fins can be practically invisible; yet can also be as large as needed for proper stability. Recommended practice is to form a tube of 0.020" thick plastic to slide onto the outside of your model and glue fins made from 0.040" thick plastic to this tube. Use clear butyrate dope for gluing and filleting. In 3" x 9" sheets, shipping weight 4 oz.

**0.020" THICK:** Cat. No. 651-CFS-20 ..... \$ .20 each  
**0.040" THICK:** Cat. No. 651-CFS-40 ..... \$ .40 each

**FIN PATTERN SHEET:** Fourteen different popular fin designs, all tried and proven, printed full size on heavy index stock. Simply cut out and trace around pattern to transfer design to balsa. A must for the model rocket designer. Shipping wt. 1 oz.  
Cat. No. 651-PP-2 ..... \$ .25 each





# CUSTOM ASSORTMENTS

Many new, unique and useful rocket designs have been produced by imaginative rocketeers. In this section you'll find representative money-saving assortments of components for the beginner and for the experienced rocketeer who wants to explore new designs and ideas.

## LAUNCH PAD SPECIAL

Perfect starter assortment for a basic foundation

All parts and supplies for the experimentally minded rocketeer to explore techniques of successful rocket building. A comprehensive design manual guides you to hours of fun and satisfaction in building serviceable rockets; aids in studying aerodynamics, stability and recovery techniques (not available on quantity discount orders).

A \$7.60 VALUE... ONLY \$5.00

<b>BODY TUBES</b>		<b>RECOVERY EQUIPMENT</b>	
6 Body Tubes	#BT-30	2 Parachutes	#PK-12A
<b>NOSE CONES</b>		1 Parachute	#PK-18A
2 Nose Cones	#BNC-30C	1 Parachute Material	#PM-2
1 Nose Cone	#BNC-30D	1 Streamer Material	#SM-1
1 Nose Cone	#BNC-30E	1 Sheet Tape Strips	#TD-2
1 Nose Cone	#BNC-30M	1 Roll Shroud Lines	#SLT-1
1 Nose Cone	#BNC-30N	6 Shock Cords	#SC-1
		6 Screw Eyes	#SE-2
<b>FIN MATERIAL</b>		6 Balsa Fin Stock	#BFS-20
<b>MISCELLANEOUS</b>			
6 Engine Blocks	#EB-30A	1 Design Manual	#P-1
3 Launch Lugs	#LL-2C	1 Fin Pattern Sheet	#PP-2

Cat. No. 651-ES-50, shipping wt. 1 lb., 2 oz. \$5.00



# KEEP A SUPPLY ON HAND

PARTS FOR  
YOUR OWN  
ROCKET DESIGNS

## LIFT-OFF SPECIAL

FOR BUILDING  
AN ALL-PURPOSE  
ROCKET FLEET

Lift-off to more rocket building enjoyment with this special-value assortment. A balanced selection of parts and supplies to build and decorate many different types of rockets. Real savings. Great for gifts, or for yourself as you build advanced or experimental models. (not available on quantity discount orders)



A \$13.40 VALUE for only \$10.00

<b>NOSE CONES</b>		<b>FIN MATERIAL</b>		<b>BULKHEADS AND HOLDERS</b>	
1 #BNC-60L	1 #BNC-20B	1 Balsa Sheet	#BFS-10	1 #NB-60	
1 #BNC-30E	1 #BNC-20N	2 Balsa Sheets	#BFS-20	1 #NB-30	
1 #BNC-30M	1 #BNC-10A	3 Balsa Sheets	#BFS-30	1 #NB-20	
1 #BNC-20A	1 #BNC-10B	2 Balsa Sheets	#BFS-40	3 #EB-30A	
<b>MISCELLANEOUS</b>		<b>RECOVERY EQUIPMENT</b>		3 #EB-20A	
1 Balsa Adapter	#TA-2060	2 Parachutes	#PK-12A	1 #EH-2060	
1 Adapter Set	#TA-1	1 Parachute	#PK-18A	<b>BODY TUBES</b>	
1 Nose Cone Stock	#NCS-1	1 Parachute	#PK-24A	1 #BT-60	
1 Nose Cone Stock	#NCS-2	1 Parachute Material	#PM-2	2 #BT-30	
3 Nose Cone Dowels	#NCD-1	1 Streamer Material	#SM-1	2 #BT-20	
6 Nose Cone Weights	#NCW-1	2 Sheets Tape Strips	#TD-2	2 #BT-10H	
3 Reinforcing Mat'l.	#PRM-1	1 Roll Shroud Lines	#SLT-1		
3 Launching Lugs	#LL-1C	3 Snap Swivels	#SV-12		
1 Decal Sheet	#D-5	9 Screw Eyes	#SE-1		
1 Design Manual	#P-1	3 Shock Cords	#SC-1		
1 Fin Pattern Sheet	#PP-2	1 Shock Cord	#SC-2		

Cat. No. 651-ES-100, shipping wt. 1 lb., 12 oz. \$10.00





## ORBIT SPECIAL

\$20.18 Value  
only \$15.00

You or your club members will "orbit" a whole host of rockets before this value-packed assortment has been used. With the representative selection of parts and supplies included, your imagination will have a chance to run free on many rocket projects and experiments. Valuable design manual included. Shipping weight 2 lbs. (not available on quantity discount orders).

Cat. No. 651-ES-150 \$15.00 each

### BODY TUBES

- 1 #BT-60
- 1 #BT-50
- 3 #BT-30
- 2 #BT-20
- 2 #BT-10H

### NOSE CONES

- 1 #BNC-60L
- 1 #BNC-50K
- 1 #BNC-30D
- 1 #BNC-30E
- 1 #BNC-30M
- 1 #BNC-20A
- 1 #BNC-20B
- 1 #BNC-20N
- 1 #BNC-10A
- 1 #BNC-10B

### NOSE BLOCKS, ENGINE BLOCKS, HOLDERS, ETC.

- 1 Nose Block #NB-60
- 1 Nose Block #NB-50
- 3 Nose Blocks #NB-30
- 2 Nose Blocks #NB-20
- 3 Engine Blocks #EB-30A
- 3 Engine Blocks #EB-20A
- 1 Engine Mount #EH-2050
- 1 Engine Mount #EH-2060
- 1 Stage Coupler #JT-50C
- 1 Stage Coupler #JT-60C

### RECOVERY EQUIPMENT

- 1 Parachute Material #PM-2
- 3 Parachutes #PK-12A
- 2 Parachutes #PK-18A
- 1 Parachute #PK-24A
- 3 Streamer Material #SM-1
- 2 Sheets Tape Strips #TD-2
- 1 Roll Shroud Lines #SLT-1
- 6 Shock Cords #SC-1
- 3 Shock Cords #SC-2
- 12 Screw Eyes #SE-1
- 3 Snap Swivels #SV-12

### ADAPTERS

- 1 Balsa #TA-2050A
- 1 Balsa #TA-2060
- 1 Balsa #TA-5060
- 1 Paper #TA-1

### FIN MATERIAL

- 3 Balsa Sheets #BFS-10
- 3 Balsa Sheets #BFS-20
- 3 Balsa Sheets #BFS-30
- 3 Balsa Sheets #BFS-40

### MISCELLANEOUS

- 1 Payload Section #PS-20A
- 1 Nose Cone Stock #NCS-1
- 1 Nose Cone Stock #NCS-2
- 3 Nose Cone Dowels #NCD-1
- 6 Nose Cone Weights #NCW-1
- 1 Reinforcing Mat'l. #PRM-1
- 1 Reinforcing Mat'l. #GR-2
- 3 Launching Lugs #LL-1C
- 1 Decal Sheet #D-5
- 1 Decal Sheet #D-6
- 1 Design Manual #P-1
- 1 Fin Pattern Sheet #PP-2



## RANGE KIT SPECIAL

### A complete Range Kit

\$9.00 VALUE  
ONLY \$6.00

A sturdy, all metal range box (RB-1), loaded with all these most needed items:

- |                      |                     |                     |
|----------------------|---------------------|---------------------|
| 21 Igniters          | 1 Roll Shroud Lines | 3 Screw Eyes        |
| 1 Bottle White Glue  | 1 Sheet Tape Strips | 3 Nose Cone Weights |
| 1 Knife Handle       | 1 Pack Flameproof   | 1 Roll Masking Tape |
| 3 Knife Blades       | Recovery Wadding    | 2 Balsa-Fin Stock   |
| 1 Tweezers           | 4 Parachutes        | 3 Launching Lugs    |
| 1 Whetstone          | 1 Streamer Material | 18 Sheets Sandpaper |
| 1 Engine Holder      | 3 Snap Swivels      | 1 Emery Board       |
| 1 Reinforcing Mat'l. | 4 Shock Cords       | 2 Micro-Clips       |

Sorry, no substitutions. Not available on quantity discount purchases. Shipping weight 3 pounds.

Cat. No. 651-RBK-1 ..... \$6.00

### RANGE BOX

Good-looking, roomy, tough all metal box — the same as included with the special above. A big 11½" x 5¼" x 4", complete with a three compartment tray for small parts. Has full-drawn seamless body, snap catch with eye for padlock. Shipping weight 2 pounds.

Cat. No. 651-RB-1 ..... \$2.50 each

### LARGE RANGE BOX

Big enough to hold an Altiscope, an Electro-Launch and a model or two, this sturdy all steel range box measures 19" x 7¼" x 6". Watertight construction protects your supplies, double action latch eliminates spilling, multi-section tray helps keep things organized. Shipping weight 6 pounds.

Cat. No. 651-RB-2 ..... \$6.00 each

### LARGE RANGE KIT SPECIAL \$12.50 Value Only \$9.50

Includes the large range box with the same supplies as the regular range kit special. Shipping weight 7 lb.

Cat. No. 651-RBK-2 ..... \$9.50 each

Not available on quantity discount purchases.







# MODEL ROCKET RECOVERY



The recovery system is one of the most important parts of a model rocket. It is designed to provide a safe means of returning the rocket and its payload to earth without damage to the rocket or presenting a hazard to persons on the ground. Also, the recovery system provides an area for competition when rocketeers hold contests to see whose rocket can remain aloft the longest. In addition, rocket recovery is an area for valuable experimentation and research as rocketeers develop new and better methods of returning their models to earth or study air currents.

Most recovery systems in use today depend on drag (or wind resistance) to slow the rocket. Each changes the model from a streamlined object to one which the air can "catch against" and retard its descent. Six main recovery methods are used by model rocketeers today. The following list gives a brief description of each:

1. Featherweight Recovery (i.e. Astron Streak): The model is designed for extra light weight (under 1/4 ounce without engine) and has a blunt nose. When the engine is ejected from the rocket, the model is so light compared to its size that it lands safely. The lightweight, aerodynamically unstable, spent engine casing tumbles back separately.
2. Tumble Recovery (i.e. Astron Scout, Sprite): The ejection charge shifts the weight of the engine in the rocket rearward. This makes the rocket unstable. With the balance point of the rocket further toward the rear, air pressures ahead of the balance point are greater than behind, forcing the rocket to start turning. When the rocket is tumbling, air drag on it is much higher and it falls slowly. Estes Pat. No. 3,114,317
3. Streamer Recovery (i.e. Astron Mark): A model with a small streamer will act like a tumble model. If the streamer is large enough, it develops enough drag by fluttering to actually hold the rocket back in its descent and it lands gently.
4. Parachute Recovery (i.e. Astron Alpha): The ejection charge forces a parachute connected to the model out of its body tube. The parachute deploys, filling with air, and supports the model on its return.
5. Helicopter Recovery (i.e. Astron Gyroc): Vanes on the model, activated by the ejection charge, catch the air in a way that makes them spin on the way down. The spinning vanes disturb the flow of air past the rocket creating a large amount of drag.
6. Glide Recovery (i.e. Astron Falcon, Space Plane): The model ascends vertically like a conventional rocket. At ejection either the balance of the model or the position of its aerodynamic surfaces is changed. Instead of streamlining straight down, the wings generate lift pulling the nose up, and the model goes into a glide. Models of this type are called "Boost-gliders". Estes Pat. No. 3,157,960. Other pat. pending.

## Recovery system installations



Step 1:

Cut two 1/2" slits and push in the area in between them.



Step 2:

Thread shock cord through slot as illustrated.



Step 3:

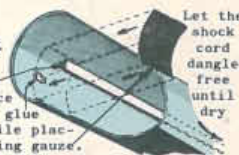
Restore slot to original tube contours, clamping shock cord in place. Cover area with glue.

For BT-50 and larger body tubes the installation method shown at the right may be used. This system is particularly desirable for scale models.



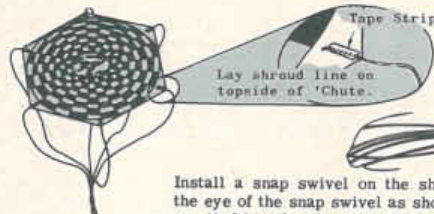
Coat gauze with a heavy layer of glue.

Hold end in place with glue while placing gauze.



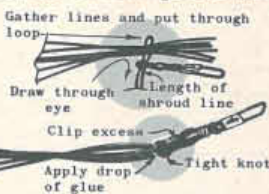
Let the shock cord dangle free until dry.

## 'Chute Assembly



Lay shroud line on top side of 'Chute.

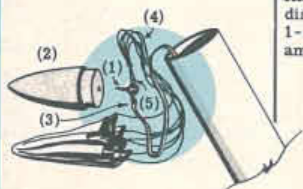
## Install a snap swivel



Install a snap swivel on the shroud lines by drawing them through the eye of the snap swivel as shown. Once through the eye the lines are tied together in a tight knot and pulled back against the eye.

## Assembly and Use of Recovery System

Install screw eye (1) in nose cone (2). Tie shock cord (3) to screw eye. Tie shroud-lines (4) to snap swivel (5) and clip to screw eye.

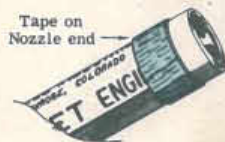


Pack your bird with flameproof wadding before each flight. The wadding should fill the tube for a distance of at least 1-1/2 times its diameter

Wadding



Tape on Nozzle end







## RECOVERY EQUIPMENT & SUPPLIES

**PARACHUTE KITS:** Get the best in parachute recovery! Two color printed plastic 'chutes give maximum visibility — feature easy to see pattern. Lightweight, durable and easily folded, these 'chutes are only 0.00075" thick, allowing the most material to be packed into the least body space. Each kit comes complete with 'chute material, tape strips and shroud lines.

Specify color combination and size when ordering. Shipping weight 2 oz.

Cat. No.	Parachute Diameter	Color Combinations Available	Net Weight	Price Each	3 for
651-PK-12	12 inches	Orange and White Red and White Red and Yellow Yellow and Black Orange and Black	.078 oz.	\$ .20	\$ .50
651-PK-18	18 inches	Red and White Red and Yellow Orange and Black	.144 oz.	\$ .30	\$ .75
651-PK-24	24 inches	Red and White Orange and Black	.298 oz.	\$ .45	\$1.00



**PARACHUTE MATERIAL:** You get a big square yard of extra strength, high visibility black plastic 'chute material. Each sheet can be cut to make one or more round or square parachutes up to 36" across. Net weight .98 oz. Shipping weight 5 oz.

Cat. No. 651-PM-2 ..... \$ .45 each



**STREAMER MATERIAL:** Bring light weight models back to earth with bright orange, flame resistant crepe paper streamers. In 7½ foot lengths, enough for two to eight streamers. Available in 1" and 2" widths. Specify size when ordering. Shipping weight 1 oz.

1" wide Net wt. .092 oz.

Cat. No. 651-SM-1 ..... 3 for \$ .30

2" wide Net wt. .184 oz.

Cat. No. 651-SM-2 ..... 3 for \$ .40

**RECOVERY WADDING:** Extra soft and flexible, light weight tissue paper (bathroom type), specially treated to make it flame resistant. Gives the very best protection from hot ejection gases for parachutes and streamers. Each package contains approximately 75 4½" squares — enough wadding for up to 25 flights. Instructions included in package. Shipping weight 6 oz. Cat. No. 651-RP-1A ..... \$ .25 each



**SHROUD LINES:** Build reliable, durable custom parachutes with this strong, hard surface shroud line cord. Comes in 72 yard spools. Shipping weight 5 oz.

Cat. No. 651-SLT-1 ..... \$ .25 each



**SCREW EYES:** Attach recovery systems to nose cones or nose blocks with these light weight metal screw eyes. Available in three sizes, specify size when ordering. Shipping weight for 3 eyes 1 oz.

LARGE EYE: 1" long; .04 oz.;

Cat. No. 651-SE-1 3 for \$ .10

SMALL EYE: ¾" long; .03 oz.;

Cat. No. 651-SE-2 3 for \$ .10

EXTRA SMALL EYE: ⅝" long; .01 oz.;

Cat. No. 651-SE-3 3 for \$ .10

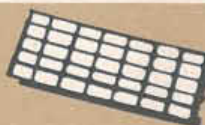


**TAPE DISCS:** Fasten shroud lines to plastic 'chutes or streamers with these ¾" pressure sensitive tape discs. Shipping weight for 12 discs, 1 oz. Cat. No. 651-TD-1 ... 12 for \$ .15



**TAPE STRIPS:** For top strength, low bulk and low weight, fasten shroud lines with these ¼" x ¾" tape strips. In sheets of 35 strips, shipping weight 1 oz.

Cat. No. 651-TD-2 ..... \$ .30 per sheet



**SHOCK CORD:** Convenient 18" lengths of model airplane contest rubber to absorb shock of ejection and recovery system deployment. In ⅛" widths for normal models, ¼" widths for heavy rockets. Specify width when ordering. Both are .03" thick. Shipping weight 1 oz.

⅛" wide: Net wt. 0.039 oz., Cat. No. 671-SC-1. \$ .10 each

¼" wide: Net wt. 0.078 oz., Cat. No. 671-SC-2. \$ .15 each



SC-1



SC-2

**SNAP SWIVELS:** For quick changes and reduced tangling in your recovery systems, use these tiny 1" long snap swivels. Net weight .01 oz. Shipping weight 1 oz.

Cat. No. 651-SV-12 ..... 6 for \$ .20





# ALTISCOPE

Determine Rocket Altitudes  
Learn Math and Trig



How high did it go? Find out with the Altiscope! Only one instrument is required for determining approximate altitudes (usually within ten percent). Use two together for even greater accuracy. Your altiscope can also be used to find heights of trees, buildings, mountains, poles, etc. Easy to assemble, easy to use, the Altiscope comes in kit form complete with instructions, trig tables, technical report TR-3 on altitude tracking and 2-D altitude computer. Shipping wt. 20 oz.

Cat. No. 651-A-1 ..... \$2.50 each

**EASY TO USE!**

# Computing Equipment

**2-D COMPUTER:** Build your own easy-to-use altitude computer. Get this set of charts and instructions — everything you need except tape, thumbtacks and glue — assemble the 2-D computer in a few minutes. Designed for use with one or two Altiscopes, easily used with other tracking systems. Shipping weight 2 oz. Kit includes technical report, TR-3

Cat. No. 651-AC-1 ..... \$ .25 each p.p.

**5" POCKET SLIDE RULE:** Solve problems in multiplication, division, proportions, reciprocals, etc. A, B, C, D, CI, and K scales accurately calibrated on white face of hardwood rule. Great for beginners, includes easy-to-follow instructions. Shipping weight 4 oz.

Cat. No. 651-SR-1 ..... \$ .40 each p.p.

**6" POCKET SLIDE RULE:** Ideal companion to the Altiscope. This durable plastic rule is complete and accurate, features A, B, C, CI, D and K scales on front plus S, T, and L scales on back for computing altitudes and working logarithm problems. With vinyl case and instructions. Shipping weight 5 oz.

Cat. No. 651-SR-3 ..... \$1.10 each p.p.

**10" DECIMAL TRIG MULTI-LOG SLIDE RULE:** A big rule at a small price. Complete with 22 scales in a functional grouping for mathematics, science and engineering — covers full log-log and trig requirements. Includes double faced, spring loaded adjustable cursor, operating instructions and protective carrying case. Shipping weight 11 oz.

Cat. No. 651-SR-4 ..... \$3.25 each p.p.

**LOG-LOG GRAPH PAPER:** Perfect for special performance graphs, altitude and velocity charts, etc. Two by two cycle grid on 8½" x 11" paper, can handle greater value ranges than standard graph paper. Shipping wt. 4 oz.

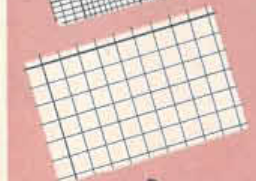
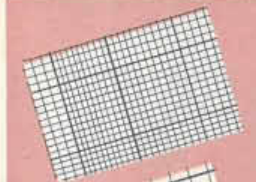
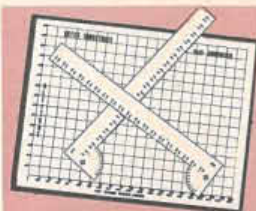
Cat. No. 671-GP-2 ..... 20 sheets for \$ .40

**GRAPH PAPER:** For rocket performance charts, stability graphs and countless other uses. 8½" x 11" sheets with 7½" x 10" grid area, divided into 1/10" squares. Shipping weight 4 oz.

Cat. No. 651-GP-1 ..... 20 sheets for \$ .40

**FLIGHT DATA SHEETS:** Keep accurate records on the performance of models. Each data sheet has spaces for complete data on four flights of a model rocket. Includes sections for pre-flight, countdown, launch weather and flight data. Sheets measure 8½ x 11 inches, printed both sides. Shipping wt. 2oz.

Cat. No. 651-DS-1 ..... 5 for \$ .20





A professional look  
for your model rockets with

## DECALS



**STARS AND BARS:** Sheet of 12 red, white and blue Air Force emblems, each 1 1/4" wide. Fit on fins and body tubes, look great on gliders. Shipping weight 1 oz.

Cat. No. 651-D-1 ..... \$ .15 each

**LARGE STARS AND BARS:** Add a special touch to your large models. Sheet contains two large 2" insignia, two medium 1 3/4" insignia and appropriate designations. Shipping weight 1 oz.

Cat. No. 651-D-2 ..... \$ .15 each

**3/8" LETTERS AND NUMBERS:** Identify and decorate models the easy way with these 3/8" high letter and number decals. Sheet contains 62 characters. Available in black or white. Specify color when ordering. Shipping weight 1 oz.

Cat. No. 651-D-3 ..... \$ .15 each

**1/4" LETTERS AND NUMBERS:** Ideal for code markings and identification on smaller rockets. Sheet contains 65 characters 1/4" high. Available in black or white. Specify color when ordering. Shipping weight 1 oz.

Cat. No. 651-D-4 ..... \$ .15 each



**GOLD MINE SPECIAL:** A real gold mine of decorative decals for your models. Lettering, vents, hatches, rivets and more, all on one big 3 1/2" x 8 1/2" sheet. Printed in brilliant red, white and black to add extra color. Shipping weight 1 oz.

Cat. No. 651-D-5 ..... \$ .25 each

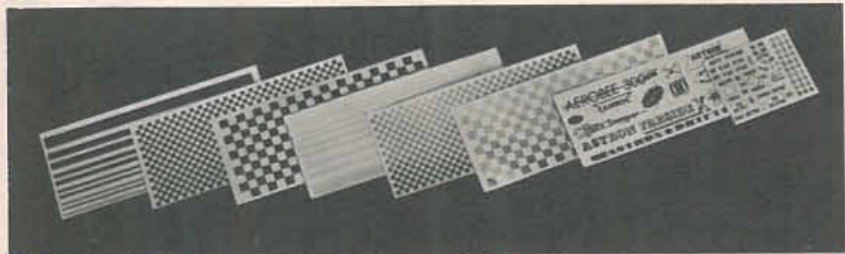
**#1 KIT NAMES DECAL:** Dress up models with these special kit names decals. Identify and decorate — easy to apply. Comes in black or white. Specify color when ordering. Shipping weight 1 oz.

Cat. No. 651-D-6 ..... \$ .25 each

Colorful decals are decorative and easy to apply. Just dip in water for about thirty seconds, slide the paper backing off and apply to either flat or round surfaces of your rocket. Large selection of emblems, numerals, etc. Complete instructions included.

**#2 KIT NAMES DECAL:** Extra colorful, this decal includes names for kit numbers K-7, 9, 12, 14, 15, 16, 17, 18 and 20 on a big 3 1/2" x 8 1/2" sheet. Printed in stand-out colors of red, yellow, white and black, this sheet provides the extra touch for good looking models. Shipping weight 1 oz.

Cat. No. 651-D-11 ..... \$ .25 each



**1/5" CHECKERBOARDS:** Glossy, colorful 1/5" square checks on clear background. Add color contrast to model for easy tracking and eye appeal. Extra-large sheets, 9 1/2" x 4", available in red, black, gold or white. Specify color and check size when ordering. Shipping weight 1 oz.

Cat. No. 651-D-7 ..... \$ .25 each

**3/8" CHECKERBOARDS:** Big 3/8" square checks for your large models. Cut out special patterns for even more striking effects. Large 9 1/2" x 4" sheets, available in red, black, white, gold or silver. Specify color and check size when ordering. Shipping weight 1 oz.

Cat. No. 651-D-8 ..... \$ .25 each

**COLOR STRIPES:** Put vertical stripes and horizontal-rings on models the easy way. Each sheet has ten stripes, 1/32" through 1/2" wide and 9 1/2" long. Available in red, black or yellow. Specify color when ordering. Shipping weight 1 oz.

Cat. No. 651-D-9 ..... \$ .25 each

**LAUNCH PANEL DECAL:** Identify controls and circuits on your launch panel with this easy-to-apply, pressure sensitive decal sheet. Aluminum letters on black background are easy to read, add extra eye appeal. Self-adhesive, just cut out and press in place. Extra-strong mylar sheet measures 3 1/2" x 4 3/4". Shipping weight 1 oz.

Cat. No. 651-D-10 ..... \$ .50 each

**DECORATING TAPE, black:** Thin, tough pressure sensitive tape is perfect for stripes, bars and other decoration. Easy to apply and only .0015" thick, decorating tape comes in rolls 1/2 inch wide and 144 inches long. Can be cut with knife and straightedge for special sizes.

Cat. No. 651-DT-1, shipping wt. 5 oz. .... \$ .25 each





## FINISHING SUPPLIES

Estes finishing materials and a little extra care in finishing can make a big difference in your model rocket's professional appearance and performance efficiency. For model finishing information, read Model Rocket News, V6-N1 (See page 81)



**ASTROSEAL** balsa filler: The first step to a perfect finish. Astroseal contains an extra high percentage of selected fillers to completely fill the grain in balsa parts. Gives smooth surface for dope or enamel application. Brush on two to four coats, letting each dry thoroughly. Sand with #SP320 sanding material between coats. In four ounce jar. Shipping weight 7 oz.

Cat. No. 651-SS-2 ..... \$ .60 each



**HEAT RESISTANT PAINT:** Protect exposed rocket parts from heat damage with easy to apply, brush-on, high heat aluminum paint. Protects to 1000°, gives a bright metallic finish. Recommended for swept fins and other parts exposed to hot exhaust gases. In 1½ ounce bottles. Shipping weight 6 oz.

Cat. No. 651-AP-1 ..... \$ .35 each



**FLUORESCENT SPRAY PAINT:** The brightest colors anywhere — make rockets easy to spot in the air and on the ground. Glowing, high visibility paint comes in handy 6 oz. spray cans, dries in minutes. For maximum brilliance use glossy white enamel as an undercoat. Available in Cerise Red, Yellow Orange, Red Orange and Green. Specify colors when ordering. Shipping weight 16 oz. each.

Cat. No. 651-FP-1 ..... \$1.40 each



**ENAMEL SPRAY PAINT:** Get that "professional" appearance for your best models. Top quality enamel in handy 5 oz. spray cans dries in minutes. Use indoors and outdoors. Not fluorescent. Available in the popular colors of Regal Blue, Hunter Green, Chrome Yellow, Glossy Black, Glossy White and Cherry Red. Specify colors when ordering. Shipping weight 16 oz. each.

Cat. No. 651-EP-1 ..... \$1.20 each



**CLEAR SPRAY:** Crystal clear spray coating goes on clear — stays clear. Gives extra gloss to enamel finishes, protects decals and decorations, makes fluorescent finishes smooth, durable and glossy. For best results, let paint dry thoroughly before applying clear spray, use several light coats for maximum gloss. In handy 5 oz. spray can. Shipping weight 16 oz.

Cat. No. 651-EP-2 ..... \$1.20 each



**BUTYRATE DOPE:** The dope preferred by expert modelers for perfect finishes. Brushes on smoothly, easily, comes in convenient 1 oz. bottles. Available in Insignia Red, International Orange, Dark Green, Gloss Black, Insignia White, True Blue, Sky Blue, Aircraft Gray, Orange Yellow, Silver, Gold and Clear. Specify colors when ordering. Shipping wt. 4 oz.

Cat. No. 651-BRD-1 ..... \$ .20 each

**SANDING SEALER:** Fills small holes in balsa, paper and other porous materials, provides a smooth surface for paint or dope. To use, sand the surface, brush on sealer, let dry and sand again. Repeat as needed to obtain a glass-like surface. In 1 ounce bottles. Shipping weight 4 oz.

Cat. No. 651-SS-1 ..... \$ .20 each

**THINNER:** For diluting butyrate dope, sanding sealer and Astroseal, and for brush cleaning. Completely colorless — won't interfere with the drying action of the dope. Comes in 1 ounce bottles. Shipping weight 4 oz.

Cat. No. 651-BDT-1 ..... \$ .20 each

**WHITE GLUE:** Preferred for rocket building! Sets fast, gives super strong joints with wood, paper, cloth and other porous materials. In 2 ounce plastic squeeze bottle. Shipping weight 6 oz.

Cat. No. 651-WG-1 ..... \$ .40 each

**BODY PUTTY:** For super-sleek models. Fill cracks, holes, grain marks in balsa parts, make smooth fin-body joints. In 21 cc. tube. Shipping weight 5 oz.

Cat. No. 651-FM-1 ..... \$ .30 each

**FINISHING WAX:** For a high gloss finish so important to appearance and low drag. Apply with soft cloth, let dry and polish with soft dry cloth. Recommended for use on enamel and butyrate finishes sold by Estes Industries. In 2 oz. jar. Shipping wt. 5 oz. Cat. No. 651-FW-2... \$ .80 each

**SANDING MATERIAL:** Fold, roll or crumple it for hard to reach places. Special mylar plastic backed abrasive sheet can be used over and over again. Helps you get a mirror finish. Extra fine 320 grit in easy to handle 2½" x 2¼" sheets. Shipping weight 1 oz.

Cat. No. 651-SP-320 ..... 3 sheets \$ .10

**SANDPAPER:** Shape and smooth model rocket parts with these handy 3" x 3" sheets of top quality sandpaper. Available in three grades. Specify grade when ordering. Shipping weight 1 ounce for 6 sheets.

6 SHEETS MEDIUM — Cat. No. 651-SPM-2 ..... \$ .10

6 SHEETS FINE — Cat. No. 651-SPF-2 ..... \$ .10

6 SHEETS EXTRA FINE — Cat. No. 651-SPEF-2 ..... \$ .10

18 SHEETS ASSORTED (6 each) — Cat. No. 651-SPA-2 ..... \$ .25

**PAINT BRUSHES:** The set designed for model rocketry. You get one #1 brush for extra fine work, one #4 brush for normal work and one #6 brush for covering large areas rapidly. Brushes are 6" long with quality camel hair bristles set in nicked ferrules. Available in sets of three only. Shipping weight 2 oz.

Cat. No. 651-PB-3 ..... \$ .30 per set

**MASKING TAPE:** Secure engines in model, mask for painting, etc. Extra strong ½" wide tape comes in 30 foot rolls. Flexible, seals tightly and strips off clean. Shipping weight 5 oz.

Cat. No. 651-MT-1 ..... \$ .30 each





## MODELING TOOLS



**PRECISION KNIFE SET:** Includes one 4¼" long #1 aluminum handle and one each #1A cutting blade, #1B punch blade, and #1C gouge blade. Recommended for precision work. Shipping weight 2 oz.

Cat. No. 651-KNS-1 ..... \$ .75 each



**RETRACTABLE BLADE KNIFE:** Heavy duty #2 aluminum handle, 4¾" long, with one double ended #2D blade. Blade retracts into handle for safe carrying. For general cutting. Shipping weight 4 ounces.

Cat. No. 651-KNS-2 ..... \$1.00 each




**UTILITY KNIFE:** Includes 5¾" long #3 steel handle and one #3E general purpose blade. Shipping weight 3 ounces.

Cat. No. 651-KNS-3 \$ .30 each

**HEAVY DUTY KNIFE:** Set of one 4¾" long #4 plastic handle with metal chuck and one general purpose knife blade similar to #4G. Shipping weight 6 ounces.




Cat. No. 651-KNS-4 ..... \$1.20 each

 Fits #1 handle only. For cutting balsa and paper.

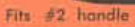
Cat. No. 651-KNB-1A ..... \$1.10 each

 Fits #1 handle only. Punch and scriber.

Cat. No. 651-KNB-1B ..... \$ .25 each

 Fits #1 handle only. Gouge for hollowing balsa nose cones, adapters, blocks, etc.

Cat. No. 651-KNB-1C ..... \$ .25 each

 Fits #2 handle only. Double ended, for general cutting.

Cat. No. 651-KNB-2D ..... \$ .35 each


 Fits #2 and #3 handles: Double ended, for general cutting.

Cat. No. 651-KNB-3E ..... \$ .15 each


 Fits #4 handle only: 1" wide x 5" long razor saw blade for balsa and body tube cutting.

Cat. No. 651-KNB-4F ..... \$ .45 each

Shipping weight on saw blade is 6 oz. All other blades, 1 oz.

 Fits #2 and #4 handles. For general cutting and carving.


Cat. No. 651-KNB-4G ..... \$ .15 each

 Fits #2 and #4 handles. For general cutting and trimming.

Cat. No. 651-KNB-4H ..... \$ .15 each

 **WHETSTONE:** Keep knife blades extra sharp for easy cutting. Pocket size, 3½" x ¾" x ¾". Use with oil for best results. Shipping weight 3 oz.

Cat. No. 651-W-1 ..... \$ .25 each

 **EMERY BOARDS:** Perfect for cleaning micro-clips, shaping airfoils, turning nose cones, etc. 4½" x 1½", medium abrasive on one side, fine abrasive on other. Shipping weight 1 ounce.

Cat. No. 651-BE-1 ..... 3 for \$ 1.00

 **TWEEZERS:** For 1,001 uses in handling small parts, attaching shock cords, etc. Steel, 3" long, 1/8" jaw. Shipping weight 2 ounces.

Cat. No. 651-T-1 ..... \$ .20 each

## MODELING KITS



**KNIFE CHEST:** Small, medium and heavy duty knives plus 9 assorted extra blades — one for practically every cutting job. In a handy, natural finish wood chest. Shipping wt. 1 lb. 8 oz.

Cat. No. 651-KNS-82 ..... \$ 4.50 each

**KNIFE AND TOOL SET:** Contains small, medium and heavy duty knives and an entire assortment of blades, gouges, routers, and punches. Has planer, 1" sander, spokeshave and balsa stripper. In wooden box, complete with see-through cover and fitted plastic tray insert that holds and shows every tool. Shipping wt. 2 lbs.

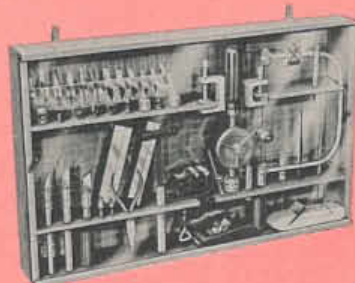
Cat. No. 651-KNS-84 ..... \$11.00 each



**COMPLETE HOBBY DEN TOOL CABINET:** A truly complete tool set for the model rocketeer. Has a full assortment of hobby tools, knives and blades against a blueprint silhouette background of each tool for easy replacement. Comes in a sturdy wooden fitted cabinet with a sliding, see-thru cover. (Size 13½" x 21¼" x 3") Shipping weight 9 pounds.

Cat. No. 651-KNS-88N ..... \$25.00 each

- 6 Extra Blades
- 6 Assorted Gouges
- 4 Assorted Routers
- 2 Punches
- 3 Knives (with blades)
- 1 Hobbycraft Saw (with extra blade)
- 2 Screw Drivers
- 2 "C" Clamps
- 1 Tweezer
- 1 Sander
- 3 Tweezer Clamps
- 1 Hand Drill
- 1 File



- 1 Planer
- 1 Hammer (with extra heads)
- 1 Bench Vise — imported
- 1 Pair Pliers — imported, service quality
- 1 Drill Bit, 2 Screw Driver Bits
- 2 Razor Saw Blades
- 2 Chucks
- Complete — \$25.00

Plus Free copy of the 35¢ "PROJECT HANDBOOK AND HOBBY TOOL GUIDE" by X-Acto

ITEMS ON THIS PAGE NOT AVAILABLE ON QUANTITY DISCOUNT ORDERS 75



## LITTLE ITEMS THAT GIVE BIG RESULTS IN ROCKETRY



**PHANTOM ENGINE:** For display and demonstrations, here's 1/2 an engine, cut the long way to show placement of nozzle, propellant, etc. Helps explain model rocket operation. Safe, uses only non-combustible materials. Shipping weight 1 oz.

Cat. No. 651-CE-1 ..... \$ .50 each



**ENGINE HOLDER:** Flat spring steel design gives easy installation and low drag. Recommended for sport and demonstration models built from BT-20 and BT-30, the engine holder is 2.8" long, 0.1" wide and only 0.025" thick. Mount it on the model with gauze and glue as shown on page 51. Net weight 0.032 oz. Shipping weight 1 oz.

Cat. No. 651-EH-2 ..... \$ .15 each



**SHORT ENGINE HOLDER:** Specially designed for use with Series III engines and BT-20 and BT-30 body tubes, this holder is 1.8" long and 0.1" wide for the same easy installation and low drag as the standard model. Net weight 0.022 oz. Shipping weight 1 oz.

Cat. No. 651-EH-3 ..... \$ .15 each



**PAYLOAD:** How high can your rocket lift an ounce of lead? This 1 oz. payload weight, 3/4" in diameter, is used in some altitude competition events. Shipping weight 2 oz.

Cat. No. 651-PL-1 ..... \$ .50 each



**NOSE CONE WEIGHT:** Balance rockets for perfect stability with these 1 1/16" diameter lead weights. Center hole for easy attachment and alignment. Stack several for more weight, cut with scissors for less. Each weighs 0.12 oz. Shipping weight 1 oz.

Cat. No. 651-NCW-1 ..... 3 for \$ .25



**NOSE CONE WEIGHT:** 7/16" diameter brass washers for delicate balancing. 1/8" center hole, weighs 0.023 oz. Attach up to four weights to nose cone by threading them on the screw eye. Shipping wt. 1 oz.

Cat. No. 651-NCW-2 ..... 10 for \$ .15



**BALANCING WEIGHT:** Flexible lead strip makes glider trimming a snap. Great for other balancing purposes too. Comes in 3" x 1/4" x 0.02" strips, net weight 0.085 oz. Shipping weight 1 oz.

Cat. No. 651-NCW-3 ..... 5 for \$ .10



**FOAM PADDING:** Protect payload specimens, pad payload capsules with plastic foam. Pieces are 6" x 6" x 1/4". Can be cut and secured in place with white glue. Net weight 0.08 oz. Shipping weight 1 oz.

Cat. No. 651-PSP-1 ..... \$ .20 each

**LAUNCH LUGS:** Super strength laminated launch lugs feature mylar plastic core for durability, paper outer layer for easy gluing. Inside diameter 5/32", fit 1/8" rod. Shipping weight 1 oz.

1 1/4" long:	Cat. No. 651-LL-2A	5 for \$ .10
2 3/8" long:	Cat. No. 651-LL-2B	5 for \$ .15
5" long:	Cat. No. 651-LL-2C	3 for \$ .15
8" long:	Cat. No. 651-LL-2D	2 for \$ .15



**GAUZE REINFORCING:** Attach shock cords, reinforce fin joints with unmarked gauze. Comes in 3" x 12" sheets. Apply by spreading a thin layer of glue over the area to be reinforced, smooth gauze down over the glue and spread one or more layers of glue over the gauze. Shipping weight 1 oz.

Cat. No. 651-GR-2 ..... 3 for \$ .30



**PAPER REINFORCING:** Double fin strength with this easy to use self-adhesive treated paper. Cut to shape, strip off protective backing and press on the balsa. Apply to both sides of the balsa for best results. Provides smooth white surface for painting. In 3" x 9" sheets, shipping weight 1 oz.

Cat. No. 651-PRM-1 ..... 3 for \$ .20



**TAPE HINGES:** Easy to use elevon hinges for boost-gliders. Treated paper, 4 1/2" x 3/4", adhesive coated on one side. Strip off protective backing, apply to joint. Shipping weight 1 oz.

Cat. No. 651-TH-1 ..... 2 for \$ .10



**ELASTIC THREAD:** Strong elastic thread, use as a spring to actuate elevons on boost-gliders. Each thread is 8" long, 1/32" diameter. Shipping weight 1 oz.

Cat. No. 651-ET-1 ..... 3 for \$ .10



**NYLON SCREWS:** Extra light, high strength screws for elevon adjustment on boost-gliders. 1/2" long, 1/16" thread diameter. Read TR-4 for information on gliders and their design. Shipping weight 1 oz.

Cat. No. 651-AS-1 ..... \$ .10 each



**STYROFOAM BALLS:** Featherweight 3" diameter styrofoam balls for "odd ball" designs. Use white glue for best results in attaching legs, antennas, stabilizers, etc. Net weight 0.2 oz., shipping weight 5 oz.

Cat. No. 651-SB-3 ..... \$ .25 each



**DOWELS:** Extra strong, light weight, seasoned maple dowels. Shipping weight 5 oz.

1/8" x 18" —	Cat. No. 651-WD-1	4 for \$ .20
1/12" x 12" —	Cat. No. 671-WD-2	4 for \$ .20





## DRAFTING AND DESIGNING EQUIPMENT



### TRIANGLE SET

Clear plastic triangles are perfect for drafting and designing work. Set includes one 6" 45° triangle and one 8" 30°-60° triangle. Beveled edges — accurate — precise ... recessed lifts from both sides permit clean, easy pick-up. Shipping weight 6 oz.

Cat. No. 651-DT-2 ..... \$ .65 per set p.p.

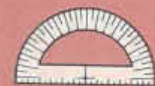


### FRENCH CURVE

Precision-made with sleek-finished edges of hairline accuracy. Perfect for designing nose cones, plotting curves, etc. Shipping weight 4 oz.

Cat. No. 651-DC-1 ..... \$ .25 each p.p.

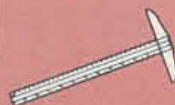
Putting your own ideas into a rocket design is a challenging opportunity. You'll find that a few "tools of the trade", listed here, can be a big help. Your measurements will be more accurate. Your drawings will be neater. Your contest designs will be more presentable, and you'll get more satisfaction from your work.



### PROTRACTOR

Large 6" clear plastic protractor makes angle measurements a "snap." Features sharp graduations, accurate 6" ruler at the base. Shipping weight 4 oz.

Cat. No. 651-DP-6 ..... \$ .15 each p.p.



### 12" T-SQUARE

Precision-made, clear plastic 12 inch T-square is accurate and easy to use. Smooth straight edges are marked in inches and millimeters. Shipping weight 11 oz.

Cat. No. 651-DR-2 ..... \$ .30 each p.p.



### METAL COMPASS

Sheet metal German tool does double duty — can be used as pencil compass or divider. Includes metal capsule of leads. Shipping weight 4 oz.

Cat. No. 651-DC-2 ..... \$ .35 each p.p.



### BOW COMPASS

Giant bow compass features thumb screw adjustment, interchangeable points for use as divider, ink or pencil compass. Heavy gauge nickel plated steel. Shipping weight 6 oz.

Cat. No. 651-DC-3 ..... \$1.10 each p.p.



## TECHNICAL REPORTS

**ROCKET STABILITY:** All about rocket stability. Easy to read, tells how to design your rockets to fly properly. No rocketeer will want to miss this one. Shipping weight 1 oz.

Cat. No. 651-TR-1 ..... \$ .25 each

**MULTI-STAGING:** New, revised version tells all about the latest discoveries in multi-staging technique. Complete, easy-to-understand and well illustrated. A necessity for designing, building and flying multi-stage birds. Shipping weight 1 oz.

Cat. No. 651-TR-2 ..... \$ .25 each

**ALTITUDE TRACKING:** The classic work on simple altitude tracking for model rocketeers. Covers thoroughly tracking and altitude computation. Easy to understand and apply. Shipping weight 1 oz.

Cat. No. 651-TR-3 ..... \$ .25 each

**REAR ENGINE BOOST-GLIDERS:** Basic information to help you understand the operation of rear-engine boost-gliders and design your own. Covers design and construction for proper upward flight and good glide characteristics. Shipping weight 1 oz.

Cat. No. 651-TR-4 ..... \$ .25 each

**BUILDING A WIND TUNNEL:** Full plans and information for building a wind tunnel to study rocket stability. Covers motor and handpowered versions, finding center of pressure, checking multi-stage rockets, etc. Great for clubs and experienced modelers — science fair projects too. Shipping weight 2 oz.

Cat. No. 651-TR-5 ..... \$ .25 each

**CLUSTER TECHNIQUES:** The complete report on clustering engines in model rockets. Thoroughly illustrated, easy to understand. Especially valuable for the modeler who wishes to loft larger payloads. Shipping weight 1 oz.

Cat. No. 651-TR-6 ..... \$ .25 each

**FRONT ENGINE BOOST-GLIDERS:** Valuable information on designing, building and flying front engine boost-gliders. Fully illustrated, recommended reading for anyone who wishes to build better gliders or get the best performance from the ones he has. Shipping weight 1 oz.

Cat. No. 651-TR-7 ..... \$ .25 each

**MODEL ROCKETRY STUDY GUIDE:** Presents a logical program for model rocketeers who want to get the most good from their activities. Includes a listing of recommended books on subjects relating to model rocketry.

Shipping weight 1 oz. Cat. No. 651-TR-8 ..... \$ .25 each

**DESIGNING STABLE ROCKETS:** Based on standard engineering practices, this report presents a method of designing rockets for proper stability on paper before any cutting or gluing is done. Worthwhile reading for beginner and experienced rocketeer alike. Shipping weight 1 oz.

Cat. No. 651-TR-9 ..... \$ .25 each

**ALTITUDE PREDICTION CHARTS:** Contains reports and graphs which explain a relatively simple method by which aerodynamic drag and other effects can be taken into account in predicting model rocket peak altitudes. With this data the probable altitude can be determined for any rocket and any Estes engine, including multi-stage and cluster power. Also suggestions for your own experiments. Shipping wt. 3 oz. Cat. No. 671-TR-10 ..... \$ .50 each



## MODEL ROCKET NEWS

The Model Rocket News is a publication of Estes Industries and is distributed free to our mail order customers. It contains articles on new developments in model rocketry.

The MRN mailing list consists of those who have placed substantial orders within the past year. As a new customer you will receive the next issue and will be sent new issues as long as you are a customer.

Back issues of MRN provide an important source of valuable information and ideas on model rocketry. You may order these back issues for useful tips 'n' hints, rocket plans, technical reports and interesting and enjoyable reading. Shipping weight on each MRN is 2 oz.

**BEST FROM VOLUMES 1 and 2:** Sixteen pages packed with the best in ideas, plans and information from volumes 1 and 2. Includes plans for the Bug-A-Bye, Dirty Bird III; stories on the Crickenauts and "Guppies into Inner Space"; Model Rocket Glossary; two full pages from the Idea Box and info on underwater rockets. (Sorry, separate issues of volumes 1 and 2 are not available. Shipping wt. 4 oz. **Cat. No. 651-MRN-1** ..... \$ .50 each



**VOLUME 3, NO. 1:** Features science fair projects, plans for Buchanan Buster, Idea Box and parachute cutting info. **Cat. No. 651-V3-N1** ..... \$ .25 each

**VOLUME 3, NO. 2:** Includes information on Estes Industries and plans for Big Bertha, demonstration rocket. **Cat. No. 651-V3-N2** ..... \$ .25 each

**VOLUME 3, NO. 3:** Carries basic info on fins, Idea Box, Safety Report, plans for Moannik-I and Sputnik-Too, Technical Report TR-4. **Cat. No. 651-V3-N3** ..... \$ .25 each

**VOLUME 3, NO. 4:** Contains information on science fair projects and booster recovery, Idea Box, plans for Sky Hook and Cobra, Technical Report TR-6. **Cat. No. 651-V3-N4** ..... \$ .25 each

**VOLUME 4, NO. 1:** Features 'chute recovery, plans for Loadlifter 1-A and MMSV-II (2 stage altitude rocket), TR-2, Idea Box and crossword puzzle. **Cat. No. 651-V4-N1** ..... \$ .25 each

**VOLUME 4, NO. 2:** Features articles on sectional construction, rocket math and how not to get started in model rocketry, plans for Flying Jenny and Tiger Shark, Idea Box and solution to V4, N1 crossword puzzle. **Cat. No. 651-V4-N2** ..... \$ .25 each

**VOLUME 4, NO. 3:** Includes articles on basic construction and rocket math, plans for Sly Bolt and Deacon, Technical Report TR-7 and Idea Box. **Cat. No. 651-V4-N3** ..... \$ .25 each

**VOLUME 5, NO. 1:** Carries articles on displaying models, rocket safety and the moon race, plans for Commuter and Aerobee Hi, Idea Box. **Cat. No. 651-V5-N1** ..... \$ .25 each

**VOLUME 5, NO. 2:** Contains winning pictures from E.I.'s 1965 Photo Contest, information on streamers, plans for Vertex and Whee II, Technical report TR-9 and Idea Box. **Cat. No. 651-V5-N2** ..... \$ .25 each

**VOLUME 5, NO. 3:** Discusses launching systems, factors which affect the flow of electricity through the systems and characteristics of some types of launcher batteries. Contains plans for the 260 space booster, Idea Box, interesting R & D Projects, and information on our nation's large space boosters. **Cat. No. 671-V5-N3** ..... \$ .25 each

**VOLUME 6, NO. 1:** Contains a comprehensive article on model finishing, facts and illustrations showing how easy altitude calculations can be, Idea Box, interesting Camroc photos, plans for the Mitosis and Gamma rockets. **Cat. No. 671-V6-N1** ..... \$ .25 each

**VOLUME 6, NO. 2:** Features some advanced drag calculations and graphs from technical report TR-10, results of Estes Science Fair Contest, drawings with building instructions for winning designs in the Odd-ball contest, Idea Box, and report on the first International Model Rocket Contest. **Cat. No. 671-V6-N2** ..... \$ .25 each

**VOLUME 7, NO. 1:** Includes an article on the 2nd annual Pittsburgh Model Rocket Convention, revised version of technical report TR-6 on clustering techniques, plans for challenger 2-stage model, plans for the Jaguar 3 engine cluster model and Idea Box. **Cat. No. 671-V7-N1** ..... \$ .25 each

**MRN COLLECTION:** Get the complete collection of available MRN back issues for one reduced price. Includes old issues listed above plus "The Best from Volumes 1 and 2." Shipping wt. 1 lb., 8 oz. **Cat. No. 671-MRN-14** ..... \$2.50 each

## Astron GYROC • Helicopter recovery • Free with \$5.00 order



Sky-high performance, plus a unique, dependable recovery system, makes this model a perfect addition to your rocket fleet. With light weight and streamlined design, the Gyroc soars to amazing altitudes; helicopter recovery brings it back gently, close to the launcher. A \$1.25 value, the Astron Gyroc is available only as a free bonus when you order \$5.00 or more of other kits and supplies. Shipping weight 5 oz.

To receive your free gift, simply write in large letters: "Free Gyroc" on the last line of your order form.

Specifications	Recommended engines
Weight: 0.58 oz.	1/4 A, B-2; 1/2 A, B-2;
Body Dia. 0.736"	A, B-3; B, B-4
Length 9.75"	Engines not included with kit

Limit one free kit per \$5.00 order







# ORDERING INFORMATION

## GENERAL INFORMATION

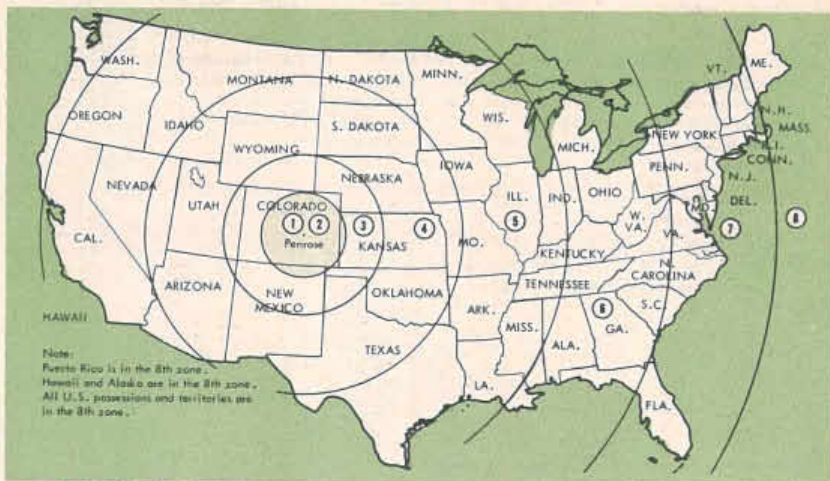
This catalog takes effect as of July 1, 1967 and replaces all previous catalogs. Please be sure that you use the correct and full catalog number for each item you order. All prices subject to change without notice. For an example of how to order merchandise, see page 83.

### POSTAGE

Estes Industries ships all orders postpaid in the U.S. by regular land mail unless the purchaser specifies otherwise or in case the order is a discount purchase or includes over 50 engines. For further information on the shipping of quantity purchases and large numbers of engines, see the **Quantity Purchases** section below.

### AIR MAIL SERVICE

While Estes Industries specializes in fast service, sometimes extra speed is necessary. For orders on which you desire extra rapid delivery, Air Mail postage may be included. Shipping weights are given on all items. Total up the shipping weights on the items you are ordering, then find the difference between surface and air rates using the map and charts. Send only this difference. For example, on a two pound order to zone 8, subtract \$.80 (the surface amount) from \$1.68 (the air rate). The difference would be \$.88 and you would send this amount. For orders under 8 ounces, send 6¢ per ounce. All orders which include engines require 6¢ per engine. Any excess will be returned with your order.



## PAYMENT ON ORDERS

Full payment must accompany all orders. Please send all remittances by either check or money order, for your protection and our convenience. If you do send currency, be sure your envelope has sufficient postage, is properly sealed, and is addressed correctly, so we will receive your order. Coins should be attached to a separate sheet of paper, not to the order blank. Use a single strip of masking tape to hold the coins in place. Avoid the mailing of coins, as they are easily lost in the mail. We cannot assume

responsibility for the loss of coins, currency or orders in the mail. Remember to include sufficient funds with your order. For your protection, **we do not ship orders COD**. Proper attention to these details will result in speedier service for you.

## QUANTITY PURCHASES

Quantity discounts are available to all individuals, clubs and other organizations who wish to buy rocket engines and rocket supplies in bulk. For discounts and shipping terms see table below.

Amount of Purchase Before Discount	% of Discount	Shipping Terms	Terms
Up to \$30.00	none	Prepaid	Cash with Order
\$30.00 to \$50.00	20%	F.O.B. Penrose	Cash with Order
\$50.00 and up	30%	F.O.B. Penrose	Cash with Order

Orders including 50 or more rocket engines must be shipped by air express, bus, railway express, truck or other common carrier. Consult your local office for rates before ordering. **Shipping Charges** may be made on a collect basis on quantity orders if you desire.

## CAUTION

We believe that we have the safest program offered in the field of rocketry today. However, it is still important that the utmost care be exercised in the use of our products. We DO NOT assume any responsibility for accidents. No warranty is either made nor implied as to reliability or performance. We assume no liability beyond the cost of replacement of a product, if any, which misfunctions or is found defective.

## POSTPAID PRICE

On certain items our price is slightly higher than the normal list on the item. The difference in prices is due to our policy of paying postage on all items. When you place an order for rocket supplies totaling \$4.00, you can be sure there are no hidden charges: All you pay is \$4.00, no extra postage, no handling and no service charges.

## POSTAL REGULATIONS

Postal regulations permit us to ship only 3 rocket engines per parcel. If all of your order does not come at the same time, please be patient — give Uncle Sam a few days to mix things up and sort them out again.

**NOTE** All foreign orders require additional postage.

SURFACE PARCELS

Weight 1 lb. and not to exceed	Local	Up to 150 miles	150 to 300 miles	300 to 600 miles	600 to 1,000 miles	1,000 to 1,400 miles	1,400 to 1,800 miles	Over 1,800 miles
	Zone	1-2	3	4	5	6	7	8
Third class rates apply up to but not including one pound								
2	\$0.40	\$0.50	\$0.50	\$0.55	\$0.60	\$0.70	\$0.75	\$0.80
3	.40	.55	.60	.65	.75	.85	.95	1.05
4	.45	.60	.65	.75	.85	1.00	1.10	1.25
5	.45	.65	.70	.80	.95	1.10	1.30	1.45
6	.45	.70	.80	.90	1.05	1.25	1.45	1.65
7	.50	.80	.85	1.00	1.15	1.40	1.60	1.85
8	.50	.85	.90	1.05	1.30	1.50	1.75	2.00
9	.55	.90	.95	1.15	1.40	1.65	1.90	2.20
10	.55	.95	1.05	1.20	1.50	1.75	2.10	2.40

AIR PARCELS

Weight in lbs. over 8 oz. to	Zone	1-3		4	5	6	7	8
	1	\$0.68	\$0.73	\$0.78	\$0.83	\$0.83	\$0.83	\$0.88
2	1.16	1.23	1.34	1.47	1.55	1.58	1.68	1.68
3	1.64	1.73	1.90	2.11	2.27	2.48	2.48	2.48
4	2.12	2.23	2.46	2.75	2.99	3.28	3.28	3.28
5	2.60	2.73	3.02	3.39	3.71	4.08	4.08	4.08
6	3.08	3.23	3.58	4.03	4.43	4.88	4.88	4.88
7	3.56	3.73	4.14	4.67	5.15	5.68	5.68	5.68
8	4.04	4.23	4.70	5.31	5.87	6.48	6.48	6.48
9	4.52	4.73	5.26	5.95	6.59	7.28	7.28	7.28
10	5.00	5.23	5.82	6.59	7.31	8.08	8.08	8.08



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BFS-80	.30	3/60 59	BT-55	.50	3/1.10 52	B.8-OP	.45¢	3/95 31	K-23	2.00	26	PK-18	.30	3/75 66
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