



A SUBSIDIARY OF DAMON

MODEL ROCKETRY CATALOG

Catalog No. 721 25c



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Blast-off





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ESTES INDUSTRIES, INC., PENROSE, COLORADO 81240



A SUBSIDIARY OF DAMON

Welcome to the real world of space . . .

Unless you're already an "old pro" at model rocketry, you're about to discover an exciting new hobby. Soon now, you'll assemble your first rocket, take it to a carefully selected site, and check it out for the last time. You'll start the countdown, "5-4-3-2-1-LIFTOFF!" Then, like scientists at the Cape, you'll whisper "Go, baby, go!" and like them, you'll experience a tremendous feeling of relief and satisfaction when the parachute blossoms to bring your rocket safely home.

That first launch is just the beginning. You'll go on to even more advanced models. The INTERCEPTOR that I'm holding below. SATURN V, the big one that sent us to the moon. The incredible CINEROC that you launch with your rocket to record on color film every stage of the flight. And CAMROC that photographs the terrain below from hundreds of feet in the air.

In all your model rocket adventures, our hopes and good wishes ride with you all the way. That's how it's always been since Estes, in 1960, introduced the solid propellant engine that brought safety to model rocketry for the first time. Look to us in months to come for more innovations — new models and new techniques.

Enjoy your new hobby. Learn from it. It is our conviction that from you, out there — today's model rocketeers — will come tomorrow's scientists opening new frontiers in space for America and the world.

Sincerely,

Vern
Vern Estes



More than 1,000,000 active rocketeers are served from this modern plant in Penrose, Colorado, "The Model Rocket Capital of the World." In its 40 buildings on a 300-acre site, Estes model rockets and accessories are born and tested. Estes was launched in 1960 when Vern Estes and his wife, Gleda, began selling their model rockets by mail. Now, reflecting the success of a splendid idea, some 300 Estes employees are dedicated to your success as a rocketeer.

© Copyright 1972
by Estes Industries
Penrose, Colorado
LITHO IN U.S.A.

Building and flying model rockets.



- 1 Rocket is launched electrically from launch pad.
- 2 Powered flight.
- 3 Model coasts upward to peak altitude during time delay.

- 4 Engine ejection charge activates to deploy the chute or other recovery system.
- 5 Model rocket drifts safely back to earth.
- 6 Gentle landing . . . ready for lift-off again.





BASIC BUILDING

Start by building and flying the Alpha. Study Technical Report TR-1 concerning rocket stability principles.

STABILITY STUDIES

Increase your understanding of stability principles by building and flying the Scout.

DESIGN PLANNING

Study Technical Report TR-9. It is an excellent guide for creating your own single stage rocket. Build and flight-prove your own design.

MULTI-STAGING

Learn about multi-staging with a 2-stage Apogee, Technical Report TR-2, explaining stage coupling separation and upper stage ignition.

Add to your skill in multi-staging by building and flying a 2-stage Farside, using experience gained from the Apogee.

CUSTOM DESIGN

Build and fly your own multi-stage model, using the techniques you've learned.

BOOST-GLIDE

This is a departure from the traditional rocket. Build and fly the Falcon which combines rocket and glider characteristics. Technical Report TR-7 gives you precise instructions on FRONT ENGINE models.

Broaden your boost-glide skills with the SkyDart, a rear engine model. Study Technical Report TR-1, you'll gain further knowledge in the art of balancing for maximum performance.

Now, test the boost-glide principles you've learned from the SkyDart and Falcon. Design and build your own boost-glider.

CLUSTERING

This is the technique of simultaneously igniting more than one engine. Master it by building the Scrambler, studying TR-6 and launching a payload with your model. Continue by building and flying the Astron Cobra or one of the clustered Estes scale models. Then build a cluster model of your own.

PHOTOGRAPHY

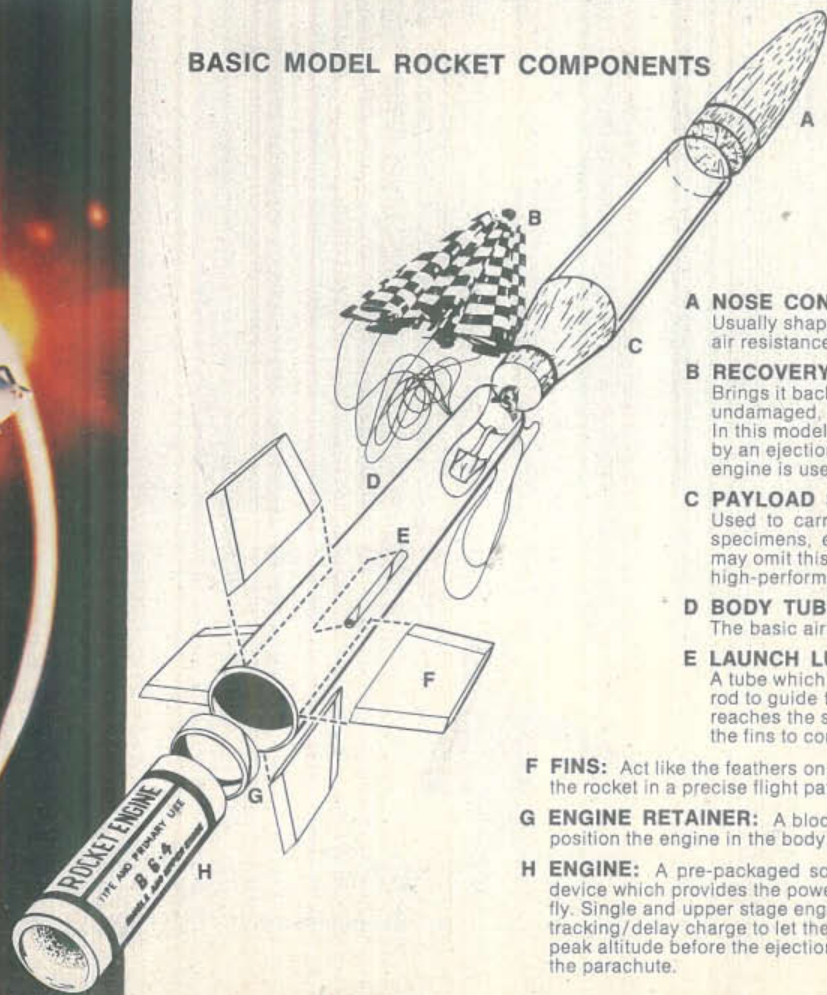
You can take pictures of your rocket flights. Color movies or still photography.



Everyone's Favorite . . .
The Interceptor. For details
and ordering instructions
see page 23.

Cat. No. K-50 \$5.25

BASIC MODEL ROCKET COMPONENTS



A NOSE CONE

Usually shaped to minimize air resistance.

B RECOVERY SYSTEM

Brings it back to earth in an undamaged, reusable condition. In this model a parachute deploy by an ejection charge in the engine is used.

C PAYLOAD SECTION

Used to carry instruments, specimens, etc. Some models may omit this section for sport or high-performance flights.

D BODY TUBE

The basic airframe of the rocket.

E LAUNCH LUG

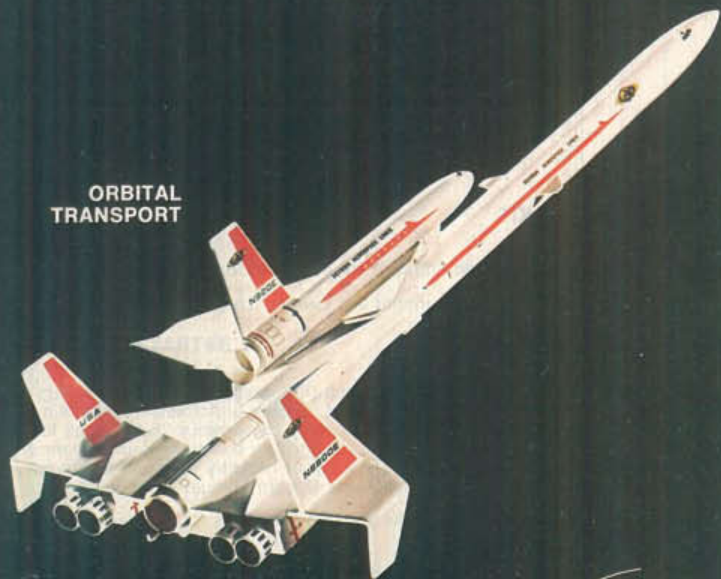
A tube which slips over the launch rod to guide the model until it reaches the speed necessary for the fins to control the flight.

F FINNS: Act like the feathers on an arrow, guiding the rocket in a precise flight pattern.

G ENGINE RETAINER: A block or ring used to position the engine in the body tube.

H ENGINE: A pre-packaged solid propellant device which provides the power to make the rocket fly. Single and upper stage engines contain a smoke tracking/delay charge to let the model coast up to peak altitude before the ejection charge pops out the parachute.

ORBITAL TRANSPORT



One of the most spectacular Estes Model Rockets is the Orbital Transport. The exciting Transport lifts off under rocket power then, at ejection the "re-entry vehicle" detaches and glides back to earth. The booster returns by parachute. For details and ordering instructions see page 24. Cat. No. 701-K-42 \$3.75

FOR BEGINNING ROCKETEERS

Engine	Rocket Type	Degree of Challenge	Select This Kit	See Page	
SOLID PROPELLANT	MINI-BRUTES	1	Mosquito Screamer	8	
			Mini-Bertha Hornet Birdie	9	
		2	Beta Midget	10	
		3	Star Blazer Mini-Bomarc	11	
	SINGLE STAGE ROCKETS	1	Alpha Alpha III Mark II Sky Hook	12	
			X-Ray Streak Big Bertha Scout	13	
			Sprite Constellation Drifter	14	
		MULTI-STAGE	3	Avenger	15
			2	Shrike	
	COLD PROPELLANT	JET PLANES	0	Shrike Jet Plane XS-1	28
1			Valkyrie 1		
SINGLE STAGE		2	Sandpiper Sergeant	29	
		3	Valkyrie 2		
ROCKET PLANES		3*	Baron Astro-Gnat X-13	30	

DEGREE OF CHALLENGE IN ASSEMBLING THE KIT

0 = Ready-to-fly 3 = Average
1 = Easy 4 = Difficult
2 = Fairly Easy 5 = Very Difficult
Weights given on the following pages are without engines.

FOR ADVANCED ROCKETEERS

Engine	Rocket Type	Degree of Challenge	Select This Kit	See Page
SOLID PROPELLANT	SINGLE STAGE ROCKETS	2	Demon Bandit Cherokee-D Cobra	16
		3	Goblin Starlight Scrambler Sprint	17
	MULTI-STAGE	3	Apogee II Farside	18
	BOOST GLIDERS	4	SkyDart Night Hawk	19
		3	Gyroc Falcon	
	SCALE FLYING MODELS	2	Wac Corporal Sandhawk	20
			V2 Aerobee 300	
		3	Arcas Saturn V Semi Scale	21
			Honest John Gemini-Titan	22
			Saturn V Saturn 1B Mercury Redstone	
EXOTIC DESIGNS	2	Saros	23	
		Interceptor		
	4	Orbital Transport Trident	24	
		Mars Snooper	25	
		Mars Lander		
FOR CAMERAS	3	Omega	33	
		Delta	35	

STARTER KITS

Porta-Pad STARTER KIT

- High-flying, easy-to-assemble Alpha III kit, 3 engines, instructions.
- Porta-Pad — sturdy tripod rod launcher and Launch Control System.
- Fact-filled Estes Design Manual.

Start with this complete outfit. The Astron Alpha III is easy to build and fly with plastic nose cone and fins. Demonstrating most rocketry principles, it can attain altitudes of 1000 feet or more. Parachute recovery brings your "bird" back for flight after flight. Both the Porta-Pad launcher and the complete launch control ignition system will serve you well throughout your rocketry career. To get you off to the right start, the comprehensive Estes Design Manual is included.

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Shipping wt. 3 lbs.

STARTER KIT INCLUDES: Alpha III kit, 3 engines — Two A8-3's and one B6-4 Launch Control System, FS-5; Porta-Pad Launcher; Design Manual; Instructions. Batteries not included. Recommended batteries: Ray-O-Vac No. 918, Eveready No. 731, Burgess TW-1, or any 6 or 12 volt car battery.

Cat. No. 701-KS-7

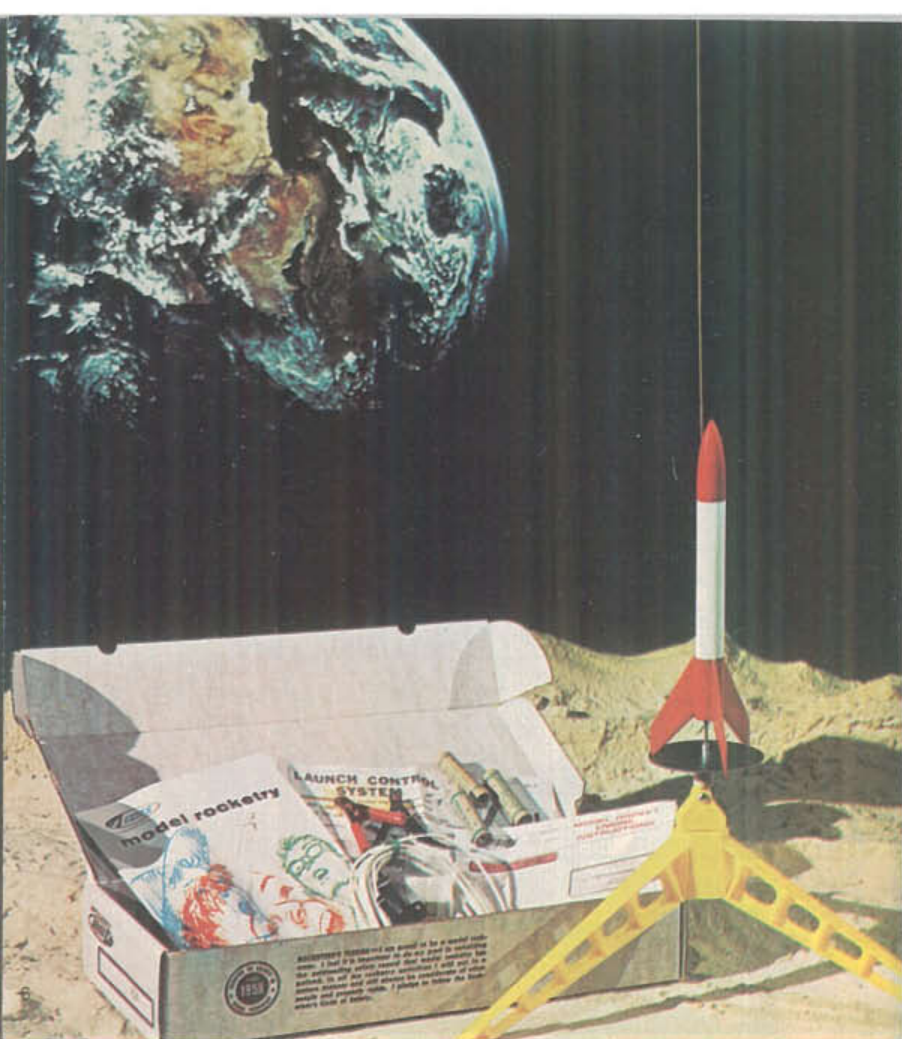
\$7.75

BEGINNER'S SPECIAL

For those who have a launcher available or wish to build their own (instructions included) all the above items except the field box, Porta-Pad and launch control system are included. Shipping wt. 12 oz.

Cat. No. 701-KS-2

\$2.75



STARTER KITS

DELUXE STARTER KIT

- Alpha Rocket (Balsa Nose Cone and Fins)
- Launch Control System
- Porta-Pad Launcher
- Estes Design Manual
- Three Safety Engineered Engines
- Construction and Finishing Supplies

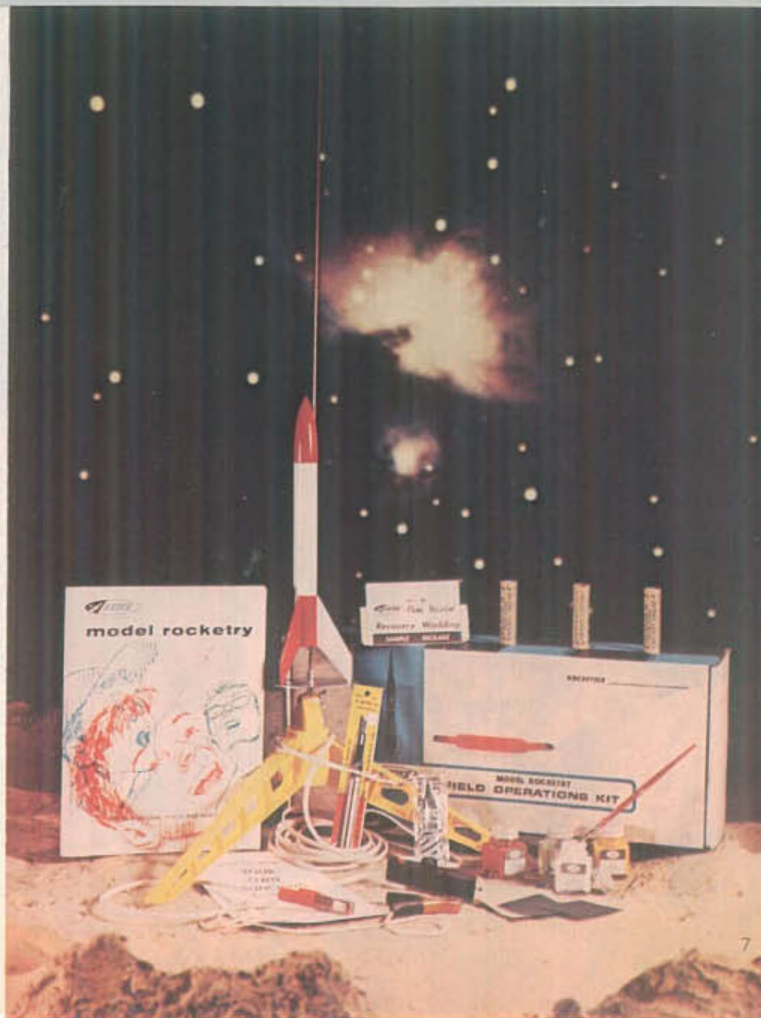
It's all here! This is the most complete outfit offered to build, finish and fly a model rocket. At one low price you get everything needed to get ready for launch: rocket, instructions, engines, launcher, electrical ignition system, tools and paints. All you need is the battery power for ignition. Use with car or heavy duty lantern battery.

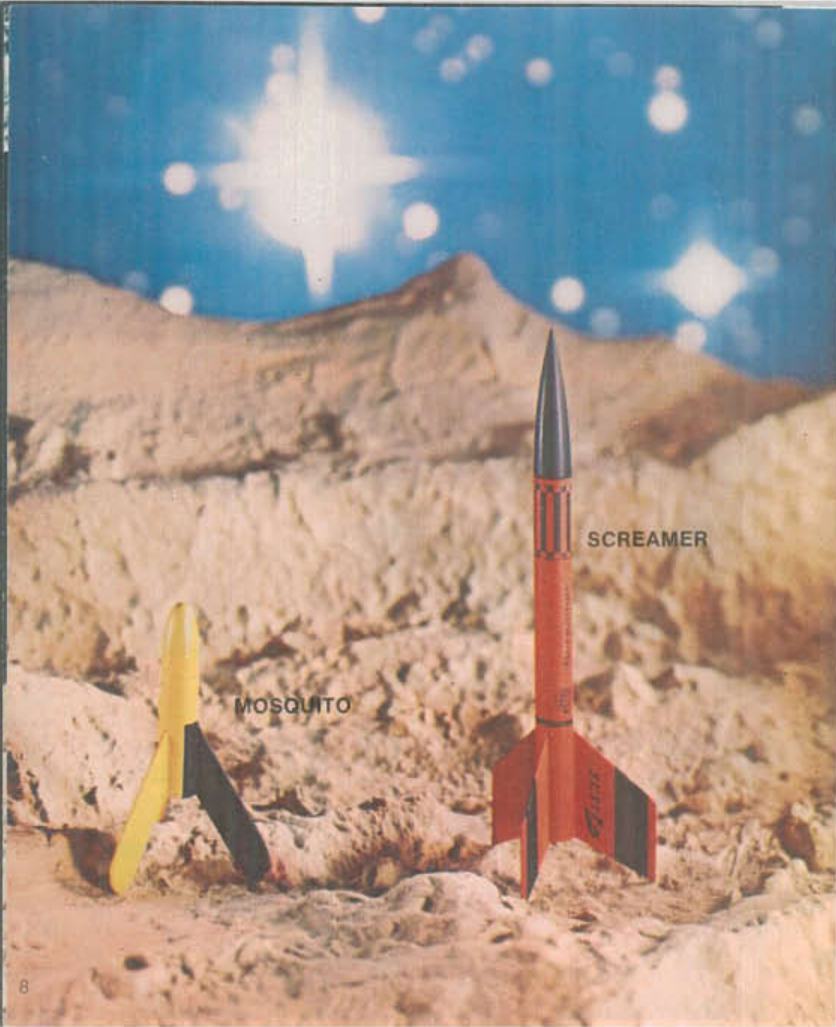
Packaged in a reusable field box with handle and compartments for engines, supplies, tools, etc., this outfit is perfect — especially if you've done no model building before.

Kit includes all construction and finishing materials — a knife, glue, sandpaper, paints, brush, brush cleaner — supplies which can be used in building several more rockets. Shipping wt. 3 lbs., 8 oz.

Cat. No. 701-KS-8

\$8.75





MOSQUITO

SCREAMER

BEGINNING ROCKETEERS: Mini-Brutes
Degree of Challenge: One

New from Estes, world-leader in Model Rocketry! MINI-BRUTES have super-powered mini-engines to send them soaring high, wide and happy into space — to open up a whole new world of mini-rocketry fun and excitement!

MOSQUITO

Fantastic performance. Featherweight recovery. Balsa and paper construction. Simple spray paint decor.

Specifications

Body Dia.	0.541" (13.73mm)
Length	3.9" (9.9cm)
Weight	0.1 oz. (2.83 gr)
Shipping wt. 4 oz.	

Recommended Engines

1/4A3-2T, 1/4A3-4T,
 1/2A3-4T, A3-6T

Order No. 712-TK-1
\$.49

SCREAMER

Spectacular streamer recovery. Balsa and paper construction with simple paint pattern and decals.

Specifications

Body Dia.	0.541" (13.73mm)
Length	7.8" (19.81cm)
Weight	0.225 oz. (6.37 g)
Shipping wt. 6 oz.	

Recommended Engines

1/4A3-2T, 1/4A3-4T,
 1/2A3-4T, A3-6T

Order No. 712-TK-2
\$.99

BEGINNING ROCKETEERS: Mini-Brutes
Degree of Challenge: One

More Mini-Brutes . . . mini priced too. Up, up and away!

BIRDIE

Badminton goes "out of sight" when you launch your mini-engine powered Birdie. It's a standard plastic badminton shuttlecock with an engine mount . . . and it goes like no bird ever thought of going.

Specifications

Length	2.8" (7.1cm)
"Fin" Span	2.6" (6.6cm)
Weight	0.28 oz. (9 gr)
Shipping wt.	5 oz.

Recommended Engines

1/4A3-2T, 1/2A3-2T, A3-2T

Use 1/2A3-2T for first flights.

Use series III engines only.

Cat. No. 712-TK-44

\$.60

HORNET

A Mini-Brute with a payload section for space experiments! Extra heavy duty construction. Quick-change engine mount.

Specifications

Length	10.25"
Body Dia.	0.767"
Weight	0.5 oz. (14 gr)
Shipping wt.	6 oz.

Recommended Engines

1/2A3-2T, A3-2T, A3-4T

Use 1/2A3-2T for first flights.

Order No. 713-TK-4

\$1.19

MINI BERTHA

The really tough Mini-Brute. Parachute recovery with colorful 8" plastic 'chute. Two color decal sheets. Balsa and paper construction.

Specifications

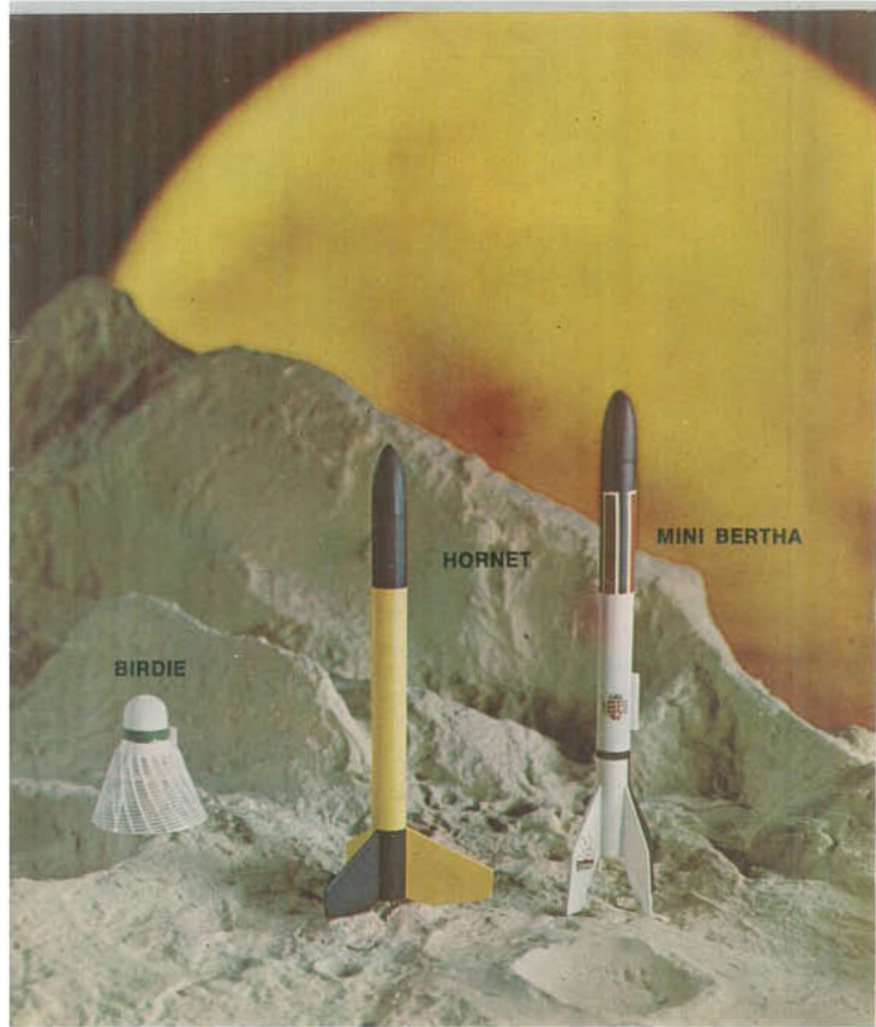
Length	11.25" (25.58cm)
Body Dia.	0.736" (18.68mm)
Weight	0.484 oz. (13.71 gr)
Shipping wt.	6 oz.

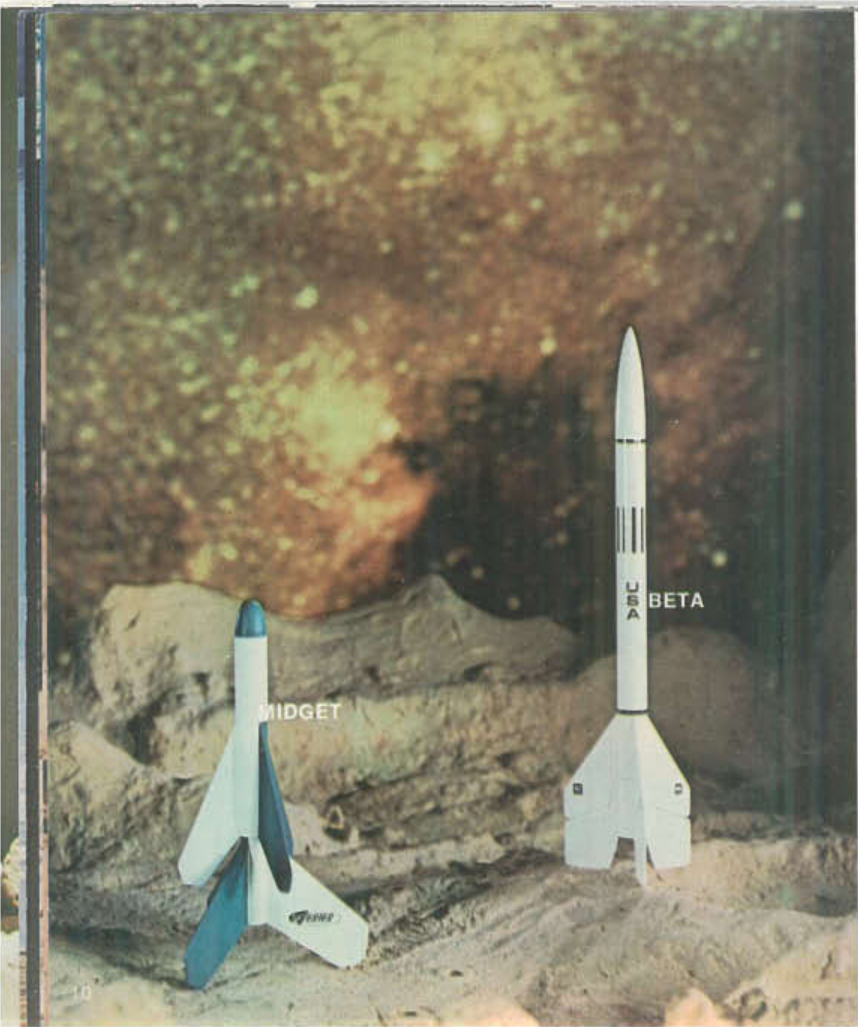
Recommended Engines

1/2A3-2T, A3-4T

Order No. 712-TK-3

\$1.29





BEGINNING ROCKETEERS: Mini-Brutes
Degree of Challenge: Two

MIDGET

No midget in performance, this unique two-stage rocket gets the most out of the mini-engines. Graceful flight, fast takeoff. Parachute for upper stage. Booster tumbles down.

Specifications

Length	8.6"
Body Dia.	0.736"
Weight	0.4 oz.
Shipping wt.	6 oz.

Recommended Engines

UPPER STAGE			
1/4A3-2T	1/2A3-4T	A3-6T	
BOOSTER STAGE			
1/2A3-0T	A3-0T		

Cat. No. 721-TK-40
\$1.25

BETA

Can be flown single stage or with a booster for high flights. Low weight, streamlined design with parachute recovery. Pat. No. 3,392,302

Specifications

Length	13.7"
Body Dia.	0.75"
Weight	0.75 oz.
Shipping wt.	6 oz.

Recommended Engines

UPPER STAGE			
1/4A3-2T	1/2A3-4T	A3-6T	
BOOSTER STAGE			
1/2A3-0T	A3-0T		

Cat. No. 721-TK-45
\$1.35



STAR BLAZER



MINI-BOMARC

MINI-BOMARC **BEGINNING ROCKETEERS:** Mini-Brutes
Degree of Challenge: Three

STAR BLAZER

Real space ship look with its forward crew cockpit canopy, structural fairing, strips and streamlined fins. Quick change engine mount. Payload section.

Specifications

Length	11.5"
Body Dia.	0.736"
Weight	0.73 oz.
Shipping wt.	5 oz.

Recommended Engines

1/4A3-2T 1/2A3-2T A3-4T

Cat. No. 721-TK-31

\$1.99

MINI-BOMARC

Famous flying scale model. Authentic full color decals for Canadian Air Force decor. Die cut and pre-printed fins.

Specifications

Length	11.75" (30.2cm)
Body Dia.	0.736" (18.7mm)
Weight	1.0 oz. (28 gr)
Wing Span	4.5" (11.5cm)
Shipping wt.	5 oz.

Recommended Engines

1/2A3-2T A3-4T

Cat. No. 721-TK-5

\$2.49



BEGINNING ROCKETEERS: Single Stage
Degree of Challenge: One

First choices for beginning rocketeers. Easy-to-build. Easy-to-fly. These birds deliver dependable high-flying performance from lift-off to parachute recovery (except the Mark, which has streamer recovery). All kits come complete, ready-to-build, with instructions. Engines not included.

Astron ALPHA

Estes' most popular rocket. It will still be a favorite as your fleet grows.

Specifications

Length	12.25"
	(31.1cm)
Body Dia.	0.976"
	(24.8mm)
Weight	0.8 oz.
	(23 gr)
Shipping wt.	5 oz.

Recommended Engines

1/2A6-2	B4-4
A8-3	B6-4
A5-4	C6-5

Use A8-3 for first flights.

Cat. No. 671-K-25
\$1.50

Astron ALPHA III

Just like the Alpha except it's easier to assemble and fly. Plastic nose cone and fins.

Specifications

Length	12.25"
	(31.1cm)
Body Dia.	0.976"
	(24.8mm)
Weight	1.2 oz.
	(33.9 gr)
Shipping wt.	10 oz.

Recommended Engines

1/2A6-2	B4-4
A8-3	B6-4
A5-4	C6-5

Use A8-3 for first flights.

Cat. No. 711-K-56
\$1.75

Astron MARK II

Ideal for sport or demonstration flying. Top-notch performance every time.

Specifications

Length	9.1"
	(23.1cm)
Body Dia.	0.765"
	(19.4mm)
Weight	0.7 oz.
	(20 gr)
Shipping wt.	5 oz.

Recommended Engines

1/2A6-2	A5-4
A8-3	B6-4
C6-5	

Use 1/2A6-2 for first flights.

Cat. No. 651-K-2
\$1.00

Astron SKY HOOK

An exciting but easy-to-build rocket. Terrific performance flight after flight.

Specifications

Length	(30.5)
Body Dia.	0.7
	(19.4)
Weight	0.7
	(20)
Shipping wt.	5

Recommended Engines

1/2A6-2	A5-4
A8-3	B4-4
B6-6	C6-5

Use 1/2A6-2 for first flights.

Cat. No. 651-K-8
\$1.25

Plastic Replacement Parts FOR ALPHA III

Nose Cone	711-PNC-50K	.50
Fins	711-PFS-50A	.50

BEGINNING ROCKETEERS: Single Stage
Degree of Challenge: One

These kits are your next step on the way to becoming a real expert. They are still easy to build and fly, single-stage rockets but with some special purpose features. All kits come complete, ready-to-build, with instructions. Engines not included.

**Astron
X-RAY**

Features a large see-through payload section. Perfect for research work of all kinds. Parachute recovery.

Specifications

Length 16.75"
(42.5cm)
Body Dia. 0.736"
(18.7mm)
Payload
Sec. Dia. 0.976"
(24.8mm)
Weight 0.7 oz.
(20 gr)
Shipping wt. 5 oz.

**Recommended
Engines**

1/2A6-2 B14-5
A8-3 A8-3
B6-4 C6-5
Use A8-3 for
first flights.

Cat. No. 651-K-18
\$1.75

**Astron
STREAK**

Lightweight (1/8 oz. without engine) and wind-cheating design... terrific for contests and records. Feather-weight recovery.

Specifications

Length 5.6"
(14.2cm)
Body Dia. 0.720"
(18.3mm)
Weight 0.1 oz.
(3 gr)
Shipping wt. 4 oz.

**Recommended
Engines**

1/4A3-2 A8-5
1/2A6-4 B6-6
A5-4 C6-7
Use 1/4A3-2 for
first flights.

Cat. No. 701-K-4
.60

**Astron
BIG BERTHA**

Ideal for demonstration flights. Slow realistic take-off that fascinates all spectators. Parachute recovery.

Specifications

Length 24"
(61cm)
Body Dia. 1.637"
(41.6mm)
Weight 2.2 oz.
(64 gr)
Shipping wt. 11 oz.

**Recommended
Engines**

A5-2 A8-3
B4-2 B6-4
C6-5
Use B6-4 for
first flights.

Cat. No. 701-K-23
\$2.75

**Astron
SCOUT**

This kit teaches balance principles. A must for the rocketeer learning to design his own models. Tumble recovery. Pat. No. 3,114,317

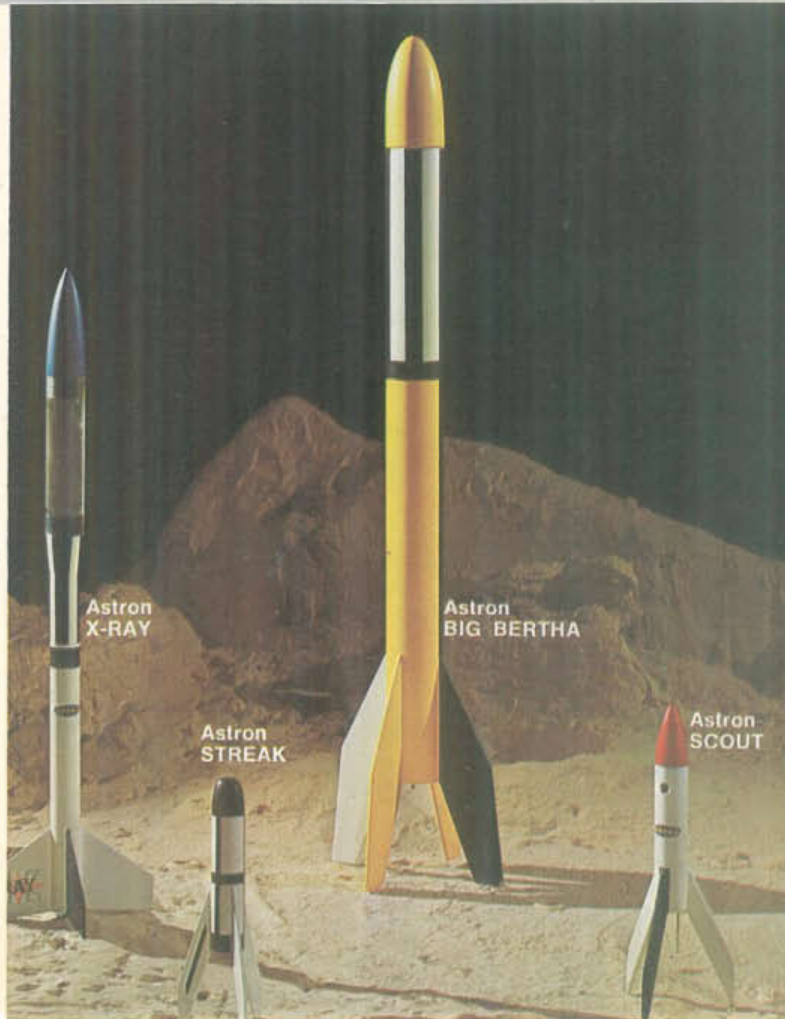
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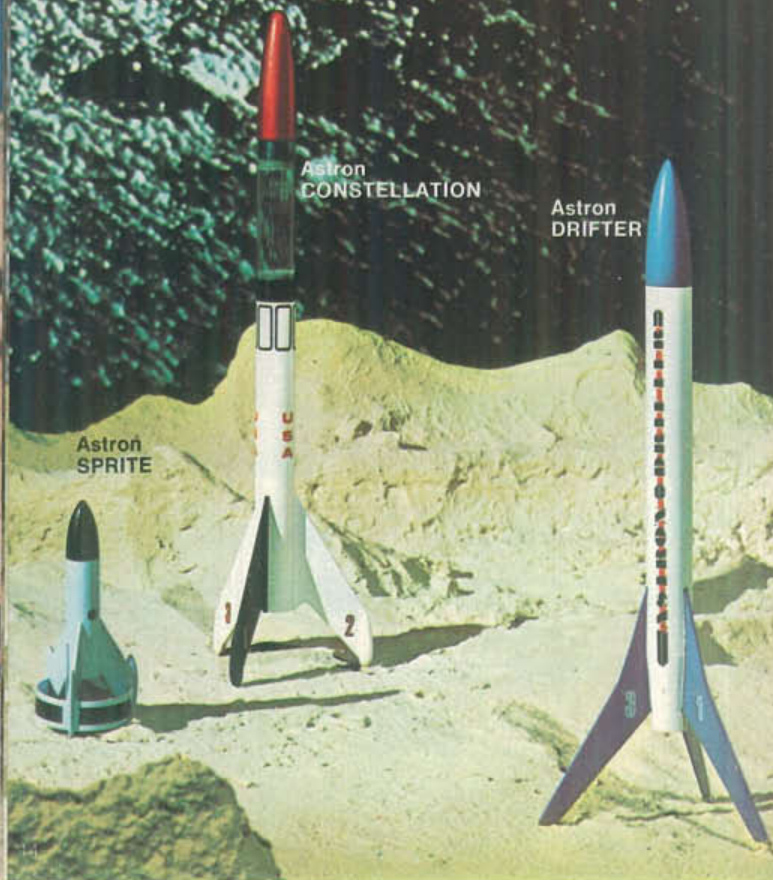
Length 7"
(17.8cm)
Body Dia. 0.765"
(19.4mm)
Weight 0.3 oz.
(9 gr)
Shipping wt. 2 oz.

**Recommended
Engines**

1/4A3-2 1/2A6-2
A5-4 A8-3
B6-4 C6-5
Use 1/4A3-2 for
first flights.

Cat. No. 651-K-1
.75





BEGINNING ROCKETEERS: Single Stage
Degree of Challenge: Three

These kits will round out your fleet with some unusual rockets. Outstanding flight performance beautiful lines . . . perfect for all types of flying . . . impressive to show. Parachute recovery (except for the Sprite). All kits come complete, ready-to-build with instructions. Engines not included.

Astron SPRITE

This unusual little rocket teaches importance of proper rocket balance. At the end of a straight-up launch the Sprite tumbles back down close to the launcher. Great for small fields. Includes Tech Report on stability. Patent No. 3,114,317

Specifications

Length 5.3" (13.5cm)
 Body Dia. 0.765" (19.4mm)
 Weight 0.3 oz. (9 gr)
 Shipping wt. 5 oz.

Recommended Engines

1/4A3-2T A3-4T
 1/2A3-2T
 Use 1/2A3-2T for first flights.

Cat. No. 701-K-15
.90

Astron CONSTELLATION

The perfect single-stage high performance rocket for payload work or just fun flying. Long slender lines, "landing shocks" on each fin tip give a futuristic look. See-through payload section.

Specifications

Length 16.2" (41.4cm)
 Body Dia. 0.976" (24.8mm)
 Weight 1.0 oz. (28 gr)
 Shipping wt. 5 oz.

Recommended Engines

1/2A6-2 A8-3
 A5-4 B6-4
 C6-5
 Use A8-3 for first flights.

Cat. No. 681-K-35
\$2.00

Astron DRIFTER

Low weight and large chute capacity make this tough bird great for competition test or sport flying. Interchangeable chutes: 24" for competition and 12" for test and sport.

Specifications

Length 14.3" (36.3cm)
 Body Dia. 0.976" (24.8mm)
 Weight 1 oz. (28 gr)
 Shipping wt.

Recommended Engine

1/2A6-2 A8-3
 B6-4 C6-5
 Use 1/2A6-2 for first flight

Cat. No. 651-K-14
\$1.85

BEGINNING ROCKETEERS: Two Stage
Degree of Challenge: Two (Avenger) — Three (Shrike)

Multi-staging represents the next level of rocketry skills. Demonstrates how real space ships operate. The first stage is always ignited electrically. Second stage ignition occurs automatically upon the burnout of the first stage. All kits come complete, ready-to-build with instructions. Engines not included.

Astron AVENGER

Long slender lines give this bird the sounding rocket look. Large 18" chute brings payload section back gently, booster employs tumble recovery.
Pat. No. 3,292,302

Specifications

Length	32" (81.3cm)
Body Dia.	1.325" (33.7mm)
Weight	2.7 oz. (77 gr)
Shipping wt.	16 oz.

Recommended Engines

UPPER STAGE

A5-4	B6-6
C6-7	

Use B6-6 for first flights.

BOOSTER

A8-0	B6-0
B14-0	C6-0

Use B6-0 for first flights.

Cat. No. 701-K-38
\$3.25

Astron SHRIKE

New easy staging method . . . just insert engines, plug the stages together and you're ready to go! Pre-cut fins. Transparent payload section with foam end pads.

Specifications

Length	29.5" (74.9cm)
Body Dia.	0.976" (24.8mm)
Weight	2.25 oz. (64 gr)
Shipping wt.	11 oz.

Recommended Engines

UPPER STAGE

1/2A6-4	A5-4
A8-5	B6-4
B6-6	B14-7
C6-7	

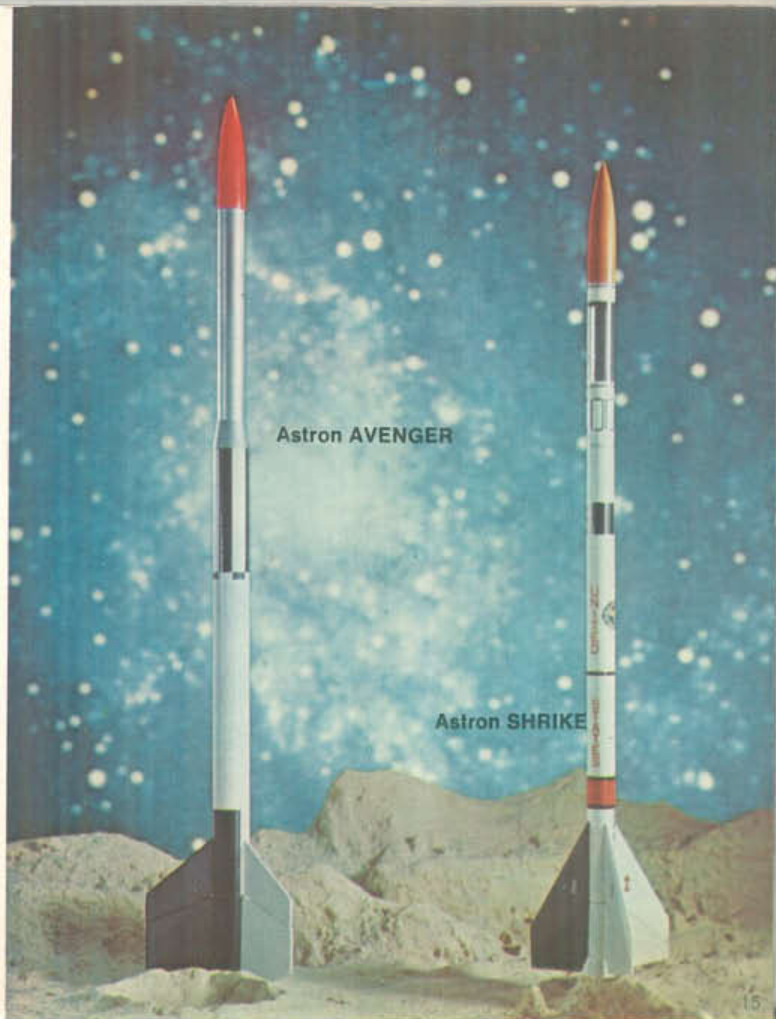
Use B6-6 for first flights.

BOOSTER

A8-0	B6-0
B14-0	C6-0

Use B6-0 for first flights.

Cat. No. 701-K-46
\$4.50



BANDIT**Astron
CHEROKEE-D****Astron
COBRA****DEMON****ADVANCED ROCKETEERS:** Single Stage
Degree of Challenge: Two

The Demon, Bandit, Cherokee-D, and Cobra are ideal kits to start with as you step up to advanced rocketry science. They give you experience with large engines and clustering. All kits have parachute recovery. All four kits come complete, ready-to-build, with instructions. Engines not included.

BANDIT

Features a new Ejection Ducting System so there's no need for recovery wadding. The Bandit has military rocket styling. The advanced recovery system will further your knowledge of model rocketry techniques.

Specifications

Length	25.75" (65.4cm)
Body Dia.	1.325" (33.6mm)
Weight	2.6 oz. (37.9 gr)
Shipping wt.	12.5 oz.

Recommended Engines

A8-3 B6-4
B4-4 B14-5
C6-5
Use B6-4 for first flights.

Cat. No. 712-K-48

\$4.25**Astron
COBRA**

Ideal for your first cluster rocket (the use of more than one engine). The Cobra gives you top performance with medium size payloads (up to 4 oz.) in a 1" diameter capsule. Includes Tech Report on Clustering.

Specifications

Length	22.25" (56.5cm)
Body Dia.	1.637" (41.6mm)
Weight	2.5 oz. (71 gr)
Shipping wt.	11 oz.

Recommended Engines

Requires 3 identical engines at launch.
A8-3 B6-4
C6-5
Use B6-4 for first flights.

Cat. No. 701-K-10

\$3.00**Astron
CHEROKEE-D**

Big strong "D" engine rocket that will practically sail out of sight. 18" chute brings it down safely flight after flight. Pre-cut fins, quick-change engine mount, decal sheets. Beautiful kit.

Specifications

Length	21.6" (54.9cm)
Body Dia.	1.325" (33.7mm)
Weight	2.75 oz. (78 gr)
Shipping wt.	11 oz.

Recommended Engines

D12-5 D12-7
Use D12-7 for first flights.

Cat. No. 694-K-47

\$3.00**DEMON**

NASA research-type vehicle. Comes with easy-to-see bright silver press-on foil trim. When applied to the payload section, the trim actually acts as a flashing beacon to help you with in-flight tracking and recovery.

Specifications

Length	2 (67.3)
Body Dia.	1.3 (33.6)
Weight	2.7 (71)
Shipping wt.	12.5

Recommended Engines

D12-7
Also:
B6-4 B14-5
(Using EM-2050 Adapter)

Cat. No. 712-K-5

\$3.95

ADVANCED ROCKETEERS: Single Stage
Degree of Challenge: Three

These rockets offer the advanced rocketeer more challenge and satisfaction in building and flying. Parachute recovery. All kits come complete, ready-to-build, with instructions. Engines not included.

**Astron
SCRAMBLER**

Huge see-through payload section holds an egg or any other large payload . . . engine cluster design gives the power to boost it. Can carry an egg to over 1000 feet and gently set it down. Two chutes. Decals. Includes Tech Report on clustering.

Specifications

Length 23.5"
(59.7cm)
Body Dia. 1.637"
(41.6mm)
Payload Dia. 1.796"
(45.6mm)
Weight 2.8 oz.
(79 gr)
Shipping wt. 13 oz.

**Recommended
Engines**

Requires 3 identical engines at launch.
A8-3 B6-4
C6-5 B14-5
Use B6-4 for first flights.

Cat. No. 701-K-37
\$4.25

**Astron
STARLIGHT**

An easy-to-build but advanced design* with large fin area for exceptional stability. Launches straight up to extreme altitudes. Great for sport, or demonstration flying. You'll be proud to display this unusual bird.

Specifications

Length 18"
(45.7cm)
Body Dia. 0.976"
(24.8mm)
Weight 2 oz.
(57 gr)
Shipping wt. 9 oz.

**Recommended
Engines**

1/2A6-2 A8-3
B6-4 C6-5
Use A8-3 for first flights.

Cat. No. 681-K-32
\$2.75

**Astron
SPRINT**

Highest performance in its class . . . up to 1600 ft. with C6-7 engine. Pre-cut fins, and tail cone. Decals included. Streamer recovery.

Specifications

Length 13.8"
(35cm)
Body Dia. 0.976"
(24.8mm)
Weight 1.0 oz.
(28 gr)
Shipping wt. 7 oz.

**Recommended
Engines**

1/2A6-2 A8-3
A5-2 B4-6
B6-6 C6-7
B14-5
Use A8-3 for first flights.

Cat. No. 701-K-49
\$2.50

**ASTRON
GOBLIN**

Powerful. Fast. This spooky kit gets up and moves. It's the rocket you'll need a good recovery team for. Adapters permit a wide range of engine possibilities.

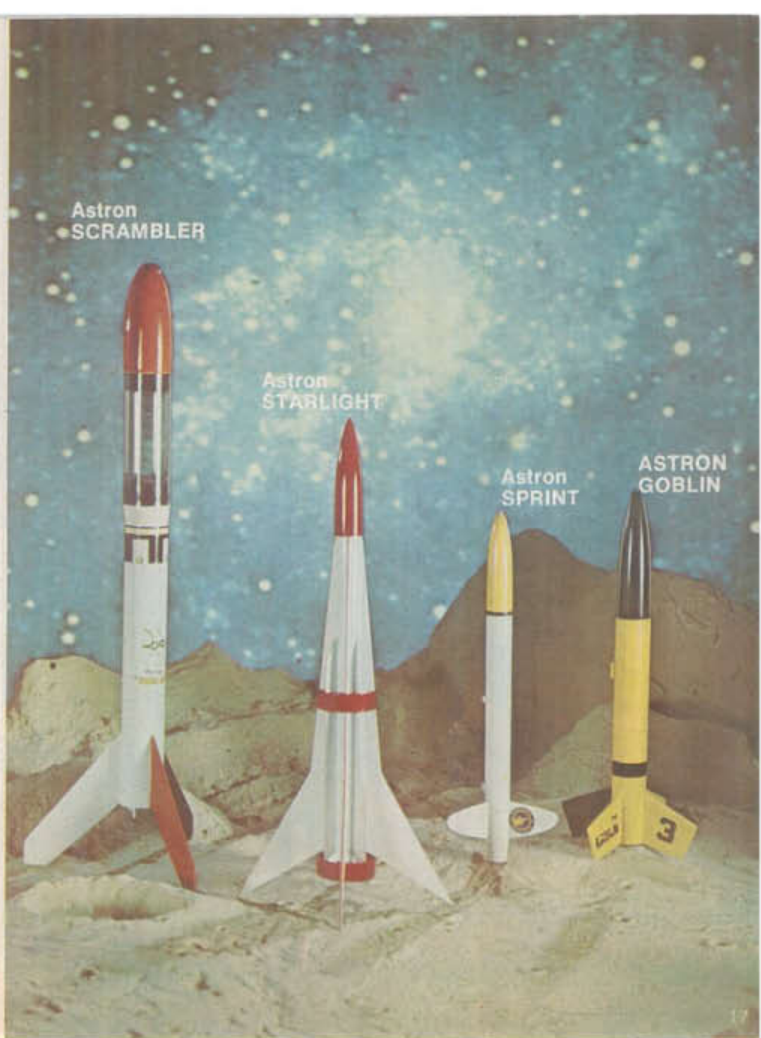
Specifications

Length 14.32"
(36.3cm)
Body Dia. 1.325"
(33.6mm)
Weight 2.0 oz.
(56.6 gr)
Shipping wt. 7 oz.

**Recommended
Engines**

D-12-7 (Or others, like C6-5, B6-4 and A8-3, with adapter EM-2050).

Order 702-K-55
\$2.50





Astron
FARSIDE

Astron
APOGEE II

ADVANCED ROCKETEERS: Multi-Stage
Degree of Challenge: Three

Estes' sophisticated two and three-stage rockets for experimental work and challenging fun flying for the expert. They represent the finest in model rocketry engineering and design. Parachute recovery. All kits come complete, ready-to-build, with instructions. Engines not included.

Astron FARSIDE

Sophisticated 3-stage ultra-high altitude probe. Top stage flies to well over 2500 feet. Includes Tech Report on staging. Pat. No. 3,292,302.

Specifications

STANDARD MODEL (Farside)	
Length	21.5" (54.6cm)
Body Dia.	0.976" (24.8mm)
Weight	2.0 oz. (57 gr)
Shipping wt.	6 oz.

Recommended Engines

FIRST STAGE		
1/2A6-0	B14-0	A8-0
Use B14-0 for first flights.		
SECOND STAGE		
1/2A6-0	A8-0	B6-0
B14-0	C6-0	
Use 1/2A6-0 for first flights.		
TOP STAGE		
1/2A6-4	A8-5	B4-6
B6-6	B14-6	C6-7
Use 1/2A6-4 for first flights.		

Cat. No. 651-K-12

\$2.75

Astron APOGEE II

Ultimate in 2-stage performance and reliability. See-through payload section lets you observe specimens without removing them from the rocket. Includes Tech Report on Multi-Staging. Pat. No. 3,292,302.

Specifications

Length	14.7" (37.5cm)
Body Dia.	0.736" (18.7mm)
Weight	0.6 oz. (17 gr)
Shipping wt.	6 oz.

Recommended Engines

UPPER STAGE	
1/4A3-4	1/2A6-4
A5-4	A8-5
B4-6	B6-6
B14-7	C6-7
Use 1/2A6-4 for first flights.	
BOOSTER	
1/2A6-0	A8-0
B6-0	B14-0
C6-0	
Use 1/2A6-0 for first flights.	

Cat. No. 651-K-5

\$1.80

ADVANCED ROCKETEERS: Boost Gliders**Degree of Challenge:** Four

Glide recovery vehicles can be spectacular fun. The model launches straight up like a conventional rocket. At ejection either the balance of the model or the position of its aerodynamic surface is changed. The wings generate lift, pulling the nose up and the model goes into a glide instead of streamlining straight down. The Gyroc has an unusual "helicopter" recovery. All kits come complete, ready-to-build, with instructions. Engines not included.

Astron NIGHTHAWK

Revolutionary pop-pod system. Swish! Straight up for hundreds of feet. . . . then pop! The power pod separates and drifts down by parachute. . . . as the glide vehicle circles lazily against the sky. Pat. No. 3,452,471

Specifications

Length	19.75" (50.2cm)
Body Dia.	0.736" (18.7mm)
Wing Span	16.25" (41.3cm)
Weight (Complete)	1.4 oz. (40 gr)
Weight (Glider only)	0.7 oz. (20 gr)
Shipping wt.	9 oz.

Recommended Engines

1/2A6-2 A5-2
B4-2
Use A5-2 for first flights.
Cat. No. 701-K-34
\$2.00

Astron SKYDART

This totally new rocket-boosted glider design features an internal rear ejection power pod. Streamlined "Business SST" body styling results in a high performance glide along with good reliability. Parachute recovery brings power pod back safely. Pat. No. 3,157,960

Specifications

Wing Span	12.6" (31.8cm)
Length	15.8" (40cm)
Body Dia.	.976" (24.8mm)
Weight	1.25 oz. (35.4 gr)
Weight of Glider with Pod	2.5 oz. (70.8 gr)
Shipping wt.	12 oz.

Recommended Engines

A5-2, B4-2, C6-3

Cat. No. 712-K-57
\$3.95

Astron FALCON

A fantastic glide recovery vehicle for experienced rocketeers. Front engine type. . . . boost glide times to over 1½ minutes. Tech Report on Boost Gliders included. Pat. No. 3,114,317

Specifications

Length	12" (30.5cm)
Body Dia.	0.736" (18.7mm)
Wing Span	10" (25.4cm)
Weight	0.4 oz. (11 gr)
Shipping wt.	5 oz.

Recommended Engines

A5-2 B4-2
1/2A6-2
Use 1/2A6-2 for first flights.
Cat. No. 651-K-13
\$1.25

Astron GYROC

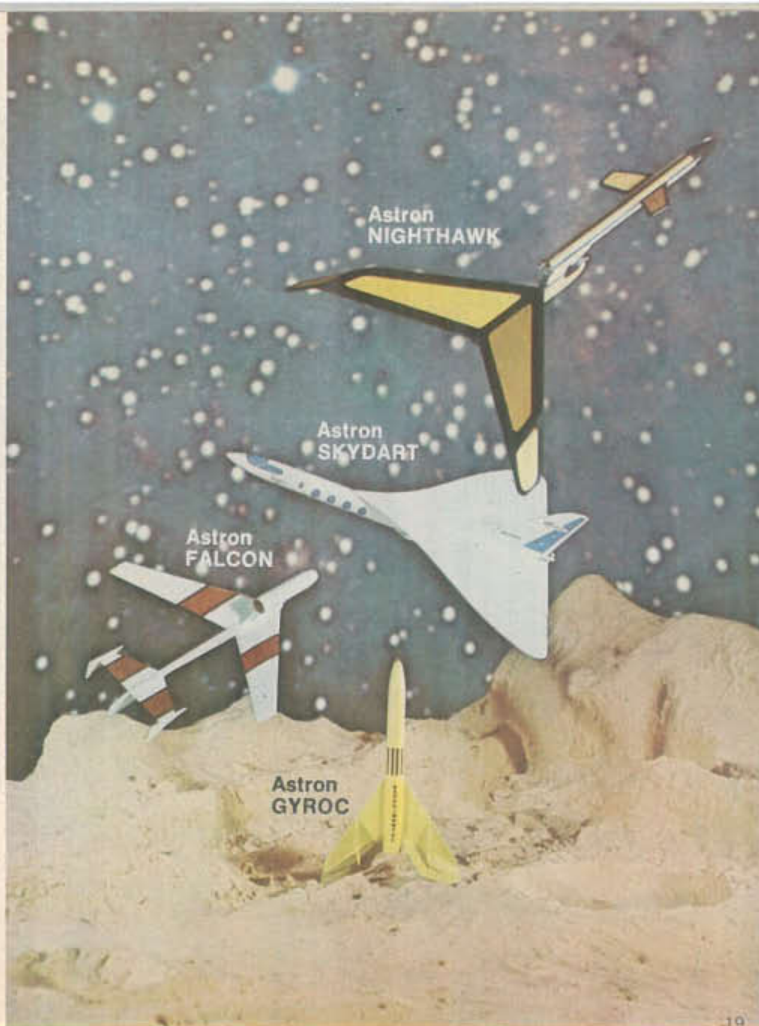
An amazing and unique "helicopter" recovery system makes the Gyroc a must for your fleet. Unusual appearance.

Specifications

Length	9.8" (24.9cm)
Body Dia.	0.736" (18.7mm)
Weight	0.6 oz. (17 gr)
Shipping wt.	5 oz.

Recommended Engines

1/2A6-2 A8-3
B6-4 C6-5
Use 1/2A6-2 for first flights.
Cat. No. 671-K-24
\$1.25



ADVANCED ROCKETEERS: Scale Models
Degree of Challenge: Two (WAC Corporal and Sandhawk)
 Three (V-2 and Aerobee 300)

These scale models are easy enough for the average rocketeer to build, yet interesting enough for the most experienced. Parachute recovery gives gentle landings flight after flight. All kits come ready to assemble with instructions. Engines not included.

AEROBEE 300

Here is a reproduction of the Aerobee 300, a famous sounding rocket. It was used in a great many space experiments during the 1950's and 1960's.

Specifications

Length 20"
 (50.8cm)
 Body Dia. 0.976"
 (24.8mm)
 Weight 0.9 oz.
 (26 gr)
 Shipping wt. 14 oz.

Recommended Engines

1/2A6-2 B6-4
 A8-3 C6-5
 Use A8-3 for first flights.

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

SANDHAWK

An ultra detailed 2½' tall scale model. Features all plastic fins, tail assembly, nose cone and payload section. Recovery is dual parachute type.

Specifications

Length 30.1"
 (76.5cm)
 Body Dia. 1.325"
 (33.7mm)
 Weight 5 oz.
 (14.2 gr)
 Shipping wt. 11 oz.

Recommended Engines

B4-2 C6-3 D12-5
 Use D12-5 for first flights. Use EM2050 adapter for other than "D" engines (adapter not included).

Cat. No. 711-K-51
\$3.00

V-2

This is a scale model of the rocket that opened the door to the space age. It was the first to solve the problems of propulsion and guidance.

Specifications

Length 11.2"
 (28.4cm)
 Body Dia. 1.325"
 (33.7mm)
 Weight 1.4 oz.
 (40 gr)
 Shipping wt. 7 oz.

Recommended Engines

1/2A6-2 A8-3
 B6-4 B14-5
 C6-5
 Use B6-4 for first flights.

Cat. No. 701-K-22
\$2.75

WAC CORPORAL

A high flying scale model . . . easy for the novice to build yet interesting for the experience rocketeer.

Specifications

Length 11"
 (28.0cm)
 Body Dia. 0.7"
 (18.7mm)
 Weight .7 oz.
 (20 gr)
 Shipping wt. 5 oz.

Recommended Engines

1/2A6-2 A8-3
 B6-4 C6-5
 Use 1/2A6-2 for first flights.

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

Replacement Plastic Parts Kit:

(SANDHAWK ONLY)
 Includes tail section, fins, payload section, nose cone and antennae.

Cat. No. 711-PRP-51

\$1.35



ADVANCED ROCKETEERS: Scale Models
Degree of Challenge: Four

These detailed scale models of famous actual rockets offer more challenge in building and flying. Handsome models you'll be proud of... to fly or display. Parachute recovery. All kits come complete, ready-to-build, with instructions. Engines not included.

**SATURN V
 (Semi-Scale)**

Though not fully detailed this model of the Saturn V is an amazingly good representation of our nation's largest launch vehicle that put the first man on the moon. Scaled 1 to 242 it is a practical size to build.

Specifications

Length 18.1"
 (46cm)
 Body Dia. 1.637"
 (41.6mm)
 Weight 1.9 oz.
 (54 gr)
 Shipping wt. 12 oz.

Recommended Engines

A8-3 B6-4
 C6-5
 Use A8-3 for first flights.

Cat. No. 701-K-39
\$2.85

ARCAS®

A precise reproduction of the famous ARCAS® sounding and meteorological rocket.

Specifications

Length 22.8"
 (58cm)
 Body Dia. 1.325"
 (33.7mm)
 Weight 1.4 oz.
 (40 gr)
 Shipping wt. 11 oz.

Recommended Engines

A5-2 A8-3
 B6-4 C6-5
 Use A8-3 for first flights.

Cat. No. 701-K-26
\$2.40

GEMINI-TITAN

This is a semi-scale model of the rocket that took America's first two-man team into orbit. This Kit features clear plastic fins for stability. Use 12v car battery and Estes FS-5 Launch Control System for dependable ignition. Includes Tech Report on engine clustering.

Specifications

Length 24.4"
 (62cm)
 Body Dia. 2.217"
 (56.3mm)
 Weight 3.8 oz.
 (108 gr)
 Ship. wt. 1 lb., 3 oz.

Recommended Engines

A8-3 B6-4
 C6-5
 Use B6-4 for first flights.

Cat. No. 701-K-21
\$5.25

HONEST JOHN

A beautiful scale model of the U.S. Army's surface-to-surface ballistic missile. An historic rocket for your display shelf.

Specifications

Length 13.75"
 (35cm)
 Body Dia. 0.976"
 (24.8mm)
 Weight 1.2 oz.
 (34 gr)
 Shipping wt. 7 oz.

Recommended Engines

1/2A6-2 A8-3
 A5-4 B6-4
 C6-5
 Use A8-3 for first flights.

Cat. No. 671-K-27
\$2.25





SATURN 1B

MERCURY
REDSTONE

SATURN V

ADVANCED ROCKETEERS: Scale Models
Degree of Challenge: Five

Here are three thrilling scale models that give real challenge to the building and flying skills of even the most experienced rocketeer. Saturn 1B lifts off under cluster power, Saturn V flies with a single "D" power engine. Recovery with multiple parachutes. Authentic full color decals, detailed building and flying instructions. Engines not included.

SATURN 1B

This is a completely detailed model of the rocket that first lofted the lunar module on its first flights in earth orbit. Great performance from the clustering of four engines. A real beauty, both in the air and on the ground. Includes Tech Report on engine clustering.

Specifications

Length 37" (94cm)
 Body Dia. 3.938" (100mm)
 Weight 9.9 oz. (280 gr)
 Shipping wt. 3 lbs., 5 oz.

Recommended Engines

A8-3 B6-4
 C6-5
 (4 engines required,
 All must be the same.)

Cat. No. 701-K-29
\$10.95

MERCURY REDSTONE

The Mercury Redstone is the vehicle that boosted Commander Alan Shepard on America's first manned space flight. Beautiful kit scaled 1 to 42.

Specifications

Length 23.5" (59.7cm)
 Body Dia. 1.637" (41.6mm)
 Weight 2.1 oz. (60 gr)
 Shipping wt. 12 oz.

Recommended Engines

A8-3 C6-5
 B6-4
 Use B6-4 for first flights.

Cat. No. 701-K-41
\$3.95

SATURN V

A truly magnificent scale reproduction of our most famous rocket... the mighty Saturn V. Scaled 1/100th of its actual size, the model stands 43 1/2" tall. Precisor molded plastic lower and engine nozzles give detailed authenticity. Includes Tech Report on engine clustering.

Specifications

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

Recommended Engines:

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

Cat. No. 701-K-36
\$16.95

ADVANCED ROCKETEERS: Exotic Designs of the Future

Degree of Challenge: Two (Saros)
Three (Interceptor)

These brand new kits are long, sleek and futuristic. Spectacular in the air, beautiful on the ground. Highly detailed plastic parts virtually eliminate the need for sanding and filling. Colorful decal sheets with the Interceptor give you beautiful detailing. Parachute recovery. Both kits come complete, ready-to-build with instructions. Engines not included.

SAROS

An excellent scale-like model for any rocketeer. A new feature is the integral fin unit-engine mount providing immediate and positive location of the thrust rings. The embossed metallic press-on material and decal arrangement add the final professional touch of realism not found in other models in its class.

Specifications

Length	22.5" (57.2cm)
Body Dia.	0.976" (24.8mm)
Weight	1.5 oz. (43 gr)
Shipping wt.	8 oz.

Recommended Engines

A8-3	B6-4
A8-5	C6-5
B4-4	

Use A8-3 for first flights.

Cat. No. 711-K-54 **\$3.25**

Replacement Plastic Parts Kit

Includes nose cone, adapter and fin unit.

Cat. No. 711-PRP-54 **\$1.50**

INTERCEPTOR

This is the spectacular model featured on page four. The most colorful and exciting Estes Rocket ever! Carefully detailed plastic wing pods, nose cone, and tail cone. Two huge decal sheets.

Specifications

Length	26" (66cm)
Wing Span	7.4" (18.8cm)
Body Dia.	1.325" (33.6mm)
Weight	3.85 oz. (109 gr)
Shipping wt.	12 oz.

Recommended Engines

B4-2	C6-5
B6-4	

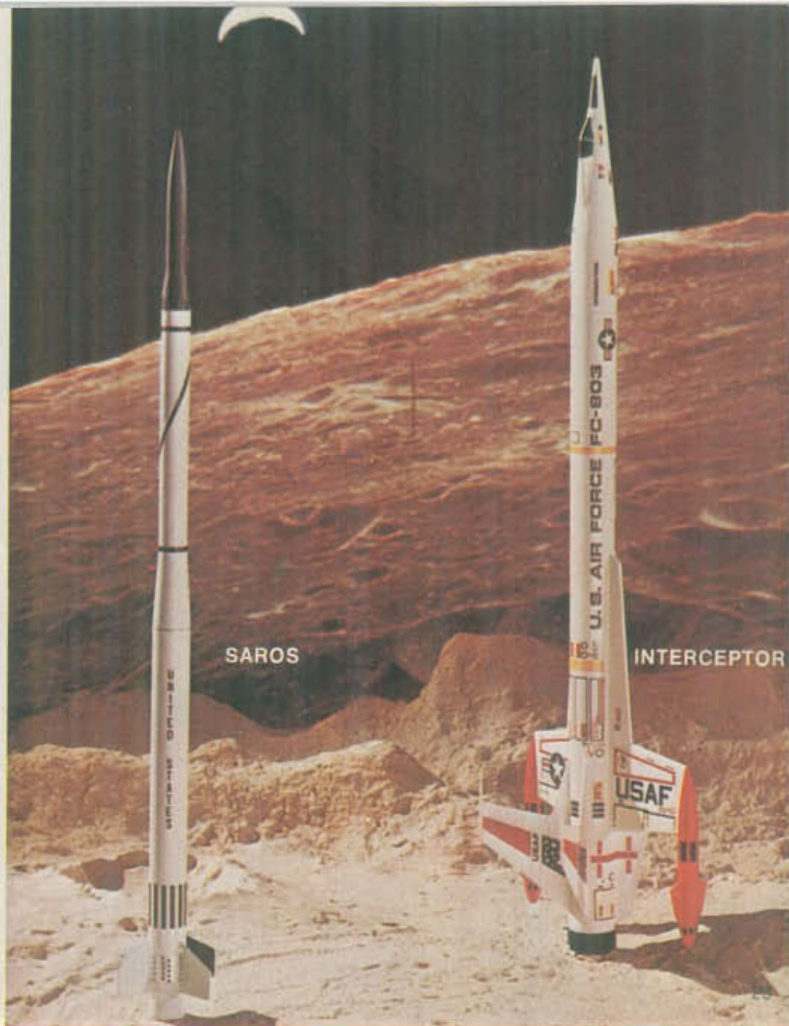
Use B6-4 for first flights.

Cat. No. 711-K-50 **\$5.25**

Replacement Plastic Parts Kit

Includes nose cone, 2 wing pods and tail cone.

Cat. No. 711-PRP-50 **\$1.35**





ORBITAL TRANSPORT

Astron TRIDENT

ADVANCED ROCKETEERS: Exotic Designs
Degree of Challenge: Four

Here are the models designed to give Estes rocketeers a look into the future. Parachute recovery. Kits complete with instructions. Engines not included.

ORBITAL TRANSPORT

Spectacular flight. Showpiece on the ground. Transport lifts off under rocket power. At ejection the re-entry vehicle separates and glides back to earth.

See page 5

Specifications

BOOSTER

Length	23" (58.4cm)
Body Dia.	0.976" (24.8mm)
Wing Span	7.9" (20cm)
Weight	2 oz. (57 gr)

RE-ENTRY VEHICLE

Length	8.6" (21.8cm)
Body Dia.	0.736" (18.7mm)
Wing Span	5" (12.7cm)
Weight	0.5 oz. (14 gr)
Shipping wt.	16 oz.

Recommended Engines

B6-4	C6-5
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Use B6-4 for first flights.

Cat. No. 701-K-42
\$3.75

Astron TRIDENT

Futuristic rocket design introduces ejecting ducting which uses ejection gases to pressurize the parachute compartment for deployment of the chute.

Specifications

Length	31.6" (80.3cm)
Main Body Dia.	0.976" (24.8mm)
Weight	2.7 oz. (77 g)
Shipping wt.	11 oz.

Recommended Engines

A8-3	B6-4
C6-5	B14-5

Use B6-4 for first flights.

Cat. No. 681-K-33
\$3.75

MARS LANDER

MARS SNOOPER

ADVANCED ROCKETEERS: Exotic Designs
Degree of Challenge: Four

More exotic designs . . . space vehicles of the future.

MARS LANDER

Authentic, futuristic concept in a planetary exploration vehicle. Lands upright on spring-loaded gear after parachute recovery. Highly detailed body panels with colorful decal sheets.

Specifications

Height	12" (30.5cm)
Body Dia.	3.8" (96.5mm)
Landing Gear Span	13.2" (33.5cm)
Weight	3.0 oz. (85 gr)
Shipping wt.	16 oz.

Recommended Engines

B4-2 C6-3
Use B4-2 for first flights.

Cat. No. 701-K-43
\$7.75

MARS SNOOPER

A truly different model combines unique appearance with reliable performance. Great for show or demonstration flying. Payload section, 18" chute and pre-cut fins.

Specifications

Length	21.7" (55.1cm)
Body Dia.	0.976" (24.8mm)
Weight	2.2 oz. (62 gr)
Shipping wt.	8 oz.

Recommended Engines

A8-3 B6-4
C6-5
Use B6-4 for first flights.

Cat. No. 701-K-20
\$2.75



**N.A.R.-H.I.A.A.
COLD PROPELLANT MODEL
ROCKET SAFETY CODE**

- 1. ENGINES** — I will use only factory made model rocket engines in the manner recommended by the manufacturer. I will re-load cold propellant rocket engines only with the propellant recommended by the manufacturer.
- 2. RECOVERY** — I will always use a recovery system in my model rockets that will safely return them so that they may be used again; I will conduct pre-flight tests to assure the recovery system functions properly before launching the rocket.
- 3. WEIGHT LIMITS** — My model rocket will weigh no more than 16 oz. at lift-off.
- 4. STABILITY** — I will check the stability of my model rockets before their first flight, except when launching models of proven design.
- 5. FLYING CONDITIONS** — I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low flying aircraft or under any conditions which might be dangerous to people or property. I will never attempt to recover a model rocket from a power line or other dangerous place.
- 6. LAUNCH ROD** — To prevent accidental eye injury, I will always 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 never place my head or body over the launching rod. When my launcher is not in use, I will always store it so that the launch rod is not in an upright position.
- 7. LAUNCH TARGETS & ANGLE** — I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead or a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.
- 8. LOADED ROCKETS** — I will never store or leave a loaded-cold propellant rocket unattended. I will always keep a loaded rocket on a launcher or firmly restrained. I will never point a loaded rocket or its rocket nozzle at anyone or allow anyone to be in the flight path of a rocket during launch preparations.
- 9. CONSTRUCTION** — I will never use metal nose cones or metal fins.

ESTES COLD PROPELLANT ROCKETS

Here they are — Estes' new line of sensational rockets and rocket planes — flying models with quality you'll appreciate — and performance you'll rave about!

What's more ... no permit or license is required for their non-flammable cold propellant!

At last — you can enjoy the full potential of fun and excitement in model rocketry with Estes' unique line of liquid propellant rockets!

Every model is powered by RP-100 — the non-flammable aerosol propellant. Easy to build and fun to fly, both rockets and rocket

planes feature a special timer system for release of a parachute at the top of the flight — the entire rocket then floats to earth.

Rocket plane kits include a separate plane which is carried piggyback hundreds of feet up by the rocket. It catapults free into aerobatic flight — while the rocket parachutes to earth!

Most kits are complete with everything you'll need to launch the rocket, including launcher and propellant. Complete kits retail for as low as \$10.95.

So don't miss the fun of the future — Estes rockets are here today!



3 EASY TO BUILD
All parts included. Build in less than a day! Rocket body made of durable aluminum.



2 FASCINATING TO TEST
Only rockets made that allow pre-launch checkout! Test parachute release, timer, separator, thrust ... indoors or out!



1 FUN TO FUEL
When all systems GO, fuel rocket on launch stand, then vent off excess fuel ... just like real thing! Unique, non-flammable cold fuel.



Blast-off
EXCITING TO LAUNCH
SWOOSH! Bird lifts skyward in a cloud of exhaust! Powered flight, burn-out, separation, parachute floats rocket back to earth. Launch again and again!



FIN
Fins provide straight, stable flight when rocket is moving fast through air.

FILL VALVE
Self-sealing rubber valve accepts fueling hose while loading engine, seals when hose is withdrawn.

SAFETY PIN
Pin holds nozzle plug in place when engine is loaded. Withdraw pin to launch rocket manually.

FIN RAIL
Plastic slot is bonded to engine. Fins slide into slot in rail, may be removed or replaced.

SAFETY VENT VALVE
Spring-loaded valve permits escape of excessive pressure, may be manually opened with pin to vent air from engine during loading.

PAPER TIMER DISCS
Two or three discs delay escape of pressure from separator, permit rocket to reach top of flight before separator releases parachute tube.

COUPLING
Threaded collar connects separator to engine. Timer discs fit inside.

ENGINE
Engine is loaded with liquid fuel under pressure, which exhausts from nozzle providing thrust to accelerate rocket.

LAUNCH GUIDE
Plastic tube is bonded to rocket, slides on 1/8" diameter launch rod to guide rocket during initial portion of flight.

PARACHUTE
Ultra-light mylar canopy packs small, opens easily. Shroud lines, tape discs for attachment are included.

SHOCK CORD
Elastic cord absorbs shock of sudden deceleration when parachute opens.

SNAP SWIVEL
Snap provides easy connection of parachute and nose cone to main rocket body.

ADAPTER
Aluminum adapter tube permits proper grip and release of parachute tube by separator.

PARACHUTE TUBE
Replaceable fiber tube contains parachute during flight.

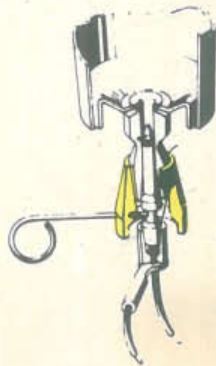
NOSE CONE
Pre-formed styrofoam cone adds sleek appearance, safety to rocket.

TAPE
Tape connects adapter to parachute tube.

LAUNCHER (Not shown)
Vertical 36" long rod guides rocket until it is moving fast enough for fins to provide straight, stable flight. Launch from the middle of a large, clear field.

REMOTE ELECTRIC FIRING UNIT
When installed, a short piece of igniter wire holds the nozzle plug in place. Battery voltage applied to the cable melts the wire, allowing the plug to blow out.

FIRING ASSEMBLY
Plug seals nozzle while engine is loaded, and is allowed to blow out when rocket is launched. Tether wire prevents loss. Optional remote unit is interchangeable.



Shrike



Shrike JET PLANE

Estes Jet Planes are exciting and fun to fly! Fuel with Estes unique cold propellant (RP-100), then launch it from your hand in a powerful thrust of white exhaust from its polished aluminum J-33 Jet Engine. Watch it climb, loop, roll, dive and glide hundreds of feet. The Shrike is constructed of the finest quality styrofoam for light weight and durability, molded with extraordinary precision to produce perfect aerodynamic balance. The wing and tail surfaces are shaped within thousands of an inch — all to give you the best in Jet Plane fun. You'll be astonished how well the Shrike flies!

Shipping weight 32 oz.

Catalog No. 721-5090..... **\$4.95**

XS-1 SPACE SHUTTLE

Rocket Powered Space Shuttle! Powered by a miniature rocket engine, the XS-1 soars through the air on a realistic jet trail, then glides hundreds of feet.

READY TO FLY — Just fill engine with propellant. Throw Straight — the Shuttle makes a loop. Throw at an angle — she'll climb in a steep spiral. Loops, dives, and climbs are all possible with practice.

The Space Shuttle plane is accurately molded of foamed styrene. The engine is sturdy aluminum, slips into plane for powered flights. Comes complete with decals, fueling hose and valve, and safe, clean, aerosol fuel for 10 flights.

Everything is there for fun with the XS-1.

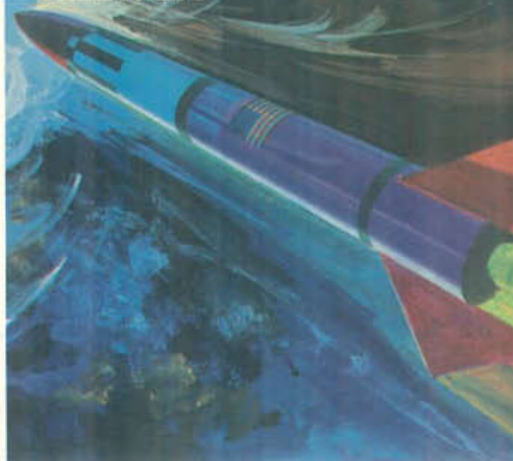
Shipping weight: 32 oz.

Catalog No. 721-5101..... **\$4.95**

XS-1



VALKYRIE 1



VALKYRIE 1 STARTER OUTFIT

Everything you'll need for your first cold propellant lift off.

KIT INCLUDES

- Complete Valkyrie-1 rocket
- Manual firing system
- Launcher
- Cold propellant for 3 launches
- Combined with another Valkyrie to form a two-stage rocket, with the Multistage Adapter Kit, Cat. No. 50

SPECIFICATIONS

Length 14"
Body diameter 1"
Shipping weight 36 oz.

Catalog No. 721-5091..... **\$10**

Sandpiper

You're right on target with this flying semi-scale model of the missile being developed for the Air Force. The actual Sandpiper is 15 feet long, and attains a speed of Mach 4 on its hybrid (liquid and solid) rocket engine. It will be used as a practice target for other missiles. This model can fly to 500 feet with only 2½ ounces of propellant.

KIT INCLUDES

- Manual Firing System
- All Parts and Accessories
- Parachute System
- Propellant for 3 flights
- Launcher

SPECIFICATIONS

Length 13.5"
Shipping weight 38 oz.

Catalog No. 721-5125.....\$11.50

SERGEANT



SERGEANT

The Sergeant is a U.S. Army battlefield support missile that is reliable, mobile, and simple to operate. It is inertially guided by means of dragbrakes to control range and fin flaps to control altitude and direction. The actual missile is 35 feet long and weighs 10,000 pounds.

KIT INCLUDES

- Decals
- Pre-formed nose cone
- Parachute system
- Manual firing system
- Launcher
- Cold Propellant for 3 flights

The Sergeant uses 2½ ounces of RP-100 per launch.

SPECIFICATIONS

Length 15.5"
Altitude 500'
Shipping weight 38 oz.

Catalog No. 721-5124.....\$11.50

VALKYRIE 2 ROCKET

Altitudes to 1000 feet.

Apply battery voltage to the electrical firing unit, and a cloud of exhaust indicates lift-off. Slowly at first, then faster and faster the Valkyrie climbs, traveling nearly 300 feet per second at "burn-out"! Then a long coast to apogee, and suddenly the parachute pops open for a safe recovery. Everything is here . . . all the best equipment for the most spectacular flights . . . in this complete Valkyrie-2 Rocket System.

KIT INCLUDES

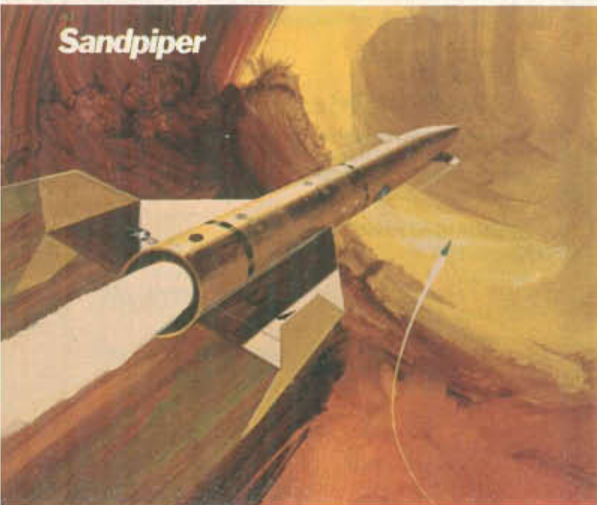
- Tripod launcher
- RP-100 Cold Propellant
- Electrical Firing

SPECIFICATIONS

Length 18"
Body diameter 1.0"
Shipping weight 40 oz.

Catalog No. 721-5092.....\$15.95

Sandpiper



VALKYRIE 2



Baron



THE **Baron** ROCKET PLANE with Booster Rocket

The Baron catapults hundreds of feet into the sky, glides longer, farther than any other cold propellant rocket plane. All parts are in the kit!

Baron Plane and Complete Booster Rocket. Launcher and propellant included.

SPECIFICATIONS

Length 22.5"
Wing span 12"
Body diameter 1"
Shipping weight 40 oz.

Catalog No. 721-5102.....\$12.95

Astro-Gnat ROCKET PLANE with Booster Rocket

The high flying Astro-Gnat leaps off the pad and zooms to a spectacular altitude on a cloud of rocket exhaust . . . then plane and rocket split and one glides while the other parachutes . . . from hundreds of feet up! Our highest flying plane, the Astro-Gnat, combines rocketry with model glider flying . . . and what better place to launch a glider than from a rocket hundreds of feet above the ground?

Complete Astro-Gnat Rocket Plane Kit . . . Booster rocket, plane, launcher and propellant.

SPECIFICATIONS

Length 18"
Wing span 10"
Body diameter 1"
Shipping weight 39 oz.

Catalog No. 721-5123.....\$11.95



X-13 ROCKET PLANE



X-13 ROCKET PLANE with Booster Rocket

This sleek delta wing design makes the X-13 Rocket Plane one of our highest flying cold propelled rocket planes. Everything is included in this high flying rocket plane kit.

SPECIFICATIONS

Length 18"
Wing span 7.5"
Body diameter 1"
Shipping weight 39 oz.

Catalog No. 721-5122.....\$11.95

SMALL PARTS KIT

All those items easily lost at the launch pad. Kit includes safety pins, plastic nozzle extension, timer discs and coupling.

No. 5058 — Ship. Wt. 3 oz. \$.50

PAYLOAD COMPARTMENT KIT

For parachute stowage, or also for small payloads if desired. A completely formed, hard styrofoam nose cone, decorated fibre tube, aluminum adapter, and assembly tape are included.

No. 5118 — Ship. Wt. 9 oz. \$.50

FIN RAIL AND LAUNCH GUIDE

Rail is used for attaching fins or as catapult rails for rocket planes, and may be used in a sophisticated rail launcher. It interlocks with itself, yet slides freely. Launch guide is for 1/8" diameter rod launcher.

Rail (2 ft.), Guide (8"), and Contact Adhesive

No. 5120 — Ship. Wt. 4 oz. \$.50

REMOTE ELECTRICAL FIRING UNIT

Remote control system adds realism and excitement to your launches. This unit can be used with any cold propellant rocket or rocket plane. See page 27 for more details.

Remote Unit plus 6 inches of ignitor wire. (Battery not included)

No. 5113 — Ship. Wt. 7 oz. \$1.95

Extra Igniter Wire (6 inch piece)

No. 5057 — Ship. Wt. 3 oz. \$.25

ROCKET ENGINES

These replacement engines are identical to the engines included in each kit. For strap-on applications, a separator and a firing unit are required for use. Engines are high quality polished aluminum construction with built-in fueling port, safety vent and 100% tested.

No. 5001 — V-2 Engine (For Valkyrie-2)

8 1/2 inch body, 4 oz. propellant capacity, with nozzle extension.

Shipping weight 8 oz. \$4.95

No. 5075 — V-1 Engine (For Valkyrie-1)

4 1/2 inch body, 2 oz. propellant capacity, with nozzle extension.

Shipping weight 7 oz. \$3.95

SEPARATOR

The separator couples to the engine and releases the parachute at the proper time in flight. Release time is adjusted by timer discs which cause a delay from the time fuel is exhausted (burnout) till the moment the separator releases the parachute tube.

No. 5002 — Separator with coupling and timer discs.

Shipping weight 4 oz. \$2.95

If your engine or separator is damaged for any reason, return the damaged part along with the correct remittance, for quick repair or replacement.

V-2 Engine Exchange — \$1.50 with old part

V-1 Engine Exchange — \$1.50 with old part

Separator Exchange — \$1.00 with old part

EXCHANGES MUST BE PRE-PAID

MULTI-STAGE ADAPTER KIT

Parts and instructions for in-flight separation and staging of a two-stage rocket. Everything is there to combine two rockets into an advanced two-stage rocket. Data-packed Multi-Stage Rockets booklet (Included) offers many other ideas for staging.

No. 5060 — Multi-Stage Adapter Kit

Parts, instructions, booklet.

Shipping weight 6 oz. \$1.00

No. 5105 — Multi-Stage Rockets Booklet

Shipping weight 3 oz. \$.25

FUELING VALVE and HOSE

For fueling rockets or jet planes. Valve fits either size can of RP-100 Propellant.

No. 5027 — Ship. Wt. 3 oz. \$.50

RP — 100 PROPELLANT

Unique non-flammable fuel, yet real performance! 15 oz. can provides 3-10 flights for all Estes cold propellant rockets and jet planes.

No. 5039 — Ship. Wt. 16 oz. \$1.95

PARACHUTE MATERIAL

*MYLAR — Fantastically light, strong film. Non-sticky, free-opening without talcum. The ultimate parachute material, one-fourth the thickness of standard chutes.

No. 43001 — Shiny, metallized film, 12 x 12.

Shipping weight 2 oz. \$.35

*DuPont Trademark

the incredible

CINEROC



MODEL ROCKET MOVIE CAMERA



The most important model rocket development in years, the Estes CINEROC enables the advanced rocketeer to make moving photographic studies from a vantage point never before possible: the rocket itself!

Fully loaded, the CINEROC weighs only 3 ounces, easily lofted by the Estes "D" engines. The Super 8mm camera is an engineering marvel. The single element 10mm acrylic lens gives the best possible image with the greatest depth of field. You'll see the launch lugs and fins of the launch vehicle as clearly as the terrain far below. A semi slow motion effect is obtained with the CINEROC's exposure rate of 31 frames per second, ideal for studying ignition, booster separation, stability, and parachute opening actions.

An essential part of the CINEROC is the Flight Pak film cartridge. No threading; just slip it into the camera and you're ready to go. See page 35 for processing information and information about ordering more Flight-Paks.

The photos at the left were taken from CINEROC films and show the clarity and detail possible. You see everything . . . from lift-off to deployment of the recovery system!

Completely assembled with Flight Pak loaded with color film, 2 batteries, and 18" parachute. Shipping weight 1.5 lbs.

CAMERA SPECIFICATIONS

10mm focal length lens f/11 —
1/500 sec. shutter, 31 frames per
second, 6" to infinity depth of
field. Takes color film.
Diameter: 1.75"
Length: 9.9"
fits BT-60 Body Tube

COMBINATION OFFER

The recommended launch vehicle for the CINEROC is the Astron Omega, a "D" engine bird specially designed to loft the CINEROC. (See page 35 for information regarding the Omega.) Now order the CINEROC and Omega together. Shipping weight 2 lbs., 4 oz.

Cat. No. 701-RC-8 **\$25.50**

UNUSUAL ROCKETRY MOVIES

CINEROC movies shot by the Estes Research and Development Department. 50 feet of color film.

Super 8mm
Cat. No. 711-MF-1S **\$5.95**

Std. 8mm
Cat. No. 711-MF-1R **\$5.95**



Cat. No. 701-CM-8
(less launch vehicle)
\$21.95



A SUBSIDIARY OF DAMON

MODEL ROCKETRY TECHNICAL MANUAL

by William Simon,

Director of Research and Development

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INTRODUCTION

Welcome to the exciting world of model rocketry! This brief technical manual for model rocketeers was written to provide both an easy-to-follow guide for the beginner and a handy reference volume for the experienced rocketeer. In the next few pages you'll find the answers to the questions most commonly asked by model rocketeers. More complete technical information on all the subjects covered can be found in the many publications listed in the current Estes catalog. We hope this booklet will help make model rocketry as exciting and enjoyable for you as it is for us.



WHY MODEL ROCKETRY ?

Few model rocketeers realize that the hobby they enjoy was started simply to provide a safe substitute for a dangerous activity. Yet, at the dawn of the space age, rocketry was one of the most dangerous sports possible for non-professionals. Experts estimated that a person had a one-in-seven chance of being injured or killed for each year he experimented with rockets. Newspapers told of fingers and eyes lost — and all too frequently of lives lost.

The rockets that killed were entirely homemade. The experimenter would obtain a metal container and fill it with a chemical mixture intended to serve as fuel. A Texas science teacher who tried this injured seven of his students and killed himself. A California boy made his rocket from a pipe filled with match heads; it exploded during loading, killing him instantly and maiming his friend for life.

Four factors were responsible for the dangers of non-professional rocketry. Many young people had a very strong desire to build and launch their own rockets. Dangerous materials for building rockets (pipes, fertilizer, matches, etc.) were readily available at low cost. Little information on the dangers involved ever reached the potential rocketeer. Safe materials for rocketry were not available.

A SAFE PROGRAM

Model rocketry was developed to provide a safe alternative for the young person wanting to build a rocket. The first step was to make available a safe, low cost rocket engine, fully assembled, to eliminate the hazards of making one's own engine.

The second step was to initiate an educational program designed to make every potential rocket builder aware of the disastrous results of "basement bomber" type activities; telling him of the dangers of home-compounded fuels and metal rockets. The third step was to develop a line of rocket designs, launch equipment, payload instruments and technical information to challenge the imaginative rocketeer and guide him safely through his "rocket career".

The success of this approach is shown by the fact that there are more active rocketeers today than ever before, yet the number of accidents per year is a very tiny fraction of those occurring 15 years ago. Model rocketeers now enjoy a sport that is safer than baseball, basketball, or swimming. That's been our goal here at Estes: to make model rocketry the safe and exciting sport it is today.

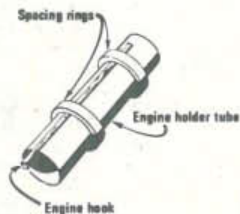
YOUR FIRST MODEL ROCKET

The Astron Alpha is shown here to illustrate the parts of a typical model rocket to the beginning rocketeer.

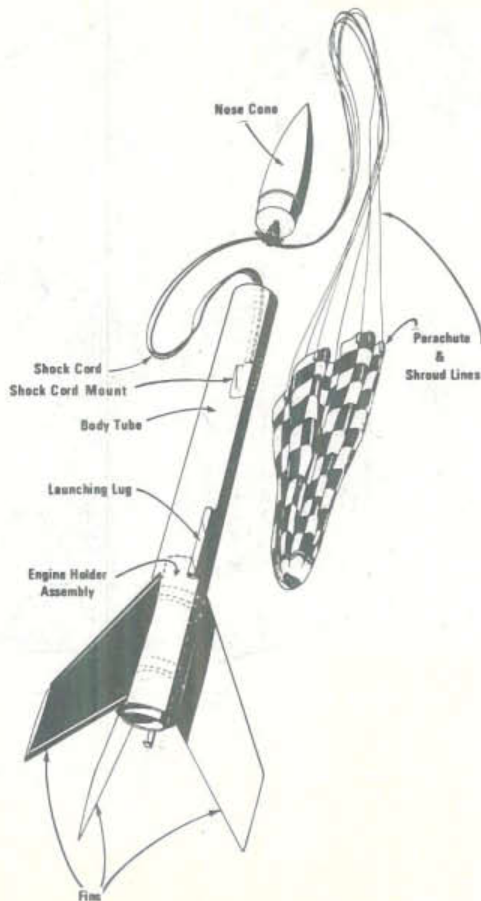
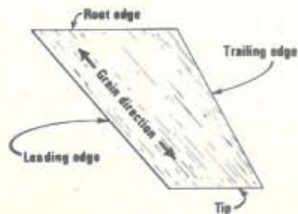
For your first model rocket we recommend the Astron Alpha (Kit K-25) or other Estes model rockets rated one in degree of challenge (see page 5 of your catalog for degree of challenge table).

The construction techniques used in this and other model rockets are explained in greater detail in this manual.

ENGINE HOLDER ASSEMBLY



FIN PART NAMES



CONSTRUCTION TECHNIQUES

In the construction of your Estes model rocket you will need the following tools and supplies:

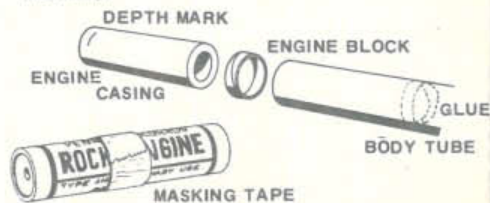
Modeling knife	Pg. 54
Astro seal, white glue	Pg. 55
Extra fine sandpaper	Pg. 55
Spray paint or dope	Pg. 55

1 ENGINE MOUNTING METHODS ENGINE BLOCK INSTALLATION

Some models use an engine block to keep the engine from traveling too far forward in the rocket body both when it is installed and when the rocket is launched.

When building a model, 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.

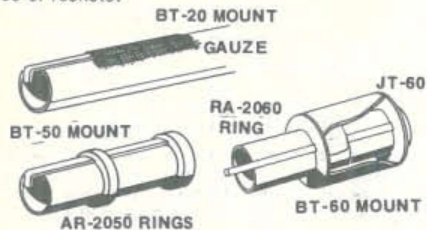
When the mark on the engine casing is even with the rear of the body tube the block will then be in the correct position. Remove the engine casing immediately.



When mounting the engine in a model with an engine block, wrap the engine with masking tape until it will make a tight friction fit in the tube. Then slide the engine into place.

ENGINE HOLDERS

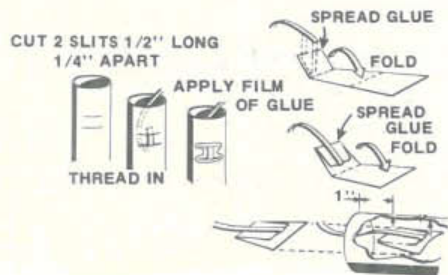
In many models an engine holder is the best device to use for mounting an engine. The drawings show how engine holders are mounted for different sizes of rockets.



To mount an engine in a model with an engine holder, spring the end of the holder up and slide the engine into place. Check to make sure the end of the holder latches securely over the end of the engine.

2 SHOCK CORD MOUNTS

Attach the shock cord securely. Both methods shown give good results. The "Slit-n-Glue" method is quicker; the "anchor" is neater, but is difficult to use on small tubes.

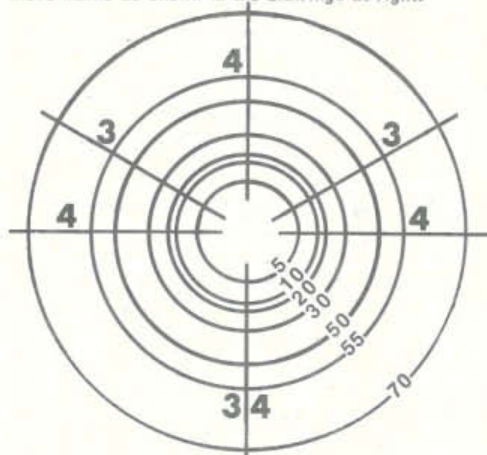


3 SECURING A SCREW EYE

To avoid losing your nose cone, make sure the screw eye is securely attached. Make a hole by inserting and removing the eye. Squirt glue into the hole and replace the eye.

4 MARK THE BODY

This Fin Spacing Guide will space equally three or four fins on all popular body tubes sold by Estes Industries. To space the fins, center the end of the tube in the circles, then mark at the (4) lines for four fins or on the (3) lines for three fins. Draw lines from these marks as shown in the drawings at right.



Mark the body tube for fin alignment using the "V" notch of a drawer sill or door frame. Match the edge of the notch with a spacing mark; run a pencil along the edge to draw your guide line. When all three or four lines are drawn, glue the fins to the body on the lines and they will be straight.

5 INSTALL THE ENGINE MOUNT

Draw the fin alignment lines on the body **before** installing the engine mount. Position the mount so the engine holder is midway between two fin lines for easier operation. First make sure the mount slides easily in the body tube. If it's tight, sand it until it slides easily. Smear a liberal amount of glue around the inside of the body over the area where the mount's ring or coupler will fit. Insert the mount into position in one smooth motion. DON'T pause, or the glue will "grab" with it in the wrong place. Support the tube "nose-up" while the glue dries.

CENTER ENGINE HOLDER BETWEEN FINS



6 MAKE THE FINS

MARKING



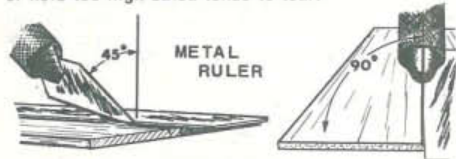
Model rocket fins are almost always made from thin sheets of balsa wood. When making fins, **always** be sure the grain of the wood is **parallel** to the leading edge of the fin.



CUTTING

Draw a full-size fin pattern on stiff paper or cardboard. Cut out the pattern, position it on the fin stock, and trace around it with a pencil or ball point pen to mark the balsa for each fin.

Use a metal straightedge whenever possible. Hold knife or saw blade at 90° angle to surface being cut, and handle at about 45° for clean cut. If blade is dull or held too high balsa tends to tear.



SHAPING

For general purposes, sand all edges round except the root edge (the edge that glues to the body). Make the root edges straight and square. The sides of the fins should be sanded smooth.

ROUNDED EDGES



STREAMLINED

On high performance models try to sand the fins to the shape shown. The front (leading) edge of the fin should be slightly rounded; the back (trailing) edge should come to a knife edge.

7 ATTACHING THE FINS

Always use a high-strength adhesive such as white glue for attaching fins. After marking the tube and sanding the fins, apply a line of glue to the root edge of a fin. Let it set a minute or two, then press it into place on the body tube. Attach the other fins in the same way. Support the rocket body in a vertical position while the glue dries.



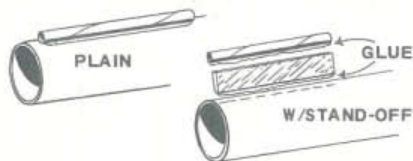
Sometime after the first glue on the fins has dried completely, the joints should be reinforced. Do this by applying a "fillet" of glue as shown. Always support the body in a horizontal position while fillets are drying.

FILLETS



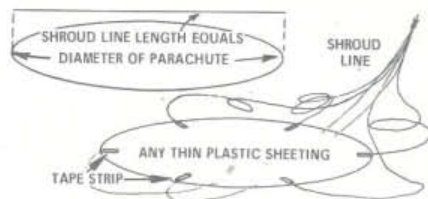
AND LAUNCHING LUG

Launch lugs are attached in much the same way as fins. If a stand-off is used to keep the rod from hitting a large diameter payload section, attach the lug to the stand-off piece first, then attach the unit to the body.



8 ASSEMBLE PARACHUTE

In addition to regular, pre-printed model rocket parachutes, a rocketeer can use a wide variety of thin plastic sheeting to slow his model's descent. When making a chute from "scratch," cut the plastic sheet to shape, then attach 6 or 8 shroud lines, each as long as the diameter of the parachute, as shown. Gather all the loose ends of the shroud lines and tie a knot at the extreme end of the group.



PARACHUTE SHAPE

The most common parachute shapes are square, round, hexagonal and octagonal. While square parachutes are the easiest to make, they are not very efficient and allow a considerable amount of sway during descent. Round parachutes are fairly stable descent, but are more difficult to make. The hexagonal and octagonal parachutes are highly stable, reasonably easy to make and generally give the best appearance. The accompanying drawings illustrate methods for making these shapes.

OCTAGONAL

FOLD AS SHOWN



HEXAGONAL

FOLD AS SHOWN



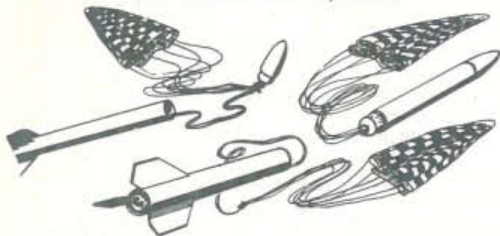
SNAP SWIVEL ASSEMBLY

It's often worthwhile to be able to quickly switch a parachute from one model to another or to replace a chute with a new one.

To install a snap swivel, simply gather the ends of the shroud lines and dampen them so as to form fairly stiff "point," then thread this point through the eye of the snap swivel. Once through the eye the lines are tied together in a tight knot and pulled back against the eye. Apply a drop of glue to the knot.

9 CONNECT IT TOGETHER

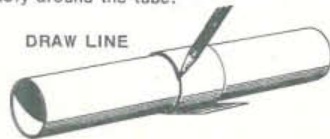
The first illustration shows how nose cone, parachute and rocket are connected on most models. If the rocket has a heavy payload section, it's best to use two chutes as shown in the second picture.



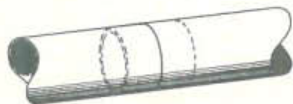
10 CUTTING TUBES

Many models call for special lengths of body tubes; the rocketeer has to cut the tube himself to build the rocket. Here's how to get a neat cut every time.

(1) Mark the tube at the point where the cut is to be made. Wrap a straight strip of paper around the tube and align the edge with the mark. Draw a line completely around the tube.

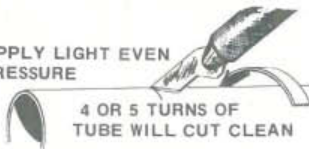


(2) Slide a stage coupler into the tube — center it under the cut position to support the tube.



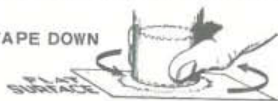
(3) Cut lightly along the line, rotating the tube as you cut. Use a sharp blade, but don't try to cut all the way through the first turn. Use a light pressure on the knife for several turns until you cut through.

APPLY LIGHT EVEN
PRESSURE



(4) Slide the stage coupler into the cut end of the tube. Hold the tube near the cut end and work it over a flat sheet of very fine sandpaper with a circular motion as shown to remove burrs and rough edges.

TAPE DOWN



11 MYLAR BODIES

BT-10 is an ultra-light mylar plastic tube which is recommended for use with 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 (PRM-1), must be used to glue parts to the tube, as ordinary glues will not stick to the mylar.

WRAP SLOWLY, PRESSING
OUT BUBBLES
AS YOU GO

TAPE STRIP



APPLY FILLET OF
GLUE OR BODY
PUTTY



FINISHING

The finish of a rocket starts with the very first steps of assembly. Sloppy gluing and other messy habits will ruin the appearance of a rocket so that nothing can be done to get the perfect appearance which is desired. On the other hand, careful construction will make a model look good even before the paint is applied.

1 SANDING AND SEALING

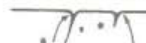
Paint cannot replace sandpaper. If a balsa surface is not sanded and sealed carefully, it will be impossible to get a smooth paint job. Begin by sanding all balsa surfaces with extra-fine sandpaper until smooth.



BALSA SANDED
BUT UNTREATED

Next, apply a coat of sanding sealer to the balsa. Let this dry completely, then sand with 320 grit (or finer) sandpaper until the surface is smooth again. Apply more sealer, repeating the procedure until all the pores in the balsa are filled.

1ST. COAT . . . SANDED SURFACE



NOTE GRAIN DEPRESSION

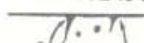
Practically all of the sealer should be sanded off after each coat. This is because the purpose of the sealer is to fill the holes, not the smooth areas of the balsa.

2ND. COAT
. . . AGAIN SANDED



SLIGHT DEPRESSION
REMAINS

3RD. COAT . . . SANDED
TILL SURFACE IS SMOOTH

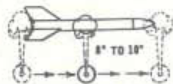


DEPRESSIONS ARE FILLED

2 BASE COLOR

Once the balsa surfaces are prepared, apply the base color. The base color is the lightest of the colors to be used on the model. Usually this will be white. If the model is to be painted with fluorescent colors, the base coat **must be white**.

Apply a light, even coat of the base color and set the model aside to dry. Always spray or brush thin coats; thick ones dry slowly and tend to "sag". When the first coat had dried completely, sand lightly with extremely fine sandpaper. Wipe any dust off with a clean, slightly damp cloth and apply another coat. Let this dry, then follow with additional light coats until the model has a clear, pure color.



MOVE CAN PARALLEL TO WORK



DON'T FORGET THE ENDS AND EDGES



"SAG" OR "RUN" RESULTS FROM HOLDING CAN TOO CLOSE TO WORK

Let the base coat dry completely. Allow at least four hours in a warm, dust-free area. A day is better, when possible. Don't let the temperature get over 120° while the model is drying.

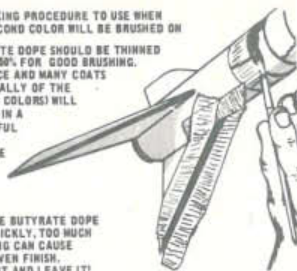
3 THE SECOND COLOR

When the base color has dried, cover all areas on the model which are to remain this color. Cover small areas with masking tape. Large areas should be covered with typing paper, held down at the edges with masking tape. It's important to seal the tape down tightly along the edge.

MASKING PROCEDURE TO USE WHEN THE SECOND COLOR WILL BE BRUSHED ON

BUTYRATE DOPE SHOULD BE THINNED ABOUT 30% FOR GOOD BRUSHING. PATIENCE AND MANY COATS (ESPECIALLY OF THE DARKER COLORS) WILL RESULT IN A BEAUTIFUL AND DURABLE FINISH.

BECAUSE BUTYRATE DOPE SETS QUICKLY, TOO MUCH BRUSHING CAN CAUSE AN UNEVEN FINISH. APPLY IT AND LEAVE IT!



With the model masked, apply an additional thin coat of the first color to finish sealing the edges of the tape. When this is dry, apply the second color in several thin coats. Use just enough paint to get good color. After the last coat is dry, remove the masking carefully to avoid peeling the paint. A third color would be applied in the same way as the second.

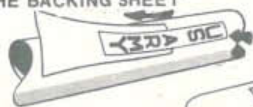
4 FINAL TOUCHES

For best results let the paint dry overnight before applying decals. Most decals should be soaked in lukewarm water for 30 seconds or until they slide on their backing sheets. The decal is then slid so one edge is off the backing. This edge is positioned and held in place on the rocket and the backing pulled out from under. Smooth the decal down with a damp finger and blot away any excess water with a rag.

DIP DECAL IN WATER



SLIDE DECAL FROM THE BACKING SHEET



BLOT AWAY EXCESS WATER

Stripes and bands may be made of either decal material or decorating tape. The pieces should be cut to size before application.

WAYS DECORATING TAPE CAN BE USED

ROLLS



Wax may be applied over most enamel or butyrate finishes, but never directly over fluorescent paint. Test the finish to be waxed by applying the wax in an inconspicuous corner of the model or a scrap of tubing with the same paint finish. Some paints will rub off when wax is applied.

When a model has been finished with fluorescent paint, apply a light coat of clear spray before applying tape or decals. With any paint finish, apply several coats of clear after the decals have dried to protect them.

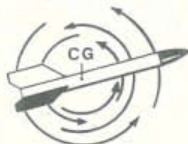
NOTE: Enamel paint may be applied over butyrate dope, but NEVER APPLY BUTYRATE DOPE OVER ENAMEL PAINT. If in doubt, test the compatibility of different paints on a piece of scrap material.

STABILITY

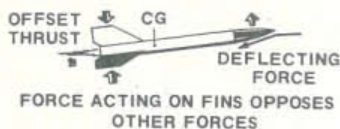
One of the first things a model rocket design learns is that a vehicle will not fly unless it is aerodynamically stable. By stable we mean that it will tend to keep its nose pointed in the same direction throughout its upward flight. Good aerodynamic stability will keep the rocket on a true flight path even though some force (such as an off-center engine tries to turn the model off course.

If a model is not stable, it will constantly turn its nose away from the intended flight path. As a result it will try to go all over the sky, but end up going 'nowhere.' An unstable rocket will usually tumble to earth after the engine burns out, damaging the model.

When a free-flying object rotates, it always rotates around its balance point. (The proper term for the balance point is the **center of gravity**, abbreviated as C.G.) Thus the balance point (CG) is the pivot for all forces trying to turn the rocket.



The most significant forces acting on a model rocket in flight are caused by the thrust of the engine, the action of air on the nose and the action of air on the fins. Off-center thrust and forces on the nose try to bring the nose of the rocket around to the rear. They are opposed by the forces acting on the fins. All these forces are amplified by the distance from the location of the force to the center of gravity.



As long as the forces on the fins of the rocket are great enough to counteract the forces on the nose and any off-center thrust, the rocket will fly straight. If the fins are too small and/or too close to the center of gravity, there will not be enough force to counteract the force on the nose. As a result, the nose will swing out to the side and the model will try to chase itself around the sky.

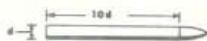


(small force \times long distance = large force \times small distance)

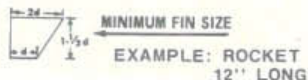
The side forces on the nose and fins of a rocket that is flying straight are very small. When something disturbs the rocket and it starts to turn sideways, the side forces on both nose and tail increase. (There is some aerodynamic force on the body; however, it is small and can usually be ignored.) Depending on the size and shape of the nose and fins and their distances to the center of gravity, one will overpower the other and force the rocket to turn its way. If the nose overpowers the fins, it's too bad. However, if the fins overpower the nose, the rocket will swing back into line and continue on its way.



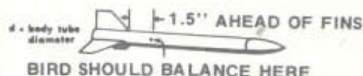
Although determining the exact relationships between various forces on a model rocket requires higher mathematics, certain practical rules can be used by even the beginning rocketeer to design stable rockets. The first rule is to use a long body. Until you have considerable experience in designing models, the length of the body tube used should be at least 10 times its diameter. This makes it easier to get enough distance between the center of gravity and the fins.



The second rule is to make the fins large. The larger the fins, the more force they will produce when the rocket starts to turn. For the first few designs, use a fin which is at least as large as the example in the illustration.



The third rule is to place the fins as far back on the rocket as possible. Generally, this means that the rear edge of the fin will meet the rear end of the body and the fin will be swept back. Do not place any fins ahead of the center of gravity.



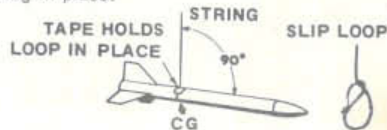
Finally, the rocket should balance at least 1/8 its length ahead of the front of the fins. This gives the fins the leverage they will need to counteract the force on the nose.

Remember that these rules are general; they are based on experience rather than precise mathematical analysis. By using more exact methods (See TR-1 and TR-9) it's possible to build rockets with less stability margin. In any event, **always** remember to test your model for stability **before** you launch it.

TESTING FOR STABILITY

The easiest way to test the stability of a model is to fly it — without launching it. Do this by attaching a string to the model and swinging it through the air. If the string is attached at the rocket's CG, its behavior as it is swung through the air will indicate what it will do in powered flight.

Make the test on your model by forming a loop in the end of a six to ten foot string. Install an engine in the rocket. (The center of gravity is always determined with an engine in place.) Slide the loop to the proper position around the rocket so the model balances horizontally. Apply a small piece of tape to hold the string in place.



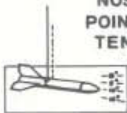
With the rocket suspended at its center of gravity, swing it overhead in a circular path. If the rocket is very stable, it will point forward into the wind created by its own motion. Some rockets which are stable will not point forward of their own accord unless they are started straight. This is done by holding the rocket in one hand with the arm extended and then pivoting the entire body as the rocket is started in the circular path. It may take several attempts before a good start is achieved.



If it is necessary to hold the rocket to start it, an additional test should be made to determine whether the model is stable enough to fly. Move the loop back on the body until the tube points down at a 10° angle below the horizontal. Repeat the swing test. If the model will keep its nose pointed ahead once started, it should be stable enough to launch.

DOUBLE CHECK A BIRD WITH QUESTIONABLE STABILITY AS FOLLOWS:

MOVE STRING BACK 'TILL NOSE OF BIRD POINTS DOWN AT TEN DEGREES - REPEAT THE SWING TEST



BIRD SHOULD STILL "FLY" NOSE FORWARD

Be careful when swinging a rocket overhead: A collision with a nearby object or person could be serious. Always do your testing in an open, uncluttered area.

Don't try to fly a rocket that has not passed the test. Most unstable rockets loop around in the air harmlessly. However, a few marginally unstable models will make a couple of loops and then become stable due to the lessening of the propellant load. When this happens, the model can crash into the ground at high speed.

If your rocket does not pass the stability test, it can usually be made stable. Two methods can be used: The balance point can be moved forward, or the fins can be enlarged. To move the balance point forward, attach nose cone weights to the base of the nose cone. Fins can either be replaced with larger ones or extra tabs can be glued to the rear or tip edges of the fins. (Some scale models use supplementary plastic fins.) After making your changes, test the model again to be sure it is now stable.

ADD A NOSE CONE WEIGHT ...

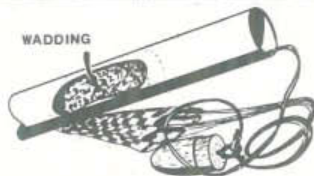


... OR ADD A TAB TO EACH FIN

HERE HERE OR BOTH

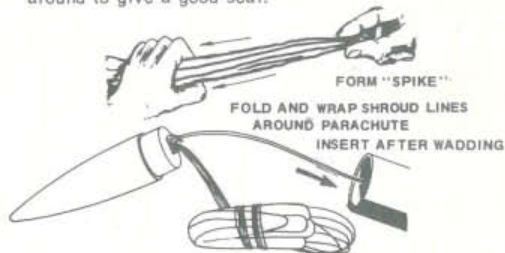


PREPARING FOR FLIGHT



Parachutes and streamers must be protected from the heat of the ejection charge. This protection is supplied by first loosely packing enough flameproof recovery wadding into the tube to fill it for a depth

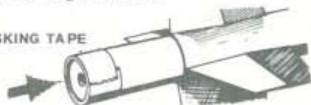
of at least twice the body diameter. The wadding should fit against the side of the tube all the way around to give a good seal.



To fold the parachute, hold it between two fingers at its center and pass the other hand down it to form a "spike" shape. Fold this spike tightly into several sections as shown. Push the folded chute down into the tube on top of the wadding. Pack shroud lines and shock cord in on top of the chute, then slide the nose cone into place.

To activate streamer or parachute recovery gear correctly, the engine MUST be held in place SECURELY. This may be done by wrapping the nozzle end of the engine with tape until it makes a snug fit in the body tube or engine mount.

MASKING TAPE



SNUG ... GAS TIGHT FIT HERE HELPS ASSURE PROPER OPERATION.

BE SURE HOLDER LATCHES SECURELY

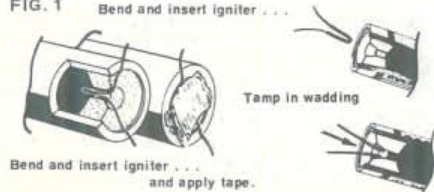


On models using engine holders, make sure the end of the holder latches securely over the end of the engine.

IGNITER INSTALLATION

Estes igniters are supplied in strips of three. Cut the igniters apart (scissors will work) midway between the coated sections. Bend the igniter at the middle as shown and push it into the engine as far as it will go. To operate properly the igniter must touch the propellant grain. Spread the leads and apply a square of masking tape to the nozzle and leads as shown in Fig. 1. The eraser on the end of a pencil is good for pressing the tape securely into place.

FIG. 1 Bend and insert igniter . . .



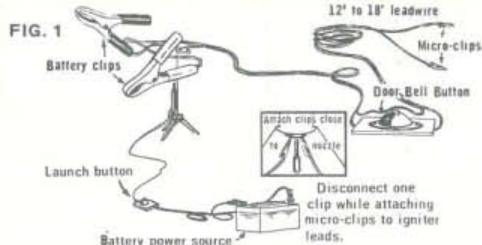
An igniter can also be held in place by rolling a 1" square of flameproof wadding into a ball and inserting it into the nozzle with a pen or pencil to hold the igniter firmly in place.

LAUNCHING

Model rockets, like professional rockets, are launched electrically. This provides both safety and realism. Each engine sold by Estes Industries is supplied with an igniter and complete instructions; still more information is supplied with launcher kits. However, the basic information needed to launch models successfully is included in these pages.

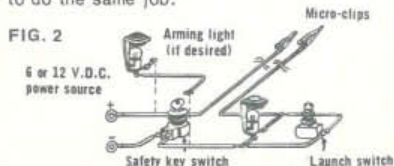
1 ELECTRICAL SYSTEMS

The electrical system which operates the igniter can be made in many ways. It can be a simple home-made unit, as the one shown in figure 1, or it can be one of the more complete systems sold by Estes Industries.



All of these systems work by passing enough electrical current through the high-resistance wire to ignite the coating on the igniter which in turn ignites the engine. The system is attached to the igniter with micro-clips as shown. When connecting the micro-clips to the igniter make sure the clips do not touch each other or the rod or blast deflector. If they do touch, the current from the battery will "short" through the clips, rod or deflector and not reach the igniter.

Any electrical system must have a spring-return launch system so the current turns off automatically when the button is released. In addition a safety disconnect must be provided. On simple systems the battery clips should be disconnected when the micro-clips are being attached to the igniter. More complete systems may have safety key switches or safety plugs to do the same job.



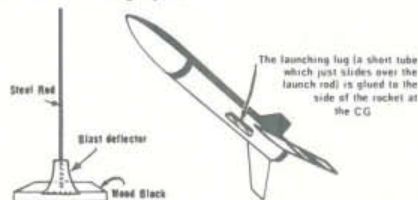
The circuit shown in figure 2 also includes a continuity check pilot light. This is a small bulb (no more than 1/4 ampere for safety) which lights when the safety interlock is closed if the clips make good connections at both the battery and the igniter. When lit, it indicates that the rocket can be launched.

2 LAUNCHER DESIGN

A rocket cannot be simply set on its fins and launched; some method of holding it in position before ignition and guiding it during the first few feet of its flight is necessary. The launcher must perform these functions.

The simplest suitable launcher design uses a wood block to support a 36" long, 1/8" diameter steel rod. A short tube, slightly larger than the rod, is glued to the side of the rocket near its balance point. This tube slips easily over the rod and keeps the rocket pointed in the right direction. Figure 3 shows a rod launching system.

FIG. 3



Some launching guides are designed to fit around the lug instead of inside it. The "C" rail is typical of these. Rails generally have the advantage of being stronger and more rigid than rods. However, most model rockets will fly very well with either system. Figure 4 illustrates a rail and some lugs to fit.

FIG. 4



When building a launcher be sure to use a base that is big enough and heavy enough to provide a secure foundation. A piece of 3/4" plywood a foot square works well for most rockets. Bricks or rocks can be used to weight the base when extra-large models are being launched.

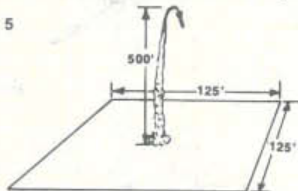
3 SAFETY

Make sure the area around the launcher is clear and has no dry weeds or highly flammable materials. When approaching the launcher to mount a rocket or check it, put your hand on the end of the rod before leaning over. This helps protect you against the possibility of eye injury from the rod.

4 LAUNCH AREAS

The best place to fly models is on a model rocket range. Many such ranges have been set up by organized groups of rocket enthusiasts. However, if such a range is not available, it is best to select a place, free of trees and houses, large enough to recover the rocket within the area. Generally the smallest side of the field should be at least one fourth the maximum altitude your rocket will reach. Set the launcher at the center of the area as shown in figure 5.

FIG. 5



COUNTDOWN CHECKLIST

Use a countdown check list when you launch your models. You'll find it makes your rocket flights more successful and enjoyable. The following procedure is recommended for most chute or streamer models. For other types of rockets, try to develop your own complete check list.

12) Pack flameproof recovery wadding into the body tube. Insert the parachute or streamer.

11) Install the nose cone or payload section. Check condition of the payload (if any).

10) Apply enough masking tape to the engine(s) for a tight friction fit in the body tube(s). When launching a multi-stage rocket be sure that the engines are in their proper relative positions and that a layer of cellophane tape is wrapped tightly around each engine joint. Mount the engine in the rocket.

9) Install a nichrome igniter in the engine.

8) Place the rocket on the launcher. Clean and attach the micro-clips.

7) Clear the area, check for low flying aircraft, a alert recovery crew and trackers.

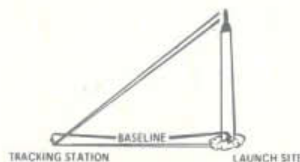
6) Arm the launch panel.

5) 4) 3) 2) 1) LAUNCH!

TRACKING

Every rocketeer wants to know how high his models fly. Many methods of determining a model's peak altitude have been tried, but only one method has proven itself. This method is known as triangulation.

The simplest form of triangulation uses only one very simple tracking device. With it, the rocketeer measures the angle between the ground and the line



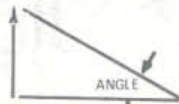
of sight to the rocket at its peak altitude. When this angle and the distance from tracker to launcher are known, it is very easy to determine the altitude.

TRACKERS

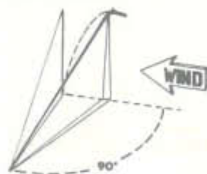
The Estes Altiscope is one of the best all-around basic tracking devices. However, the rocketeer can also easily make his own tracker. An inexpensive plastic protractor, mounted securely on a post set in the ground, with a sighting stick pivoted at the "center" of the protractor, will do the job. The tracking device must be set so that it reads 0° when aimed at the rocket on the launcher and 90° when aimed straight up. If the tracker is not "zeroed in" on the launcher, it will give incorrect information.



When the operator at the tracking station is ready, the rocket is launched. The operator follows the rocket with his tracker as the rocket rises. When the rocket reaches its peak altitude he stops or locks the tracker. The indicated angle is then read from the protractor scale.



The tangent of this angle is found by checking the table on the next page. Multiply the tangent by the distance from tracker to launcher (baseline distance) to find the altitude.



A single tracker will give best results on calm days. Wind interferes with accuracy since models tend to tilt over into the wind as they fly. The result is that the rocket will not be straight over the launch site at peak altitude, but instead will be some distance over in the direction of the wind. To keep error due to wind drift to a minimum, locate the tracker at a 90° angle to the wind direction as shown.

In determining where to locate a tracking station, estimate the altitude your model will reach. The tracking station should be approximately this distance from the launcher (usually 500 to 1000 feet). Measure the distance from launcher to tracker carefully to insure accurate altitude calculations.

For more precision, use two trackers on opposite sides of the launcher. The easiest way of calculating rocket height using two trackers is to find the altitude for each tracking station and then take the average of these two altitude figures.



More complete information on basic altitude tracking is contained in Estes Industries Technical Report TR-3.

TABLE OF TANGENTS

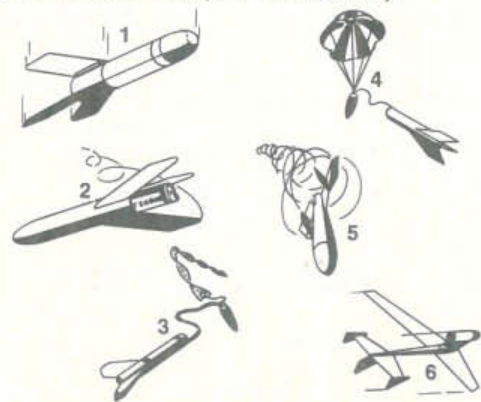
Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.
1°	.02	17	.31	33	.65	49	1.15	65	2.14
2	.03	18	.32	34	.67	50	1.19	66	2.25
3	.05	19	.34	35	.70	51	1.23	67	2.36
4	.07	20	.36	36	.73	52	1.28	68	2.48
5	.09	21	.38	37	.75	53	1.33	69	2.61
6	.11	22	.40	38	.78	54	1.38	70	2.75
7	.12	23	.42	39	.81	55	1.43	71	2.90
8	.14	24	.45	40	.84	56	1.48	72	3.08
9	.16	25	.47	41	.87	57	1.54	73	3.27
10	.18	26	.49	42	.90	58	1.60	74	3.49
11	.19	27	.51	43	.93	59	1.66	75	3.73
12	.21	28	.53	44	.97	60	1.73	76	4.01
13	.23	29	.55	45	1.00	61	1.80	77	4.33
14	.25	30	.58	46	1.04	62	1.88	78	4.70
15	.27	31	.60	47	1.07	63	1.96	79	5.14
16	.29	32	.62	48	1.11	64	2.05	80	5.67

RECOVERY SYSTEMS

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 damaging 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:

1. Featherweight Recovery, 2. Tumble Recovery, 3. Streamer Recovery, 4. Parachute Recovery, 5. Helicopter Recovery, 6. Glide Recovery.



Some of the most common errors causing recovery system failures are listed below with their solutions.

PROBLEM (1) Engine not held securely and ejects, instead of recovery device being deployed.

SOLUTION: On models with engine holder hooks, make sure hook latches properly over end of engine. If engine is held by friction fit, wrap enough masking tape around engine to hold it tightly. (see page 32L.)

PROBLEM (2) Hole or crack in rocket allowing ejection gases to leak through.

SOLUTION: Construction at rear of rocket must be air tight when engine is in place.

PROBLEM (3) Failure to deploy recovery device because body tube is too large for proper pressurization.

SOLUTION: Add a stuffer tube, usually made from BT-20 or BT-50. Center stuffer tube inside rocket with paper-rings and glue securely in place. Stuffer tube reduces area to be pressurized.

PROBLEM (4) Parachute deploys, but wind carries rocket away.

SOLUTION: Replace parachute with streamer. Use a 1" wide piece of flameproof crepe paper, usually at least twice as long as the rocket.

PROBLEM (5) Parachute or streamer is melted or scorched by hot ejection gases.

SOLUTION: Be sure you have used sufficient recovery wadding. (see page 32I.)

PROBLEM (6) Nose cone fails to separate from body tube.

SOLUTION: Check fit of nose cone in the body tube. Parts should be easily separated, but not loose. If fit is too tight, sand inside of body tube or lip of nose cone with fine sandpaper.

PROBLEM (7) Nose cone falls off before ejection.

SOLUTION: Fit is too loose. Add wrapping of masking tape to lip of nose cone.

MULTI-STAGING

1 IGNITION

The first stage of a multi-stage rocket is always ignited by standard electrical means. Second stage ignition occurs automatically upon burnout of the first stage. Figure 1A shows that the first stage engine has no delay or ejection charge. This gives instant ignition of the next stage at burnout.

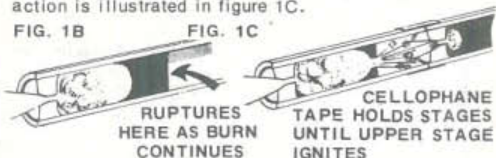
FIG. 1A



In figure 1B the propellant is partially burned, leaving a large combustion chamber. As the propellant continues to burn, the wall of propellant becomes thinner until it cannot withstand the high pressure inside the chamber. At this point the remaining propellant wall ruptures, and the high pressure exhausts forward toward the nozzle of the next stage, carrying hot gasses and small pieces of burning propellant into the nozzle of the second stage engine. This action is illustrated in figure 1C.

FIG. 1B

FIG. 1C



For this system to work, the stages must be held together until the upper stage engine has ignited. When this happens, the stages must then separate in a straight line. This is accomplished by wrapping one layer of cellophane tape around the joint between engines and then recessing this joint 1/2" rearward in the booster body tube, as in figure 2. Recessing the joint forces the stages to separate in a straight line.

FIG. 2

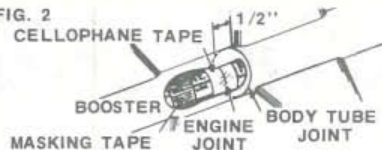


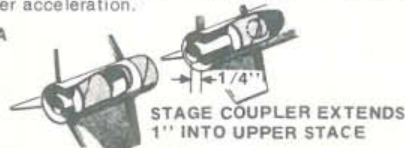
Figure 2 shows the engine installation in a typical two-stage model. Always tape the engines together before inserting them into the rocket. Check carefully before and after taping to be sure the engines are in their proper positions (nozzle of upper stage engine against top end of booster engine). Failure to check carefully can be highly embarrassing as well as damaging to the rocket.

FIG. 3



After taping the engines together, wrap masking tape around the upper stage engine at the front and rear as in figure 3 to give it a tight fit in the body. Push it into place. Wrap the booster engine and push it into position. Failure to get the upper stage engine in place tightly enough will result in the recovery system malfunctioning; failure to secure the booster stage tightly can result in its dropping off under acceleration.

FIG. 4A



Rockets using large diameter tubes (BT-50 and BT-60) require somewhat different methods, but the same principles of tight coupling and straight line separation must be followed. The recommended coupling method for large diameter tubes is illustrated in

figure 4. The stage coupler is glued to the booster body tube, with the adapter for the upper stage engine mount positioned forward to allow the stage coupler to fit into the upper stage, while the tube adapter in the booster is positioned to the rear.

FIG. 4B

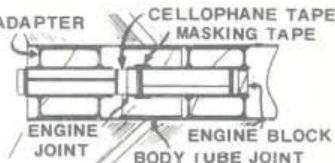
MASKING TAPE WRAPS HALF ON ENGINE TUBE AND HALF ON UPPER STAGE ENGINE



The upper stage engine holder tube projects 1/4" rearward from the end of the upper body tube. The engine is held in place by wrapping a layer of masking tape tightly around the end of the tube and the end of the engine as in figure 4B. The engine mount in the booster must be built to leave space for this system (see figure 4C).

FIG. 4C

BOOSTER ADAPTER



2 STABILITY

Since two or more engines are mounted near the rear of a multi-stage rocket, it has a tendency to be tail-heavy. To compensate for this, extra large fins are used on lower stage. Generally, the lower set of fins on a two-stage rocket should have two or three times the area of the upper set. Each additional stage requires even greater fin area.

FIG. 5

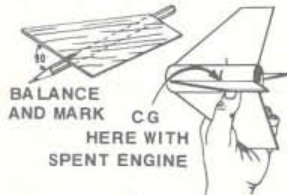


FIN AREA INCREASED ON EACH ADDED STAGE

When checking for stability, test first the upper stage alone, then add the next lower stage and test, and so on. In this way you can be sure that the rocket will be stable in each step of its flight, and you can locate any stage which does not have sufficient fin area. Always check for stability with the largest engines to be used in place.

3 BOOSTER RECOVERY

Most lower stages are designed to be unstable after separation. The booster should be built so that the center of the area of the fin (its balance point) matches or is up to 1/4" ahead of the booster's balance point with an expended engine casing in place. Thus, boosters will require no parachute or streamer, but will normally tumble, flutter or glide back to the ground. If the booster is to be used again, it should be painted an especially bright color, as it does not have a parachute or streamer to aid in spotting it once it is on the ground.



4 TYPES OF ENGINES

Lower and intermediate stages always use engines which have no delay and tracking charge, and no parachute ejection charge. There is no delay so that the next stage will receive the maximum velocity from its booster. The engines which are suitable are those which have designations ending in zero, such as the A8-0, B6-0, 1/2A3-0T, and B14-0.

In the upper stage an engine with a delay and tracking charge and parachute ejection charge is used. As a general rule the longest possible delay should be used. Engines suitable for upper stage use are those with long delays such as the B6-6, A8-5, C6-7, etc.

CLUSTERING

When large models and heavy payloads have to be launched, one engine often cannot supply enough power. A cluster of several engines is generally the answer to this problem.

ENGINE ARRANGEMENTS

FIG. 1



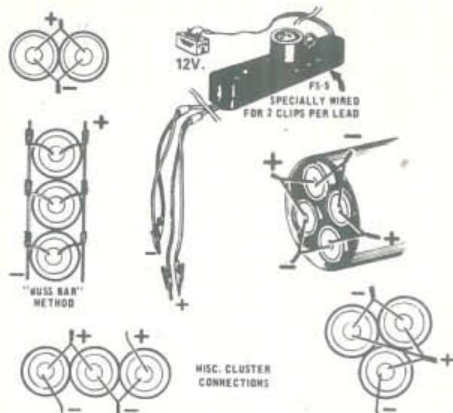
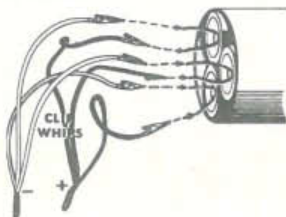
In designing a clustered model the first rule to remember is that thrust must be balanced around the centerline of the rocket. Figure 1 shows several engine arrangements that satisfy this requirement. All engines should be located close together to keep unbalanced thrust from forcing the model off course.

CLUSTER IGNITION METHODS

Ignition is the most important part of successful clustering. All engines must be ignited at the same time. To do this, always use a 12 volt car battery for the power supply and a heavy duty electrical system (such as the Estes FS-5 Launch Control System). Install the igniters carefully and connect them in parallel.

Several typical methods of connecting igniters are shown in figure 2. Make connections carefully to get good contact and to avoid pulling the igniters from the engines. Always connect igniters in parallel — never in series.

FIG. 2



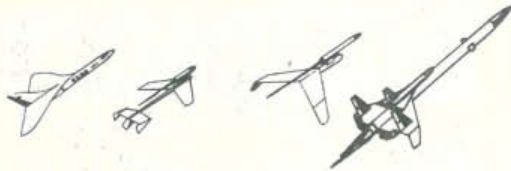
GENERAL INFORMATION

Use a heavy-duty launcher such as the Tilt-a-Pad with cluster models. When heavy rockets are being flown, the launcher should be anchored to the ground with rocks or bricks.

Before installing the engines in your cluster rocket, pack the front of each engine above the ejection end cap with flame-proof wadding. This eliminates the possibility of one engine's ejection charge igniting the ejection charge of another engine and damaging the rocket when one engine in a cluster fails to ignite at lift-off. For more complete information on clustering, see Estes Technical Report #TR-6.

BOOST-GLIDERS

Boost-gliders are models which fly straight up like any other rocket. However, they glide back to earth instead of coming down suspended from a parachute.



There are four main types of boost-gliders: Conventional front engine, conventional rear engine, poppod and parasite. Although these types appear very different, many of the same principles apply to all.

A boost-glider, as any other rocket, must be stable to fly upward. For this reason, most boost-gliders are designed with their engine mounts as far forward as possible. During glide a model must still be stable, but not by nearly so great a margin. If most or all of the engine is positioned ahead of the model's balance point, it will help make the model fly correctly.

GLIDE TESTING

A boost-glider must be "trimmed" to glide correctly before launching. Most rear engine models are trimmed by adjusting the elevons until a straight flat glide is achieved. Other models are trimmed by adding or removing weight at the nose.

When trimming a model, give it a straight, smooth, level toss into the wind and note how it performs. If it stalls, add weight to the nose. If it dives, remove weight from the nose. If it turns too much, place a very small weight on the wing which is on the outside as it turns.



Few models are as spectacular in flight and as enjoyable to watch as a good boost-glider. The rocketeer looking for a challenge will find that developing improved boost-glide designs is one of the most rewarding areas of research in model rocketry.

MODEL ROCKET ENGINES

Today's model rocketeer can choose from an amazing variety of engines to power his models. He has an engine available for almost every purpose.

The engines the rocketeer uses come in two main types: end-burning and center-burning. End-burning engines are by far the most popular with model rocketeers. They have a big advantage because they can be built to give a dual level thrust action as shown by the B6-4 thrust curve.

This design is especially effective with lightweight high performance rockets. The high initial thrust boosts the rocket to a suitable flying speed almost immediately; thrust then drops to a lower sustaining level to maintain speed and gain the most distance with the least fuel consumption.

For heavy rockets, especially those carrying large payloads, a second type of engine is available. The center-burning engine produces a very high average thrust, but only for a short period of time. This is more efficient for the heavy rocket since it brings the rocket to an adequate flying speed with less fuel than would be used by low thrust engines. The B14-5 is typical of center-burning engines.

Single and upper stage model rocket engines of both types operate the same after the propellant has been burned. The end of the propellant ignites a slow-burning smoke tracking/delay element. This "delay charge" produces no thrust, but lets the model coast upward, leaving a smoke trail behind.

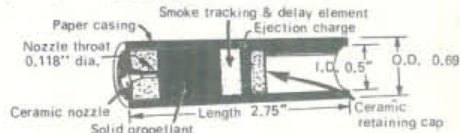
After several seconds the delay charge ignites an ejection charge which pressurizes the forward end of the rocket body to force the parachute out of the tube. (This gas pressure can be used instead to operate many types of recovery system other than parachutes.) If the correct engine is selected, ejection should occur at about the time the rocket has reached its peak altitude.

NOTICE

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 or design nor do we recommend that you attempt to build your own rocket engines.

CROSS-SECTION VIEW B6-4 ENGINE

Exhaust Velocity - 2550-2650 Ft./Sec.
Specific Impulse - 80-83 Lb.-Sec. per Lb.



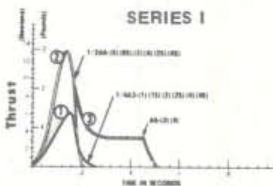
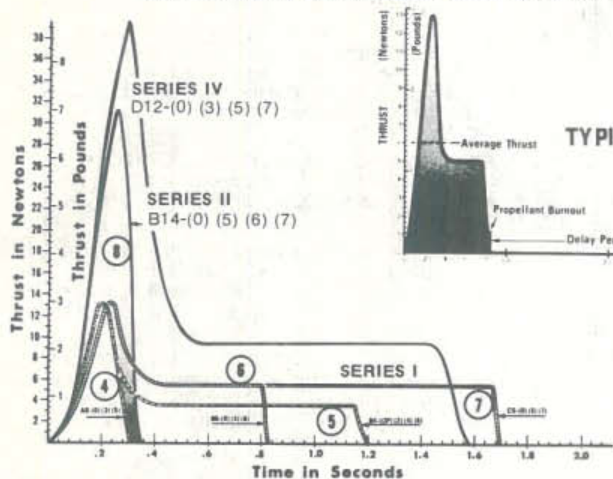
1 ENGINEERING

Today the Estes engine represents the result over 13 years' efforts in engineering, craftsmanship and quality control. The total impulse of the Estes engine is closely controlled, which allows us to make our engines very near the maximum permissible size in a given class. In addition, the average thrust peak thrust and delay times are set to give the best overall performance for sport flying and competitive events.

TOTAL IMPULSE CLASSIFICATION

Code	Pound-Seconds	Newton-Seconds
1/4A	0.14	0.625
1/2A	0.28	1.25
A	0.56	2.50
B	1.12	5.00
C	2.24	10.00

COMPARATIVE TIME/THRUST CURVES OF ALL ESTES ENGINES



2 QUALITY CONTROL

Three out of every hundred engines made by Estes Industries are 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 machines automatically reject all engines which do not contain the correct amount of propellant. All tolerances are kept as small as possible so that these engines make excellent propulsion units for contests, exhibitions and science studies.

3 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. Use common sense and follow the safety code. Don't spoil model rocketry's excellent record of safety.

4 MODEL ROCKET PERFORMANCE

HOW HIGH WILL YOUR MODEL GO? The chart below shows the approximate altitudes that can be achieved with single stage rockets.

Engine Size	Altitude Range (depending on rocket size and weight)	Approximate Altitude in a typical 1 oz. model
1/4 A3-2	50' to 250'	100'
1/2 A6-2	100' to 400'	190'
A6-3	200' to 650'	450'
B6-4	300' to 1000'	750'
C6-5	350' to 1500'	1000'

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

5 ENGINE SIZE

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 kits, components and engines produced by Estes Industries 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.

6 WEIGHT

In most cases, the heavier a rocket, the less altitude it will reach. A baseball can be tossed higher than an 8 pound cannon ball; 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.

7 WIND RESISTANCE

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 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.

MODEL ROCKETRY SAFETY CODE

1. **CONSTRUCTION**—My model rockets will be made of light-weight materials such as paper, wood, plastic and rubber, without any metal as structural parts.
2. **ENGINES**—I will use only pre-loaded factory made rocket engines in the manner recommended by the manufacturer. I will not change in any way nor reload these engines.
3. **RECOVERY**—I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.
4. **WEIGHT LIMITS**—My model rocket will weigh no more than 453 grams (16 oz.) at liftoff, and the engines will contain no more than 113 grams (4 oz.) of propellant.
5. **STABILITY**—I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.
6. **LAUNCHING SYSTEM**—The system I use to launch my model rockets must be remotely controlled and electrically operated, and will contain a switch that will return to "off" when released. I will remain at least 10 feet away from any rocket that is being launched.
7. **LAUNCH SAFETY**—I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.
8. **FLYING CONDITIONS**—I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low flying aircraft, or under any conditions which might be dangerous to people or property.
9. **LAUNCH AREA**—My model rockets will always be launched from a cleared area, free of any easy to burn materials, and I will only use non-flammable recovery wadding in my rockets.
10. **JET DEFLECTOR**—My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.
11. **LAUNCH ROD**—To prevent accidental eye injury I will always 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 never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is not in an upright position.
12. **POWER LINES**—I will never attempt to recover my rocket from a power line or other dangerous places.
13. **LAUNCH TARGETS & ANGLE**—I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.
14. **PRE-LAUNCH TEST**—When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

TECHNICAL PUBLICATIONS

For additional information on the technical aspects of model rocketry refer to the following publications:

ROCKET STABILITY: Easy-to-read report explaining how rockets are designed to fly properly and including a before-launch test to assure rocket stability.

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

MULTI-STAGING: A complete, easy-to-understand report providing the information needed for designing, building, and flying multi-stage rockets.

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

ALTITUDE TRACKING: The classic work on simple altitude tracking for model rocketeers with easy-to-understand instructions for tracking and altitude computation.

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

REAR ENGINE BOOST-GLIDERS: Basic information covering design, construction, and operation of rear engine boost-gliders.

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

BUILDING A WIND TUNNEL: Full plans and information for building and using a wind tunnel with data on both hand-powered and motorized versions.

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

CLUSTER TECHNIQUES: The complete report on clustering engines to launch larger payloads.

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

FRONT ENGINE BOOST-GLIDERS: Valuable information on designing, building, and flying front engine boost-gliders.

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

MODEL ROCKETRY STUDY GUIDE: A planned sequence of activities to guide anyone toward becoming an expert model rocketeer.

Cat. No. 711-TR-8.....\$.75

DESIGNING STABLE ROCKETS: Based on standard engineering practices, this report presents a method of

designing rockets for proper stability on paper before any construction work is done.

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

ALTITUDE PREDICTION CHARTS: Explains a relatively simple method by which aerodynamic drag and other atmospheric effects can be taken into account in predicting rocket peak altitude.

Cat. No. 711-TR-10.....\$1.00

AERODYNAMIC DRAG OF MODEL ROCKETS: All factors that influence drag are explained, and practical examples of ways to minimize drag are given.

Cat. No. 711-TR-11.....\$1.00

MODEL ROCKET ENGINES: Information on engine types, classifications, design, and performance. Time thrust curves for Estes 1/4A through C engines are provided. Designed for reproduction on overhead projection transparencies.

Cat. No. TN-1.....\$.25

MODEL ROCKET ENGINE PERFORMANCE: by Edwin D. Brown. This brochure explains the operation of model rocket engines. Well-illustrated, this 8-1/2 x 11" publication contains equations for calculating engine performance.

Cat. No. TN-2.....\$.25

MODEL ROCKET LAUNCH SYSTEMS: An easy-to-understand booklet covering basic electrical theory launcher design, multiple launchers, and electrical math.

Cat. No. 701-BK-12.....\$.25

SPACE AGE TECHNOLOGY: A comprehensive booklet about the theory of flight, history of flight, airplanes, jets, rockets, and model rockets.

Cat. No. 711-BK-14.....\$1.00



A SUBSIDIARY OF DAMON

ESTES INDUSTRIES

BOX 227, PENROSE, COLO. 81240

FLIGHT-PAK MOVIE CARTRIDGE

Cartridges contain 10 feet of Super-8mm color film for approximately 40 seconds of projection time. Two PFB-2 batteries (good for one flight) included with each cartridge. Shipping weight 4 oz.

Cat. No. 701-CFH-8

\$4.75

FLIGHT-PAK PROCESSING

You'll want top quality processing of your Flight-Pak film! After exposure, place the Flight-Pak back in its black plastic bag, package it for safe mailing, enclose \$2.00, and send to:

Estes Film Lab
Box 227
Penrose, Colo. 81240

Cat. No. 701-FDP-2

\$2.00

NOTE: The CINEROC, CAMROC, and the "D" engine rockets are recommended only for experienced rocketeers. First flights should be single stage.



Astron OMEGA

The ultimate in big engine performance blasts off heavy payloads such as the Cineroc movie camera (camera not included). Simplified pop-and-go staging.

Specifications

With Payload Section and nose cone
(for use *without* Cineroc)

Length	30.5" (77.5cm)
Body Dia.	1.637" (41.6mm)
Weight	4.0 oz. (113 gr)
Shipping wt.	15 oz.

Without Payload Section or nose cone
(for use *with* Cineroc)

Length	19.0" (48.3cm)
Body Dia.	1.637" (41.6mm)
Weight	2.6 oz. (74 gr)
Shipping wt.	14 oz.

Recommended Engines

Booster: D12-0
Upper Stage: D12-7
Single Stage Flights: D12-5
Use D12-5 for first flights.

Cat. No. 701-K-52P
(with payload sec.)

\$5.75

Cat. No. 701-K-52
(without payload sec.)

\$4.25

CAMROC

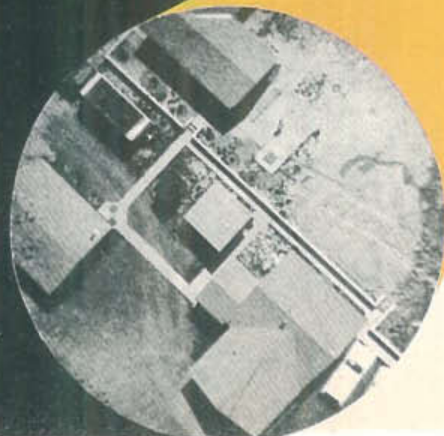
OPENS NEW VISTAS TO THE ADVANCED ROCKETEERS

Aerial photography has long been acknowledged for its value in map making, geographical studies, reconnaissance and related research fields. The Camroc aerial camera opens a new field of science studies to the rocketeer who wants to get a better understanding of the scientific uses of aerial photography. Recommended booster vehicle is the Delta. Other models can be adapted.

In addition to learning principles of camera construction and operation, many challenging aerial photographic projects can be developed.

Study space science reconnaissance techniques the practical way — over familiar terrain with known objects. Map your flight area with Camroc photos. Use photo pairs, which produce a stereoptic image when properly viewed, to emphasize geological features or estimate heights of different objects quite accurately.

Pat. No. 3,537,369



Negative: 1½" dia.
Print size: 3" dia.

Processing information
on page 35



CAMROC SPECIFICATIONS

Single exposure film negative
1½" dia. Print 3" dia. Fits body
Tube BT-50. In kit form with
all parts and assembly instructions.
Comes with 1 film holder with
unexposed film and 1 empty film
holder and exposed film disk
for practice loading and
experimenting.

Shipping wt. 7.5 oz.

Cat. No. 701C-1 \$5.00

SPECIAL OFFER

Camera kit and Astron Delta rocket
(See page 35)

Cat. No. 701RC-1 \$6.75

DEVELOPING-PRINTING

Film is developed under controlled conditions. One glossy print is made at 2 times enlargement (3" dia. image). A refund of \$9.20 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 will be returned unprinted. We recommend sending your film for processing in its original container or other totally light-tight container.

Cat. No. 691-FDP-1 **.50**

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 **.30 ea.**

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

CHANGING BAG

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

Cat. No. 701-FCB-1
\$2.25



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 Astropan 400 film disc. Film holders may be returned with the film for processing. They are reusable and subject to refund when returned as explained below. Shipping weight 2 oz.

Cat. No. 651-FFH-4 **4 for \$3.25**

REFUND PLAN ON FILM HOLDERS

A refund of \$.15 will be allowed for all film holders returned to us in good re-usable condition. When returning film holders for any reason you may deduct \$.15 for each holder returned. Unless you specifically request their return, all holders sent us will be automatically retained and the refund will be made or credit allowed.

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 \$1.25**



Astron DELTA

Recommended 2-stage booster for Camroc rocket camera (camera not included). Can be flown either single or two stage. Accommodates all BT-50 size payload sections and nose cones. Advance stage coupling for top dependability. Includes Tech Report on TR-2. Nose cone not included. Pat. No. 3,292,302

Specifications

Length	13.6" (34.5cm)
Body Dia.	0.976" (24.8mm)
Weight	1.5 oz. (43 gr)
Shipping wt.	6 oz.

Recommended Engines

		With Camroc	Without Camroc
SINGLE STAGE FLIGHTS		B14-5 C6-7	A8-3 B15-B B6-4 C6-5
	Booster	B14-0	B6-0 B14-0 C6-0
MULTI-STAGE FLIGHTS	Upper Stage	B14-6 B14-7 C6-7	B6-6 B14-7 C6-7

Cat. No. 701-K-16
\$2.25

ROCKETRONICS



- TX-1A (assembled and tested) **\$21.95**
- TX-1 (kit form).....**\$14.95**
- Accessory Kit TXA-1.....**\$ 2.95**
- Accessory Kit TXA-2.....**\$ 3.95**
- Accessory Kit TXA-3.....**\$ 5.95**
- Accessory Kit TXA-4.....**\$ 5.95**
- TC-903 Walkie-Talkie (each) ..**\$14.95**

Shipping wt. for Walkie Talkie is 16 oz. All others, 6 oz.

The Rocketronics Catalog lists all Rocketronics Kits and has a complete Technical Section. It is free upon request.

Now Estes brings a whole new concept and dimension to Model Rocketry.

The TRANSROC Transmitter (TX-1) is your basic unit. Launched in its basic module it sends back an intermittent "beep" to serve as a rocket finder or demonstration unit. After taking this first step you'll soon want to add other (not included) low-cost components to make your TRANSROC flights even more valuable. By adding the Microphone Kit (TXA-1) to the basic unit you will be able to hear, even record and analyze, all the sounds from on board your rocket, including the countdown, lift-off, stage separation, wind noises and parachute ejection. With the Spin-Rate Telemetry Kit (TXA-2) you can study the effects of the fin alignment, or conduct experiments on the effects of other aerodynamic surfaces. You can also add Temperature Telemetry Kits (TXA-3 and TXA-4) and measure temperature-versus-altitude, an exciting way of studying temperature inversions or predicting air pollution.

The TRANSROC system is available now, and is so versatile you'll be able to adapt it to all your future telemetry needs; yet the basic unit and all add-on components are engineered to fit the rocketeer's budget.

TRANSROC TRANSMITTER

When the rocket is launched, this tiny transmitter which requires no FCC license sends back an intermittent beep every second which can be received on standard walkie-talkie receivers (such as the Estes TC-903) or other Citizen's Band receivers set to any Channel in the 27 mhz. Citizen's Band (Channel 14 standard). This beacon signal is perfect for a basic demonstration of radio broadcast techniques and for recovering models difficult to locate.

The closer you approach the rocket, the stronger the signal becomes. A small 15-volt battery powers loud and clear signals with an effective range of 5 miles in flight and several hundred yards on the ground. The kit, when assembled, weighs only 0.6 oz. (without battery) and comes complete with crystal and trailing wire antenna. The battery, which operates the transmitter up to 24 hours, is not included. The device assembles in an evening, fits perfectly in a BT-50 body tube, or can be easily adapted to larger rockets.

For those with no electronic kit building experience, we suggest the completely assembled and tested TRANSROC (TX-1A.)



Measure temperature then recover rocket using the TRANSROC system.



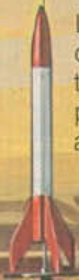
Check temperature changes or record exact moment of staging or burn-out.



Monitor the countdown and lift-off with the microphone system.



Follow the changing rocket rotation with Roll Rate Sensor. Follow the flight with the Transmitter Unit.



Listen to ejection charge for exact timing to compute precise rocket altitude.



Pick it all up with a citizen's band receiver.

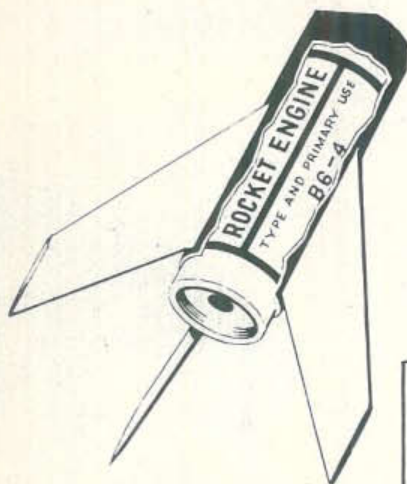
*This is a simulation only. All of these operations cannot be accomplished on the same flight.



Scott Harrison

ROCKET ENGINES quality-tested engines for high-performance flights

The finest engine made... you can depend on it... for every flight application



Designed for specific launch and flight functions, rocket engines are expendable — not reusable.

The design and development of the Estes model rocket engine was the real beginning of the safe, educational and exciting hobby that model rocketry has become.

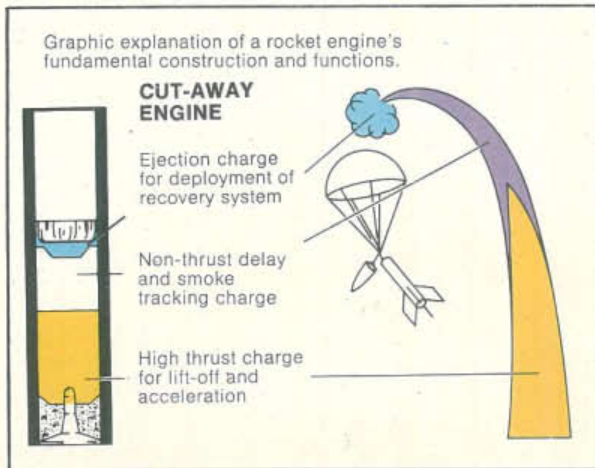
Today's modern rocket engine is the result of over 14 years of engineering efforts at Estes Industries. Consequently, today's rocketeer has dependable, safety-proven engines to carry on his rocket activities.

The energy-packed, solid-propellant Estes model rocket engine is a complete power system for your rocket. It is designed and pre-manufactured to perform all power functions for dependable launch and activation of a recovery system. In one compact package it provides thrust for quick lift-off and acceleration to high altitudes, allows for a timed delay period to reach peak

altitude while delivering smoke trail for easy tracking, and supplies ejection power for the parachute or other system for your rocket's safe return to earth.

Reliability-proven in over 30 million launchings, Estes engines are manufactured under controlled conditions within exact tolerance limits. You can count on them for consistent performance from one launch to the next. You'll launch with confidence in contest and exhibition flying.

Six power levels are available in Estes engines. Total impulse is tailored to fit the various NAR-FAI classes. Average thrust peak thrust and delay times are set up to give the best performance within these classes and to provide the most useful selection of engines for all rocketeers.



ENGINE CODING FOR QUICK-N-EASY IDENTIFICATION

1. Label color indicates recommended use of the engine.

- a. GREEN.....Single stage rockets
- b. PURPLE & BLUE...Top stage and multi-stage rockets
- c. RED.....Booster and intermediate stages of multi-stage models

2. Code designation stamped on the engine gives useful and important information on its performance capabilities.

- a. This portion indicates total impulse or total power produced by the engine.
- b. This portion shows the engine's average thrust in newtons and helps you choose the right engine for your rocket's flight.
- c. This number gives you the delay in seconds between burnout and ejection charge. Lets you choose the engine with the delay time you want for any flight.

Igniters and complete instructions are included with Estes engines.



MINI-ENGINE SELECTION CHART

Cat. No. and Engine Type	Prices	Total Impulse		Time Delay (±15%)	Maximum Lift-off Weight	
		lb-sec	n-sec			
SINGLE STAGE ENGINES*						
1/4 A3-2T	4 for \$.99	0.14	0.625	2 sec	1 oz.	
1/2 A3-2T	4 for \$1.09	0.28	1.25	2 sec	2 oz.	
A3-2T	4 for \$1.19	0.56	2.50	2 sec	3 oz.	
A3-4T	4 for \$1.19	0.56	2.50	4 sec	2 oz.	
UPPER STAGE ENGINES*						
1/4 A3-4T	4 for \$.99	0.14	0.625	4 sec	0.75 oz.	
1/2 A3-4T	4 for \$1.09	0.28	1.25	4 sec	1.00 oz.	
A3-6T	4 for \$1.19	0.56	2.50	6 sec	1.25 oz.	
BOOSTER ENGINES						
1/2 A3-0T	4 for \$1.09	0.28	1.25	none	3.50 oz.	
A3-0T	4 for \$1.19	0.56	2.50	none	3.50 oz.	
Cat. No. and Engine Type	Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight	
			Oz.	Gr.	Oz.	Gr.
SINGLE STAGE ENGINES						
1/4 A3-2T	23 oz.	0.18 sec	0.173	4.9	0.031	0.88
1/2 A3-2T	28 oz.	0.36 sec	0.198	5.6	0.062	1.75
A3-2T	28 oz.	0.86 sec	0.254	7.2	0.124	3.50
A3-4T	28 oz.	0.86 sec	0.268	7.6	0.124	3.50
UPPER STAGE ENGINES*						
1/4 A3-4T	23 oz.	0.18 sec	0.187	5.3	0.031	0.88
1/2 A3-4T	28 oz.	0.36 sec	0.212	6.0	0.062	1.75
A3-6T	28 oz.	0.86 sec	0.282	8.0	0.124	3.50
BOOSTER ENGINES						
1/2 A3-0T	28 oz.	0.36 sec	0.166	4.7	0.062	1.75
A3-0T	28 oz.	0.86 sec	0.226	6.4	0.124	3.50
Each pack of 4 engines includes 5 igniters. Designed for specific launch and flight functions, rocket engines are expendable — not reusable.						
Average thrust: 3 newtons.						
*Or, single stage engines if used in very light rockets.						
Shipping Wt. for mini-engine is 3 oz. for a pack of 4.						

MINI-ENGINE ADAPTER

Fly your short engine (Series III) bird with a mini-engine — reduce weight and get higher performance. Heavy duty construction, yet weighs only 0.09 oz.

Cat. No.
713-EM-520
35¢



Here are all the parts you'll need to design and build your own Mini-Brute Kit.

FIN STOCK

BFS-20..... 3/.40
BFS-20L..... 3/.55

Nose Cones:

BNC 5V..... .25
BNC 5E..... .25
BNC 5S..... .25
BNC 5W..... .40
BNC 5AW..... .35

Body Tubes:

BT-5 — 18" long.... .30
BT-5P — 5.1" long... .15

Engine Block:

EB-5B..... 3/.20

Engine Holder:

EH-3..... 3/.60

Adapter Ring

AR-520..... 3/.20

Balsa Tube Adapter:

TA-520..... .30
TA-550..... .35

Stage Coupler:

JT-5C..... .10

Parachute:

PK-8..... .35

Small Parts:

Screw-Eye SE-3... 6/.30

Nose Cone Weights:

NCW-4..... 20/.40



A SUBSIDIARY OF DAMON

ROCKET ENGINE SELECTION CHART

Prices and Specifications

Data for correct engine choice

Cat. No and Engine Type	Prices 3 for	Total Impulse		Time Delay ($\pm 15\%$)	Maximum Lift-off Weight With Engines	Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight		Replaces Old Engine Type	Notes:
		lb sec ¹	n-sec ¹					Oz.	Gr.	Oz.	Gr.		
SINGLE STAGE ENGINES						GREEN LABEL							Complete instructions and igniter (NW-1) are included with each rocket engine ordered from Estes Industries. All Series I and II engines are 2.75 in. long and 0.690 in. dia. ¹ Pound seconds. ² Newton seconds (figures shown are maximum.) ³ Closest previous equivalent is shown.
1/4A3-2	\$.80	0.14	0.625	2 sec	1.0 oz.	22 oz.	0.24 sec	0.50	14.2	0.027	0.78	.....
1/2A6-2	\$.90	0.28	1.25	2 sec	2.5 oz.	46 oz.	0.20 sec	0.53	15.0	0.055	1.56	1/2A 8-2	
A5-2	\$1.00	0.56	2.50	2 sec	3.0 oz.	46 oz.	0.50 sec	0.59	16.7	0.110	3.12	.....
A8-3	\$1.00	0.56	2.50	3 sec	4.0 oz.	48 oz.	0.32 sec	0.57	16.2	0.110	3.12	.....
B4-2	\$1.10	1.12	5.00	2 sec	4.0 oz.	48 oz.	1.20 sec	0.70	19.8	0.294	8.33	B 8-2	
B4-4	\$1.10	1.12	5.00	4 sec	3.5 oz.	48 oz.	1.20 sec	0.74	21.0	0.294	8.33	B 8-4	
B6-2	\$1.10	1.12	5.00	2 sec	3.0 oz.	48 oz.	0.83 sec	0.68	19.3	0.220	6.24	.....
B6-4	\$1.10	1.12	5.00	4 sec	4.5 oz.	48 oz.	0.83 sec	0.78	22.1	0.220	6.24	B 8-4	
B14-5*	\$1.30	1.12	5.00	5 sec	5.0 oz.	7 lb.	0.35 sec	0.69	19.6	0.220	6.24	B 3-5	
C6-3	\$1.30	2.25	10.00	3 sec	4.0 oz.	48 oz.	1.70 sec	0.88	24.9	0.440	12.48	.....
C6-5	\$1.30	2.25	10.00	5 sec	4.0 oz.	48 oz.	1.70 sec	0.91	25.8	0.440	12.48	.....
UPPER STAGE ENGINES⁴						PURPLE or BLUE LABEL							⁴ OR single stage engines if used in very light rockets. ⁵ Replaces both 1/4A 8 and 1/2A 1 booster engines. ⁶ Static test engine with plug to prevent blow through.
1/2A6-4	\$.90	0.28	1.25	4 sec	1.0 oz.	46 oz.	0.20 sec	0.54	15.3	0.055	1.56	1/2A 8-4	
A5-4	\$1.00	0.56	2.50	4 sec	1.5 oz.	46 oz.	0.50 sec	0.64	18.1	0.110	3.12	A B-4	
A8-5	\$1.00	0.56	2.50	5 sec	2.0 oz.	48 oz.	0.32 sec	0.62	17.6	0.110	3.12	.....
B4-6	\$1.10	1.12	5.00	6 sec	1.5 oz.	48 oz.	1.20 sec	0.78	22.1	0.294	8.33	B 8-6	
B6-6	\$1.10	1.12	5.00	6 sec	2.0 oz.	48 oz.	0.83 sec	0.71	20.1	0.220	6.24	B 8-6	
B14-7*	\$1.30	1.12	5.00	7 sec	2.5 oz.	7 lb.	0.35 sec	0.73	20.7	0.220	6.24	B 3-7	
C6-7	\$1.30	2.25	10.00	7 sec	2.5 oz.	48 oz.	1.70 sec	0.95	26.9	0.440	12.48	.....
BOOSTER ENGINES						RED LABEL							See Page 44 For Igniters Shipping wt. of each engine is approximately 1 1/2 oz.
1/2A6-0	\$.90	0.28	1.25	none	4.0 oz.	46 oz.	0.18 sec	0.48	13.6	0.055	1.56	1/2A 8-0 ⁵	
A8-0	\$1.00	0.56	2.50	none	4.0 oz.	48 oz.	0.30 sec	0.51	14.2	0.110	3.12	.....
B8-0	\$1.10	1.12	5.00	none	4.0 oz.	48 oz.	0.80 sec	0.58	16.4	0.220	6.24	B 8-0	
B14-0*	\$1.30	1.12	5.00	none	6.0 oz.	7 lb.	0.35 sec	0.61	17.3	0.220	6.24	B 3-0	
C6-0	\$1.30	2.25	10.00	none	4.0 oz.	48 oz.	1.68 sec	0.80	22.7	0.440	12.48	C 8-0	

*Series II Engine

MIGHTY 'D' ENGINES

Cat. No. and Engine Type	Prices 3 for	Total Impulse		Time Delay (±15%)	Maximum Lift-off Weights With Engines	Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight		Recommended Use	Notes:
		lb sec ¹	n-sec ²					Oz.	Gr.	Oz.	Gr.		
D12-0	\$2.25	4.48	20.00	none	13.0 oz.	9 lb.	1.48 sec	1.44	40.9	0.879	24.93	Booster Engine	Complete instructions and igniter (NWI-1) are included with each rocket engine ordered from Estes Industries.
D12-3	\$2.25	4.48	20.00	3 sec	13.0 oz.	9 lb.	1.50 sec	1.49	42.2	0.879	24.93	Single Stage	
D12-5	\$2.25	4.48	20.00	5 sec	10.0 oz.	9 lb.	1.50 sec	1.52	43.1	0.879	24.93	Single Stage	
D12-7	\$2.25	4.48	20.00	7 sec	8.0 oz.	9 lb.	1.50 sec	1.55	44.0	0.879	24.93	Single or Upper	

ESTES 'D' POWER FOR HIGH ALTITUDE PERFORMANCE, BIG PAYLOAD LAUNCHES



RECOMMENDED ONLY FOR EXPERIENCED ROCKETEERS

With the advancement of model rocketry to bigger birds, larger payloads and higher altitude demands, Estes Industries has developed the 'D' engine (Series IV).

The Estes big 'D' provides twice the power of the largest Series I engine. It's the first dependable 'D' engine to provide the consistent high-thrust and total impulse levels necessary for peak performance in its class.

Precision manufacturing capability, experience and quality control at Estes Industries assure superior and consistent performance for Estes 'D' power — the same quality and reliability which have been proven in over 30 million Estes-powered launches.

When flying your rockets with the more powerful 'D' engines give even greater consideration to normal safety precautions. Refer to items 5, 6, 7, 13 and 14 in the safety code on inside back cover.

Shipping wt. of each engine is approximately 2 1/4 oz.

All Series IV engines are 2.75 in. long and 0.945 in. dia.

¹Pound seconds.

²Newton seconds (figures shown are maximum.)

³Closest previous equivalent is shown.

⁴OR single stage engines if used in very light rockets.

Series III engines are 1.75 in. long and 0.690 in. dia.

SHORT ENGINES

Cat. No. and Engine Type	Prices 3 for	Total Impulse		Time Delay (±15%)	Maximum Lift-off Weights With Engines	Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight		Replaces Old Engine Type ³
		lb sec ¹	n-sec ²					Oz.	Gr.	Oz.	Gr.	
SINGLE STAGE ENGINES												
GREEN LABEL												
1/4A3-2S	\$.85	0.14	0.625	2 sec	1.0 oz.	22 oz.	0.24 sec	0.38	10.8	0.027	0.78	.....
1/2A6-2S	\$.90	0.28	1.25	2 sec	2.5 oz.	46 oz.	0.20 sec	0.41	11.6	0.055	1.56	1/2A 8-2S
A5-2S	\$1.00	0.56	2.50	2 sec	3.0 oz.	46 oz.	0.50 sec	0.47	13.3	0.110	3.12	.....
UPPER STAGE ENGINES⁴												
PURPLE or BLUE LABEL												
1/2A6-4S	\$.90	0.28	1.25	4 sec	1.0 oz.	46 oz.	0.20 sec	0.42	11.9	0.055	1.56	1/2A 8-4S
A5-4S	\$1.00	0.56	2.50	4 sec	1.5 oz.	46 oz.	0.50 sec	0.52	14.7	0.110	3.12	.....
BOOSTER ENGINES												
RED LABEL												
1/2A6-0S	\$.90	0.28	1.25	none	4.0 oz.	46 oz.	0.18 sec	0.36	10.2	0.055	1.56	1/2A 8-0S
A5-0S	\$1.00	0.56	2.50	none	3.0 oz.	46 oz.	0.48 sec	0.42	11.9	0.110	3.12	.....

NEW LAUNCH CONTROL SYSTEM
AND SOLAR IGNITERS



FS-10 available May 1, 1972

**ESTES "NEW" SOLAR
LAUNCH CONTROL SYSTEM**

This futuristically designed launch control unit requires only 4 pen light batteries for power. Advanced shape allows for perfect hand held control. Unit is easily assembled in minutes and features safety key, continuity check lamp, and 15 feet of lightweight launch cable. System is constructed of durable "non-breakable" plastic. "Micro-clips" are presoldered. Use with Estes new solar igniters (NWH-2) (batteries not included).

Shipping weight 8 oz.
Cat. No. 721- FS-10 **\$2.95**

NWI-2 available May 1, 1972

**"NEW" from ESTES ...
... SOLAR IGNITERS**

Add increased reliability at lift-off with Estes "NEW" high performance Solar Igniter. This uprated igniter is designed especially for the new ESTES SOLAR LAUNCH CONTROL SYSTEM, FS-10. Features easy engine installation and is suitable for all ESTES launch control systems. Requires only a 6 volt power source.



Shipping weight 1 oz.
Cat. No. 721- NWI-2 **6 for 3**

LAUNCHERS

TILT-A-PAD Wooden Tripod

This flexible launcher gives you ideal launch control and convenience. Tripod stand permits launching of rockets up to 12 oz. (and adjusts to fit uneven ground). Tilts to compensate for wind direction and speed. Legs fold down for compact storage. Comes in easy to assemble kit form with complete instructions. Shipping wt. 2 lbs.

Cat. No. 701-RL-3..... **\$3.75**

PORTA-PAD Plastic Tripod

Space-age designed, the Porta-Pad is rugged enough to take the stress of countless launchings, even with the big Estes "D" engines, yet is lightweight and compact enough for easy carrying and storage. Strong, girder construction, yellow plastic legs snap off for storage in field box. Friction grip secures rod firmly (accommodates standard $\frac{1}{8}$ " rod or heavy-duty $\frac{3}{16}$ " rod). Tilt adjustment allows you to compensate for wind. For extra versatility, adapt your Porta-Pad for rail launchings (see page 47) by using a separate blast deflector.No. BD-1 (see page 46). Shipping weight 1 lb., 8 oz.

Cat. No. 701-RL-4..... **\$3.25**

TILT-A-PAD
Wooden Tripod

PORTA-PAD
Plastic Tripod





The recommended electrical system for use with the Tilt-a-Pad and Porta-Pad is the FS-5 Launch Control System (see page 45) and a 6- or 12-volt car battery or other power source.

Rocket not included.

LAUNCHING SUPPLIES and ACCESSORIES

	<p>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</p>
	<p>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. For a constant 1/8" diameter launch rod, join two or three add-on sections together. Shipping weight 6 oz. Cat. No. 701-RLR-3..... \$.25 per section</p>
	<p>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. 701-BD-1..... \$.50</p>
	<p>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. 701-BD-2..... \$.55</p>
	<p>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 No. 3,363,559). Shipping weight 1 oz. Cat. No. 701-NWI-1..... 6 for \$.30</p>
	<p>SWIVEL ASSEMBLY: Perfect launcher swivel for all launchers. Provides 360° rotation and full tilt adjustments, yet locks securely in selected position. Handles 1/8" rod, 3/16" rod, and C-rail. Shipping weight 3/4 oz. Cat. No. 711-LP-2..... \$1.50</p>

	<p>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. No. 30, 15-FOOT ROLL: Cat. No. 651-NW-30A..... \$.60 No. 32, 15-FOOT ROLL: Cat. No. 651-NW-32A..... \$.50</p>
	<p>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. 701-MT-1..... \$.55</p>
	<p>MICRO-CLIPS: Equip your launcher with the best. Spring-loaded solid copper clips connect 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 \$.35</p>
	<p>BATTERY CLIPS: Ideal for hookup to car batteries, heavy duty clips connect to terminals up to 1" in dia. Clips are 3" long, available with black and red insulators. Specify color(s) when ordering. Shipping weight 5 oz. Cat. No. 701-BC-1..... 2 for \$.90</p>
	<p>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. 701-LW-12..... \$.85</p>

ELECTRICAL EQUIPMENT



PILOT LIGHT HOLDER: Adds visual control to launch panel. 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. 701-LH-1..... \$.95



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

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



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

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



KEY SAFETY SWITCH: 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. Shipping weight 4 oz.

Cat. No. 691-KSW-1A..... \$3.00

EXTRA KEY: Cat. No. 651-KSW-1K..... \$.50



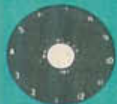
PUSH BUTTON SWITCH: Heavy duty construction momentary type, SPST, normally open. Excellent for use as a firing switch. Mounts in 1/2" hole. Shipping weight 4 oz.

Cat. No. 651-SWM-1..... \$1.25



ROTARY SWITCH: Twelve position single pole rotary switch — use as a selector switch with firing systems using more than one launcher. Non-shorting, mounts in 3/8" hole. Shipping weight 5 oz.

Cat. No. 701-SWR-1..... \$2.25



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. 701-DP-1..... \$.45



SOLDERING IRON: 25 watt. Develops up to 720°F. Handle remains cool. Replaceable, pre-tinned nickel-plated tip. Use with rosin core solder. Shipping weight 1 lb.

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

LAUNCH EQUIPMENT



COMPLETE LAUNCH CONTROL SYSTEM: Use with a 12 volt car battery (no need to remove battery from car; just connect the Launch Control System's battery clips to the battery terminals) for any model, including the large birds. If you don't have access to a car battery, use a Ray-O-Vac No. 918 Eveready No. 731, or a Burgess TW-1, available at most hardware stores. Shipping weight 12 oz.

Cat. No. 701-FS-5..... \$3.75



MULTI-PAD: Ideal for clubs. Sequentially launches 1 to 6 models. Plug-in an extra rack to increase capacity to 12. Operates from any 12-volt car battery. Safety key switch for power supply. Panel lights for power supply and for continuity check for each pad. Public address system. Shipping weight 24 lbs.

Cat. No. 711-MFS-1..... \$150.00



ALTISCOPE: Find out how high it went with Altiscope! Can also be used to find heights of trees, buildings, mountains, poles, etc. Comes in kit form complete with instructions, trig tables, technical report TR-3 on altitude tracking and 2-D altitude computer. Patent No. 3,208,147. Shipping weight 20 oz.

Cat. No. 701-A-1..... \$3.95



LAUNCH RAILS: Rigid aluminum 'C' rails offer countless new possibilities for your launcher designs.

'C' RAIL: 3/8" square (outside). Comes in 18" long sections. Durable aluminum for long life and rust-free service. Use at least 2 sections connected with a joiner (see below) for launch rail. Shipping weight 6 oz.

Cat. No. 681-LR-18A..... 2 for \$130

RAIL JOINER: Spring clip 2" long by 1/4" wide, fits inside rail ends, holds two rail sections securely together for assembling launch rails 36" long and longer. Shipping weight 2 oz.

Cat. No. 691-RJ-18A..... \$.40 each

RECOVERY EQUIPMENT AND 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 0.0075" 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. Shipping weight 2 oz.

Cat. No.	Parachute Diameter	Net Weight	Price Each
701-PK-8	8 inches	.035 oz.	\$.35
701-PK-12	12 inches	.078 oz.	\$.35
701-PK-18	18 inches	.144 oz.	\$.45
701-PK-24	24 inches	.298 oz.	\$.60

ALUMINIZED PARACHUTE MATERIAL: Fire-resistant, extra strong coated polyethylene. 3 feet x 3 feet. 1.25 mil. thick. Shipping weight 2 oz.

Cat. No. 711-PM-3..... **2 for \$1.50**



STREAMER MATERIAL: Bright orange, flame resistant crepe paper streamers. In 7½-foot lengths, enough for two to eight streamers. Specify size when ordering. Shipping weight 1 oz.

1" wide — Net wt. .092 oz. **6 for \$.70**

2" wide — Net wt. .184 oz. **6 for \$.90**



RECOVERY WADDING: Gives 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. 701-RP-1A..... **\$.40**



SHROUD LINES: Build reliable, durable custom parachutes with this strong, hard surface shroud line cord. Comes in 72 yard spools. Shipping wt. 5 oz.
Cat. No. 701-SLT-1..... **\$.50**



SCREW EYES: Specify size when ordering. Shipping weight for 3 eyes 1 oz.

LARGE EYE: 1" long; .04 oz. **6 for \$.30**

SMALL EYE: ¾" long; .03 oz. **6 for \$.30**

EXTRA SMALL EYE: ½" long; .01 oz. **6 for \$.30**



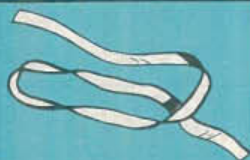
TAPE DISCS: Fasten shroud lines to plastic chutes or streamers with these ¾" pressure sensitive tape discs. Shipping weight for 12 discs, 1 oz.

Cat. No. 651-TD-1..... **2 sheets of 12 for \$.40**



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..... **2 sheets of 35 for \$.60**



SHOCK CORD: Specify width when ordering. Shipping weight 1 oz.

½" wide: Net wt. 0.039 oz., Cat. No. 671-SC-1 **\$.10**

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

Also 36" long for greater stretch on those larger birds.

⅜" wide: Net wt. 0.078 oz., Cat. No. 681-SC-3 **\$.20**

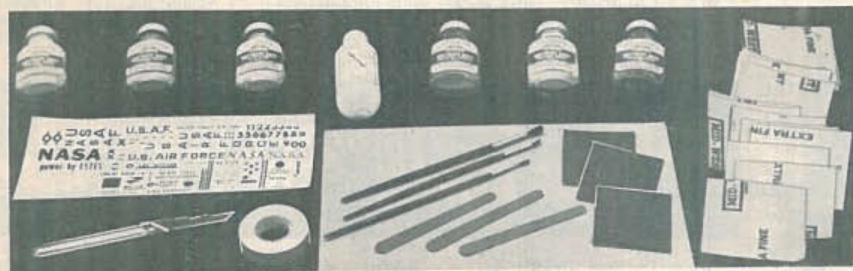


SNAP SWIVELS: For quick changes and reduced tangling in your recovery systems, use these tiny 1" long snap swivels. Net weight .01 oz. Shipping weight for 6 swivels 1 oz.

Cat. No. 701-SV-12..... **12 for \$.80**

ASSEMBLY SPECIAL A Complete Construction and Finishing Set

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.



- | | | |
|--------------------------------------|-----------------------------------------|--------------------------------|
| 1 Bottle White Glue No. WG-1 | 1 Bottle Dope Thinner No. BDT-1 | 1 Knife No. KNS-3 |
| 3 Emery Boards No. BE-1 | 18 Sheets Sandpaper No. SPA-2 | |
| 1 Bottle Sanding Sealer No. SS-1 | 1 Bottle White Dope No. BRD-1 | 3 Paint Brushes No. PB-3 |
| 1 Bottle Silver Dope No. BRD-1 | 1 Roll Masking Tape No. MT-1 | 1 Bottle Orange Dope No. BRD-1 |
| 3 Sheets Sanding Material No. SP-320 | 1 Bottle Black Dope No. BRD-1 | |
| | 1 Gold Mine Special Decal Sheet No. D-5 | |

Cat. No. 701-CK-3A, shipping wt. 1.5 lb. \$4.75

RANGE BOX

Good-looking, roomy, tough all-metal box. 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. 701-RB-1..... \$4.25

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. 701-RB-2..... \$9.50



BUILDING WITH ESTES SUPPLIES



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. Designed around the durable BT-30 body tube... for easy to build, long-lasting "birds."

Contains all parts and supplies necessary 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. A good basic assortment for studies in aerodynamics, stability and recovery techniques. Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Ideal range box. Shipping wt. 1 lb., 14 oz.

Cat. No. 701-ES-55..... **\$7.50**

BODY TUBES

6 Body Tubes#BT-30

NOSE CONES

2 Nose Cones #BNC-30C
1 Nose Cone ...#BNC-30D
1 Nose Cone ...#BNC-30E
1 Nose Cone ...#BNC-30M
1 Nose Cone ...#BNC-30N

RECOVERY EQUIPMENT

2 Parachutes ...#PK-12A
1 Parachute#PK-8A
1 Parachute Material #PM-2

1 Streamer Material #SM-1
1 Sheet Tape Strips #TD-2
1 Roll Shroud Lines #SLT-1
6 Shock Cords#SC-1
6 Screw Eyes#SE-2

FIN MATERIAL

4 Balsa Fin Stock #BFS-20
2 Balsa Fin Stock #BFS-30

MISCELLANEOUS

6 Engine Blocks #EB-30A
3 Launch Lugs ...#LL-2C
1 Design Manual ...#P-1
1 Fin Pattern Sheet #PP-2
1 Fin Pattern Sheet #PP-3

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. Shipping wt. 2 lbs., 5 oz.

Cat. No. 701-ES-110..... **\$12.95**

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Ideal range box.

NOSE CONES

1 #BNC-60L 1 #BNC-20
1 #BNC-30E 1 #BNC-2C
1 #BNC-30M 1 #BNC-1C
1 #BNC-20A 1 #BNC-10

FIN MATERIAL

1 Balsa Sheet#BFS-
2 Balsa Sheets#BFS-
3 Balsa Sheets#BFS-
2 Balsa Sheets#BFS-

BODY TUBES

1 #BT-60 2 #BT-2
2 #BT-30 2 #BT-10

BULKHEADS AND HOLDER

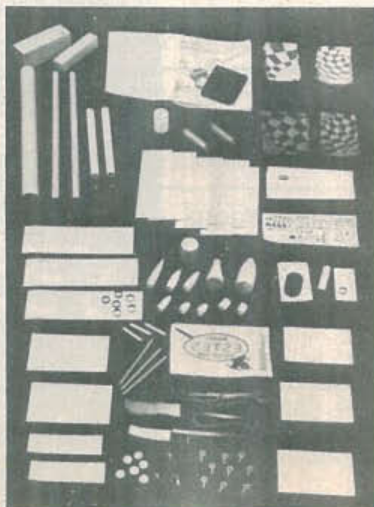
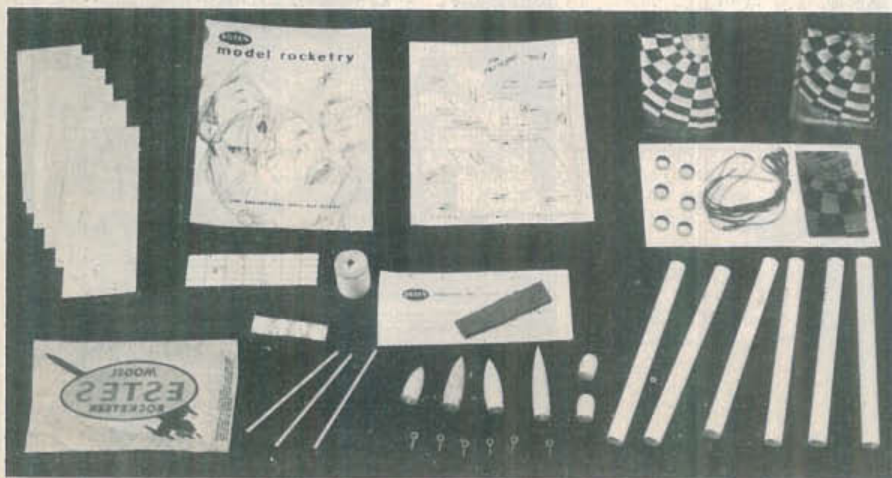
1 #NB-60 3 #EB-30
1 #NB-30 3 #EB-20
1 #NB-20 1 #EH-20E

RECOVERY EQUIPMENT

1 Parachute#PK-8
2 Parachutes#PK-12
1 Parachute#PK-15
1 Parachute#PK-24
1 Parachute Material ...#PM-
1 Streamer Material ...#SM-
2 Sheets Tape Strips ...#TD-
1 Roll Shroud Lines....#SLT-
3 Snap Swivels#SV-1
9 Screw Eyes#SE-
6 Shock Cords#SC-
1 Shock Cord#SC-

MISCELLANEOUS

1 Balsa Adapter#TA-20E
1 Adapter Set#TA-
1 Nose Cone Stock#NCS-
1 Nose Cone Stock#NCS-
3 Nose Cone Dowels#NCD-
6 Nose Cone Weights #NCW-
3 Reinforcing Material #PRM-
3 Launching Lugs#LL-2
1 Decal Sheet#D-
1 Design Manual#P-
1 Fin Pattern Sheet#PP-
1 Fin Pattern Sheet#PP-

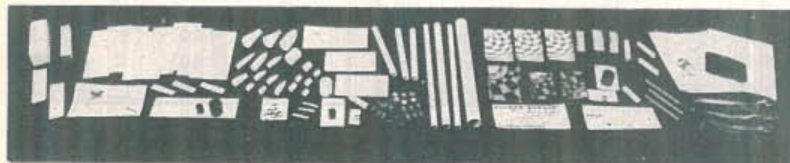


ORBIT SPECIAL

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Ideal range box.

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 change to run free on many rocket projects and experiments. Valuable design manual included. Shipping weight 2 lbs., 9 oz.

Cat. No. 701-ES-165 \$18.75



NOSE BLOCKS, ENGINE BLOCKS, HOLDERS, ETC.

- 1 Nose Block#NB-60
- 1 Nose Block#NB-50
- 1 Nose Block#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

BODY TUBES

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

ADAPTERS

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

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

RECOVERY EQUIPMENT

- 1 Parachute Material ..#PM-2
- 2 Parachutes#PK-8A
- 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

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
- 3 Reinforcing Material #PRM-1
- 1 Reinforcing Material #GR-2
- 6 Launching Lugs ...#LL-2C
- 1 Decal Sheet#D-5
- 1 Decal Sheet#D-6
- 1 Design Manual#P-1
- 1 Fin Pattern Sheet...#PP-2
- 1 Fin Pattern Sheet...#PP-3

RANGE KIT SPECIAL



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

- | | | |
|----------------------|-------------------------------------|------------------------|
| 21 Igniters | 2 Packs Flameproof Recovery Wadding | 3 Launching Lugs |
| 1 Bottle White Glue | 4 Parachutes | 18 Sheets Sandpaper |
| 1 Knife Handle | 1 Streamer Material | 1 Engine Holder |
| 3 Knife Blades | 3 Screw Eyes | 1 Reinforcing Material |
| 1 Tweezers | 3 Nose Cone Weights | 3 Snap Swivels |
| 5 Flight Data Sheets | 1 Roll Masking Tape | 4 Shock Cords |
| 1 Roll Shroud Lines | 2 Balsa Fin Stock | 1 Emery Board |
| 1 Sheet Tape Strips | | 2 Micro-Clips |

Shipping weight 2 lbs., 13 oz. Sorry, no substitutions.

Cat. No. 701-RBK-1 \$9.50

ROCKET BODY TUBES

Cat. No.	Price Each	Length	Inside Diameter	Outside Diameter	Wall Thickness	Wt. in Ounces Net	Ounces Ship.
Spiral-Wound Paper Tube, for nose sections and strap-on payloads							
651-BT-5	\$.30	18"	0.515"	0.541"	0.013"	.219	11
Mylar Plastic Tube, for featherweight models							
701-BT-10	\$.30	9"	0.710"	0.720"	0.005"	.088	4
Spiral-Wound Paper Tube, for competition and sport models							
651-BT-20	\$.30	18"	0.710"	0.736"	0.013"	.288	11
651-BT-20B	\$.15	8.65"	0.710"	0.736"	0.013"	.138	4
651-BT-20J	\$.10	2.75"	0.710"	0.736"	0.013"	.044	4
Parallel-Wound Paper Tube, for sport models							
701-BT-30	\$.30	9"	0.725"	0.765"	0.021"	.270	4
Spiral-Wound Paper Tube, for sport and high performance payload models							
651-BT-50	\$.40	18"	0.950"	0.976"	0.013"	.378	11
701-BT-50W	\$.30	9.5"	0.950"	0.976"	0.013"	.200	5
Spiral-Wound Paper Tube, for sport and demonstration models							
701-BT-55	\$.60	18"	1.283"	1.325"	0.021"	.672	11
Spiral-Wound Paper Tube, for sport and demonstration models							
701-BT-60	\$.65	18"	1.595"	1.637"	0.021"	.960	11
701-BT-60D	\$.50	11"	1.595"	1.637"	0.021"	.583	11
Spiral-Wound Paper Tube, for monster models and tail rings							
651-BT-70	\$.85	17.5"	2.175"	2.217"	0.021"	1.30	14
Spiral-Wound Paper Tube, for general purpose models							
711-BT-101	\$1.75	16 1/2"	3.896"	3.938"	0.021"	1.974	16
Clear Plastic Tubes, for payload sections							
651-PST-20	\$.30	8"	0.710"	0.736"	0.013"	.168	4
651-PST-20J	\$.15	2.75"	0.710"	0.736"	0.013"	.058	4
701-PST-50S	\$.25	4"	0.950"	0.976"	0.013"	.110	4
701-PST-60R	\$.50	5"	1.595"	1.637"	0.021"	.350	6
701-PST-65R	\$.55	5"	1.750"	1.796"	0.023"	.450	6

BALSA BLOCKS

Just the handy odds-and-ends you always need — but rarely have.

You can build accessories for your launch pad. Make repairs. Customize. The handiest bag you'll ever find.

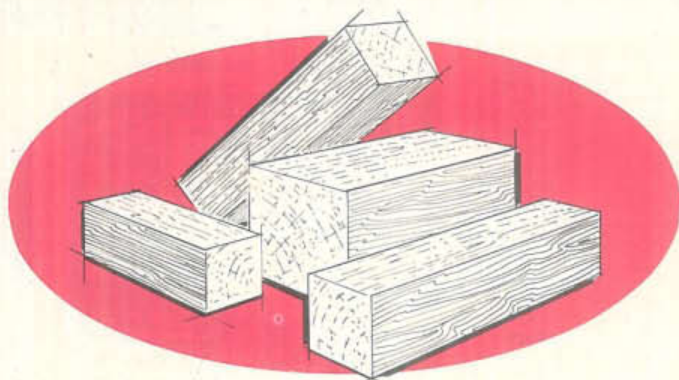
Shipping weight 15 oz.

Cat. No. 711-NCS-10.....\$1.00



PAYLOAD SECTIONS

Cat. No.	Price Each	Body Mat'l.	Weight oz. Net	Ship.	Fits	Inside Dia.	Inside Length	Overall Length
651-PS-20A	\$.80	Clear Plastic	.16	1	BT-20	.710"	2"	4"
651-PS-20C	\$.85	Clear Plastic	.40	4	BT-20	.950"	3"	7"
651-PS-30B	\$.65	Regular Tube	.24	1	BT-30	.725"	2"	3.75"
651-PS-50A	\$.90	Clear Plastic	.39	4	BT-50	.950"	3"	6.50"
701-PS-50C	\$1.85	Clear Plastic	1.0	11	BT-50	1.59"	4"	10.5"
701-PS-50E	\$1.85	Clear Plastic	1.1	11	BT-50	1.75"	4"	10.5"
701-PS-55B	\$1.25	Regular Tube	.53	11	BT-55	1.28"	3"	7.63"
701-PS-60A	\$1.75	Clear Plastic	.98	11	BT-60	1.59"	4"	9.50"
701-PS-60C	\$1.75	Clear Plastic	1.0	11	BT-60	1.75"	4"	9.50"



BALSA BLOCKS FOR NOSE CONES

You can order nose cone stock in 4" to 6" lengths, perfect for turning your own nose cone shapes. These are cut-off pieces from our manufacturing process. Slightly damaged corners will not interfere with their usability. With each block ordered, Estes includes a nose cone dowel, NCD-2.

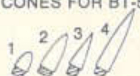



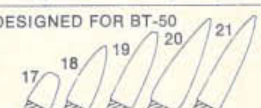





1" x 1" blocks, shipping wt. 1 oz., Cat. No. 691-NCS-1A.....ea. \$.15

2" x 2" blocks, shipping wt. 3 oz., Cat. No. 691-NCS-2A.....ea. \$.20

NOSE CONES



Nose cone dimensions listed to the right, columns 1, 2 and 3.

DESCRIPTION	No.	Catalog No.	Price Each	Dimension 1	Dimension 2	Dimension 3	Average Weight	Ship. Weight
LIGHTWEIGHT CONES FOR BT-5 	1	651-BNC-5V	\$.25	3/4"	0.541"	1/4"	0.013 oz.	1 oz.
	2	651-BNC-5E	\$.25	1-3/8"	0.541"	1/4"	0.020 oz.	1 oz.
	3	651-BNC-5S	\$.25	1-1/2"	0.051"	1/4"	0.016 oz.	1 oz.
	4	651-BNC-5W	\$.40	2-7/8"	0.541"	1/4"	0.039 oz.	2 oz.
PERFECT FOR BT-10 	5	651-BNC-10A	\$.25	13/16"	0.728"	1/4"	0.03 oz.	1 oz.
	6	701-BNC-10B	\$.30	1-11/16"	0.728"	5/16"	0.05 oz.	1 oz.
VARIETY FOR BT-20 	7	651-BNC-20A	\$.25	13/16"	0.736"	1/4"	0.03 oz.	1 oz.
	8	701-BNC-20P	\$.40	1-5/16"	0.900"	7/16"	0.07 oz.	4 oz.
	9	701-BNC-20B	\$.30	1-11/16"	0.736"	5/16"	0.05 oz.	1 oz.
	10	651-BNC-20R	\$.40	2-3/4"	0.736"	3/8"	0.07 oz.	2 oz.
	11	651-BNC-20N	\$.45	2-3/4"	0.736"	1/2"	0.08 oz.	2 oz.
BALSA BEAUTIES FOR BT-30 	12	651-BNC-30C	\$.30	3/4"	0.767"	3/8"	0.04 oz.	1 oz.
	13	701-BNC-30D	\$.35	1-1/2"	0.767"	3/8"	0.06 oz.	1 oz.
	14	651-BNC-30M	\$.40	1-1/2"	0.767"	1/2"	0.06 oz.	1 oz.
	15	701-BNC-30E	\$.45	2-3/16"	0.767"	7/16"	0.07 oz.	1 oz.
	16	701-BNC-30N	\$.50	2-3/4"	0.767"	1/2"	0.08 oz.	2 oz.
DESIGNED FOR BT-50 	17	651-BNC-50J	\$.40	1-3/8"	0.976"	1/2"	0.08 oz.	4 oz.
	18	701-BNC-50K	\$.50	2-3/4"	0.976"	1/2"	0.13 oz.	4 oz.
	19	701-BNC-50X	\$.60	3-1/4"	0.976"	1/2"	0.15 oz.	4 oz.
	20	671-BNC-50AD	\$.75	4-1/16"	1.300"	1/2"	0.25 oz.	6 oz.
	21	651-BNC-50Y	\$.75	4-3/8"	0.976"	3/8"	0.16 oz.	6 oz.
JUST RIGHT FOR BT-55 	22	651-BNC-55AA	\$.75	3-1/8"	1.325"	1/2"	0.15 oz.	4 oz.
	23	701-BNC-55F	\$.80	3-7/8"	1.325"	1/2"	0.19 oz.	4 oz.
	24	701-BNC-55AC	\$.90	5-3/8"	1.325"	3/8"	0.32 oz.	6 oz.
	25	711-BNC-55AD	\$.90	5"	1.325"	3/4"	0.43 oz.	4 oz.
	EXCLUSIVELY FOR BT-60 	26	701-BNC-60AB	\$.75	2-5/8"	1.637"	3/8"	0.23 oz.	4 oz.
27		651-BNC-60T	\$.75	2-7/8"	1.637"	1/2"	0.17 oz.	4 oz.
28		651-BNC-60L	\$.75	3-1/8"	1.637"	5/8"	0.34 oz.	4 oz.
29		681-BNC-60AH	\$1.50	7-1/4"	1.637"	7/8"	1.0 oz.	6 oz.
IDEAL FOR PST-65 		30	701-BNC-65L	\$.85	3-1/4"	1.796"	1/2"	0.41 oz.	4 oz.
FITS BT-70 	31	681-BNC-70AJ	\$1.50	4-1/4"	2.217"	1"	0.85 oz.	6 oz.
TAIL CONE FOR BT-55 (With pre-drilled hole) 	32	701-BTC-55Z	\$1.00	3"	1.325"	1/2"	0.25 oz.	4 oz.

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.	Price	Dimensions (In Inches)	Weight oz.		Major Use
			Net	Ship.	
701-BFS-10	3 for \$.50	1/32 x 3 x 9	.065	4	High Performance
651-BFS-20	3 for \$.40	1/16 x 3 x 9	.130	4	High Performance
651-BFS-20L	3 for \$.55	1/16 x 3 x 12	.173	6	High Performance
651-BFS-20B	2 for \$.10	1/16 x 1/2 x 6	.015	2	Glider Elevon
651-BFS-30	3 for \$.45	3/32 x 3 x 9	.150	4	Sport Models
651-BFS-30L	3 for \$.60	3/32 x 3 x 12	.200	6	Sport Models
701-BFS-40	3 for \$.55	1/8 x 3 x 9	.200	4	Cluster Rockets
701-BFS-40L	3 for \$.70	1/8 x 3 x 12	.265	6	Glider Wings
711-BFS-30W	\$.75 each	4 x 18	.50	16	Boost Glider

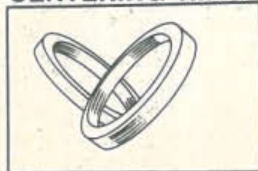
FIN PATTERNS

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. Ship. wt. 1 oz.

SHEET No. 2 (14 patterns) Catalog No. 651 — pp-2..... \$.25

SHEET No. 3 (15 patterns) Catalog No. 681 — pp-3..... \$.25

CENTERING RINGS



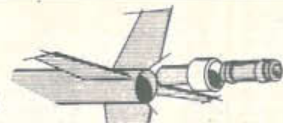
For centering a BT-20 body tube with a BT-50. Greater strength makes for use with high thrust engines. Weight per pair .285 oz. Shipping weight 3 oz.

Cat. No. 681-AR-2050..... **10 for \$.50**

To center a BT-50 tube in a BT-55 body tube. Extra strong for "D" engine mounts. Weight 0.062 oz. each. Shipping weight 2 oz.

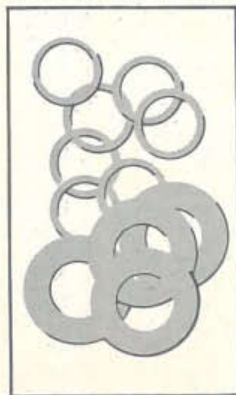
Cat. No. 694-AR-5055..... **4 for \$.35**

ENGINE MOUNTS



Engine Type	Name	Fits	Net Weight Oz.	Shipping Weight Oz.	Cat. No.	Price
For Series I & II Engines — A, B, & C type 0.69" x 2.75"	EH-2050	BT-50	0.1	5	651-EH-2050	\$.40
	EH-2055	BT-55	0.14	5	651-EH-2055	.40
	EH-2060	BT-60	0.17	5	651-EH-2060	.40
For Series IV Engines O type 0.945" x 2.75"	EM-5063	Saturn V	0.4	5	694-EM-5063	.60
For T Series Mini-Engines .5" x 1.75"	EM-520	BT-20	0.09	5	713-EM-520	.35
Special Purpose Quick-Change Conversion Mount From Series IV Engine to Series I & II Engines	EM-2050	BT-50	0.19	5	694-EM-2050	.45

PAPER ADAPTERS



Add still another dimension to rocket design. Easy to use paper adapters, are perfect for making transition between tube sizes for countless designs.

MULTI-PURPOSE SET — Includes a total of 2 rings for positioning BT-5 in BT-20; BT-5, BT-20, BT-3 in BT-50; and BT-5, BT-20, BT-30, and BT-50 in BT-60. Also three universal tapered shrouds and instructions. Shipping weight 2 oz.

Cat. No. 701-TA-1..... \$.4

20-50 RINGS — 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 — 10 rings for centering and mounting BT-20 in BT-55. Shipping weight 2 oz.

Cat. No. 671-RA-2055..... \$.30 per set

20-60 RINGS — 10 rings for centering and mounting BT-20 in BT-60. Shipping weight 2 oz.

Cat. No. 651-RA-2060..... \$.30 per set

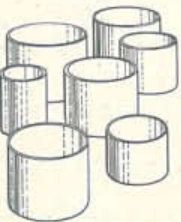
NOSE BLOCKS



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.

Catalog No.	Price Each	Outside Diameter	Length	Fits	Weight oz. Net Ship.
651-NB-20	\$.30	.710"	¾"	BT-20	.014 1
701-NB-30	\$.35	.725"	¾"	BT-30	.014 1
701-NB-50	\$.40	.950"	1"	BT-50	.040 4
671-NB-55	\$.45	1.283"	1¼"	BT-55	.115 4
651-NB-60	\$.50	1.595"	1½"	BT-60	.190 4

STAGE COUPLERS



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. Shipping weight for all is 3 oz. each.

Catalog No.	Price Each	Outside Diameter	Inside Diameter	Fits Length Tube	Average Weight
651-JT-5C	\$.10	.513"	.455"	¾" BT-5	.020 oz.
651-JT-20C	\$.10	.708"	.650"	¾" BT-20	.027 oz.
651-JT-30C	\$.10	.724"	.650"	¾" BT-30	.030 oz.
651-JT-50C	\$.15	.949"	.920"	1" BT-50	.051 oz.
651-JT-55C	\$.15	1.28"	1.25"	1.3" BT-55	.088 oz.
651-JT-60C	\$.15	1.59"	1.55"	1½" BT-60	.124 oz.
671-JT-70A	\$.20	2.175"	2.115"	1¼" BT-70	.140 oz.

BALSA ADAPTERS



Adapters give flexibility for 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 to make a passage for ejection gases. All adapters have at least ½" mating surface on each end.

Catalog No.	Price Each	Mates Tubes	Length	Taper Length	Weight oz. Net Ship.
651-TA-520	\$.30	BT-5 to BT-20	1.75"	0.75"	0.04 1
651-TA-550	\$.35	BT-5 to BT-50	2.2"	1.0"	0.06 4
651-TA-2050A	\$.35	BT-20 to BT-50	2.0"	1.0"	0.11 4
681-TA-2055	\$.45	BT-20 to BT-55	2.5"	1.5"	0.22 4
651-TA-2060	\$.95	BT-20 to BT-60	3.0"	2.0"	0.20 4
701-TA-5055	\$.55	BT-50 to BT-55	2.0"	1.0"	0.60 4
651-TA-5060	\$1.10	BT-50 to BT-60	3.0"	2.0"	0.23 4
701-TA-5065	\$.65	BT-50 to PST-65	3.0"	2.0"	0.26 4
701-TA-5560	\$.60	BT-55 to BT-60	2.2"	1.0"	0.25 4
701-TA-5565	\$.65	BT-55 to PST-65	2.7"	1.5"	0.38 4
701-TA-6065	\$.60	BT-60 to PST-65	2.0"	0.5"	0.23 4
701-TA-6070	\$1.00	BT-60 to BT-70	2.7"	1.5"	0.65 4

ENGINE BLOCKS



Used for positioning the engine in the rocket. Provides a hollow bulkhead for the engine to develop thrust against, as well as an opening for gases to pass for normal ejection.














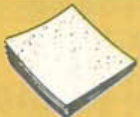



Catalog No.	Price 3 for	Outside Dia.	Inside Dia.	Length	Fits	Weight oz. Net Ship.
651-EB-20A	\$.20	.708"	.65"	¼"	BT-20	.009 1
651-EB-20B	\$.20	.708"	.65"	⅜"	BT-20	.005 1
651-EB-30A	\$.20	.724"	.65"	¼"	BT-30	.010 1

MODELING TOOLS

	<p>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. 701-KNS-82..... \$4.95</p>
	<p>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. 701-KNS-84..... \$13.95 each</p>
	<p>KNIFE SET: Conveniently packaged in a clear plastic case, the set contains scribe and 9 assorted blades to take care of most cutting needs. Balanced, streamlined, lightweight aluminum handle. Shipping wt. 10 oz. Cat. No. 701-KNS-24..... \$3.50</p>
	<p>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 13 1/2" x 21 1/4" x 3"). Shipping wt. 9 lbs. Cat. No. 701-KNS-88N..... \$35.00 each</p> <p>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 Plus Free copy of the 35¢ "PROJECT HANDBOOK AND HOBBY TOOL GUIDE" by X-Acto.</p>
	<p>PRECISION KNIFE SET: Includes one 3/4" long #1 aluminum handle and one each #1A cutting blade, #1B punch blade, and #1C gouge blade. Recommended for precision work. Shipping wt. 2 oz. Cat. No. 651-KNS-1..... \$.65 each</p>
	<p>HEAVY DUTY KNIFE: Set of one 3/4" long #4 plastic handle with metal chuck and one general purpose knife blade similar to #4G. Shipping wt. 6 oz. Cat. No. 651-KNS-4..... \$1.25 each</p>

	<p>RETRACTABLE BLADE KNIFE: Heavy duty #2 aluminum handle, 4 3/4" long, with one double ended #2D blade. Blade retracts into handle for safe carrying. For general cutting. Shipping wt. 4 oz. Cat. No. 691-KNS-2..... \$1.10 each</p>
	<p>UTILITY KNIFE: Includes 5 3/8" long #3 steel handle and one #3E general purpose blade. Shipping wt. 3 pz. Cat. No. 651-KNS-3..... \$.35 each</p>
	<p>BLADES</p> <p>Fits #1 handle only: For cutting balsa and paper. Cat. No. 651-KNB-1A..... \$.10 each</p> <p>Fits #1 handle only: Punch and scriber. Cat. No. 651-KNB-1B..... \$.25 each</p> <p>Fits #1 handle only: Gauge for hollowing balsa nose cones, adapters, blocks, etc. Cat. No. 651-KNB-1C..... \$.25 each</p> <p>Fits #2 and #4 handles: For general cutting and trimming. Cat. No. 651-KNB-4H..... \$.15 each</p> <p>Fits #2 handle only: Double ended, for general cutting. Cat. No. 651-KNB-2D..... \$.35 each</p> <p>Fits #2 and #4 handles: For general cutting and carving. Cat. No. 651-KNB-4G..... \$.15 each</p> <p>Fits #2 and #3 handles: Double ended, for general cutting. Cat. No. 651-KNB-3E..... \$.30 each</p> <p>For use with tool kits KNS-24, 82, 84, and 88N. The best blade shape for most every model rocket construction application. Cat. No. 711-KNB-5J..... \$.30 each</p>
	<p>ACCESSORIES</p> <p>RAZOR SAW: Fits #4 handle. 1" wide x 5" long. Use razor saw blade for cutting balsa and body tube. Shipping wt. 6 oz. Cat. No. 701-KNB-4F..... \$.50 each</p>
	<p>TWEEZERS: For 1,001 uses in handling small parts, attaching shock cords, etc. Steel, 3" long, 3/8" jaw. Shipping wt. 2 oz. Cat. No. 701-T-1..... \$.25 each</p>
	<p>WHETSTONE: Keep knife blades extra sharp for easy cutting. Pocket size, 3 1/2" x 3/4" x 3/8". Use with oil for best results. Cat. No. 651-W-1..... \$.50</p>

FINISHING SUPPLIES

	<p>ASTROSEAL balsa filler: Gives smooth surface for dope or enamel application. Sand between coats. Four ounce jar. Shipping weight 7 oz. Cat. No. 701-SS-2..... \$1.00</p>		<p>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. 701-BDT-1..... \$.25</p>
	<p>HEAT RESISTANT PAINT: Protects exposed rocket parts from heat damage up to 1000°. Bright metallic finish. Recommended for swept fins and other parts exposed to hot exhaust gases. 1½ ounce bottle. Shipping weight 6 oz. Cat. No. 651-AP-1..... \$.65</p>		<p>WHITE GLUE: 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. 701-WG-1..... \$.75</p>
	<p>FLUORESCENT SPRAY PAINT: The brightest colors anywhere. Glowing, high visibility paint in 6 oz. spray cans, dries in minutes. Cerise Red, Yellow Orange, Red Orange and Green. Specify colors when ordering. Shipping weight 16 oz. each. Cat. No. 651-FP-1..... \$1.40</p>		<p>BODY PUTTY: 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..... \$.50</p>
	<p>ENAMEL SPRAY PAINT: Top quality enamel in 5 oz. spray cans dries in minutes. Use indoors and outdoors. Not fluorescent. True Blue, Bright Silver, Bright Gold, Cherry Red, Glossy White, Glossy Black, Flat White, Ultra Flat Black. Specify colors when ordering. Shipping weight 16 oz. each. Cat. No. 651-EP-1..... \$1.20</p>		<p>FINISHING WAX: For the high gloss finish and low drag. Recommended for use on enamel and butyrate finishes only. In 2 ounce jar. Shipping weight 5 oz. Cat. No. 701-FW-2..... \$1.00</p>
	<p>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. 5 oz. spray can. Shipping weight 16 oz. Cat. No. 651-EP-2..... \$1.20</p>		<p>SANDING MATERIAL: Special mylar plastic backed abrasive sheet can be used over and over again. Extra fine 320 grit in easy to handle 2½" x 2¼" sheets. Shipping wt. 1 oz. Cat. No. 651-SP-320..... 6 sheets \$.50</p>
	<p>BUTYRATE DOPE: Brushes on smoothly, easily. 1 oz. bottles. 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 weight 4 oz. Cat. No. 701-BRD-1..... \$.25</p>		<p>SANDPAPER: Shape and smooth model rocket parts. Available in three grades. 3" x 3" sheets. Specify grade when ordering. Shipping weight 1 ounce for 6 sheets. 12 Sheets Medium — Cat. No. 651-SPM-2..... \$.40 12 Sheets Fine — Cat. No. 651-SPF-2..... \$.40 12 Sheets Extra Fine — Cat. No. 651-SPEF-2..... \$.50 36 Sheets Assorted (6 each) — Cat. No. 651-SPA-2..... \$.80</p>
	<p>SANDING SEALER: Fills small holes in balsa, paper and other porous materials, provides a smooth surface for paint or dope. In 1 oz. bottles. Shipping weight 4 oz. Cat. No. 701-SS-1..... \$.35</p>		<p>PAINT BRUSHES: One #1 brush for extra fine work, one #4 brush for normal work and one #6 brush for covering large areas rapidly. Sets of three only. Shipping wt. 2 oz. Cat. No. 691-PB-3..... \$1.00</p>
			<p>STYRENE CEMENT: BOTTLE — for cementing plastic to plastic. Shipping weight 3 oz. Cat. No. 711-PC-1..... \$.29 TUBE — for cementing plastic to other materials. Shipping weight 1¼ oz. Cat. No. 711-PC-2..... \$.15</p>

DECALS...FOR THE PROFESSIONAL ROCKETRY LOOK



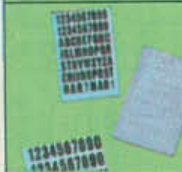
STARS AND BARS: Sheet of red, white and blue Air Force emblems. Shipping weight 1 oz.

2" and 1 3/4" insignia

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

1 1/4" insignia

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



LETTERS AND NUMBERS: Identify and decorate models the easy way. Over 60 characters per sheet. Available in black or white. Shipping weight 1 oz.

1/4" size (specify color) Cat. No. 651-D-4..... \$.15 each

3/8" size (specify color) Cat. No. 651-D-3..... \$.15 each



LAUNCH PANEL DECAL: Identify controls and circuits on your launch panel with this pressure sensitive decal sheet. Aluminum letters on black background are easy to read, add eye appeal. Self-adhesive. 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. Shipping wt. 5 oz.

Cat. No. 701-DT-1..... \$.30 each



CHECKERBOARDS: Glossy, colorful 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. Shipping weight 1 oz.

1/5" size (specify color) Cat. No. 651-D-7..... \$.25 each

3/8" size (specify color) Cat. No. 651-D-8..... \$.25 each



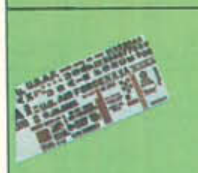
MODEL MARKINGS: Collection of black markings, numbers, patterns, etc., on 4" x 9" clear backing. Shipping wt. 1 oz.

Cat. No. 692-D-12..... \$.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 wt. 1 oz.

Cat. No. 651-D-9..... \$.25 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 wt. 1 oz.

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



NAMES KIT: Dress-up models with these easy-to-apply kit names decals.

Kit #1 black or white (specify color)

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

Kit #2 printed in red, yellow, black and white.

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









MISCELLANEOUS DECALS: "20" DECAL: 3" x 4 1/2" decal just right for BT-20 size models. Printed black on clear backing. Shipping weight 1 oz.







Cat. No. 693-KD-45..... \$.15 each

"50" DECAL: 4-color, 4" x 9" decal for BT-50 size models. Shipping weight 1 oz.

Cat. No. 693-D-13..... \$.50 each

LITTLE ITEMS THAT GIVE BIG RESULTS IN MODEL ROCKETRY

	<p>WIND METER: Rugged, pocket-size instrument for determining wind velocity. Indispensible to the serious rocketeer for studying wind effects on rocket and parachute performance. Shipping weight 5 oz.</p> <p>Cat. No. 693-WM-1..... \$7.25</p>
	<p>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 60. Net weight 0.032 oz. Shipping weight 1 oz.</p> <p>Cat. No. 701-EH-2..... 3 for \$.60</p>
	<p>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.</p> <p>Cat. No. 701-EH-3..... 3 for \$.60</p>
	<p>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.</p> <p>Cat. No. 651-PSP-1..... 3 for \$.60</p>
	<p>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.</p> <p>Cat. No. 651-PL-1..... 2 for \$1.00</p>
	<p>WEIGHTS: Balance rockets for stability.</p> <p>ROUND LEAD WEIGHTS — 11/16" dia. center hole. Weight: 0.12 oz. each. Shipping weight: 1 oz.</p> <p>Cat. No. 701-NCW-1..... 6 for \$.60</p> <p>BALANCING WEIGHTS — Flexible lead strips. 3" x 1/4" x 0.02". Weight: 0.085 oz. each. Shipping weight: 1 oz.</p> <p>Cat. No. 701-NCW-3..... 10 for \$.60</p>

	<p>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.</p> <p>1 1/4" long: Cat. No. 691-LL-2A..... 12 for \$.50</p> <p>2 3/8" long: Cat. No. 651-LL-2B..... 10 for \$.50</p> <p>5" long: Cat. No. 701-LL-2C..... 6 for \$.60</p> <p>8" long: Cat. No. 701-LL-2D..... 4 for \$.60</p>
	<p>REINFORCING: Reinforce fin joints, attach shock cords.</p> <p>3" x 12" sheets of gauze.</p> <p>Cat. No. 651-GR-2..... 6 for \$.60</p> <p>3" x 9" self-adhesive treated paper.</p> <p>Cat. No. 651-PRM-1..... 6 for \$.40</p>
	<p>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.</p> <p>Cat. No. 651-AS-1..... 6 for \$.60</p>
	<p>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.</p> <p>Cat. No. 701-SB-3..... 2 for \$.70</p>
	<p>DOWELS: Extra strong, light weight, seasoned maple dowels. Shipping weight 5 oz.</p> <p>1/8" x 18" —</p> <p>Cat. No. 651-WD-1..... 8 for \$.40</p> <p>1/12" x 12" —</p> <p>Cat. No. 671-WD-2..... 8 for \$.40</p>
	<p>GLUE GUN: Handles all makes of glue and cement. Conserves glue, speeds assembly. Shipping weight 1 1/4 oz.</p> <p>Cat. No. 711-GG-1..... \$1.50</p>

SPECIAL PUBLICATIONS

AEROSPACE EDUCATION AND MODEL ROCKETRY: An excellent teachers guide for introducing model rocketry into the classroom.

Cat. No. 711-BK-18..... \$1.00
(Single copies free to educators requesting it on school stationery.)

SPACE AGE TECHNOLOGY: A comprehensive mini-text for use in aerospace education, science, and industrial arts classes.

Cat. No. 711-BK-14..... \$1.00
A "Teacher's Manual" (Cat. No. 711-BK-14M) is available to educators for \$1.00.

MODEL ROCKET LAUNCH SYSTEMS: An easy-to-understand booklet covering basic electrical theory, launcher design, multiple launchers, and electrical math.

Cat. No. 701-BK-12..... \$.25

MODEL ROCKETRY TECHNICAL MANUAL: An excellent beginner's guide as well as a handy reference. This booklet is probably the most popular technical manual in model rocketry.

Cat. No. 721-BK-21..... \$.10

TECHNICAL REPORTS

ROCKET STABILITY: Easy-to-read report explaining how rockets are designed to fly properly and including a before-launch test to assure rocket stability.

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

MULTI-STAGING: A complete, easy-to-understand report providing the information needed for designing, building, and flying multi-stage rockets.

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

ALTITUDE TRACKING: The classic work on simple altitude tracking for model rocketeers with easy-to-understand instructions for tracking and altitude computation.

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

REAR ENGINE BOOST-GLIDERS: Basic information covering design, construction, and operation of rear engine boost-gliders.

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

BUILDING A WIND TUNNEL: Full plans and information for building and using a wind tunnel with data on both hand-powered and motorized versions.

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

CLUSTER TECHNIQUES: The complete report on clustering engines to launch larger payloads.

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

FRONT ENGINE BOOST-GLIDERS: Valuable information on designing, building, and flying front engine boost-gliders.

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

MODEL ROCKETRY STUDY GUIDE: A planned sequence of activities to guide anyone toward becoming an expert model rocketeer.

Cat. No. 711-TR-8..... \$.75

DESIGNING STABLE ROCKETS: Based on standard engineering practices, this report presents a method of designing rockets for proper stability on paper before any construction work is done.

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

ALTITUDE PREDICTION CHARTS: Explains a relatively simple method by which aerodynamic drag and other atmospheric effects can be taken into account in predicting rocket peak altitude.

Cat. No. 711-TR-10..... \$1.00

AERODYNAMIC DRAG OF MODEL ROCKETS: All factors that influence drag are explained, and practical examples of ways to minimize drag are given.

Cat. No. 711-TR-11..... \$1.00

ROCKETEERS . . . Enter Estes Design of the Month Competition

YOUR DESIGN COULD WIN YOU A \$50 MERCHANDISE CERTIFICATE

DESIGN OF THE MONTH RULES

1. All entries become the property of Estes Industries; no entries can be returned.
2. Employees of Estes Industries and members of their immediate families are not eligible to enter.
3. Designs should be sent to the Design of the Month Editor, Estes Industries, Inc., Box 227, Penrose, Colorado 81240. However, all plans sent to us which are not specifically addressed to another contest or department will be automatically placed in the Design of the Month Competition.
4. Any type of model rocketry design can be entered (rockets, boost-gliders, launching or recovery devices, etc.).
5. All designs reaching Estes Industries during the calendar month will be entered in that month's competition. (Date of receipt, not postmark, will determine the month in which a design will be judged.)
6. If two or more exceptional entries are received during any month, the judges may, at their discretion, make identical first-place awards or give additional special merit awards.

Each month the designer of the winning entry will receive a certificate entitling him to \$50.00 in merchandise and an award certificate suitable for framing.

Award winners will be notified by mail.



NEW CONTEST EVERY MONTH

Here's a contest for every rocketeer. Put your creative skills of original design to the test with Estes model rocket parts. Just follow the rules to the left.

SEND AS MANY ENTRIES AS YOU LIKE!

Entries will be judged on practicality, originality, neatness, completeness, and clarity. Plans do not have to be flight tested and proven. However, a proven design is more apt to win.

Designs should be new, original, and different, but they also need to be workable.

The goal is to develop something new that other rocketeers can build and use successfully, too.

Please do not send the actual model as it cannot be returned.

Your design entry should include a parts list and any instruction or diagrams you feel would be helpful.

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

GOOD LUCK!!!



MODEL ROCKET CLUBS

Rocketeers and groups interested in organized model rocketry and community model rocket programs should take advantage of ESTES CLUB SERVICES. Complete details available for club organization including guidelines for public demonstrations, special meetings, fund raising, contests, launch site operations, workshop activities, R & D projects, and much, much more. Groups desiring assistance should write to Rocketeer Communications Dept., Estes Industries, P.O. Box 227, Penrose, Colorado 81240. ESTES CLUB SERVICES also offers a variety of club oriented publications and products.

ESTES GUIDE FOR AEROSPACE CLUBS.

Features complete details for club organization and activities. A must for active clubs.

Cat. No. BK-19..... \$.50

ESTES MODEL ROCKET CONTEST GUIDE

Great for planning model rocket contests and meets. Features rules for exciting competitive events plus suggestions for contest organization.

Cat. No. BK-17..... \$.50



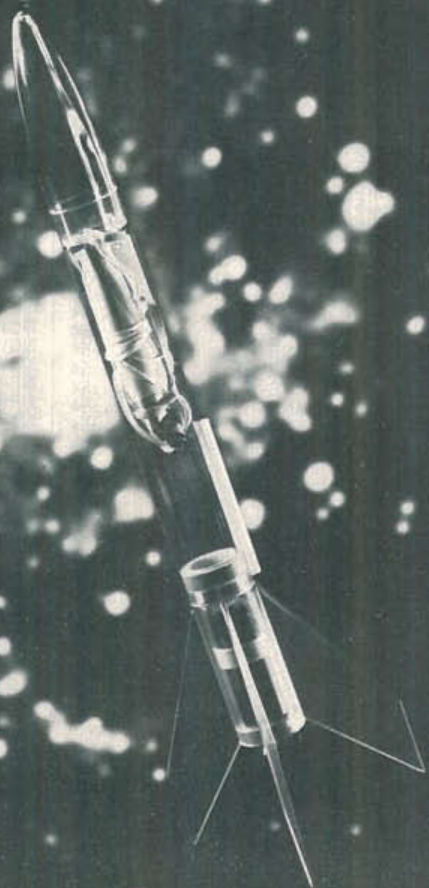
MULTI-PAD

Ideal launch system for clubs. Sequentially launches one to six model rockets. Plug-in an extra launch rack to increase capacity to twelve rockets. System operates from any 12-volt car battery. Safety key switch for power supply. Panel lights for power supply and for continuity check for each pad selected. Built-in public address system includes push-to-talk microphone and efficient outdoor speaker. Shipping wt. 24 lbs.

Cat. No. 711-MFS-1..... \$150.00

ADDITIONAL SIX-PAD RACK (speaker not included)

Cat. No. RL-6..... \$60.00



Astron PHANTOM

This bird will never fly, but it makes a great demonstration model. The transparent body shows all of the structural insides of a model rocket . . . even a special molded plastic version of a C6-5 engine.

Great for answering rockery questions. Ideal for displays and demonstrations.

Specifications

Length	12.6"
Body Dia.	0.976"
Weight	1.35 oz.
Shipping wt.	

Cat. No. 713-K-7B

\$1.75

EDUCATION DEPARTMENT

Headed by an experienced science teacher, this department provides many services to educators at all levels. Please write to Education Department, Estes Industries, Department 199, Box 227, Penrose, Colorado 81240 for information on the services available. If you are a student, please provide the name of your teacher and your school's name and address.

Several products of special interest to teachers are produced by Estes Industries. Our new Astron Phantom (713-K-7B, Price \$1.75) is a good demonstration and display item. Publications for educators as well as technical publications for use in the classroom and by individual rocketeers are available.

Catalog Number Cross Reference Index

No.	Price	Page	No.	Price	Page	No.	Price	Page	No.	Price	Page	No.	Price	Page			
A																	
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AL-6	.20	45	BNC-50AD	.75	51	D-8	.25	56	K-41	3.95	22	LW-12	.85	44			
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K-14	1.85	14	L														
K-15	.90	14	L														
K-16	2.25	35	L														
K-17	2.00	20	L														
K-18	1.75	13	L														
K-20	2.75	25	L														
K-22	5.25	21	L														
K-23	2.75	13	L														
K-24	1.25	19	L														
K-25	1.50	12	L														
K-26	2.40	21	L														
K-27	2.25	21	L														
K-29	10.95	22	L														
K-32	2.75	17	L														
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Model Rocketry Safety Code

- 1. Construction** — My model rockets will be made of lightweight materials such as paper, wood, plastic and rubber, without any metal as structural parts.
- 2. Engines** — I will use only pre-loaded factory made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.
- 3. Recovery** — I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.
- 4. Weight Limits** — My model rocket will weigh no more than 453 grams (16 ozs.) at liftoff, and the engines will contain no more than 113 grams (4 ozs.) of propellant.
- 5. Stability** — I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.
- 6. Launching System** — The system I use to launch my model rockets must be remotely controlled and electrically operated, and will contain a switch that will return to "off" when released. I will remain at least 10 feet away from any rocket that is being launched.
- 7. Launch Safety** — I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.
- 8. Flying Conditions** — I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low flying aircraft, or under any conditions which might be dangerous to people or property.
- 9. Launch Area** — My model rockets will always be launched from a cleared area, free of any easy to burn materials, and I will only use non-flammable recovery wadding in my rockets.
- 10. Jet Deflector** — My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.
- 11. Launch Rod** — To prevent accidental eye injury I will always 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 never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is **not** in an upright position.
- 12. Power Lines** — I will never attempt to recover my rocket from a power line or other dangerous places.
- 13. Launch Targets & Angle** — I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.
- 14. Pre-Launch Test** — When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

Revised 2/4/70

As a member of the Estes Model Rocketry Program, I promise to faithfully follow all rules of safe conduct as established in the above code.

Signed

This Solid Propellant Model Rocketry Safety Code is Approved by The National Association of Rocketry and The Hobby Industry Association of America.



The Interceptor. For details
and ordering
instructions see page 23

Cat. No. K-50 \$5.25



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7



6



5



4



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