WELCOME TO ESTES MODEL ROCKETRY!

Within the pages of this catalog you will find Estes rocket kits and accessories for every age and skill level! It's never been easier to get started in Estes model rocketry. Try one of our Starter Sets which includes a high flying rocket, engines, and your very own Porta-Pad® II Launch Pad and Electron Beam® Launch Controller. Then move on to our other easy-to-build rockets in the E2X® Series. The Manta™ includes a glider which circles home while the rocket returns with a streamer. The Turbo Copter™ has turbo-charged helicopter recovery! Collect them all! When you are ready to move up in the Estes rocketry world, go for the Beta Tron™, which has everything you need to build two Beta™ Series rockets, and much, much more. Everyone will love the Estes Rocket Builder's Marking Guide, which makes it quick and easy to mark and measure body tubes for fin placement, circumference, and anything else you need to mark! It even holds fins in place while they dry. Long-time Estes rocketeers and those who are getting back into Estes rocketry will have a blast with our new "E" engines! Choose the Maniac™, which flies on our "C"s, "D"s, or "E"s and builds in less than an hour! This performer flies out of sight and is easily recovered with a fluorescent streamer. The Broadsword™ and The Shadow™ are massive rockets that also use our "D" or "E" engines. Whatever your mood, only Estes holds the excitement for you. The possibilities are endless, the choices are yours. Ignite your imagination!

LAUNCH AREA:
Choose a large field away from power lines, tall trees, and low-flying aircraft. This chart shows the smallest recommended launch areas:

<table>
<thead>
<tr>
<th>ENGINE TYPE</th>
<th>ESTIMATED ALTITUDE</th>
<th>MINIMUM LAUNCH SITE DIMENSION</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>FEET</td>
<td>METERS</td>
</tr>
<tr>
<td>A</td>
<td>400</td>
<td>122</td>
</tr>
<tr>
<td>B</td>
<td>600</td>
<td>174</td>
</tr>
<tr>
<td>C</td>
<td>1,000</td>
<td>489</td>
</tr>
<tr>
<td>D</td>
<td>1,500</td>
<td>749</td>
</tr>
<tr>
<td>E</td>
<td>2,000</td>
<td>1,110</td>
</tr>
</tbody>
</table>

*Minimum circular area = Diameter in feet or meters. Minimum rectangular area = Shortest side in feet or meters. Launch site must be free of obstructions and highly flammable materials.

HOW TO USE YOUR ESTES CATALOG
To get the most out of your catalog, please read this section. It will help determine what kit fits your needs and what the specifications are of that kit. This catalog is divided into kit series. Each series has a skill level: E2X™ Series (almost ready to fly); Beta™ Series (skill level 1); Explorer™ Series (skill level 2); Challenge™ Series (skill level 3); and Master™ Series (skill level 4). Pro™ Series and Estes R/C are separate product lines. Kits in these series can range from easy to difficult. In the catalog each series contains an introduction that gives you the characteristics of that skill level. Each kit listing gives you the kit name, its product number and price. In addition, you will find a brief description that gives you features, length, diameter, and weight. You will also find the engines, from least to most powerful, that we recommend for that rocket. We will sometimes list on an engine that we recommend in breezy conditions. "Fast Right" indicates which engine should be used to become familiar with your rocket's flight profile. One of the more important features is the Kit Feature Symbol. These symbols will give you the size and type of recovery system, type of fins, nose cones, decals and other features. Below is the symbol key:

RECOVERY SYSTEM:
- Plastic parachute with diameter in inches
- Nylon parachute with diameter in inches
- Streamer

NOSE CONE:
- Plastic
- Balsa

DECALS:
- Pressure sensitive
- Water soluble
- Die-cut balsa
- Die-cut plastic
- Die-cut fiber

MAXIMUM ALTITUDE:
- In meters with most powerful engine recommended

ENGINE MOUNT:
- Quick release

FIN TYPE:
- 450
- Plastic fin unit

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- Pro™ Series
- Commemorative Series
- R/C Series
- Engines

Model Rocketry is recommended for those age 10 years and up. Adult supervision is recommended for those under 12 years of age.

Use only Estes products with Estes model rockets. Unless specified, all models require assembly. Engines, launch system, glue and finishing supplies are not included with kits unless specified.

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Starter Sets

There's no better way to get started in this terrific hobby than with one of our five great starter sets. Each set contains a high-flying, easy-to-assemble E2X™ Series model rocket kit. These models assemble so simply and precisely that we guarantee success. And, with pre-finished parts and no painting required, you'll have a sharp looking model ready to go in almost no time!

You also get:
- A Porta-Pad® II launch pad
- An Electron Beam® electrical launch controller
- Cobra® model rocket engines, igniters and revolutionary new igniter plugs for sure-fire launches every time!

Plus, the launch equipment can be used to launch nearly every Estes rocket in the E2X® through Master™ Series!

All of this comes packed in a sturdy range box with a carry handle. You'll save a bundle over individual retail prices. All you need is batteries and glue, and in about an hour, you'll be ready to launch!

AIRWALKER™
EST 1410
$28.99

Each starter set requires four AA-type alkaline batteries and adhesive - not included. Avg. Ship Wt. 1.4 kg (3 lbs.)

PATRIOT™
EST 1450
$26.99

PATRIOT™

Each starter set requires four AA-type alkaline batteries and adhesive - not included. Avg. Ship Wt. 1.4 kg (3 lbs.)

AIRWALKER™

STEAK SOUNDS: rocket styling and a clear cargo box highlight this sharp performer. Unique chrome-colored body tube, bright red fire and nose cone give this 30.8 cm (20") tall rocket a clean, professional appearance. Includes Cobra® engines and supplies for your first three flights.

Engines: A8-3 (Red Right), B4-4, B6-4, B6-5, C5-3, C6-3, C6-5

PATRIOT™

STEAK SOUNDS: high flyer features a scale appearance with military surface-to-air missile decor. Stands 49 cm (19.5") tall and features fast, easy assembly; no painting and parachute recovery. Includes Cobra® engines and supplies for your first three flights.

Engines: A8-3 (Red Right), B4-4, B6-4, B6-5, C5-3, C6-3, C6-5

*Unless otherwise specified, all models in this catalog require assembly.
StarterSets

ALPHA® III
EST 1406
$27.99

This set features the tried-and-true Alpha® III with bright orange and black decor. Assembly is easy with a one-piece plastic swept-fin unit. Great performance with parachute recovery for safe landings. Includes Cobra® engines and supplies for your first three flights.

Engines: A8-3 (First Flight), B6-4, B6-6, C6-5, C6-7

AMERICA™
EST 1447
$24.99

The 38 cm (15”) tall America™ rocket features NASA-style decor and lead lines. Assembly is quick and easy with one-piece plastic fin unit and self-adhesive decals. Fantastic performance flight after flight using parachute recovery. Comes with Cobra® engines and supplies for your first two flights.

Engines: A8-3 (First Flight), 1/2A6-2, A8-5, B6-4, B6-6, B6-6, C6-5, C6-7

SUPER SHOT™
EST 1449
$30.99

Each starter set requires four AA-type alkaline batteries and adhesive - not included. Avg. Ship Wt. 1.4 Kg (3 lbs)

The two-rocket combo starter set delivers super value and super performance.

The EZX Series Super Shot™ rocket is the first and features super-quick assembly, with pre-colored parts and hot decals. 42 cm (16-1/2”) tall, tough and durable. It can be launched again and again up to 800 feet high and returns by parachute. The Twister™ is an Explorer™ Series rocket and includes crazy mind-twisting decals. Instead of a parachute, the 24 cm (9-1/2”) tall Twister™ separates into two pieces and spins down helicopter style from up to 1000 foot altitudes! The ideal second rocket.

Includes Cobra® engines and supplies for your first three super flights.

Engines:
Super Shot™ - A8-3 (First Flight), B6-4, B6-6, C6-5, C6-7
Twister™ - 1/2A6-2 (First Flight), A8-3, A8-5, B6-4, B6-6, B6-6, B8-5
E2X®
ALMOST READY TO FLY

There is no modeling experience required in this series. As a matter of fact, the rockets in this skill level are assembled, not constructed. What this means, simply and easily, is that:

- There is practically no cutting or sanding
- There are very clear and simple to follow instructions
- There is no painting or sealing
- These kits are a very quick build - almost 30 minutes

These precision engineered kits, with exacting plastic parts and pre-colored body tubes, let the novice assemble a rocket with a craftsmanship result. By including rockets, such as the piston-actuated Cato™, the helicopter-recovered SkyWinder™ and the glider recovered Manta™ in this skill level, there are features that even the experienced modeler will enjoy.

"Unless otherwise specified, all models in this catalog require assembly."
OMLOID™
EST 2078
$13.99

OMLOID™

With a huge 51 mm (2") diameter twin-together cargo capsule, you can fly an egg or all kinds of scientific payloads in this multi-purpose launch vehicle. Pre-colored and assembled in minutes! A 46 cm (18") reflective silver 'chute brings it down safely even with heavy payloads. Perfect for school and science fair projects, or just plain fun!

Specifications:
Length: 47.6 cm (18.8")
Dia: 34.2 mm (1.346")
Wt: without egg - 70.8 g (2.5 oz)
Engines: with egg - C5-3, C6-3, without egg - B4-2
First Flight: B6-2, C5-5

Launch an Egg!

BAIL-OUT™
EST 2070
$13.99

BAIL-OUT™

Explore interactive rocketry with this model! Can eject your favorite 96 mm (3 7/8") action figure with parachute (parachute not included, but two for your figure are).

Specifications:
Length: 62 cm (24.4")
Dia: 48 mm (1.891")
Wt: without figure - 57 g (2.0 oz)
Wt: with figure - 104.0 g (3.67 oz)
Engines: B4-2 (First Flight), B6-4 (with no wind), C5-3, C6-3, C5-5

CATO™
EST 2071
$14.99

CATO™

The supreme "plop" rocket, this rocket breaks apart into pieces after a short flight, is safely recovered in a small area, and re-assembles in minutes for flight after flight. Internal fin system shows how the ejection charge works in different ways! The Cato™ features multiple recovery systems - parachute, streamer and tumble. The Cato™ is easy to build and to fly.

Specifications:
Length: 51 cm (20.2")
Dia: 42 mm (1.67")
Wt: 125 g (4.4 oz)
Engines: B6-0 (First Flight), C6-0
Bandit™, Rampage™ and Dagger™ Kits

Feature:
- Pre-Colored Body Tubes
- Plastic Nose Cone and Fins
- Pre-Slotted Body Tubes
- Stick-On Decals
- No Painting

**BANDIT™**
EST 2060
$9.99

**RAMPAGE™**
EST 2061
$10.99

**DAGGER™**
EST 2062
$11.99

**GNOME™**
EST 0886
$4.59

**ALPHA III**
EST 1256
$8.89

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**BANDIT™**
The perfect beginner's model in a tube almost ready-to-fly style. The rocket, capable of trialing performance, will be a guaranteed hit. E2X™ standard features include slotted body tubes for easy alignment and precision engineered for a fast build.

**Specifications:**
- Length: 47 cm (18.5")
- Dia.: 25.4 mm (1.0")
- Wt.: 45.5 g (1.6 oz)
- Engines: A8-3 (First Right), B4-4, B6-4, B8-5, C5-3, C6-3, C6-5

**RAMPAGE™**
With slotted body tubes for easy alignment and strong fin attachment, a double thick body tube and plastic nose cone, this rocket will fly high when the competition has given up. The Rampage™ has a payload section and can be built under an hour.

**Specifications:**
- Length: 44 cm (17.5")
- Dia.: 25.4 mm (1.0")
- Wt.: 50.2 g (1.8 oz)
- Engines: A6-3 (First Right), B4-4, B6-4, B8-5, C5-3, C6-3, C6-5

**DAGGER™**
The flagship of our E2X™ series, this rocket is sleek, long and lean. It's a winner whether it's on the pad, in the air or on display. This super quick build features a chrome colored payload section, slotted body tube and pre-finished plastic fins.

**Specifications:**
- Length: 52.2 cm (20.5")
- Dia.: 25.4 mm (1.0")
- Wt.: 70.5 g (2.5 oz)
- Engines: A8-3 (First Right), B4-4, B6-4, B8-5, C5-3, C6-3, C6-5

**GNOME™**
This mini-engine entry into the E2X™ level is perfect for small flying fields. The Gnome's great features include an electric blue colored, one piece, plastic fin unit, chrome colored body tube, and great performance.

**Specifications:**
- Length: 21.0 cm (8.25")
- Dia.: 13.6 mm (0.535")
- Wt.: 12 g (0.42 oz)
- Engines: A2A-3/2T (First Right), 1.2A3-4T, A3-4T, A10-3T

**ALPHA III**
One of the oldest, most reliable, easiest-to-build rockets has a dynamic decor - glossy black body tube, fluorescent orange plastic fins and nose cone. This old-timer is a durable flyer and requires no painting.

**Specifications:**
- Length: 31.1 cm (12.25")
- Dia.: 24.8 mm (0.975")
- Wt.: 34 g (1.2 oz)
- Engines: A8-3 (First Right), 1.2A3-2T, A9-5, B4-4, B6-6, B8-6, C5-6, C6-7
ATHENA™
EST 2026
$9.99

PEGASUS™
EST 2076
$9.99

ATHENA™

Gleaming and fast. rugged and beautiful, this model will please.
With white and chrome plastic, the Athena™ will become one
of your favorites. Folds great on a wider selection of engines.

Specifications:
Length: 38.1 cm (15.0")
Dia: 24.6 mm (0.97")
Wt: 36 g (1.27 oz)
Engines: A8-3, AB-6, B4-4, B6-6, B8-5, C5-6, C6-7

PEGASUS™

The new Pegasus™ is ready to become the first in your stable of
rockets. This great-looking, sleek rocket is quick to build and quick
to fly. Features durable and rugged construction and there's no
painting required.

Specifications:
Length: 33.1 cm (13.0")
Dia: 24.6 mm (0.97")
Wt: 36 g (1.27 oz)
Engines: A8-3 (First Flight), 1B4-6-2, AB-5, B4-4, B6-6, B8-5, C5-6, C6-7

SKYWINDER™

EST 2077
$14.99

• Copters Back
To Earth!

SKYWINDER™

This amazing model assembles fast and launches like any "regular" model rocket, but at the peak of its flight, it transforms! Three
helicopter blades with brightly colored decals unfold from the body and start spinning faster and faster, creating a kinetic color
display and lowering the SkyWinder™ gently to the ground. It has one-piece recovery and preps for flight in seconds - no wadding,
parachute or streamer.

Specifications:
Length: 50.8 cm (20")
Dia: 34.2 mm (1.34")
Rotor Span: 50.8 cm (20")
Wt: 70.9 g (2.5 oz)
Engines: B4-2 (First Flight), B6-2, C5-6

Engines, launch system, glue, and
finishing supplies not included.
Avg. Ship Wt: 340 g (12 oz)
BETA™ SERIES

SKILL LEVEL 1

These dramatic, exciting-looking kits will fill many modelers' needs: from the inexpensive Mosquito™ to the hot performing Zinger™ to the payload-carrying Nova Payloader™ to the sensational Big Bertha™.

This is a traditional starting point for some modelers. The Beta Tron™ Rocket Builder's Kit is an excellent introduction to this type of model building. The kits in this series have simple construction, although some modeling experience can be helpful (sanding, cutting, measuring and gluing). This skill level will help you acquire those skills. These kits are often used in schools, Boy Scout Troops, 4H Clubs, summer camps, Civil Air Patrol and Young Astronauts programs. The kits feature:

- Die cut fins with some fin alignment necessary
- Simple painting
- Pressure sensitive or water transferable decals
- Up through “C” engine power

BETA TRON™
EST 1464
$24.99

Includes Estes Marking Guide which marks tube easily

New!

Easy-to-Use Technical Manual

Custom Decals

Two of many designs you can build

The Beta Tron™ is the logical next step after the E300 Series because it teaches the basic skills of model rocket construction. The cornerstone of this set is the Rocket Builder's Marking Guide™ tool set, a series of tools that makes the construction of model rockets easier (see page 53 for more details on the Marking Guide). This set also supplies everything you need to build two rockets including body (1/2 size), engine mounts, nose cones, two sets of the cut bolts, self-trace tail and water transferable decals, parachute and streamer material, and a clear payload section - multiple designs are possible! Also includes a paper attitude tracking device, a modeler's Technical Manual, Model Rocket News, and three engines (A8-3, B4-4 and C10-5) with wadding, plugs and igniters.
**BETA SERIES**

**MONGOOSE™**  
EST 2092  
$8.99  

The perfect first two-stage rocket! The Mongoose™ has two one-piece fins, colored body tubes, and it flies to over 1800 feet! This rocket builds very quickly and doesn't need paint. Can also be flown single stage.  

**Specifications:**  
- Length: 67.3 cm (26.5")  
- Dia.: 24.8 mm (0.976")  
- Wt.: 46 g (1.63 oz.)  
- Engines: A8-3 (First Stage), B4-4, B6-4, B8-5, C6-5

**NINJA™**  
EST 0882  
$4.59  

Dark and mysterious, this hot performer flies on mini-engines. Builds quickly and makes an excellent first rocket.  

**Specifications:**  
- Length: 25.8 cm (10.15")  
- Dia.: 18.7 mm (0.736")  
- Wt.: 15.6 g (0.56 oz.)  
- Engines: F24-4 (First Flight), A8-4, A10-3T

**YANKEE™**  
EST 1381  
$4.59  

This rocket has the performance worthy of an All American - capable of out-of-sight flights! This model has self-stick adhesive decals, streamer recovery and can use a wide selection of engines.  

**Specifications:**  
- Length: 27.9 cm (11.0")  
- Dia.: 16.7 mm (0.658")  
- Wt.: 11.9 g (0.42 oz.)  
- Engines: A24-6 (First Flight), A8-3, A8-4, B4-4, B6-4, B8-5, C6-5, C6-7

**WIZARD™**  
EST 1292  
$4.59  

You don't need magic to put this rocket up over 1400 feet high. Just plug in a "C" engine and go! A big 76 cm (30") streamer makes tracking and recovery easy.  

**Specifications:**  
- Length: 30.5 cm (12")  
- Dia.: 18.7 mm (0.736")  
- Wt.: 22.4 g (0.79 oz.)  
- Engines: A8-3 (First Flight), B4-4, B6-4, B8-5, C6-5

**THUNDERHAWK™**  
EST 2002  
$8.59  

Long, lean sportster featuring a superstable fin configuration. Simple to construct and finish, and delivers impressive performance.  

**Specifications:**  
- Length: 55.9 cm (22")  
- Dia.: 24.8 mm (0.976")  
- Wt.: 34.6 g (1.22 oz.)  
- Engines: A8-3 (First Flight), B4-4, B6-4, C6-5

**MOSQUITO™**  
EST 0801  
$2.79  

Don't let size fool you - the smallest rocket in our fleet moves out fast and flies almost out-of-sight every time! Ultra lightweight construction and fantastic performance.  

**Specifications:**  
- Length: 9.9 cm (3.9")  
- Dia.: 13.8 mm (0.54")  
- Wt.: 2.8 g (0.1 oz.)  
- Engines: A24-4 (First Flight), A3-4, A10-3T
BETA SERIES

VIKING™
EST 1949
$4.29

YELLOW JACKET™
EST 2008
$7.99

ALPHA®
EST 1225
$7.29

ASTROCAM® 110
with Launch Vehicle
ASTROCAM® 110
$26.99

BIG BERTHA™
EST 1948
$10.69

Uses ASA 200 Film
Easy to Build

Engines, launch system, glue, and
finishing supplies not included.
Avg Ship Wt.: 392 g (14 oz.)

Specifications:
Length: 30.8 cm (12.15")
Dia.: 15.7 mm
(0.62")
Wt.: 16.5 g (0.57 oz.)
Engines: A8-3 (3/4" Right), A8-3, A8-4, B6-4, B6-5, C6-4, C6-5

Specifications:
Length: 42.2 cm (16.6")
Dia.: 24.8 mm
(0.97")
Wt.: 30.6 g (1.10 oz)
Engines: A8-3 (1/4" Right), A8-3, B6-4, B6-5, B6-6, B6-8, C6-4, C6-5, C6-7

Specifications:
Length: 31.1 cm (12.25")
Dia.: 24.8 mm
(0.97")
Wt.: 22.6 g (0.8 oz.)
Engines: A8-3 (1/4" Right), A8-3, B6-4, B6-5, B6-6, B6-8, C6-4, C6-5, C6-7

Specifications:
Camera
Length: 16.5 cm (6.5")
Dia.: 33.3 mm (1.3")
Wt.: without film
35.5 g (1.29 oz.)
with film
49.8 g (1.76 oz.)
Shutter Speed: 1/500 sec.
F-Stop: 11

Specifications:
Camera and Launch Vehicle
Length: 48.6 cm (19.1")
Dia.: 34 cm (1.34")
Wt.: 106.1 g (3.75 oz.)
Engines: C6-7

Specifications:
Length: 91 cm (36")
Diameter: 38.1 mm (1.5")
Wt.: 52.3 g (1.89 oz.)
Engines: B6-2 (2/4" Right), A8-3 (in no wind conditions)
B6-4, B6-5, C6-4, C6-5

Specifications:
Length: 61 cm (24")
Diameter: 41.6 mm (1.63")
Wt.: 62.3 g (2.22 oz.)
Engines: B6-2 (2/4" Right), A8-3 (in no wind conditions)
B6-4, B6-5, C6-4, C6-5

Specifications:
Length: 114 cm (45")
Diameter: 50.8 mm (2.0")
Wt.: 141.8 g (5.00 oz.)
Engines: C6-7

Specifications:
Length: 152.4 cm (60")
Diameter: 50.8 mm (2.0")
Wt.: 226.8 g (8.0 oz.)
Engines: C6-7

Specifications:
Length: 182.9 cm (72")
Diameter: 50.8 mm (2.0")
Wt.: 295.7 g (10.5 oz.)
Engines: C6-7

Specifications:
Length: 213.4 cm (84")
Diameter: 50.8 mm (2.0")
Wt.: 364.6 g (12.8 oz.)
Engines: C6-7
**ZINGER™**

Efficient aerodynamic design makes this our best performing single-stage rocket. Easily reaches 610 meters (2000 foot) altitudes, making it an excellent sport or competition model.

**Specifications:**
- Length: 23 cm (9.09 in)
- Dia.: 18.7 mm (0.73 in)
- Wt.: 25.5 g (0.9 oz)
- Engines: A8-6, B4-6, B6-6, C6-7

**SPACE RACER™**

This nifty rocket with the easy looks is easy to build and has "out-of-sight" performance. Features easy-to-finish fiber fins, a special plastic molded nose cone and can use a wide variety of engines.

**Specifications:**
- Length: 32.1 cm (12.65 in)
- Dia.: 18.7 mm (0.73 in)
- Wt.: 25.5 g (0.9 oz)
- Engines: 100% 400 (first flight), A8-6, B4-6, B6-6, C6-7, B6-6, B8-8, C6-7

**SPARROW™**

A mini model with big missile decor, this rocket is so lightweight that it only requires breakaway recovery for safe landing! Additional features include fiber fins - no igniting required and colorful self-adhesive decals.

**Specifications:**
- Length: 27.3 cm (10.75 in)
- Dia.: 13.8 mm (0.54 in)
- Wt.: 11.1 g (0.39 oz)
- Engines: 1/2 A2-5 (first flight), A3-47, A10-37

**MINI-PATRIOT™**

The only mini engine scale (1/22nd scale) model available! This semi-scale version features construction techniques that keep the handling simple. This model features fiber fins - no igniting required.

**Specifications:**
- Length: 35.4 cm (13.94 in)
- Dia.: 18.7 mm (0.73 in)
- Wt.: 17.1 g (0.6 oz)
- Engines: A8-1 (first flight), A10-37

**NOVA PAYLOADER™**

With its clear payload capsule, this easy-to-build rocket is perfect for experiments and science projects. A great second or third rocket! A "C" engine will power this model out of sight and a parachute will recover it nicely for the next flight.

**Specifications:**
- Length: 35.7 cm (14.02 in)
- Dia.: 24.8 mm (1.0 in)
- Wt.: 17.6 g (0.6 oz)
- Engines: A8-1 (first flight), A10-37

**RELIANT™**

This hot performer features self-adhesive, sounding rocket decals and a quick release engine mount - a perfect beginner's rocket! Can use a wide selection of engines.

**Specifications:**
- Length: 31.8 cm (12.5 in)
- Dia.: 16.7 mm (0.66 in)
- Wt.: 17.6 g (0.6 oz)
- Engines: 1/2 A2-5 (first flight), A8-6, A8-8, B4-6, B6-6, B8-8, C6-7, C6-7
EXPLORER™ SERIES

SKILL LEVEL 2

When you have learned the basics of model rocketry and are ready for something new and different, the next step is the Explorer™ Series. This series offers interesting features with more involved construction and finishing. Here you will polish your skills and learn about the variety of fascinating design and recovery possibilities. Glider recovery models like the A.R.V. Condor™ and high flying two stagers offer new dimensions of in-flight excitement. There are scale models and futuristic designs that fly just as great as they look! Or step up to exciting "D" powered models like the Mean Machine™ or Delta Clipper™.

A.R.V. CONDOR™
EST 2075
$11.79

A.R.V. CONDOR™

This is Estes' dynamic concept of an upper atmospheric vehicle. This NOAA (National Oceanic and Atmospheric Administration) rocket would boost to the high reaches of our atmosphere via the booster vehicle, where the two research drones would detach. In this exciting version, the streamer-recovered booster pops two parafoil gliders off of rejection. These "diffuser tip" winged drones glide ecstatic, chasing each other gently back to the ground. Our kit features an easy-to-build, vacuum-formed plastic mounting system for the gliders and a three-color water-transferable decal.

Specifications:
Booster - Length: 47.0 cm (18.5"), Dia: 24.8 mm (1.0", 9/16"), Wt: 32.0 g (1.13 oz.)
Drones - Length: 15.6 cm (6.13"), Dia: 13.8 mm (0.54", 9/32"), Wt: 14.0 g (0.49 oz.)
Engines: B4-69 (1st Flight), B6-2, C5-3, C6-3
SOLAR WARRIOR™
EST 0895
$4.59

TORNOADO™
EST 2004
$4.59

HERCULES™
EST 1377
$12.79

SUPER NOVA™
EST 2011
$11.79

BLACK BRANT II™
EST 1958
$12.79

MINI-COBRA™
EST 0898
$4.29

BLACK BRANT II™
High flying 1/13 scale model of the Bristol Aerospace sounding rocket used by the Canadian Airspeed Research and Development Establishment for upper atmospheric research. An ideal first "D" engine powered model.

Specifications:
Length: 63.2 cm (24.75 in); Dia.: 33.7 mm (1.325 in); Wt.: 152.8 g (5.4 oz); Engines: D12.5 (first flight), D12.7 (second stage) 1/2/A3-4T.
**BULL PUP 12D™**

EST 1972

$8.89

This is our sport scale version of the U.S. Air Force's AGM-12D Bull Pup. The Bull Pup 12D™ is the perfect first scale model. Its unique appearance will make it stand out on the launch field or while on display.

**Specifications:**
- Length: 39.7 cm (15.6")
- Dia.: 33.7 mm (1.325")
- Wt.: 50.9 g (1.8 oz)
- Engines: AB-3 (First Flight), B4-4, B4-4, B6-4, C6-5

---

**HAWKEYE™**

EST 1987

$12.79

Military surface-to-air missile styling and out-of-sight flight are the trademarks of this fun flyer. Features patriotic red, white and blue decor plus great performance.

**Specifications:**
- Length: 21.6 cm (8.5")
- Dia.: 13.6 mm (0.54")
- Wt.: 119 g (0.42 oz)
- Engines: 10/3-2T (First Flight), A3-4T, A10-3T

---

**SENTINEL™**

This big model features on- and off-air missile styling and realistic liftoffs. An impressive addition to your fleet and a real crowd-pleaser. Extra large sheet makes finishing easy.

**Specifications:**
- Length: 70.2 cm (27.6")
- Dia.: 41.6 mm (1.637")
- Wt.: 76.4 g (2.7 oz)
- Engines: AB-3, B4-4 (First Flight), B6-4, C6-3, C6-5

---

**HELIO COPTER™**

EST 1996

$12.79

With clean lines and decor, this rocket soars high. On "C" engines. Then watch eyes open when the nose cone separates and depletes three spring-loaded helicopter blades and begins its slow, spinning descent to the ground.

**Specifications:**
- Length: 64.5 cm (25.4")
- Dia.: 34.2 mm (1.346")
- Wt.: 81.8 g (2.9 oz)
- Engines: C6-3 (First Flight), C6-5

---

**MEAN MACHINE™**

EST 1295

$20.99

Stand back on this one! Over six feet of bobby tube with a slick-in-the-pants "D" engine to boot. This tall, lean rocket is the perfect first "D" engine model and a spectacular flight! Requires 8 mm (3/16") diameter Maxi Rod™ (37.2348) to launch.

**Specifications:**
- Length: 200 cm (78.7")
- Dia.: 41.6 mm (1.637")
- Wt.: 164 g (5.8 oz)
- Engines: D12-5
CHALLENGE™ SERIES
SKILL LEVEL 3

When you are ready for a challenge or looking for more power, then it's time to step up to the Challenge™ Series. Here's where you will find models that demand the Estes "E" engine for full flight satisfaction. There is the easy-to-build, highly-affordable Maniac™ that will have you out flying in less than a hour (on "E"s, "D"s, even "C" engines). The Challenge™ Series also features the beautifully detailed model of the SR-71 Blackbird™. Fans of glider rocketry will enjoy the exciting Tomcat™ Swing-Wing Fighter.

Challenge™ Series models involve more time and skill for assembly. They may demand the use of other adhesives such as epoxy or advanced finishing and painting techniques. The construction, finishing and flight of a Challenge™ Series rocket is a proud accomplishment.
INTRODUCTION

Welcome to the exciting world of Estes model rocketry! This technical manual was written to provide both an easy-to-follow guide for the beginner and a reference for the experienced rocket enthusiast. Here you’ll find the answers to the questions most commonly asked. More complete technical information on all the subjects can be found in the many publications listed in your Estes catalog.

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WHY ESTES MODEL ROCKETY?

The hobby of model rocketry originated in the dawn of the space age in the late 1950s. Seeing space boosters carry the first artificial satellites into Earth's orbit inspired many enthusiastic young people to try to emulate the rocket pioneers by building their own rockets. Unfortunately, these homemade "rockets" usually involved stuffing flammable chemicals into metal pipes, very often with tragic results. Newspapers told of fingers and eyes lost—and all too frequently of lives lost. What was needed was a safe alternative that would allow young people to experience the thrill of constructing and launching their own rockets and provide them with the opportunity to explore the fascinating science of rocketry. Estes model rocketry is the answer.

A SAFE PROGRAM

Estes model rocketry is a safe activity because it incorporates three important features. The first is the model rocket engine, a professionally manufactured, low cost, solid-fueled rocket engine. This frees the rocket builder from the inherently dangerous procedures of mixing chemicals and packing propellant. The second feature is the use of safe materials for constructing the rockets. All model rockets are built using light-weight materials such as paper, plastic, and wood. Metal parts are never used for the main structural components of the model. The third feature is the incorporation of the Model Rocket Safety Code into all our flying activities. The safety code provides guidelines for the safe operation of model rockets, such as launching the rocket electrically from a safe distance, and using recovery systems to gently return the model to Earth. When the safety code is followed, model rocketry is an extremely safe activity, safer than baseball, soccer, or cycling. Our hobby's excellent safety record spans over six years and 500,000 rocket launches.

YOUR FIRST MODEL ROCKET

The Estes Alpha is shown here to illustrate the parts of a typical model rocket for the beginning rocket builder. The construction techniques used in this and other model rockets are explained in greater detail in this manual.

For your first model rocket we recommend one of the Estes EZ2 series. No modeling experience is needed to build an EZ2 model. Construction involves almost no cutting or sanding, and the models do not need painting.

The Beta series of models is an excellent choice for your second or third model. The Beta models are also a good starting point if you have previous model building experience.
4. MARK THE BODY
This Pin Mounting Grid will space equally three or four fins on all popular body tubes with equal edges. First, set the 'pin' at the end of the tube in the desired position. Then, mark the body outline with the aid of a compass or a circle cutter. Next, mark the body outline with a pencil or a ball point pen to mark the pin for each fin.

5. INSTALL THE ENGINE MOUNT
Be sure the glue on the engine mount is completely dry before you install the mount in the body tube. The fin alignment lines should be drawn on the body tube before installing the engine mount. You will position the engine holder midway between two fin lines for proper operation. Before gluing, make sure the mount slides easily in the body tube. If it's tight, sand it until it slides easily. Secure a liberal amount of glue around the inside of the body tube where the engine's ring or coupling will fit. Insert the mount into the position in one smooth motion. DONT PANIC, or the glue will "grab" it in the wrong place! Support the tube "snug-up" while the glue dries.

6. BALSA FINS
Fins are used to aerodynamically guide your rocket. Each model rocket uses fins made from thin sheets of balsa wood. In many kits, the fins are precut for you by a punch die. In other kits, you must cut the fins yourself. To cut the fins, use a pattern for each fin and cut the fin out of a blank sheet of balsa. All balsa fins must be cut so that the grain of the wood runs parallel with the leading edge of the fin for maximum strength.

7. ATTACHING THE FIN
After marking the tube and sanding the fins, you are ready to attach them to the body. The best way to attach balsa or fiber fins to a rocket with glue is by using a "double glue joint". Apply a layer of glue to the root edge of a fin and a thin layer of glue to the tube where the fin will be attached. Do this for all fins and allow the glue to dry. Then apply a second line of glue to the root edge and press the fin into place onto the body, holding it in place until the glue begins to set. Before the glue sets completely, adjust the fin along the center axis of the tube, and then secure the fin using modeling cement or a similar substance. Support the rocket body in a vertical position while gluing the fins securely.

8. ATTACHING LAUNCH LUGS
The launch lug is used to position the rocket on the launch pad. Attach the lug to the bottom of the rocket before applying the fin. A 2° launch lug is recommended, as it provides a small amount of stability to the rocket during flight. Attach the lug to the rocket and sand it smooth before applying the fins. If the lug is too large, it may create instability and affect the rocket's flight characteristics.

9. PARACHUTE ASSEMBLY
The parachute is the critical component of the rocket. It is the only part of the rocket that is designed to safely decelerate the rocket after it has reached its maximum altitude. When assembling the parachute, follow the instructions carefully and ensure that all parts are securely attached. In addition, the parachute should be tested before flight to ensure that it is functioning properly. If the parachute is not deployed correctly, it may fail to slow down the rocket, resulting in a dangerous and potentially hazardous flight.

In summary, the rocket consists of several critical components, including the engine mount, fins, and parachute. Each component must be assembled and tested carefully to ensure that the rocket functions correctly and safely. By following the instructions carefully and testing the rocket before flight, you can ensure that your rocket reaches its intended destination safely and successfully.
Snap Swirl Assembly

It's often worthwhile to attach your parachute to a snap swivel so as to allow the 'cage' to be easily removed. This lets you change parachute size in response to different wind conditions, or swap chutes between models. A snap swivel has an eyepile on one end and a wire snap hook on the other. The swivel connection is between the eyelets and the rubber bands turning up if the eyelets are cut off. Snap swivels are available from Rites or where fishing supplies are sold.

10. CONNECT IT TOGETHER

The final illustration shows how the cone, parachute, and rocket are connected on most models. If the rocket has a bulky payload section, it's a good idea to use two clamps as shown in the second picture.

11. CUTTING TUBES

When building custom design rockets or replacing damaged tubes on your models, you will often need to cut a specific length of tubing. Here's how to get it cut right:

(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. You can also use the pencil holder on the Ener-Tube Marking Guide to draw the line.

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

(3) Using a sharp blade, cut lightly along the line, unfolding the tube as you cut. Don't try to cut all the way through the first time. Use a light pressure on the knife for several turns until you cut through.

(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 irregularities and rough edges.

12. CLEAR PAYLOAD SECTIONS

Models that have a clear plastic payload section require a special problem. While glue will not bond the plastic to a hard nose block. To overcome this, use tape strips to the inside of the payload tube, then glaze the bond line black to the tape strips using white glue.

FINISHING

The finish of a rocket starts with the very first steps of assembly. For example, gluing and other messy hands will ruin the appearance of the model. Details will be done after the glue is dry. A model with a smooth finish not only looks more professional, but often needs less paint in flight, so it's lighter.

The degree of difficulty in finishing a model rocket depends on the materials used in its construction. Most models made of balsa have a very smooth finish, while those made of plastic need to be sanded before finishing.

1. SANDING AND SEALING BALSA PARTS

To get a smooth finish, the wood grain of the balsa must be filled. There are many types of wood filler and sandpapers available at hobby shops and hardware stores. Sanding papers differ in grit size and are used to smooth the surface of the model. If you are using a pre-colored surface, you may need to add color to thin them to a brushable consistency.

Paint cannot replace sandpaper. If a balsa surface is not sanded and sealed correctly, it will be impossible to get a smooth finish. By sanding all balsa surfaces with fine sandpaper and sealer, you'll have a smooth, brushable surface.

Next, apply a coat of sealer to the balsa. Let this dry completely, then sand with 320 grit (or finer) sandpaper, until the surface is smooth enough to apply sealer, repeating the procedure until all the filler and sealer are filled.

1st Coat... Sanded Surface

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

2nd Coat... Sanded Surface

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

2. SPRAY PAINTING THE MODEL

Using a good aerosol spray paint is the easiest way for a rocket to get a smooth, uniform finish on a model rocket. Other types of paint are used, but keep them at a distance. Different types of paint on the same model may cause paint compatibility problems. The finish of the rocket is a very fine, smooth line. If the edge is too heavy, the paint may not go on evenly. Use a fine sandpaper and smooth the surface of the model.

To hold the model during painting, make a "painting wand" by pulling a sheet of newspaper into a very long, narrow cone and inserting it into the engine section cavity. An installed engine casing glued onto a wooden dowel makes a great...
Deflective Force

How A Side Force Visibly Affects Course Of Normally Stable Rocket

Although determining the exact relationships between various forces on a model rocket requires higher mathematics, certain practical rules can be used to predict the behavior of a rocket. These rules are based on experience and can be used to design stable rockets. The first rule is to use a long body. With a long body, the rocket's moment of inertia is increased, which helps to stabilize its flight. 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 with at least as long a base as the example in the illustration.

Minimum Fin Size

Example: Rocket 12" Long

Rocket Should Balance Here

The third rule is to place the fins as far back on the rocket as possible. Generally, the rear of the fins should be at least 10" ahead of the CG. If the fins are placed too far forward, they will act as a brake, decreasing the rocket's performance.

Sway Testing For Stability

The easiest way to test the stability of a model is to fly it—without launching it. To do this, attach a string to the model and swing it through the air. If the string is attached to the rocket's CG, its behavior will be similar to its behavior when in flight. If the string is attached to the rear of the rocket, its behavior will be different. To test your model, attach a string to the rear of the rocket and swing it through the air. You can also attach a string to the front of the rocket and see how it behaves. This will help you determine if the rocket is stable or not.

Double Check A Rocket With Questionable Stability As Follows:

Move String Until Nose Of Rocket Points Ten Degrees Forward Then Repeat The Swing Test

Rocket Should Still "Fly" Nose Forward

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

Don't try to fly a rocket that has not passed the test. Most unstable rocket's nose point around in the air harmlessly. However, a few marginally unstable models may make a couple of loops and then come to a stable nose up flight. The popular tank burns. If 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 more 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, add weight to the nose cone. For models with hollow plastic nose cones, pack some clay into the tip of the nose cone. To add weight to hollow nose cones, attach weights to the base of the cone. The CG can also be moved forward by adding a small add-on to the nose cone. This can either be replaced with larger nose cones or extra tabs can be glued to the rear or tip edges of the fins. The CG must also be added to the model. Some scale models use additional nose cones. After making your changes, test your model again to see if it is now stable.

Add A Nose Cone Weight...

Hence Here Here Or Both

PREPARING FOR FLIGHT

Parachutes and streamers must be protected from the heat of the test rocket. Never test a rocket without a parachute. Ordinary tissue paper will continue to burn after the rocket has landed and can cause dangerous fires. Luckily, there are enough flame-resistant recovery wadding to fill the tube to 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 snug seal.

To add the parachute, hold it between two fingers at its center and pass the other hand down to form a "spiral" shape. Pull this spiral into several sections as shown. Push the tissue cone and shock cord in the top half of the wadding. Push the fabric cone into the tube of the shock lines and shock cord, then slide the nose cone into place.

LAUNCHING

Model rockets, like professional rockets, are launched electronically. This provides both safety and reliability. Each motor is supplied with an igniter, igniter plug, and complete instructions; still more information is supplied with launching kits. However, the basic information needed to launch models successfully is included in this page.

1 LAUNCH CONTROL SYSTEMS

The electrical launch system controls the flow of electrical current to the igniter. Safety features built into the controller ensure that current does not reach the igniter until it is time to launch. An electronic launch controller is shown below.

All launch control systems work by passing electrical current through the high-voltage wire in the tip of the igniter. This current heats the wire, which ignites the propellant of the igniter. When the igniter propellant ignites, the thrust of the engine is transferred to the rocket. The igniter is attached to the rocket with micro-caps, one cap on each igniter wire. When connecting the micro-caps to the igniter, make sure the caps do not come into contact with the rocket or the plastic tube. If they do come into contact with the rocket or the micro-caps, the plastic tube could melt or the igniter could be damaged. Use a friction or gas-ignition method to connect the micro-caps.

IGNITER INSTALLATION

For safety reasons, do not install igniters in model rocket engines until the end of the engine. Never ignite a rocket engine without an igniter.

Use sensors to separate the igniters. The igniter is connected to the micro-cap with a wire. When the safety key is removed, the igniter is disarmed automatically. You can also use a micro-switch to connect the igniter. This allows you to arm the igniter and then launch the model.

Any homemade electric launch control system must include all the safety features outlined above. The Estes publication "Model Rocket Launch Systems" for details. A typical launch controller circuit is shown below.

2. LAUNCHER DESIGN

A model rocket cannot be simply set on its fins and launched since the rocket requires a fast airflow over its fins to stabilize it. The model must be guided until it is moving fast enough for the fins to operate; the launcher provides this initial guidance.
3. LAUNCH SAFETY

Only launch model rockets from a large open area. Make sure the ground around the launch area is clear and that there are no power lines or high-energy materials within your vicinity. For maximum safety, tie the launch controller safety key to the plastic launch rod, which is supplied with the rocket. Always carry the cap and key with you to the launch area. After fusing the rocket onto the launch rod, place the cap on the rod before looking up the igniter. The igniter protects you from accidental injury in case of a failure. If the igniter is not available, place your hand on the end of the rod before leaving.

Before immediately launching a rocket, check for low-flying aircraft. If there are other people in the launch area, announce the launch loudly to get their attention. Follows and audible two-second countdown.

After a successful launch, remove the safety key from the controller. If the rocket becomes entangled in a power line or other dangerous place, DO NOT attempt to retrieve the model.

4. LAUNCH AREAS

Choose a large field away from power lines, tall trees, and low-flying aircraft. The sides of the field should be at least 500 feet away from any side of the rocket's expected maximum altitude. The Model Rocket Safety Code contains a table of minimum field sizes for every engine size.

COUNTDOWN CHECKLIST

Use a countdown checklist when you launch your models. You'll find it makes your rocket flights more successful and enjoyable. The following procedures are recommended for most parachute or streamer models. For some types of rockets, you may be able to develop your own complete checklist:

12. Pack flame-resistant recovery wadding into the body tube.

13. Install the nose cone or payload section, checking for proper fit. Check condition of the payload (if any).

14. Apply enough wadding tape to the ignition point for a light friction fit in the body tube (2" needed for a 24" rocket).

15. Launching a multistage rocket should be done carefully, as there are more possible points of failure. Use a layer of cellulose tape tightly wrapped around each engine joint. Mount the engine(s) in the rocket. If the engine uses engine holders, check that the proper height locks the nose end of the engine in place.

16. Install an igniter in each engine.
In figure 18 the propellant is partially burned, leaving a large combustion chamber. As the propellant continues to burn, the wall of propellant becomes thinner until it is empty, and the high pressure inside the chamber. At this point the remaining propellant, wall ruptures, and the high pressure blows forward into the muzzle of the rocket, causing it to go forward and small pieces of burning propellant into the nozzle of the second stage engine. This action is illustrated in figure 19.

For this system to work, the stages must be held together until the upper stage engine has ignited. When this happens, the stages must separate in a straight line. This is accomplished by wrapping one layer of cellophane tape around the joint between the engines and expanding this joint. 1/2 inch rearward in the booster body tube, as in figure 20. Releasing the joint forces the stages to separate in a straight line.

Figure 21 shows the engine installation in a typical two-stage model. Always tape the engines together before inserting them into the rocket. NEVER CUT. Check carefully before and after taping to be sure the engines are in the proper positions ( básico of upper stage engine against tip end of booster engine). Failure to check carefully can be highly embarrassing and as damaging to the rocket.

After taping the engines together, wrap masking tape around the upper stage engine at the front and rear in the figure 3 to give it a tight fit in the body. Push it into position. 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.

Stage Coupler Extends 1" Into Upper Stage

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

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 (at balance point) matches or is up to 1/4" ahead of the booster's balance point with an expanded engine casing in place. Boosters should have no parachute or streamer, but will normally tumble, flutter, or glide back to the bottle. A booster stage should be painted an especially bright color because it does not have parachute or streamer and so it spottles it one in the ground.

Types of Engines

Lower and intermediate stages always use engines which have no delay element, and no parachute ejection charge. No delay is used so that the next stage will receive the maximum velocity from its booster. Suitable engines have designations with a "0" delay, such as the B60, C60, D126, and A104. In the upper stage an engine with a delay and a parachute ejection charge is used. A general rule for the longest possible delay should be used. Engines suitable for upper stage are those with long delays such as the AB6, B64, C67, D127, etc.

CLUSTERING

When large models and heavy payloads have to be launched, one engine often cannot supply enough power. A cluster of several engines can be used in this case.

ENGINE ARRANGEMENTS

In designing a clustered model the first rule to remember is that thrust must be balanced around the centerline of the rocket. Figure 5 shows several engine arrangements that satisfy this requirement. All engines should be located close together to keep unbalanced thrust from fusing the model off course.

CLUSTER IGNITION METHODS

Reliable ignition is the most important part of successful clustering. All engines must be fired simultaneously, so this requires a heavy-duty launch controller that can supply high current levels. The Estes Control Command launch controller is extremely satisfactory for cluster ignition. A custom designed controller using a 12 volt battery can supply the power supply and a heavy gauge wiring is also suitable.

CURRENTLY, igniters in the cluster engines using igniter plugs in the normal way, make sure the tips of the igniter points are touching the propellant and are held firmly in place.

ENGINE must be connected in parallel—not in series! The easiest way to do this is using "clip wires." Mechanically clean all clips with sandpaper before hooking up the igniters. Every igniter must be connected to all the others so that no one igniter could seriously injure or kill the animal. For a similar challenge, try flying a raw egg.

Close Igniter Leads As Shown

Attaching Close Igniter Leads As Shown

Three Engine Cluster Arrangement

Four Engine Cluster Arrangement

In general, clustering igniters are connected in parallel—not in series. The easiest way to do this is using "clip wires." Mechanically clean all clips with sandpaper before hooking up the igniters. Every igniter must be connected to all the others so that no one igniter could seriously injure or kill the animal. For a similar challenge, try flying a raw egg.

Boost-Gliders

Boost-glders are models which fly straight into the air like any other rocket. However, they glide back earth instead of coming down suspended from a parachute.

There are several types of boost-glders, including 1. Bare Glider, 2. Front engine, 3. Poplock, 4. Variable geometry, and 5. Para-Sail. Some boost-glders use radio control to allow the model to fly to a parachute. Although these types vary very different, many of the same principles apply to all.

A boost-glider, as any other rocket, must be stable to fly upward. During a glide a model must still be stable, but not by nearly as great a margin. Boost-glders can accomplish the transition from boost to glide configuration in several ways. Some use a cowl in balance point, others by ejecting engines; others use a shifting of aerodynamic surfaces still others use combinations of both methods. See TR-4 and TS-7 for further discussion on gliders.

GLIDE TESTING

A boost-glider must be "trimmed" to glide correctly before launching. Some models are trimmed by adjusting the positions of elevators or other aerodynamic control surfaces. Other models are trimmed by adding or removing weight, such as clay, to the nose or tail of the glider.

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

Glide Paths Observed As Glide Is Tossed Lightly Into the Wind From Shoulder Height
MODEL ROCKET ENGINES

Today's rocket flyers can choose from a wide variety of engines to power their models, each with an engine available for almost every imaginable purpose and type of flight. Each engine is designed and engineered for specific purposes. Manufacturing rocket engines is an inherently dangerous activity that should only be attempted by professionals.

OPERATION

The figures show the internal structure and thrust curves of a typical model rocket engine.

THRUST CURVES

Jet engines come in different types including end-burning and side-burning. The different thrust curve shapes of these two types are primarily the result of the depth of the "pump" formed in the nozzle.

MODEL ROCKET PERFORMANCE

Several factors affect the altitude performance of model rockets.

ENGINE SIZE

The greater the total impulse of an engine, the higher it will boost a model. The approximate altitude achieved by typical single-stage rockets is listed in the table on page 12; high-performance models can exceed these values. The jet, 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.

SELECT THE CORRECT ENGINE

Always use an appropriate engine to fly your rocket. Consult the Estes catalog or ask your local dealer for the proper engine size and thrust level to use in a rocket.

ENGINEERING AND QUALITY CONTROL

Today's Estes engines are static tested on a recording type of test stand, which graphically records the maximum thrust, thrust variation, maximum thrust, overall thrust duration, length of time, and the strength of the engine charge. Any batch of engines which does not test to these standards are automatically rejected. Estes engines are made to rigid specifications and undergo rigid inspection before being shipped. Each engine is individually tested to ensure that it performs as designed.

SAFETY

Rocket engines are not toys, but scientific devices. With common sense and adherence to safety rules, model rocketry is a safe, fun, and educational hobby for any other scientific study.

The most common model rocket engine is the end-burner. It is usually a solid rocket engine and is used to provide high performance rockets. The high-thrust rocket burns the propellant in a single chamber and a solid propellant rocket. The rocket is designed to give the required performance for the specific mission.

MODEL ROCKET PERFORMANCE

Several factors affect the altitude performance of model rockets.

ENGINE SIZE

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WEIGHT

In most cases, the heavier a rocket, the lower the altitude it will reach. Weighing in at its lowest weight is not always the answer. The rocket must lift the payload and the rocket itself, and both must be designed to withstand stresses and strains.

SELECTING THE CORRECT ENGINE

Always use an appropriate engine to fly your rocket. Consult the Estes catalog or ask your local dealer for the proper engine size and thrust level to use in a rocket.

ENGINEERING AND QUALITY CONTROL

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The Classic Collection
A comprehensive collection of technical reports and notes that makes a valuable information tool. Includes Th-1 through Th-7 and TN 1, TN 2, TN 4, and TN 6.
EST 2840

Model Rocketry Study Guide
A logical program for anyone who wants to move from model rocketry. Guides a beginner on the path to becoming an expert rocketeer.
EST 2841

Altitude Prediction Charts
A simple system by which aerodynamic drag and other effects can be taken into account in predicting rocket peak altitudes. Technical Report TR-12.
EST 2842

Aerodynamic Drag of Model Rockets
EST 2843

Elementary Mathematics of Model Rocket Flight
Information on how to make your own altitude tracker and calculate speeds and accelerations. Technical Note TN-5.
EST 2844

Model Rocketry Technical Manual
Handy guide for construction and flight of model rockets. Tips on "scratch building," launch systems, tracking, staging, hot-splinters, and more.
EST 2845

Estes Educator News
Interesting technical articles, new product information, plus activities and resources on space and model rocketry suitable for classroom use. Available through many local retailers.

Guide for Teachers and Youth Group Leaders
Introduces you to Estes' model rocket technology and the complete services offered in our educational program.

Estes 2846

Model Arts Teachers Manual for Model Rocketry
Very practical 52-page guide on model rocketry and its applications in the study of manufacturing, transportation, R&D, communications, and construction.
EST 2847

Camp Leader's Model Rocketry Manual
Proven guide for introducing model rocketry successfully into camp programs. 10 pages.
EST 2848

Video - Model Rocketry - The Last Frontier*
Capture the excitement of model rocketry in this full color VHS video presentation, narrated by and featuring William Shatner of Star Trek. An excellent primer to model rocketry with dramatic launch footage and graphic, easy-to-understand illustrations. 15 minutes.

*Copyright Estes Industries 1989. All Rights Reserved.
**Copyright Paramount Pictures Corporation 1979. All Rights Reserved.

EST 2849

Estes Industries
1295 H Street
Penrose, CO 81240

New!
Quick Building

New!
Upgraded

MANIAC™
EST 2091
$9.99

SHADOW™
EST 2094
$26.99

PHOENIX™
EST 1380
$21.49

MANIAC™
You have to be crazy not to like this low-cost performer. Quick building, no painting, heavy-duty construction, and it flies on "E" engines for over 2000 feet! The Maniac also uses "D" engines, and with the optional quick-change engine mount (EST 3154) even flies on "C's. Requires a 5 mm (1/16") Maxi™ Rod (EST 2240) or 8 mm (5/32") launch rod to launch.

Specifications:
Length: 78.5 cm (30.8''), Dia.: 40.64 mm (1.6''), Wt.: 130 g (4.6 oz), Engines: D12-5 (3 flight), D12-7, E15-5, E16-4. With optional En-MaxX (EST 3154) to C5-3, C5-4. Special Introduction Price.

SHADOW™
No holding this rocket — it's nearly four feet tall and 2.6 inches in diameter. The Shadow™ flies magically to over 550 feet on "E" and can be powered by "D" engines! Kit includes a massive self-adhesive decal. Requires a 5 mm (1/16") Maxi™ Rod (EST 2240) or 8 mm (5/32") launch rod to launch.

Specifications:
Length: 120.7 cm (47.5''), Dia.: 66 mm (2.6''), Wt.: 230 g (8.1 oz), Engines: D12-3 (3 flight), D12-5 (3 flight), E15-5, E16-4.
COMANCHE-3™
EST 1382
$12.79

SR-71 BLACKBIRD™
EST 1942
$16.99

COMANCHE-3™
If two stages are not enough, here's three. And to really get this show moving fast, there is a "D" engine in the first stage! This rocket can fly over 1/2 mile in altitude and is recovered with a streamer. Can also be flown in a single or two stage configuration. 4.5 mm (.166") Maxi-Rod™ EST-2246 is required for launch. Specifications:
Length: 104.1 cm (41.0") Dia.: 24.8 mm (0.975") Wt.: 589 g (20.6 oz) Engines: single stage configuration: 46-3 (First Flight), 84-4, 86-4, 88-5, C6-5, multistage configuration: upper (top) stage - 48-5 (First Flight), 84-6, 86-6, C6-7, second stage - 86-0 (First Flight), C6-0, first stage - D12-0

SR-71 BLACKBIRD™
Jet black, lean and mean, the SR-71 smashed numerous speed and altitude records as far back as 1965. Some still stand after more than 25 years! After three decades of service, the SR-71 is now used by NASA for testing propulsion systems and materials for use in the X-38 program.
Specifications:
Length: 48.3 cm (19") Dia.: 24.8 mm (0.975") Wt.: 105.6 g (3.2 oz) Engines: 84-2 (First Flight), 86-2, 86-4, 86-6, C6-4

TOMCAT™
Swing-Wing Rocket Glider
EST 2086
$15.99

TOMCAT™
Swing-Wing Rocket Glider
Out of the Estes stink works, the TOMCAT™ is ready for action! Climb vertically with the wings swept back, then the engine's escape charge activates the release mechanism and the wings sweep forward into glide mode. The TOMCAT™ soars down into a graceful climbing glide path. Release the engine, sweep the wings back, reset the release mechanism, and you're ready to go battle!
Specifications:
Length: 53.7 cm (21.2") Wingspan: Swept - 26.0 cm (10.2") Extended - 47.3 cm (18.6") Wt.: 116 g (4.1 oz) Engines: C6-3 (First Flight), C5-3

BROADSWORD™
Powered by "E" engines (but can fly on "D"s too!), this rocket boasts altitudes of almost 1,200 feet! The BROADSWORD is three feet tall, 2.6 inches in diameter, decked by a huge self-adhesive decal and features realistic lift-offs. The BROADSWORD makes a bold statement! Requires a 6 mm (3/16") Motor™ Rod (EST-2246) or 4 mm (.16") rod to launch.
Specifications:
Length: 92.7 cm (36.5") Dia.: 66 mm (2.56") Wt.: 171 g (6 oz) Engines: D12-3 (First Flight), D12-6, E15-4, E15-6
This is the goal of every rocket builder. These are flying rockets that are aimed at the serious rocket modeler - the modeler who likes the emphasis to be on construction. The Saturn V™ is the flagship of this series, an impressive model whether on the pad or on display. The accurately-detailed, fully-stacked Space Shuttle™ features an actual gliding shuttle. Highly detailed models from the Star Trek® world also grace this level - the USS Enterprise™ and the infamous Klingon™ Battle Cruiser.

Master™ Series instills patience, quality, and skill along with construction satisfaction and flying fun.

SATURN V™
On July 20th, 1969, humankind’s greatest adventure had reached its climax. The world held its collective breath as Neil Armstrong gently placed a footprint on the moon. The first man on an alien world. It was a giant leap. Estes celebrates that historic moment with the 25th anniversary commemorative Saturn V™ - the vehicle that took the Eagle lunar lander to the moon. This special edition contains a special 25th anniversary poster, sticker, and a coupon for a factory rebate. The kit itself is a magnificently detailed 1:100 scale model - from the plastic molded escape tower and Apollo capsule, to the highly accurate decals, down to the detailed plastic injection engines. At 1:100 scale, this model stands an impressive three and one half feet tall and is over four inches in diameter. Extensive detailing includes the corrugations on the fuel tanks (spaceloaft embossed body wraps) and external details such as the vents, separation motors, pyramidal panels, etc. (mocked piloted). The Estes Saturn V™ has now been modified to accept E15 engines. This model will draw nods of appreciation from master modelers and envy from the novices. The Estes Saturn V™ requires 0.5 mm (0.02”) Max™ rod or a 0.6 mm (1/32”) rod to launch - not included.

Specifications:
Length: 109.2 cm (43.25”); Dia.: 100 mm (3.94”); Wt.: 288.7 g (10.12 oz.); Engines: E15-4 (First Flight), D12-3
**ESTES Masters Series**

**STARSHIP ENTERPRISE®**

EST 1274
$25.99

Contains：“Constellation” class starship was the flagship of the Federation. Its mission encompassed galactic security and exploration. Our version requires special modification (with the addition of a recovery probe) to fly in our atmosphere. The recovery probe can easily be disengaged. Other features include vacuum-formed plastic parts and highly accurate decals.

Specifications:
- Length: 42.6 cm (16.8’’)
- Recovery Probe Length: 77.2 cm (30.4’’)
- Primary hull Dia.: 19 cm (7.5’’)
- Wt.: 110 g (3.8 oz.)
- Engines: B6-2 (First Flight), C6-3

**KLINGON™ BATTLE CRUISER**

Accurately detailed 1/162 scale model of America’s most famous space vehicle. Like the real one, the orbiter glides back to Earth, while the external tank and boosters return under a 46 cm (18’’) parachute. Removable stabilizer fins plug in for flight. A great display and demonstration model.

Specifications:
- Total Length: 34.5 cm (13.5’’)
- Orbiter Length: 22.9 cm (9’’)
- Orbiter Wingspan: 18 cm (7.1’’)
- Weight: 136 g (4.7 oz.)
- Engines: C5-3 (First Flight), C6-3

**SPACE SHUTTLE™**

EST 1284
$24.99

**EXPLODER AUARIUS™**

EST 1216
$19.99

**Hatchlift™**

This represents the most verisimilar missile to have been built in America. With the addition of a recovery probe, the model can easily be flown in our atmosphere. The missile is a realistic representation of America’s most famous space vehicle, and can be used for display and demonstration purposes.

Specifications:
- Length: 66.2 cm (25.75’’)
- Diameter: 66.9 mm (2.65’’)
- Wt.: 118.9 g (4.2 oz.)
- Engines: D12-3 (First Flight), D12-5
**PRO™ SERIES**

**SKILL LEVEL 4**

Estes high-powered product line can be found in the Pro™ Series. These are large models using, at the very least, single or clustered "D" engines. All models also use the more powerful "E" engine. Engineered for performance and safety, we only recommend these rockets for modelers 16 years of age or older.

Rockets in this line feature rugged, yet simple construction designed to withstand the stresses of higher-powered flight. What do you get when you combine heavy-duty body tubes, through-the-wall fin mounting, plywood centering rings and rip-stop nylon parachutes? Models that are tough, but surprisingly lightweight.

Plus, we have the right accessories to go with these impressive models - The Command Control™ launch controller and the Power Plex™ launch pad. These are the ultimate in ruggedness, versatility and safety.

**TERRIER/SANDHAWK™**

Nestled nose to tail, this lightweight, but strongly-built 1/9.8 scale model is an excellent performer. Flies single stage in two configurations: as is or detach the Sandhawk™ and fly it alone! Scale data and documentation included.

**Specifications:**
- Length: 10.6 cm (4.2"")
- Dia.: 46.6 mm (1.85"")
- Wt.: 246 g (8.6 oz.)
- Engines: Terrier/Sandhawk™ - D12-3, E15-4; Sandhawk™ - D12-6 (first flight), E15-6; With EM-2030 Adapter - B4-2, B6-2, C6-3

**JAYHAWK™**

A magnificent, highly-detailed 1/9th scale model of the U.S. Navy's supersonic AGM-84A Marble Target drone. This unique-looking rocket will become your favorite, whether on display or in the air. The Jayhawk™ kit features giant, colorful, scale, water-transferable decals, nylon parachute, ripped heavy-duty body tube, and plastic-molded nose cone and stand.

**Specifications:**
- Length: 76.2 cm (30"")
- Dia.: 63.5 mm (2.5"")
- Wt.: 245 g (8.6 oz.)
- Engines: D12-3 (first flight), E15-4
**IMPULSE™**
The power of two "D" engines, ignited simultaneously, whoosh this rocket into the air. The easy impulse™ makes the introduction to clustering simple. This model is easy to build for the experienced rocket modeler. The impulse™ features the standard heavy-duty Pro™ series construction.

**Specifications:**
- Length: 94 cm (37")
- Dia.: 6.5 mm (0.25")
- Wt.: 235 g (8.3 oz.)
- Engines (two required)
- D12-5 (first flight), D12-7, E15-5, E15-6

**Patriot™**
This is one huge 1/8 scale model of the Desert Storm version. The thunder and smoke of four "E" engines, clustered together, hurl this model missile to over 1500 feet. This rocket is a rewarding build for the experienced modeler. Scalecontoured fins and contours along with a highly detailed decal sheet enhance this kit.

**Specifications:**
- Length: 99 cm (39")
- Dia.: 7.2 mm (0.3")
- Wt.: 346 g (12.3 oz.)
- Engines (four required): D12-5, D12-7, E15-5, E15-6
- FAA notification or waiver may be required to fly this rocket.

**Maxi-Force™**
With the combined force of three "E" engines, this huge bird soars to over 1600 feet altitude on a column of smoke. Definitely an attention-getter. Rugged construction and a tough rip-stop nylon parachute assure reliable, high-powered flights.

**Specifications:**
- Length: 127 cm (50")
- Dia.: 63.5 mm (2.5")
- Wt.: 480 g (16.9 oz.)
- Engines (three required): D12-5, E15-5, E15-6
- FAA notification or waiver may be required to fly this rocket.

**Star Wars Saga**
Now you can own these artifacts from a long time ago in a galaxy far, far away! Estes is pleased to reintroduce these Commemorative Series models from the exciting Star Wars saga.

**X-wing Fighter™**
- EST 2103
- $16.99

**R2-D2™**
- EST 2104
- $24.99

**TIE Fighter™**
- EST 2102
- $21.99

**X-wing Fighter™**
A scale reproduction of the X-wing fighter piloted by Luke Skywalker. The Estes X-wing features a blow-molded, plastic fuselage, detailed plastic parts, die-cut balsa wings and authentic decals. Not only is the X-wing great for display, but it flies to over 3300 feet!

**Specifications:**
- Length: 27.6 cm (10.9")
- Wing span: 23.5 cm (9.2")
- Dia.: 33.6 mm (1.3")
- Wt.: 146 g (5.1 oz.)
- Engines: 65-3 (first flight), C6-3

**R2-D2™**
Estes is pleased to give you the flying version of the famous R2-D2 droid. Our R2-D2 is a 1/8 scale model standing nine inches tall. Kit includes a molded plastic body dome and tail cone, molded plastic legs and a detailed, self-adhesive body wrap.

**Specifications:**
- Length: 13.7 cm (5.4")
- Wing span: 13.7 mm (5.4")
- Flying length w/prop: 33.2 cm (13")
- Wt.: 107.4 g (3.8 oz.)
- Engines: C6-3 (first flight), C6-3
r/c gliders

These radio-controlled aircraft are for the model aviation enthusiast who is looking for something unique. Rocket-powered model aircraft require R/C experience and R/C gear (servos, receivers, transmitters, etc.)

**STRATO BLASTER™**
EST 2090
$69.99

Go ballistic with our next generation of rocket-powered R/C gliders! The Strato Blaster™ features a blow-molded fuselage, covered from wing to cut-out tail parts. The Strato Blaster™ flies on E15-P's (about 300 feet) or D11-P's, can be converted to fly R/C with an .049 glow engine, and is an excellent slope glider! The Strato Blaster™ requires R/C experience to fly, two-channel (minimum) mini or micro gear (R/C gear not included) and a 3 mm (1/8") Maxi™ Rod (EST 2244) or a 6 mm (1/4") launch rod to launch (The Kittey Power™ Launch Pad (EST 2235) is recommended).

Specifications:
- Wingspan: 17.6 cm (6.5")
- Length: 31.3 cm (12.3")
- Wing Area: 14.1 sq. dm (2.19 sq. in.)
- Wt. (typical): 309 g (1.1 oz)
- Power: D11-P, E15-P, .049 glow engine

**ASTRO-BLASTER™**
EST 2073
$79.99

A new dimension in excitement for rocket enthusiasts and R/C modelers alike. Combining rocket boost glider technology with R/C aerobatic capability gives a model that delivers maximum fun! Includes a quick-change adapter for .049 glow engine power. In seconds, the Astro-Blaster™ transforms into an aerobatic powership, R/C rocket glider, sport plane, .049-powered sport bi, 3-in-1 versatile! Features conventional quality model aircraft construction and requires two channel radio equipment with mini or micro flight pack (not included). Requires 6 mm (3/16") Maxi™ Rod (EST 2244) or a 6 mm (1/4") launch rod to launch.

Specifications:
- Wingspan: 91.4 cm (36")
- Wt. (typical): 397 g (14 oz)
- Power: D11-P, E15-P, .049 glow engine
ENGINES OVER 35 SAFE YEARS

Safe, intelligent design, precise manufacture and strict engineering tolerances have made Estes model rocket engines the standard in the industry. They have been proven consistent and reliable in more than 300,000 launches.

Some important features are:
- Lightweight non-metallic castings made from specially formulated paper with clay nозles.
- Pre-loaded with propellant - the motor case does not handle any hazardous materials.
- Estes engines comply with the codes of the National Fire Protection Association and are certified by the National Council of Rocketry.
- 33% of all Estes engines are static-tested at the factory for reliability and adherence to performance specifications. If our standards aren’t met, the engines are rejected and don’t make it to market.
- The concept of the pre-assembled model rocket engine is the foundation of this safe, scientific and educational activity.

TOTAL IMPULSE

This letter indicates the total impulse range of the engine. Total impulse is the total power the engine produces, which directly indicates how much propellant it contains. Total impulse is measured in Newton-seconds. One Newton-second is the amount of total impulse produced by one Newton of thrust for a duration of one second. A five Newton-second engine would produce five Newtons of thrust for one second, ten Newtons for one second, or any combination that equals five Newton-seconds when multiplied. The chart below shows the possible values for each engine type.

AVERAGE THRUST

This number tells you the average thrust the motor delivers during the thrust phase. The actual thrust varies, and is shown on the thrust curve (see example below). For a particular engine size, let’s say a “B”, the propellant may be burned quickly, giving high thrust for a short time, or slowly, giving lower thrust for a longer time. A higher average thrust engine (B8) is best for heavier models, while a lower average thrust, longer burn engine (B6) is more efficient in smaller, lighter models.

TIME DELAY

Unit = seconds

The time delay is the number of seconds between the end of the thrust phase (propellant burned) and activation of the ejection charge. The time delay allows the model to coast to its peak altitude before the recovery system is deployed. The kill instructions and this catalog list the current engine choices for your model.

COLOR CODING:

Estes model rocket engines have color-coded labels that indicate their applications.
- Red Label - Single stage models
- Black Label - Special plug engines are for R/C gliders. They contain no delay or ejection charge.

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Estes model rocket engines have color-coded labels that indicate their applications.
- Red Label - Single stage models
- Black Label - Special plug engines are for R/C gliders. They contain no delay or ejection charge.

COLOR CODING:

Estes model rocket engines have color-coded labels that indicate their applications.
- Red Label - 'T' delay engines, for use in booster stage and special projects only. Contains no delay or ejection charge.
- Black Label - Special plug engines are for R/C gliders. They contain no delay or ejection charge.

REGULAR ENGINES (GREEN LABEL)

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 3 for</th>
<th>Total Impulse lb./sec.</th>
<th>Time (sec.)</th>
<th>Max. Lift Wt. oz/g.</th>
<th>Max. Thrust lb./in.</th>
<th>Thrust Duration sec.</th>
<th>Initial Weight g</th>
<th>Propellant Weight g</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2A-6*</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
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<td>1/2A-6</td>
<td>3.50</td>
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<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
<tr>
<td>1/2B-6</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
<tr>
<td>1/2C-6</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
<tr>
<td>1/2D-6</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
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<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
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BOOSTER ENGINES (RED LABEL)

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 3 for</th>
<th>Total Impulse lb./sec.</th>
<th>Time (sec.)</th>
<th>Max. Lift Wt. oz/g.</th>
<th>Max. Thrust lb./in.</th>
<th>Thrust Duration sec.</th>
<th>Initial Weight g</th>
<th>Propellant Weight g</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4A-6</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
<tr>
<td>1/4B-6</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
<tr>
<td>1/4C-6</td>
<td>3.50</td>
<td>0.28</td>
<td>1.25</td>
<td>2.50</td>
<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
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<td>5.65</td>
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<td>1.25</td>
<td>2.50</td>
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<td>28.8</td>
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<td>70.8</td>
<td>28.8</td>
<td>0.20 sec.</td>
<td>0.65</td>
<td>5.65</td>
</tr>
</tbody>
</table>

Regular engines are 7 cm (2.75 in.) long and 17.5 mm (0.69 in.) in diameter. Ship Wt. of each package of engines is approximately 11.2 g (4 oz.).
### MINI ENGINES

**SINGLE STAGE ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 4 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1503</td>
<td>1/2A3-2T</td>
<td>$6.19</td>
<td>0.28</td>
<td>1.25</td>
<td>2/ 56.6</td>
<td>1.75</td>
<td>7.8</td>
<td>0.56</td>
<td>1.98</td>
</tr>
<tr>
<td>1507</td>
<td>A3-4T</td>
<td>$4.29</td>
<td>0.56</td>
<td>2.50</td>
<td>2/ 56.6</td>
<td>1.75</td>
<td>7.8</td>
<td>0.86</td>
<td>2.68</td>
</tr>
<tr>
<td>1511</td>
<td>A10-3T</td>
<td>$4.29</td>
<td>0.56</td>
<td>2.50</td>
<td>5/141.5</td>
<td>3.00</td>
<td>13.3</td>
<td>0.26</td>
<td>2.77</td>
</tr>
</tbody>
</table>

**UPPER STAGE ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 4 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1504</td>
<td>1/2A3-4T</td>
<td>$6.19</td>
<td>0.28</td>
<td>1.25</td>
<td>1/ 28.3</td>
<td>1.75</td>
<td>7.8</td>
<td>0.35</td>
<td>2.12</td>
</tr>
</tbody>
</table>

**BOOSTER ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 4 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1510</td>
<td>A10-OT</td>
<td>$4.29</td>
<td>0.56</td>
<td>2.50</td>
<td>none</td>
<td>5/141.5</td>
<td>3.00</td>
<td>13.3</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Mini-engines are 4.4 cm (1.75 in) long and 12.7 mm (0.5 in) in diameter. Ship Wt. of each package of mini-engines is approximately 17.8 g (0.5 oz.)

### 'D' ENGINES

**SINGLE STAGE ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 3 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1666</td>
<td>D12-3</td>
<td>$7.79</td>
<td>4.48</td>
<td>20.00</td>
<td>3/ 296.2</td>
<td>6.4/ 28.5</td>
<td>1.70</td>
<td>1.49</td>
<td>42.2</td>
</tr>
<tr>
<td>1667</td>
<td>D12-5</td>
<td>$7.79</td>
<td>4.48</td>
<td>20.00</td>
<td>5/ 296.2</td>
<td>6.4/ 28.5</td>
<td>1.70</td>
<td>1.52</td>
<td>43.1</td>
</tr>
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</table>

**UPPER STAGE ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 3 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1666</td>
<td>D12-3</td>
<td>$7.79</td>
<td>4.48</td>
<td>20.00</td>
<td>5/ 296.2</td>
<td>6.4/ 28.5</td>
<td>1.70</td>
<td>1.55</td>
<td>44.0</td>
</tr>
</tbody>
</table>

**BOOSTER ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 3 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1665</td>
<td>D12-9</td>
<td>$7.79</td>
<td>4.48</td>
<td>20.00</td>
<td>none</td>
<td>14/ 296.2</td>
<td>6.4/ 28.5</td>
<td>1.70</td>
<td>1.44</td>
</tr>
</tbody>
</table>

**PLUGGED ENGINES** for use with R/C rocket gliders (BLACK LABEL)

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 3 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1669</td>
<td>D11-P</td>
<td>$7.79</td>
<td>4.48</td>
<td>20.00</td>
<td>none</td>
<td>16/ 453.1</td>
<td>6.2/ 27.6</td>
<td>1.82</td>
<td>1.55</td>
</tr>
</tbody>
</table>

'D' engines are 7 cm (2.8 in) long and 24 mm (0.945 in) in diameter. Ship Wt. of each package of 'D' engines is approximately 184 g (6.5 oz.)

### 'E' ENGINES

**SINGLE STAGE ENGINES**

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 2 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1680</td>
<td>E15-4</td>
<td>$8.19</td>
<td>7.14</td>
<td>32.00</td>
<td>4/ 197.2</td>
<td>4.5/ 20.5</td>
<td>2.60</td>
<td>2.00</td>
<td>35.6</td>
</tr>
<tr>
<td>1682</td>
<td>E15-6</td>
<td>$8.19</td>
<td>7.14</td>
<td>32.00</td>
<td>6/ 197.2</td>
<td>4.5/ 20.5</td>
<td>2.60</td>
<td>2.02</td>
<td>57.3</td>
</tr>
<tr>
<td>1684</td>
<td>E15-8</td>
<td>$8.19</td>
<td>7.14</td>
<td>32.00</td>
<td>8/ 197.2</td>
<td>4.5/ 20.5</td>
<td>2.60</td>
<td>2.05</td>
<td>58.0</td>
</tr>
</tbody>
</table>

**PLUGGED ENGINES** for use with R/C rocket gliders (BLACK LABEL)

<table>
<thead>
<tr>
<th>Prod. No.</th>
<th>Engine Type</th>
<th>Prices 2 for</th>
<th>Total Impulse lb-sec</th>
<th>Time Delay sec</th>
<th>Max. Lift Wt. oz/2</th>
<th>Max. Thrust lb/N</th>
<th>Thrust Duration sec</th>
<th>Initial Weight oz</th>
<th>Propellant Weight oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1686</td>
<td>E15-P</td>
<td>$8.19</td>
<td>7.14</td>
<td>34.00</td>
<td>none</td>
<td>15/ 225.4</td>
<td>4.5/ 20.5</td>
<td>2.60</td>
<td>2.12</td>
</tr>
</tbody>
</table>

'E' engines are 8.9 cm (3.5 in) long and 34 mm (1.34 in) in diameter. Ship Wt. of each package of 'E' engines is approximately 202 g (7.1 oz.)

Complete instructions, igniters and igniter plugs are included with each package of Estes model rocket engines.

---

**ACCESSORIES**

**BLAST-OFF™ FLIGHT PACK**

<table>
<thead>
<tr>
<th>Prices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$31.99</td>
<td>BLAST-OFF™ FLIGHT PACK</td>
</tr>
</tbody>
</table>

The great assortment of engines features 24 of our most popular engines included in the flight pack are 30 igniters plus a package of recovery wadding - an outstanding deal! The engines include all of the A8-3, B6-4, C2-5 and C6-7 upper stage engines, but also included for lightweight single-stage rocket sets) engines includes 24 igniter plugs too!

**RECOVERY WADDING**

<table>
<thead>
<tr>
<th>Prices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2.69</td>
<td>RECOVERY WADDING</td>
</tr>
</tbody>
</table>

Release resistant recovery wadding protects your recovery system from hot glues of ejection to ensure reliable deployment. Handy package contains 25 squares - enough for about 25 flights. Instructions for use are printed on the package.

**IGNITERS**

<table>
<thead>
<tr>
<th>Prices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2.69</td>
<td>IGNITERS</td>
</tr>
</tbody>
</table>

Dependable, easy-to-use Estes igniters in a convenient 10-pack. It's always a good idea to keep a few spares around! Used with our new igniter plugs, the safest and most reliable ignition system available.

**RECOVERY WADDING**

<table>
<thead>
<tr>
<th>Prices</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2.69</td>
<td>RECOVERY WADDING</td>
</tr>
</tbody>
</table>

Release resistant recovery wadding protects your recovery system from hot glues of ejection to ensure reliable deployment. Handy package contains 25 squares - enough for about 25 flights. Instructions for use are printed on the package.

Ship Wt. 28 g (1 oz.)

---

**ESTES MODEL ROCKET ENGINES HAVE BEEN PROVEN CONSISTENT AND RELIABLE IN MORE THAN 300,000,000 LAUNCHES!**
**COMMAND CONTROL™**

This is it - the ultimate launch controller! Take command of your next launch with NICad batteries and heavy-duty launch cable, the Command Control™ can pour out enough current to ignite three or four-engine clusters as fast as you can push the button! Loaded with safety features and built to last.

**E2™ LAUNCH CONTROLLER**

- A New Level of Safety!

**POWER PLEX™ LAUNCH PAD**

Designed for our Big Pro™ Series models, this versatile and rugged pad can handle any size model rocket since it accepts 3 mm (1/8"), 5 mm (3/16") and 6 mm (1/4") launch rods. Ultra-wide 102 cm (40") footprint plus feet that may be extended down to ensure positive stability. Easy trajectory adjustment up to 30° from vertical in any direction. Folds up for convenient transport and storage. 6 mm (1/4") x 122 cm (48") two-piece launch rod, stainless steel blast reflector and stand-off included.

**E2™ LAUNCH CONTROLLER**

A two-flipped approach to launch rockets. Once the safety key is inserted, you get a red flashing light and a beeping audible confirmation of continuity. The left button gets pushed to release or arm the E2™ and then, keeping the left button pushed, the right button is pushed to launch - the high-fear-yet-simple approach to maximum launch safety. The E2™ provides plenty of power for many launches with two C cells or one 1.2 volt 6/20C NiCad-type battery (batteries not included). There is also built-in storage for the five meter (15 ft) igniter leads. Do not use for clustering - use the Command Control™ (EST 2234).

**POWER PLEX™ LAUNCH PAD**

EST 2235

$69.49

**TRANSROC II™ ROCKET LOCATOR**

Now You Can Find Your Rocket or Anything Else Too!

EST 2237

$31.99

**TRANSROC II™**

Recovery is easy with this compact, lightweight sonic tracking and locating system for model rockets. The on-board unit fits in any ET-20 size rocket or larger and emits a strong location tone. The direction and frequency sensitive hand-held receiver will pinpoint the sending unit up to 183 meters (600 feet) range. Includes headset and magnetic compass. Requires one 9 volt and one 6 volt (type 2CR15N) battery - not included.
ELECTRON BEAM® LAUNCH CONTROLLER

The easy-to-see 11 1/2' high launch pole comes equipped with a 13 1/4' long launch rod, providing enough room to hold the standoff. The Electron Beam® Launch Pad (EST 2218) is a sturdy, rubberized pad that can support the rocket during launch. A safety key is provided to ensure that the rocket is securely held before launch.

PORTA-PAD® II LAUNCH PAD

The Porta-Pad® II Launch Pad (EST 2215) is a lightweight, portable launch pad that can be used with rockets of various sizes. It features a rubberized surface that provides a secure grip for the rocket, and a safety key to prevent accidental launches.

ROCKET BUILDER'S MARKING GUIDE™

The Rocket Builder's Marking Guide™ (EST 2227) is a useful tool for marking your rockets. It includes a marking tool and a paper template for easy alignment. A special feature is a " Slip-a-Clip" that allows you to easily clip the marking tool to your rocket, making marking quick and easy.

DECAL PACKS

Decal packs are available in a variety of designs, including starship designs, military designs, and more. They are easy to apply to your rocket and add a custom look.

ROCKET BUILDER'S ACCESSORIES

These accessories include standoffs, blast deflectors, and more, all designed to enhance the performance and appearance of your rocket. They are easy to use and add flexibility to your rocket building experience.

Micro-Clips (2 per package)

Blast Deflector Plate with Standoff

Launch Rod Safety Cap with Safety Key

All items are available in various quantities and are designed to meet the needs of rocket builders of all skill levels.
**DESIGNER'S SPECIAL™**

**EST 1463**

**$39.59**

DESIGNER'S SPECIAL™

Turn your imagination into reality! This comprehensive parts assortment contains everything you need to build up to eight rockets of your own design. Over 75 pieces of excellent savings!

Ship Wt: 0.14 lb (2 lb)

---

**EMERGENCY REPAIR KIT**

**EST 2233**

**$46.79**

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**FIN ALIGNMENT GUIDE**

**EST 2231**

**$17.69**

---

**EMERGENCY REPAIR KIT**

Tuck this away in your range box and you'll have many of the things you need to field-repair your model rockets. The reconfigurable pouch contains these items:

- Sandpaper
- Screw Eyes
- White Glue
- Shock Cord Mounts
- Launch Lugs
- Red Safety Cap
- Basic Shock Cords

Ship Wt: 226 g (8 oz.)

---

**FIN ALIGNMENT GUIDE**

This useful tool will allow you: to position and glue 2 mm (3/32") and 3 mm (1/8") fin slots quickly and easily. Designed to fit body tubes up to a BT-80, three or four-fin designs, aligning the fins at 90° or 120° to each other. Assemble easily with slip-together plastic parts. Adjusts quickly with plastic fin position clips.

Ship Wt: 1.55 g (1/64 oz.)
FIN STOCK: Use quality cutaway sheets for making fins. Remember that the trailing edge of the fins needs to be parallel to the grain of the wood.

ENGINE MOUNTS: These high performance engine mount kits are designed for all your existing designs. All engine mount kits are easy to assemble, have detailed instructions and lightweight components. The EM-40 kit is ideal for quick change conversion for fly-by-wire engines. In lightweight, lightweight engine kits and the EM-50 kit is perfect for using lightweight engine mounts. Check engine charts to insure that maximum rpm's are not exceeded. Avg. Ship Wt. 14.75 oz (5 oz).

ENGINE BLOCKS: Fits inside a BT-20 engine or body tube. Use with or without an engine hook to create a retractable body tube. Design for easy to use, easy to hold. Design for regular and "D" engine. Design for BT-20 engine. Design for BT-20 engine.

CENTERING RINGS - AR-2050: Extra-strong centering rings that center BT-20 tube in a BT-50 tube. Perfect for custom engine mount. Weight of body, 0.8 oz (2.8 g). Design for BT-50 engine. Weight of body, 0.8 oz (2.8 g). Design for BT-50 engine.

RING ADAPTERS: These ring adapters will center a BT-20 tube into the given outer tube, 0.5 oz (1.4 g). Design for BT-20 engine. Design for BT-20 engine. Design for BT-20 engine.

BALSA ADAPTER: Smoothly from one side body tube to another. Great for payload, payload capacity, attachment points, quick release, quick release. Can be followed out for payload capacity. Both ends on adapter have at least 1.5 mm (1/12 inch) mounting surface.

PARACHUTE KITS: These two-color parachute kits give maximum visibility and are very durable. Lightweight and easily folded. Each parachute kit comes with chute material, riser rings and shock cord. The Solar™ chute comes in a silver-coated plastic with red and black canopies. Great for those futuristic models. Each kit weighs less than 6.5 g (0.3 oz). Shrs. Wt. 57 g (2 oz).


SCREW EYES: Attach your shock cords and recovery systems to balsa nose cones, nose blocks and adapters with these screws. Specify size when ordering (5 per package). Shrs. Wt. 28 g (1 oz).

LARGE EYE, perfect for BT-55 and above. 28.4 mm (1.1" long). Shrs. Wt. 1.1 g (0.03 oz). Shrs. Wt. 2.25 g (0.08 oz). Shrs. Wt. 3.38 g (0.07 oz). Shrs. Wt. 4.57 g (0.07 oz). Shrs. Wt. 5.76 g (0.07 oz).

TAPE RINGS: Fastens shock lines to plastic parachutes or streamers with these 19 mm (0.75") diameter extra adhesive vinyl pressure sensitive tape rings. In sheets of 4 rings per package. Shrs. Wt. 28 g (1 oz).

TAPE STRIPS: These strips have high strength and are ideal for tailing shock lines. Dimensions of each strip are 6.5 mm (1/4") x 19 mm (0.75") . 12 strips per sheet, 6 sheets per package. Shrs. Wt. 28 g (1 oz). Shrs. Wt. 28 g (1 oz).

STRIKER MATERIAL: Bright orange, frame resistant, crease paper makes great high performing streamers. Comes in 22 cm (9") x 12 foot lengths - enough for two to eight streamers. Specify size when ordering. Shrs. Wt. 28 g (1 oz). Shrs. Wt. 28 g (1 oz). Shrs. Wt. 28 g (1 oz).

SNAP SWIVELS: Allows for quick changes between recovery systems. Also reduces stress on parachutes. These swivels are 25.4 mm (1") long and come in 12 per package. Shrs. Wt. 0.3 g (0.01 oz). Shrs. Wt. 28 g (1 oz).

STAGE COUPLERS: Use for multi-hanging, joining body tubes, making engine mounts, etc. Makes pretty good coupling for joining body tubes. Shrs. Wt. for all 0.3 g (0.03 oz) each.

NOSE BLOCKS: Use nose blocks to partition off payload sections or anywhere else a solid bullet is needed.
EDUCATIONAL MATERIALS

ROCKETRY SCIENCE KIT
A complete model rocketry outfit with a detailed project manual. The step-by-step program demonstrates basic scientific principles and teaches proper experimental procedures. Perfect for school projects, science fairs and exhibits.

ROCKETRY SCIENCE KIT™
EST 0900
$36.39

PHANTOM™
EST 1207
$7.29

ALITRACK™
EST 2232
$16.99

How high does it fly? Simply follow your rocket in the sights to its highest point, then release the trigger to lock in the record. Displays your rocket's height directly in meters and elevation in degrees. A meters-to-feet conversion table is included. Use two for even greater accuracy.

IDEA: Compare the results to predictions made with our Aerotrack™ software. Ship wt. 425 g (15 oz)

CAMP LEADER'S MODEL ROCKETRY MANUAL
Proven guide for introducing model rocketry successfully to camp programs. 10 pages.
EST 1823
$1.65

VIDEO - MODEL ROCKETRY - THE LAST FRONTIER™
Capture the excitement of model rocketry in the full-color VHS video presentation narrated by and featuring William H. Barter, Star Trak™ kflate. An excellent primer to model rocketry with dramatic launch footage and graphics, easy-to-understand illustrations. 15 minutes.
EST 2793
$9.99

SOFTWARE

ASTROCAD™
Written by Michael Gasseri. This easy-to-use computer program is ideal for basic model rocket performance analysis. This program menu has the following items:
- Applique Determination
- Model Rocket Design (two versions)
- Drag Prediction
- Aerodynamic Stability
- Performance Prediction
- Optimum Weight
- Flight Simulation
- Graphical User Interface
Apple
EST 9024
$6.49
EST 9027
$8.49
Learns about the principles of aerodynamics, physics, and space flight with these three programs.

PHYSICS OF MODEL ROCKETRY™
Action-reaction; mass acceleration; energy; stage and stability.
EST 9025
$10.69

FLIGHT: AERODYNAMICS OF MODEL ROCKETS™
Forces; aerodynamics; stability; drag; center of gravity; center of pressure.
EST 9026
$21.60

IN SEARCH OF SPACE - INTRODUCTION TO ROCKETRY™
Right profile parts engine and classification activity. Code plus bonus program on multi-stage and interstage installation and function.
EST 9035
$10.69

CURRICULA

SCIENCE AND MODEL ROCKETS
For Grades 5, 6, 7 & 8
Written by Sylvia Noble, Ed. D. Based on Nancy Street's Course Outline:
- Day-to-day lesson plans with specific goals and objectives.
- Excellent for teaching science and mathematics including Newton's Laws of Motion and How to Develop Principles of Rocketry, Formulas, Calculations, Simple Aerodynamics, and Graphing.
- Includes background for the educator, overhead transparencies, activity sheets, material requirements and a guide for the student.
EST 2847
$3.25

PHYSICS AND MODEL ROCKETS
For Grades 6, 7, 8, 9 & 11
Written by Sylvia Noble, Ed. D. Edited by Thomas Beach, PhD and Tim Van Wegman, A.
- The next logical step after the Science and Model Rockets Curriculum.
- A ready-to-use lesson plans, with Newton's Laws of Motion and Aerodynamics principles applied to rocket projects.
- Includes teacher background, student manual with workbook, math extensions, transparencies and activity sheets.
EST 2848
$3.25

MATHEMATICS AND MODEL ROCKETS
Written by Sylvia Noble, Ed. D. Based on a course by Harold McConnell, PhD
- Take the next step: rocket engineering?
- Explore the interaction between centers of pressure and mass
- Apply mathematics and graphics to rocket design
- Wind tunnel experimentation and evaluation.
EST 2849
$3.25

PUBLICATIONS

MODEL ROCKET NEWS MAGAZINE
Provides articles of interest, technical tips, information about new products, special offers, and much more. Available to ESP members and through local retailers.

MODEL ROCKETRY TECHNICAL MANUAL
A handy guide for construction and flight of model rockets. Tips on "Scotch building," "burnt cement" techniques, firing, staging, boost-glowes, and more.
EST 2819 (Updated & Revised)
$8.80

ALPHA BOOK OF MODEL ROCKETRY
An informative book for beginners in model rocketry. 32 pages.
EST 2820
$1.20

THE LAWS OF MOTION AND MODEL ROCKETRY
The three laws of motion are explained in easily understood terms. Simple examples and experiments are included. 12 pages.
EST 2821
$7.75

ESTES GUIDE FOR AEROSPACE CLUBS
The perfect source book for organizing and operating a successful model rocket club (or ESP chapter). 34 pages.
EST 2817
$2.60

MODEL ROCKET CONTEST GUIDE
Presents model rocket contest rules for clubs or schools. Details on competitive events and suggestions on all facets of contest organization. 18 pages.
EST 2818
$3.20

PROJECTS IN MODEL ROCKETRY
Suggests how to plan, prepare, and present research projects. Ideas for over one hundred projects.
EST 2822
$9.95

THE CLASSIC COLLECTION
A comprehensive collection of technical records that makes a valuable reference tool.
EST 2823
$3.70

MODEL ROCKETRY STUDY GUIDE
A logical program for anyone who wants the most from model rocketry. Guides you in the path to becoming an expert rocketeer.
EST 2824
$1.65

ALTITUDE PREDICTION CHARTS
A simple system by which aerodynamic drag and other effects can be taken into account in predicting rocket peak altitudes. Technical Note TN-13.
EST 2842
$2.15

AERODYNAMIC DRAG OF MODEL ROCKETS
EST 2843
$2.15

ELEMENTARY MATHEMATICS OF MODEL ROCKETRY
Information on how to make your own altitude tracor and calculate speeds and accelerations. Technical Note TN-8.
EST 2844
$3.90

ESTES EDUCATOR NEWS
Interesting technical articles, new product information, plus activities and resources on space and model rocketry subjects suitable for classroom use. Available through many local retailers.

GUIDE FOR TEACHERS AND YOUTH GROUP LEADERS
Introduces you to the fun of model rocketry technology and the complete services offered in our educational program.
EST 2814
$2.15

INDUSTRIAL ARTS TEACHERS MANUAL FOR MODEL ROCKETRY
Practical applications of model society in the study of manufacturing, transportation, R & D, communication and construction. 22 pages.
EST 2816
$1.55

MODEL ROCKET LAUNCH SYSTEMS
Electrical theory of launches is clearly explained. Complete with photographs, schematics and study problems. 20 pages.
EST 2817
$1.95
BULK PACKS

Save with the purchase of economical bulk packs for your group! No fancy packaging! Each rocket pack contains parts to construct 12 rockets plus extra small parts, just in case!

Your students will love creating their own decor on these fun-to-build rockets!

**ESTES EDUCATOR**

**Explore™ Series Rockets - 12 per bulk pack**
- Explorer™ Bulk Pack - See page 2a for description
- EST 1789
- $128.99

**Tornado™ Series Rockets - 12 per bulk pack**
- Tornado™ Bulk Pack - See page 2a for description
- EST 1756
- $35.59

**Model Rocket Engine Bulk Packs**
- Includes 24 rocket engines, 30 motor cases igniters, 38 nozzles, igniter plugs, 75 - 11.4 cm (4.5") squares of recovery wadding, enough for approximately 25 launches.
- EST 1790
- $35.99

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- Performance™ Rocket Bulk Pack - See symbol below
- $35.99

**NATIONAL AEROSPACE PLANE™**
- EST 2037 $14.99 $10.99

**DEEP SPACE TRANSPORT™**
- EST 2034 $14.99 $13.99

Supplies for school classes and youth groups

ESTES TEACHER'S STARTER SET

- Designed specifically for the educator just beginning model rocketry studies.
- Become familiar with ESTES model rocketry technology, and then use the enclosed booklets to introduce your students to the excitement of hands-on learning.
- Skill Level 1
- Set contains:
  - Big Beltha II two (2) solid fuel single engine demonstration rocket, para chute recovery
  - Guy wire,,latigo, and napskin to build the Big Beltha II
  - Sectional control system
  - Radio-Fast II Launch pack
  - Engines, recovery wadding, igniters and plugs included - enough for six launches
  - Teacher and Class (Guide)
  - Science and math apply offers using model rocketry
- EST 1456
- $34.99

Not display packaged
- Paint not included

**NEW!**
- The Deuce Revisited and the Radio-Fast II can be used to launch most rockets shown in this catalog except Pro™ Series and ESTES R/C
- 4 AA alkaline batteries not included
NAR SAFETY CODE
(Effective 10-91)

1. Materials—My model rocket will be made of lightweight materials such as paper, wood, foam, rubber, and plastic suitable for the power used and the performance of my model rocket. I will not use any metals for the nose cone, body, or fins of my model rocket.

2. Motors/Engines—I will use only commercially made or NAR certified model rocket engines. I must be familiar with the manufacturer’s recommendations. I will not alter the motor/rubber engine, its parts, or its ingredients in any way.

3. Recovery—Will always use a recovery system in my model rocket. The rocket will return to the ground as instructed by the manufacturer. I will not use any safer device to recover the rocket.

4. Ignition System—The system I use to launch my model rocket will be remotely controlled and electrically operated. It will contain a启动 switch that will only turn to “on” when the rocket is ready to deploy. The system will be capable of deploying the rocket after it has reached a safe altitude.

5. Weight and Power Limits—My model rocket will have a weight of more than 1,500 grams (3,000 lbs) and its total launch weight will not exceed 200 pounds. The rocket engines will not exceed 1,500 pounds of thrust. The total launch weight of the rocket will not exceed 5,000 pounds.

6. Post-launch—After the rocket has landed, I will remove the motor/rocket and store it in a safe place.

7. Launch Site—My model rocket will be launched in a cleared area, free of trees, power lines, buildings, and dry brush or grass. Launch site will be at least 100 feet away from any inhabited areas.

LAUNCH SITE DIMENSIONS

<table>
<thead>
<tr>
<th>Installed Total Impulse (Newton-Seconds)</th>
<th>Minimum Site Dimension (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01-25.0</td>
<td>200</td>
</tr>
<tr>
<td>25.1-50.0</td>
<td>400</td>
</tr>
<tr>
<td>50.1-100.0</td>
<td>600</td>
</tr>
<tr>
<td>101.0-200.0</td>
<td>900</td>
</tr>
<tr>
<td>201.0-400.0</td>
<td>1200</td>
</tr>
<tr>
<td>401.0-600.0</td>
<td>1500</td>
</tr>
<tr>
<td>601.0-900.0</td>
<td>1800</td>
</tr>
<tr>
<td>901.0-1200.0</td>
<td>2100</td>
</tr>
<tr>
<td>1201.0-1500.0</td>
<td>2400</td>
</tr>
</tbody>
</table>

8. Launches—When launching my model rocket from a stable launch device, I will always place the launch no more than 20 feet from the end of the launch device.

As a member of the Estes Model Rocket Safety Program, I promise to faithfully follow all rules of sound conduct as established in the above code.

Signed

Date

This is the official Model Rocketry Safety Code of the National Association of Rocketry and the Model Rocketry Manufacturers Association.

Full One Year Warranty

Your Estes product is warranted for defects in materials or workmanship for one year from the date of the original purchase. Any Estes dealer who sells Estes products, which becomes defective during the warranty period, shall replace the defective part at no charge. If the dealer is unable to repair the product, he shall exchange it for a new product of like kind and quality. This warranty does not extend to damage caused by the user, which is beyond the control of the manufacturer. The user must return the defective product to a dealer of the manufacturer.

Customer Service Department
1239 N. Street
Penrose, CO 81240

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24. Rings™
25. Rocket Builder's Marking Guide™
26. Rocket Science Kit™
27. Safety Code™
28. Saturn™
29. Screw Eyes™
30. Seatbelts™
31. Shroud Lines™
32. Skyshark™
33. Snap Suits™
34. Space Suit™
35. Space Rover™
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59. Turbo Explorer™
60. USS Enterprise™
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62. Voyager™
63. Wizard™
64. X-Wing Right™
65. Yankee™
66. Yellowjacket™
67. Zeiger™
JOIN THE LARGEST ROCKET CLUB ON EARTH!

The Estes Space Program™ was developed to increase your fun AND perfect your skills while flying your rockets. The Estes Space Program™ is set up so that members can earn official Achievement Awards. These awards can be earned as you progress through the various aspects of model rocketry such as multi-staging gliders, aeronautics, photography, and/or scale.

Your membership packet is loaded with the following exciting rocket items:

- The exclusive Yankee Clipper™ flying model rocket, available only to the Estes Space Program™ (ESP). This high-performing, almost 45 cm (17-1/2") tail rocket flies on A8-3 (First Flight), B4-4, B6-4, B8-5 or C6-5 engines.
- ESP Cloth Patch - the official club emblem comes on a 51 mm (2") x 76 mm (3") patch.
- Full-color ESP Decals - an assortment of large and small decals, fantastic for decorating your Yankee Clipper™, your range box or anywhere else.

- A beautiful wall Membership Certificate/Achievement Record and a Membership Card - both identify you as a member of the Estes Space Program™. Attach your ESP Achievement Awards to the certificate.
- Estes Space Program™ Stationery for all your rocketry correspondence.
- Information on how to earn your first five Achievement Awards. The Awards come with a colorful cloth patch and four corresponding decals. So far, there are ten possible Achievement Awards.
- A Special Edition of the Model Rocket News. As long as you get Achievement Awards, you will continue to receive this information-packed newsletter published three to four times a year.

Watch for some forthcoming additions and changes to this program!

ESTES SPACE PROGRAM™

ESTES

Estes Industries
1266 H Street
Petaluma, CO 81240

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