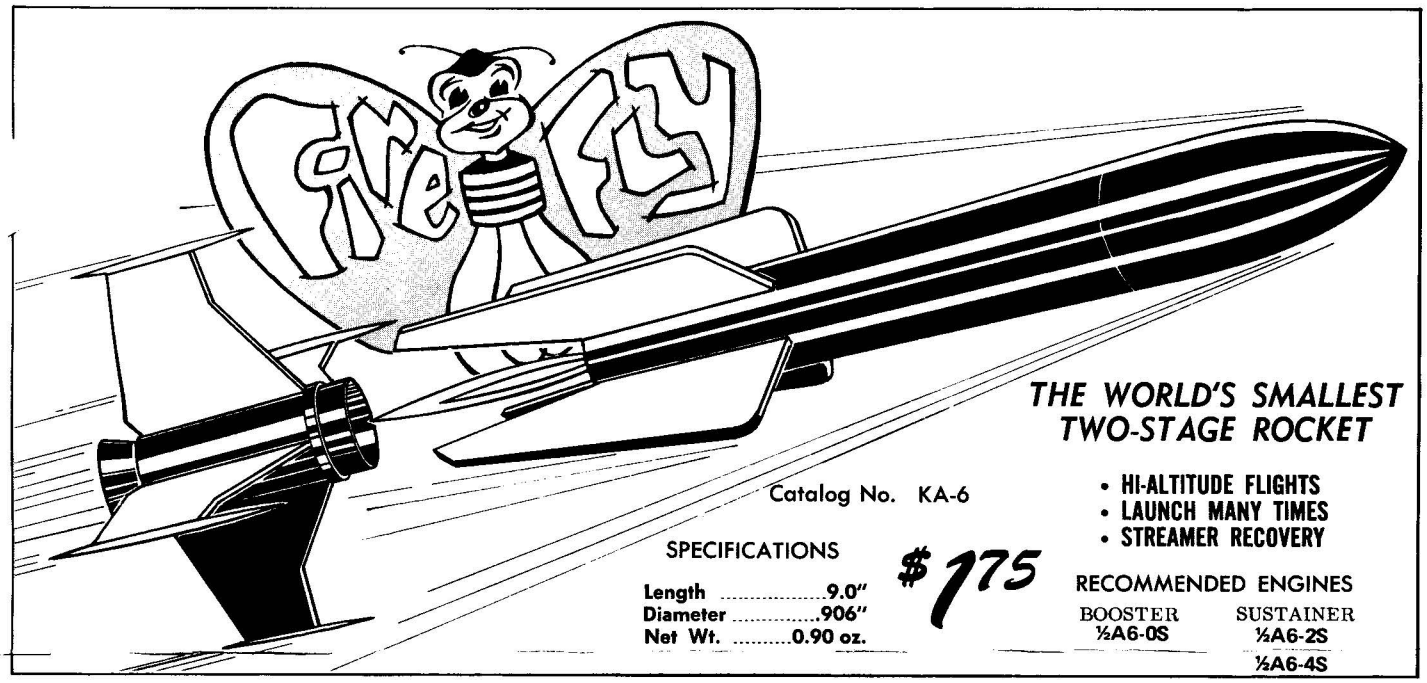


THE WORLD'S SMALLEST TWO-STAGE ROCKET

- HI-ALTITUDE FLIGHTS
- LAUNCH MANY TIMES
- STREAMER RECOVERY

Catalog No. KA-6

SPECIFICATIONS

Length .....9.0"
Diameter .....906"
Net Wt. .....0.90 oz.

$1.75

RECOMMENDED ENGINES

BOOSTER	SUSTAINER
½A6-0S	½A6-2S
	½A6-4S

INTRODUCTION

The new FIREFLY is truly an exciting kit. It packs a lot of power and altitude into a very small package. Centuri's "Dual Lock" stage coupling provides reliable upper stage ignition and separation. With its "lo-drift" streamer recovery, the FIREFLY sustainer returns safely to the ground while the booster returns intact by tumbling. Its sustainer or second stage can be flown by itself for excellent single stage flights. When properly assembled and prepared for flight, the FIREFLY will provide you with many thrilling flights.

ASSEMBLY INSTRUCTIONS

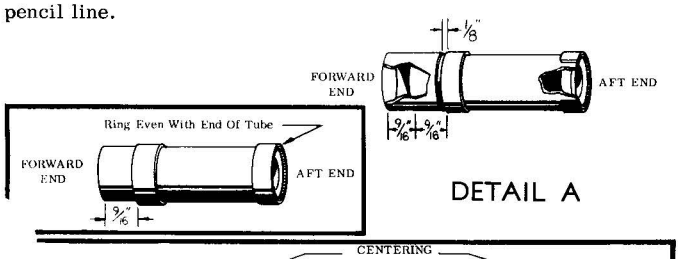
In addition to the parts supplied, you will need the following items to assemble the kit:

Modeling knife with sharp edge
White Glue or Centuri Superbond
Fine Sandpaper - Scissors - Ruler
Pencil with sharp point
Paint for finishing - preferably spray type

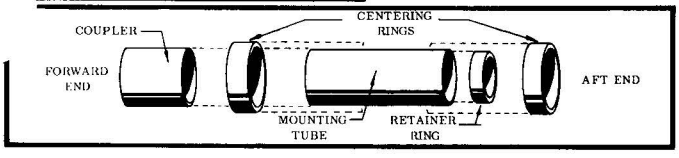
STEP 1 ASSEMBLE BOOSTER ENGINE MOUNT

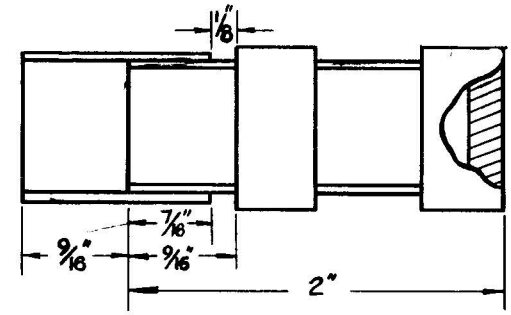
The booster engine mount consists of one mounting tube, two centering rings, one retainer ring, and one blue coupler tube. Assemble these parts together, with white glue or Centuri Superbond, as shown in Detail A. First, glue the retainer ring into the aft end of the mounting tube so that the SPACING TUBE, when fully inserted is even with the forward end of the mounting tube. Next glue the centering rings onto the mounting tube as shown in Detail A.

Using a ruler and pencil, mark a line 7/16" from the forward end of the mounting tube. Apply glue around the forward end area and slide on the small diameter blue coupler tube until it contacts the pencil line.



DETAIL A

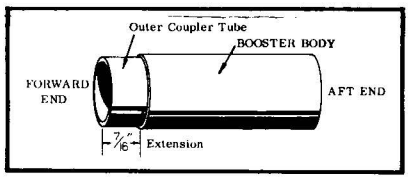


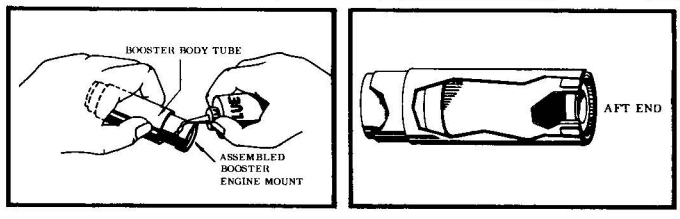


STEP 2 INSTALL BOOSTER ENGINE MOUNT

First, glue the larger diameter, blue coupler tube into one end of the booster body tube so that it extends out 7/16", as shown in Detail B. Next, insert the assembled mount, coupler end first, part way into the aft end of the booster body tube. Squirt a ring of glue around the forward edge of the rear centering ring and quickly push the mount in further until its aft end is even with the end of the booster body. It is important to move rapidly to keep the mount from "sticking" in the wrong position.

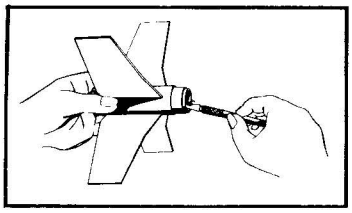
DETAIL B

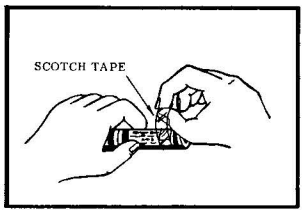


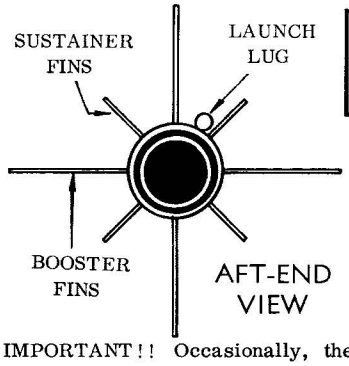


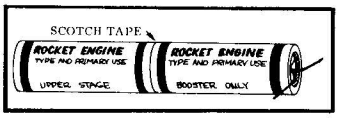
STEP 3 ASSEMBLE SUSTAINER ENGINE MOUNT

The sustainer or second-stage engine mount consists of one mounting tube, two centering rings, and one thrust ring. Assemble and glue all parts together as shown in Detail C. First, glue the thrust ring into the forward end of the mounting tube so that the SPACING TUBE, when fully inserted, is even with the aft end of the mounting tube. Position the forward centering ring even with the front end of the mounting tube and the rear ring 5/8" from the aft end.









DETAIL I

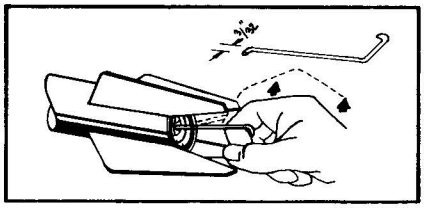
When properly assembled for flight, the sustainer fin should be centered between the booster fins when viewed from the aft end.

IMPORTANT!! Occasionally, there is a slightly flared edge on the inside front edge of the small coupler tube. Trimming off the flare with a modeling knife as shown in Detail I, will permit easier stage coupling.

Install igniter in booster engine nozzle before coupling on booster. Now, slide the booster stage over the extending engine and into the sustainer base until both body tubes contact each other. This fit should be fairly tight. If the connection fitting is loose, wrap cellophane tape around the Stage Coupler until a tight fit is obtained. Glue the launch lug to the body tube in the position shown.

Upon burnout of the booster engine, hot gases issue forth from its forward end to auto-ignite the sustainer engine. This combination of booster burnout gases and sustainer exhaust causes the tape to break and the stages to separate. The sustainer stage continues on while the booster tumbles back to Earth.

An engine removal tool can be made by bending a right angle crook in the end of a piece of stiff piano wire. Insert the crooked end in through the nozzle of the spent engine, twist to one side, and pull. To remove the spent booster engine, push against the nozzle from the aft end with a wood dowell or pencil.



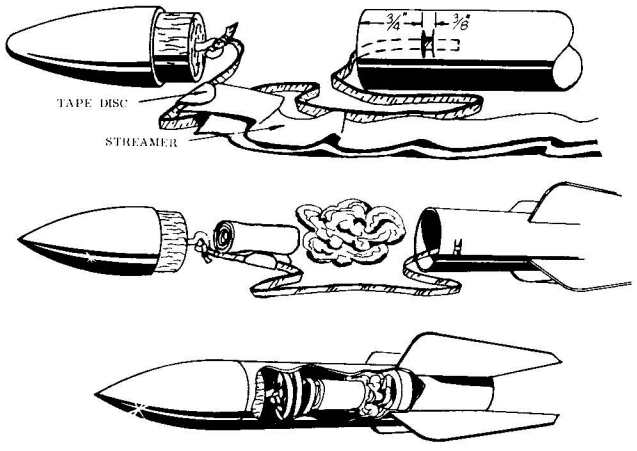
After each flight, wipe the exhaust residue off the entire coupling region with a dry cloth. Look for frayed edges around the forward mounting tube and both coupling tubes. Trim off or glue back in place before the next launch.

STEP 9 RIG STREAMER AND SHOCK CORD

The FIREFLY'S recovery streamer provides sufficient drag for a safe return of the second stage. First thread the screw eye into the base of the nose cone. To insure that it will not pull out, unthread the screw eye, place a drop of glue in the resulting hole, slip the nose weight over the eye and thread back into place.

Attach one end of the shock cord to the body tube as shown in the Assembly Drawing. Cut two slits in the tube 3/8" long and 3/8" apart; 3/4 inch down from the top end. Insert one end of the rubber cord into the body tube from the top end. Bring the cord out through the first slit and back into the body through the second slit. Apply glue to this connection to form a strong bond. Tie the other end of the shock cord to the nose cone screw eye. Trim off any loose ends.

Finally, with the paper tape disc provided, attach one end of the streamer to the shock cord in the position shown. Cut streamer to 48" length.



STEP 10 FINISHING THE FIREFLY

Roll up streamer temporarily and insert into the top of the body tube. Place the nose cone on the body tube end and the FIREFLY is ready for finishing.

To obtain maximum altitude flights, all model rockets should be painted to a gloss finish. First, the grain texture of the nose cone and fins should be filled in with several coats of balsa filler. Sand smooth between applications. The body tube does not require this treatment. Finish entire model with a lightweight paint such as spray dope or laquerized enamel. To aid in tracking, use bright colors such as white, yellow, orange, or red. Flourescent colors are quite easy to spot at high altitudes.

STEP 11 LAUNCHING THE FIREFLY

The FIREFLY can be launched with any of the following en groups:

	Group #1	Group #2
Booster	½A6-0S	½A6-0S
Sustainer	½A6-2S	½A6-4S

Engine combination **#2** will give maximum altitude. However, if your launch area is limited, use engine group #1 to assure recovery within the available ground area.

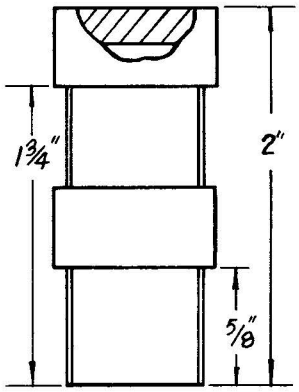
Launch the FIREFLY from a 1/8" dia. x 36" long steel launching rod. Use electrical ignition only, as outlined in Centuri's Engine Operating Instructions. IMPORTANT!! When hooking up your electrical ignition system to the igniter, be sure to attach your micro clips onto the igniter wire legs as close to the booster engine nozzle as possible.

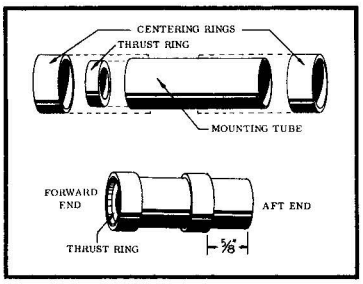
Select a clear unobstructed launch site away from buildings, trees, highways, or houses. Launch from the center of an open field measuring at least 400 feet on a side. Always give a short countdown to alert spectators before launching.

The FIREFLY'S second stage can be launched by itself without the booster. Power for single stage flights can be supplied by either the **½A6-2S or ½A6-4S** engine.

For additional information concerning rocket engines, launchers, ignition devices, accessory parts, or replacement parts, write to:

Centuri® ENGINEERING CO
P. O. Box 1988 • Phoenix, Arizona 8500





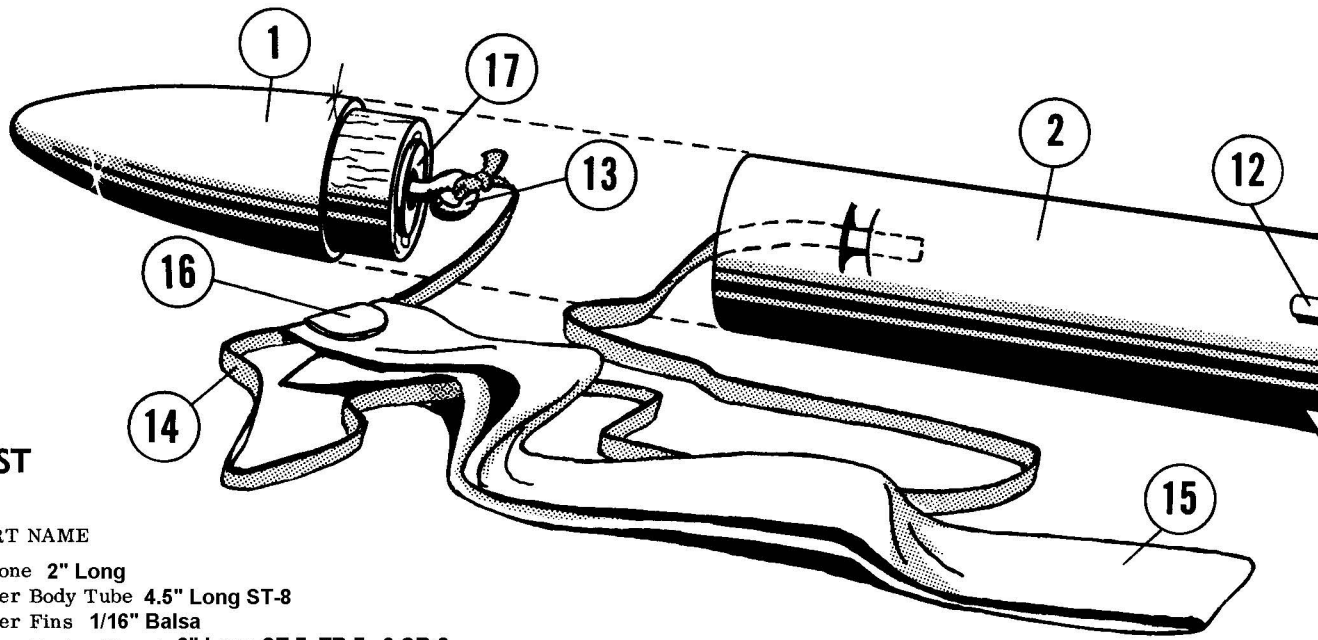
DETAIL C

STEP 5 ATTACH STABILIZER FINS

Prepare and attach the fins for both stages in the following manner:

Carefully cut out all the indicated fins from the printed balsa sh with a sharp modeling knife. Using a metal straight edge to gu your knife will greatly improve cutting accuracy. (See Detail Using fine sandpaper, slightly round the leading and tip edges a slightly taper the trailing edges. Square the root chord edges. Also, lightly sand body sides of each fin.

Cut out the paper Fin Positioning Guide, wrap it around the body tube and mark the fin locations with a pen or pencil. Apply glue sparingly to each fin root chord edge, one at a time, and also along the body tube where fin is to be attached. When glue has begun to set, place fin in position on the body tube. Stand the tube on its top end and allow glue to dry. With the Fin Alignment Guide check the angle between fins before glue has set. (Should be 90^{o}.)

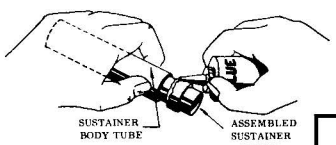


PARTS LIST

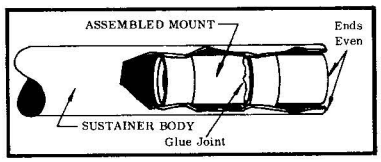
PART NO.	PART NAME
1.	Nose Cone **2" Long**
2.	Sustainer Body Tube **4.5" Long ST-8**
3.	Sustainer Fins **1/16" Balsa**
4.	Sustainer Engine Mount **2" Long ST-7, TR-7, 2 CR-8**
5.	Booster Body Tube **2" Long ST-8**
6.	Outer Stage Coupler
7.	Inner Stage Coupler **Redesigned to HTC-7CDH with holes**
8.	Booster Engine Mount **2" Long ST-7, 2 CR-8**
9.	Booster Fins **1/8" Balsa**
10.	Booster Nozzle **Card Stock**
11.	Fin Tip Spikes **Round Toothpicks**
12.	Launch Lug **1.5" Long**
13.	Screw Eye **SE-10**
14.	Shock Cord **SC-18**
15.	Streamer **RS-20**
16.	Tape Disc **TD-35**
17.	Metal Nose Weight

STEP 4 INSTALL SUSTAINER ENGINE MOUNT

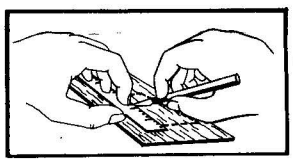
Insert the assembled mount, forward end first, part way into the sustainer body tube. As shown in Detail D, apply a ring of glue around the forward edge of rear centering ring and push the mount forward until the aft end of the mounting tube is even with the end of the sustainer body tube.

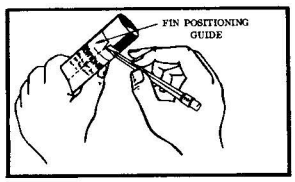


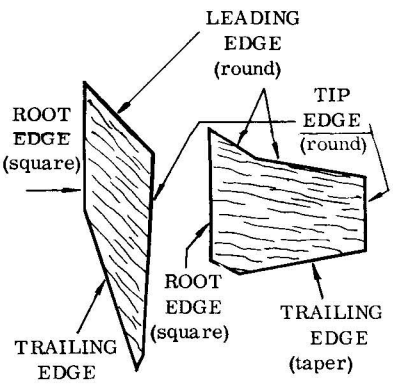
DETAIL D

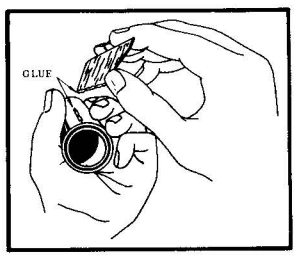


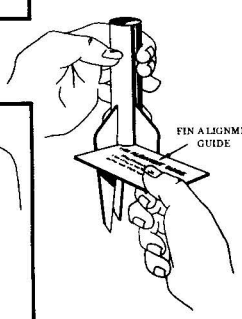
DETAIL E

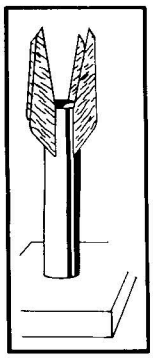






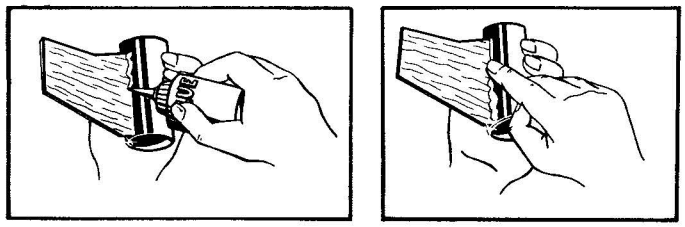




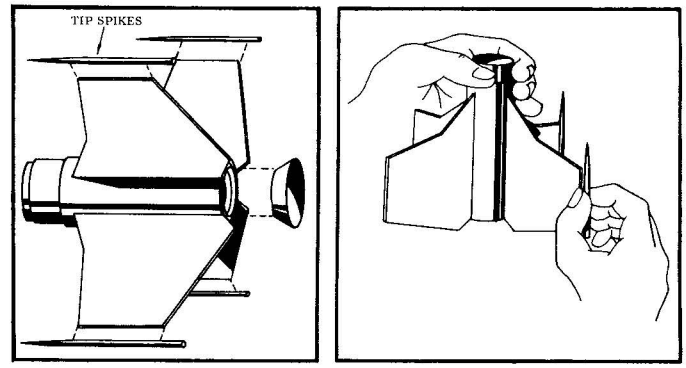


STEP 6 APPLY GLUE FILLETS TO FIN JOINTS

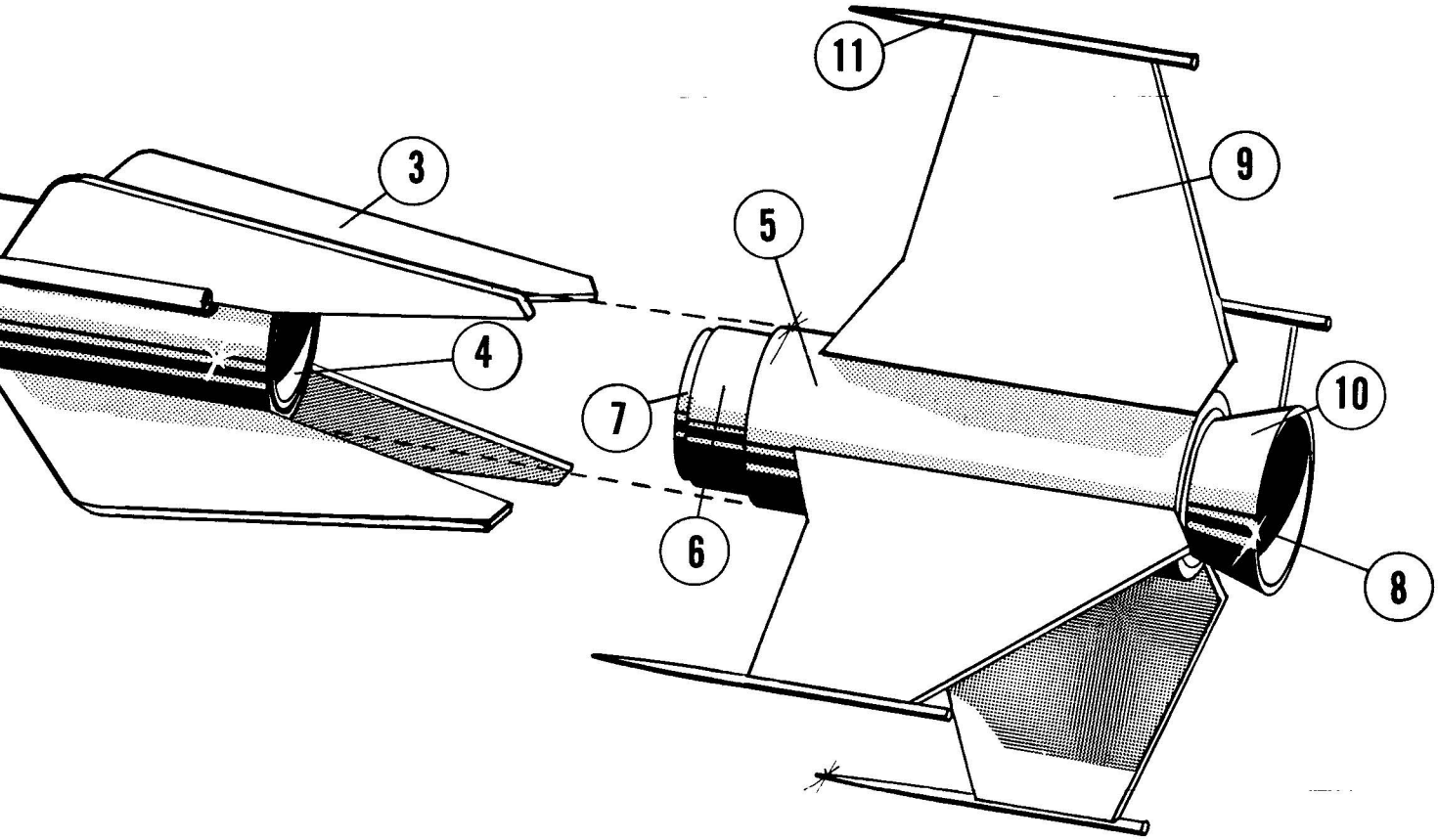
For increased fin joint strength, run a fillet of the same glue along each fin/tube joint, after the initial glueing has thoroughly dried. Remove any excess glue and smooth out the fillet as shown in Detail F.



DETAIL F



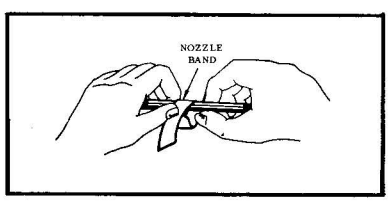
DETAIL G CONT.

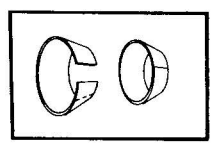


STEP 7 ATTACH BOOSTER NOZZLE & FIN TIPS

The FIREFLY design includes a simulated exhaust nozzle. Carefully cut out the paper nozzle bands. So that this band will roll into a complete ring, curl the band by rolling it over a round pencil, pen, or the handle of a modeling knife. Roll the band into a ring and glue ends together as indicated. The Firefly design also includes tip spikes on the booster fins. Glue these spikes to the fin tips as shown in Detail G.

DETAIL G

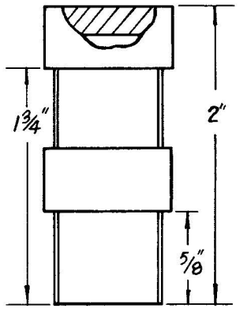


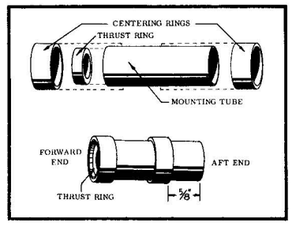


STEP 8 BOOSTER – SUSTAINER STAGING

The Dual-Lock stage coupling system used in the FIREFLY provides reliable upper-stage ignition and separation when properly joined. In principle, it uses two pair of precision telescoping tubes together with coupled engines. To prevent paper "swelling" and a "binding fit", keep the rocket in a cool, dry place until ready to launch. Avoid launching on moist or humid days.

As shown in the Engine Coupling Detail I, place the Booster and Upper Stage engines end to end, and tape together with one layer of thin cellophane tape (scotch tape). Make sure that the nozzle end of the Upper Stage engine is connected to the forward (opposite of nozzle) end of the Booster Stage engine. Friction fit the Upper Stage engine into the sustainer mounting tube, and push into place until it contacts the forward thrust ring.





DETAIL C

STEP 5 ATTACH STABILIZER FINS

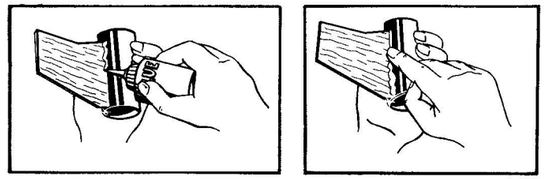
Prepare and attach the fins for both stages in the following manner:

Carefully cut out all the indicated fins from the printed balsa sh with a sharp modeling knife. Using a metal straight edge to gu your knife will greatly improve cutting accuracy. (See Detail Using fine sandpaper, slightly round the leading and tip edges a slightly taper the trailing edges. Square the root chord edges. Also, lightly sand body sides of each fin.

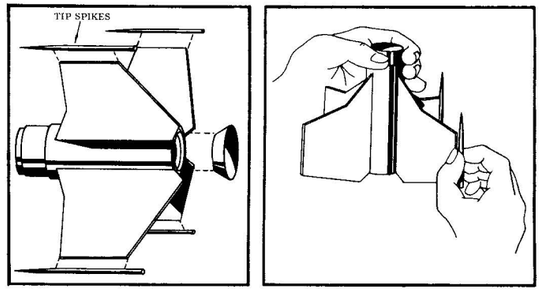
Cut out the paper Fin Positioning Guide, wrap it around the body tube and mark the fin locations with a pen or pencil. Apply glue sparingly to each fin root chord edge, one at a time, and also along the body tube where fin is to be attached. When glue has begun to set, place fin in position on the body tube. Stand the tube on its top end and allow glue to dry. With the Fin Alignment Guide check the angle between fins before glue has set. (Should be 90^{o}.)

STEP 6 APPLY GLUE FILLETS TO FIN JOINTS

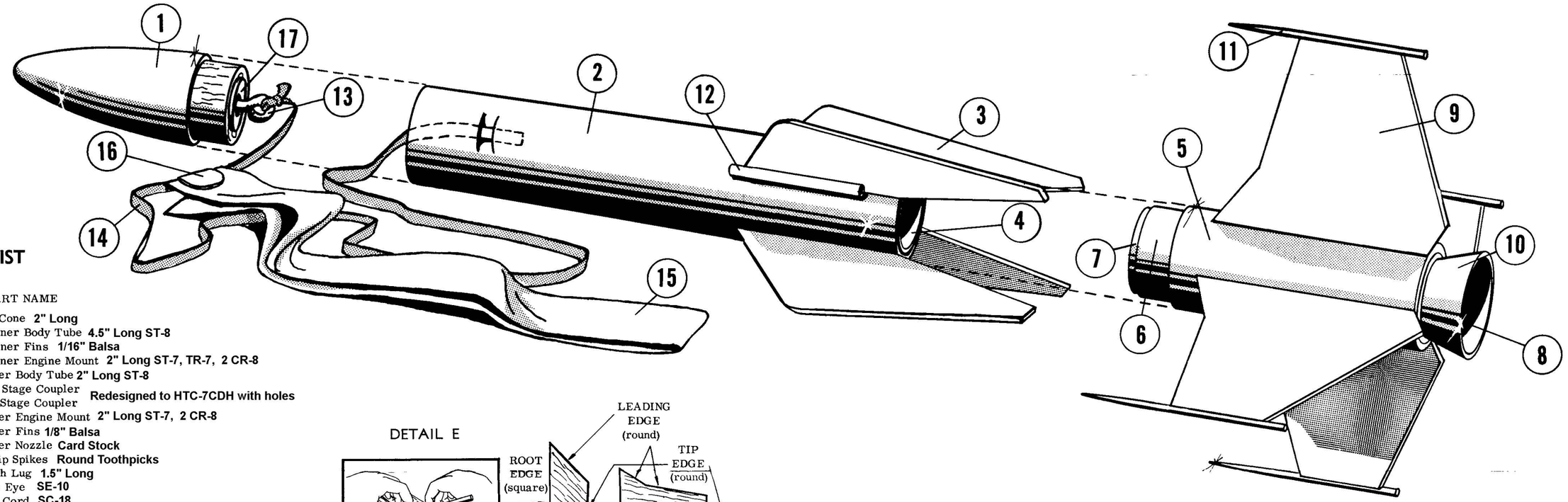
For increased fin joint strength, run a fillet of the same glue along ea fin/tube joint, after the initial glueing has thoroughly dried. f any excess glue and smooth out the fillet as shown in De-



DETAIL F



DETAIL G CONT.

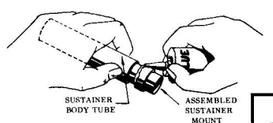


PARTS LIST

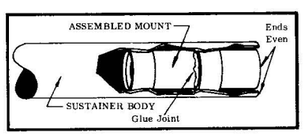
PART NO.	PART NAME
1.	Nose Cone **2" Long**
2.	Sustainer Body Tube **4.5" Long ST-8**
3.	Sustainer Fins **1/16" Balsa**
4.	Sustainer Engine Mount **2" Long ST-7, TR-7, 2 CR-8**
5.	Booster Body Tube **2" Long ST-8**
6.	Outer Stage Coupler
7.	Inner Stage Coupler **Redesigned to HTC-7CDH with holes**
8.	Booster Engine Mount **2" Long ST-7, 2 CR-8**
9.	Booster Fins **1/8" Balsa**
10.	Booster Nozzle **Card Stock**
11.	Fin Tip Spikes **Round Toothpicks**
12.	Launch Lug **1.5" Long**
13.	Screw Eye **SE-10**
14.	Shock Cord **SC-18**
15.	Streamer **RS-20**
16.	Tape Disc **TD-35**
17.	Metal Nose Weight

STEP 4 INSTALL SUSTAINER ENGINE MOUNT

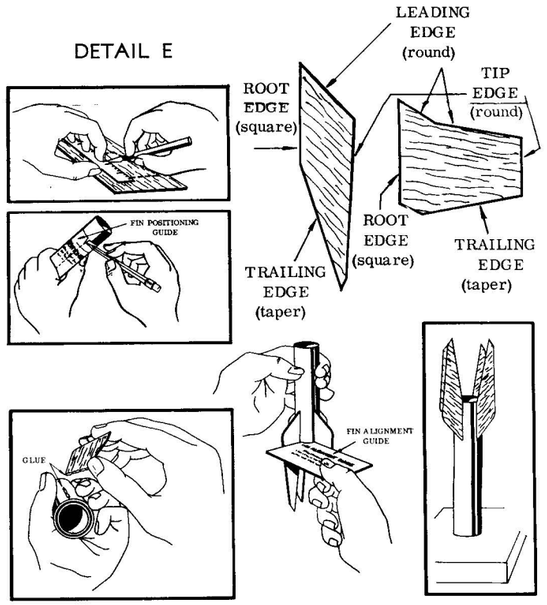
Insert the assembled mount, forward end first, part way into the sustainer body tube. As shown in Detail D, apply a ring of glue around the forward edge of rear centering ring and push the mount forward until the aft end of the mounting tube is even with the end of the sustainer body tube.



DETAIL D



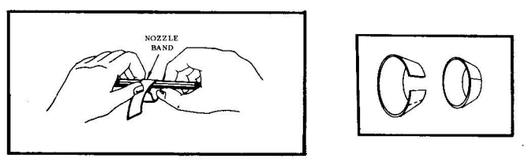
DETAIL E



STEP 7 ATTACH BOOSTER NOZZLE & FIN TIPS

The FIREFLY design includes a simulated exhaust nozzle. Carefully cut out the paper nozzle bands. So that this band will roll into a complete ring, curl the band by rolling it over a round pencil, pen, or the handle of a modeling knife. Roll the band into a ring and glue ends together as indicated. The Firefly design also includes tip spikes on the booster fins. Glue these spikes to the fin tips as shown in Detail G.

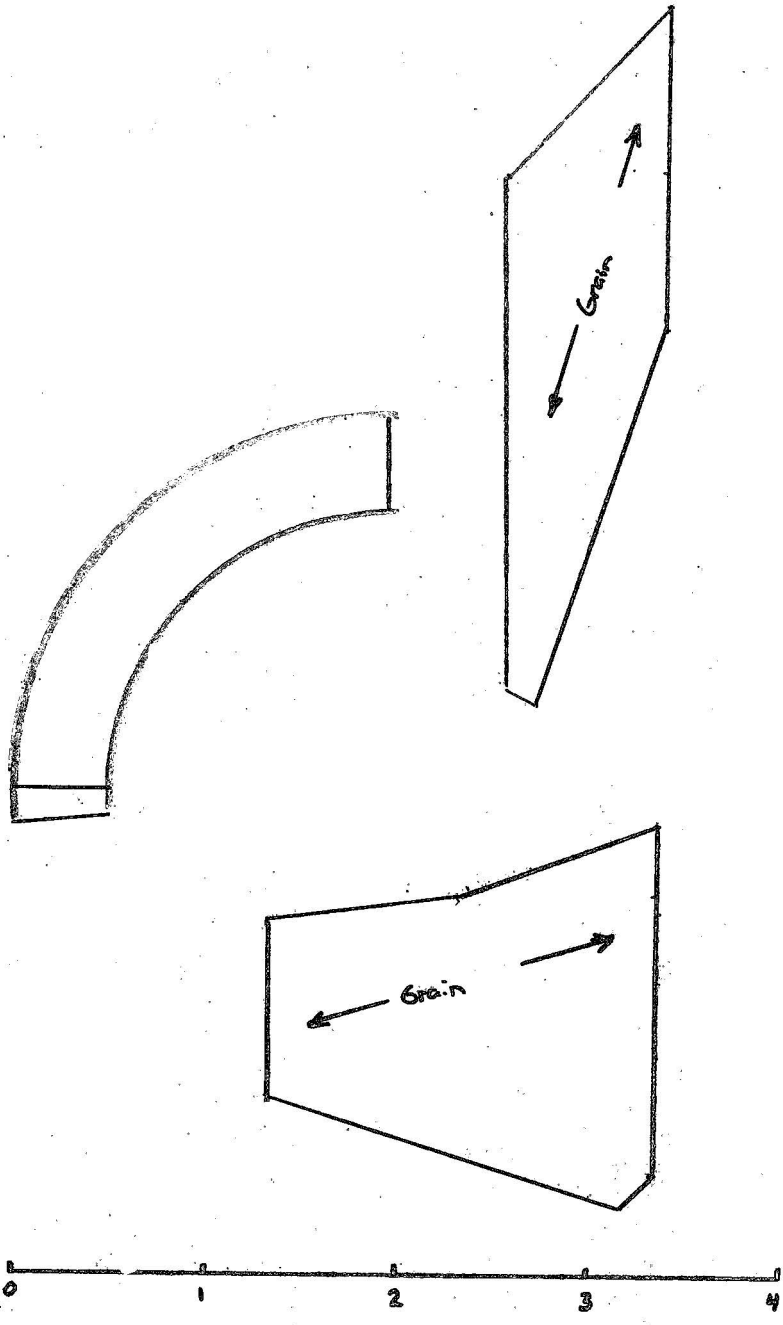
DETAIL G



STEP 8 BOOSTER – SUSTAINER STAGING

The Dual-Lock stage coupling system used in the FIREFLY provides reliable upper-stage ignition and separation when properly joined. In principle, it uses two pair of precision telescoping tubes together with coupled engines. To prevent paper "swelling" and a "binding fit", keep the rocket in a cool, dry place until ready to launch. Avoid launching on moist or humid days.

As shown in the Engine Coupling Detail I, place the Booster and Upper Stage engines end to end, and tape together with one layer of thin cellophane tape (scotch tape). Make sure that the nozzle end of the Upper Stage engine is connected to the forward (opposite of nozzle) end of the Booster Stage engine. Friction fit the Upper Stage engine into the sustainer mounting tube, and push into place until it contacts the forward thrust ring.


Grain
Grain
0
1
2
3
4
Inches

FIREFLY

KA-6

STABILIZER FINS

ROOT CHORD
Glue this edge to body tube

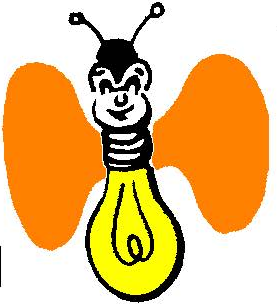
ROOT CHORD
Glue this edge to body tube

ROOT CHORD
Glue this edge to body tube

ROOT CHORD
Glue this edge to body tube

Cut out with sharp modeling knife

Cut Out Balsa Parts Carefully

FIRE  FLY

Fire-Fly

THE WORLD'S SMALLEST TWO-STAGE ROCKET!

$1.75

Centuri

FLYING MODEL ROCKET KIT