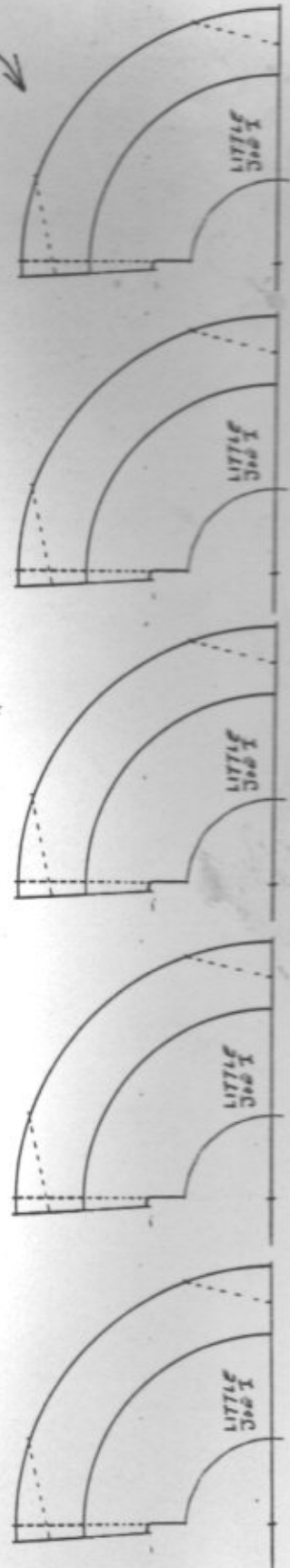


ALL PATTERNS DRAWN BY YITAH WU, COPYRIGHT 1998 © P2A VERSION 3.1

ENGINE NOZZLES
(4 REQUIRED)



LITTLE JOE I BODY WRAP
FOR BT70

D O T

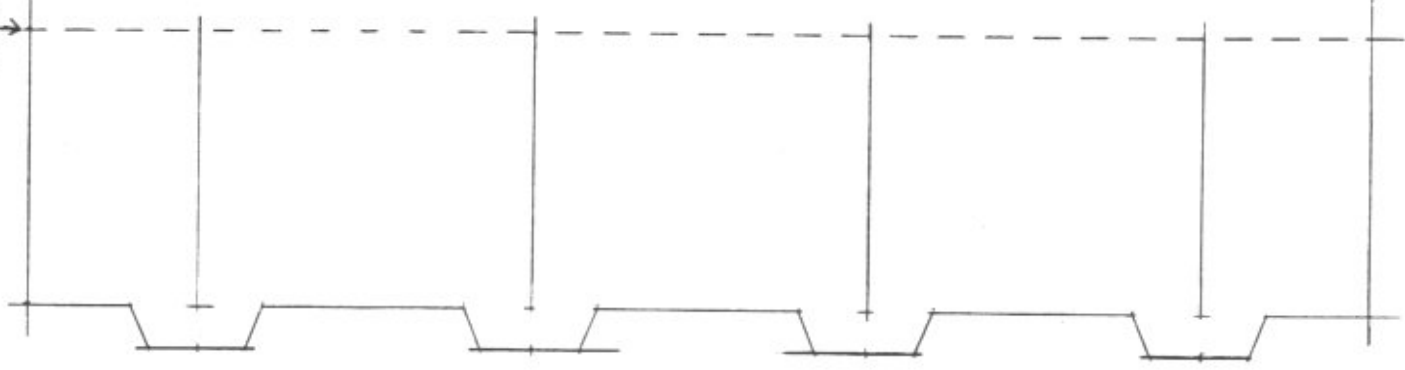
VERSION 3.1
1:35 SCALE

YITAH WU 1998 ©

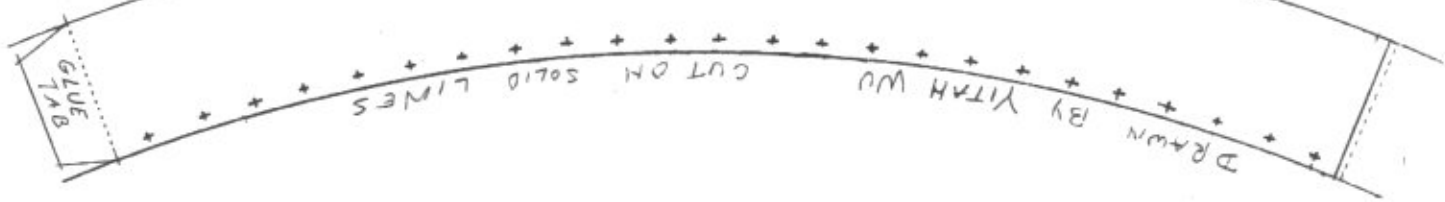
SCORE

SCORE

SCORE



BT-70 → ST20 TRANSITION SHROOD FOR LITTLE JOE I



DRAWN BY YITAH WU

CUT ON SOLID LINES

GLUE
TAB

6 STRINGERS ↑

JI
ST20
MARKING
GUIDE



Little Joe I (Mercury Little Joe)

Skill Level 5: Expert

A little Joe I has been a near-obsession for me, so I've scratch built one for my own enjoyment. All the parts can still be scrounged from various sources.

The Little Joe I was used to prove out the Mercury Capsule escape rocket system for the U.S. Space Program. One even carried a passenger (A chimp named "Miss Sam")

My intent was to reproduce a scale model of the LJ-5B round which was tested at Wallops Island, Virginia. Many thanks to Peter Alway and his book, Rockets of the World, which served as an indispensable resource. A picture of my finished model can be found at: <http://www.mich.com/~ywu/rocket.htm>

Yitah Wu / ywu@mich.com

Parts List:

- 1) BT70 Tube - 6.25" Long
- 2) ST20 Tube - 4" Long
- 3) BT20 Tube - 3" Long
- 4) 1/8" Launch Lug - 1" long
- 5) 18MM Engine Thrust Ring
- 6) Mercury Capsule, 1/35 scale (Estes P/N 34125)
- 7) Balsa stock - 1/16 square x 8" Long
- 8) Balsa stock - 8" x 2" x 3/32"
- 9) Balsa stock - 3/8" x 1.5
- 10) Body Wrap / Shroud Sheet / ST20 pattern sheet
- 11) Fin/ Engine tube /Engine strut pattern sheet
- 12) Elastic Shock Cord

You will Need:

Hobby Knife or Razor Saw (Recommended)
White or Yellow Glue
Plastic Cement /CA Adhesive (Super Glue)
Sanding Block (Recommended) or Sandpaper
Sealing Putty (Recommended) or Sanding Sealer
Pen/Pencil/Ruler
Drill with 1/8" Bit (Needed for internal lug construction)
Primer / Paint
Expendable 18 mm Engine Casing
12" parachute

Yellow Glue: Better than white glue, though be very careful not to use too much as it shrinks a lot when drying.

Sanding Block: If you do not have a sanding block, you can spray-mount or glue sandpaper to a piece of cardboard, wood, or foamcore. I use 150 and 280 grit sandpaper spray mounted to foamcore, which makes a great disposable sanding block.

Sealing Putty: People have reported success with Elmer's Fill & Finish. I haven't tried it, but have had excellent results with Red Devil OneTime Spackling. It is very light and very sandable.

Plastic Cement: Tube Type is easier to use and often gives stronger bonds, but Liquid Type gives much cleaner results.

Section A: General preparation.

- 1) Lay out all the parts to make sure they are present.
- 2) Lightly sand the outside of all body tubes.
- 3) Decide whether you will be using an External Launch lug. An internal lug looks better, but is much more harder to build correctly.

Section B: Engine Mount Construction:

- 1) Take an expended engine casing and make a mark 1/2" from the nozzle end. Smear glue inside the engine tube and insert the thrust ring.
- 2) Use the expended casing to push the thrust ring up until you reach the mark. Remove the casing quickly so it doesn't end up glued inside as well.
- 3) Apply CA to the rear of the engine tube. Wipe away excess with wax paper or plastic bag. This will strengthen the tube and prevent fraying.

Internal Lug Directions:

- 1) Using the pattern, cut (4) engine mount braces. **Make sure you sand them together so that they are all the same size**
- 2) Using the engine mount pattern, mark the engine tube and extend the lines to run the length of the tube. Make a mark 1/2" from the rear of the tube on each fin line.
- 3) Glue the engine centering braces to the engine tube. Allow to dry, then add a fillet of glue to each side of each centering brace.
- 4) Cut out the ejection bulkhead. Cut out internal lug hole with a hobby knife. Insert the launch lug so that approx. 1/4" protrudes through the top of the bulkhead and glue the bulkhead and launch lug to the engine tube and engine centering braces (see figure 1.) **Make sure that the launch lug is parallel to the engine tube.**



Figure 1

- 5) After the glue is dry, Test fit the engine mount assembly in the BT70 main body. It should fit loosely, but should not be able to wobble. If too snug, sand the braces. If too loose, glue a thin strip of paper to each brace.

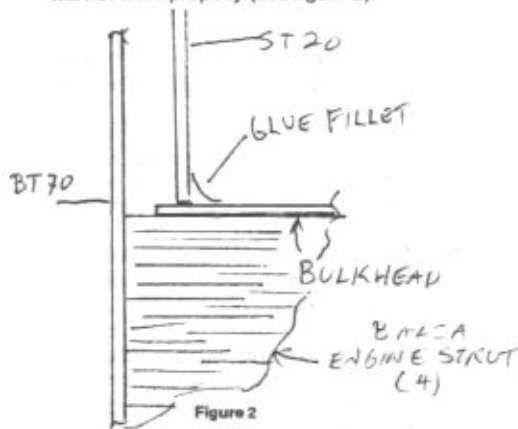
External Lug Directions:

- 1) Cut out the external option centering ring and the ejection bulkhead from the pattern sheet.
- 2) Glue or spray mount to a piece of cardboard (not included. 4-ply posterboard or mat board is ideal.) Cut out as indicated.

- 3) Glue the centering ring to the engine tube $\frac{1}{2}$ " from the back end of the engine tube. When dry, add a fillet of glue to both sides.
- 4) Glue the ejection bulkhead to the top of the tube, $\frac{1}{2}$ " from the end of the tube. Allow to dry.

Internal/External Directions:

- 1) After test fitting the assembly in the main body, glue the assembly into the body with the ejection bulkhead making contact with the ST20. Make sure that the bulkhead is glued securely to the ST20, otherwise the ejection charge will not work properly (see figure 2).



Section C: Body Assembly

- 1) Carefully cut out the main shroud wrap. Pull the wrap across the edge of a table or a ruler to put a curl into the wrap.
- 2) With an empty ball point pen, score the wrap at the 3 dashed lines as indicated.
- 3) Using spray adhesive or contact cement, apply the outer wrap to the BT70.
- 4) Cut out the BT70 at the bottom edge of the body tube to match the profile of the wrap. Use sandpaper to clean up the edges as required.
- 5) Using the ST20 marking guide, place 8 pencil marks around the top of the ST20 tube. Extend these lines at least 3" down the side of the tube. Mark the tube 1.3" from the end.
- 6) Cut 6 2" long pieces of 1/16 square balsa stock. Glue these to the outside of the ST20 tube. Allow to dry.
- 7) Test fit the ST20 in the BT70. Sand the balsa as needed. The fit should not be so tight as to cause warping of the BT70 when assembled.

- 8) Apply a light coat of glue to the top inside 2" of the BT70. Slide the ST20 into the tube until the pencil mark lines up with the top of the tube. (See figure 3) Allow to dry.

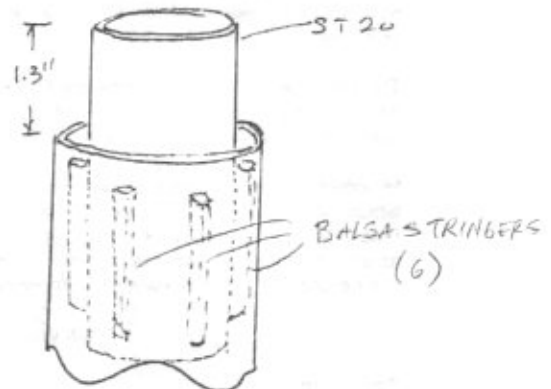


Figure 3

- 1) Carefully cut out the shroud along the solid lines. Using a thumbtack, punch a small hole at the bolt locations on the shroud as indicated. Curl the shroud along the edge of a table.
- 2) Using masking tape, test fit the shroud on the body. Glue the shroud and allow to dry.
- 3) Score the shroud at the glue joint to make reduce the visible step.
- 4) Apply a thin layer of glue to the top of the BT70 and on the ST20, $\frac{1}{2}$ " from the end. Slide the shroud down and apply a thin bead of glue to where it contacts both the BT70 and ST20. When dry, sand the joints lightly to reduce visibility of joint.
- 11) Smear the shroud with CA or epoxy and sand when dry. This will give a smoother finish and stronger shroud.
- 12) (**External Lug**) Glue the launch lug to the outside of the body between the fins.

Section D: Engine Mount Installation

- 1) Apply a thin bead of glue to the top of the ejection bulkhead. Slide the engine mount into the body until the bulkhead contacts the ST20. Line up the engine mount struts with the fins.
- 2) Using a piece of scrap balsa, add a bead of glue to the inside of the ST20 and to the engine mount struts. Allow to dry.

Section E: Fin Assembly

- 1) Sand and seal the fin surfaces before cutting out the fins.
- 2) Cut out the pattern and lay onto the balsa stock. Make sure the pattern is properly oriented. **Trace the pattern onto both sides of the fins stock. This will ensure you cut the fins out correctly.**

- 3) Cut and sand, making sure the leading and trailing edge angles are correct. (see figure 4).

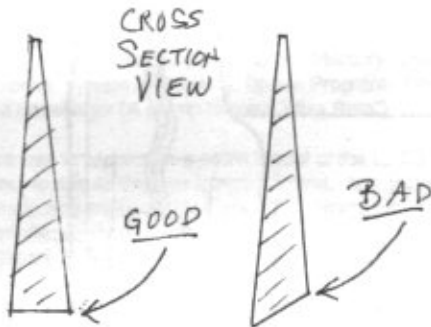


Figure 4

- 1) Using a sharp object, punch at least 5 holes in the body tube along each fin attach line. This will give a much stronger attachment for the fins.
- 2) Glue the fins to the BT70 body tube. After dry, add fillets to the base of each fin.

Section F: Capsule Assembly

- 1) Remove all plastic parts from the mold trees using a hobby knife or diagonal cutters. Remove excess flash.
- 2) Test fit the capsule sections to each other and the base. Sand as necessary to fit. Glue the upper shell of the capsule together **but not to the base**.
- 3) Test fit the capsule, base, and body together. Insert a launch rod or dowel into the internal launch lug and mark the inside of the capsule. Drill a hole in the shell of the capsule and enlarge the hole with a hobby knife so that the launch rod slides freely through all 3 holes (see figure 5).



Figure 5

- 1) Glue the capsule to the base, making sure that the hole is not blocked. Test fit the launch rod again.
- 2) Assemble the tower and escape rocket and glue to capsule.

Section G: Finishing

- 1) The display nozzles may create an ignition hazard as well as making engine installation and removal difficult. If you plan to fly your model, you should *not* install the nozzles.
- 2) Cut out 4 of the display nozzles along the solid lines and glue together. When dry, cut along the dotted line to remove excess material.
- 3) Glue to the inside of the body, aligning the solid black line with the bottom edge of the body tube (see figure 6)

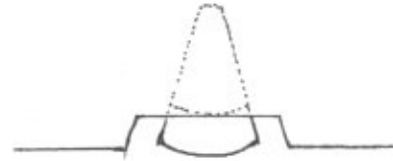
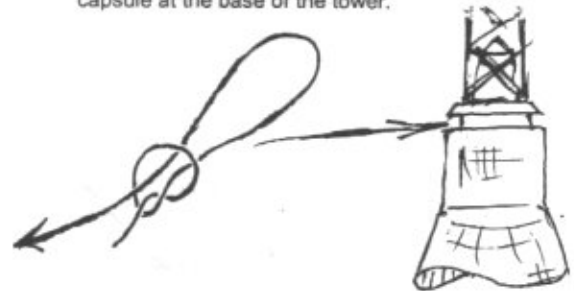


Figure 6

- 1) Paint the capsule gloss black. Paint the tower and the thin ring at the base of the capsule gloss red. Set aside.
- 2) Seal and sand all balsa surfaces. Lightly sand all glue joints and fillets. Remove any excess glue with sandpaper. Spray the body with primer. For the best finish, lightly sand all body surfaces with a 300+ grit sandpaper. Spray the entire body silver. Paint one fin and the tips of the remaining fins fluorescent orange.
- 3) Apply "United States" emblems. For more detail, the white capsule decal is available from Estes as P/N 037149 (Price 2/98: \$2.96)

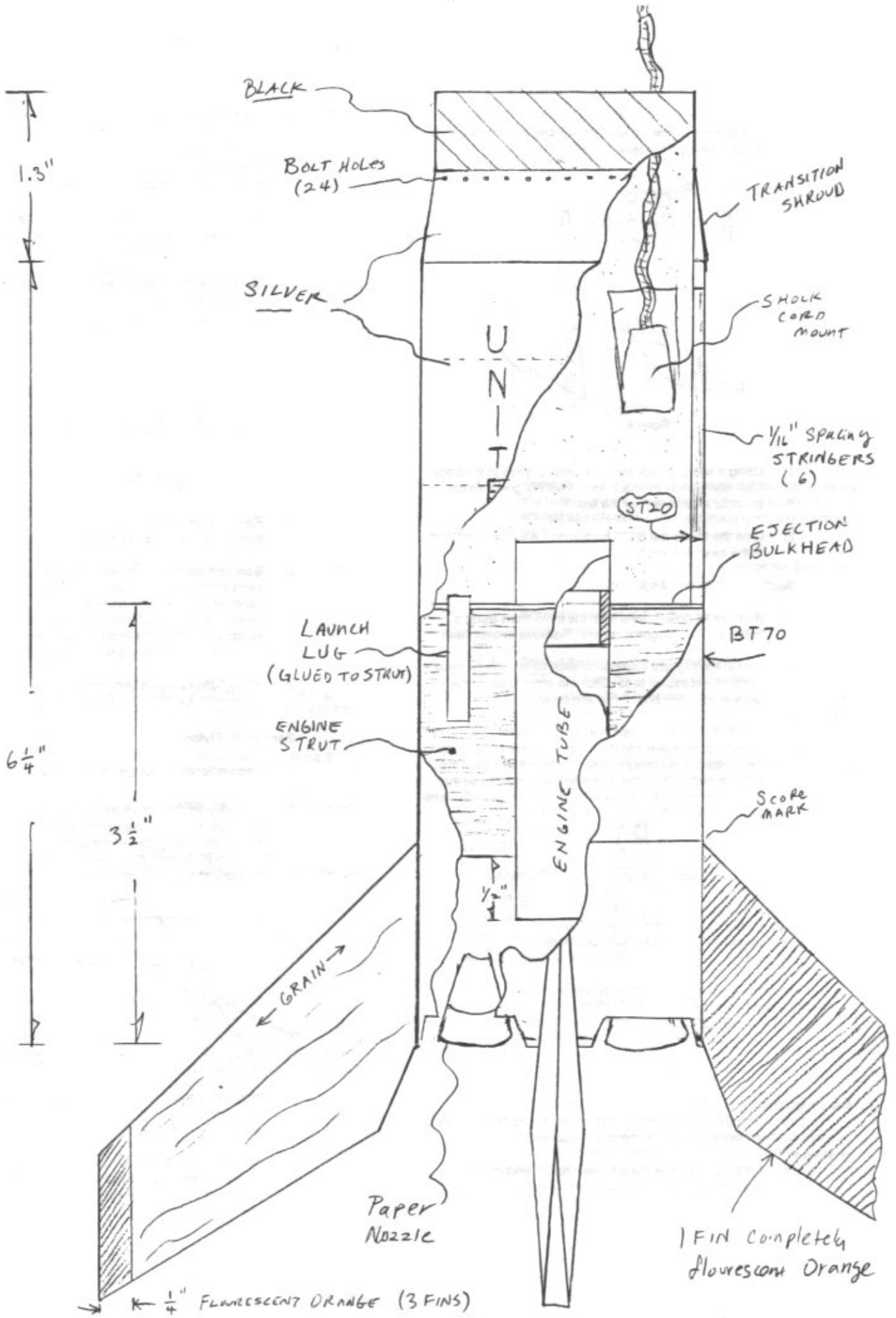
Section H: Flying

- 1) Recommended engines: B6-4, C6-3, C6-5, C5-3
- 2) Securely tie the heavy thread to the shock cord. Tie a 12" parachute to the middle of the thread. At the end of the heavy thread, tie a slipknot. When flying the rocket, secure the slipknot to the outside of the capsule at the base of the tower.



- 3) Insert 3 - 4 squares of recovery wadding into the body tube. Fold and insert the 12" parachute. **Make sure you do not block the launch lug.** Line up capsule mark.
- 4) Insert the engine and secure with masking tape on the *outside* of the engine mount tube. Carefully thread the rocket onto your launch rod, and follow normal launch procedures.....5.....4.....3.....2.....1...Blast Off!!!

DRAWN BY YITAH WU ©1998



BLACK

BOLT HOLES (24)

SILVER

TRANSITION SHROUD

SHOCK CORD MOUNT

1/16" SPACING STRINGERS (6)

EJECTION BULKHEAD

BT70

SCORE MARK

1 FIN completely fluorescent Orange

1.3"

6 1/4"

3 1/2"

LAUNCH LUG (GLUED TO STRUT)

ENGINE STRUT

ENGINE TUBE

ST20

Paper Nozzle

1/4" FLUORESCENT ORANGE (3 FINS)

GRAIN