

HD HOLVERSON
DESIGNS, INC.

WICKED WINNIE™

FLYING MODEL ROCKET KIT

cat# VDI2003

**BIG ROCKET
THAT
PERFORMS!**

**BIG PAYLOAD
SECTION**

for your
experiments

**LASER-CUT
BALSA**



requires assembly
skill level 3
average experience

**OPTIMIZED
AERODYNAMICS FOR
EXTRA HIGH FLIGHTS**

**PARACHUTE
RECOVERY**

easy-to-follow instructions
are designed to be
filed and collected

diameter: 42mm (1.64")
length: 60.3cm (23.75")
net weight: 70g (2.5oz.)
launch weight 96g (3.4oz.)

recommended engines:
B4-4 (first flight),
B6-4, C6-5

predicted altitudes:
B4-4: 75m (245'),
B6-4: 79m (260'),
C6-5: 180m (590')

**made
in the
USA**

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1/2003 975

Holverson Designs, Inc.
25075 CO HWY 120 • Soldier, IA 51572
<http://www.pioneer.net/~holverson>

W I C K E D W I N N I E E A S E

tm



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Thank you! We would like to thank you for purchasing this Holverson Designs flying model rocket. We hope that you enjoy building and flying this model as much as we have. Please let us know if you like your kit, or if you have any questions or need technical advise. Contact us at: Holverson Designs, Inc. 25075 CO HWY L20, Soldier, Iowa 51572 or <http://www.pionet.net/~holvrson>.

This instruction sheet is laid out to allow you to start a rocket plans reference file. Save your entire set of instructions for future reference.

Big Rocket that Performs!

The Wicked Winnie™ is a large sport rocket that is unique because it doubles as a heavy lift payload carrier and has optimized aerodynamic features that enable it to fly higher than comparable sized rockets on the same total impulse.

Almost all professional rockets carry payloads to allow us to learn more about the universe. Sounding rockets send meteorological instruments into the upper atmosphere for brief periods of time. Military rockets and many civilian rockets place satellites into orbit. Larger rockets send scientific probes to nearby planets and into deep space. The most glamorous rockets lift their astronaut or cosmonaut payloads into space. Heavy lifting launchers like the Space Shuttle will be carrying sections of our first permanent space

station into orbit enabling longer duration observations to be made of the earth and heavens.

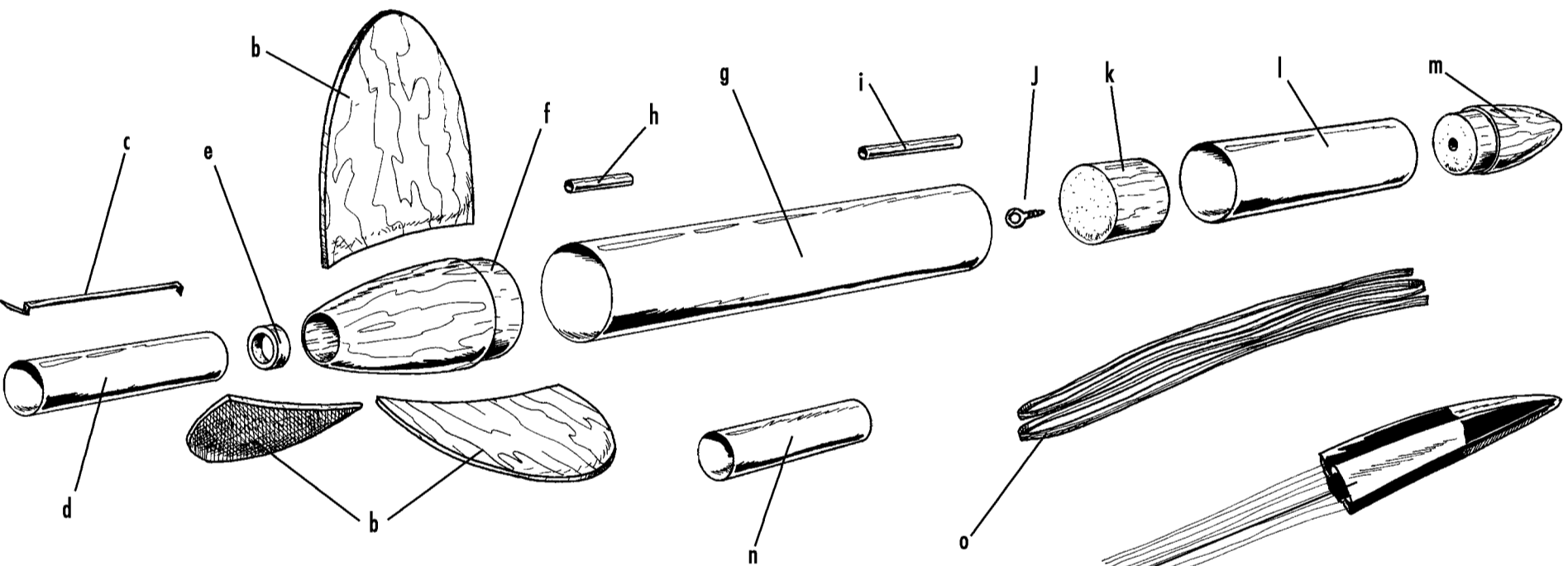
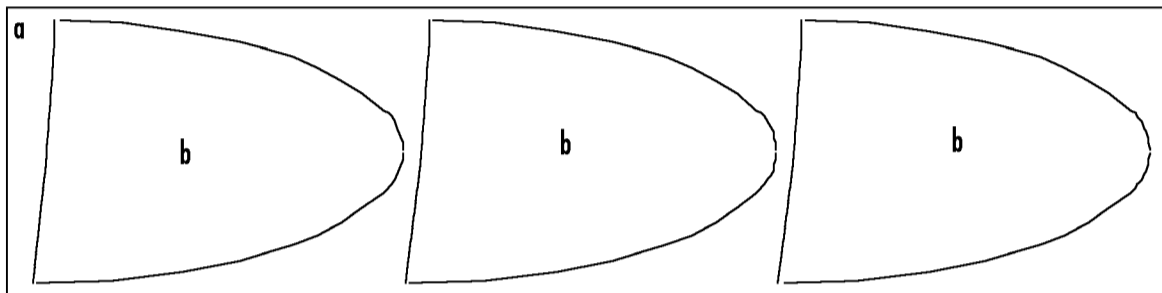
While Wicked Winnie™ may be flown as a sport flyer any time you please, the generous payload section provides room for many types of payloads. Investigations into such things as: air sampling, meteorology photography, altimetry, acceleration, audio and video recording and transmitting of the telemetry to the ground are just a few suggestions. Many simple plant or insect studies can be designed to fly aboard Winnie™ too. The types of payloads Winnie can carry are only limited by your imagination and ingenuity.

A properly built Winnie™ will lift from the pad faster and fly higher on the same size of engine than a similarly sized rocket with a blunt rear and angular fins. This is because Winnie's™ profile reduces drag by

applying basic aerodynamic theories to its construction. The nose cone has a parabolic curve allowing a cleaner airflow than more common elliptical and ogive nose cones found on most model rockets. The rear end tapers to a "boat-tail" which reduces base drag, the performance robbing wake, left by blunt tails in the form of turbulent air flow separation. Between the nose and boattail, Winnie™ has three fins; the minimum number needed to keep a model rocket stable, generating less drag than four or more fins. The fins are elliptically shaped, a form that generates the least drag while slicing through the air at subsonic speeds.

parts views

Check the parts in your kit with this illustration. This drawing shows how the parts go together. It is not intended to be used to assemble your kit.



- a. laser-cut balsa sheet (ba120040)
- b. fins
- c. engine hook (eh00070)
- d. engine tube (bt01909)
- e. engine block (ar01914)
- f. boat-tail (tr04200)
- g. body tube (bt42030)
- h. short launch lug (ll04025)
- i. long launch lug (ll04051)

- j. screw eye (msc00002)
- k. bulk head (bh04240)
- l. payload tube (bt42015)
- m. nose cone (bnc42001)
- n. guide tube (dt18000)
- o. shock cord (sc06200)
- p. parachute (pp00046)
- q. decals (dec02003)



required building materials

- Carpenter's (preferred) or white glue
- Pencil
- Sandpaper: 120, 200, and 400 grit
- Hobby knife
- Scissors
- Cotton swabs
- Nail file

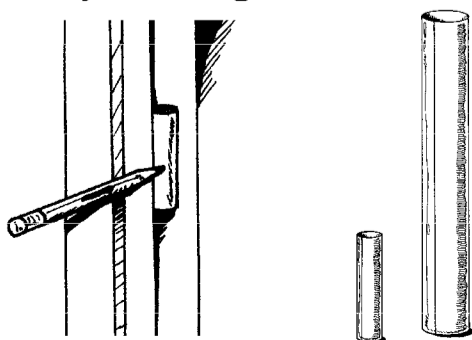
optional building materials

- balsa filler or spackling
- putty knife or other applicator
- flexible ruler (thin plastic type)
- sanding sealer
- spray paint

getting started

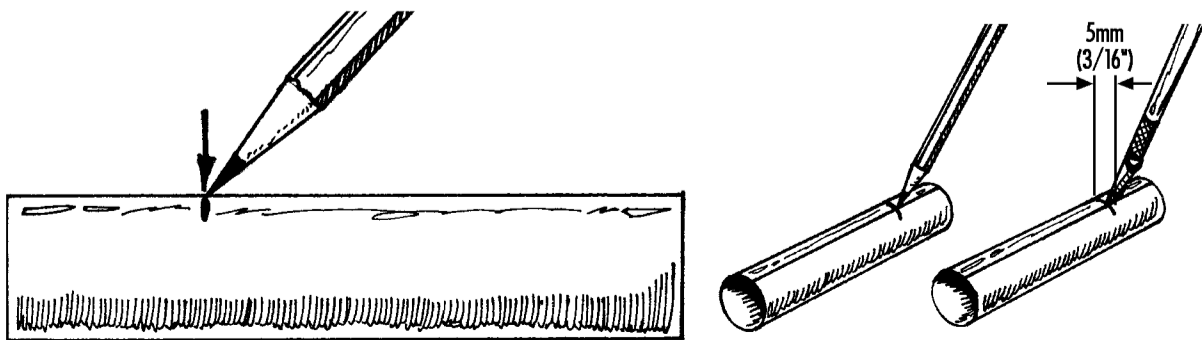
- You will need a flat surface to work on. A piece of flat cardboard works great to protect your table top and allow you to glue and sand. When the cardboard gets too rough, replace it with a new sheet.
- After reading the instructions and visualizing the assembly steps, work slowly and carefully and most of all, have fun!
- Test fit all parts before gluing them in place! Sand as needed to make parts fit, then glue.
- The more care you use in building your model, the better it will perform and the more fun you will have flying it!

1. body and engine tube marking



- Find a convenient channel or groove, such as a door jamb, partially open drawer, or molding to use as a guide to draw a single straight line along the entire length of the body tube.
- Do the same with the engine tube.

2. engine tube slotting



- Place engine tube on illustration as shown.
 - Mark the engine tube as indicated by the arrow.
- NOTE: Make this mark about 3/16" long and perpendicular over the

- line made in step 1.
- Cut a 5mm (3/16") slot across this mark.

3. guide tube marking

- Place guide tube on illustration as shown
- Mark the guide tube as indicated by the arrow.

4. engine block installation

full sized cross section

slot

clean up excess glue with swab

NOTE: Read this step carefully before proceeding!

- Apply a bead of glue 13mm (.5") inside the slotted end of the engine tube.
- Insert the engine block into the slotted end of the engine tube and press into place with the locating tool.

NOTE: Insert engine block in a smooth even motion until the mark on the locating tool reaches the end of the engine tube.

- Quickly remove the guide tube. It is not a part of the finished rocket.
- Clean excess glue from inside the engine tube with a cotton swab.

5. remove the fins from balsa

- Carefully sand edges of the balsa pieces, remove burrs. Remove as little balsa as possible and avoid changing the general elliptical shape of the fins.

6. streamline the airfoils

poor

best

leading edge

trailing edge

NOTE: While the fins can be left blunt edged, you may want to streamline the fins to maximize Wicked Winnie's™ aerodynamic qualities.

- Sand the fins into a symmetrical cross section. A basic shape has both the leading and trailing edges tapered. The Winnie™ prototypes utilized a rounded leading and trailing edge with the tips tapered sharply. The surfaces can be further streamlined and thinned as long as they remain symmetrical from side to side.

7. boat-tail notching

- Cut out boat-tail notch guide, located in the patterns section.
- Use the guide to mark the boat tail. Match end of guide to the end of boattail, making sure guide is straight and square.
- Use a sharp hobby knife to cut out balsa section along the marks.
- Clean up any rough or unevenly cut edges with a nail file or other small file.

8. engine tube installation

NOTE: The notch allows the engine hook to bend, allowing an engine to be installed without damaging the boattail.

- Insert engine hook into the slot on engine tube. Check to see if hook lays straight along marked line.
- Apply a very liberal ring of glue to inside of notched end of boat-tail.
- Insert engine tube, **BLOCK END FIRST**, into the notched end of the boat-tail. Align the engine hook with notch.
- Press engine tube into place using a smooth even motion until the rear edges of the tube and boat-tail are flush. Make sure the engine hook keys straight into notch.
- Clean up any excess glue and allow assembly to dry.

9. boat-tail installation

- Apply a liberal ring of glue around inside of body-tube as shown.
- Insert boat-tail into this end of body tube.

NOTE: Align notch with the body tube line drawn in step 1.

- Double check this alignment by sight, and adjust if necessary, before glue dries.

10. payload tube and bulkhead attachment

- Check to see if bulkhead fits snug in payload tube. Sand to fit if necessary.
- Mark the bulk head as shown.
- Apply a liberal ring of glue around inside, of body-tube as shown.
- Insert bulkhead into payload tube.
- Press bulkhead into tube until mark is even with tube end.
- Clean up excess glue and let dry.

10.5 (optional)

NOTE: this step improves the aerodynamics and appearance of your Wicked Winnie™.

- If the glue from step 8 is completely dry, apply some spackling or balsa filler into the seam.
- Sand smooth when dry.
- Repeat filling and sanding until seam is smooth.

11. marking the boat-tail for fin alignment

NOTE: Take your time and be precise on this step. Good fin alignment is critical for maximum altitude performance!

- Carefully cut out two circular fin guides from the patterns section.
- Place guides on boat-tail as shown.
- Align them against the line on the body tube by sight.
- Mark the boat-tail as indicated by arrow-heads.

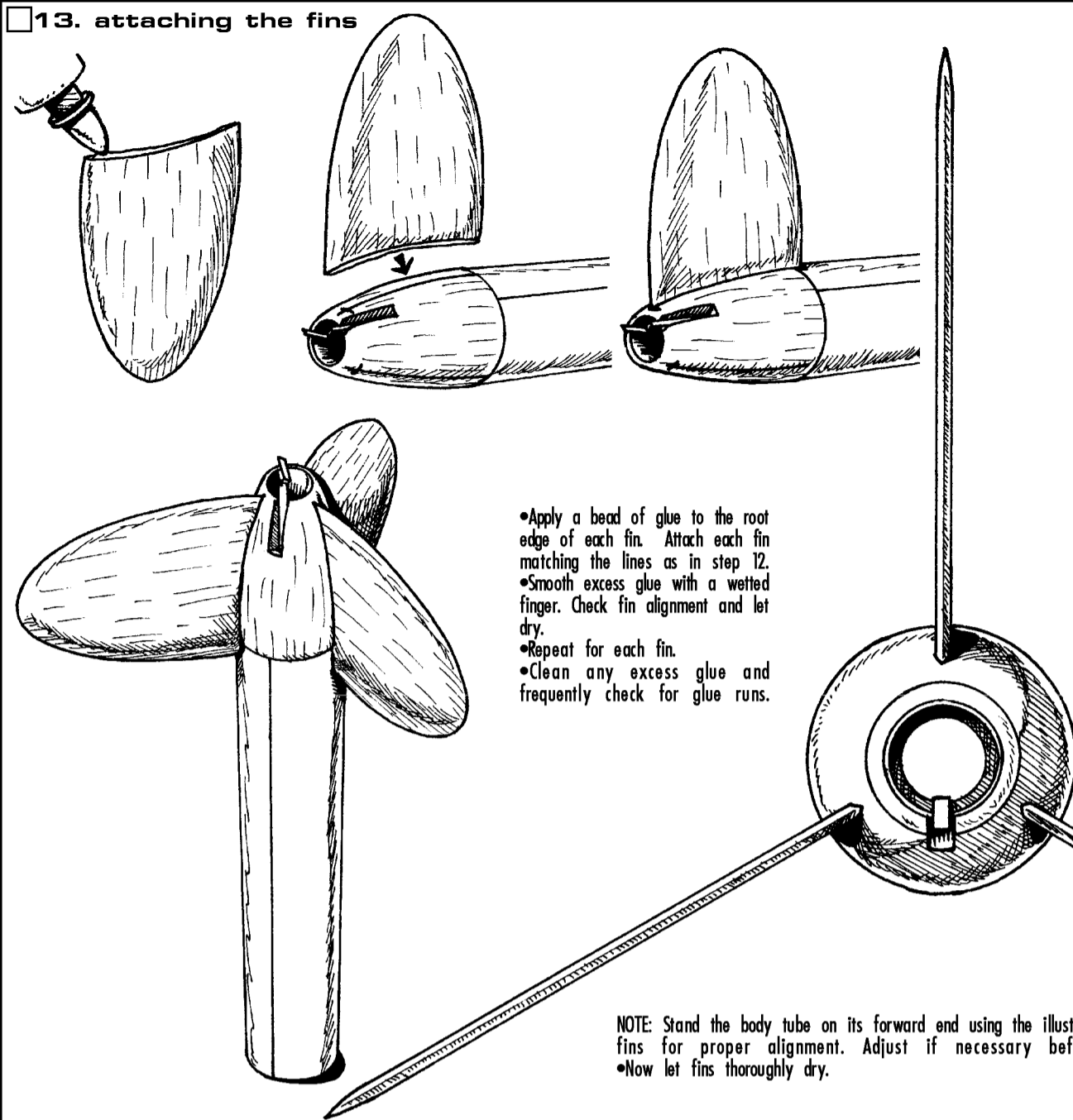
- Remove the marking rings.
- Using a flexible ruler (such as one of the thin plastic ones) or even the edge of this sheet or kit card, draw lines connecting each set of marks extending the length of the boat-tail.
- Use the time honored "calibrated eyeball" method of checking to see if lines are straight with the center-line of the boat-tail and body tube.

12. preparing the fins for mounting

- Lay boat-tail on illustration.
- Mark boat-tail as shown.
- Match fin root edge against lines on boat tail. Check the fit of root edge of each fin against boat tail. Sand root to match contours if necessary.

NOTE: For strong fin attachment, no gaps should exist between fin root edge and boattail.

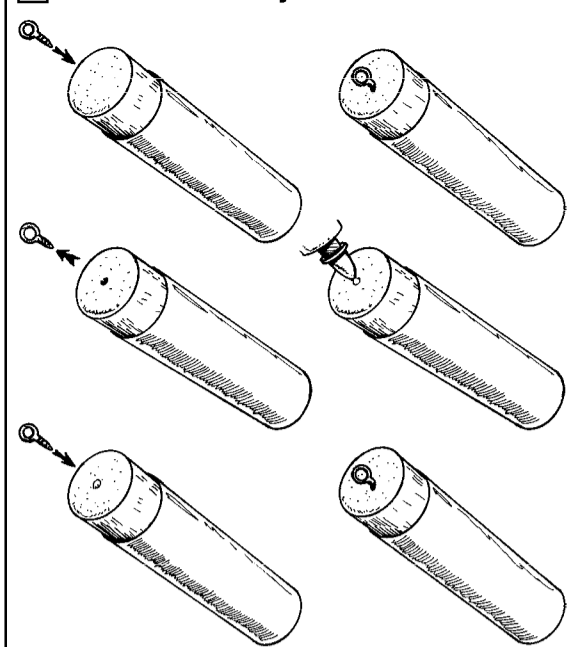
13. attaching the fins



- Apply a bead of glue to the root edge of each fin. Attach each fin matching the lines as in step 12.
- Smooth excess glue with a wetted finger. Check fin alignment and let dry.
- Repeat for each fin.
- Clean any excess glue and frequently check for glue runs.

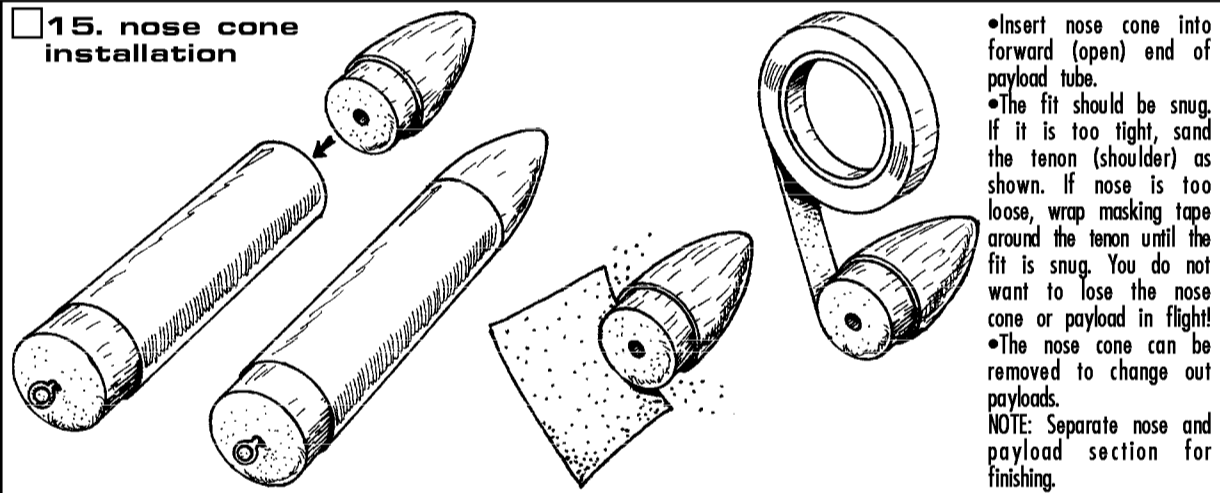
NOTE: Stand the body tube on its forward end using the illustration above and check the fins for proper alignment. Adjust if necessary before the glue sets up.
•Now let fins thoroughly dry.

14. screen-eye attachment



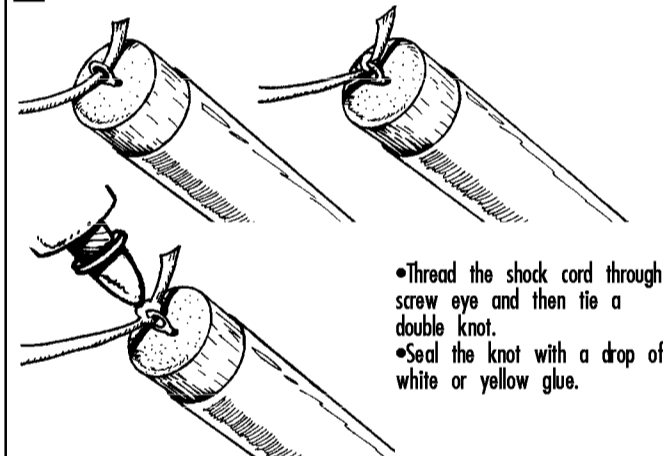
- Thread screw-eye into center of bulkhead base. Now unscrew and remove.
- Apply glue into hole made by screw eye.
- Rethread screw eye back into hole and let dry.

15. nose cone installation



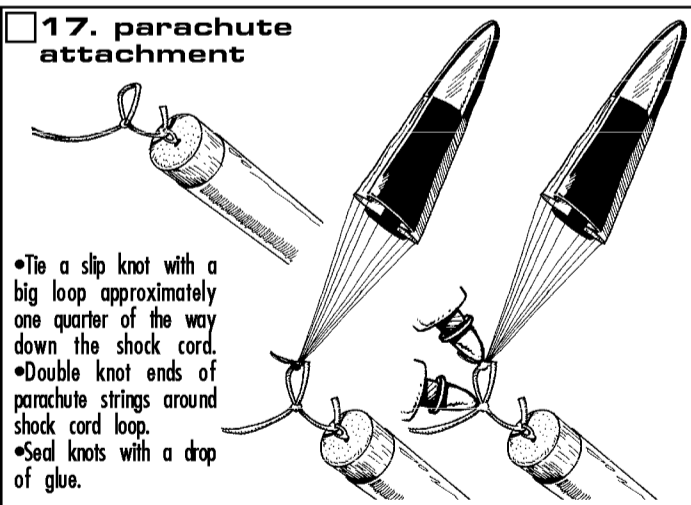
- Insert nose cone into forward (open) end of payload tube.
 - The fit should be snug. If it is too tight, sand the tenon (shoulder) as shown. If nose is too loose, wrap masking tape around the tenon until the fit is snug. You do not want to lose the nose cone or payload in flight!
 - The nose cone can be removed to change out payloads.
- NOTE: Separate nose and payload section for finishing.

16. shock cord attachment



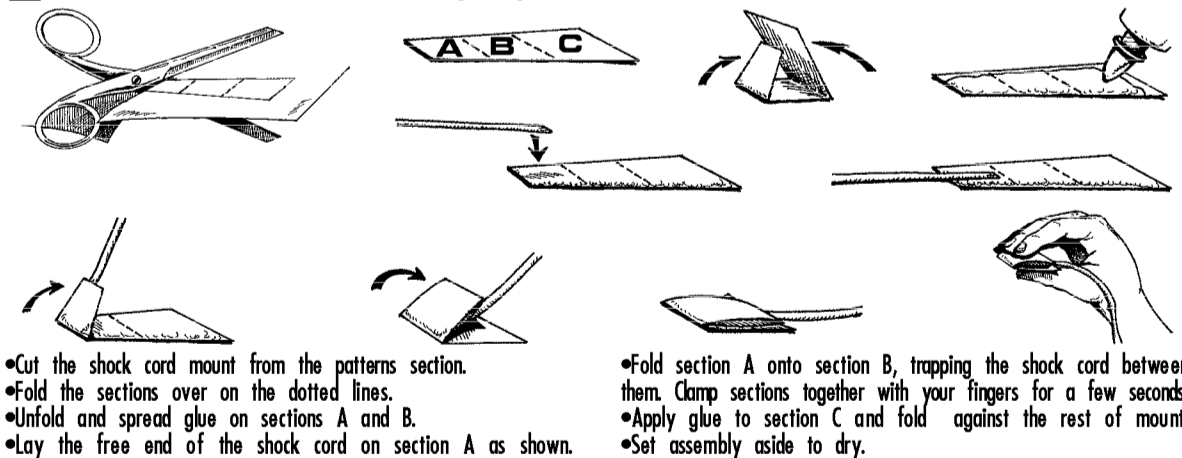
- Thread the shock cord through screw eye and then tie a double knot.
- Seal the knot with a drop of white or yellow glue.

17. parachute attachment



- Tie a slip knot with a big loop approximately one quarter of the way down the shock cord.
- Double knot ends of parachute strings around shock cord loop.
- Seal knots with a drop of glue.

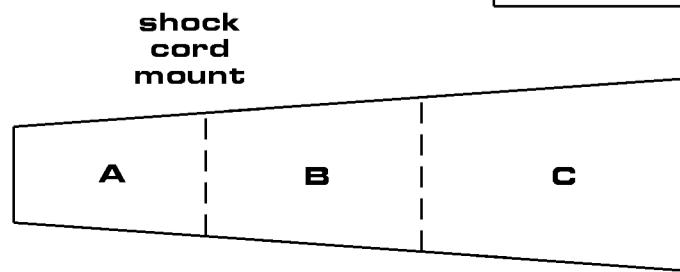
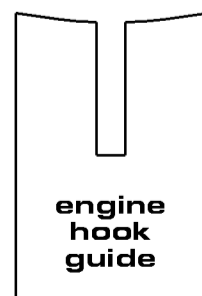
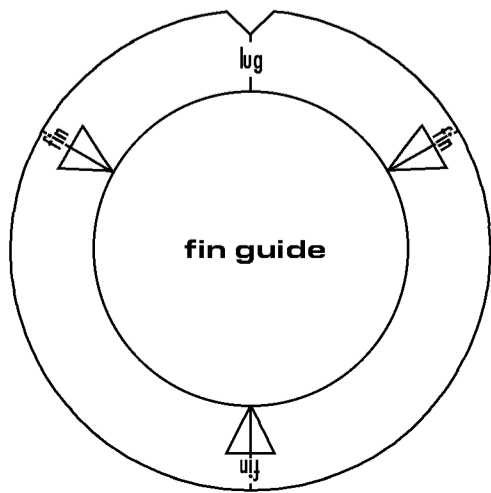
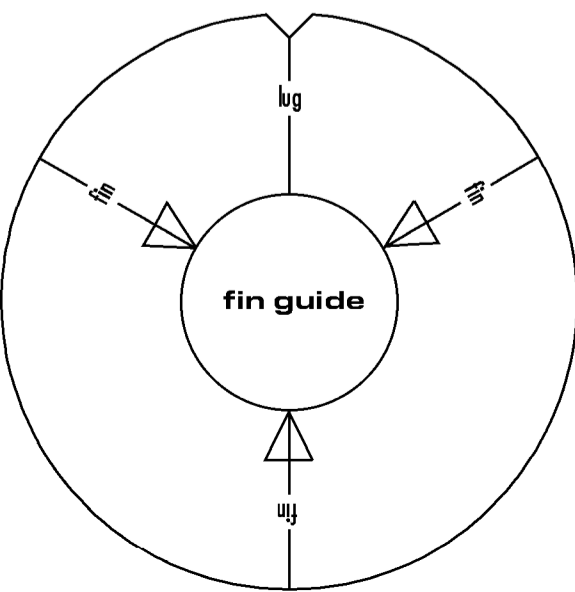
18. shock cord mount preparation



- Cut the shock cord mount from the patterns section.
- Fold the sections over on the dotted lines.
- Unfold and spread glue on sections A and B.
- Lay the free end of the shock cord on section A as shown.

- Fold section A onto section B, trapping the shock cord between them. Clamp sections together with your fingers for a few seconds.
- Apply glue to section C and fold against the rest of mount.
- Set assembly aside to dry.

PATTERNS



19. shock cord attachment to body tube

25mm (1")

- Apply a liberal amount of glue to a side of shock cord mount.
- Attach mount so that it is at least 25mm (1") from forward end (inside) of body tube. Press mount against the inside of body-tube with you fingers. Hold for 30 seconds.
- Use more glue to blend mount into inside wall of body tube. Smooth glue and allow to dry.

NOTE: Shock cord mount needs to be positioned more than an inch away from edge of tube to allow the payload section bulkhead to properly seat into tube. DO NOT INSERT PAYLOAD SECTION INTO TUBE UNTIL SHOCK CORD MOUNT IS THOROUGHLY DRY!

20. launch lug attachment

NOTE: Lightly sand launch lug and body tube to improve bond strength between components.

- Apply a bead of glue to launch lugs.
- Adhere each launch lug onto body tube line. The large lug is flush with front end of body tube. The smaller lug is flush with the rear of body tube.
- Look straight through the lugs to make sure they are aligned before glue sets.

21. adding the fillets

3mm (1/8") radius fillet

- Apply fillets to the various joints in places shown.
- Fillet by running a generous bead of glue at joint then evenly smooth and radius the glue with your wetted finger-tip.
- A fillet radius of 1/8" or less is optimum. Larger fillets result in added surface area which create drag. The extra glue only adds unneeded weight.

22. finishing

NOTE: The nose cone and payload section may be temporarily removed for finishing and multi-toning. Rockets fly better when they are as light as possible and have a smooth finish for better airflow. Smooth finishes add weight, so a compromise between a smooth appearance and added weight must be found. Because you will have to track your model on both sky and ground, it's best to use very bright, high visibility colors. Sand the balsa surfaces lightly with 200-400 grit-sand paper. Apply a coat of sanding sealer and let dry. Apply a second and maybe third coat. Sand the sealer smooth when dry. Apply a coat or two more of sanding sealer. Sand this smooth when dry. Sand with grain of wood. Use a rag, dampened in denatured alcohol, or a tack cloth to wipe away all sanding dust. Let the alcohol evaporate thoroughly and then apply spray paint. Apply the primer coat first. After drying, apply the color coat in even strokes parallel to the surface being painted. Use the least amount of paint possible to cover. The first color coat should be a light dusting of paint. The second coat, a little heavier, should resemble an orange peel texture. The third or final coat should be the heaviest coat. Allow it to go on smooth and glossy. To aid in painting, make a painting wand from a spent engine on a 1/2" wood dowel. Hold the rocket steady while painting and slowly rotate it to allow paint to cover without running after spraying. The Decals can be applied once the chosen finish has dried. Cut decals from sheet, remove the backing, and place on the model.

24. suggestions on payloading.

Your Wicked Winnie™ is capable of carrying more than just simple weights to extreme altitude. Some areas of investigation were mentioned at the beginning of these instructions. Room does not permit us to give you specific steps for a payload design, but listed below are some resources available from your local hobby shop. These publications show, in detail, how to build, fly, and learn from experiments that they suggest. If you cannot find these materials locally, contact us directly for more information. Our contact address is Holverson Designs, CO HWY L20, Soldier, IA 51572.

1. Estes Publication #2845. The Classic Collection contains TN-4 by Robert Cannon on "The Fine Art of Payload Launching".
2. Estes Publication #2831. Projects in Model Rocketry by Robert Cannon.
3. NARTS Publications #TR-203 Soundroc Multiplexed Telemetry System For Model Rockets by David A. Ketchledge.
4. NARTS Publications #TR-204 Sun-Seeking Rocket by George Gassaway.
5. NARTS Publications NCTRA3 Electronic Payloads
6. Apogee Publications Product No. 0102. Second Stage - Advanced Model Rocketry. 2nd Edition, Compiled by Michael Banks and Timothy Van Milligan
7. Apogee Publications Product No. 1007. 69 Science Fair Projects with Model Rockets: Aeronautics Written by: Timothy S. Van Milligan
8. Sport Rocketry Magazine contains articles on payloading, and manufacturers' advertising on payloads and electronic measuring devices designed to fly in model rockets.
9. Handbook of Model Rocketry by G. Harry Stine. Specifically Chapter 15 (Sixth Edition) is devoted to the art and science of Payloading.

23. preflight preparations

spent engine casing stand-off

wadding

parachute

ejection

coast

burn-out

boost

lift-off

recovery

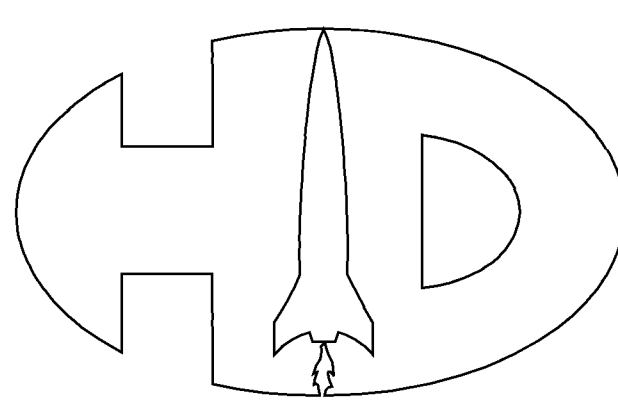
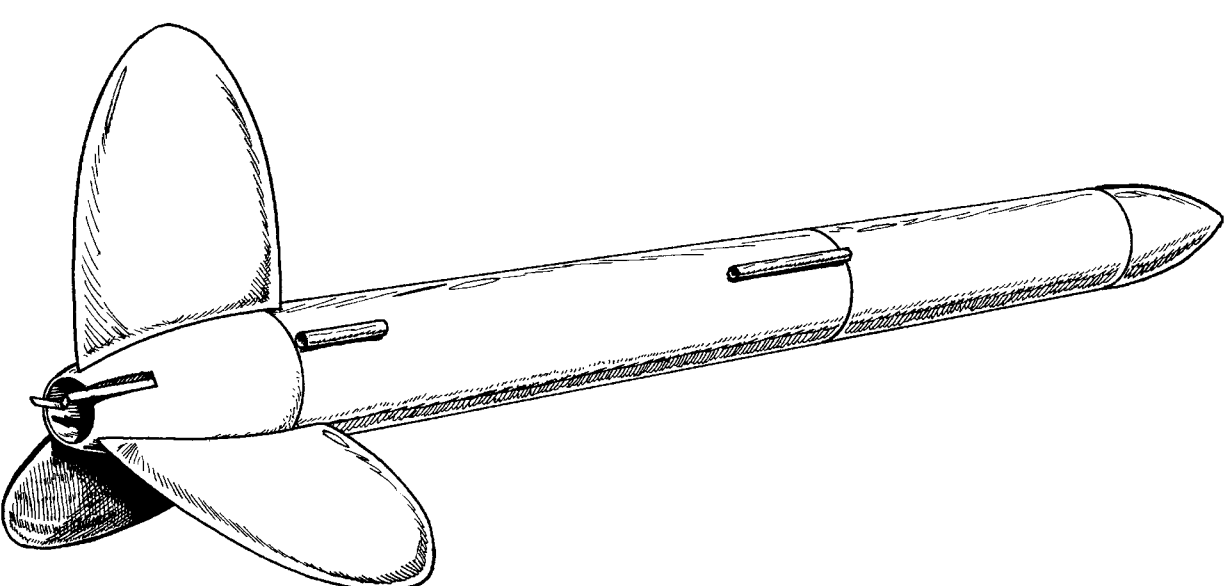
ignition

NOTE: Place the payload (if any) into the payload section. Cushion payload with foam or paper to prevent shifting during flight.

- Check the fit of nose cone to make sure it is snug and won't separate during flight or recovery.
- Remove the payload section and place recovery wadding into body tube.
- Carefully fold and roll parachute until it easily fits into body tube.
- Place bundled chute and coiled shock cord into body tube.
- Replace payload section, making sure it slides in smoothly without binding.
- Prep the engine according to the manufacturer's suggestions. B4-4 (first flight), B6-4, and C6-5 are the recommended engines ON FLIGHTS WITHOUT PAYLOADS.
- NOTE: Use only C6-3 when launching payloads. Maximum payload weight is 60 grams (2oz).
- Insert engine into motor mount.
- Launch your Wicked Winnie™ from a pad with an 1/8" launch rod and electric launch controller.
- Use tape on the launch rod or a hollowed out spent engine casing, to support rocket just above the blast deflector. Supporting the rocket prevents the igniter and clips from touching the blast deflector, causing a short circuit and preventing ignition.

what to expect when flying your Wicked Winnie

- The Wicked Winnie™ will boost and coast vertically.
- After coasting to its maximum altitude or apogee, the ejection charge will separate the payload section from the main body tube. The parachute will deploy and the rocket and payload will return safely to the ground for analysis.



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