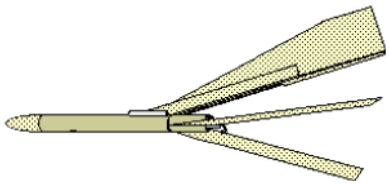
Cyclone

Model Rocket Plans

Created by Jonathan Mills
Instructions revised and edited by Chris Gonnerman chris.gonnerman@newcenturycomputers.net

The Cyclone is a BT-20 medium-sized model rocket that uses a "unicopter" recovery system based on the dynamics of a maple seed. These plans are derived from the final version of the rocket, which has been extensively flight tested. The model is easy to fly and works reliably. As usual, you should be careful whenever you launch any rocket.



A BT-5 version was also built, but is harder to see and easy to lose due to its small size. Therefore only the plans for the easy-to-see and easy-to-find BT-20 version are listed. Still, the BT-20 version can take up to 20 seconds to descend in light winds. Launch it on a very windy day and you could lose it.

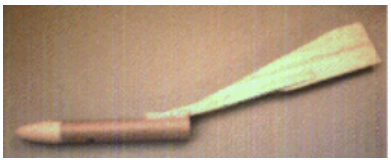
Be especially careful to follow the directions exactly when you build Cyclone. The weight distribution, the spin unit's fin angle, and its structure are critical for correct unicopter operation. The design is also interesting because the spin and stabilizing units are stable when connected together, but highly unstable individually. The instability in each is what causes them to spin, each in a different way, to the ground, without the need for extra fins or canted fins (as in the Estes® Tornado and Estes® Twister).

Therefore, making changes to this design can result in flights that are hazardous to the builder and spectators. Undertake design modifications and subsequent flight testing very cautiously.

The rocket is composed of two units. The parts list and assembly instructions are given for each.

The Spin Unit

The Cyclone Spin Unit is an unstable single propeller, or a "unicopter" recovery system, based on the dynamics of a maple seed. It was designed after many experiments were performed on maple seeds and an origami model.



Spin Unit Parts List

Editor's Note: *In the following parts list, part numbers given are from Semroc's product list at www.semroc.com. I was unable to match the part numbers given in the original Cyclone plan with any current vendor's product line. I have also provided inch measurements in addition to the metric measures originally provided.*

BNC-20B Nose Cone

BT-20 Body Tube, 105 mm (4 1/8”) long

Launch Lug, 1/8” diameter, 35 mm (1 3/8”) long

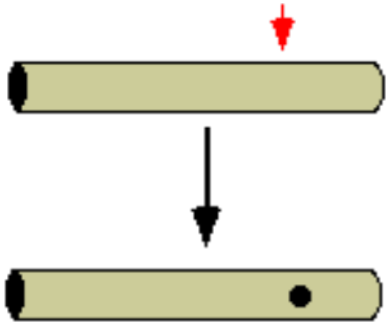
Dowel (fin weight), 1/8” diameter, 103 mm (4 1/16”) long, chamfered 13 mm (1/2”) at one end.

Fins, 1/16” balsa (see diagrams)

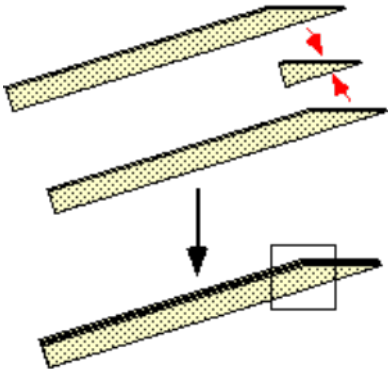
Spin Unit Assembly

1. First, cut out the fins mentioned above. Templates are provided in these instructions.

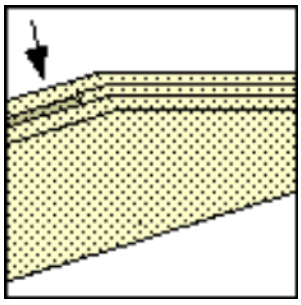
2. Punch a vent hole with a paper punch as far into the body tube as it will reach, about 25mm (1”).



3. Glue the fin spar spacer in between the two fin spars with white glue. Clamp and let dry completely before proceeding.



Note that there should be a space between the fin spars (see enlarged detail). This gap will later be used to hold the fin.



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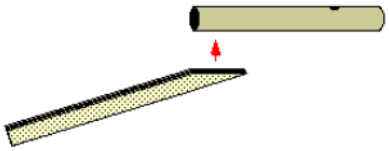
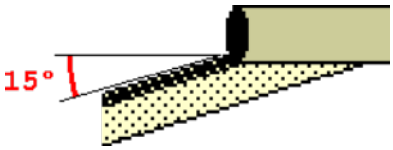
4. Attach fin spar and ensure fin spar angle is 15° ± 1°. Attach the fin spar opposite the vent hole with white glue.



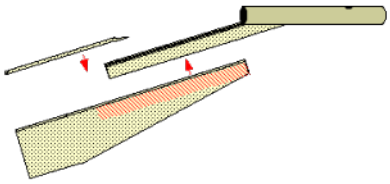
Check that the angle between face 1 of the fin spar and the body tube is 15° ± 1° (see enlarged detail). This is a critical measurement! If the angle is too large the spin unit will not rotate. If it is too small, the exhaust gas will scorch the fin during launch.



If the angle is not 15° or within tolerance, then remove the fin spar before the glue dries and sand the root of the spar to remove enough balsa to obtain the correct angle.

When the fin spar angle is correct, let it dry completely before proceeding.

5. Spread white glue on both sides of the fin in the red shaded area and along the root of the fin (face 2). Insert fin into the gap in the fin spar and clamp. Glue the fin dowel onto the trailing edge of the fin, overlapping the fin spar, as shown.



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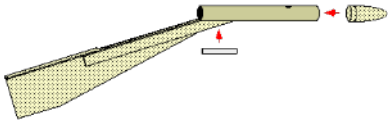
6. Glue the launch lug along the root of the fin spar. Glue the nose cone into the body tube. Let dry.



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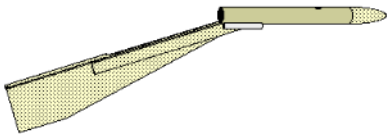
7. This is the completed spin unit. Don't paint the unit until you have given it at least one test launch. While an even coat of paint should not disturb the dynamics of the Cyclone, it is best to have a "baseline" of an unpainted model to compare performance to later, after you paint it. Also be careful if you attach chrome tape or any other "heavy" decoration to the model, as it can affect its ability to rotate.



The Stabilizer Unit

The Cyclone Stabilizer Unit uses the helicopter recovery method to return to earth. However, the weight of the unit and the relatively short fins causes it to descend about three to five times faster than the spin unit.

Stabilizer Unit Parts List

Editor's Note: *In the following parts list, part numbers given are from Semroc's product list at www.semroc.com. I was unable to match the part numbers given in the original Cyclone plan with any current vendor's product line. I have also provided inch measurements in addition to the metric measures originally provided.*

Also, the original plan calls for a "long AR520" adapter ring, which is evidently not available from anyone anymore. I have amended the plan to use commonly available centering rings and a tube coupler, which should not significantly affect this rocket's performance.

BT-20 Body Tube, 35 mm (1 3/8") long

TB-5 Thrust Ring

BT-5 Body Tube, 45 mm (1 3/4") long

EH-18 Engine Hook

RA-520 Centering Rings, 2 each

JT-20C Tube Coupler

Fins, 1/16" balsa (see diagrams)

Stabilizer Unit Assembly

1. First, cut out the fins mentioned above. Templates are provided in these instructions.

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2. Cut a slot in the BT-5 engine tube, about as wide as the end of the engine hook, as far from the end of the tube as the thrust ring is thick (I'm not able to verify the measurement at this time). Insert the engine hook into the slot in the engine tube as a location guide, then glue the mini-engine block into the end of the engine tube. Let it dry.

3. Glue the centering rings to the engine tube, one at 16 mm (5/8") from the tail end of the tube, the other at 25 mm (1") from the tail end. Let the glue dry before proceeding.

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4. Glue the assembled engine mount into the BT-20 tube so that the tail end of the engine tube is flush with the end of the BT-20 tube. This will leave 10 mm (3/8") of the front end of the engine tube protruding from the BT-20 tube; this is correct. Now glue the tube coupler into the front end of the BT-20 tube, pushing it all the way in to the forward centering ring of the engine mount (which should leave 10mm, or 3/8", of the coupler exposed, and therefore flush with the forward end of the engine tube). Again, allow the assembly to dry.

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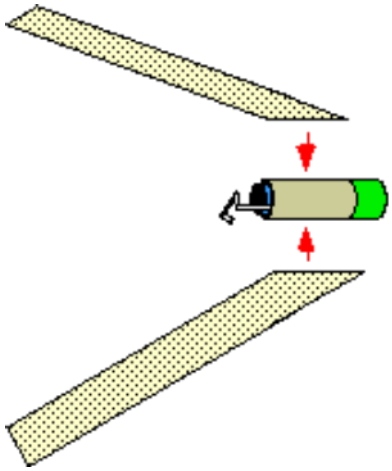
5. Make two marks on the body tube of the stabilizer unit 18mm apart. This will produce an angle between the fins of approximately 100°.

Glue the stabilizer fins to the body tube. Let dry.



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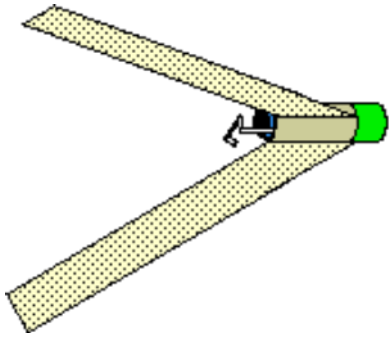
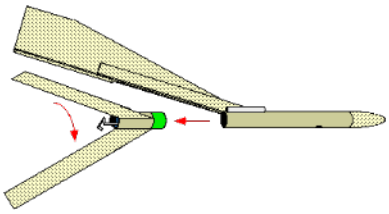
6. This is the completed stabilizer unit. Don't paint it until you have given it at least one test launch.



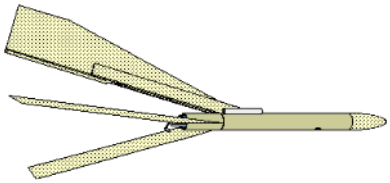
When the glue on both the spin unit and stabilizer unit has completely dried, you are ready to connect the two units together and launch your Cyclone!

Assembling the Cyclone for Launch

Assemble the Cyclone by rotating the stabilizer unit until the fins and engine hook are opposite the spin unit's fin. Then slide the two units together.



The rocket will look rather like a large Estes® Mosquito.



Standing the Cyclone on end, you can see that there is not much to it! The ability of the Cyclone's spin unit to rotate and descend slowly is due solely to the asymmetries in the fin's area and weight distribution.

No moving parts are necessary!

Launch the Cyclone with a 1/2A3-2T for its first flight, or if it is a windy day. Use A3-4T mini-engines for normal flights.

No ejection wadding is necessary. Do not pack any into the spin unit, or it may fail to rotate.

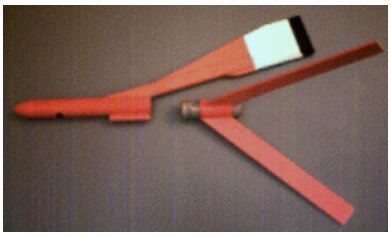
Attach an igniter and a launch plug to the mini-engine, then place the rocket on the launch rod. Make sure your safety key has been removed from your launch controller, then attach the micro-clips. Insert the key into the controller, give a 5-4-3-2-1-Launch! Countdown, and send Cyclone up! You will hear the rocket whistle during its ascent (due to the exhaust gas vent), then at apogee it will separate into the spin and stabilizer units. The stabilizer unit will fall back quickly, while the spin unit will take up to 20 seconds to return, appearing to hover in the sky.

Maintain your Cyclone by blowing into the vent hole of the spin unit after each flight to remove the ash from the ejection charge. Periodically use a toothbrush or small bottle brush to remove accumulated ash from the inside of both the spin unit and the stabilizer unit.

Painting the Cyclone

After building each unit, paint or decorate it according to your preference. This painting scheme emphasizes the flat rotation of the spin unit (painted BT-5 Mini-Cyclone shown).

You might add chrome tape to the spin unit and see if anybody reports seeing a flashing UFO!



This edition edited and revised by Chris Gonnerman chris.gonnerman@newcenturycomputers.net – please direct all questions and comments on this edition to the email address given. The original version of these instructions was retrieved from: http://www.cs.indiana.edu/~jwmills/EDUCATION.NOTEBOOK/rocket/rocket.plans.html

Fin Templates