



an introduction to

Catapult Launched Gliders

by Martin Larsson

Most people have never seen a free flight aeroplane. Small gliders is even rarer in Europe, where the FAI type of aeroplanes are the most common. Somehow the small all balsa gliders are more popular in English speaking countries. What is this then? A catapult glider is basically a handlaunch glider which is “catapulted” into the air with a loop of rubber tied to a stick. It can be used in various way, to compete, to educate, to recruit beginners to a club or just for pure fun.

These gliders are small, cheap and quick to build. This means no big waiting time to get to fly and everybody can afford it. Flying them is tricky, but most people that have never seen a free flight aeroplane fly, will be impressed if it climbs and then circles down. The climb or launch is very impressive, with great speed which makes the plane climb real high.



Getting started

My best advice comes right up, try to find a club in your area. You will probably find helpful people, lots of fun and some new friends. You should also check out the web, lots of info, read more under Resources in the end of this paper. A kit is the quickest way to success. If that's not an option for you, make the glider from a drawing from Tony Mathews, Stan Buddenbohm or Lee Hines.

CLGs as a tool for recruitment

This may sound odd, but as I wrote in the beginning, there are a number of things that makes this a really good type of aeroplane to start with. We have tried this in our club, and the moment our kids did let the plane go for the first time, they were hooked!

There is a number of things I learnt.

Not all kids have got the patient to build aeroplanes, the building sessions and time must be short. We made a kit and spent 2 hours on two occasions to build the glider.

Not all kids have got the skills to build aeroplanes, I had to see to that the plane had potential to fly. At the same time I didn't want to build the glider myself, as then it hadn't been something they had done themselves. So I had to step back on things like airfoil shape and be content with rounded leading edge and tapered back to trailing edge.

To be sure of flying success I helped with basic setup. That's easy to do by hand gliding the glider, showing how to hold and pull and when they got it right, they could let it go.

This worked for all of the kids that we have tried this concept on, all gliders climbed and transitioned to glide. Some needed some fine tuning, but that hadn't been necessary as the kids barely had time to say WOW, before starting to run after their gliders!

“-Where do I find 10 kids that are interested in simple Free Flight gliders?” you ask?

Well, we did put up an add in the local school. It actually can be just as easy as that. Helping more than 2 kids at once is nearly impossible, if you want them to sit still for 2 hours, make sure their parents is participating.



Making kits

To make it easier on yourself and not to bore out your “pupils”, let the build be as short as possible. There is cheap easybuilt kits, but it is possible to make them yourself. Making a number of kits, cost of materials are coming down to 1 Euro per kit.

A short description of how I make these kits. I cut out the wing with a dremel tabletop hacksaw, razor works but takes more time. Stab and rudder with razor. Fuselage is cut, then top of fuselage is tapered with a razor plane and smoothed with sandpaper. Fuselage is marked with pencil where the wing, stab and rudder should be glued. 2 triangular pieces of balsa is cut. A piece of lead and a small piece of sandpaper and all parts are done. I tape all parts on the wing blank and the kit is complete. This could be done in 15 minutes or so.

The Catapult

I use the Lee Hines type of catapult. Its made from a dowel and two 15 mm deep parallell slots are cut in one end. It's easy done with a saw. The slots should be less than a mm wide, I use a plumbers saw that has a 0,8 mm thick blade. The slots are smoothed with sandpaper to reduce wear of the rubber. This catapult is best for one loop of rubber. Cut a lenght of 1x6 mm contest rubber to 3 grams. That is approx 330 mm Tan(beige coloured) or 450 mm FAI(black coloured) rubber. If the rubber is greased it has to be washed or degreased. Cut of a 10 mm piece and glue this on top of one end with cyanoacrylate glue. Then glue the other end on to the rubber piece. Now you have a loop of rubber. Grab the end and pull the rubber hard so it gets thin. Keep the pull and slide the rubber down the cut in the dowel. You might need 3 hands for this, I hold the dowel between my knees. Then turn the rubber in the other direction and pull and slide it down next cut. Pull the rubber hard to secure it.



Tools

You will probably need some tools. The most important, and also hardest to find, is a razor plane. This can probably be found in stores that sell paint and such. It is used for trimming wallpaper, at least what it said on mine. At the same store, get some industrial safety razors. And some sandpaper with grits of 80 and 150. Some wet and dry paper of 300 and 600 is good if you are really serious about this. The sandpaper should be glued to a big flat piece of wood, say 25x50x100 mm. When I think about it, you maybe could get all the tools in the same store. Try to find a sealer that is not waterbased, as these will warp thin balsa. Urethane Varnish, nitrate or nontautening dope or any of the old type wood laquers is what you should look for. A couple of good quality brushes, 15 mm wide, and you are good to go.

Materials

Balsa sheets come in 100x1000 mm with different thickness. You need balsa sheets of 3 to 6 mm thickness for the wing. It is recommended to use quarter grain balsa, but this is really hard to find. Local hobby supplies stores is probably the best bet, as you can choose for yourself. So try to choose the lightest you can find, 10 grams per mm thickness is a good weight. Stab and rudder use 1 or 1,5 mm balsa sheets. For these, it's even more important to get the right wood. It needs to be light and stiff as stab and rudder hold the gliders trim adjustments. They are also thinner and thus easier warp.

Fuselage can be made of spruce/pine, balsa or thin walled 3 mm carbon tubes. Also get glue. White glue (or even better Alpahtic resin glue, yellow in colour) for kids, epoxy for beginners and Cyanoacrylatic for the field repairs.

Build

I will only describe this briefly, so you get the overall picture.

Wing is cut out of a sheet of balsa and the airfoil is shaped before the wing is cut for dihedral. First the bulk of material is taken away with a razor plane and then sanded to final shape with a block with coarse sandpaper glued to it. The dihedral breaks are sanded by putting the wing just outside the edge of the table and raised to half the dihedral, put something under and then sanded flat against the edge of the table. Repeat on the other panel. Sanding in on both panels makes the panels line up better if the dihedral angle is large. Put wing upside down and tape it together with office tape, it will act as a hinge so it will be easier to glue the dihedral joint.

Stab and rudder is cut from a sheet of balsa and sanded to airfoil. With 1 mm balsa it is enough to round the leading edge. Rest is just to glue together, seal the wood by laquer, sand and put on 3 layers total. Rubber hook must be rounded and really smooth, to make the rubber last as long as possible. Tape a piece of lead on the nose, so you have the CG at 50% (or slightly forward what the plan tells) of the wing and you're done. If you like to find the glider after you flown it, some fluorescent paint and phone number may help.





Trim and fly

The adjustment that works best, is if you use the stabiliser just for controlling the launch pattern. Rudder for controlling the roll on launch. Glide angle is controlled by CG, adding or taking away lead. Turn is controlled with tilt or tipweight. Some washout in wingtips also makes better transitions and better stability.

The glider flies with fixed surfaces and practice have told us that it works best if the glider is launched in one direction and glides in the other. Rudder control is more effective with higher speed and these small gliders are not very stable. This makes best practice to just use as much rudder as needed for launch and transition. Easiest way to make the glider turn is to use clay, applied on the wingtip in which direction you want the glider to turn.

The launch is best described as a arc upwards, where the glider rolls and turns as it slows down into glide. Launch should be into the wind and transition directly downwind. If it turns and rolls more than that, too much rudder is used. It can also be too much up elevator. This is the most common trim as most pilots doesn't realise how much altitude loss this creates. Severe cases of too much up produces looping. Most common problem if the glider doesn't fly, is too little up elevator. This is easy to detect as there will be no transition to glide.

There is even a word for it, lawndart. The glider launches straight until there is no more speed, then it dives straight back into the ground. This can be avoided by putting the CG to 50% of the wing (or a couple mm in front of what the plan say) and

handgliding it, while adjusting the stab trailing edge up, until it glides flat. Some slight adjustment on the rudder will be needed for launch transition.

When handgliding, check that the glider has a slight turn. Adjustments is best done by bending the balsa until it cracks and glue it in the desired position with thin cyanocrylate adhesive. This will not go back, like the old "breath and bend" method always described. Hardest part of trimming is analysing the launch behavior. Choose a calm day for the first flights. Handgliding, analysing and adjusting will be much easier then.

Rules

There is no FAI class for Catapult gliders. Flying these gliders in organized competitions first started in USA. In Europe, to my knowledge, there is only rules for these gliders in UK and Sweden.

There are no limitations to the glider.

The handle is allowed to be max 150 mm long.

The rubber amount is limited to 2 grams (UK) or 3 grams (Sweden). Flight times is 1 minute and there is 7 flights all counted (UK) or 8 flights best 5 counts (sweden).

Resources

Links to great info:

Hip Pocket Builders' Forum > Outdoor Free Flight Forum > Catapult Launched Gliders

http://www.hippocketaeronautics.com/hpa_forum/index.php/board,59.0.html

Newbie's Guide to CLG

http://www.hippocketaeronautics.com/hpa_forum/index.php/topic,2120.0.html

Trimming and flying a hlg - Kevin Moseley

http://www.hippocketaeronautics.com/hpa_forum/index.php/topic,11455.0.html

Tony Mathews picasaweb albums

<https://picasaweb.google.com/105619038517716117641?noredirect=1>

NFFS DVDs

<http://freeflight.org/Communications/Announcements/announcement1-2-13NewDVD.htm>

Stan Buddenbohm's 2013 catalog

<http://www.discuskid.com>

A2Z Corp E-Commerce Store

<http://www.a2zcorp.us/store/>

Campbell's Custom Kits

<http://www.campbellscustomkits.com/>

