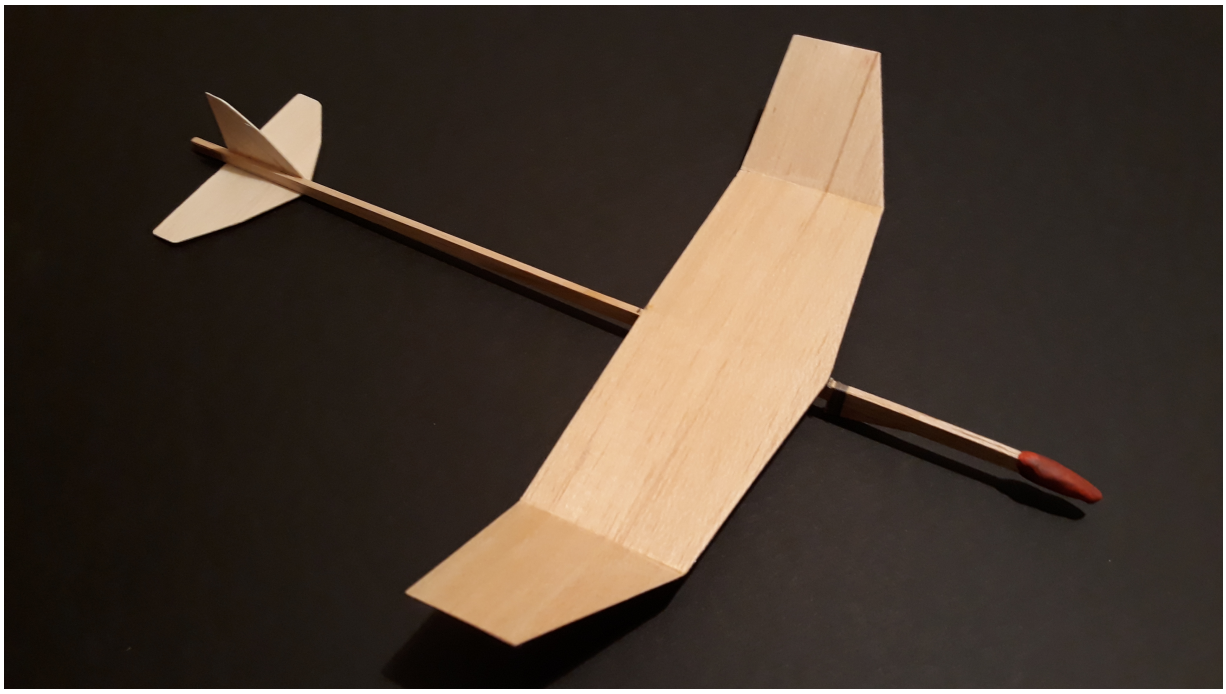
FP-11 MK. II Catapult Glider Building and Flying Instructions

1. Find a 1/8” thick by 3/8” wide by 36” long rock-hard balsa wood stick for the fuselage. Go to a hobby shop or craft store and ask where the balsa wood is kept. Find a stick that cannot be squished when pinched very firmly between your thumb and forefinger. The stick should be extremely stiff and springy. Also, sight down the length of the stick to ensure that it is free of warps and twists. You can make two fuselages from this stick.
2. Note that the lower surface of the fuselage tapers from 3/8” (0.375”) just forward of the catapult hook to 1/4" (0.25”) at the aft most end where the sandpaper grip is attached. This straight taper can be made by carefully sanding the stick using a 100 grit to 150 grit sand block. This taper provides barely enough negative stabilizer incidence (0.5 degrees) to allow the glider to pull out of a dive during the high speed to low speed transition. Some gliders require a slight (around 1/64”) amount of up elevator trim (by warping the trailing edge of the elevator up) to allow the glider to pull out of a dive. Other gliders may need a slight (around 1/64”) amount of down elevator trim (by warping the trailing edge of the elevator down) to prevent the glider from looping during the high-speed launch phase.
3. You can make patterns for the rudder, a wing half and a stabilizer half from card stock or thin cardboard from old cereal boxes. You can use these patterns to draw on the balsa wood with a fine tip felt pen. Alternatively, you can use low tack double stick tape to temporarily stick paper patterns onto the balsa wood and cut through the paper and the wood with a sharp razor blade or hobby knife. I used a 12” metal scale (available at Office Depot) and a sharp razor blade to cut out the parts.
4. The wing should be made from soft 1/16” thick balsa wood sheet (squishy wood of about 4 to 6 pounds per cubic foot density, although up to 9 pounds per cubic foot balsa wood will work, it will just make your glider heavier and the flight times will be shorter). The plans say to use ‘C’ grain balsa (also known as quarter sawed), which has a speckled appearance and is very stiff across the grain. You may not be able to find any ‘C’ grain balsa, so just try to find any somewhat soft 1/16” thick balsa wood. If you have an electronic scale, you can weigh the wood in grams and calculate its density in pounds per cubic foot by dividing the weight of the wood in grams by its volume in cubic inches and multiplying by 3.81 to convert to pounds per cubic foot.
5. The stabilizer and rudder are also made of fairly soft balsa wood sheet that is only 1/32” thick. Again, the plans say to use ‘C’ grain balsa, and you might not be able to find any, so just try to find any soft 1/32” thick balsa wood.
6. Use your favorite glue to assemble the glider. I have built some gliders with Elmer’s yellow woodworker’s glue (or Titebond glue) and other gliders with Duco household cement (Testors and Sig-Ment glues are similar to Duco and are available at most hobby shops). You could also use a thick C/A (cyanoacrilate) type glue available at hobby shops and most retail stores such as Wal-Mart or Dollar Tree stores. If you use Sig-Ment glue, it will take a good 24 to 48 hours for it to completely set up.
7. When scoring the wood at the wing dihedral joints, score the lower surface of the wing with a new razor blade or number 11 Exacto knife. Don’t score all the way through the wood, only go about 60% to 75% through. If you accidentally go all the way through, use masking tape on the upper surface of the wing to hold the pieces together while gluing the dihedral doubler.
8. I use a wood block for the dihedral tool. A book of the correct thickness or two regular DVD cases stacked on top of each other will also work as a dihedral tool. The plan calls for a dihedral height of 1.25”. This dimension is not super critical, so you could go down to 1.15” or up to 1.3”.

Wing tip dihedral joints. Wing is taped to DVD spacer and building board, prior to doubler installation.

9. The wing dihedral joints show Japanese tissue paper doublers on the lower surface of the wing. Japanese tissue is not easy to find (some hobby shops have it, or you can use silk span also at some hobby shops). You could use domestic tissue found at Hallmark stores and most craft stores. Do not use domestic tissue with water-based glues such as Elmer's or Titebond as it will tend to tear apart. Instead, use Duco or Testors or Sig-Ment wood model glues. Tissue paper and silk span has a grain direction just like wood. You can determine the direction of the grain in tissue paper and silk span by tearing it parallel to an edge of the tissue. If the tears are straight and parallel with the edge, then you are tearing with the grain, but if the tear is jagged and wanders, then you are tearing against the grain. Make sure the grain of the tissue paper is parallel with the wood grain (the wood grain is parallel with the trailing edge of the wing). If you use thick C/A glue, you can eliminate the dihedral doublers.
10. The plan shows a wash-in wedge on the trailing edge of the left wing's lower surface. This is set up for a left turning glider, which is the preferred turning direction for a right-handed person (Note: right handers prefer holding the catapult stick in the left hand and the glider in the right hand, and left handers prefer the opposite of this.) For a right turning glider, glue the wash-in wedge to the right wing's lower surface. You could make the wash-in wedge from scrap balsa wood left over from the wing rather than buying the 3/32" by 3/8" trailing edge stock. The left wing's wash-in wedge increases lift on the left wing (the inside wing of a left turning glider) to help keep the model from entering a left spiral dive into the ground. If the glider turns to the right, gluing the wash-in wedge to the trailing edge of the right wing (not the left wing!) will increase lift on the right wing and help keep the model from entering a right spiral dive into the ground.
11. The plan shows heavy thread (carpet thread) glued to the leading edge of the wing for "ding" protection. This thread may also reduce the drag, especially during the high-speed launch phase. I prefer using Duco cement to glue the thread to the wing L.E., because it dries fairly fast, but it still allows you enough time to reposition the thread before it fully dries. Even if the thread is glued on crooked, you can use acetone to reactivate the Duco and reposition it.

12. You can make the rudder turn wedge from scrap 1/32” balsa. The plan shows the rudder glued to the left side of the fuselage for a left turn. If you are left-handed and want a right turning glider, glue the rudder and rudder wedge to the right side of the fuselage. You may also have to warp the trailing edge of the rudder slightly to the left to get the glider to turn in a left circle, or warp the trailing edge of the rudder slightly to the right to get the glider to turn in a right circle As a last resort, you can also add a small pea size piece of modeling clay to the left wing tip to help the glider turn to the left, or to the right wing for a right turning glider.
13. I recommend gluing the rudder to the fuselage first, allowing it to dry, and then dry fitting the stabilizer to the fuselage to make sure that the rudder does not stick down and interfere with the stabilizer. You may have to sand the lower edge of the rudder flush with the lower surface of the fuselage. Make sure the stabilizer is parallel with the wing’s center section as shown on the plan. **Note: the trailing edge of both the rudder and stabilizer is located 0.8 inches forward of the aft end of the fuselage.**
14. The sandpaper grips are cut from sandpaper of around 150 to 220 grit. Use an old, worn out razor blade or X-Acto knife blade to cut out the sandpaper, and cut on the back (smooth) side of the sandpaper using a steel straight edge.
15. **Note: position the wing’s leading edge (at its root) 3.5” aft of the forward end of the fuselage.** After you have glued the wing to the fuselage and allowed it to dry, apply glue fillets to the wing to fuselage joint (both sides). This will help strengthen this highly stressed joint and help keep the wing from departing the fuselage during the high-speed launch phase.
16. Glue the catapult hook to the lower surface of the fuselage such that the aft end of the hook is located at the wing’s leading edge at its root. Don’t forget to wrap thread around the hook and fuselage and apply glue, otherwise the hook may break off during the launch phase.
17. Finishing the glider: If you fly the glider early in the morning when the flying field is wet, you will have problems with the glider soaking up water and it will be nearly impossible to get the glider to fly properly. One way to keep the glider from getting waterlogged is to apply a finish to it. You can apply Minwax Helmsman Polyurethane Spar Varnish (it comes in a 1 quart green can) with a foam brush. Use a folded paper towel and wipe carefully across the wood grain to remove all excess varnish. An alternative finish is to mix some talcum powder into a small bottle of nitrate dope and apply two coats to the glider, sanding with 300 to 400 grit sandpaper between coats and after the final coat.
18. When you’ve finished building the glider, add modeling clay (the kind of clay that can not be fired in an oven and available at most craft stores) to the nose of the fuselage until you can balance the glider on your fingertips at the B.P. (Balance Point) shown on the plan.



Finished FP-11 Catapult Glider ready for test flying.

19. You can make a catapult handle from a 1/2" diameter dowel cut 6” long. Saw a narrow slot in one end of the handle for holding the rubber catapult loop. Use a 6” to 9” loop (16” to 20” total length of rubber before forming the loop) of 1/8” wide rubber strip available at the hobby shop or from a mail order hobby supplier. If you use 3/16” wide or 1/4” wide rubber strip, you may have to be careful not to pull too far back on the catapult or the wing may break during the launch phase of the flight. If you made the wing from 8 to 9 pound per cubic foot density wood, it should be strong enough to withstand the full force of a 1/4” wide rubber catapult.

1/2” diameter catapult dowel cut to 6” length. Note the saw slot for 1/4" wide rubber catapult.

20. Before launching the glider with the catapult, pick a calm day and gently push (don’t throw) the glider angled slightly nose down. Aim the glider at an imaginary point on the ground about 30 to 50 feet in front of you. The glider should glide to the left (or to the right if you’re left-handed) in a fairly flat glide with a 40 to 60 foot diameter circle. If the glider immediately dives, you either pushed the glider with the nose pointed too far down or the glider is too nose heavy (requiring a recheck on the B.P. location) or the glider needs a slight (as in 1/64”) upward adjustment of the stabilizer trailing edge. Make only one adjustment at a time and try to be consistent in how you throw the glider. If the glider climbs, slows down and stalls, and then dives, you may have thrown the glider instead of gently pushing the glider. Or, you may have pushed the glider with the nose angled up or the glider may be tail heavy (requiring a recheck on the B.P. location). It could take a dozen or more test glides to get the glider to obtain a flat glide with a turn.
21. Catapult launching can be quite tricky. Try to pick a calm day. I would not recommend launching your glider in winds above 10 miles per hour. Your first catapult launches should not be at full strength. You want the glider to go up about 40 to 50 feet on the first launches to learn how to get the glider to transition from the highspeed launch phase to the low speed glide phase. It is important to remember how you launched the glider each time so that you can make slight adjustments in the bank angle (the angle of the glider’s wing with respect to the horizon) and the inclination angle (the angle between the catapult rubber and the ground).
22. If your glider has a built-in left turn, you will want to bank the right wing down about 10 to 20 degrees and keep the inclination angle at about 10 to 30 degrees up from level for the initial catapult launches. If the glider rolls too far to the left and goes upside down and hits the ground, you can try launching the glider with more like 30 to 45 degrees right wing down. Sometimes when doing a full-strength launch (rubber band stretched as far as possible), you may have to bank the right wing down about 90 degrees or more during launch. If the glider doesn’t roll far enough to the left and zooms up and stalls and then dives, you will need to reduce the right bank angle as required to eliminate this tendency. If the glide circle is too tight (less than 40 feet in diameter) you may have problems with the glider rolling violently to the left in the high-speed launch phase. You can reduce this left rolling tendency by adjusting the rudder trailing edge slightly to the right. For a glider with a built-in right turn, make all adjustments opposite to those for a glider with a built-in left turn. If the glider tends to want to loop during launch, you will have to adjust the elevator slightly down (1/64”) and remove a small amount of clay from the nose. With a properly adjusted glider you should be able to get it to climb between 80 and 120 feet in altitude and get flight times of 30 to 40 seconds in dead air (no thermals).
23. Gliders can be a lot of fun and a lot of frustration, and they are certainly not as simple as they look. It takes a while to learn how to adjust them so that they glide properly. Once you get the glider to transition properly from high-speed flight to low-speed flight, watch out, the thermal gods will grab your glider and never let it go!!!