The Kitchen Sink designed by Mark Benns is a high performance low ceiling HLG/ Catapult glider.

For 27 years I have been fascinated by designing and flying hand launched gliders of all shapes, launch methods, sizes and weights all with the same goal in mind, `enjoying their duration'. Much of my flying over the last 10 years has been focused indoors fortunate to travel to the best halls & arenas worldwide and competing with many of the greatest HLG fliers, such as Lee Hines, Mick Page, Len Surtees, Jim Buxton, Stan Buddenbohm, Phil Ball and John Buskell to name just a few. Model launching developments outdoors and at high ceiling sites have moved on dramatically since my indoor World Record in 2005 with a discus launched model, however at low ceiling venues the story is quite different.

Within the UK the British Model Flying Associations holds an extensive list of British Records for all 4 categories of indoor ceiling heights many of the HLG records devoid of times. The Indoor Technical Committee of which I have an active role is reinventing its approach in the midst of declining numbers of duration fliers and as part of this regeneration I would like to see some new records set.

In the 1978 April Aeromodeller the Stoy brothers from the USA published their innovative designed `Coot', a 12" (304.8mm) low ceiling IHLG which set the spectacularly successful philosophy of the `flapper wing'. The wing was designed to achieve a lower drag at launch by the airfoil flattening and then allowing it to reform its highly under-cambered section at glide. This model became a yardstick for all of the current Cat 1, 2 World Records.

The Kitchen Sink Mk1 was originally designed in 1999 for flying in Peterborough Model flying Clubs small school hall on a Friday evening for fun but soon emerged to be a performance model. The Mk2 was born after the inevitable demise of its predecessor to an accidental size 10 boot and has flown in a many of the Uk's top venues with a top pedigree. The marked differences are the tip reinforcement to reduce drag at launch by maintaining minimal camber at the tip and the extended nose to providing a better and more consistent launch attitude. The other notable change is the inclusion of a hook for an optional catapult launch, especially useful for when the arm is numb!.

Equipment & tools.
The most important piece of equipment to making an exceptional model is to Invest in a set of accurate scales (0.01gram accuracy). These can be obtained for under £10 online or by web auction sites.
Single edged razor blades make splicing and butting your selected balsa far easier than scalpels, replace them frequently to maintain the edge.
An hour or so making a long flat sanding block and a narrow convex one will make the task of forming the wing a straightforward. The entire model is glued together with `Ambroid' unless otherwise stated.

Wood selection
This is essential in building an IHLG as weight and balsa stiffness will make a big difference to the models performance, however this does not mean it cannot be sourced from the local model shop. Think outside the box a little as the best wood inevitably comes from thicker stock thicker than you require, ie expect to sand a 2.5mm thick sheet down to less than 1mm if required. Most of my wood has been horded over a twenty year period, always restocking even if I am not building. If you are looking for a quick fix there are a number of specialist indoor wood balsa suppliers in the UK that can supply the lighter balsa, contact me and I can advise.
The leading edge of the wing is constructed from nom. 3/32 (2.5mm) `C' grain balsa with a density of ideally not more than 5.5lb.cu.ft   The tips are from the same sheet with the direction of grain front to back. The most critical balsa is the flap wood, this should ideally not exceed 5.0lb.cu.ft the grain has to be `A' grain or the flaps will be too rigid.

The Wing.
I use templates cut from laser printed drawings (email me and I will gladly send you outlines for the wing and tail feathers) spray mounted onto 1mm plywood, cut and sanded to profile to cut around. This gives an extremely accurate cut for butting the various wing components perfectly together with minimum glue. Glue all the components together using cellulose type glue such as `Ambroid' and leave to dry for a couple of hours. Do not use cyano as this can place undue stresses in joints, it is also too heavy and the joints do not sand. Remember use glue sparingly as it is heavy!
I make each wing separately however on a small model it can be made in a single piece which will save some construction time. Shape the wing as shown, I form all of my components on a melamine shelf from the local DIY superstore. I always start by forming the taper from root to tip using a hobby razor plane followed by a wide pad of medium course grit paper before roughing the airfoil section with the same. Work with the medium grit paper initially being careful at all times not to press too hard as this will only compress the balsa and increase its density. Turn the wing underside up and carefully using the curved sanding block form the slight undercamber in the `C' grain portion of the wing deepest at the root feathering out by 2/3rds span. Step down to a finer grit paper and finish both sides of the wings to a smooth accurate airfoil.  Shape the dihedral joint by raising each wing by 36mm and sanding the `C' grain part only against the vertical edge of the building board. Offer up both wings to ensure an accurate joint is formed before gluing with Ambroid. Do not glue the `A' grain flaps together. For the carbon fibre wing spars I use a unidirectional 0.005" (0.13mm) thick sheet from Free Flight Supplies. Carefully cut out the shapes in one length and lightly sand off the shiny finish on one face only, always draw the paper away from you and never use your fingers behind the paper as carbon shards and splinters are extremely painful…. believe me!. At the centre of the carbon spars dull side up lightly score across to allow for forming the angle over the

dihedral joint when they are to be adhered, pre-glue with Ambroid before gluing top and bottom spars in place and leaving overnight. Any overspill can be lightly sanded off or if repositioning is necessary release with cellulose thinners and reapply. The final shaping of the flaps is carried out by lightly pinching the balsa between your thumb and fingers and bending the shape, at the same time sliding your hand span wise. This can take a while to form and often will require replacement before flying, eventually the wood will stay where it is told to.

The Fuselage.

Like many things in life the construction of the fuselage is straightforward when you know how. I cannot claim any groundbreaking method as I mine is based on Stan Buddenbohm's published method after reading it in the September 1993 Free flight News.

Carbon fibre is applied to both sides of the fuselage to provide an exceedingly robust frame, I use nom. 5lb.cu.ft density. Start with a 1/16th (1.5mm) sheet of \`A' grain Balsa cut to the fuselage length and circa 1" (25mm) wide, sand in to one side only half the correct taper. Cut two strips of the 0.005" carbon sheet circa 1/4" wide and lightly sand away the shiny surface before applying glue to its entire length. Working quickly add a similar coating to the tapered balsa and then press the carbon onto it tape down with masking tape and leave to set. Turn the balsa over and repeat the whole process again to for the 3 ply lamination. The fuselage should be straight however by locally applying thinners the fuselage can be manipulated to straighten as required. Once fully hardened, slice the fuselage outline from the larger sheet, sand to shape and carefully reduce to a taper the carbon thickness along the boom commencing from the rear of wing mount. Again be cautious of carbon splinters. Add the small triangular launch hoof to the front of the model from scraps of the laminated fuselage and add a further reinforcement of carbon to bridge the two components. The pylon may be cut from the same sheet with care to ensure the grain runs vertical. Make the pylon 2mm higher than required to ensure that when the correct wing incidence is set the pylon height is still adequate to hold for launch (refer trimming). Sand the pylon to neatly receive the wing and adhere using a healthy coating of glue.

Rudder and tailplane.

Making the tail feathers is a task best carried out when one is in a good mood as it is time consuming and cannot be rushed. It is also extremely wasteful as the required thickness required is tiny. If you wish to purchase thin sheet specialist indoor wood suppliers can save hours of fun. I recommend that once selecting the lightest \`C' grain balsa you can find cut a piece large enough to make at least 3 sets of each and then studiously sand to reduce it as close to the required thickness as possible. When you get below 1/64 thickness sanding in one direction only is advisable to prevent buckling the sheet. As with the wing make simple 1/32 plywood templates and cut the tailplane and rudder from the prepared sheet and very carefully with very fine grit paper profile and taper the surfaces. Glue to the fuselage square and set aside.

`What to expect'.
With a model built to plan, weighing 1.8g-2.8g you can expect to gain a maximum altitude of 40ft. Its glide duration from 40-45ft should exceed 45seconds, with a Cat1 ceiling times are in the 30's are achievable. Hand launching upto a Cat 1 ceiling is achievable much higher requires a `cricketers arm!'. The use of a thin rubber loop is the easiest way to reach the taller ceilings, you know when the limit is met when the flaps start to buzz on launch.

Trimming & flying.
The first step is to cut 2 small pieces of masking tape to temporarily fix the wing & pylon to the fuselage. The next step is to mark onto the pylon the centre of gravity which is 3mm from the rear of the pylon and then ballast using very soft plasticine (modelling clay) ensuring that it overhangs the end of the fuselage by at least 5mm. This will give an amazing cushion if the model ever `dives in'. I am right handed and have always worked with a right launch into a right hand glide and will describe my trimming methods for the same, obviously for a left hander all can be reversed. Firstly we must set the wing to tail incidence this can be achieved by throwing the model fast, level and straight to observe its actions. We are aiming to see the model maintain a level flight with no more than a very minor stall before it recovers quickly, reaches glide speed and then continue with a level glide. If the model dives remove the pylon and sand more incidence into the pylon less incidence if the model climbs on launch. Replace the wing and repeat the process until you are happy then glue the pylon to the fuselage.

Toss the model firmly into a `forced' right hand circuit and observe its transition. If the model `clicks into' its turn almost instantly it is safe to proceed, if however the model speeds up or even nose dives before its glide speed the likely cause is that the flaps are too flexible. Do not despair a simple application of thinned glue in a straight line across the flaps in a couple of locations will stiffen them up. Repeat as necessary until model transitions correctly. Conversely if the model struggles to climb to the expected height the flaps could be too rigid and will require a light sanding with a fine grit paper to reduce their thickness. A few strokes with a small sanding block on site, then try again until the model travels upward with purpose.

There are three effective means of making the model turn 1. rudder offset 2. tip weight & 3. differential flaps. I would suggest you start trimming by carrying out gentle hand glides adding rudder and then progressing to tip weight on the inboard wing to obtain a sensible circle. Using the flaps as ailerons is tricky as it inevitably changes the launch direction. I would suggest that the tiniest tweaks to the rudder and small balls of soft plasticine pressed flat onto the RH tip are employed initially with option 3 being used only as a last resort.
Once a sensible glide circle is achieved short stabbing launches are advisable to check the models direction and recovery from launch speed.

Try not to hand launch the model with any arc in the throw, maintain a straight angle at circa 60 degrees upwards banking the outboard wing very slightly away from you to aid the model into a RH turn.
Alternatively use a 8” loop of 0.030” rubber, grip the tab firmly before locating the loop over the hooked nose and stretching before releasing the model at 50-60 degrees upward with no right bank. Increase the pull gradually from one flight to the next until you hear flap flutter which is warning you that you are reaching the models limit.

Throughout a flying session miniature amounts of ballast can be added & removed from the nose and tip to adjust the glide to perfection, acknowledging that lightweight models such as the `Kitchen Sink’ will always require slight re-trimming due to a buildings differing air conditions.

For travelling purposes I always put my models in a sturdy cardboard box with a 1.5” square piece of sponge foam double sided taped to the base with a slit partially through it to grip the models fuselage. This way the model should last you for years and give you endless indoor fun.

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