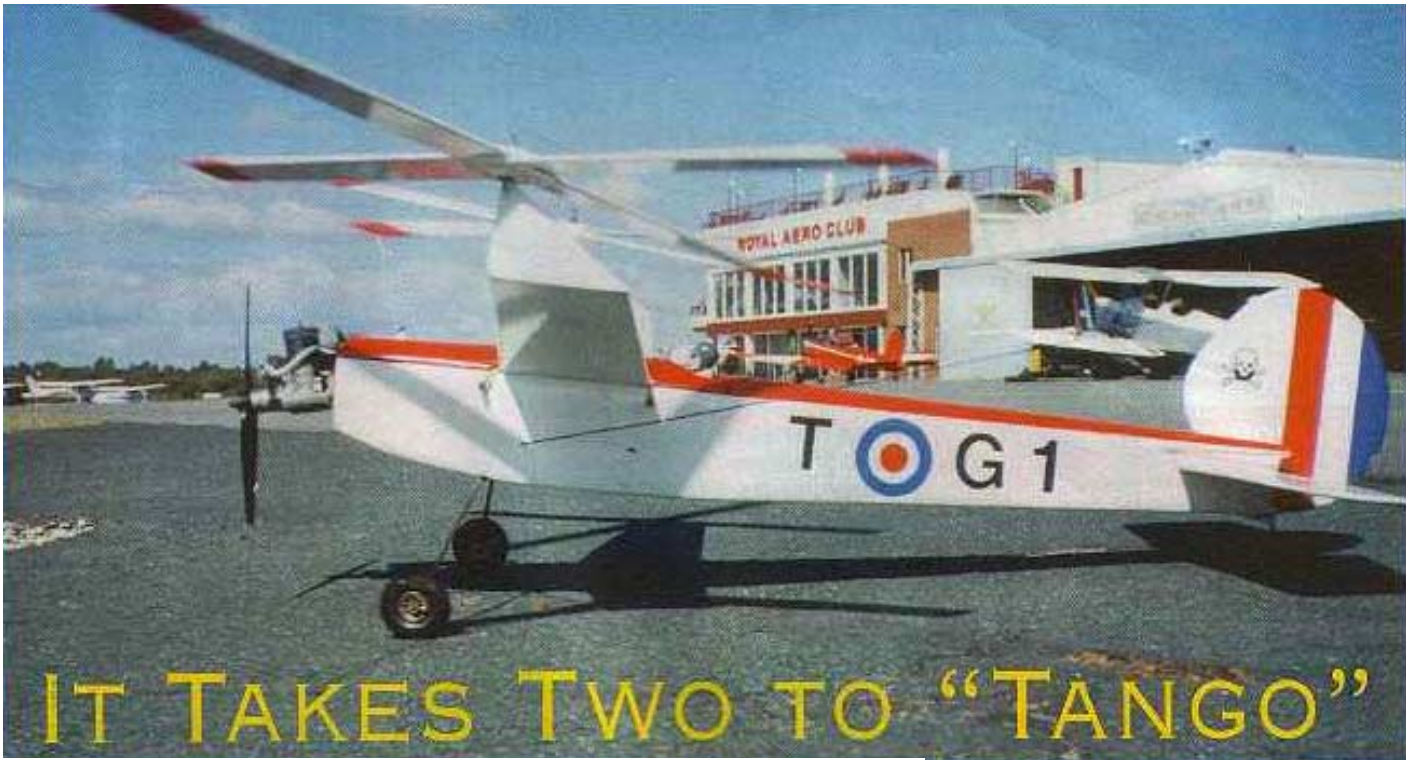


THE STORY OF A TWIN ROTOR AUTOGYRO CALLED

T A N G O

By RAY SHERBURN

Introduction

Tango Autogyro is an aerobatic autogyro designed for .30 to .40 two stroke or .40 to .50 four stroke engines. Tango Autogyro will perform loops, rolls and Cuban eights with ease and is the only autogyro that I know of which will fly inverted. A feature of rolling inverted is to watch the rotors stop momentarily and reverse rotation.! Roll it back up the right way and the rotors again stop and reverse rotation, it is fascinating to watch.

If you use a good .40 and put the C.G. in the right place it will perform outside loops, not very good ones, but outside loops just the same. What it won't do ? Just don't try knife edge.

I do not pretend to have re-invented the wheel, I read all I could find on autogyros, which was not very much and I have pinched a few ideas for here and there and included a few of my own. All this coupled with along development and testing program has produced a fin flying aerobatic autogyro.

The model is not complicated to build, just a little different to what you may be used to. Standard sizes of timber and metal components are readily available from good model shops.

TANGO Autogyro has been designed with a certain amount of nostalgia in mind, looking similar to

Above: Stabilizer, fin and rudder are cut from 6 mm balsa sheet. Rotors are prepared for assembly .
Below: Fuselage assembled showing removable hatch cover.

CONSTRUCTION

Fuselage

Cut out all plywood formers. If you do not have 6 mm ply for F1 then make two out of 3 mm ply and glue them together making sure you do not make two left hand sides. Add the 3 mm square joining strips and build the fuselage upside down on the plan using epoxy glue on all hardwood parts. Do not forget to protect your plan with waxed lunch wrap or something similar.

When dry, remove the fuselage from the plan, add formers T4 to T9 and build the turtle deck. Using formers T1 to T3 build the removable hatch cover on top of the fuselage to ensure a good fit. Add the hardwood undercarriage blocks but do not glue on the bottom sheeting until you have fitted the servos and pushrods.

Tail surface

Cut the stabilizer and elevators from 6 mm sheet, and the cross grain tips and the hardwood elevator joining piece and sand to shape. Fit three hinges on each side put it all together. Now epoxy glue the stabilizer onto the fuselage making sure it is set a 3º positive as shown on the plan.

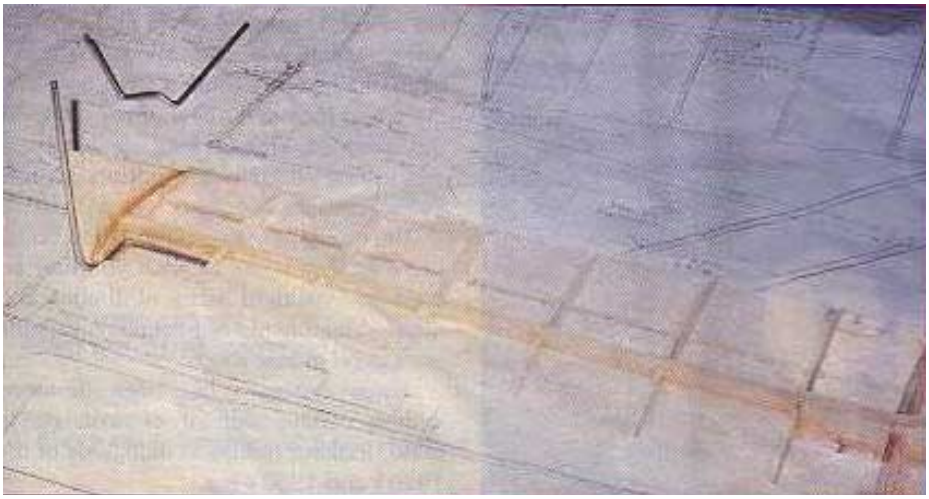
Cut out the fin and rudder and sand to shape. Glue the fin to the top of the stabilizer and add the strengthening fillets. Now fit three hinges to the fin and one into the back of the fuselage. Cut out the hinge slots in the rudder and fit it all together, again remembering to pin the hinges.

Wing

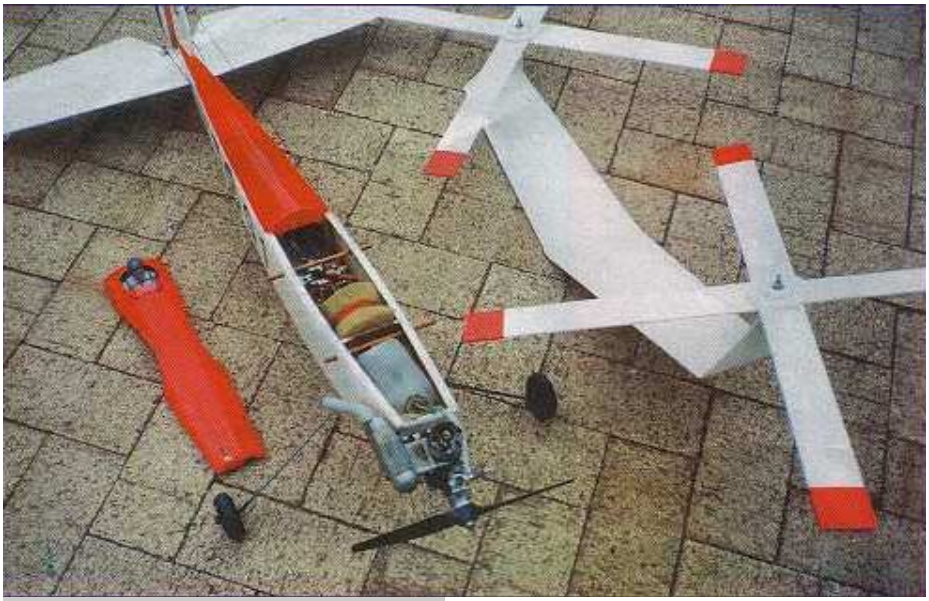
Cut out two R1 ribs and two R8 ribs from 3 mm ply. Make all other ribs using the sandwich method, that is sandwich six pieces of 2.5 mm balsa sheet between R1 and R8, drill two holes through the lot and bolt them together. Now carve and sand them all to shape between R1 and R8. Simple. Now do this again for the other side of the wing. Cut out the bottom sheeting and mark in the rib and spar positions. Glue on the bottom main spar and all the ribs with exception of R1. Rib R8 should lean out 4º . Use a template on the plan to set it at the correct angle. Now glue on the top spar and the laeding edge. Cut the wing centre to the correc angle, jack the wing tips up to the correct hight as shown on the plan and glue together with the dihedral braces. Cut the centre out of both R1 rubs and glue in position. Cut out two M1 rotor mast braces from 3 mm ply and epoxy glue to the wing tip ribs R8 using the template to maintain the correct 4º lean out angle.

Next bend two rotor masts to sahpe our of 5/32 dia. piano wire and sew and glue to the M1 rotor mast braces using plenty of epoxy glue, particularly where it fits along the main spar. Now add the vertical grain webbing between the ribs and cover thetop of the wing. Dampen the 2.5 mm top sheeting with a sponge to help it bend to shape without splitting.

Sand the wing to shape and add a fiberglass bandage around the centre joint for additional strenth.



Left: Wing assembly showing rotor mast attachment before final sheeting.



Tango Autogyro dismantled showing compact radio installation and fuel tank. Engine is an OS .40 two stroke.

Rotors

Make up 8 rotor blades from balsa and hardwood. Note: aerofoil shape is flat with rounded leading and trailing edges.

Cut our four 3 mm ply rotor hubs and four 3 mm ply smaller hubs and drill 5/32 inch holes in the centres. Cut out the eight 5 mm balsa rotor blades and glue on the 5 mm square hardwood leading and trailing edges. When dry round off the leading and trailing edges with sandpaper. The best way to build the rotors is to make up a jig. Obtain a piece of particle board or ply large enough to build the rotos on, or use your work bench, but not wifes dining room table.

Drill a 5/32 diameter hole in the centre into which you glue a 100 mm length of 5/32 piono wire, making sure that I is perfectly vertical, now mark ouit the position of the rotors on the board and hammer small nials around the edges of the blades so that they won't move while the glue is drying.

Fit one of the large ply rotor hubs over the wire cenre shaft and using scrap balsa, make up four 5º wedges from the template on the plan. Lay the first rotor blade on the jig at the 5º angle using one of the wedges. Now fit the other three rotor blades overlapping them in the centre as shown on the plan. You may have to do a little trimming to make them fit nicely. When you are sure that everything fits correctly remove the blades and apply plenty of epoxy glue to the rotor hub, making sure that the glue does not get onto the center wire shaft. A little oil on the shaft may help. Now replace the rotor blades as before, apply more glue to the blades and fit the other 3 mm ply hub over the shaft and glue it onto the top of the blades. When it has dried remove it and buidl the other rotor making sure that the blades slope theopposite way so that you have contra-rotating rotors. Tango Autogyro will not fly unless the rotors are counter rotating.

Next glue on the four smaller 6 mm rotor hubs and redrill the centres to 3/16 inch and glue in the 3/16 OD brass tubing. This gives you a perfect fit over the 5/32 inch rotor shafts. When dry, fit the rotors onto the wing with washers top and bottom and 5/32 wheel collars to secure it in place. Also file a small flat in the shaft where the screw in the steel collar fits. Alternatively small ball bearings may be used either side of the rotor hubs if you are able to obtain them.

Completing the model

Make two undercarriage legs from 5/32 inch piano wire as per plan and fit the wheels. Drill two 5.32 inch holes in the hardwood blocks in the bottom of the fuselage and the undercarriage is ready to fit when the model is completed. Install the servo rails, fit the three servos and pushrods to the elevator and rudder and the engine throttle arm. Cover the bottom of the fuselage with 1.5 mm balsa cross grain and fit the commercial tail wheel bracket and tail wheel.

Drill the 1/4 inch holes in the fuselage and fit the hardwood wing dowels but do not glue them in. Fit the wing to the top of the fuselage with rubber bands over the dowels. Place the hatch cover over the wing on top of the fuselage and scribe the hatch cover with a pencil to make the wing cut out. Cut this out a bit at time until you get a neat fit. Also cut out the section for the cockpit, glue in a pilot and make a windscreen and glue this on too. Make a wire hatch release as per plan or buy a commercial one and fit it to the front of the hatch cover.

Now paint the model in your favorite colours of cover with your favorite film. Bolt the motor to the front of the model, fit the radio gear and the under carriage and check that the centre of gravity is within the limits shown on the plan.

Lubricate the rotor shafts with care engine oil. Do not lubricate with C.R. C. or light machine oil because it will burn out in only two flights. Car engine oil will stand the heat and will last a long time. If you do not carry engine oil at home a few drops off your dip stick will do, but I would prefer cleaner oil.

Balance the rotors by holding them vertical and press a small nail or two into the ends of the lightest blades. Balance is not critical but I think a badly vibrating model would soon fall to pieces.

FLYING
THIS IS THE FUN PART!

To take off, point the model directly into the wind and hold full up elevator as soon as the model starts to lift off ease the elevator back to normal. The reason we hold the tail wheel hard on the ground during the take off run is to get the rotors up to full revs as quickly as possible. The Tango Autogyro will climb quite steeply and will not stall under any circumstances. As soon as you have enough height, rest the elevator and rudder trims if necessary and fly around on half throttle while you get the feel of it.

Tango Autogyro will do loops, rolls, and Cuban eights, stall turns inverted flight and with a .40 up front will do an outside loop, but do not try this close to the ground.

One of my favorite manoeuvres is to climb up quite high, throttle back to idle and point the nose straight down,

which causes the rotors to stop. This scares the hell out of the onlookers including myself the first time I tried it. Pull out gradually giving the rotors time to build up revs again. Once I pulled out too quickly and threw a rotor blade. This is when I found out the Tango AutoGyro flies quite happily with a blade missing, although you do have to push in a little opposite rudder trim and land fairly quickly before it shakes itself to pieces.

Tango Autogyro can also be hovered into the wind and with a little practice be flown backwards.

Auto rotation is also another fun thing to do. Simply throttle back to idle and pull full up elevator. Tango Autogyro will slowly decent like a flat spin without the spin. I have se my transmitter fail safe to give idle and full up elevator. I have fun by switching off my transmitter and Tango Autogyro comes down in a perfectly vertical descent. I turn my transmitter on again before it hits the ground and it changes from vertical descent to horizontal flight with dropping a wing (rotor?).

Landing can be done just the same as ordinary models or it can be dragged in very slowly and landed with only one or two foot rollout.

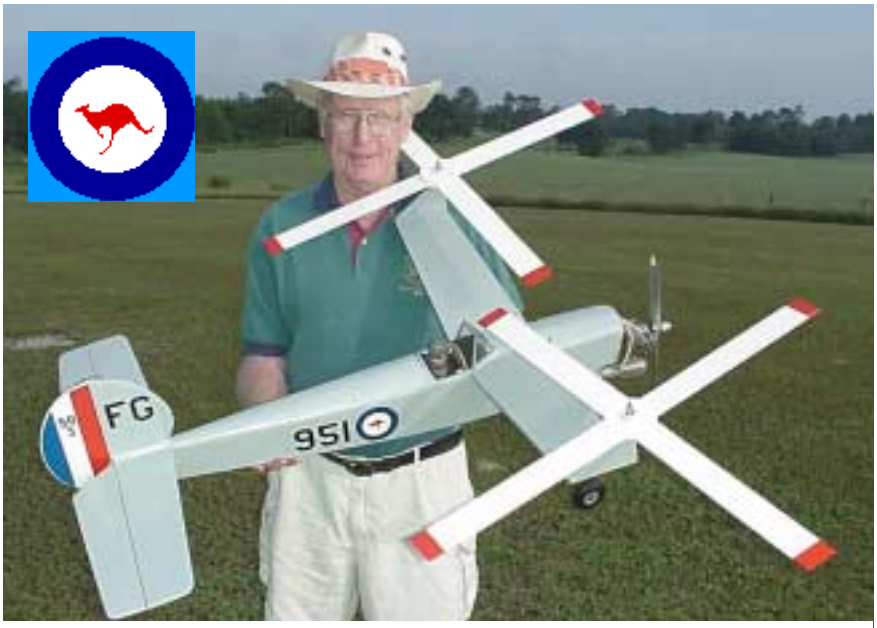
I was very surprised as how easy it is to taxi this autogyro in a strong cross wind. Just hold full up elevator and steer it wherever you want to go.

CONCLUSION

I have experimented with three blade rotors and even though I think they look better, the do not give as much lift, so four blades is better for shorter take offs and slower landings.

I also tried rotor blades with an airfoil section and these did give a bit more lift but the inverted performance was terrible due to the fact that the airfoil blade is flying inverted and also going backwards due to the rotors reverse rotation when inverted, The flat blade rotors on the plan gave the best overall performance for sport flying and aerobatics.

This model is a delight to fly around on half throttle and is more stable than the average trainer, due in part to the gyroscopic effect of the twin rotors.



Red Scholefield's Tango. Bolt on wing, double strut 1/8 inch piano wire landing gear, built up tail surfaces, removable tank hatch, side mounted engine. Covered in monokote. Otherwise built to plan. 4 1/2 lbs. OS .40FP