Flying a twin on one donk!

Aerotech kit balsa and foam B-25 Mitchell bomber by Ted Angelo. Flaps, retracts and two OS .48 four strokes. The right hand engine is fitted with reverse camshafts for contra rotating props. This photo was taken after a successful flight on one engine.

A large scale P-38 Lockheed Lightning at 2.5 metre wingspan powered by two 30cc engines has been a long term project of a friend of mine, Ted Angelo. His P-38 is an impressive, a complex and expensive aeroplane with one servo for each control surface plus four flaps retracts, doors, throttles and on board glow.

When I say expensive I don't just mean the price of gear but also cost of the labour of love. After reading an article by John Considine about brown paper covering for scale aircraft, most of Ted's WW11 aircraft have been finished using this method to add panel lines and rivets. Installing rivets each side of a panel line on an aeroplane with three fuselage components, two fins, tailplane plus the inboard and outboard wing panels takes quite a few bottles of Johnny Walker black label. The scotch helps deal with the boredom that develops with endless repetition of adding rivets and this has a useful side effect, for scale purposes only, After a few nips the rivet lines begin to wander and this adds authenticity.

It was highly likely I will be rostered on for test flight duty and the thought of this fantastic aeroplane losing an engine on take off and going in with me at the controls galvanised me into taking affirmative action. When you fly a lot of models for other people the inevitable does occasionally happen. People seem to forget the ones you saved but if a crash occurs everyone turns to see who is at the controls, "yep Greenie's stacked another one". A few years ago I redesigned a single engined aeroplane to carry a video camera for a T.V. commercial. Although it flew very well I did have a small moment with one engine losing power and with the onboard camera rolling I was able to review the flight after a successful landing. I will touch on this later in the article.

The day the P-38 gets flown everyone will be watching and so I thought it would be prudent to experience some advanced twin engine flying manoeuvres. My plan was to was to be able to practise flying on one engine, the aeroplane being an ARF Britten Norman Islander, 1800mm span with two OS 25 FX powerplants. This is one of those applications where you can use the free mixers on a computer radio and the JR 388 radio system has to them. The throttle channel controls the left hand servo and the auxiliary channel operates the right. Throttle is the master control which makes the right hand (auxiliary) the slave. The secret to getting this working correctly is to set up the throw on the master servo the old fashioned mechanical way. The aim is to get the carburettor to open fully and close to the approximate idle position by changing the throw on the servo arm holes and the idle speed with the clevis. I have found if you set up the master by using reducing ATV (endpoint adjustment) it is hard to get the correct movement on the slave. You set the slave travel at 100% of the master and if the total travel of the master has been reduced to say, 80% there is not enough throttle movement on the right hand engine. You can usually get by with about 5% plus or minus ATV (master) but it just gets tricky with values greater than this.

The next thing was to decide which switch to use to kill the right engine. The Islander had fixed gear and flaperons so although the gear lever was the easiest to actuate I used the spare aux/dr rudder switch. There was now eight aircraft geared up ready to fly from the one JR388 transmitter and when things go wrong experience has taught me to keep the control set ups as standard as possible. It would be a terrible thing to accidentally stop one engine on the test flight of a P-38 as I selected the gear up because of a different switching arrangement. I digress, but at a later stage I fitted the Islander with a complex system of lights for night flying and nearly came unstuck. The flight plan was to taxi out and switch on the cabin and nav lights. After turning on to the runway switch on the landing lights and strobes then take off. Now a lot of people thought I was crazy flying a thing like this at night and most of them didn't know I had a lot of time on this model, even at night. I thought it would be fun to fly around and turn off the lights then utter a choice phrase rather loudly. The gag worked really well except I turned off one engine by mistake and I could not remember which switch did what! It was dark and I couldn't turn on a light and the TX does not have a backlit control panel or switches. I immediately held some rudder and a touch of aileron and by the time all the lights were

An eight year project nearly ready for test flying this P-38 Lockheed Lightning has two 30cc powerplants with an expected all up weight of thirty pounds. Built from a balsa kit by Ted Angelo and a lot of additional scale detail by Johhny Walker.

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switched back on the Islander was cruising along in the section of sky. It was, proving once again practise can pay off. After landing I believe I had gained my asymmetric night rating.

Setting the idle speed of the right engine to cut is achieved by using ATV on the slave channel. Initially I set a slow idle and later changed for a complete engine stop. I was ready to try an engine failure in flight and if it became unmanageable I could flick the switch and fly right on by, still there was no danger. Flying along at full power and cutting the right engine was uneventful and the model would slowly yaw and roll to the right. Full left rudder trim at this speed was almost enough compensation and no problem to keep going as long as you want. Pulled the nose up to climb and as the speed decayed I was quite surprised at the angle of climb you could maintain holding full left rudder and a little left aileron. Holding the nose up until you lose directional control will result in a really well developed spin if you keep the nose up which is no problem at altitude but a bit spectacular and risky just after getting airborne.

Twin engine flying rule number one, "if you lose an engine resist the temptation to climb straight away." Backup plan or rule number two, "you can always pull back the power and glide in.

Next on the checklist was a landing approach followed by a go around. The trick is to keep the approach speed a little higher than usual until you are sure the model will make the strip. On the go around apply the rudder at the same time you open the throttle, don't wait to see what you already know will happen; the plane is going to turn to the right. One quarter stick of left rudder and a touch of left aileron was enough was enough to keep the Islander straight. The thing is to allow the aeroplane as much time as possible to gain speed. Resist the temptation to climb until the model is stable in level flight with the correct, even incorrect but some arount of rudder. Things will only get critical if you attempt to climb with low airspeed. If you think about your flight beforehand remember that on a go around the plane is already lined up on the runway and most model aircraft runways usually have the approaches clear of trees for quite some distance. Provided you stay aligned with the strip there will be quite a bit of time to get it sorted before you have to worry about clearing obstacles. Aviate first then navigate and you will be will be quite surprised, it is not that hard to do. This is something you can try at altitude until you get more confidence.

Turning into the dead engine is straight forward providing you have airspeed and be ready to apply more rudder as the angle of bank increases. The Islander lost the left side just after take off at a Melbourne Club Float Day and it was immediately apparent there was no way a single OS 25 FX was going to lift this five kg aeroplane (now on floats) ☞

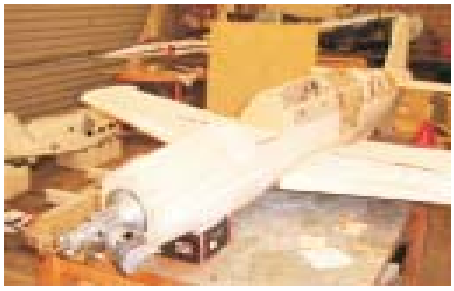
A pair of twin C-160's by Joseph Frost. Five cc four stroke power swings 8x6 three blades and has done so for 170 flights.

A closer look at the OS 48 four stroke installation in Ted's B-25.

over the trees at the end of the lake. The only thing to do was a sharp left turn into the dead engine. Full right rudder, nose level and a forty five degree bank and when the Islander came around 180 degrees I opted for rule number two and landed downwind. Whew! Later in the day I found the model would maintain height on one even with the extra weight and drag of the floats.

Back to when it was on wheels and after a few flights I decided to actually stop the engine completely and this turned out to be no different. Now I was ready for some advanced single engine manoeuvres and then after that an engine failure on take off. The Islander would maintain about a 20 degree climb angle with full rudder and if it got too slow lowering the nose slightly was enough to regain directional control. Spins with full throttle on the outside engine were amazingly fast as was the stall turn. Even a touch and go was okay although I did land with more speed than usual to make it easier to climb away.

Time for the big one so I figured a true test would be to half fill one tank and fill the other then not pay attention as I sucked some fuel back out. Now I was not sure which engine would stop first. As it turned out I was performing a go around coming in from the left and the right engine quit. The plane was really quite slow and I was unable to hold the model straight holding full left rudder. Lowering the nose was not an option thanks to the five feet of altitude so a reduction in power was needed, fast. Back to idle long enough to allow the left turn that was now required in order to avoid the clubhouse. Navigating was in order so back to aviating. Power to half which was enough to maintain five feet, held the rudder, slowly to full throttle while I held it straight until the speed increased. Aviating okay now back to navigating. Still plenty of room before the trees so I could either climb or turn. This stuff really works and I was stoked and so were the people on the verandah of the club house.



No assymetric trim required if one engine loses power on a Dornier 335.

The most important thing I have found about tuning the engines is getting them to throttle up reliably and that synchronising for top end power is a waste of time. Years before I built a twin to carry a HI8 video camera with stereo sound for a TV commercial at a golf course. I modified a Pilot QB 2500 to carry the camera in the nose and put two OS 46 engines on the wing. This was my first twin and I had read many strange theories and seen plenty of stacks so I was a bit concerned about carrying a $2000 camera that wasn't mine. The wing was built with anhedral which I thought may help reduce roll induced yaw when operating on one engine. I also put a reverse crankshaft in one engine to give me contra rotating props, I don't know why but I must have read ☞

somewhere this is something you should have if it is available. Anyway if you like gadgets counter rotating props sound and look like a good one. After the initial test flight I was booming around and as I flew over the strip I heard an engine sagging, "uh oh which one was too lean". Whipped it around, throttled back to richen the lean donk and with plenty of height on hand extended the downwind momentarily to get a feel for single engined flight. At this stage I thought my design with anhedral for improved single engine handling was brilliant as the QB hardly required any rudder or aileron to fly level.

After retuning the engines I had a few more flights then went home to watch the tape on my stereo VCR and boy what a surprise that turned out to be. My recollection of the flight was hearing an engine sag when flying over the strip at high speed with full throttle. The tape bears this out and you can see when I recognised the engine problem, the aircraft then turns downwind to set up an approach. The camcorder had stereo sound and you could hear which engine was losing power. What amazed me was the left engine had been losing power during the previous two circuits of the field and I had no idea. I think I have a pretty good ear for model plane engines in flight and as the aeroplane hadn't changed trim at all I was amazed that two laps of the field were completed with one engine struggling to put out what sounded like about half power. That poor engine was so lean it is embarrassing to show the tape to an engine man. After all the articles and stacks seen, it amazed me that one could fly around losing power for two minutes not even notice. The other thing the tape showed was what a waste of time getting the engines synchronised is. In flight the engines went in and out of sync all the time, so much that I don't see the point of bothering with this at all. Each time the model climbed, dived or even turned they changed.

The starting sequence I use is to crank up the left engine first, tune it, check the idle and try the throttle response. When happy shut it off, start the right and do the same procedure. Leave that engine running and restart the left and check the tune together. If you flick start it is very easy to follow through into the propeller arc on the left engine so that is another reason to stop it while the other is started. Also they will have consumed a similar amount of fuel. When checking the needle setting with both running let them run a bit longer than normal to make sure they are right. It seems to be easier to get a lean run with a twin, not sure why but the two engines sound a lot different than one. Most people tune the needle from behind and with a twin it is easy to hold the model by the nose as you run them up. The engine sounds different from the front as you are further from the exhaust and you hear a lot more prop noise. Go slightly rich in case you lose a motor the other will get hotter due to the reduced airflow at lower airspeed. Less cooling will make the engine get hot and you could find yourself with two lean engines. Engines don't often quit if they are a little rich and as I found earlier, one was producing full power the other about half power and I did not know for quite some time.

Spend some time setting up the throttle response so the engine accelerates away from slow idle to full power reliably. Tune the idle needle and get it right. The test is to allow the engine to idle for 30 seconds and then hit the throttle because that's what you do in the air. When going around you should be able hit the power and forget about that to concentrate on flying. I think this is the critical factor if you intend to making your model last, any model for that matter but particularly a twin. If the engine won't pass this test change the fuel, plug or get an expert to have a go and if that doesn't work try another brand. The reason I say this is because losing an engine at low altitude and airspeed (take off and going around) requires corrective action to be applied quickly. If the plane is slow and the nose is ☞

up and one engine accelerates away cleanly and the other coughs and splutters a few seconds longer this will make your job of aviating more difficult.

If the twin is a sport type I would have no hesitation running in brand new engines in the air, that's what I did with the Islander. If you are building a scale masterpiece you could get a few flights on each in a sport model with the mounting configuration the same. If the twin has inverted engines set up the sport model the same way. Once the idle is tuned that is one less thing you have to worry about when the big day arrives.

Another model I have flown is a 1800 mm span B-25 Mitchell powered by two OS 48 four strokes. The sound of a twin engined model plane is really great and if your project and budget will accept four strokes, a pair of them sound absolutely brilliant together. This model is similar is size to the Islander although the wing loading is higher with retracts, flaps and heavier engines being fitted. If you look closely the identity of the owner will be revealed by the rivet detail. Not sure how many bottles but definitely the Johnny Walker technique is evident. This model has also been flown a few times on one engine and just because it sounds impressive, reverse cam shafts were fitted for contra rotating props.

Twin Islanders one with OS25FX the other electric power. The inset is a night flight.

With single engine flight the key controls are the rudder and elevator, aileron is secondary. Rudder is the key if in doubt just lay into it. Too much won't really matter at first where as not enough probably will. As soon as the rudder has stabilised the plane then look at the attitude and if the nose is up get it level. Once you have set it up just keep the rudder on and then pay attention to aileron and start thinking about where the planes is going and how you are going to set up the approach. It is not as hard as you might think. As I mentioned earlier a good way to practise holding rudder is to fly around the field with full left rudder. The aim is to complete a circle holding the wings and nose level. Aeroplanes usually change pitch when rudder is applied so the plane may climb or dive a bit. The yaw will probably cause a slight roll either left or right. When you have that under control try circling to the right. If you can do that flying a twin on one engine is pretty much the same.

When you are used to single engine circuits then try climbing. In level flight about half rudder is sufficient to counteract the yaw providing rudder to spare if the speed drops off, like when in a climb. Apply more rudder as you ease the nose up. If you climb to steeply the nose will start to pull to the right when the airspeed decays. When you are game, try pulling in more up elevator and within a second the aeroplane will be upside down in a some sort of spin. When you have completed this manoeuvre a couple of times and see how much altitude you lost in the process that will serve as a reminder of the result if you climb with too early when down low.

The big day for P-38 is not far away and if it does lose an engine I feel confident if one engine stops, the other one wont just take the aeroplane to the scene of the crash..

Stephen Green •