Why did the engine stop?

An instant short term way to get relief from the frustration of a baulky engine.

Years ago my brand new trail bike would not start and after checking all the obvious things I just lost it, gave it a kick then went to get the trailer to take the wretched thing back to the Yamaha dealer. Upon seeing this my mate came outside to give me a hand to sort it out. At the time he was employed as a washing machine mechanic and after applying a simple process of elimination soon had the bike running. Unfortunately though, my steel capped Italian Vendramini riding boots had ripped the seat. Since then I have learned the best way to sort out engine problems is a process of elimination.

From my experience the two stroke model aero engine is without a doubt, the simplest internal combustion engine you could ever get. If you include the carburettor barrel there are only five moving parts plus the addition of the three basic ingredients the engine needs to run which are fuel, oxygen and fire; it would be logical to assume that incredible reliability would be inclusive with the overall package.

Spend some time at a model plane field and invariably you will witness either an individual or a group of men standing around glaring at an infuriating chunk of aluminium. One of the best comments I have heard was " I can't even melt the useless thing down for ballast, it's too light."

What to do first.

Assuming the aeroplane has been reliable when flown, if the engine starts to become erratic this is what I do. Check the plug first, then remove the needle valve and clear the jet. Reset the needle valve and that usually fixes the problem but if not, then I check for other causes.

Tuning the needle valve for max rpm on the ground will give a lean run and cause overheating.

The main needle valve.

One day soon you may be able to buy a model aero engine that tunes itself. Unless you buy a jet turbine engine or go electric, setting the needle valve is unavoidable. This setting of this device incorrectly is without doubt the reason for most engines stopping soon after the wheels leave the ground. Going for max rpm on the ground is the usual cause because the engine will spin at higher rpm in the air when the prop unloads. Maximum rpm on the ground will most likely result in a lean setting. As an example a .46 two stroke spinning a 10x7 at 12,500 static will probably pick up a few hundred revs in the air. Listening to the engine just as the model gets airborne can tell you how the engine is set.

If the rpm increases slightly the setting is right, if it stays the same it is too lean and will most likely begin to overheat in a few minutes If the rpm sags at take off the engine is far too lean and will probably stop within a minute. A good flying tip to handle a lean run is to reduce to half throttle. This richens the mixture and should give enough time for a circuit and landing, with power. Most models will even maintain altitude at one quarter throttle so you can struggle around at that if you have to.

On most engines once the needle is set, only a few clicks are needed either way to get change the setting. For example if I go flying in the afternoon, at around four o'clock it starts to get cooler, so the engine has to richened. Cool air is more dense than warm air so there is more oxygen which changes the fuel air ratio. The opposite happens if you fly in the morning, down here in Melbourne at around ten a.m. the engine has to be leaned. Fly on a hot day and the next day is cold, the engine will be too lean if it is not reset. That is why it is best to check the needle each time before take off. Some people tune with the nose high but I don't. I lean it out till max power then back off a click or two until the engine rpm reduces slightly. Don't set the engine with the glo clip on, remove it and tune before you take off otherwise the setting will be wrong.

A bent needle valve can cause you to tear your hair out so consider this a possibility if you haven't fessed up to a recent crash. Also the o-ring on the needle can have dirt which lets air in, or the older types can suck air through the threads when they become worn. A simple fix for the old type is to put a small piece of silicon fuel tube over the thread.

The idle needle.

This is often overlooked but usually an incorrect setting is the main cause of idle unreliability. Manufacturers have to err on the side of caution and set it rich, because although they may cough and splutter a bit, most engines don't stop if they are set a bit rich. Most of the time has to be leaned out to achieve a dead slow idle that can be relied upon. When I start a new engine the as soon as I have set the main needle I then attend to the idle. What is the point of risking an engine stopping on a new aeroplane which you are unfamiliar with.

Setting the idle is easy. Let it idle for twenty seconds then hit it. If it coughs and splutters it is too rich. Lean it a bit and keep trying until the pick up is clean. Keep going until it starts to sag, that's too lean then back it off a bit. When it will do that I then do the test flight. I use twenty seconds as a test because that's about how long it takes

from turning base to touch down. After the engine is run in and the main needle is set I then do a fine adjustment of the idle needle when the fuel tank is low and the engine is warm, like at the end of a flight. I do that because that is how most flights end, tow fuel and warm engine. If your engine has a simple airbleed carburettor the screw has to wound out to let more air in to lean the mixture. The opposite applies with a twin needle unit, you go in for leaner settings.

Fuel

Make sure the engine is getting fuel so check the clunk line is not hard up against the end of the tank. This is a major cause of intermittent engine failures. Check the filter is not blocked and then remove the needle valve. Open the throttle then hook your fuel pump to the inlet nipple on the carb. Crank the pump so fuel spurts out the needle to clear any obstructions in the jet. Items such as a seed, or a combination of dust and congealed oil are most likely. From my experience castor oil seems to be more prone to this than the modern synthetic products. The tank may have dirt it in so when you check that also make sure the bung is not loose and the fuel lines do not have any pin prick holes lurking. This is not an urban myth, I did actually hear a customer in a hobby store reply to the salesman, "no thanks I don't use filters any more, they keep getting blocked."

The clunk in the tank bending forward and partially kinking is another common cause of erratic running. If the model has undergone a rapid de-acceleration, such as running into long grass at the end of the strip or a cartwheel. This can happen if you store the fuselage on it's nose. To fix it point the nose up and give the model a really good shake then you should be able to hear the clunk, clunk. I think that is why it is called a clunk tank. If the fuel supply is okay then is the fuel any good.? The simplest way to find that out is to borrow a bit from someone whose engine is running sweetly.

Glo-plug

Inside the glo-plug is a piece of stainless steel wire that is wound into a coil. The wire is treated with platinum which creates a chemical reaction when mixed with methanol. To start the engine the glo plug is heated by a battery and the heat from combustion keeps it alight once the battery is disconnected. Plugs are available in various heat ranges and as a general rule of thumb, a hot plug has thin wire and a cold plug has much thicker wire. A thin wire requires less heat than a thick one to get it to glo. When the engine is throttled back to idle there is less heat from combustion so the engine and the plug cool down. If the plug gets too cold the engine may stop or falter when more power is required so in theory a hot plug is therefore better for a reliable idle.

Glo plugs don't cost much and they do wear out. If the element loses the shine, gets pitted, frosty, badly distorted or only a few coils glow, chuck it away.

If you have a modern sport engine

chances are the manufacturer will recommend a medium heat range plug. Sport engines operate from 2,500 to 13,000 rpm so at full power that tiny little glo plug is subjected to pressure variations from one to nine atmospheres, forty one times a second. And it gets hot inside a cylinder ,damn hot. At the other end of the scale an FAI pylon engine uses a cold plug because it does not need to idle and at up to 30,000 rpm the cold plug which, when battered at five hundred times a second, will last longer. I learned a valuable lesson about glo plugs when competing in FAI pylon at a national championships. There was one round to go and if I completed the flight at the times I had been doing, third place was in the bag. After every flight I always replaced the plug but this time I did not check it. A sandbag start is when you crank you engine into life fifteen seconds before the flag drops, rather than running it for the full minute to help keep it cool. It didn't fire and there was no time to find out why but the brand new glo plug turned out to be faulty.

A ducted fan engine runs at twenty thousand rpm and a reliable idle is a real requirement in this environment because these models are both fast and expensive. These engines use a medium plug but it has to be replaced more often. One indication a plug may be too cold is if there is a significant drop in rpm when the glo clip is removed. Unless you have mistakenly installed a cold plug, before you get too analytical this usually indicates the plug has had it.

When the engine is started keep the plug heat on for a few seconds to allow some heat to build up. If it is a brand new engine I leave it on until the main needle is set. I have seen a lot of guys whip the plug clip off and when the engine stops they waste time checking for other causes. Glo-plugs have to be hot to work properly. Most times the first indication the plug is on the way out is at idle or when the throttle is advanced, the engine stops. Start it up and leave the glo plug clip on and try the idle again. If that works then pull the plug out, look at the element and compare it to a new one. The new one is shiny and if the old element is pitted, distorted and if dull the platinum has been eroded, just replace it. If you are not sure just replace it anyway because at least you know the plug is okay leaving your mind free to look for some other cause.

The simplest way to get a reliable idle on an inverted engine is raise the nitro content of the fuel.

At the field one day a watched a few guys stuff around with an engine, they checked everything then replaced the plug and fuel. After an hour they gave up so I wandered over and offered to take a look. A bit annoyed after removing the tired old glo plug with hardly any element left, I threw it into the paddock and asked if he had a spare. The pained expression on his face said it all, that one was even worse so I had to give him a new plug to get him going. I didn't mind, I hate seeing people not flying because they are having trouble caused by a simple thing.

Water and heat are two things that give glo-plugs a hard time, moisture in the fuel will ruin a plug within half a flight. If you suspect the fuel, when you try another batch do yourself a favour and put in a brand new plug. Good fuel and a bad plug will still have you scratching your head wondering why it's still not right.

The easiest way to get a model aero engine hot is by running it lean and after a few of these, the element deteriorates. I have found helicopter engines are harder on plugs than aeroplanes and once again, the first sign is the engine either falters when the plug heat is removed or as it is being run up.

The older loop scavenged engines suggest an idle bar plug and in the early days this was definitely needed for an inverted installation. The bar shields the element to prevent large drops of oil dousing the plug at idle. Today's schnurle ported engines have much better carburettion and synthetic oils have all but eliminated the need for these plugs. If you doubt this claim go to an F3A aerobatic competition and watch how well those engines idle, inverted.

The glo plug in a four stroke engines has an extended thick walled housing which is designed to retain more heat. A four stroke fires every second time, therefore the element has more time to cool down. A two stroke plug will often work in one of these engines, until the battery is disconnected.

Nitro.

We use nitro methane, not nitro glycerine. This wonderful product, rich in oxygen when it combusts, has an undeserved reputation that it hurts engines. Many people say you have to run straight castor fuel through the engine to flush it out after using nitro. When I started using Klotz Techniplate, the first synthetic oil twenty years ago and mixed it with nitro, I never

had any such problems. In fact I have used it in twin cylinder four strokes, heli, ducted fan, pylon and aerobatic engines and never had any trouble. When four strokes came along sometimes they used to develop some corrosion on the bearings, if they were left unused for six months. These days the good oils have detergents and anti corrosion agents so you don't have to bother.

Theoretically anyway, nitro should be harder on the engine because you get more power. When I was single I used to go flying every Sunday, week in week out with my O.S. 61H powered Bell 222 helicopter and my tune piped, Rossi 61 aerobatic model to the field. I took twenty litres of fuel with fifteen percent nitro and synthetic oil, plus a fast charger and I burned the lot, each time. After two years I stopped going, not because the people on my frequency were complaining, I met a girl. Those engines lasted for years.

Is the engine capable of delivering what you expect is another facet of reliability. I expect my engine to tick over at a dead slow idle for a minute and accelerate away without hesitation. For example a .46 two stroke running a 10 x 7 prop, a slow idle is 2,500 to 3,000 rpm. Any higher it starts getting hard to wash off speed on final to slow the aeroplane down to land. That means either a side slip or a long low approach with the nose up. I am yet to see any engine , that is commercially available in this country, meet my criterion when running straight fuel, castor oil with no nitro.

Five percent nitro is a minimum, but ten percent is a lot better. Whilst you are at it get rid of the glug and try some synthetic oil. Higher nitro, twenty to thirty percent is better again but the cost does start getting up there. Once you get used to high nitro it is hard to go back, you get used to compliments on how well your engines tick over. Nitromethane is the cheapest and easiest way to get both a boost in power coupled with tremendous reliability. From my observations I think smacking your engine into the ground because it has stopped in a bad place is much harder on any engine than running good fuel through it.

I don't have engine problems very often and hope these tips help you like they have helped me.
Stephen Green.

Nitro - methane is what we use, it's not nitro glycerine. This is the easiest way to improve engine reliabilty and you get increased performance. Be warned though, once you use higher nitro there is usually no turning back. You get hooked because your hobby has become more enjoyable.