Who Says my Model's too Noisy?

Whilst we may think that the sound of an i.c. engine screaming upwards at 16,000 r.p.m. is fantastic, unfortunately, other people don't. In order to strike a compromise between “them” and “us” we have restrictions on our flying times and the level of noise generated by our models. This is all laid down in the club's planning permission with the Broads Authority.

We have now learned to live with the limitations on the times and days of the week we can fly i.c. models and the number of models allowed in the air at a time. However, it's equally important that we make sure that each of our models generates no more noise than our planning permission allows.

The only definitive document on model aircraft noise is the “Code of Practice for the Minimisation of Noise from Model Aircraft 1982” produced by the then Department of the Environment (a copy of this document is included in the BMFA Handbook which can be downloaded from http://www.bmfa.org/handbook/Handbook2007.pdf). The C.O.P. is now over 25 years old but the restrictions in our planning permission are based on it so, like it or not, that's what we have to use. The Code of Practice was written before model helicopters were “invented”, so for them we have to use the guidelines in the BMFA Handbook.

There are lots of arguments (many of them probably correct) that some noise is worse than others; e.g. 4 strokes sound quieter than 2 strokes but, at the end of the day, if we just stick to what the Code of Practice says, no-one can claim that we are not meeting the terms of our planning permission.

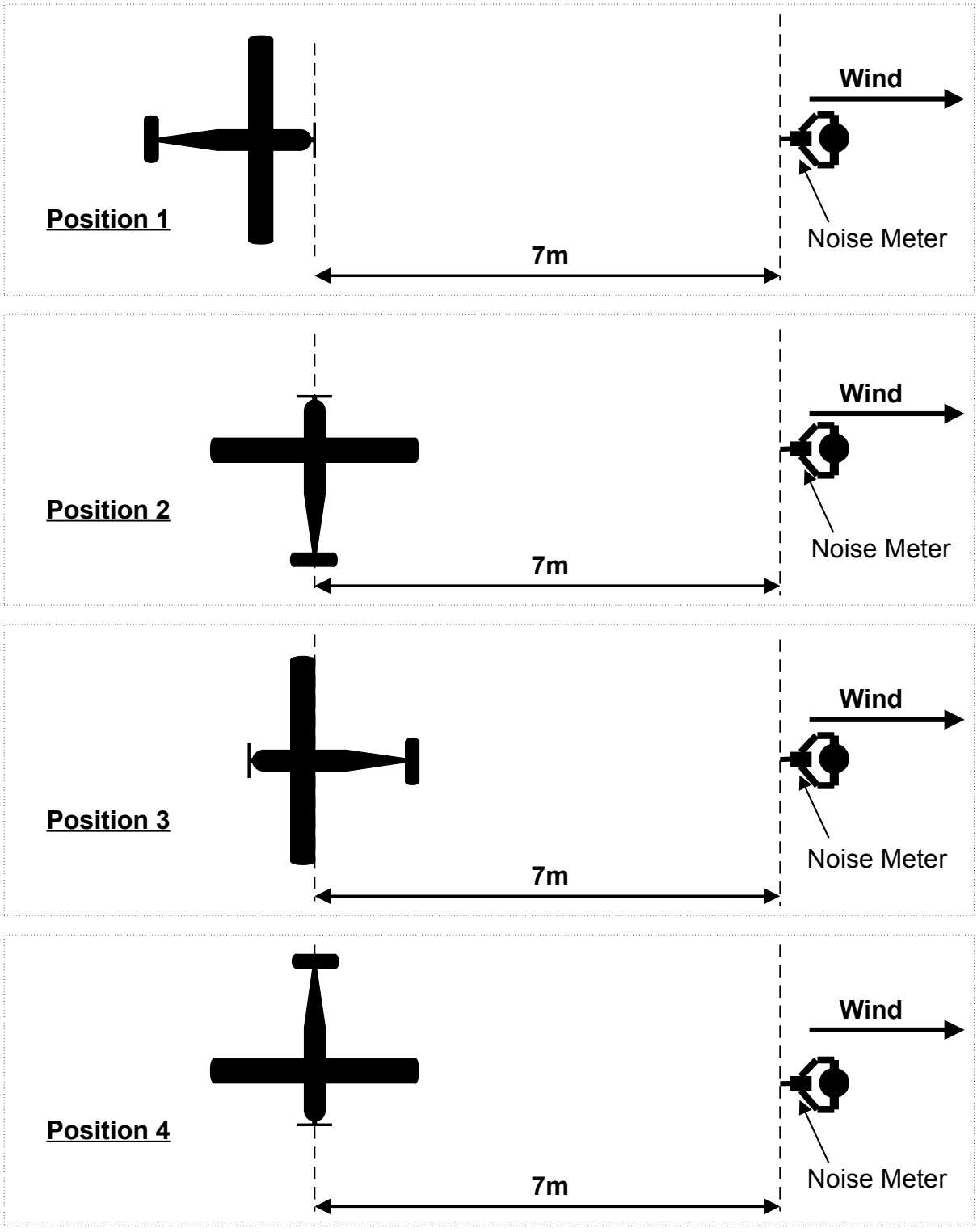
“Silent Flight” models (i.e. electric and gliders) are the only types which do not have to be noise tested.

THE NOISE TEST

Fixed Wing I.C. Models

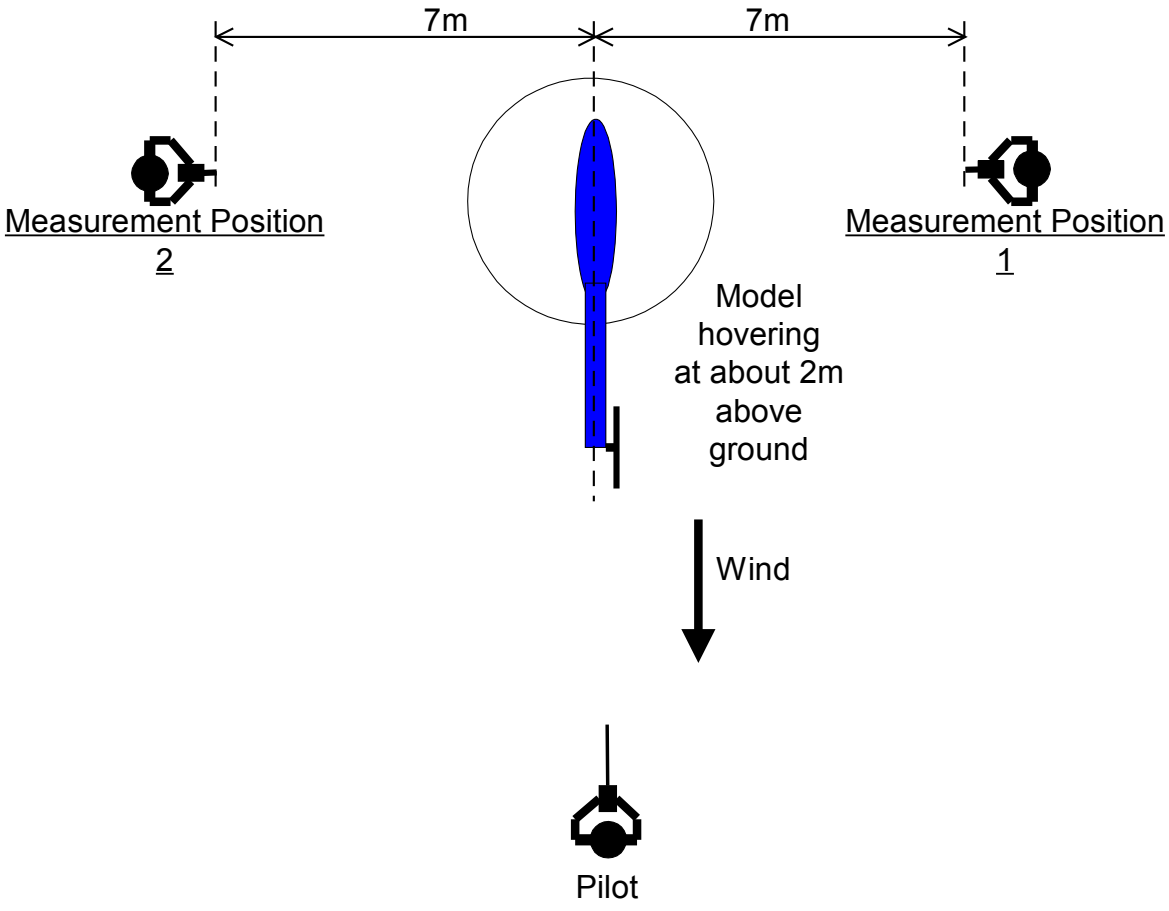
The noise test is really quite simple. The model is held at 1 – 2 metres above the ground with the engine running at max. revs. The noise is measured 7 metres away with a sound level meter. The noise meter must be downwind of

the model and the wind speed should not exceed 3 metres per second (about 7 m.p.h.). Four measurements are made, firstly with the model pointing directly at the meter, then right-side on, then from the rear and finally left-side on. The highest indicated noise reading from any position must not exceed 82dBA. The four positions are illustrated below:



Helicopters

Helicopters should be measured at a distance of 7 metres either side of the model, whilst the aircraft is held in the hover. The pilot for this test should be downwind of the model and the measuring points are therefore crosswind from the model. The diagram below shows the arrangement.



Club Testing Procedures

Testing at the club field should be carried out as described above. We have a calibrated noise meter and testing can be made by any committee member. To avoid disrupting flying, it is suggested that testing is carried out away from the mown field, for example in the area between the field and the road (near where the barbeque was held). Testing should only take a few minutes per model.

It is proposed to put one of the flight preparation tables in the noise test area on which any fixed wing models being tested can be placed. The table can be rotated through 90 degree steps to the four test positions. A length of cord

marked off at 7 meters will be provided to help measure out the correct distance between model and noise meter.

Every model that passes the noise test will be issued with a tag similar to those currently issued for transmitter frequency control. The background colour of the tag will, as now, be orange for 35MHz models and black for 2.4GHz and carry the following information on the front:

- Member's name
- Model name/type
- Radio channel number (if for 35MHz)
- Engine
- Propellor used – diameter, pitch and manufacturer
- Muffler details
- Date of test

Thus, we will have one tag per model. Once the testing scheme is established, these tags should be used on the “track” queuing system in place of the “one per transmitter” tags. This will ensure that only noise tested models are flown.

If a model is changed in any way which might alter the noise it generates (e.g. change of engine and/or prop.), then another noise test must be carried out and a new tag issued.

EXPLANATION OF NOISE MEASUREMENTS IN dBA

The ear can cope with an enormous range of sound intensity. For example, the noise 10m away from a diesel truck is about a billion times more powerful than the faintest noise we can hear. To avoid having to deal with such enormous numbers, noise intensity is measured using a logarithmic scale in dBA units. Each time the sound intensity doubles, its level in dBA goes up by 3dBA. So, if our model measures at 85dBA, it is making twice as much noise as the permitted 82dBA. Four times as much noise as 82dBA is 88dBA (82+6), eight times is 91dBA (82+9), and so on.

On the dBA scale, the faintest noise we can just hear is 0dBA and the diesel truck at 10m would measure 90dBA. Out of interest, some typical noise levels are:

Quiet bedroom at night	-	30dBA
Average Home (no kids?!)	-	50dBA
Vacuum cleaner at 1m	-	70dBA
Chainsaw at 1m	-	110dBA
Threshold of pain	-	130dBA

Obviously, noise level decreases as we move away from the source. Without any objects to reflect or get in the way, the sound level goes down by 6dBA every time the distance is doubled. On that basis, a model which just passes the noise test level of 82dBA at 7m will have a noise level of about 46dBA 450m away – that's less than the noise level in an average home.

A consequence of the very wide range of sound levels that the ear can accept is that we are not very sensitive to small changes in sound intensity. In fact, a halving in sound level doesn't sound very much at all. So bear in mind that what sounds like not much change in noise output from your model can be quite significant when measured on a sound level meter.

TIPS ON HOW TO REDUCE MODEL NOISE

From experience, most “ordinary” fixed wing models (sports models with a 40/46 engine and standard silencer) are marginal when noise tested. If you're lucky, it'll pass but, more likely, it'll just fail.

There's a very good website from the “Fellbridge Flyers” at http://www.flyingsites.co.uk/howto/noisereduct.htm which gives a lot of useful tips on noise reduction. There's a link to a page listing a range of model/engine/silencer/prop. combinations that have passed the noise test at http://www.flyingsites.co.uk/howto/noisechart.htm .

Choice of Prop.

In many cases, the right choice of prop. is sufficient to get your model through the test.

1. Use a prop. on the large side (diameter and pitch) for your engine. This keeps the revs down and so the noise generated is less.
2. Select a “low noise” prop. Some designs of prop. are noticeably noisier than others. The Master Airscrew type with square ended blades seem to be particularly bad. APC props seem to be better (if you don't mind chewing up your fingers on their sharp edges!).

Engine Silencer

If a simple prop. change isn't enough, then it's time to do something with the engine silencer (muffler as the Yanks call it).

The very simplest and cheapest thing to do is to fit a silicone exhaust stub like this:

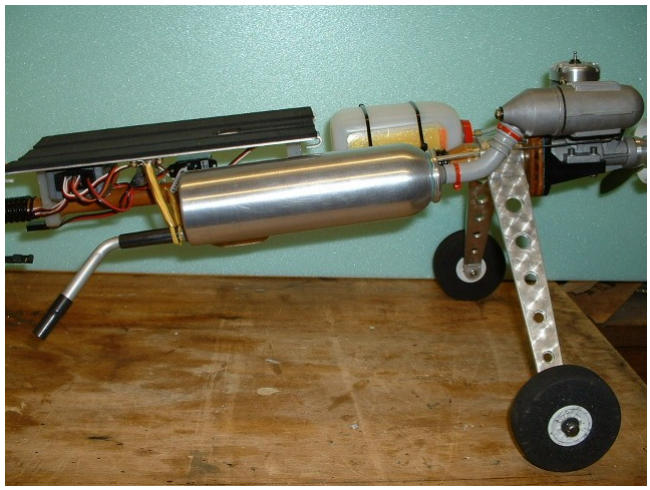
Truth be known, it probably won't make a lot of difference, but it's worth a try.

The next step is to change to a quiet or super quiet silencer. From a quick web search, it seems that most engine manufacturers nowadays don't offer anything other than standard silencers. However, JustEngines do a range which will fit most engines. Have a look at their website at http://www.justengines.unseen.org/acatalog/Silencers.html . Prices range from about £11 to £25, depending on engine capacity.

How to Make your own Silencer

If you want to save your hard earned dosh (and who doesn't) then why not try building your own silencer. Howard has kindly put together details of his design which you can make yourself with little more than an empty aerosol can and a length of ali. tube.

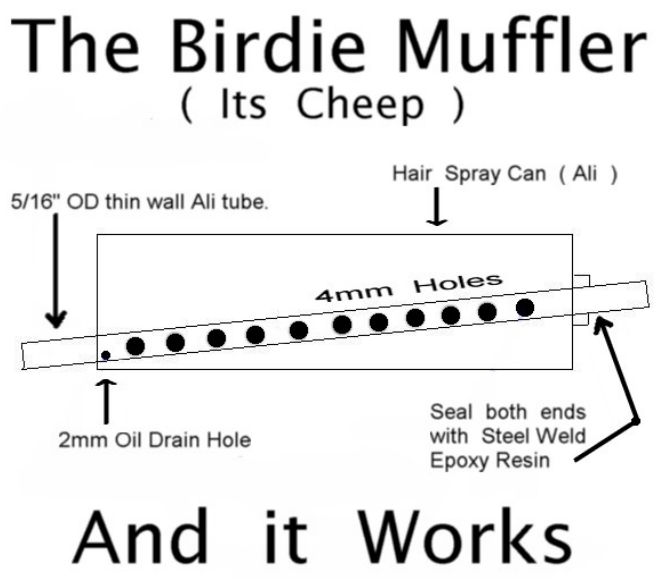
Here's a photo of the finished article on Howard's “Gnat”. It connects to the outlet of the normal engine silencer.



These are the materials you need to make it (more details later):

- An empty aerosol can (several types shown).
- Length of aluminium tube
- Pack of "Locktite Super Steel" Cold Weld Epoxy

Over to Howard for his sketch, notes and photos of the construction:



Regarding muffler details, the size of the can is not that important. It all depends on how much noise reduction is required.

Even the smallest can I've tried (70mm x 35mm) works well.

The largest can I have tried (210mm x 47mm) was so quiet when the plane was in the air, that I took it off and put a smaller one on because I kept thinking I had gone dead stick.

The one I am using on my SC25 is 127mm x45mm, a "Nail Dry Spray" three for the price of one from the 99p shop, Anglia Sq, Norwich.

I think this size would be fine for a 40/46 size engine. but even the smallest container will take the crack out of the exhaust noise.

The governing factor regarding noise reduction is the relationship between Muffler Volume and Exit Hole Diameter. The larger the exit hole dia., the bigger the muffler volume must be to achieve the same level of noise reduction.

The tube I use is 5/16" x .015" wall thickness round aluminium tube, Stock No 1115 from "Pegasus Models". Choose a tube with an inside diameter that is the same size or only very slightly larger than the inside diameter of the outlet stub on the stock engine silencer in question. Using a smaller pipe may upset the breathing of the engine at higher revs

and BOG DOWN. The idea is to get the exhaust gases away from the engine, let them expand and cool before before allowing them escape to atmosphere as a steady stream of low pressure gases rather than a series of high pressure pulses. Using a larger size pipe will require the use of a larger size muffler as stated above.

First remove the valve assy., drill the top of the can with a 4mm pilot drill and ream to the size of the pipe to be fitted.

Next remove the drilled out valve and plastic tube from inside the can and discard.

Next, working from bottom end of can, centre-punch the bottom (curved) face, half the dia. of the tube to be fitted from the edge. This will be the lowest point of the muffler and is the position the exhaust stub will be.
Next drill a 4mm pilot hole and ream to size of pipe to be fitted.

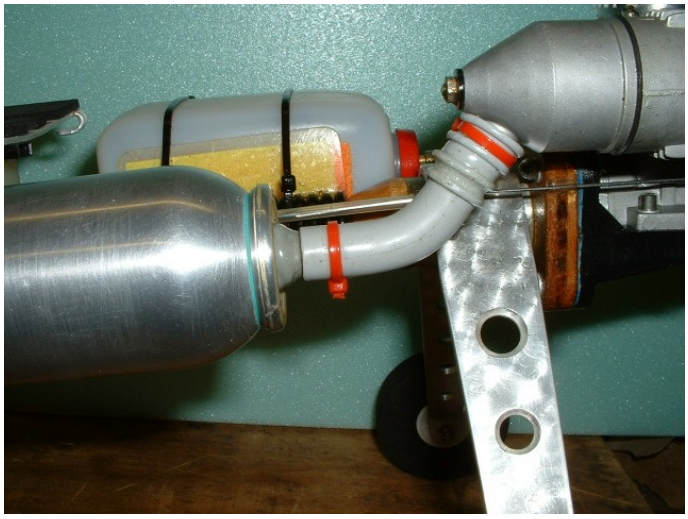
Mark off length of can on pipe and mark positions for holes at 10mm spacing.

The 4mm pepper pot holes in the pipe are drilled THROUGH @ 10mm spacing. Then turn pipe 90deg and drill THROUGH and between 1st drilling. Continue drilling to 75% length of muffler can. A small 2mm oil drain hole is drilled in one end of the pipe in a position to sit just inside the muffler can. This is to enable any oil and water collected in the muffler, to exit via the outlet stub.

Deburr and degrease the pipe and muffler can, removing all sharp edges.

Next take the pipe and feed through the top of the muffler can with the 2mm oil drain hole first. Position the pipe so all holes are covered and that the 2mm hole is to the edge of the can, but within the can itself. In this position, resin the pipe in place using "Locktite Super Steel" Cold Weld Epoxy. Leave for 2 hours to fully harden.

Attach the muffler to the silencer using silicon tubing or a silicon exhaust deflector from local model shops.



The muffler can be mounted to the airframe using tie-wraps / elastic bands / fuel tube & self tappers or wire.
The complete muffler only weighs a few grams, so minimal support is required, in fact it is good practice to rubber mount it to reduce vibration.