AMA Sound/Noise Abatement Recommendations

What is a pretty sound to us as modelers isn't necessarily a pretty sound to our neighbors. This is a reality that we must deal with. The largest contributor to the loss of flying sites is the noise our aircraft produce. A common scenario is that someone is going to build his or her dream country home within earshot of your flying field, and if you don't have noise under a certain degree of control, you will quickly become a target.

This document will help you react to a noise complaint, but you should also use these guidelines to become proactive in controlling sound before problems arise. After the authorities are alerted to a noise problem is not really the best time to start getting a handle on it. Set up noise guidelines before there's an issue and, if it's done sincerely and adequately, there may never be a problem. Keep in mind also there is a difference between a recommendation and what is legal for a particular piece of property. We'll discuss this difference later in this document.

What Is dB?

It is the acronym for decibels, which is a measurement of sound wave impact, also known as sound level pressure. It is a measurement that increases exponentially on the scale. In layman's terms, as the number increases, the impact increases. For practical applications, 45 dB is just above a whisper, 96 to 98 dB is tolerable; at 107 dB and up noise starts to do real damage to your hearing.

The easiest way to measure sound/noise is with a decibel meter. Most are relatively inexpensive and are generally battery operated, so using them at remote locations is easy. The one most often used is a small, hand-held model sold at your local Radio Shack for less than $50, so all clubs should have at least one. They can be mounted on a camera tripod which will make testing and consistency simple. When you use this unit to measure noise, it should be set on the "A" weighting selection.

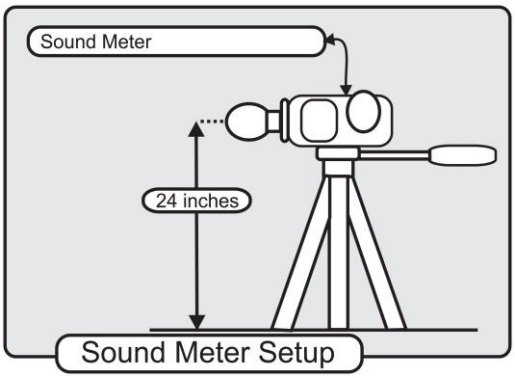
Sound Limit Guidelines:

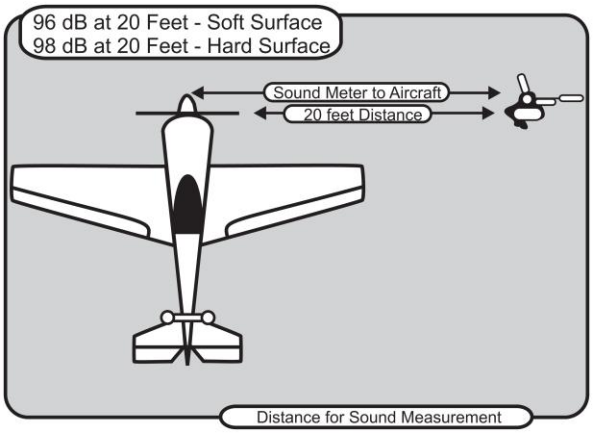
The following guidelines are meant to provide a starting point for clubs that currently have no sound issues. Your club can use any level you deem appropriate, but it is suggested that you do some testing with your own club members and models and come to a decision regarding an appropriate level.

96 dB measured from a 20-foot distance over soft field (sod)

98 dB measured from a 20-foot distance over hard surface (pavement/concrete)

The following diagrams and description will help you set up a sound-testing station at your flying site. Keep in mind that you need an area away from anything that would reflect sound, so you want to be away from buildings, fences, etc. Make sure you are consistent with your set-up and testing procedures so that you get accurate results.





The dB meter should be held approximately two feet above the surface in the direction of the aircraft. Take a few readings at different angles to the aircraft (front, back, side, etc.) and take an average. This method should do an adequate job of measuring the real sound level being emitted by a particular aircraft/engine/muffler combination. The meter setting should be in the "A" weighted position.

These sound-level recommendations are not quiet by any stretch, but are generally tolerable to most people in the vicinity, pit area, and spectators. These recommendations should also be a starting point for controlling the sound level outside your overfly area while in the air. If you are working to meet a specific county or city ordinance, or just want to be quieter, please read on!

What Is Actually Legal?

Unless you live in the middle of no-man's-land, all property will fall under the jurisdiction of a set of ordinances of some type. Whether it is state, county, township, etc., there will be a set of rules for what can and can't be done with or on a particular piece of property. In these ordinances there are rules for fence lines, building set-backs, types of building, and so on. There will also be a rule for how much noise (dB) that is allowed to cross the property line. It may be hard to find but if you look deep enough or ask the right person, you'll find it. Normally that number will be somewhere between 50 and 65 dB. After you find the information on your property, check to see if you're legal by setting your dB meters at different places on the property line and take the readings. Other factors can add to the dB readings you get. If your field is located close to a major highway or busy road, the tire noise and other road noise can make a big difference.

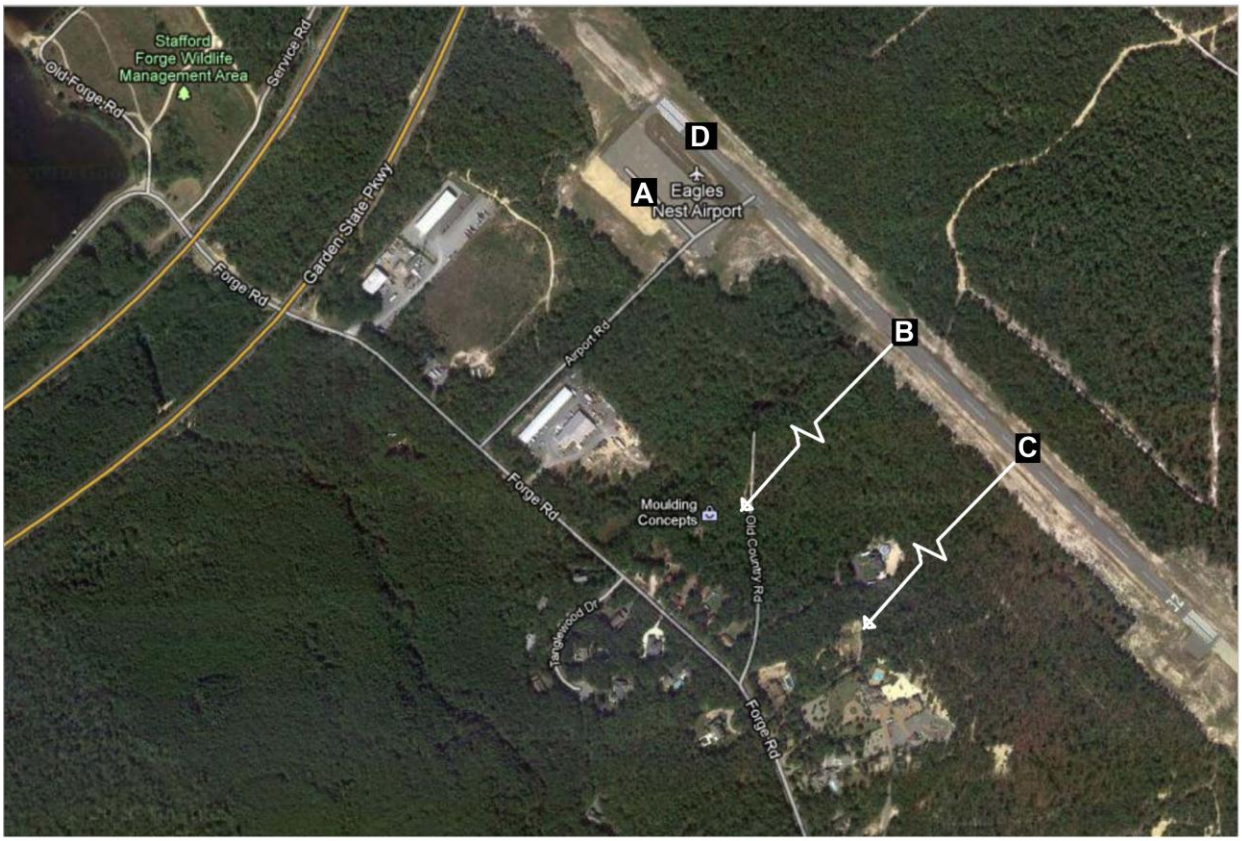
This may sound trivial, but knowing where you're flying site stands legally with regards to noise can and will give you an advantage if and when the need arises. Think of how handy it would be if you were to be confronted with a complaint, to know and be able to state that your flying site is within the noise ordinance limits.

The following few pages have examples of how a professional engineering firm conducts sound studies for the purpose of measuring whether a flying field is legal according to local ordinances. It begins with a map overview of where the measuring devices (sound meters) were placed. Time, date, and sound level measurements were taken at the specific sites as well as the type of sound producer in the immediate

area when the measurement was taken. The device positions correlate with the tables by the letter designations given to the devices and are shown in the “location” column on the table sheet. Table 2 contains the measurements taken for ambient noise, birds, auto traffic, wind, etc. Table 3 is a list of the actual measurements taken of RC aircraft in different operating regimes. Table 4 is a good estimate of the distance and sound measurement that can be expected from the average model aircraft. Note the word “average.” Large gas-engine-powered models will often be louder and electric-powered models will, of course, be quieter. This table will give you an estimate of the distance required to reach the desired sound level for your legal limit. The key is in knowing what the limit is for your local area.

Table 4 uses a sound level of 96 dB at 3 meters (9.8 feet) from the model. This level was used by the testing facility because it came directly from the AMA *Competition Regulations* rule book for RC Aerobatics competition rules. Note that 96 dB at 9.8 feet is much quieter than the recommendation of 96 dB at 20 feet. Here again, you will need to determine the specific noise level allowed by law and work from there. This information shows that if you use the 96 dB at 3 meters standard, you can expect to get a 65 dB noise level at roughly 350 feet from the model. If you local ordinance is 65 dB at the property line, you would need to ensure that all models are kept at least 350 feet from the property line at all times to be within the law.

You will also need to measure your flying site and its boundaries. You will need to observe the in-flight operation of models to determine the flight path and the extremes of distance models are flown to see how close the models come to the property line or if in fact they cross the property line.



Eagles Nest Airport, New Jersey

Table 1 Weather Conditions					
Date	**Location**	**Time**	**Conditions**	**Temp.**	**Wind**
Saturday 7 May 2011	Eagles Nest Airport Eagleswood Township Ocean County, NJ	10:32 AM	Clear	66°F	< 5 MPH
		12:40 PM	Clear	70°F	< 8 MPH

Table 2 Eagles Nest Airport Eagleswood Township - Ocean County, NJ Daytime Ambient Measurements - 07 May 2011			
Location	**Time**	**Reading Range (dBA)**	**Comments**
A	10:46 - 10:47 AM	45.6 - 45.8	Primary: vehicular traffic on Garden State Parkway,
	10:47 - 10:48 AM	49.2 52.7	Birds; Secondary: off-road motorcycles / ATVs
B	11:01 - 11:02 AM	41.9 - 45.6	Primary: vehicular traffic on Garden State Parkway,
	11:02 - 11:03 AM	42.5 - 45.3	birds
	11:03 - 11:04 AM	42.4 - 42.9	
	11:16 - 11:17 AM	43.3 - 43.9	
	11:17 - 11:18 AM	42.9 - 43.9	
C	11:25 - 11:26 AM	42.9 - 46.2	Primary: vehicular traffic on Garden State Parkway,
	11:26 - 11:27 AM	41.9 - 43.7	birds
	11:29 - 11:30 AM	42.3 - 53.2	
	11:30 - 11:31 AM	44.3 - 53.8	
	11:31 - 11:32 AM	41.9 - 43.4	
	11:32 - 11:33 AM	43.4 - 44.8	
	11:33 - 11:34 AM	44.0 - 51.6	
D	12:45 - 12:46 PM	46.4 - 62.9	Primary: vehicular traffic on Garden State Parkway,
	12:46 - 12:47 PM	50.3 - 52.7	Birds; Secondary: off-road motorcycles / ATVs
	12:47 - 12:48 PM	49.4 - 54.2	
	12:48 - 12:49 PM	49.0 - 50.4	
	12:49 - 12:50 PM	52.4 - 54.5	
	12:50 - 12:51 PM	51.2 - 55.7	
	12:51 - 12:52 PM	51.7 - 53.0	
	12:52 - 12:53 PM	51.4 - 56.3	
	12:53 - 12:54 PM	51.9 - 58.8	
	12:54 - 12:55 PM	54.3 - 59.2	
	12:55 - 12:56 PM	49.4 - 54.5	
	12:56 - 12:57 PM	47.4 - 47.9	
	12:57 - 12:58 PM	47.1 - 48.1	
	12:58 - 12:59 PM	45.2 - 45.9	
	12:59 - 1:00 PM	43.7 - 44.7	
	1:00 - 1:01 PM	52.1 - 55.5	

Table 3
Eagles Nest Airport
Eagleswood Township - Ocean County, NJ
Daytime Source-On Measurements - 07 May 2011

Location	Time	Reading Range (dBA)	Corrected (Source) Level	Comments
	10:40 - 10:41 AM	46.3 - 52.0	---	RC aircraft taxi
	10:41 - 10:42 AM	48.1 - 55.3	---	RC aircraft flight
	10:42 - 10:43 AM	51.2 - 55.9	---	"
	10:43 - 10:44 AM	46.9 - 59.6	---	"
A	10:44 - 10:45 AM	47.4 - 55.1	---	"
	10:45 - 10:46 AM	44.5 - 59.7	---	"
	10:48 - 10:49 AM	47.5 - 55.3	---	RC aircraft take-off
	10:49 - 10:50 AM	52.8 - 58.6	---	RC aircraft flight
	10:50 - 10:51 AM	49.8 - 55.2	---	"
	10:57 - 10:58 AM	48.7 - 59.1	---	RC aircraft flight
	10:58 - 10:59 AM	47.0 - 61.8	---	"
	10:59 - 11:00 AM	47.6 - 62.0	---	"
	11:00 - 11:01 AM	45.5 - 60.0	---	"
	11:04 - 11:05 AM	44.7 - 47.2	---	RC aircraft taxi
	11:05 - 11:06 AM	60.7 - 63.1	59.7	Full-size aircraft
	11:06 - 11:07 AM	50.4 - 65.7	---	RC aircraft flight
B	11:07 - 11:08 AM	47.3 - 60.4	---	"
	11:09 - 11:10 AM	52.2 - 62.9	---	RC aircraft flight
	11:10 - 11:11 AM	46.4 - 62.7	---	"
	11:11 - 11:12 AM	45.8 - 60.0	---	"
	11:12 - 11:13 AM	48.2 - 62.6	---	"
	11:13 - 11:14 AM	47.4 - 66.1	---	"
	11:14 - 11:15 AM	47.2 - 62.9	---	RC aircraft overhead loop
	11:15 - 11:16 AM	46.2 - 59.0	---	"

Table 3 - Continued Eagles Nest Airport Eagleswood Township - Ocean County, NJ Daytime Source-On Measurements - 07 May 2011				
Location	**Time**	**Reading Range (dBA)**	**Corrected (Source) Level**	**Comments**
C	11:22 - 11:23 AM	45.1 - 56.5	---	RC aircraft flight
	11:23 - 11:24 AM	45.4 - 58.0	---	"
	11:24 - 11:25 AM	44.8 - 50.7	---	"
	11:37 - 11:38 AM	45.8 - 49.2	---	RC aircraft flight
	11:38 - 11:39 AM	46.7 - 54.4	---	"
	11:39 - 11:40 AM	44.8 - 52.2	---	"
	11:40 - 11:41 AM	44.6 - 51.9	---	"
	11:41 - 11:42 AM	47.6 - 54.2	---	"
	11:42 - 11:43 AM	46.8 - 52.9	---	"
	11:43 - 11:44 AM	47.3 - 54.3	---	"
	11:44 - 11:45 AM	45.5 - 53.0	---	"
	11:45 - 11:46 AM	45.2 - 57.2	---	"
	11:46 - 11:47 AM	45.1 - 51.6	---	"
	11:47 - 11:48 AM	44.5 - 50.9	---	"
	11:48 - 11:49 AM	42.8 - 54.1	---	"
	11:49 - 11:50 AM	45.6 - 50.0	---	"
	11:50 - 11:51 AM	43.2 - 50.9	---	"
	11:51 - 11:52 AM	43.1 - 52.6	---	"
	11:52 - 11:53 AM	45.8 - 52.6	---	"
	11:53 - 11:54 AM	44.4 - 49.4	---	"

Table 4 Eagles Nest Airport Eagleswood Township - Ocean County, NJ Sound Pressure Level (SPL) Projections	
Distance (ft)	SPL (dBA)
9.8	96.0
20	90.0
35	85.0
62	80.0
110	75.0
196	70.0
349	65.0
621	60.0
1104	55.0
1964	50.0
3492	45.0
6211	40.0

The dissipation of sound pressure levels (SPL) follows the inverse square law, where SPLs are reduced by half with a doubling of the distance. Please note that because decibels are a logarithmic scale, halving of SPLs results in approximately -6 dB difference

Inverse Square Law Formula: SPL2 = SPL1 – 10Log10(d2squared/d1squared)

Where: SPL = Sound Pressure Level (dBA); d = distance in feet

Using the inverse square law and AMA's RC Aerobatics Rule 4.2 which states the maximum sound limit of 96 dB at 3 meters (9.8 feet) from centerline of the model while at full power, the above table 4 provides various distance projections given a sound pressure level. As shown in Table 4, 96 dB should dissipate to 65 dB at a distance of 349 feet, in the absence of atmospheric conditions and physical barriers.

Ways of Abating Noise Problems

1. Try a three-blade propeller

The most important thing to remember about airplane noise is that most of what you hear does not come from the engine, it comes from the propeller. What you hear when your engine unloads in the air is the propeller tips going supersonic, so reducing the engine rpm will limit much of that. So, you think a bigger, two-blade propeller will slow the engine down, right? Wrong! Yes it will slow the engine down, but now you have longer blades and the tips are actually going faster (physics). The answer is to *add* blades so you keep the diameter down while also reducing the rpm. The reason you see most of the IMAC pilots using three-blade propellers is not for performance, but noise control. If you don't know

how to figure for a three-blade propeller, you might ask your engine manufacturer for a recommendation. A rule of thumb is to reduce diameter by 1 inch or pitch by 1 or both if needed.

2. Use as large as possible canister-type muffler

Nearly all gas and glow engines sold in the US market today are supplied with a large can-type muffler. Most of these supplied mufflers will do an adequate job of controlling the combustion noise coming from the cylinder. Adding a piece of rubber hose to the outlet pipe can also help stop some of the ringing sound that can be produced by the muffler. The rubber hose doesn't have to extend past the pipe, just cover it like insulation.

Soft mount your engine

Often there can be quite a bit of noise coming from your airframe, especially if it contains much fiberglass or is an open structure covered in plastic film. When the engine is hard mounted to the firewall the vibration will be carried back through the airframe and essentially act as a drum unless there is some type of absorption material in there to damper it. Many of the newer 30 and 40% aerobatic aircraft have foam turtle decks and other foam parts that absorb much of the vibration noise, if not your beautiful machine will sound more like a drum kit than a purring kitten. There are several soft-mount systems on the market today. Nearly all full-scale piston engines are soft mounted.

In conclusion, sound is an important issue that all AMA members should be aware of. Creating club standards for model noise is a must in many club flying site locations. Ignoring the noise generated by models can be a recipe for disaster! Please take the time to consider what actions your club should take to ensure the future of your flying site.