

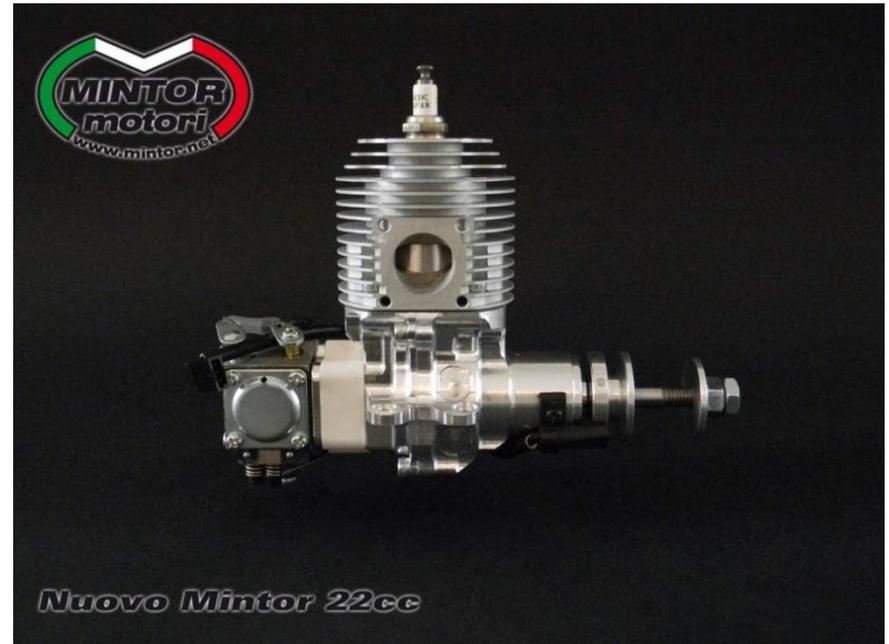
Sound at the field

Presented by Randy Ling
5/8/2015

Sound at the field

Airplane too loud

This project started with the assembly of a Hanger 9 SBACH 342 60 ARF. The engine was a Mintor 22cc with the stock muffler turned a 17 X6 Zoar propeller at 9,000 RPM. Unfortunately it was too loud and was grounded until it could meet the clubs sound pressure requirement. It measured 96 dB at 25'



Field Rules

(February 2018)

Members and Guests Must Understand and Follow the Field Rules

Like all clubs, the Lake Sawyer Hawks have rules. Developed to ensure safety and avoid the loss of AMA insurance coverage in the event of an accident, the rules also remind us to have some basic common sense as we enjoy the hobby of flying Radio Controlled Models. Remember, rules are intended to minimize the occurrence and impact of those things that are not likely to ever happen! Here are those rules accepted by the membership:

- SAFETY IS THE FIRST PRIORITY. Do not fly in a reckless, careless, or dangerous manner.
- SIGN THE LOG BOOK before you fly and when you are ready to leave.
- At all times the AMA Safety Code is to be adhered to.
- All aircraft limited to 85 dB or less sound level at 25 feet fly Mon, Wed, Fri, Sat, 9:00am to 5:00pm.
- All electric Aircraft under 79db sound level at 25 feet fly Sunrise to Sunset 7 days a week.
- Sound level test is required of new or modified glow/gas aircraft prior to first flight.
- Mufflers are required on all engines.
- All models limited to 20 lbs maximum takeoff weight.
- Engines are to be shut down on the runway. No taxiing into the pit area.
- High speed passes shall be no closer to the pilot stations than the centerline of the runway.
- AMA Membership is mandatory for all pilots.

Please see the complete list of Field Rules under [Flying Sites > Field Rules](#) in the blue menu bar.

Sound at the field

King County Title 12 Public Peace, Safety and Morals

http://www.kingcounty.gov/council/legislation/kc_code/15_Title_12.aspx

12.88 ENVIRONMENTAL SOUND LEVELS

Sections:

- 12.88.010 Unlawful sounds.
- 12.88.020 Maximum permissible sound levels.
- 12.88.030 Modifications to maximum permissible sound levels.
- 12.88.040 Construction and equipment operation.

12.88.010 Unlawful sounds. It is unlawful for any person to cause sound, or for any person in possession of property to permit sound originating from such property, to intrude into the real property of another person whenever such sound exceeds the maximum permissible sound levels established by this chapter. (Ord. 3139 § 301, 1977).

Sound at the field

King County Code

[Title 12 Public Peace, Safety and Morals - King County](#)

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12.88.020 Maximum permissible sound levels.

A. For sound sources located within King County or the city of Seattle, the maximum permissible sound levels are as follows:

District of Sound Source	District of Receiving Property Within King County			
	Rural	Residential	Commercial	Industrial
Rural	49 dB(A)	52 dB(A)	55 dB(A)	57 dB(A)
Residential	52 dB(A)	55 dB(A)	57 dB(A)	60 dB(A)
Commercial	55 dB(A)	57 dB(A)	60 dB(A)	65 dB(A)
Industrial	57 dB(A)	60 dB(A)	65 dB(A)	70 dB(A)

B. For sound sources located outside King County and the city of Seattle, the maximum permissible sound levels are as follows:

EDNA of Sound Source	District of Receiving Property Within King County			
	Rural	Residential	Commercial	Industrial
Class A	52 dB(A)	55 dB(A)	57 dB(A)	60 dB(A)
Class B	55 dB(A)	57 dB(A)	60 dB(A)	65 dB(A)
Class C	57 dB(A)	60 dB(A)	65 dB(A)	70 dB(A)

(Ord. 3139 § 302, 1977).

Sound at the field

King County Code

[Title 12 Public Peace, Safety and Morals - King County](#)

12.90.010 Sounds created by operation of motor vehicles. It is unlawful for any person to operate upon any public highway any motor vehicle or any combination of motor vehicles under any conditions of grade, load, acceleration or deceleration in such manner as to exceed the following maximum permissible sound levels for the category of vehicle, as measured at a distance of fifty feet from the center of the lane of travel within the speed limits specified, by measurement procedures established by the State Commission on Equipment.

Vehicle Category	35 mph or less	over 35 mph
Motorcycles	80 dB(A)	84 dB(A)
Motor vehicles over 10,000 pounds GVWR or GCWR	86 dB(A)	90 dB(A)
All other motor vehicles	76 dB(A)	80 dB(A)

12.90.050 Sale of new motor vehicles which exceed limits. It is unlawful for any person to sell or offer for sale a new motor vehicle, except an off-highway vehicle, which produces a maximum sound level exceeding the following maximum permissible sound levels at a distance of fifty feet, by acceleration test procedures established by the State Commission on Equipment.

Vehicle Category	
Motorcycles manufactured after 1975	83 dB(A)
Any motor vehicle over 10,000 lbs. GVWR manufactured after 1975 and prior to 1978	86 dB(A)
Any motor vehicle over 10,000 lbs. GVWR manufactured after 1978	83 dB(A)
All other motor vehicles	80 dB(A)

Sound at the field noise source comparison



My personal mower is similar to this one
But is green in color.

21" cut

6.5 HP

85 dB @ 25'

Sound at the field noise source comparison



Riding lawn mower
The club's mower is similar
To this one measured
82 dB @ 25'

Methods to reduce sound pressure

propeller noise

According to the Academy of Model Aeronautics. If you keep your propeller tip speed at .5 Mach or less propeller noise will be minimized.

Propeller noise increases at a linear rate as propeller tip speed increases. Here is the equation to calculate tip speed.

Propeller tip speed = $.00297 * \text{Diameter} * \text{RPM}$

Speed of Sound approximately 726 MPH

There is a table on the next page where the math has done for you.

For gas or glow aircraft one would need a tachometer to measure engine RPM at full throttle to perform this calculation.

For electric you can use this equation.

$\text{RPM} = \text{BV} * \text{KV}$

BV – battery voltage

KV – motor constant

Sound at the field

Propeller noise

0.00297	FACTOR																
	726	SPEED OF SOUND															
	0.5	MACH LIMIT															
	6000	6500	7000	7500	8000	8500	9000	9500	10000	10500	11000	11500	12000	12500	13000	13500	14000
6	0.15	0.16	0.17	0.18	0.20	0.21	0.22	0.23	0.25	0.26	0.27	0.28	0.29	0.31	0.32	0.33	0.34
7	0.17	0.19	0.20	0.21	0.23	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.34	0.36	0.37	0.39	0.40
8	0.20	0.21	0.23	0.25	0.26	0.28	0.29	0.31	0.33	0.34	0.36	0.38	0.39	0.41	0.43	0.44	0.46
9	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.42	0.44	0.46	0.48	0.50	0.52
10	0.25	0.27	0.29	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55	0.57
11	0.27	0.29	0.32	0.34	0.36	0.38	0.41	0.43	0.45	0.47	0.50	0.52	0.54	0.56	0.59	0.61	0.63
12	0.29	0.32	0.34	0.37	0.39	0.42	0.44	0.47	0.49	0.52	0.54	0.56	0.59	0.61	0.64	0.66	0.69
13	0.32	0.35	0.37	0.40	0.43	0.45	0.48	0.51	0.53	0.56	0.59	0.61	0.64	0.66	0.69	0.72	0.74
14	0.34	0.37	0.40	0.43	0.46	0.49	0.52	0.54	0.57	0.60	0.63	0.66	0.69	0.72	0.74	0.77	0.80
15	0.37	0.40	0.43	0.46	0.49	0.52	0.55	0.58	0.61	0.64	0.68	0.71	0.74	0.77	0.80	0.83	0.86
16	0.39	0.43	0.46	0.49	0.52	0.56	0.59	0.62	0.65	0.69	0.72	0.75	0.79	0.82	0.85	0.88	0.92
17	0.42	0.45	0.49	0.52	0.56	0.59	0.63	0.66	0.70	0.73	0.77	0.80	0.83	0.87	0.90	0.94	0.97
18	0.44	0.48	0.52	0.55	0.59	0.63	0.66	0.70	0.74	0.77	0.81	0.85	0.88	0.92	0.96	0.99	1.03
19	0.47	0.51	0.54	0.58	0.62	0.66	0.70	0.74	0.78	0.82	0.86	0.89	0.93	0.97	1.01	1.05	1.09
20	0.49	0.53	0.57	0.61	0.65	0.70	0.74	0.78	0.82	0.86	0.90	0.94	0.98	1.02	1.06	1.10	1.15
	6000	6500	7000	7500	8000	8500	9000	9500	10000	10500	11000	11500	12000	12500	13000	13500	14000
	14000	14500	15000	15500	16000	16500	17000	17500	18000	18500	19000	19500	20000	20500	21000	21500	22000
6	0.34	0.36	0.37	0.38	0.39	0.41	0.42	0.43	0.44	0.45	0.47	0.48	0.49	0.50	0.52	0.53	0.54
7	0.40	0.42	0.43	0.44	0.46	0.47	0.49	0.50	0.52	0.53	0.54	0.56	0.57	0.59	0.60	0.62	0.63
8	0.46	0.47	0.49	0.51	0.52	0.54	0.56	0.57	0.59	0.61	0.62	0.64	0.65	0.67	0.69	0.70	0.72
9	0.52	0.53	0.55	0.57	0.59	0.61	0.63	0.64	0.66	0.68	0.70	0.72	0.74	0.75	0.77	0.79	0.81
10	0.57	0.59	0.61	0.63	0.65	0.68	0.70	0.72	0.74	0.76	0.78	0.80	0.82	0.84	0.86	0.88	0.90
11	0.63	0.65	0.68	0.70	0.72	0.74	0.77	0.79	0.81	0.83	0.86	0.88	0.90	0.92	0.95	0.97	0.99
12	0.69	0.71	0.74	0.76	0.79	0.81	0.83	0.86	0.88	0.91	0.93	0.96	0.98	1.01	1.03	1.06	1.08
13	0.74	0.77	0.80	0.82	0.85	0.88	0.90	0.93	0.96	0.98	1.01	1.04	1.06	1.09	1.12	1.14	1.17
14	0.80	0.83	0.86	0.89	0.92	0.95	0.97	1.00	1.03	1.06	1.09	1.12	1.15	1.17	1.20	1.23	1.26
15	0.86	0.89	0.92	0.95	0.98	1.01	1.04	1.07	1.10	1.14	1.17	1.20	1.23	1.26	1.29	1.32	1.35
16	0.92	0.95	0.98	1.01	1.05	1.08	1.11	1.15	1.18	1.21	1.24	1.28	1.31	1.34	1.37	1.41	1.44
17	0.97	1.01	1.04	1.08	1.11	1.15	1.18	1.22	1.25	1.29	1.32	1.36	1.39	1.43	1.46	1.50	1.53
18	1.03	1.07	1.10	1.14	1.18	1.22	1.25	1.29	1.33	1.36	1.40	1.44	1.47	1.51	1.55	1.58	1.62
19	1.09	1.13	1.17	1.20	1.24	1.28	1.32	1.36	1.40	1.44	1.48	1.52	1.55	1.59	1.63	1.67	1.71
20	1.15	1.19	1.23	1.27	1.31	1.35	1.39	1.43	1.47	1.51	1.55	1.60	1.64	1.68	1.72	1.76	1.80
	14000	14500	15000	15500	16000	16500	17000	17500	18000	18500	19000	19500	20000	20500	21000	21500	22000

Using RPM to reduce sound pressure

www.flyingsites.co.uk/howto/noisechart.htm

Flying Sites
The R/C Aero Portal

How To...
Getting Noise Down To Acceptable Limits

www.flyingsites.co.uk
Wed 6 May: 2015

Keep Your Site With Quiet (& Low RPM) Flight!

Noise Reduction Chart- Felbridge Flyers RMFC
(It Can be Done!)

Model	Engine	Prop	Silencer	RPM	DbA
Aero 10	OS 15 FB	8x5 Graupner	Standard + pipe	9.3k	70
Tiger trainer	Th Tigre GP 40	11x7 Kyosho	Std + Mouse	9k	71
Speedy Bee	OS 26 FS	10x6 Graupner	Standard	9.2k	71
Wot 4	OS 40 FP	11x6 Graupner	Std + mute	9.8k	72
O/D	ASP 12	8 x 4 Graupner	Std	9.1k	72
U-Sky	OS 46 LA	11x7 Graupner	Std + anti vib. Mount	9.3k	72
Own 4	OS46LA	11x7 Graupner	Standard	9.2k	73
Commanche	OS 40 FP	11x7 APC	Standard	6.5k	74
High Boy	OS 40 FP	11x6 Master	Standard	9.8k	74
Own design	OS40 Blue	10.5x6 Graupner	Standard	9.5k	75

Model	Engine	Prop	Silencer	RPM	DbA
U-Sky	OS40 LA	11x6 Graupner	Standard + pipe	9k	75
Magnatilla	OS 52 FS	12x6 APC	Standard	9.5k	75
O/D	OS 40 LA	11x6 Graupner	Standard	9k	75
Hi-Boy	OS 46 LA	11x7 Graupner	Standard	9.5k	75
Super Sport	46 SC	11x9 APC	Std + mouse	8.8k	75
Kamco Cavalier	OS 46 LA	11x6 Graupner	Std + outlet tube	9.8k	75
Moronic	OS 46 SF	12x7 APC	Standard	8.8k	75
WOTS WOT	Saito 65	11x7 3 blade	Std + insert	9.4k	75
Tiger Trainer	OS 46 LA	11x7 Graupner	Standard	9.8k	75
Tiger Trainer	OS 46 LA	11x6 Graupner	Std + rubber pipe	10k	75

ama noise study.pdf | bothered_by_noise_l....pdf | pb13761-model-airc....pdf

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9:04 PM 5/6/2015

Methods to reduce sound pressure

Use a canister muffler



Use a Tuned pipe



Change mufflers



Soft mount your engine



Sound at the field

What can be done to reduce the noise foot print of your aircraft.

- Glow/Gas aircraft
 - Use a good muffler, canister or muffled tuned pipe
 - Add a rubber ring the muffler outlet to control ringing of the outlet tube.
 - Soft mount the engine.
 - Reduce propeller tip speed.
- Electric
 - Reduce propeller tip speed.
- Glow/Gas/Electric
 - Keep the propeller away from the airframe. Especially on pusher type aircraft.
- Reduce the number of airplanes in flight at the same time.
 - Sound pressure is a summation of all of the sources.
- Decrease the area you flying over
 - Sound dissipates at 6dB every time the distance doubles.

distance in feet	25	50	100	200	400	800	1600	3200	6400	12800
Sound level in dB	89	83	77	71	65	59	53	47	41	35

My solution

1. Reduce engine RPM by changing the propeller to an APC 15 X10.
2. Create an adapter to allow a Bisson muffler for a Moki 30CC engine to be used.
3. Install the muffler and adapter.

Results:

Sound pressure is now 82 dB at 25'

Side effects:

The engine is now turning 7,000 RPM. This is a 2,000 RPM loss. The airplane still flies well but could use more power.

Future plans

Add a canister muffler since the Bisson muffler seems to restrictive.

References

<http://www.modelaviation.com/basicsofnoise>

<http://www.modelaircraft.org/files/927.pdf>

<http://allrcflight.com/model-aircraft-engine-noise/>

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69542/pb13761-model-aircraft.pdf

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[http://www.kingcounty.gov/council/legislation/kc_code/15 Title 12.aspx](http://www.kingcounty.gov/council/legislation/kc_code/15_Title_12.aspx)