

# Sound Calculations for HVRFC Field, Mufflers, Add-on mufflers, DIY mufflers, policies of other clubs

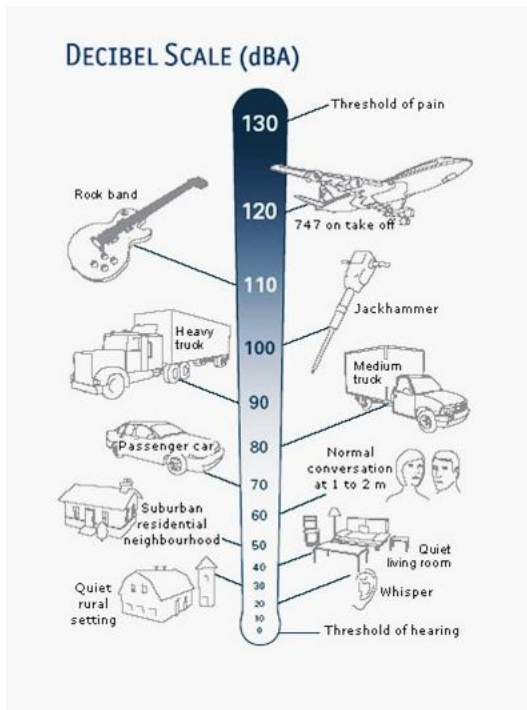
By: Milt Charlton

Updated: October 26, 2017

I do not claim any expertise here. I'm just putting out results of calculations that anyone can do. On Google Earth, the distance from the HVRFC flight line to the apartment building on the SE corner of Steeles and Kipling is about 1,134 feet (345 meters). From center of runway to: New townhouses 1251 feet (379m). To houses SW of Kipling/Steeles 1297 feet, (395m).

Using the calculator at <http://www.sengpielaudio.com/calculator-SoundAndDistance.htm>, we see that noise of 75db at 90' would be cut to 53db at 1,134' at the apartment building. This is about the ambient level in a residential area. As you can see in the chart below, other things such as cars and trucks would be much louder at the apartments than our planes. **If the sound is 88db at 25' then there would be 55db at the apartments.**

Sound loses 6db for each doubling of distance. The sound scale is logarithmic and sensory systems use log coding of intensity. I think the loss of 6db cuts noise in half. Some sites say 3db loss for doubling of distance. Why the difference?



It appears that 88db at 25' (7.7m) would be audible at the apartment but not loud compared to other noise. If the background noise is reduced on weekends or holidays due to reduction in traffic then the 88db plane would be noticeable.

<http://www.masenv.co.uk/noisecalculator> 88db at 25' (7.7m) would be 55db at 345m (1134')

<https://www.easycalculation.com/physics/classical-physics/decibels-distance.php> 25' to 1134' gives loss of -33db. 88db -33=55db

[http://www.engineeringpage.com/cgi-bin/noise/dis\\_one.pl](http://www.engineeringpage.com/cgi-bin/noise/dis_one.pl) 88db 7.7m gives at 54.9db at 345m

What happens if a plane makes **94db at 25'(7.7m)**?

[www.sengpielaudio.com](http://www.sengpielaudio.com) predicts 94db at 7.7m gives 63db at 345m (apartment). That is still less than traffic noise but of course noticeable if traffic noise is lower.

**How loud is a 94db plane flying with a 96db plane and a 98db plane? The total of all 3 planes is just 101.1 dB! Here is a calculator for summing sound <https://www.noisemeters.com/apps/db-calculator.asp>**

## Sound Physics and measurement

From IMAC study [http://old.mini-iac.com/Portals/0/downloads/documents/STF\\_GH.pdf](http://old.mini-iac.com/Portals/0/downloads/documents/STF_GH.pdf)

Basic information about sound, measurement and perception.

<https://en.wikipedia.org/wiki/Decibel>

## Mufflers and After-mufflers

Muffler video <https://www.youtube.com/watch?v=8klnH1vLHbc> "Here in the UK we have a noise limit, it's 82dB, measured from 7 meters." Cheap mufflers don't have baffles.

Silencer plug/insert noise video <http://www.rcgroups.com/forums/showthread.php?t=1701884>

Troy silencer insert <http://www.troybuiltmodels.com/items/TBMDLE20SILENCER.html>

**Snuffler** add-on <http://jtecrwww.jtecrc.com/snufflermufflers.htm> . Reply to a question from Milt about Snuffler: "Milton, It really does depend on the engine size that you are dealing with but you can see anywhere from 3-10 DB reduction in noise by adding the snufflers. As far as the pipe it is a chambered pipe.

If you want to let us know what you looking to use them on we may be able to give you a more accurate db estimation. Let us know if you have any other questions.

Thank you, Kevin Young

JTEC RADIOWAVE

704-799-1658

[www.jtecrc.com](http://www.jtecrc.com) "

Many quality mufflers, canisters, pipes, some model specific <http://www.jtecrc.com/>

Quietest canisters on Flying Giants <http://www.flyinggiants.com/forums/showthread.php?t=201226>

Why are there no dB ratings for mufflers?

IMAC and sound forum 3 pages <http://www.mini-iac.org/The-Hangar/g/posts/t/416/Why-Sound-is-important>

Redwing muffler silencer for DLE 30, 35,55,60 <https://www.youtube.com/watch?v=mQN4-df-rZM> shows installation and a little sound reduction, loss of rpm

Compare DLE30 Pitts mufflers to stock <https://www.youtube.com/watch?v=PfKK69ACvt4>

Hi Milton

We do have several Low DB versions of some of the mufflers we sell. For example the DA 50 or DLE 55 Low db Wraparound has a noise level of 95db @ 10 feet turning a 23 x 8 @ 6300 rpm. The smaller baffled Wraparound mufflers for 20cc to 33cc are down to approximately 92 – 93db @ 10 feet.

What are your sound restrictions set at? And what size of engine is most popular at your field?

Regards Lance Bisson, Bisson Mufflers, 9 Moffat Rd., McKellar, Ontario

Canada, P2A 0B4, (705) 389-1156

[www.bissonmufflers.com](http://www.bissonmufflers.com)

**From:** Milton Charlton

**Sent:** Thursday, September 29, 2016 12:21 PM

**To:** [sales@bissonmufflers.com](mailto:sales@bissonmufflers.com)

**Subject:** extra quiet mufflers needed

Dear Bissons,

Our club, Humber Valley RC Flyers (HVRCF.ORG) has a flying field in an urban environment on the edge of Toronto. We have had noise complaints from nearby residents. Part of the problem is due to prop ripping and part to exhaust noise.

While researching mufflers, it seems that most attention is paid to best engine performance and not lowest noise. I would like to encourage the development of mufflers with much higher attenuation of noise than presently available. Such a development might allow preservation of fuel engine flying at our field and many others threatened by noise complaints. Naturally, it would be good for your business if fuel engines continue to be used. I realize that there would be power and weight penalties if mufflers were made quieter but I think many pilots would prefer those trade-offs instead of mothballing their fuel planes.

Some of our club members might participate in testing new muffler designs. We have a sound meter with which to compare results.

Please let me know if there is any likelihood of quieter muffler designs coming along and whether we can help with that.

Yours sincerely, Milton Charlton, Program Director, Humber Valley RC Flyers

## **DIY Mufflers: Yes you can can! (sorry Obama)**

DIY muffler for DLE 20 <https://www.youtube.com/watch?v=EuCHJx8L7ul>

RC Nitro Helicopter Homemade Muffler - Video 1 of 2 <https://www.youtube.com/watch?v=kDuoDZZWpHQ>

Video 2 <https://www.youtube.com/watch?v=kDuoDZZWpHQ>

Selfmade RC Silencer made from copper pipe parts probably silver solder. On RC car

<https://www.youtube.com/watch?v=XSD3i8GugV4>

Have a ball! **Webra Speed .32 Model Engine with Ball Type Muffler** . OK, the sphere has the largest volume per weight of any shape so that is good but-- [https://www.youtube.com/watch?v=U6M-c\\_2nuxY](https://www.youtube.com/watch?v=U6M-c_2nuxY)

rc nitro car silencer <https://www.youtube.com/watch?v=DLNzXYJpZnl>

Tony Phan demo <https://www.youtube.com/watch?v=tFzP0kivk-g> <https://www.youtube.com/watch?v=8SR9k4uQ5wE>  
<https://www.youtube.com/watch?v=vwr2Qe78d9M> <https://www.youtube.com/watch?v=soG-KcOFk2U>

Beautiful multichamber DIY canister <http://www.rcuniverse.com/forum/gas-engines-142/4222862-home-build-cannister-mvvs-116-a.html#post4222862>

Welding aluminum " DuraFix aluminum welding rods work well just using a propane hand torch."

<http://www.durafix.com/index.html> -some failures of welds

Al-braze aluminum brazing <http://www.harrisproductsgroup.com/en/Products/Alloys/Brazing/Aluminum/AL-Braze-1070.aspx>

Heavy duty beer cans. Drink your brew and make a muffler. Lots of pictures and ideas in this thread.

<http://www.flyinggiants.com/forums/showthread.php?s=01e91be368d2103bee8a1b0aa81ca362&t=6322>

## **Trouble and Policies of other clubs**

Trouble with neighbours 7 April 2016 <http://weartv.com/news/local/homeowners-dispute-with-airplane-club-over-noise-from-planes>

Still Trouble with neighbours 9 April 2016 <http://weartv.com/news/local/noise-dispute-continues-between-homeowners-and-plane-club>

AMA Sound/Noise Abatement Recommendations [www.modelaircraft.org/files/927.pdf](http://www.modelaircraft.org/files/927.pdf)

Some AMA advice and examples [www.modelaircraft.org/insider/09\\_07/Less%20Noise.htm](http://www.modelaircraft.org/insider/09_07/Less%20Noise.htm)  
[http://www.modelaircraft.org/insider/13\\_11/13Insider11.pdf](http://www.modelaircraft.org/insider/13_11/13Insider11.pdf)

Flying faster than pitch <http://www.rcgroups.com/forums/showpost.php?p=231096&postcount=5>

Another club's rules <http://www.capitalcityflyers.com/sound-testing.html>

**A Toronto area club** <http://www.rcfctoronto.ca/safety.html> "Noise Level: All aircraft must meet the designated sound level determined by the club executive. At the moment this is under review. The executive is suggesting that the maximum noise level would not exceed that which is produced by a 50cc gas powered engine turning a standard 23" x 8" propeller and using a standard muffler. Any aircraft failing to meet this level is prohibited from flying until it meets the requirement." An exec at RCFCT reports that they have many noise complaints and most are on weekends. IMAC flyers gave up. Their field is east of Steeles and Markham Road. There are residences even closer than at HVRCF but there is no major road immediately near the residences.

A UK thread: "**Poor quality silencers threatening flying sites? Lots of info on mufflers , policies, DIY mufflers.** <http://www.modelflying.co.uk/forums/postings.asp?th=54679&p=1>

## **Townhouse development immediately west of cricket pitch:**

[http://www.cbre.ca/AssetLibrary/Woodbridge\\_Park\\_Towns.pdf](http://www.cbre.ca/AssetLibrary/Woodbridge_Park_Towns.pdf) -picture of site boundary looking west from HVRCF field.

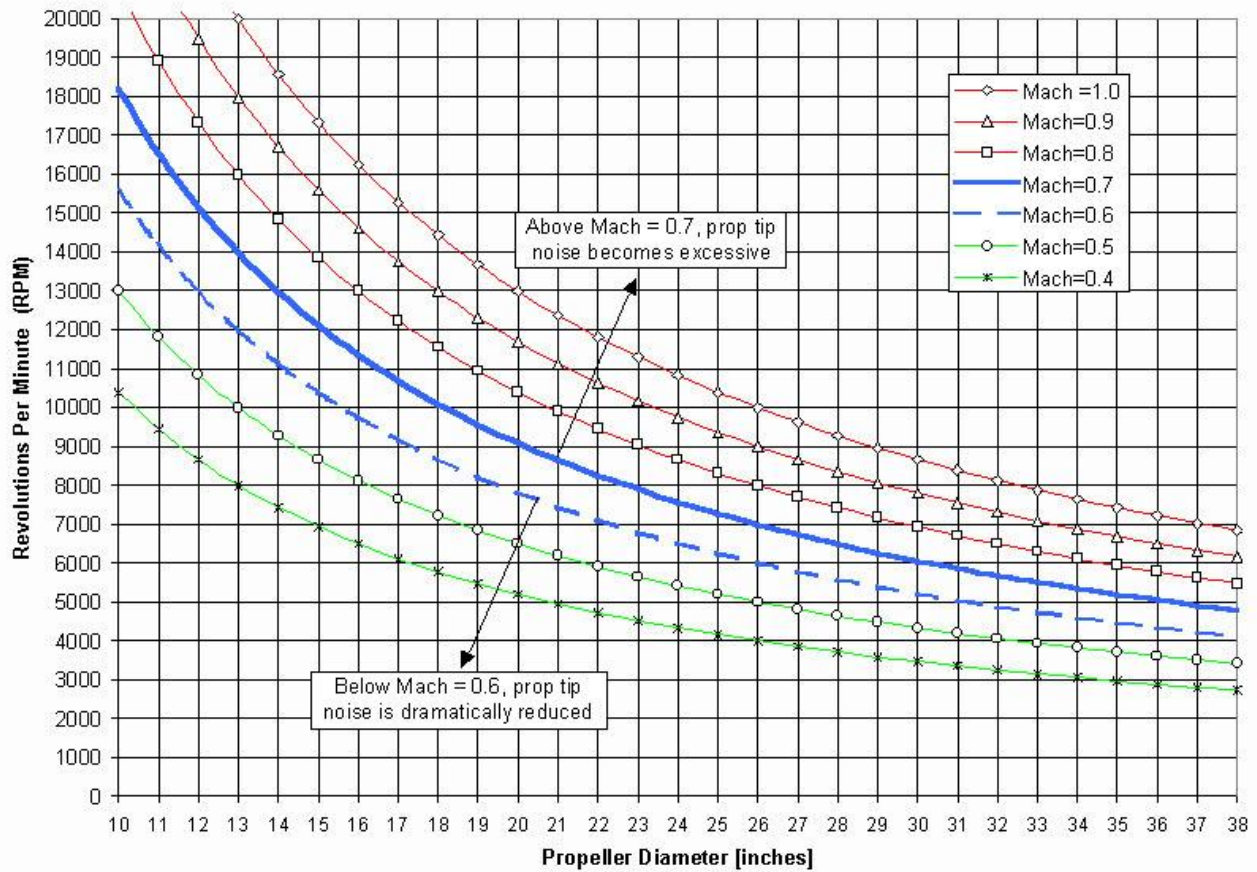
<https://fortressrealdevelopments.com/projects/kipling-court/>

"Woodbridge Park is a 14.8 acre site planned as a low-rise townhouse development. The current plan calls for 256 townhomes, 118 traditional towns and 138 back-to-back towns. Additionally the site will include two 3-storey mixed-use buildings, including commercial at grade and residential rental units above. Located just north of the municipal border of Vaughan and Toronto, on Steeles Avenue just north of Kipling road – "

<http://woodbridgepark.ca/>

**Prop ripping prediction nomogram originally posted by Andrei. From IMAC study. Try to keep prop tip speed under Mach 0.7 to avoid ripping.** IMAC 2005-2006 Sound Task Force mentioned in January 2010 HVRCF Flyer!

Figure 1. Propeller Tip Mach Numbers (@ 75 degree F, ambient temperature)



## Basic sound

Decibel is 1/10 of a Bell (Alex.G. Bell).

Used to measure the ratio of sound to the threshold of pain sound level.

$\beta(\text{dB}) = 10 \log_{10}(I/I_0)$  where  $\beta$  is intensity ratio in dB,  $I$  is intensity of sound in units of power/area and  $I_0$  is intensity at threshold of pain  $10^{-12}$  watt/m<sup>2</sup> or 20  $\mu\text{Pa}$  of pressure amplitude. // some sources have  $\text{dB} = 20 \log I/I_0$  see below

The decibel (abbreviated dB) is the unit used to measure the intensity of a sound. The decibel scale is a little odd because the human ear is incredibly sensitive. Your ears can hear everything from your fingertip brushing lightly over your skin to a loud jet engine. In terms of power, the sound of the jet engine is about 1,000,000,000,000 times more powerful than the smallest audible sound. That's a big difference!

On the decibel scale, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1,000 times more powerful than near total silence is 30 dB. Here are some common sounds and their decibel ratings: Near total silence - 0 dB

A whisper - 15 dB

Normal conversation - 60 dB

A lawnmower - 90 dB

A car horn - 110 dB

A rock concert or a jet engine - 120 dB

A gunshot or firecracker - 140 dB

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Measuring sound <https://www.ehp.qld.gov.au/licences-permits/pdf/noise-measurement-manual-em1107.pdf>

Air or sound pressure is measured in Pascals (Pa) but is expressed as a sound pressure level ( $L_p$ ) in decibels (dB), which is a logarithmic scale used to compress the range of audible sound pressure. The relationship between sound pressure and  $L_p$  is as follows:  $L_p(\text{dB}) = 10 \log(p^2 /$

$\text{pref}^2) = 10 \log( p / \text{pref} )^2 = 20 \log ( p / \text{pref} )$  //OK that explains  $20 \log P/\text{Pref}$  but why was it squared?

Where  $L_p$  = sound pressure level (dB)

$p$  = sound pressure (Pa) and  $\text{pref} = 2 \times 10^{-5}$  - reference sound pressure (Pa)

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## Sound unit

From Wikipedia, the free encyclopedia

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A **sound unit** is any acoustic unit of [sound](#) measurement.

- [dB](#), decibel - noise of sound measurement is called decibels (dB). Ratio of the sound pressure to reference pressure to something.
- [sone](#) - a unit of perceived loudness equal to the loudness of a 1000-hertz tone at 40 dB above [threshold](#), starting with 1 sone.
- [phon](#) - a unit of subjective [loudness](#).
- [Hz](#), hertz = unit of sound frequency is called hertz (Hz)