Part #46
The Stealth Rotax

by Mike Stratman

Stealth - the high tech wonder of the '90's. An aircraft that does not announce it's arrival ahead of time can do a lot of things not possible in the past. Ask Saddam Hussein! US Air Force F-117 Nighthawks prowled the night skies over Baghdad virtually at will, invisible on radar. The frustrated Iraqi gunner's only defense was to spray anti-aircraft fire wildly into the night sky, hoping an F-117 would be unlucky enough to get in the way.

While your Ultralight may already have a minimal radar signature, reducing powerplant noise can also go along way in improving your flying enjoyment as well as keeping peace with the neighbors. through the use of several options available from Rotax, the decibel output can be substantially reduced.

Rotax factory Silencer Kits are not a new option. They are actually quite common in Europe where strict dB regulations make them nearly mandatory. I have heard some Ultralight clubs in the US that require members install these options in an effort to appease the neighbors and hold on to club flying sites. This month we'll examine what's available from Rotax and what changes you can look forward to when installing these kits. While the extra weight and mounting considerations require some compromising, the reduction of dB output can be substantial.

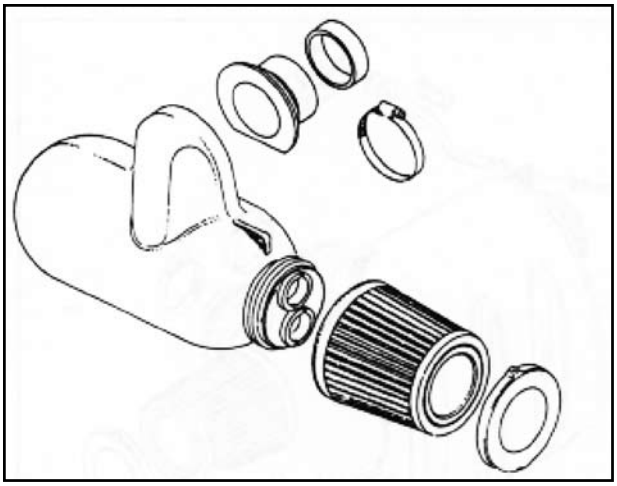

Figure #1 - The Single Intake Silencer Kit will fit any Rotax engine with one carb and does an excellent job of eliminating intake noise. Some addition mounting is required.

Aircraft dB Sources: The noise produced by most any powerplant comes from three different sources. Carb Intake, Exhaust pipe, and propeller noise. While there is no way to silencer prop noise, you can design the gear box and prop combination to make the minimum amount of noise. The rule to follow here is that a big prop turning slow will always produce less noise than a small prop turning fast. Early ultralights running 36" direct drive props got a much deserved rap for obnoxious hi pitched noise levels. The small diameter prop turning over 6000 rpm was the epitome of poor propeller efficiency. The tips were traveling near the speed of sound, chopping the air in an incredibly inefficient manner. For the early years it was a simple but crude way to get airborne. Taking the same powerplant and installing a reduction drive proved to not only reducing noise levels dramatically but improved thrust by at least a factor of 2X. Choosing the right prop is a whole subject by itself that is handled in complete detail in "The Proper Care & Feeding of the Rotax Motor" . See Parts # 5, 6, & 31 for more on prop selection.

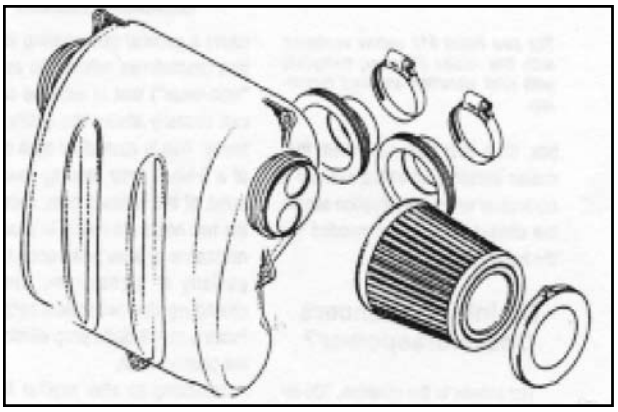

Figure #2 - The large dual intake box measures a substantial 12" x 12" x 6". The air cleaner can be mounted on either side allowing some flexibility.

Single Intake Silencer Kits - To the surprise of many the intake airbox system reduces the loin's share of noise when compared to the Rotax After Muffler Kits. Carb intake noise amounts to a large percentage of powerplant noise. Using a plastic airbox assembly that fits on in place of the standard air filter, much of the intake noise is contained and deafened here. While Intake Silencers do an excellent job, they are less than aerodynamic and can be a pain to mount securely. While the airbox must be fairly large to act as a sufficient sound dampener, it is lightweight tipping the scales at 16 oz. See Figure #1 for the single carb intake silencer kit # 12207 (also referred to as # SISK, or Single Intake Silencer Kit).

Just using the carb flange and hose clamp arrangement to hang the airbox is not sufficient. More than one airbox has been launched through the prop when mounted only in this way. "Ears" on the corners of the airboxes should be secured to some sort of structure attached to the engine block. The air filter is a K&N #CM-0300 that threads on to the airbox and is secured by a #825-520 Cover Plate and safety wired to the airbox "ears".

Dual Intake Silencer Kits - For any dual carb engine a universal kit is available to cover any aircraft engine model. A pair of eccentric rubber sockets allows the same kit to fit the different Carburetor center line spreads. The airbox used on the dual kit is again quite large and less that aerodynamic. But here is where the sound dampening takes place making the size of the airbox a necessity.

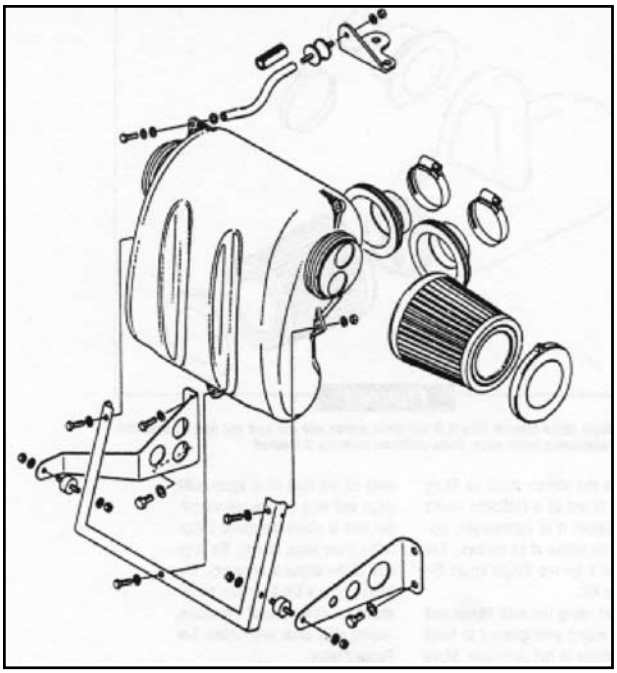

Figure #3 - The new Rotax 618 comes equipped with this Intake Silencer complete with slick vibration isolating mounting.

The thread on K&N filter can be installed on either side of the airbox helping clear other assemblies. See Figure # 2 for parts breakdown. Specify Part #12105 or DISK (Dual Intake Silencer Kit).

Rotax 618 Silencer Kit - Until recently a secure mounting system was left to the builder to fashion. With the advent of the 75 HP 618 an intake silencer is now standard equipment when purchasing the engine kit from Rotax. Complete mounting hardware including vibration dampeners and three point mounting system is part of the silencer assembly. This hardware can also be used on the Rotax 532-582 engines where space permits. This kit uses the side bosses on both ends of the crankcase to carry the main mounting brackets. These bosses are commonly used in snowmobile and other applications for engine mounting instead of the four base studs used in the aircraft business. The top corner of the airbox is attached to the head studs as shown in Figure #3. Rubber bushings support the main mounting frame that holds the perimeter of the airbox. A neat finished system that makes installing an intake silencer a no brainer when the situation allows the considerable space needed for the assembly. Use Part # 618DISK when ordering this complete assembly.

Do Intake Silencers Cost Horsepower? - This question depends on whom you talk to. The factory claims little or no horsepower loss. Field reports suggest a few percentage points. With today's high performance engines the loss of a few ponies is generally not a big problem. At any rate you will need to rejet the main jet due to the increase in air restriction. A drop in the main jet size from 15 to 20 points is necessary when using an intake silencer. See Figure #4 for the Bing Recommended Jetting. You will note the A, B, & C footnotes indicating how the engine is equipped. Intake silencer or not. Obviously when entertaining tech calls on carb jetting I am forced to ask the question "Do you have an Intake Silencer?" which is usually followed by the response "What's an Intake Silencer?" If you don't know what it is odds are high that you do not have one.

After Muffler Kits - As mentioned before the exhaust outlet is another source of aircraft noise. An unmuffled exhaust outlet produces a pop or pulse as the gases exit. It has long been known that a 2 to 1 reduction ratio can cause a peculiar slow pulsing vibration (sometimes referred to as the "waa-waas") that in extreme cases can actually shake the entire airframe. This is caused each blade of a two blade prop passing near the pulse of the exhaust note. Because the two notes are nearly in phase a resonance or slow pulse occurs especially at higher RPM's. Simply changing the reduction ratio or moving to a three blade prop eliminates the phenomenon. Installing an after muffler helps quiet the exhaust note as well as change the noise frequency. To get this job done Rotax offers two different exhaust silencing kits. While both are equally effective installation is offered in either weld on or bolt on kits.

Weld On After Muffler Kits - Any Rotax exhaust can be outfitted with this inexpensive kit with a few welded joints. The after muffler is a "straight thru" chamber that offers no flow restriction. The exhaust note is deadened by the chamber and the additional length of the systems. Most any muffler shop can gas weld this assembly for anywhere between $20 to $30 in a matter of a few minutes. See Figure #5 for parts breakdown.

If you fly in the west where fire danger is a public concern you can often convince local law enforcement that this unit is really a spark arrestor and that you are in compliance. This unit weights in at 3.5 lbs. complete. Specify Part # 12205 or AMKW After Muffler Kit Weld-on.

Recommended Jetting for Bing Carburetors

Engine Type → / Tuning Component ↓	Rotax 277 (A)	Rotax 277 (B)	Rotax 377 (A)	Rotax 377 (B)	Rotax 447 (A)	Rotax 447 (B)	Rotax 447 DC (A)	Rotax 447 DC (C)	Rotax 503 SC (A) Up to #3785371	Rotax 503 SC (B) Up to #3785371	Rotax 503 SC (A) After #3785372	Rotax 503 SC (B) After #3785372	Rotax 503 DC (A)	Rotax 503 DC (C)	Rotax 532 SC (A)	Rotax 532 SC (B)	Rotax 532582 DC (A)	Rotax 532582 DC (C)	Rotax 618 DC (A)	Rotax 618 DC (C)
Main Jet	148	140	165	155	165	155	135	128	180	158	185	165	158	148	195	170	185	145	158	135
Idle Jet	45	45	45	45	45	45	50	50	45	45	45	45	45	45	55	55	55	55	55	55
Needle Jet	2.72	2.72	2.70	2.70	2.70	2.70	2.70	2.68	2.74	2.74	2.72	2.70	2.70	2.68	2.74	2.74	2.72	2.68	2.72	2.70
Jet Needle	BL2	BL2	B02	B02	15K2	15K2	6G1	15K2	8G2	6H2	15K2	15K2	11K2	11K2	15K2	15K2	11G2	15K2	15E5U	15E5U
Clip Position	2	2	2	2	2	2	3	2	3	3	3	3	2	2	3	3	3	3	3	3
Airscrew (Turns out)	1.0	1.0	0.5	0.5	0.5	0.5	1.0	1.0	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0

(A) Without Rotax Intake Silencer Kit, tested with K&N filter #RC 1200
(B) With Rotax Single Intake Silencer Kit, with K&N filter #CM 0300
(C) With Rotax Dual Intake Silencer Kit, with K&N filter #CM 0300

Figure #4 - The Bing Recommended Jet chart includes specs for engine with and without intake silencer. Specs subject to change without notice.

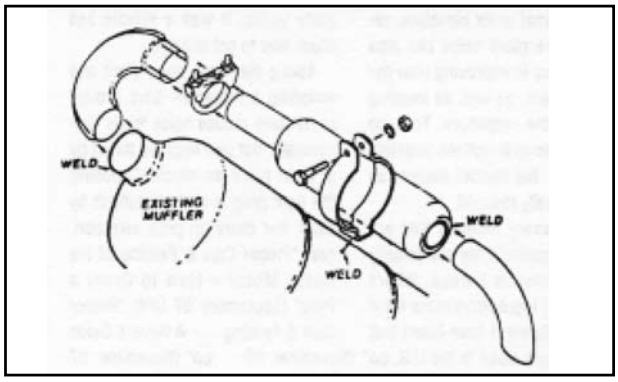

Figure #5 - This after muffler kit can be installed by most any muffler shop in 20 to 30 minutes.

Clamp-on After Muffler Kit - This unit is designed for those of us that don't want to hassle with a trip to the muffler shop. You must have a new style exhaust canister with the outlet spout ready to except the clamp-on 180 degree elbow. If you have the bent outlet common on older ex

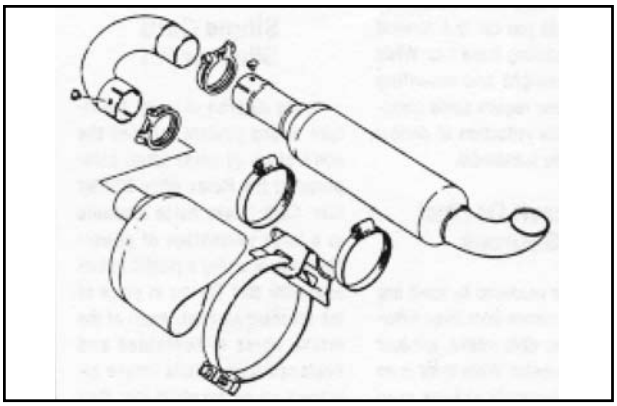

Figure #6 - This after muffler kit is an easy bolt-on unit that can be installed in minutes with simple hand tools.

haust systems some cutting and welding is going to be necessary. This clamp-on kit is a well thought out unit that includes special security pins that position the joint clamps and keep them from sliding. While there are no torque specs are given for the fasteners common sense is essential when tightening this unit in place. Excessive torque can cause parts to crack. Safety wire installed at strategic points is an excellent precaution. see Figure #6 for parts breakdown. The entire kit weights in at about 4 lbs. Specify Part # 12103 or AMKC or After Muffler Kit Clamp-on. Installation time should be about 15 minutes with simple hand tools.
As with any exhaust component careful inspection and preflight procedures are a must. Exhaust parts that crack and separate are notorious for destroying propellers and have been credited with some real nasty in-flight situations. Personally I think the weld on type professional installed would be likely to last the longest and be less likely to fail than the clamp-on type that includes twice as many parts.

The RK400 Prop Clutch - Not really designed with Stealth in mind, the addition of this item can silence ground operation greatly. Gear box capabilities have not kept pace with the trend to larger and larger props. The limited flexibility of certain parts in the gear box have a difficult time allowing the powerplant to operate smoothly under starting or idle conditions. The RK 400 Clutch is a centrifugal clutch unit that only engages the prop when the engine exceeds 2500 rpm. Replacing the rubber hardy disc and flywheel in the “C” Gearbox the unit is an easy bolt on conversion. As rpm increases the spring tension holding the shoes retracted is over come engaging the outer ring and starting the propeller. The advantages here are huge. First, starting is accomplished without prop load. Recoil hand starting requires only a pull against compression. Short strokes inside cockpits are much more likely to succeed. Secondly, idle speeds as low as 1000 rpm are possible, making warm up and ground operations incredibly quiet. Third, because the prop disengages below 2500 a “non-powered” decent is now possible allowing more attitude control by the pilot. Finally, the RK 400 makes prop inertia restrictions much less restrictive. As detailed in “The Proper Care & Feeding of the Rotax Motor” Part #31 “Measuring Prop Inertia”, gearboxes have limitations as to how big a prop that can be swung. This limitation is primarily based on how much flexing is available from the gearbox flex joint. Over propping causes a poor idle or difficult starting. Because this joint is replaced by a disengaging clutch prop inertia is limited only to the strength of the physical mounting system, i.e. there obviously is a point at which you could literally rip the box from the crankcase using an oversize prop. The use of the higher ratios and large diameter props (remember the reduced noise from a large prop turning slow we mentioned in the beginning) are now possible. This completes the equation for the true Stealth Rotax. See Figure #7 for parts illustration. Note that all the parts indicated by arrows are removed from a stock “C” box and replaced by the RK 400.

It must be noted that the RK 400 is an aftermarket product that is not produced or endorsed by the Rotax factory. Because the “C” Gearbox is not used in large qualities, a limited number of RK 400 units are in the field. They have been available for several years so they are a well-tested product. The reports I hear from owners of the RK 400 is a real love affair. It does everything we discussed here and does it automatically. There is a possibility that a similar clutch will be available for the “B” gearbox in the future. This could really revolutionize current powerplant systems because of the huge popularity of the “B” box. For now please don’t call CPS to buy a unit for a “B” box. CPS has an exclusive deal to import the RK clutches and a big announcement will be made when proper development and testing is completed.

Summary: When the major sources of noise are addressed individually substantial reduction in dB outputs can be excepted. All these kits are reasonable priced and easy to install. My suggestion is to start with the intake silencer because it is the most effective and then move to the after muffler kits to quiet things further. Unfortunately, the intake silencer is usually too large to be used on enclosed engine compartments. Check your aircraft for obstructions before making the purchase.
It has long been obvious that street machine owners who love a loud exhaust system get the most attention from the local police. The same can be said about a loud and obnoxious aircraft, your welcome can wear thin after a short time.