SCALE MATTERS: ARTICLE 8

SOPWITH PUP 1/3 Scale

By John Armarego

This 8th article features information on some additional detail on my 1/3 scale Sopwith.

Insert Photo Opening photo

'Scale Matters' article 8, is a continuation of the previous article and provides information and background around some more functional detail . Again I have used my 1/3 scale Sopwith Pup as the example in this article. This aircraft was presented in my introductory article in a previous edition of *Airborne*.

The maximum enjoyment when flying your scale master piece can only be achieved when you have the upmost confidence that your engine will perform faultlessly. For reliable engine running it is important to provide adequate cooling as well as easy access to the engine so that tuning and servicing can be performed with ease. Don't design your aircraft so that it is difficult or complicated to work on.
I enjoy flying my aircraft down the strip low and very close to the stall, I think that looks spectacular and it really highlights the aircrafts ability to fly on the wing. I am always amazed at how slowly a well setup aircraft can fly.

When flying low and slow is imperative that you have a reliable idle and smooth transition. If the aircraft starts to drop into a stall, slight application of down elevator and a little throttle will soon generate laminar flow over the aerofoils and the wings will be creating lift again for a smooth continuation of forward flight.

I always setup my engines and run them in while installed in the aircraft. It is important that the engine is tuned and setup as close to the conditions that it will be flying in as possible. Apart from basic tuning one of the most important tests is to ensure the effectiveness of the cooling that your cowled installation is going to provide.
The engine installed in my 1/3 scale Sopwith pup is the magnificent Saito FG-57cc twin cylinder 4 –stroke petrol engine. There is no substitute for quality and this is truly a delightful engine in every respect.
Before I start any of my engines for the first time, particular four stroke engines, I ensure that they are well lubricated. In my petrol 4 stroke engines I use Castrol super TT and I run them on a ratio of 25:1 Before I run my engines for the first time I ensure that they are well internally lubricated. I remove the rocker covers and with a syringe I inject straight super TT oil into the pushrod tubes and also lubricate the valve guides and rockers. I also inject about 15-25 ml of supper TT into the crankcase breather to ensure that the bottom end is also well lubricated. Any excess oil will be blown out of the breather anyway. I also remove the spark plugs and inject an oil rich mixture of fuel into each cylinder. I then hand crank the engine a few dozen times to ensure that the oil finds its way to all the moving surfaces. This is my method of ensuring that there is no way that I can get a dry start or seize a new engine due to overheating. This is particularly important when an engine is installed in a scale installation that may not offer the most ideal cooling arrangement. Overheating conditions will usually be the most apparent with a new tight engine due to additional friction heating. I monitor the temperature of the engine during the initial runs and I usually make the ground runs quit short. If I suspect any overheating issues I will correct the problem quickly. You will find with the Saito Twin that you can set the mixture for one cylinder correctly and will have to run the other cylinder a bit rich, this is due in most part to the fact that the cylinders have different intake track lengths. Do not/not set one cylinder correctly and the other one lean. Always run the engine a bit fat (rich). I do not fly my aircraft for the first time until I am 110% confident in the engines performance or installation. This is the best way to get to know the engine and keep adjusting and running it until you have the upmost confidence. This is also a good opportunity to check if anything works loose or needs attention. This stage of the preparation can be very enjoyable and should not be rushed.

Cowl Mounting

When mounting the cowl on the Sopwith pup I did not want to use screws or bolts around the outside of the perimeter of the cowl in the usual way as they would look unsightly on this scale cowl. Photo 2 shows a bolt mounted to the inside of the cowl, there are two bolts one on each side of the cowl. These bolts line up with holes in the fire wall. Wing nuts are attached to these bolts through the inspection hatches on each side of the cowl. The inspection catches provide easy access to these cowl attachment wing nuts and one the wing nuts are tight, closing the hatches prevents the wingnuts from loosening. This has proven to be a very effective way of attaching the cowl and it makes it very easy and quick to remove the cowl and gain the necessary access.

Insert Photo 1 Sopwith Pup Cowl with dummy Le Rhone radial mounted.

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Insert Photo 2
Cowl mounting bolt fixed to ply ring. Note: foam mounted in the cowl to prevent the air taking the easiest path out past the internal baffles

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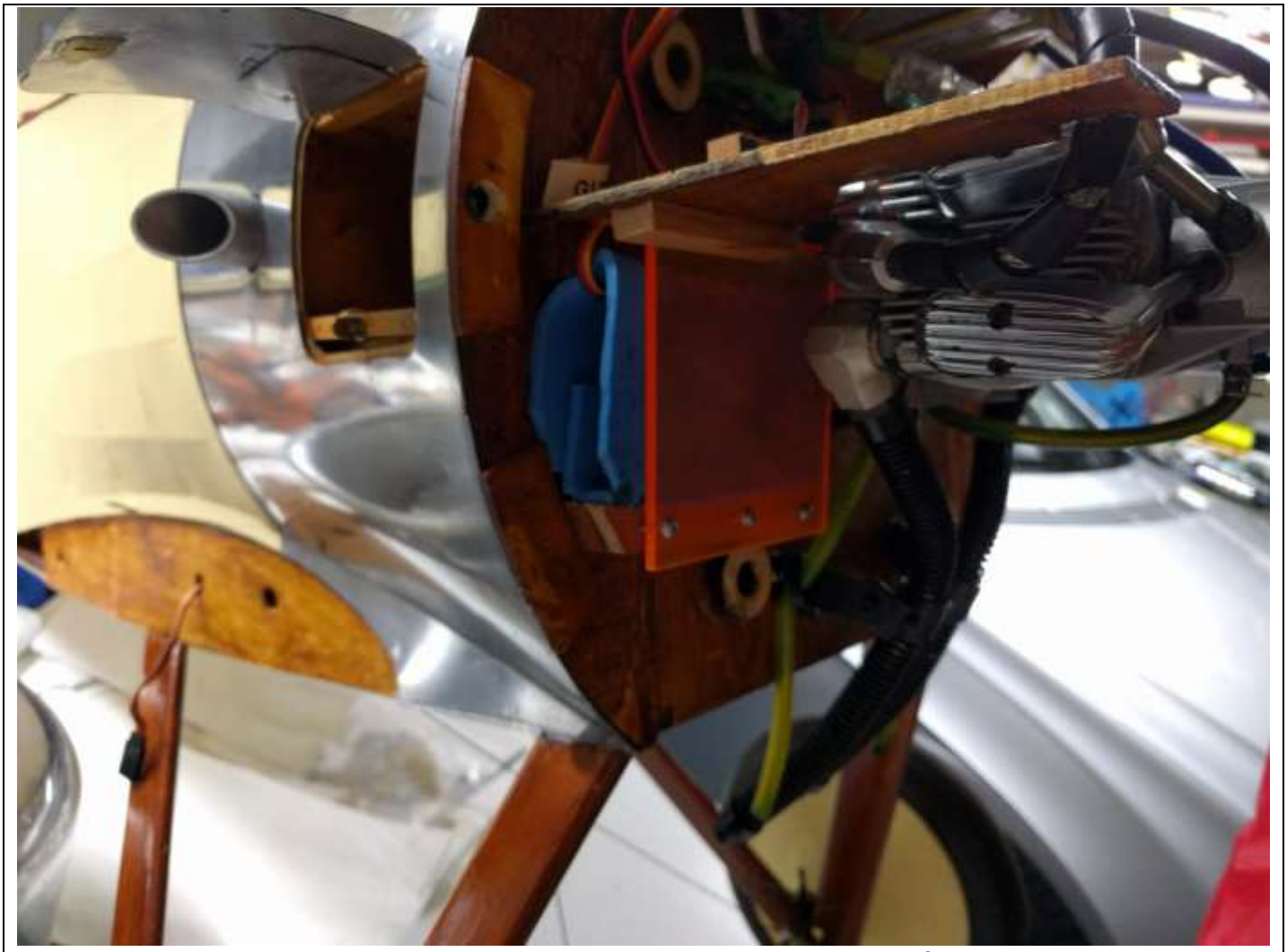
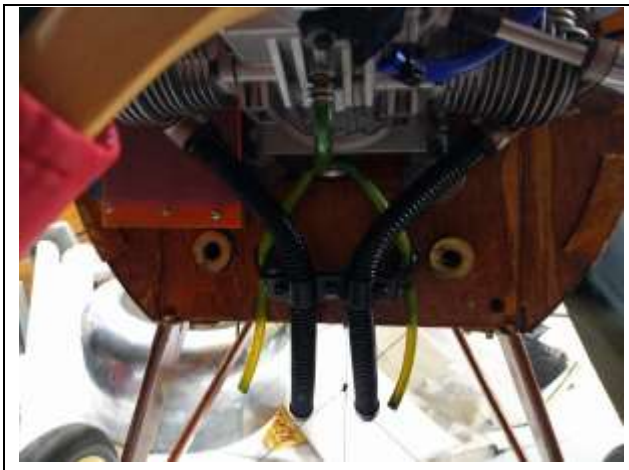


Insert Photo 3 Right hand side hatch opened, the hole in the cowl can be seen for the cowl bolt.

Dummy Engine Mounting

Once the cowl is removed the dummy engine is mounted on four dowel rods that line up with four brass tubes in the fire wall. The dummy engine is simply removed by pulling it forward and sliding the dowels out of the tubes see photo 4.

Insert Photo 4 Dummy engine and four dowel rods being slide out of the four locating tubes in the cowl.



Insert Photo 5,6 Brass tubes mounted in the fire wall for the dummy engine mounting rods.

The dummy engine frame can be seen in photo 7. You can see the four mounting dowels and you can also see four dowels ply disks glued to the dowels , these are stoppers so that I know when the dummy engine is all the way inserted into the firewall tubes. This is important as the centre of gravity of the aircraft can be adjusted by moving this assembly forward or back.

Sound System

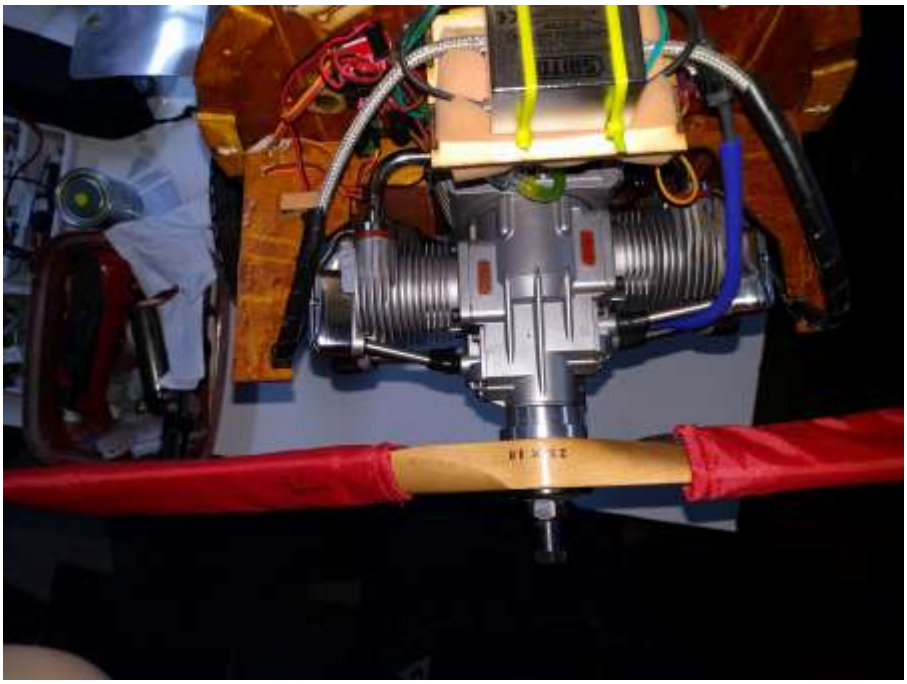
You can also see 2 x 200watt speakers mounted to the back of the dummy engine. These speakers are for the sound system. The sound system is an MP3 player sound board which can play any range of sounds that you can record or obtain and load onto the MP3 player. Currently I have the sound of a real Vickers gun firing. The Vickers gun sound file is played in loop mode along with muzzle flashing of the gun when I activate one of my transmitter switches.

Insert Photo 7 2 x 200 watt speakers mounted to the dummy engine along with audio board and amplifier.

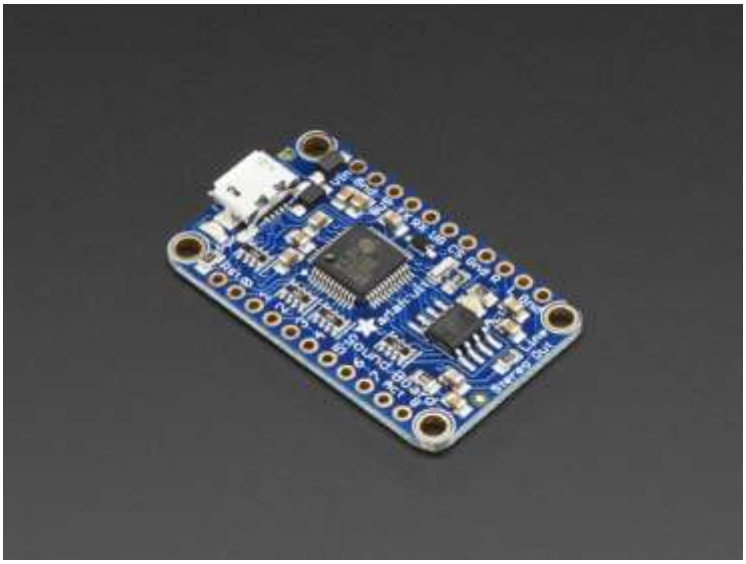
Insert Photo 8 Bottom view of the baffles around the engine cylinders.

Cooling Baffles

Photo 8 and 9 show the ply wood baffles constructed to force the air around the cylinders of the Saito Twin. The air will always take the easiest path, you have to make the easiest path for the air to take to be around your hot bits. The cowl is open at the front and to stop the air passing straight out to the bottom back of the cowl and taking the path of least resistance, the baffles have been designed to force the air around the fins and as close to the engine as possible.



Insert Photo 9 Top view of the baffles, note the gap on the outside of the baffle with respect to the fuselage diameter, this is filled in with the foam that is mounted in the cowl. This was designed this way so that the cowl could be easily removed and that this space was filled in to stop the passage of air.



Insert Photo 10 Adafruit Audio FX Mini Sound Board - WAV/OGG Trigger - 2MB Flash $22.49.

Sound System

The hart of the sound system on my Sopwith Pup is the fantastic Adafruit Audio FX Mini Sound Board - WAV/OGG Trigger - 2MB Flash $22.49.

The Sound Board has a lot of amazing features that make it very useful for aeromodelling sound effects:

Basic specification form there web page www. http://core-electronics.com.au

- **No Arduino or other microcontroller required!** It is completely stand-alone, just needs a 3 to 5.5VDC battery
- **Small** - only 1.5" x 0.9"
- **Built in storage** - yep! you don't even need an SD card, there's 2MB of storage on the board itself. Good for a few minutes of compressed stereo, and maybe half a minute of uncompressed stereo. Double that if you go with mono instead of stereo. **If you need more space Adafruit have a 16MB version here**
- **Built in Mass Storage USB** - Plug any micro USB cable into the Sound Board and your Windows computer, you can drag and drop your files right on as if it were a USB key
- **Compressed or Uncompressed audio** - Go with compressed Ogg Vorbis files for longer audio files, or uncompressed WAV files
- **High Quality Sound** - You want 44.1KHz 16 bit stereo? Not a problem! The decoding hardware can handle any bit/sample rate and mono or stereo
- **8 Triggers** - Connect up to 8 buttons or switches, each one can trigger audio files to play
- **Stereo line out** - Right and Left, AC-coupled audio out. Use headphones, powered speakers or even wire up one of Adafruit's amplifiers to make loud sounds.
- **Five different trigger effects** - by changing the name of the files, you can create five different types of triggers which will cover a large range of projects *without* any programming
- **Control over UART** (9600 Baud) via any microcontroller, Adafruit have an Arduino Library for basic control over playback and volume.

What do Adafruit mean by trigger effects?, depending on your project you may need to have audio play in different ways. Adafruit thought of the five most common needs and built it into the Sound Board so you just rename the file to get the effect you want. With the Sopwith Pup by loading the machine gun sound file into the device and naming the file T01HOLD.wav means that when input pin 1 is activated the audio file is played in repeat mode and continuously played the Vickers gun sound.

The sound board is designed to be simple: it does not have polyphonic ability, can't play MP3's (MP3 is patented and costs $ to license, so this board uses the similar but not-patented OGG format, there's tons of free converters that will turn an MP3 into OGG).

Adafruit designed this board specifically for people who wanted to make props, costumes, toys, and other small portable projects. Check out the tutorial on their webpage for all the powering options. For my Sopwith pup project I used a model aircraft BEC to power the sound board and a audio amplifier from Jaycar, hobby king also have suitable audio amplifiers.

I have found one of the easiest receiver activated switches to turn devices on and off is to use DC brushed motor controllers. They are now very cheap and if you set then up to be on or off they can be used as very effective high current switches. You can also use Turnigy receiver controlled switch SKU: 9107000266-0 they are around $8.00 each Maximum current and voltage 10A / 30v and weight is around 7 grams. I used to use a range of products from FIRMTRONICS that were very good but they seem to have disappeared.

Insert Photo 11 HobbyKingAudio amplifier

Specs:
Supply voltage: **9.6-18V** (4S LiPo recommended)
Output power: **4 x 40W at 2 Ohm, THD=10%, 14,4 V**
Recommended speaker impedance: **4 Ohm**
Dimension: **55 x 50 x 35mm**
Weight: **40g,** incl. heat sink

Audio Amplifier Kit 2x 38W - STA540 http://core-electronics.com.au/audio-amplifier-kit-sta540.html
SKU: KIT-09612 $45.57

Insert Photo 12 Audio Amplifier Kit 2x 38W - STA540

Insert Photo 13 Turnigy receiver controlled switch SKU: 9107000266-0

Wiring the Sound System

A standard receiver mechanical switch is used to connect a 3 cell Lithium battery to power up the amplifier and the BEC. The BEC powers up the MP3 sound board. A receiver activated switch is used to activate one of the 8 input control lines (Triggers) on the sound board when you want the recording to start. A previously loaded sound file is loaded in to the sound board through the USB interface on the sound board. The name of the sound file will cause it to be played when the corresponding trigger is activated. The naming convention of the file will also cause it to either repeat play or only play once. The receiver activated switch also activates a 555 timer circuit that flashes the mizzle LED in the Vickers gun at the same time. The other spare triggers on the sound board can be connected to other receiver activated switched for a full array of sound affects, you could even have the pilot speak to people in the pits.

If you have specific questions about any of the Scale Matters articles you can email me aeromodeller@outlook.com and I will do my best to answer any questions.
You may also find some interesting "build information" at www.nitrodude.forumer.com
The web site for the National Aeromodelling and Aviators' Society (NAAS) can be found at www.naas.org.au. or on facebook. www.facebook.com/naasact/

Until then, happy building and plenty of flying.