SCALE MATTERS: ARTICLE 10

A start on the Fokker D7 and some additional detail on scale bits for the DR1 and the Wedell Williams Racer.

By John Armarego

This 10th article features scale detail on a range of project.

Picture: Mercedes 6 cylinder aero engine used in the Fokker D7

I am currently clearing my building tables so that I can start work on the construction of a Balsa USA 1/3 scale Fokker D7. If time permits (between 9:00 to 5:00 job, NAAS events and general flying) the following "Scale Matters" articles will describe the progress and detail modifications to the Balsa USA D7 kit number 406, wingspan 118 inches.

As an introduction into the building of the D7, I have started work on the dummy Mercedes D111 engine. The D111 when first manufactured was too powerful for most aircraft of the time (150hp) and was first put into service mounted in the Albatros in 1916. By the end of the war the D111 was generating 217hp at 1,750 rpm. The D111 has a displacement of 14.8 litres and a compression ratio of 4.5:1. As the quality of fuel improved the compression ratio was increased to 5.73:1. The design was advanced for it time and incorporated many innovative features such as an overhead cam valve train.

The start-up procedure that was followed by the ground crew is as follows:

- Turn ignition switch to Off
- Retard Ignition
- Throttle closed
- Decompression lever to De-compress (lever pointing down)
- Hand rotate the propeller 6 revolutions. This will draw a fresh fuel mixture charge into each cylinder
- Close de-compression lever
- Magneto switch to M1 (start)
- Rapidly turn the Hand Start Magneto - Engine will fire
- Idle at 200-250 rpm for 5 to 10 minutes
- Slowly increase revolutions to 600 rpm
- Magneto switch to M2 and check for rpm drop (magneto check)
- Magneto switch to 2 and move ignition advance lever to mid position
- When running cleanly, fully advance ignition and check full throttle against rpm reading
- When engine checks are complete, idle at 300 – 350 rpm until the pilot is in the airplane

One of the main disadvantages of this type of engine is clear from the start up procedure. Being a water cooled engine the time consuming engine run-up had to be performed with care to evenly heat up the cylinders and water cooling systems to prevent cold seizure of the cylinders. The nine-cylinder rotary aircraft engine like the French produced Gnome et Rhône could be started and ready for take-off in just a few minutes.

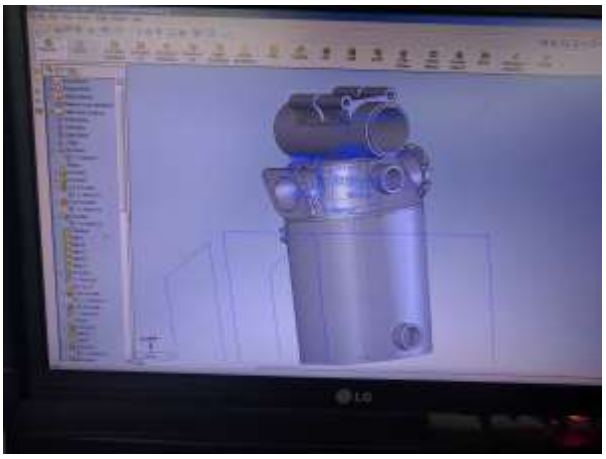
Imagine sitting at your airfield with incoming enemy aircraft rapidly approaching and having to wait for your engine to come up to operating temperature of 10 - 15 minutes before take-off, you would feel like a sitting duck.

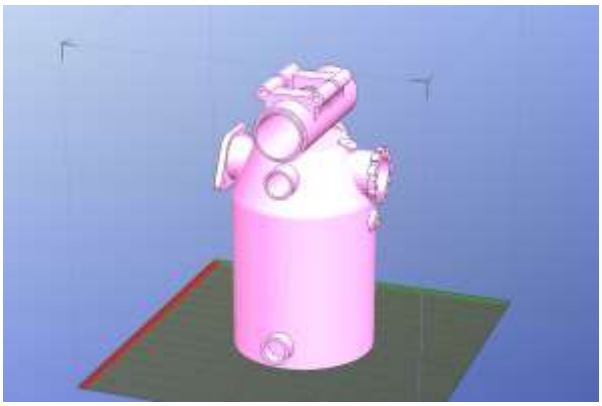
Mercedes D111 Cylinder and head.

Each individual cast iron steel cylinder is bolted directly to the upper crankcase surface. The cylinders have sheet steel water jacket to cool the combustion process. Water jackets were interconnected with flexible lines to provide a continuous water flow system with cooling provided through a top wing mounted radiator. The radiator is fitted with louvers that are manually controlled by the piloted depending on conditions and the power setting. Repairs could be undertaken to each individual cylinder if require which greatly aiding to the ease of maintenance. The cylinders were fitted with dual spark plugs and also incorporated a decompression mechanism to reduce the cranking torque required for starting.
These were long stroke engines with a bore of 140mm and stroke of 160mm enabling high torque figures at low rpm’s.

I drew the cylinder using Computer Aided Design (CAD) package and a range of images of the D111 engine from the internet for the specific details. I then printed out a prototype cylinder for closer inspection on the UPS 3D printer. You can spend many hours perfecting your design on the computer but sometimes it is faster to cut to the chase and print off a prototype. Once you get your hands on the part, sometimes any required changes can more easily and readily spotted. My intention is to make the valve gear actually operate this should add to the scale effect. The cam gear will be driven by an electric motor and speed controller mixed to the throttle. I have purchased several spring kits as a source for the value springs. The next design requirement will be to model and manufacture the rocker arrangement, cam and cam drive gear.

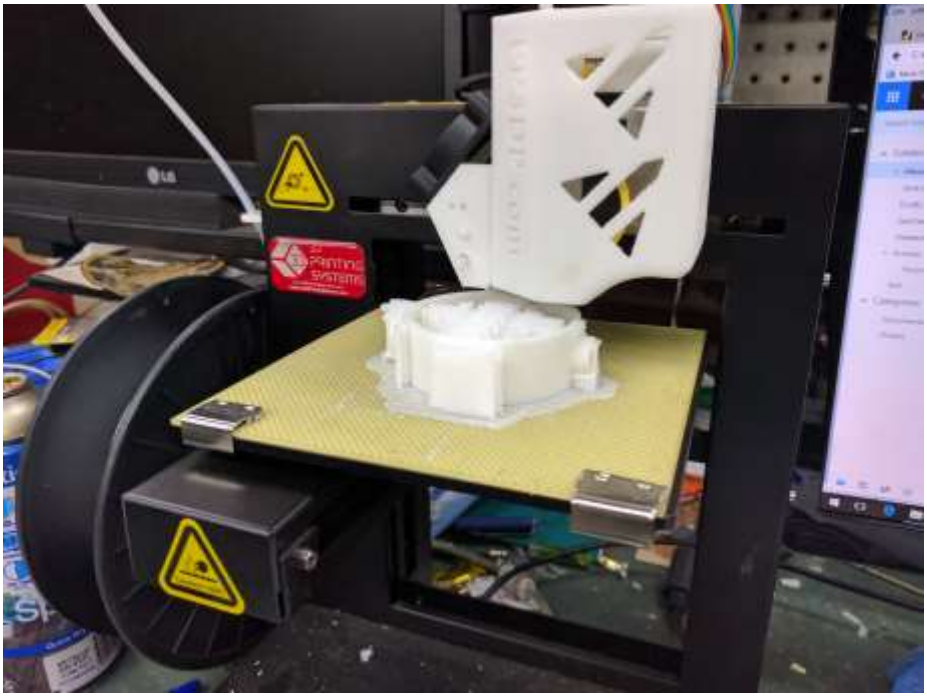
Picture: Some of the fantastic images of the D111 engine produced my Alexandr Novitsky 3D artist.





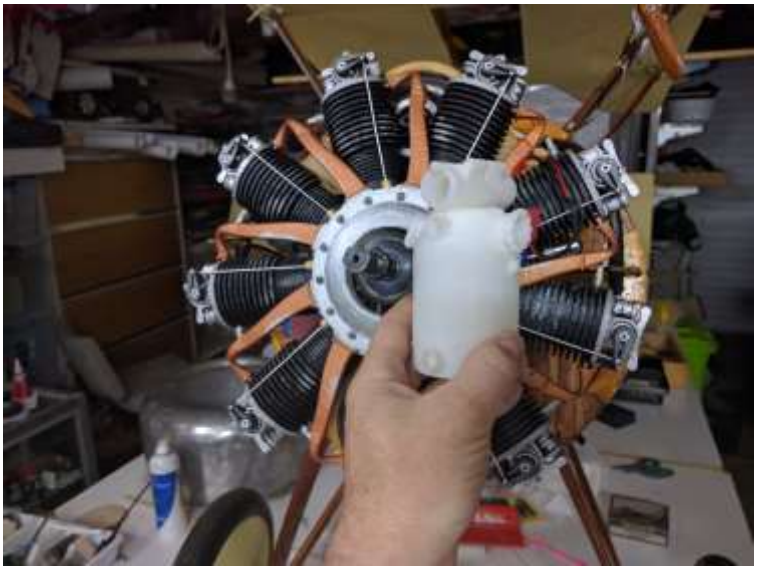
Picture: D111 cylinder draw using CAD system and then the STL file is generated and loaded into the 3D printer software to control the 3D printing process.

Picture: Handy spring kits from eBay to be used to make the valve springs for the D111. Spring kits always come in handy for aeromodelling and at around $15.00 for 200 springs it is good value.



Picture: Mercedes D111 cylinder being 3D printed on the UP printer in ABS plastic.

Picture: Prototype cylinder arrangement.



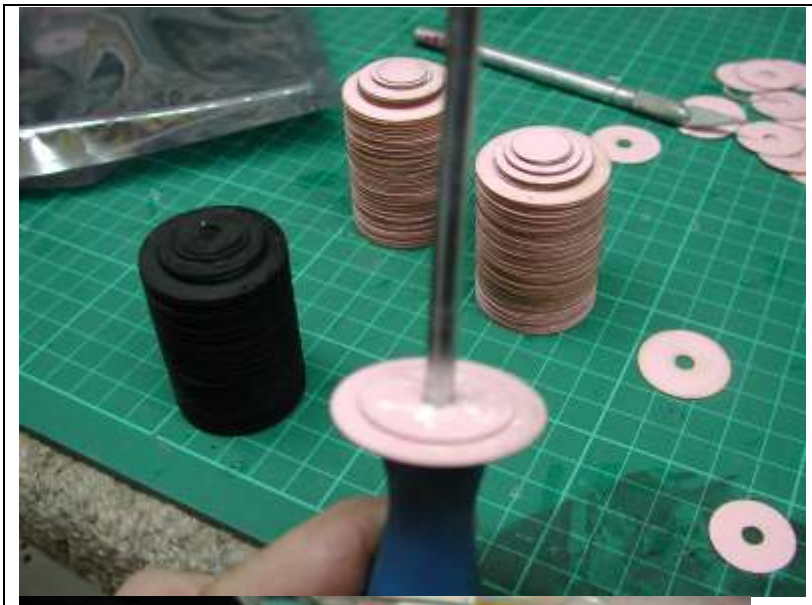
Picture: 1/3 scale Mercedes D111 cylinder compared with the Le Rhone 1/3 radial engine that I made for the Sopwith Pup.

Fokker DR1 cardboard scale parts.

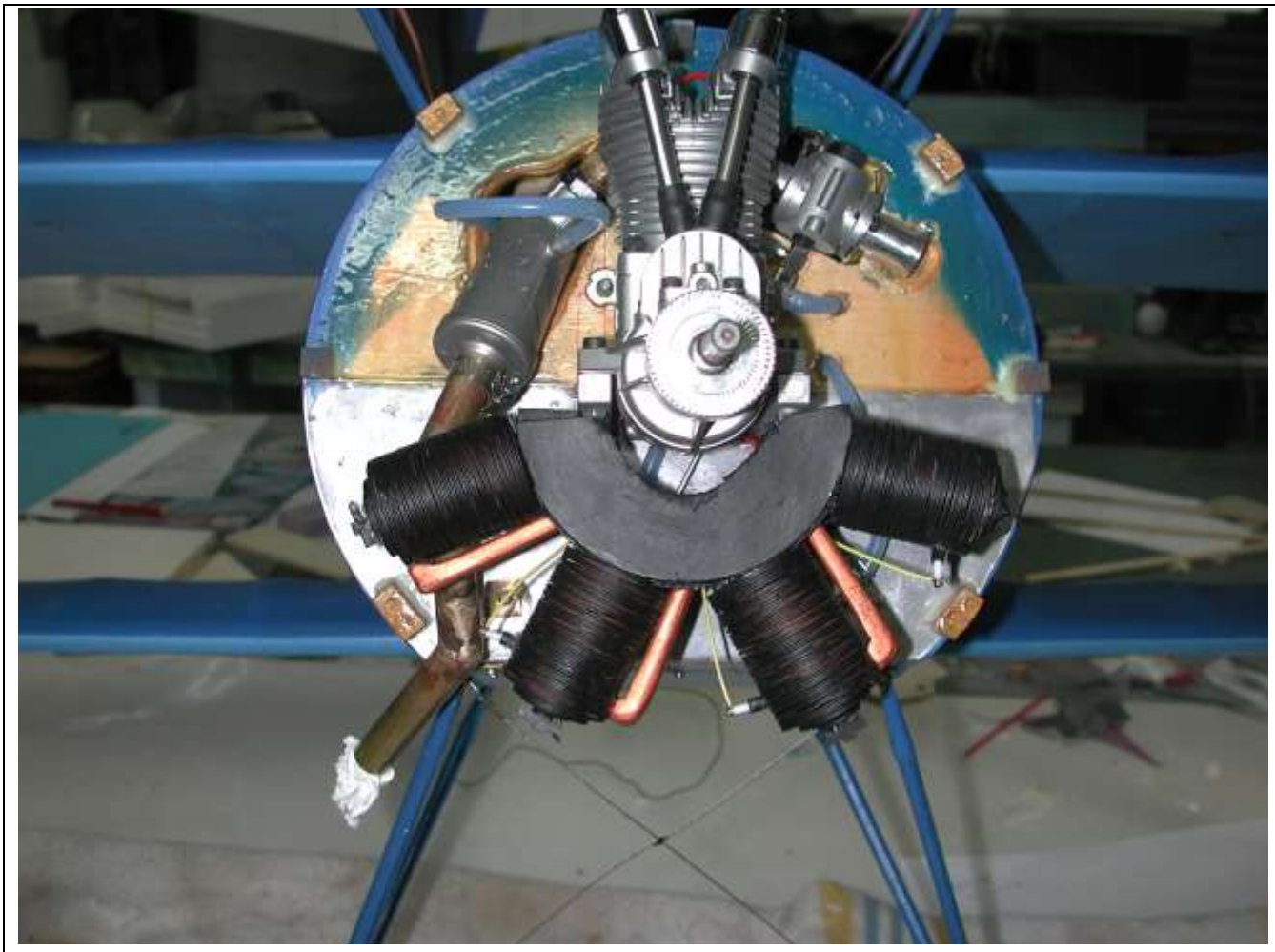
I built a Flair ¼ Fokker DR1 some 15 years ago and it is still a delight to fly.
I constructed the dummy rotary engine and the machine guns for the DR1 before 3D printing was readily available using relatively easy and simple yet effective scale detail techniques.
The cylinders were constructed by cutting out cardboard discs of several different size and gluing them together in a stack over a Philips head screw driver to keep them aligned.
To make the discs faster to cut out I used a laser cutter but they can be cut-out any way you like. The spark plugs were made from ever green styrene tube stock. The other bits like the crank case, rockers and inlet tubes were carved from wood stock. The parts were then painted using Tamiya acrylic paints in the desired colours. The mounting of the dummy engine to the fire wall was achieved using dowel rods cut to the required length and inserted and glued into two hole located in the fire wall. Litho plate was used to simulate the aluminium fire wall bulk head and to protect the ply fire wall from fuel and exhaust.

The machine guns are also constructed using cut-out cardboard and rolled and glued together using white wood glue. Additional detail is made by carving out wood stock to form the rear section of the guns and then painting the assemble using Tamiya acrylic paint for the finished effect. The cardboard parts are light and have stood up very well over time to the conditions they have been subject too.

Picture: ¼ scale DR1 dummy engine and machine guns made from cardboard.



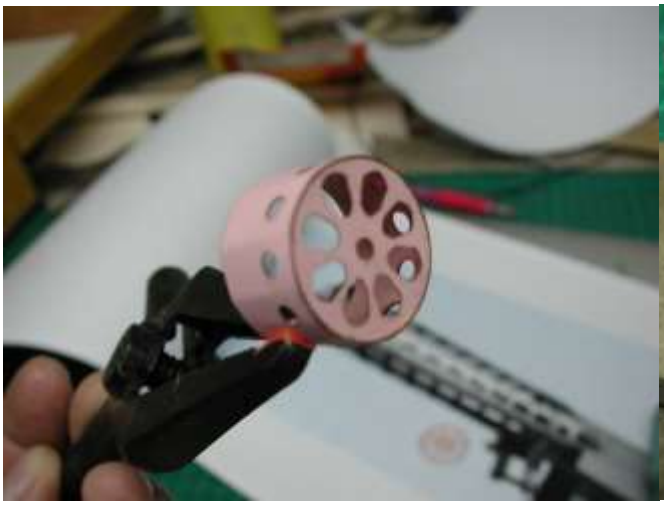
Picture: Cardboard discs glued together to form the cylinders. A few carved parts added to finish the detail.



Picture: Dummy engine fitted on dowel rods. ¼ scale DR1 powered by Saito 180.

Picture: Picture of the DR1 machine gun, Spandau IMG 08

Picture. Cardboard gun barrel rolled and then glue, simple and effective.



Picture: Ends of the barrel also constructed by gluing the cardboard parts.

Picture: Barrel completed, light and robust. The gun sight is also made from laser cutting cardboard and then coated with thin CA and painted with acrylic paint to provide greater strength.

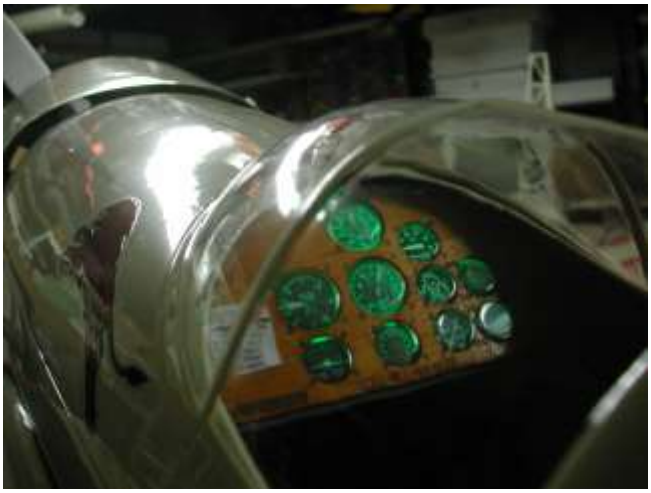
Another spin on model aircraft Instrument panels

Picture: Widell Williams Racer

To add a little bit of additional scale detail to the Wedell Williams racer I made my own instrument panel. The panel itself was laser cut out of balsa wood and laser engraved to add some additional effect and then wood stained.
The instrument clear plastic faces can be made from pill packets like then ones that come with Panadol or vacuum formed them using and then you can make them make them to the exact size you require. I have machined my own instrument gauge forms using a CNC mill and this has now been used many time. The instrument dials are drawn on the computer or loaded from the internet and then printed to the required size on an ink jet printer. Once printed the dials are cut out and glued to the back of the instrument panel using white wood glue once the clear lenses have been inserted. Green Light Emitting Diode (LED) strips are then glued to the back of the instrument panel. The LED strips are powered up when the receiver is turned on to illuminate the instruments.

Picture: CNC machined instrument gauge forms made from aluminium. One set has rounded gauge faces of various sizes and the other one has a more square edge profile. These forms are used in the vacuum former to make the instrument clear faces in large quantities.

Picture: Completed custom instrument panel for the Wedell Williams racer.



Picture: Completed custom instrument panel for the Wedell Williams racer with the gauge illumination on.

Useful Gadget

My model aircraft trailer is fitted with solar panels, battery and LED lighting along with a range of other necessary and unnecessary modern convenience functions. The trailer has become a fantastic accessory (very oversized flight box) and it really adds to my enjoyment of aeromodelling. If I can't get the trailer close to the pit area it can be make life quite difficult. I have everything I ever need in my trailer, I just can never find it. The trailer has become the ultimate charging station and become additionally useful when we go flying interstate or stay out overnight at our field.

I control the lighting system in my trailer using this very effective 12V Caravan Camper LED Strip Light Controller Dimmer Multi Mode with Remote. This is available form eBay for around $10.00 and around $2.00 freight.

It allows you to turn on and off as well as dim and flash your 12v light system in a full range of different ways. It is extremely simple to install and works very well.

Picture: Simple 12v remote control system to control your 12 v power system used in model aircraft trailers or camping trailers.

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.