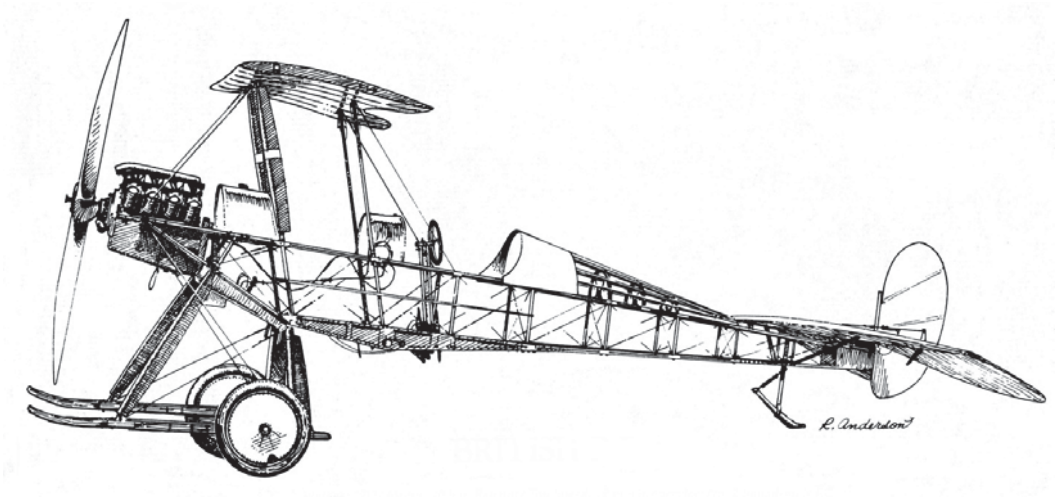


World War I Aeroplanes, Inc.

P.O. Box 730

Red Hook, NY 12571

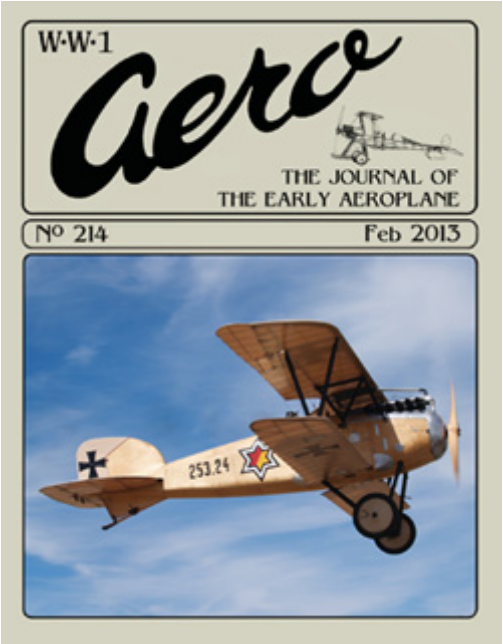
USA

Website: www.ww1aeroinc.org

Email: ww1aeroinc@yahoo.com

Notice:

The attached article appears in *WW1 Aero #214* (February 2013). This issue, as well as our entire selection of current and back issues, is available from the WW1 Aeroplanes, Inc. website in both print and PDF formats. Please visit: **ww1aeroinc.org/blog1/store**.



On The Camel Trail

John S. Shaw
www.johnsshawaviation.co.uk

John S. Shaw's magnificent Sopwith Camel as it appeared in September, 2012. In the four years since the project began, John has split his time between the center region of France, where the woodwork and assembly is taking place, and Cornwall, England, where the pattern work, casting, metal machining and research is performed. Photo: John S. Shaw

Introduction

I love both building planes and flying them. Some people advance as the years go by, but not me. My latest project goes back to World War I and the famous Sopwith Camel F.1.

I'm building an operational Camel, full-size and from original, though unfortunately incomplete, plans. I am incorporating serviceable original parts when I can find and afford them and it is safe to do so. In addition to providing details, this article was written in the hope that I can inspire someone to part with the missing plans or search an old barn to unearth original WWI vintage aviation parts for me! I am ever the optimist.

I am building four airframes because it has enabled me to trade: one for an original 1917 Clerget 9b engine, a second to alleviate my metalwork costs, and a third for our engineer. It also makes it more worthwhile to build jigs for the various tasks. All are being built on the French vintage register under the supervision of Patrick Siegwald of Classique Aero Service.

My background in carpentry and joinery, coupled with many vintage glider restorations and a Tiger Moth rebuild, means that I want to be "hands on" with the wood and fabric work. However, I have learned and used rather more skills than anticipated - sometimes because I like to learn new things, and other times

because I can't get what I want in terms of authenticity unless I make it myself. We all have to compromise to a degree today, but I would like to do as little compromising as possible, and will go a long way to use the materials, parts and methods of 1917.

What was obvious to the skilled man in 1917 is not so to one today. Machines may have improved, but the way of working is so different that it takes a lot of research and some experimentation to get it right. It is hard to find people to do quality work or share quality information because it takes passion and patience as well as the necessary skill.

Research

My original Sopwith drawings came from a 35mm film of the Sopwith Schedule which I re-photographed and digitized on the computer. The rights to this film remain with the owner. I purchased Replicraft drawings which appeared to have been redrawn from the Sopwith originals, but there are inconsistencies with regard to materials and measurements.

I have other original documentation and useful reference sources including Windsock Datafiles, magazines from WW1 Aero, Cross & Cockade, WW1 Aero Historians and various books on the Camel or warfare in World War I.

Cross-referencing against museum aircraft is not necessarily useful, as many are reproductions and not necessarily built to 1917-18 specifications. Both the Brussels and Krakow museums have been particularly helpful and have authentic Sopwith Camels. Northern Aeroplane Workshops, who are in the process of building a Sopwith Camel for the Shuttleworth Collection, have also been very helpful for discussion and problem solving. You meet a lot of time-wasters, but I have been lucky with one or two real enthusiasts who have been very helpful.

I hunt out old photographs, but care is needed, as many modifications were made to the machine in the field. Some of these modifications became "approved", such as the center section clear view panel, while others were just expedient, such as the spade grip recovered with rope when the rubber had worn off.

Research is essential, but inevitably you have to make a start if you want to fly. We started with the plans and good wood in plank form. I recommend starting with the fuselage, as everything fits around this.

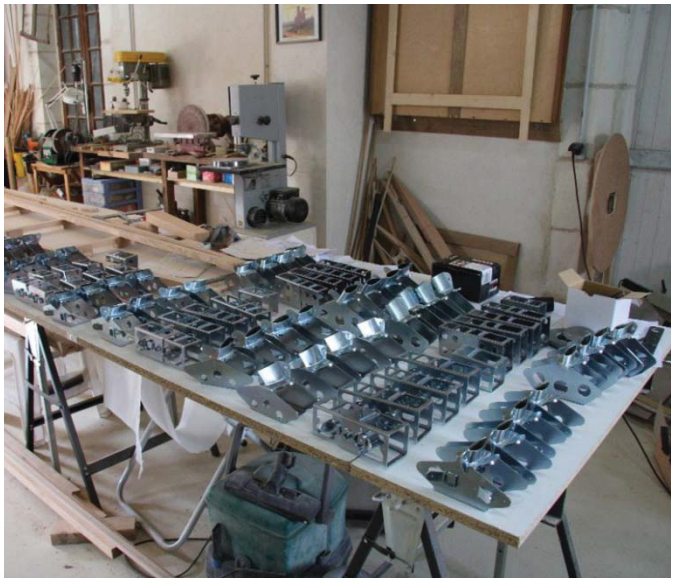
Fuselage

There are a lot of pieces to make for the fuselage in wood and metal with subtle differences in size, shape and angles. Weight was a real issue in the early flying days because of a lack of engine power, so there is a lot of routing out on the woodwork. Of course, the shake in the wood only shows at the last lightening effort! There were masses of templates to make for this work. The longerons are particularly nerve wracking.

We made a special bending tool for the tension wires and other tools for bending the fitted wire and to make the ferrules. The ferrules are hard work on the hands and fingers so it is best to make a few a day and try to get in front of the assembly task.

Once everything is prepared, sanded and varnished, we move on to assembly. I built a jig for this which allowed me to build left and right sides, complete with bracing wires. I then used the same jig with different fixing points to put the two sides together and fit the crosspieces and their bracing wires. The front plate and sternpost are then added and everything squared up carefully in the flying attitude. These two metal pieces are both critical and complex pieces to make, and suppliers have struggled to get them right, causing some headaches and delays.

After everything is tensioned you can fit the top formers and turtle deck rear of the pilot. Again, the formers required the making of jigs to get the right fit.



A great number of metal fittings must be manufactured for the wings and the fuselage. Many are very complex, requiring laser cutting, forming, folding, welding and protecting. CAD drawings have been necessary as well as jigs and, in some cases, even the creation of special tooling. Photo: John S. Shaw

Above: The port fuselage side seen assembled in its jig and awaiting metalwork. Below: The two sides of the fuselage upside down and ready for horizontal members.

Photos: John S. Shaw

Above: The front and rear engine plates fitted to the inverted fuselage. Below: The fuselage seen from the rear after the installation of the sternpost and turtle deck. Many turnbuckles and wires are incorporated into the structure which must be adjusted to exactly the right tension - a 3 dimensional jigsaw puzzle!

Photos: John S. Shaw

Fuel System

Next comes the fun of fitting out. The three tanks were made in the UK by a specialist. There is one oil tank, a gravity fuel tank and the main fuel tank. Although I do have an original oil tank, I am not using it because I am concerned about potential porosity in the short or long term. The tanks are fitted with metal straps with a protective cork lining. I have done some of the pipe work and made my own sight gauge from original drawings. I have also fitted an original needle valve and Tampier throttle control, although I still need a fuel filter and three way fuel valve.

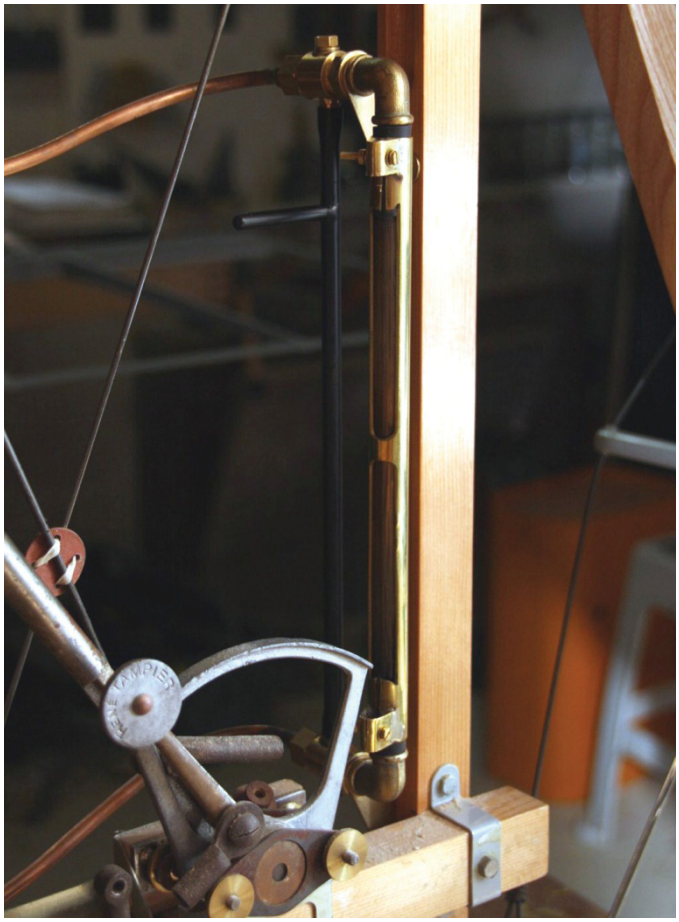
The fuel system requires pressurization of 1.5 to 2 psi, which is provided by a hand air pump during starting procedures (and in emergency) and by a wind driven Rotherham pump when the engine is running. I am lucky enough to have an original Rotherham pump and an original hand pump, both of which are being reproduced with my newly developed metalworking skills.

Photo: Skysport

Above: The author's original Sopwith oil tank. Below: The reproduction will be equipped with a new set of tanks made from tinned steel by Grant Garner of G&M Aerotanks.

Photo: John S. Shaw

Above: The fuel sight gauge, which was scratch built from original drawings. Photo: John S. Shaw



Above: The sight gauge fitted in position. Photo: John S. Shaw

Above: Two hand air pumps (one disassembled for detail) which were reverse engineered from an original example.

Photo: John S. Shaw

Detail of the fuselage seat and tank bearers with the main tank in position. Photo: John S. Shaw

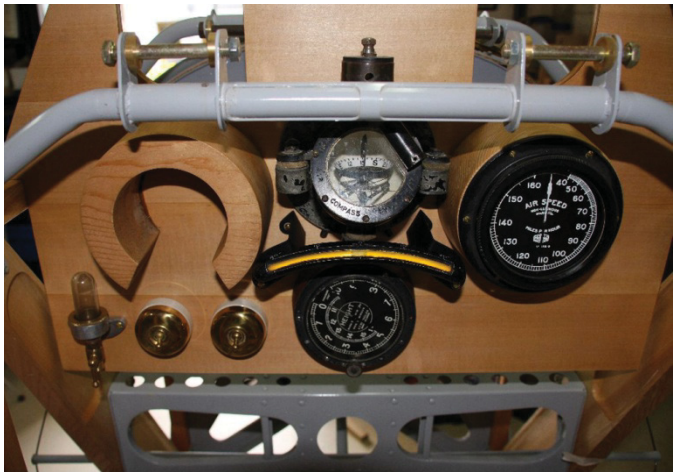
Cockpit

The seat was fashioned from cane using the original plans and is fitted to the fuselage with seat bearers. The construction of the seat was a new skill for me and I was fortunate to find someone sufficiently interested to teach me how to do it. I am exploring different options for straps and may decide to veer from full authenticity for the sake of safety.

The instrument panel is bass wood. I laminated three thin layers in a sort of plywood to avoid warping. Many of the instruments require packers so that they stand proud of the board, which was necessary due to the guns obstructing the pilot's vision. You have to make the packers to fit the instruments and the board before making the decking, so planning and collecting in advance is a requirement. My instrument panel houses an original Hughes 5/17 compass, an original Casella 40-160 air speed indicator Mark IV, an original Short and Mason 0-16,000 foot altimeter Mark V, and an original inclinometer. The pulsometer is a reproduction with original glass, and the magneto switches are straight out of house electrics of the time! I was able to amass quite a few of these switches, as they can still be found occasionally at car boot sales.

I am currently searching for an original watch holder, a Jones valve with gauge, and an original tachometer, preferably 600-2,200 rpm, although I could live with one to 2,600 rpm.

An original Camel seat at the Kent Battle of Britain Museum at Hawkinge. Photo: John S. Shaw



Above Left: Two new Camel seats fashioned from Sopwith drawings. Although the plans said "wicker" we found cane was a more common material for the times, as seen in the 1917 AGS catalog. Above Right: Detail of the instrument panel with wooden packings for the air speed indicator and altimeter.

Photos: John S. Shaw

Given that the Camel was tail heavy, it is useful to have guns of the correct weight to provide counter balance. I have a pair of non-functioning Vickers guns which are not original but are made to the plans and look as though they incorporate original parts. They are complimented by an original Aldis sight and other gun sights made from original plans.

The decking is a complicated job, and required the building of a full size plug. The original was two pieces of 1/8" ply joined in the middle of the cockpit opening. As I don't have the right machines, I had to make mine using 4 pieces of 1/16" ply, joined in the same way as the original, laminated together over the plug.

I found I needed to learn about foundry work to get the parts I wanted. I started with a windscreen, followed by the spade grip and gun triggers, all of which were sand cast. I made patterns, which often needed to be both inside and outside and left and right handed. The air admittance T alone required 4 or 5 core pattern attempts and a very patient foundry man to get right. To get a smoother finish on brass, a lost wax casting method was used, which offered more learning opportunities. The original spade grips were covered with a textured rubber, and since none could be found, I created my own using patterns and molds. I have started on fitting the controls and have learned the art of wire splicing.

The nose cowling has been spun and pressed out. Later, we will need to cut and finish it to fit around the engine and propeller boss. Work has started on the firewall and lower side shields. We borrowed an original propeller and had new ones made by an expert who uses the original World War 1 techniques to laminate, shape, balance, stamp and finish.

Above and Below: The spade grip wooden outer pattern and inner core box.

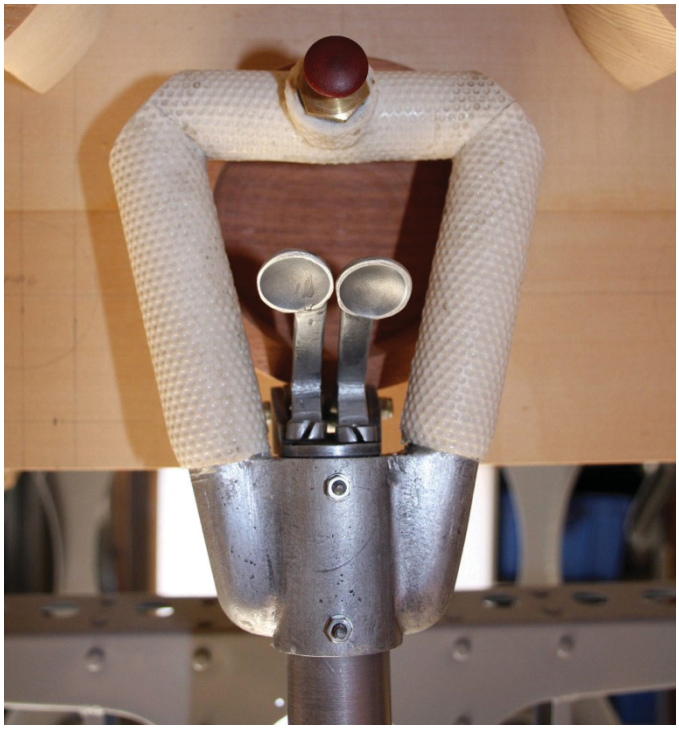
Photos: John S. Shaw

The spade grip and trigger castings seen in the sandbox after casting. Photo: John S. Shaw

The completed spade grip casting before machining.

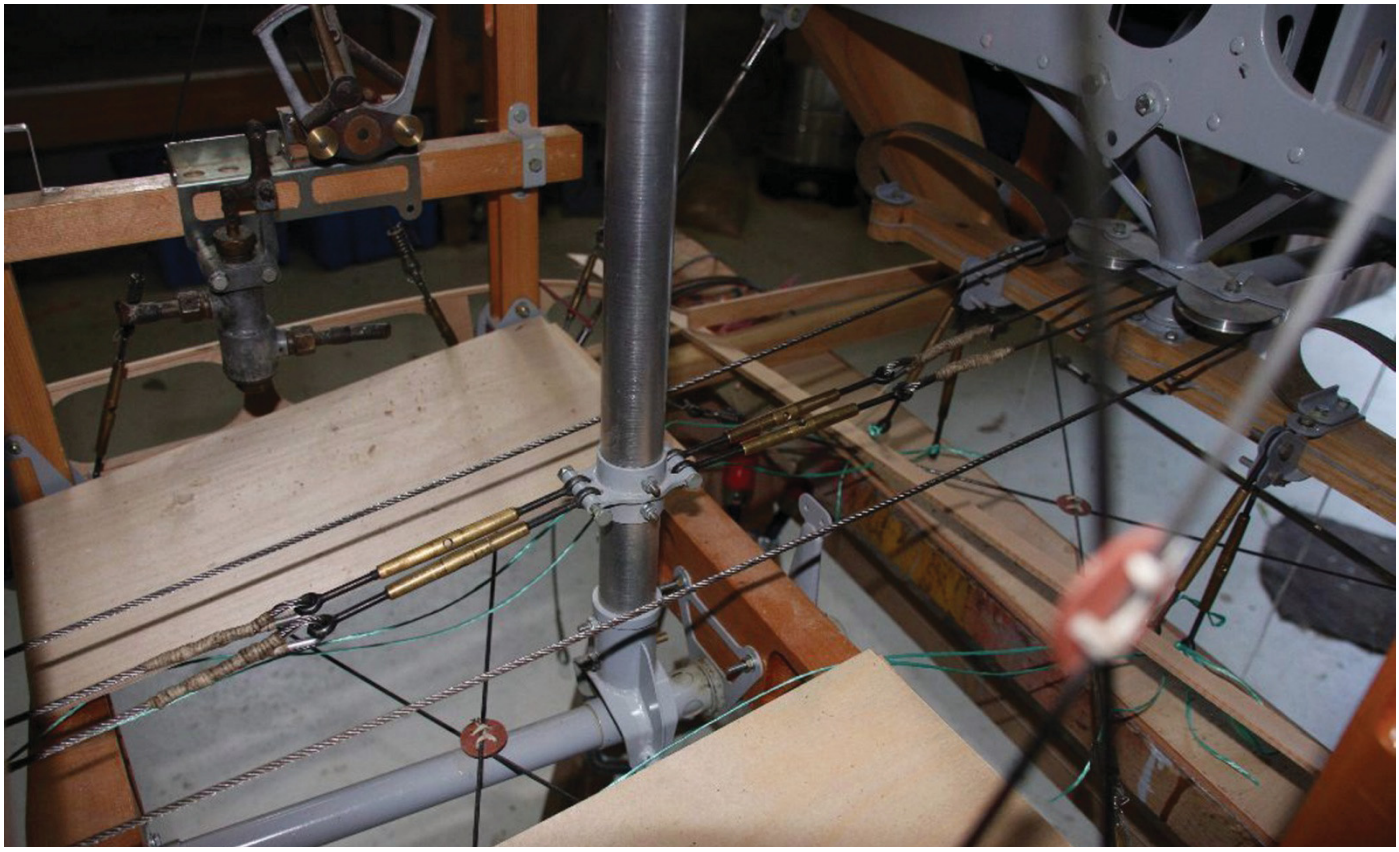
Photo: John S. Shaw

This jig was used to cast the honeycomb patterned rubber that covers the spade grip. Photo: John S. Shaw



The finished spade grip fitted to the top of the control stick, complete with triggers and blip switch. Photo: John S. Shaw

The control column jigged and ready to fit cables. Photo: John S. Shaw



Above: Spliced control cables fitted to the control column. We prepared a test splice and found that a 15 cwt cable parted at 1 ton, with no affect on the splice itself. Below: The fuselage with Vickers machine guns fitted. Photos: John S. Shaw

Wings

Work on the wings is similar to the fuselage – jigs, scalloping, hand woodwork, metal parts and a major assembly line - all trued up with piano wire and turnbuckles. Special spindle molder cutters were needed for the 10 spars. The 2 upper and 2 lower wings are very similar but the center section is different. We have managed to get AP121 trailing edge tubing specially made, which required special rollers. The curving, especially around the center section cut out, needs another jig.

Above: An aileron being assembled on a jig. Photo: John S. Shaw

Above Left: Wing rib formers with templates and assembly jigs. Many of the ribs are "handed" left or right. This makes an already complicated array of ribs even more so. Weight was a real issue in 1917 so there is a lot of work in scalloping out and making lightening holes. Cap strips are used to bind the ribs together. Above Right: A tip bow being fitted to wing and aileron. Photos: John S. Shaw

Patrick Seigwald stands in the starting pose while the author crouches behind the Camel's upper wing, dreaming of things to come.

Photo: Natacha Jean

Empennage

The empennage is of metal construction, except for the wood horizontal stabilizer. Again, jigs are used. The skid was one of those instances where the original Sopwith drawings and Replicraft plans varied. We had no original Sopwith plans for the metal fittings, so we have had to interpolate from drawings and photographs.

A great deal of research went into the undercarriage, wheels and axles to try to achieve maximum authenticity, as the wheels and tyres are no longer manufactured. We had AP155 tube specially rolled for the undercarriage legs. Work is in progress on the rest and we estimate that three months will be needed to finish this part.

I will be covering the Camel in linen and have chosen the color scheme of a particular Sopwith manufactured aircraft that was based in France during World War 1: B6413, posted to 66 squadron.

Anyone keen to contact myself or associated specialists, or simply keep an eye on progress, can do so via my website: www.johnsshawaviation.co.uk. ■

Above: The assembled rudder being cleaned prior to painting. Below: The horizontal stabilizer being checked on a rigging board prior to final assembly. Photos: John S. Shaw

The finished empennage fitted to check mountings and cable runs from rear starboard quarter. Photo: John S. Shaw