Building a Mick Reeves 1/4.5 scale Hurricane—

Instalment 10

Half Finished Review—Engine and Wings

Open Mind: This kit comes with very basic instructions and plans that are more or less just outlines so most of the construction details are left up to the builder. As I'm now about half way through this build I thought it was time to have a good look at the model as it is to date with a view of what could be improved or any other concerns I might have.

The first concern I had and it had been niggling me for a while was did I have enough engine in this thing and secondly, I was concerned with the structural integrity of the three piece wing.

The power from the JC60EVO engine looked ample on paper and it also looked good on the test stand but I was concerned about the vibration caused by the long standoffs and the shaft extender required to hide the engine in the cowl. The shaft extender I'm stuck with but getting rid of the standoffs was another matter. As the plane grew on the work bench the more I thought I needed more power than a 60cc engine could provide. Stuck in my mind was the need to go around after a botched landing approach, especially when toward the Western end of the field with the bush and the hill fast approaching. I needed a reserve of power to be able to safely climb and turn a 110" 16-19kg scale model out of trouble so I came to the decision to replace the JC60EVO with something bigger.
I did a comprehensive search via Google looking for the best replacement and ended up with the 3W 85XI CS. Dave Pound has one in his big P47 and I have been impressed with the way that it hauled that around. It is directly mounted on a radial mount and the sweetener is the three bearing crankshaft is more able to take the still required shaft extender. Its 85cc's and is rated at 9.66HP.
To retro fit this beast required some pretty extensive re-building to the front end of the airframe.

Before :

JC60EVO

60cc

6.0HP @ 7500rpm

1.74kg

After :

3W-85Xi CS

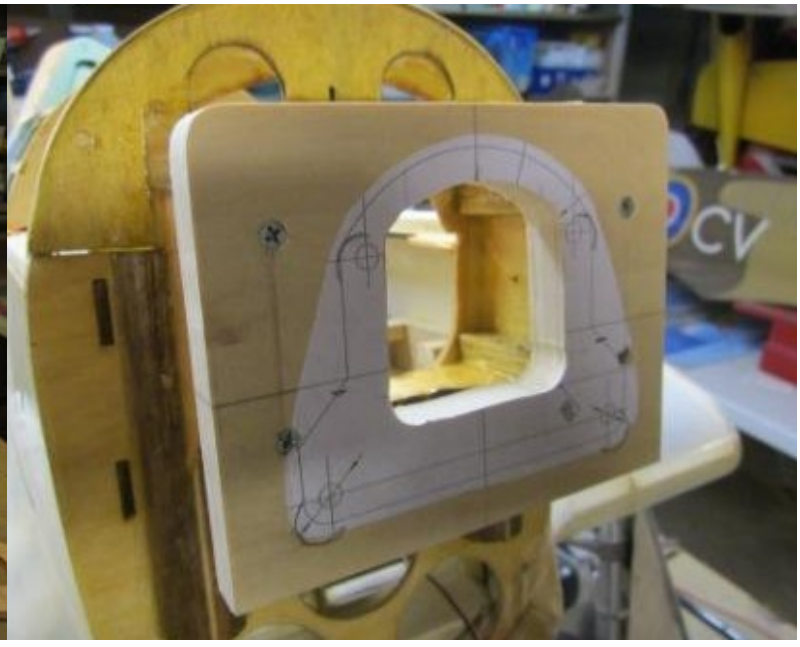
85cc Competition Special

9.66HP

2.4kg

Shoehorning the thing in:

I had to cut off the end of the engine box on the end of the fuselage to fit a new mounting plate of 15mm ply and then cut away the firewall to allow the carburet-tor and ram tube to fit inside the fuselage. Extensive reinforcing with hardwood quad was added to all joins.



I hung the fuselage over the edge of our deck again and centred the engine with the cowl and spinner backplate in position, removed backplate and cowl, marked engine position on mounting plate, drilled and bolted into position. The best part of all this is that it still all fits inside the cowl.

Throttle, Choke Servos & Tank Mods :

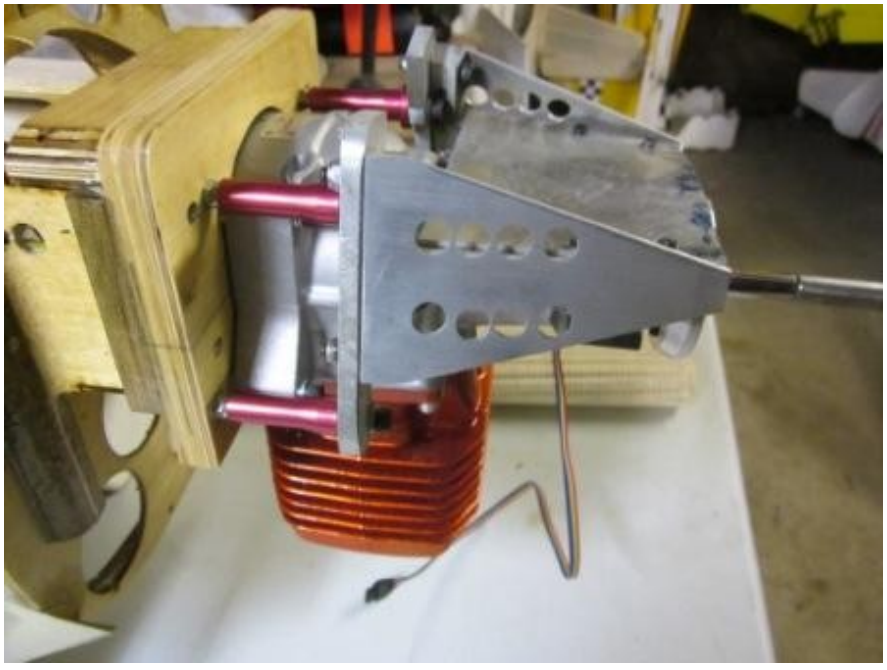
I have had to fit a bigger tank for the bigger engine. It's 800cc, positioned over the C of G and it's now a tight squeeze to fit the throttle and choke servos . I have had to extend the throttle and choke levers on the carburettor and used Sullivan ball links to actuate both. With a bit of a fiddle they work well.

The picture on the left is of the throttle servo, Hitec HS635HB rated at 6 Kg/cm and the Hextronic HX5010 7kg choke servo,

There is now no room for the elevator servo so I have had to re-position it back of the cockpit and shorten the carbon fibre pushrod.

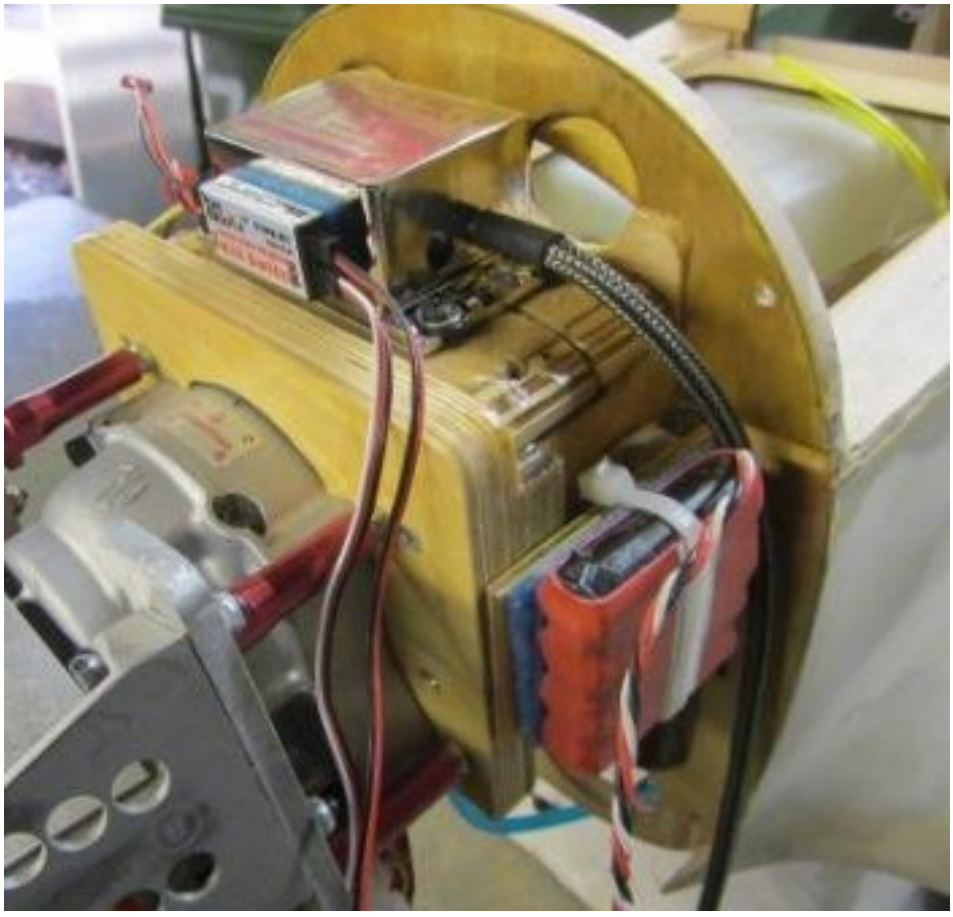
Exhaust Mods:

The standard Pitts muffler for the 3W is a beautifully made aluminium job as the picture above shows but it just fouls the cowl. I have to cut and weld a plate at 45 degrees on the end to give it clearance. I don't know why more mufflers aren't made with an angled end as it directs the gasses away to the outlets and would make it easier to fit in planes that had an inline engine in the full size. I'll extend the exhaust pipes to exit through the Vokes filter.



Ballast Tray:

The ratio of engine weight to fuselage weight is very different from full size to a model so even with the bigger engine I'm expecting to add weight to the nose to trim to the correct C of G.
I've modified the old tray to fit on stand offs to get the longest possible lever at the front of the C of G.



Re-positioning all the batteries:

Now that the new motor has robbed all the space where I had the batteries I've got to re-distribute them around the plane as much as possible in front of the C of G.

The picture on the left shows the ignition battery, CDi unit and electronic switch all in front of the firewall.

The picture below shows the new position of all the remaining batteries. All batteries are made up from Sanyo Eneloop cells.

There are four packs on this plane, one 2000mah NiMh 4.8V pack is for the receiver alone, one 4000mah 6V NiMh pack for the servo buffer, navigation and landing lights, one 2000mah NiMh 4.8V pack for ignition and the last pack is another 2000mah NiMh 4.8V pack for the electric retracts.

Below is a picture of the service panel. All charging, switching, filling and adjusting can be done here after the removal of the Proskin hatch.

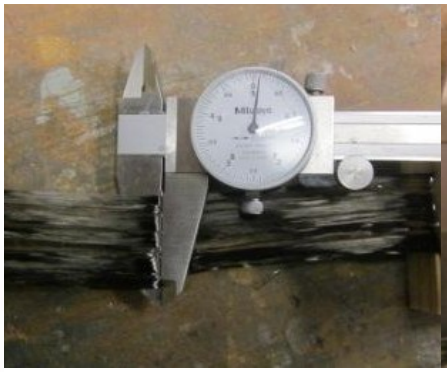
Wing Strength:
The strength of the three piece wing has been a concern of mine for awhile now, the joining tubes are fairly short and are offset from the spars and centre section "I" beams which imparts a twisting load on the beams.
The wing centre section is designed around a rigid "D" section forward of the front "I" beam and a rigid triangular section aft of the rear "I" beam, these sections are only rigid if their skins are intact. The centre section of the wing has only the top skin under stress as the bottom section is open for the wheel wells.

From the start of this project I have been worrying about engine cooling and decided at the beginning that I would draw the hot air away from the engine through the fuselage and out the rear of the radiator moulding, this meant cutting the stressed skins on the leading edge and cutting holes in the top and bottom surfaces of the rear section.

I am not too concerned about the top surfaces as they have a bending and compression load and will only be in tension if I fly inverted but I am concerned about the open under surface so before this plane flies I want to load the airframe to detect any possibility of structural failure.

Reinforcing the Wing Centre Section: The load on the centre section from the outer wings is all carried by the two beams front and rear of the wheel wells and the skins.
In normal flying attitude the top of the structure will be loaded with a bending and a compression load, the bottom will be in tension. The top is an enclosed structure with the skins preventing any distortion of the beams so I can't see any problems there but the open bottom is another matter. The two cross beams are made up from laminated plywood to a thickness of 6.5mm and are 90mm deep, fixed in the vertical by the fore and aft ribs and the skins. The front beam has various holes in it to affix the retract mechanism and limit switches. IMO this is the weakest point in the structure. The only way I could think of to reinforce the beams was to laminate carbon fibre tow on their outer edges but how strong is this stuff?

Dave Brown markets a 1/2” tape so I bought a couple of cards of the stuff but I couldn't find any tech data on its strength in all of Google. It looks pretty light on. It’s only 0.1mm thick and it really isn’t a tape as it’s made up from individual strands that when they are side by side are 12mm wide.



Anyway, to cut a long story short I decided to test its breaking strain. I epoxied a length between wood blocks, screwed one end to the rafters and applied weights to the other end with a fish scale in between.

I was expecting failure about the 10kg mark but was blown away when I had over-filled the twenty litre container and all was good at 21.5kg. I then added all the lead weights I use for building and it still hadn't failed at 34kg.

I’m now fairly confident that I have added about 100kg of strength across the structure by laminating two tows on the front beam and one on the rear beam. I’ve laminated the tows with strips of 2oz. glass to bond them to the spars and fair them into the surface .

This is all pretty back-yard engineering so I’m still going to apply loads to the completed aircraft before flying but I am more comfortable than I was.

So the critical appraisal of the plane has cost me three extra weeks to get back to where I was and a heap of extra bucks but I’m happier with the wing strength and the engine looks like it will be a beauty. It will be a better plane.

Next on the agenda should be some pretty bits like cockpit, canopy, lights, cannons etc.

Stan