Robin DR400-180 Electronic Ignition upgrade.

Most of light aviation regards the Robin & Jodel aircraft with curious suspicion part of this is the unusual upturned wings, another part is a lot of the plot revolves around the mature technology cellulose composite construction (wood). Sprinkle in the ability for the manufacturer to go bust and then rise from the ashes within weeks and you have the metalcentric industry running for cover at the first sight of a Robin.

My current Aircraft has been with me for thirty years having had a history of flying club use and then an accident in France. It was repaired to quite a high standard by a U.K. company before I acquired it and looked very nice however after 25 years of flying some issues with the rebuild became apparent with the aircraft underperforming the flight manual numbers by about 4-5 Kt in the cruise. The paint finish looked like glass but was thickly applied and this added considerable weight and eventually started to crack that was my final motivator for the re-build along with the lack of rib stitching over spar that allowed the fabric to bulge up in the cruise that I suspected was the reason for the missing 4-5 Kt.

Substantial work was undertaken that I won't bore you with the details but you will get the idea from the photos save to say only a few bits of wood needed replacing and the total lack of rib stitching across the spar box was corrected.

The aircraft emerged from the hangar looking good, and about 20lb lighter than it went in and this included the substantial new Avionic fit, following a few test flights to adjust the rigging the aircraft was flying straight, level and in balance and making the flight manual numbers for performance. The Fuel flow indicator has been useful to check the consumption, this I have calibrated against fuel uplift and have not had to adjust the system as it has been accurate straight from the box with the final conclusion after some long sectors that the aircraft performs to the flight manual numbers in all respects. This despite a rather old but low time engine.

About a year before my Avionic fit was finalised a colleague fitted an Electroair ignition system to his Cessna Bird Dog and it has been working very well , the system provides a very high power spark over a long period of crank rotation and varies the spark timing in accordance with a map programmed by engine speed and manifold pressure. This motivated me to leave panel space for the switches and circuit breakers required to fit the system , but I was not going to invest further in my rather old engine.

For me the motivation for the electronic ignition is to improve the fuel consumption, smoother running, better starting and stable running at low RPM, the manufacturer data claims a reduction of IRO 1 USG/hr fuel saving without any change in operating procedure with more fuel saving if you can fly the aircraft high. Smoother running is likely to be a bit too subjective to test especially as I have already dynamical balanced the propeller and better starting is also falls into the subjective category as the Bendix Magneto starts the aircraft very well. The other advertised benefit is lower maintenance costs, the only requirements are the RPM sensor is overhauled at

engine overhaul and ignition harness renewal at the same time, this saves on the requirement of a four year / 500 hour magneto inspection (cost IRO £500 + fitting). So the measure of success will be based on fuel consumption and reliability.

As luck would have it a serial Vans builder I know was looking for an engine for his next project, as the home built market is less worried about engine age following a test flight in my aircraft he made me an offer I could not refuse and took my old Engine. I had anticipated this and already had a Lycoming O-360 core that had only run one life available to overhaul. The plan being to drag the Lycoming into the current century with some electronic engine control.

As some of you are aware the biggest problem with Robin DR400 aircraft is they never got FAA certification and therefore American equipment manufacturers simply don't bother getting Supplemental Types Certificates (STC) to fit the equipment they manufacture into Robin DR400 aircraft. This is a costly and time consuming endeavour under EASA but following Brexit the U.K. CAA takes a far more practical view (if still time consuming) and we worked along with them on the basis that the Electroair unit was already flying in a U.K. registered Piper aircraft with a Lycoming engine and as the electrical system (alternator & regulator) is the same as on the Piper aircraft the unit was unlikely to perform any differently in a Robin.

One of the things the CAA did show concern about was the electrical load in the case of alternator failure and the ability of the battery to meet the electrical load for 30 minutes under the worst plausible conditions (Night , IFR & Icing). The result of the analysis based on the demonstrated (not calculated) loads was that the system could perform for 42 minutes . As the Robin is not cleared for flight in icing it is likely that the large load of the pitot heat would not be needed so the real world system performance it going to exceed the worst case by some margin.

It was decided that it was best to replace the impulse magneto as these are usually the most troublesome and keep the non impulse Bendix mag (more reliable than Slick) . Replacing both magneto's gives little in the way of performance benefits and gets you into the world of back up batteries and the weight and complications that go along with them. If I was running a six cylinder engine I would likely reconsider this decision. (if I owned one of those dreadful Bendix dual magnetos it would have been replaced the instant the EIS was approved)

Electroair publish the installation manual so before parting with any money I checked that have the space to fit the system, the drawings in the manual enabled us to 3D print dummy parts to check they fitted on the aircraft and the chosen locations did not interfere with other systems.

As with all aircraft modifications you need more than arrives in the box, in the case of this ignition system it is one circuit breaker, a circuit breaker / switch and the unions and hoses to get manifold pressure into the controller that is installed on the cold side of the firewall. This is all kit that is available from LAS , RS & Saywell.

What's in the box.

Having got all the bits together along with a newly overhauled engine I set to work to fit the system making sure to follow the instructions as well as the wire diagram, I was fortunate that access was helped on the cockpit side of the firewall by removing the G500 screen so the control unit that requires a cool environment was easy. The same can't be said for the coil pack as the Robin engine bay is very busy forward of the firewall especially if you have the B&C full flow oil filter fitted. The RPM/ timing sensor just bolts on the magneto pad and timed at TDC either a small pin to keep the sensor rotor in the correct place. The thing I almost missed was to ground the P lead outer screen, this is not shown in the wire diagram but is mentioned in the small print ! Electroair say it is two days work to fit and I think this is about right for an aircraft with reasonable access but add another half day if it is a Robin as part of the problem was a new engine breather line had to be fabricated to avoid the coil pack on the firewall (it will be interesting to see how long the second Robin installation takes).

Ground engine running was uneventful apart from practically zero mag drop when the standard magneto was turned off and a normal drop when the EIS was turned off. Maximum static RPM was about 50 RPM higher than with the previous engine but I suspect to see a little more as the new engine loosens up after a few hours in the air.

The first two hours in the air proved to be uneventful, the first hour was run with mixture full rich 75% power to keep the cylinders cool, the usual new engine marked drop in oil temperature happened at about 45 minutes into the flight. The second hour was flown at 75% power but with the mixture set to lean of peak smooth running. The aircraft maintained RPM and book cruise speed but the fuel flow was indicating 34 LTS / HR as opposed to the book number of 39 LTS/HR. This is in the range of improvement that the Ignition system manufacturer claims.

Later in the year after the new engine has flow a few more hours I will fly the CAA airtest schedule (from the days of C of A air testing) and see how the climb and high level cruise performance checks out and will publish the results.