My experience with the Electroair Dual EIS Installation

Disclaimer:

What you are about to read is my experience. It is not installation instruction. Your installer is bound by the STC and must follow the provided instruction set. What follows are my insights and does not supersede the instructions in the STC / installation manuals. Use the below at your own risk.

Background

The aircraft is a 1979 TR182. We have flown it since 2009 and have flown over 700 hrs. without incident. The total time on the airframe is about 4000 hours. My motivation for the installation of the Electroair dual system was and is Safety. The additional power and fuel savings are a bonus in my case.

The R182 and TR182 aircraft all came with the famous / infamous Bendix dual magneto (D2000 / D3000). In my opinion, the D3000 suffers from a common mode failure scenario. That is, the ignition sources are not truly independent. Both Mags share a common drive shaft that drives the nylon gearing for each magneto. A failure of the gear driven drive shaft eliminates the magneto altogether. A failure of the nylon gear on one magneto could affect the other magneto. In addition, Bendix no longer supports the magneto. This means that replacement parts are scarce and getting much harder to find. It also requires a 500 IRAN to ensure it is functioning properly.

The engine (O-540-L3C5D) has 2014 hrs. SMOH. TBO is 2000 hrs. It has been well cared for and flown at 65% power for most of its cruise life. The engine is normally set in cruise to 23”MP, 2200 rpm and 12.5 GPH with the cowl flaps closed. This would yield CHTs of #1: 376; #2: 370; #3:365; #4:365; #5:355, #6:372°F. The metal and flexible baffling are in good condition. Cylinder Compressions are all greater than 74 psig (last annual) and borescope inspections indicate intake and exhaust valves that are SAT. The engine would normally start in one revolution of the Prop. There are no other anomalies, or so I thought.

Installation Tips and Suggestions

I engaged the services of FlyBoy Aviation, LLC. Adam Ondrajka is the head of the company. He will travel to your site to perform the installation. The installation generally takes two days, or so. Every installation is a custom job for your specific aircraft. He is a certified Electroair installer. He is out of Michigan and installs in the Midwest and East Coast. I found him to be knowledgeable and a good trouble shooter.

The system consists of 2 control boxes (the brains), 2 coils (70K volts), Spark Plug wires, a Crank Shaft Timing Wheel (CSTW) and Sensor, Magneto Timing Housing (MTH) with sensor, and cabling to connect it all together. My installation also included the Electronic Ignition System (EIS) switch panel and TCW backup Battery and TCW control panel. The TCW control panel and battery are required for the dual installation.

It is vitally important to get the system timing right (#1 TDC, ±0.5°). Therefore, time the engine with an inclinometer on the propeller. This will time the engine to TDC #1 very accurately. You can use other methods, but in my opinion, they are far less accurate. Next install the MTH per the manual. It installs where your dual mag used to be. This will enable you to use the MTH to "find" TDC when the propeller is removed. My engine flywheel must be removed to install the CSTW and Sensor. You do not want to do this twice.

It is also crucial to ensure that the CSTW / MTH sensor wires do not come within 1 inch of the spark plug wires, **period**. The CSTW sensor will probably require a new penetration through the rear metal baffling and a grommet. Ensure these wires are secured so that they cannot move within 1 inch of the spark plug wires (zip ties).

R/TR 182 layout requires the wire harness that connects the TCW battery behind the rear bulkhead to the switch panel run between the headliner and the roof. In my case, the supplied wire loom is about 36" too short. We spliced the appropriate wire lengths to cover the distance. I believe a longer wire harness is now available.

On an R/TR 182 the EIS switch panel requires fitment (Dremel tool) to fit into the ignition switch hole / opening. It is tight and this could use some design improvement. See pictures.

I have installed upgraded avionics in my airplane. Therefore, there was not room for the required Electroair circuit breakers on the panel itself. You may have to fab a separate circuit breaker panel. See pictures.

First Start

The first start was exciting. The engine started but only one of the EIS systems provided spark. We found the cable from the MTH to the control box had failed at the connector. A replacement was sent and installed. At this point, we rerouted the signal cable from the CSTW sensor to ensure it did not receive electrical interference for the spark plug wires.

The control box will not fire the coil until it senses the engine has reached 60 rpm. It turned out that my battery was weak. I had to replace the battery and I upgraded the starter to a Skytec high torque unit. This solved the starting issue and both EIS systems were now firing the coils.

First Flight

The first flight was exciting. The takeoff and climb were smooth, and the additional power was evident. The engine has never run more smoothly. There is no question that the engine is making more power than with the dual magneto system. We climbed to 4000 feet and set the power to cruise, trimmed for hands off control, and placed the autopilot to altitude hold. OAT was 55°F. My cruise settings are: 23” MP, 2200 RPM, 12.5 GPH and cowl flaps closed.

The CHTs steadily rose beyond normal. The highest cylinder reached 435°F. This was atypical for my powerplant. We made a landing to troubleshoot the situation. We found several spark plugs fouled with lead combustion products. #4 upper spark plug was bridged from the center electrode to the side electrode. The engine has fine wire plugs installed in all positions.

If your engine is high time, you can expect some piston and combustion chamber cleaning. The lead deposits are “cleaned” from these areas by the heat of combustion. This will continue for 2-7 hrs. of operation. This depends on the amount of lead deposits in your engine. You will have to clean the plugs during this period. Alternatively, Lycoming has a Service Instruction for cleaning the combustion chamber, S.I.-1418. It directs the use of walnut shells to remove the combustion products (carbon and lead compounds). This is basically a walnut shell blasting of the piston top, valves and combustion chamber. I would recommend this if your engine is high time.

The Electroair electronic ignition system is high energy. The typical Magneto produces about 12-15K volts per spark when new. The EIS system produces about 70K volts when new. This means each spark plug receives approximately 4.5 times the spark energy. This translates into a more complete burn for the air / fuel mixture in each cylinder. This means more heat to dissipate through the cooling fins on each cylinder. This manifests itself as higher CHTs for the same power settings (MP, RPM, FF).

In addition, the system uses a vacuum timing advance system. This ensures the optimum timing to maximize the air / fuel mixture burn throughout the rpm range. You will find that your CHTs are higher throughout the operating range. I did not experience high CHTs at full throttle (30” MP; 2400 RPM; FF≈25 GPH).

We made several more flights with the same CHT result. I began to look at other factors that could affect CHTs. It tested the engine for induction leaks. I found two small leaks at the manifold connections. I repaired them with new gaskets. I found a huge leak at the carburetor shaft. I could hear it hissing. The shaft had significant play in it. I replaced the carburetor.

Timing Advance on my Turbo normalized 0-540

The subsequent flights yielded more stable CHTs but still in the 425°F range at cruise parameters. I tried running Lean of Peak (LOP) as well. This brought the temperatures down about 5°F overall. I contacted Electroair for advice. They can provide three timing advance curves, 16° beginning at 24” MP, 4° beginning at 24” MP, and 0° advance.

I sent my control boxes back to Electroair to reprogram them with the 4° advance curve. This lowered the CHTs. However, I was still running around 415°F. This was not within my comfort zone. I know that Lycoming states that these cylinders can withstand these temperatures. However, Lycoming will not be in the cockpit with me when a cylinder separates.

At this point, I had flown the aircraft about 15 hours in cruise. I contacted Electroair. I spoke to their engineer. He indicated that the no advance setup might be the solution to the CHT problem. I sent my control boxes back to Electroair to reprogram them with the no advance curve. I must say that the team at Electroair is knowledgeable and helpful. They are also very busy, so persistence is in order.

The 0°advance control boxes were installed. CHTs are now within my tolerance. My highest cylinder is no greater than 390°F in cruise at 65°F OAT. In addition, my fuel burn is down to 11 GPH from 12.5 GPH. The engine will run smoothly LOP at around 10.2-10.5 GPH. You should also expect higher oil temperatures for the same engine power settings.

The run up for my engine is done at 1700 rpm and peak mixture. The RPM drop for each of the advance curves varies. The RPM drop during run up with the 16° curve is almost zero. The RPM drop with the 4° curve is about 50 rpm. The RPM drop with the 0° curve is about 90 rpm.

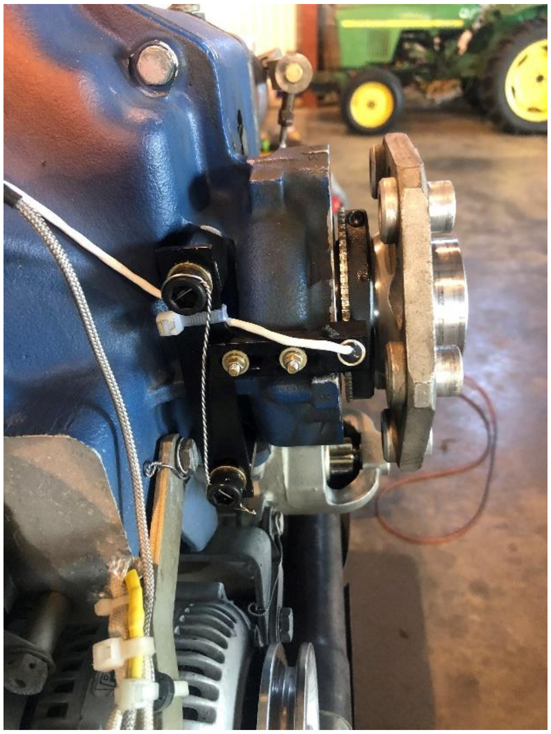
Conclusion

The Dual EIS system is a great upgrade for engines that have the dual magneto system. The Electroair system improves your safety margin and provides additional performance. I would recommend a certified installer. They can use their knowledge to avoid pitfalls. I would also recommend you check all the parts in the kit to ensure that they are in good shape (cables in my case). I would also recommend new Electroair fine wire spark plugs at the time of system installation. I have had a few plugs fail during the first 15 hours of flight. This is a major modification, and you need to have patience. In my opinion, it is worth the cost to improve the safety margin. The performance gains and fuel savings are an appreciated and palpable bonus.

Bill Lloyd

My 1979 TR182

FlyBoy Aviation, Adam Ondrajka, installing the CSTW and sensor.



CrankShaft Trigger Wheel and Sensor

Closeup oF CSTW Sensor alignment

TCW Backup Battery installation

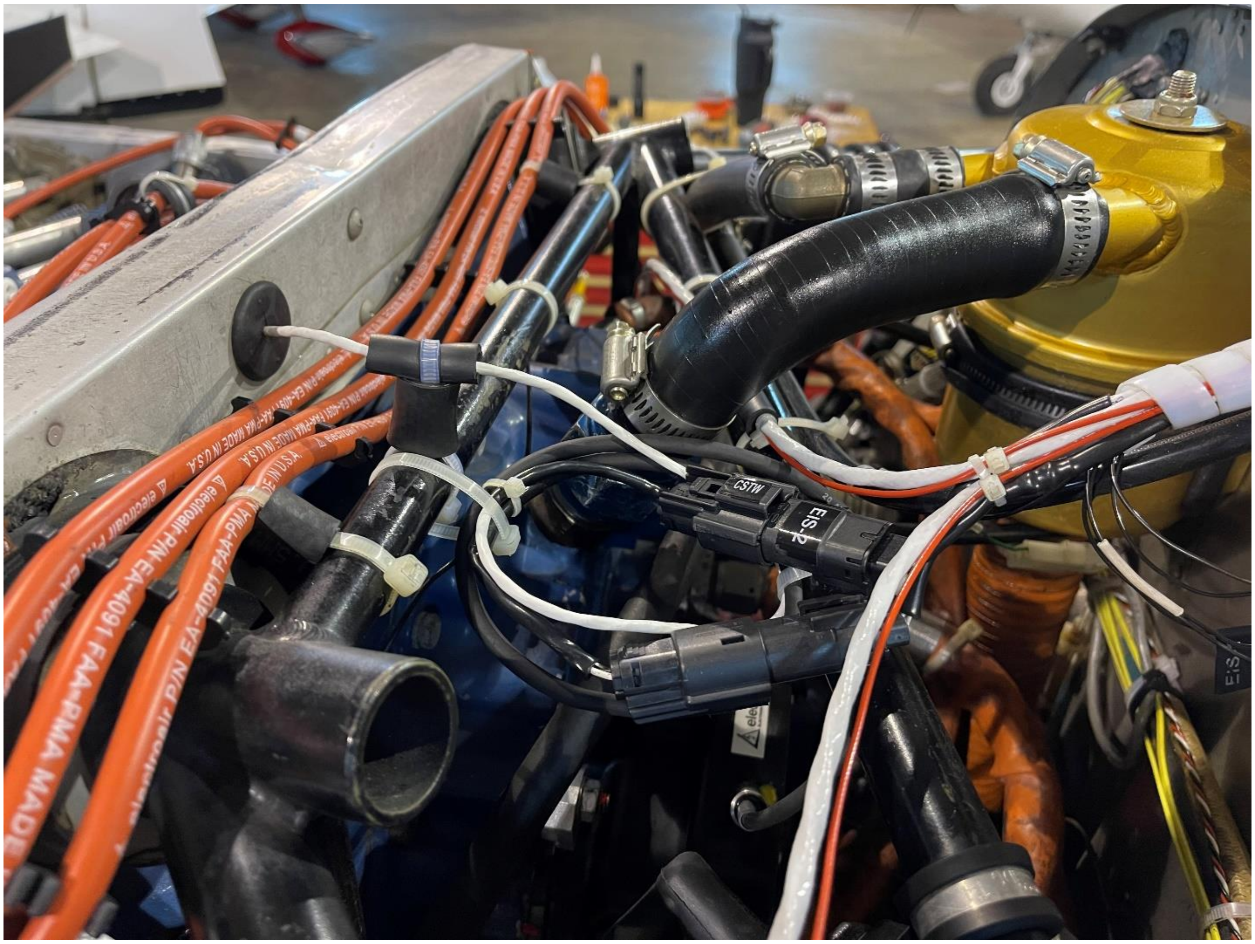
Right Side Installation, Coil and Wires Left Side Installation, Coil and Wires


Coil mounted Horizontally.
AVCO
LYCOMING
AVCO
LYCOMING
AVCO
LYCOMING

CSTW Sensor routing (white wire) around sparkplug wires

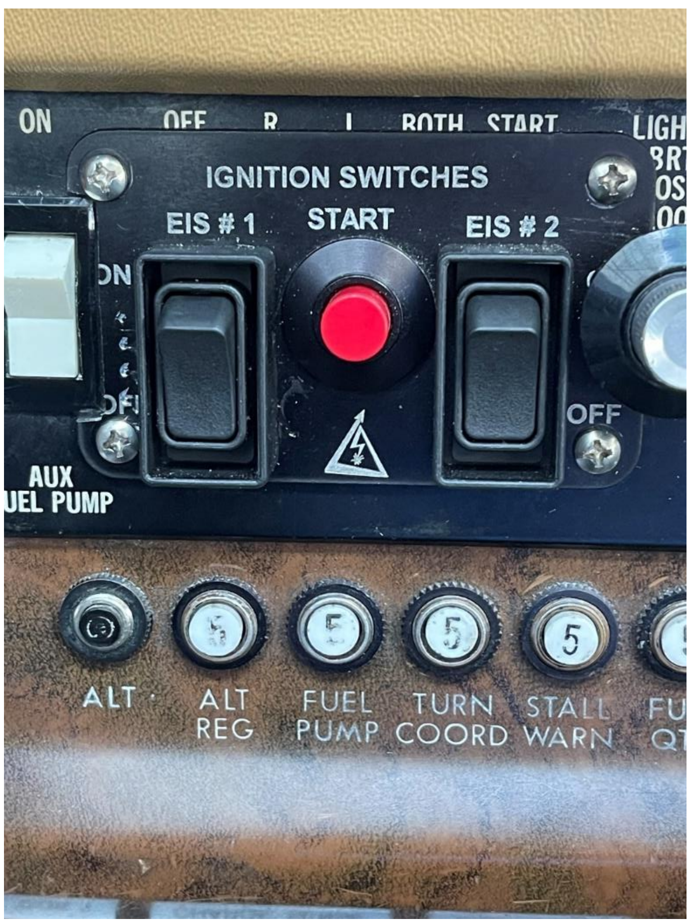
Electroair cable harness routing through the firewall

Closeup of cable routing showing EIS-1 and EIS-2 connectors to the main harness



Breaker Panel for the required Electroair breakers, fabricated from Aluminum sheet

EIS Switch Panel, notched to fit the Cessna Key hole area



Fouled Sparkplugs After First Flight