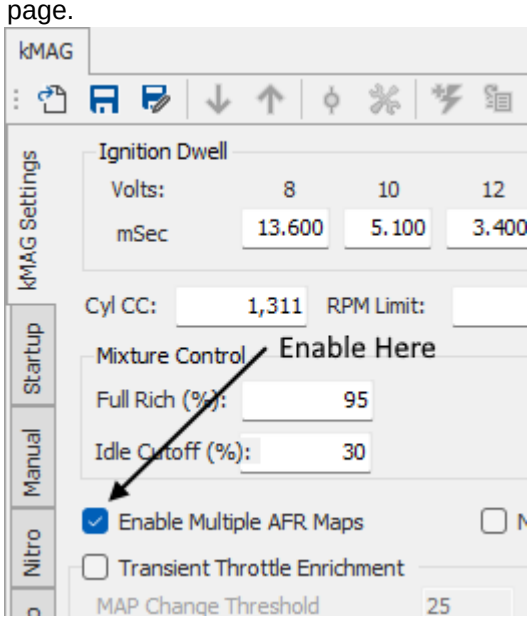
Phase Title:	Operation of system and resolution of problems.
Goal:	To test that the basic operation of the CanFly system and essential reliability.
Expected Duration:	3-5 Hours
Ground Time:	3-5 Hours
Flight Time	Nill
First Start:	Start aircraft and verify the basic timing parameters and installation is stable
	Inspect engine and installation and verify that no leaks or chafing has occurred.
	Check and verify the range of controls is sufficient, adjust idle stop and cable to ensure idle speed can be adjusted.
	Refit all cowls and check engine compartment is sealed.
Tuning Run:	Start CanFly logger to capture engine test data.
	Restart engine and adjust to 1200rpm and allow engine to achieve operational temperatures and stable EGT.
	Increase RPM to 1600rpm and find peak EGT using the mixture control.
	Return mixture to full rich and increase RPM to 1850rpm, wait for the temps to stabilize. Find peak EGT using the mixture control.
	Return mixture to full rich and check operation on left / right kMAG and ensure the system operates as expected. Since the engine may be running very rich at this point, do not leave on left or right only for too long to prevent plug fouling.
	Disconnect the power from the left and right kMAG and check that the generators function as expected.
	Return mixture to full rich and increase RPM to 2100rpm, wait for the temps to stabilize. Find peak EGT using the mixture control.
	Return mixture to full rich and increase RPM to 2350rpm, wait for the temps to stabilize. Find peak EGT using the mixture control. With the engine running so rich it may not be possible to achieve this test point without some leaning of the mixture.
	Return the mixture to full rich and close the throttle. Note if the idle is not in the correct range (750-900 rpm). Pull the mixture to minimum and check that the engine stops.
Review the logs.	Review the data obtained in the logs. The important things to note are the stability of the EGT readings, and fuel pressures etc.
	Note that the procedures above assume a Kotuku EDU is being used to monitor the engine performance. If another engine monitor is used then the logs will need to be compared by the best method possible.
Implement the changes.	Once the logs are viewed and the operation of the engine can be determined, the changes to the VE map for each cylinder can be made and the test run repeated to check if the desired changes work.
Expected results.	At the completion of this test phase the basic manual map and use of the mixture control will be confirmed.
	The durability of the implementation will be measured and verified that it can operate for at least the expected second phase testing routine
	The installation can be verified to be suitable and the kMAG systems do not overheat or have any problems.

Phase Title:	Basic operational flight testing
Goal:	To test that the basic flight operation of the CanFly system.
Expected Duration:	1 Hr
Ground Time:	0.5 hrs
Flight Time	0.5 hrs
High speed test:	Start aircraft and perform the normal startup checks. Set 1800rpm test each kMAG and exercise the CS prop if fitted. Prepare the aircraft for flight (seatbelts, canopy locked, other checks completed. Use a runway with sufficient length to accelerate the aircraft to 0.8 of rotation speed (vs1) and still have enough length to safely stop using brakes. If the aircraft does attempt to take off, cut power and stop if safe to do so, otherwise go to the flight test. Start the logger and ensure the PC is secured. Perform a dummy take of run. If enough power is available abort testing. Once complete backtrack and perform a flight test.
Flight Test.	Ensure that the weather and clearance is available to fly overhead the field to 3000 ft and perform a simulated circuit from 3000ft to 2000ft and back to 3000ft. Take off and climb to 3000ft. Check all temps and pressures. Note any issues on a journal during the flight Once at altitude perform a simulated downwind, base, final and go-around of the airfield. Use the mixture control to manage the performance of the aircraft as a climb/cruise map has not been defined yet (the base map is set for full-rich at all times). If any issues that affect the flight safety, perform a precautionary landing immediately. Otherwise perform a normal rejoin and landing.
Post Flight:	Remove the cowlings and verify that all of the system is still installed as required and no leaks,or chaffing has occurred.
Review the logs.	During this run a large log will be created. This log needs to be reviewed and
Implement the changes.	Once the logs are viewed and the operation of the engine can be determined, the changes to the VE map for each cylinder can be made and the test run repeated to check if the desired changes work.
Expected results.	At completion of these tests the basic operation of the aircraft will be checked and the operation of the system is verified.

Phase Title:	Alternate AFR maps
Goal:	Enable and test the optional AFR maps
Expected Duration:	1 Hr
Ground Time:	0.25 hrs
Flight Time	0.75 hrs

Enable alternate maps.

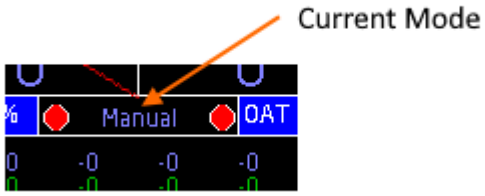
The kMAG's have 2 alternate maps that can be enabled in the CanFly commander. Firstly load from file, or download the kMAG settings. Enable these maps by selecting the 'Enable Multiple AFR Maps' on the basic settings page.



Check that the cruise and climb maps are suitable. The system defaults to a climb AFR setting of 12:1 which is approximate for best power for a Lycoming engine. The cruise afr setting is 16.5:1 which is approximate for lean-of-peak operation on a Lycoming engine. Phase 4 deals with using the log files and the Commander to tune these settings

Check the operation of AFR map switching.

The current AFR map is selected between one of 3 maps; Manual, Climb and Cruise. The Kotuku EDD will show the current mode:



The Manual mode is selected when the mixture control is NOT at 100% (usually set to 95% of full rich).

The CanFly USB adapter has a push button that is illuminated when climb/cruise is selected. Pressing the button will swap between climb/cruise.

On the ground this can be checked as follows.

Set the mixture lever to 50% and the Manual mode should be selected (no LED on the CanFly USB adapter)

	Set the mixture lever to 100% and Climb should be indicated on the EDD and the LED on the CanFly USB adapter will be green. Press the button on the CanFly USB and the LED should turn RED and Cruise is displayed on the EDD. To cancel Cruise either move the mixture to manual control or press the button till Climb is displayed and the LED turns green.
Flight Test.	Prepare the aircraft for flight and check all systems. Start the CanFly logger application and secure the PC running the software. Set the mixture lever to 100% and Climb should be indicated on the EDD and the LED on the CanFly USB adapter will be green. Perform a normal takeoff. If the performance of the aircraft is not what is expected move the mixture lever till manual is shown and land as soon as possible. Perform a climb to 5000 ft and stabilise at that altitude. Once in normal cruise and the power is less than 75% (Never engage when power is greater than 75%!) engage the cruise map. The power should reduce and the fuel flow will drop noticeably. This is normal lean of peak operation. Perform 2 reciprocating track flights of at least 5 min each. Press the button on the CanFly USB and re-select teh Climb map (or move the mixture lever). Return and land.
Post Flight:	Remove the cowlings and verify that all of the system is still installed as required and no leaks,or chaffing has occurred.
Review the logs.	During this run a large log will be created. This log needs to be reviewed and and recommended changes made to the maps.
Implement the changes.	Once the logs are viewed and the operation of the engine can be determined, the changes to the VE map for each cylinder can be made and the test run repeated to check if the desired changes work.
Expected results.	At completion of this test, the alternate maps functionality will be completely tested as working.

Phase Title:	Optional tuning
Goal:	Revise and establish a suitable map for the aircraft performance
Expected Duration:	Variable
Ground Time:	Variable
Flight Time	Variable
Fine tune the maps.	The kMAGs have a sophisticated programmability that allows for a limitless number of tuning options. This phase allows the tuner to adjust the map or maps for specific operational requirements. For example, with a fixed pitch propeller it is possible to run a single map with sections for each phase of flight. That is takeoff/climb and reduced power cruise. A constant speed engine is somewhat more difficult as there is really only full rpm and cruise/climb. If lower power is used for cruise (say 2400 rpm) then a map to handle full-power/climb and cruise can be created as would be the case with a fixed pitch propeller.
Cold start enrichment.	The cold-start enrichment table can be used to enrich the mixture during cold-starts. A value of 2000 when cold (20x mixture on first start) tends to work for most cases. This can be changed with experimentation.
Transient throttle enrichment.	This uses the change in manifold pressure to enrich the mixture. For most cases this will not be needed as pilots are used to not aggressively changing the throttle position. However there are some use cases (STOL competition for example). This can be enabled and tuned in the CanFly Commander
Flight logs.	The CanFly Commander log file generator captures all data in real-time. This generated large log files. The kEDU engine data unit has a flight logger that allows for storage up to 3 hrs of engine data. This can be downloaded at the end of the flight into the Commander for analysis with the log viewer or sent to an online engine analysis service.
Post Flight:	Remove the cowlings and verify that all of the system is still installed as required and no leaks,or chaffing has occurred.
Review the logs.	During this run a large log will be created. This log needs to be reviewed and and recommended changes made to the maps.
Implement the changes.	Once the logs are viewed and the operation of the engine can be determined, the changes to the VE map for each cylinder can be made and the test run repeated to check if the desired changes work.
Expected results.	These are optional steps to enhance the installation of the CanFly system.