Additionnal DEM system features:

Voice Alerts (optional feature)	The integrated voice generator in the Enhanced display panel will generate voice Warning and Alert messages for the aircraft's audio system.
Data Logging (standard feature)	Each ECU stores engine parameters at 6-second intervals, with a storage capacity of over 100 flight hours. The recorded data can easily be downloaded via the RS232 or USB interfaces for post-flight data-logging and to be transferred to the factory for analysis.
EFIS	The system parameters are available for driving any EFIS display.

Field bus failure

A CAN bus failure does not affect the functioning of the engine, but interrupts the transfer of engine data to the display. The two ECUs continue to run the engine safely, unless there is a multiple failure. The state of each ECU is still displayed to the pilot by the way of two LEDs per ECU (four total). Each ECU LED pair is connected by a single, direct wire to its respective ECU. By modulating the voltage polarity, the red and/or the green LED can be illuminated. This simple, reliable and independent back-up can effectively assist the pilot's decisions in the case of an engine instrument display failure. Should a malfunction occur with the CAN bus operating, then the display will also identify the problem by flashing the Warning or Alarm message in plain English. The following table reflects the indications of *one ECU LED pair*. There are two pair sets.

	State	**Possible errors**	**Red LED**	**Green LED**	**Pilot action**
1	No error		off	**on**	
1a	*Minor* error detected by one ECU	- Minor sensor loss - Engine parameter getting in or moving to yellow range	**flash**	**on**	Acknowledge error by pressing display button; take appropriate pilot actions
2	One ECU has detected a wiring problem *(Major)*	- 1 injector circuit open - 1 ignition circuit open	**flash**	**flash**	No action required on DEM system, plan to land as *soon as practicable*
3	Engine instrument display goes blank *(Minor)*	ECU bus failure (CAN)	off	**flash**	Continued flight is possible but extra caution should be taken in managing the engine
4	ECU detects a severe condition *(Major)*	-Water loss -Low oil pressure	**on**	**on**	Reduce power to minimum required by flight conditions and land *as soon as possible*
5	Wiring problem *(Minor/Major)*	- No power to ECU or bad LED wiring	off	off	Confirm defect from display (if CAN operating). Try restoring power to the ECU, if not successful, land *as soon as practicable/possible*
6	Powered but non-functioning ECU	- Initialisation phase - Software error	**on**	off	- Wait a few seconds if ECU was just turned on - Land *as soon as practicable*

ECU(Engine Control Unit)

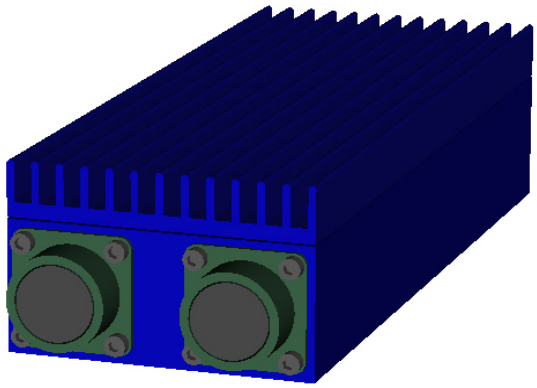

Illustration 4:
Electronic Control Unit (ECU)

The DEM system is composed of two independent and physically separate ECU enclosures to ensure ultimate redundancy. Each ECU acquires signals from a number of sensors, process them and then controls actuators (fuel injectors, ignition coils, propeller governor, turbo wastegate for a turbocharged engine, etc.) to optimize engine operation on a per-revolution basis. Each unit of two can safely run the engine alone at full power. In normal operations, the two units each inject half the total fuel quantity. In case of an ECU failure, the other unit injects the required total quantity to achieve the power selected by the pilot.

Each unit is run by a Motorola MPC-555 high-performance processor which is also available in military-specification version.

Each unit runs a recorded, self-diagnosis and evaluation of its connections to sensors and actuators. This information is exchanged with the partner unit confirming its healthy function. Should either ECU not receive this message from its partner, it concludes a partner ECU failure and instantly asserts overall engine control.

The two ECUs are individually packaged to increase resiliancy against mechanical or chemical intrusions, as well as to increase mounting flexibility. The two units may be mounted side-by-side in a standard radio rack, or separately in the cabin or within the cowl. ECU's sturdy enclosure, as well as the design of their circuitry and their components' specifications, accommodate rigorous engine compartment conditions (not yet a final spec).

Error detection

The ECU is able to detect electrical errors on most connections. For example, the injector driver detects either a short or open circuit of the wiring, and reports this diagnostic to the main processor. Each error is processed so that the system automatically finds a new method which keeps the engine running.

Specifications

General:

	ECU	Display TFT	Display LCD
Processor	Motorola MPC-555	TBD	TBD
Height	50mm	90mm or 127mm	83mm
Width	79mm	170mm or 159 mm	83mm
Length	200mm		
Power	8-33VDC 7W only ECU	8-33VDC	8-33VDC
Connectors	Power 26-pin MIL-C-26482 Measuring 26-pin MIL-C-26482	26-pin MIL-C-26482 RS232 D-SUB9 USB, RJ-45	26-pin MIL-C-26482 RS232 D-SUB9 USB

Environmental
System design is to the following environmental RTCA/DO-160D standard:

	ECU	**Display or LCD**
Temperature/Altitude	B3	B1
Operating Temperature	-45 to 90°C	–20 to 55°C
Short-Time Operating High	100°C	70°C
Storage Temperature	-55 to 100°C	-30 to 85°C
Operating Ceiling	25’000ft 7600m	25’000ft 7600m
Temperature Variation	A	C
Humidity Category	C	A
Shock	B	B
Vibration	L	M
Explosion	H	X
Waterproofness	R	X
Fluids	F	X
Sand & Dust	S	X
Salt	S	X
Magnetic Effect	B	A
Power Input	B	B
Voltage Spike	B	B
AF Susceptibility	B	B
Induced Signal Susceptibility	Z	Z
RF Susceptibility	TBD	TBD
EMI	L	M
Lightning Indirect Effects	A4E4	A3E3
Lightning Direct Effects	3	X