

M1 Abrams Tank Turbine Engine Diagnostics (TED)

U.S. Army Ordnance Center and School

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Background

TED (Turbine Engine Diagnostics) is a diagnostic expert system for the M1 Full Up Power Pack (FUPP). It is a DS level tool, designed to provide the DS shop the ability to efficiently and effectively diagnose faults, perform necessary repair, order parts and validate serviceability. TED was designed and built by the U.S. Army Ordnance Center and the U.S. Army Research Laboratory at Aberdeen Proving Ground, MD. The program began in 1991 and will be completed by FY 1996. PM Abrams has agreed to field the completed package in 1996. TED will replace FUPP TM's and ABOB will eventually replace parts of STE-M1.

The National Guard is receiving an early release. This version of TED is being issued to Guard sites to:

- Help reduce maintenance costs
- Provide feedback to ARL to improve the product

The Basic Components

1. V2-LC Computer with keyboard
2. ABOB or BOB
3. AC/DC Converter/Charger
4. Software (TED CD)

Each is described in more detail below

1. The V2 LC computer features a detachable keyboard front cover assembly that contains an alphanumeric American Standard 82 key keyboard with arrow keys, and a trackball pointing device with three buttons (See Fig 1). The keyboard supports AT compatible 101 key keyboard functions. Key combinations are required to emulate some of the functions of a 101 key keyboard. Keyboard functions may change, depending on the software program. Check your software documentation for specific key functions. (See Fig 3).

2. The ABOB (Automated Breakout Box) or BOB may be used with the V2 LC. The TED program also contains an internal BOB in the tool use section of the DITS Training Module.

3. The AC/DC Converter/Charger takes either AC power at 110/220 VAC, 50/60 HZ (Hertz), or DC power within the range of 23 to 33 VDC and converts it to the proper voltages for powering the V2 LC (and simultaneously charging the V2 LC rechargeable battery pack, if installed (See Fig 2).

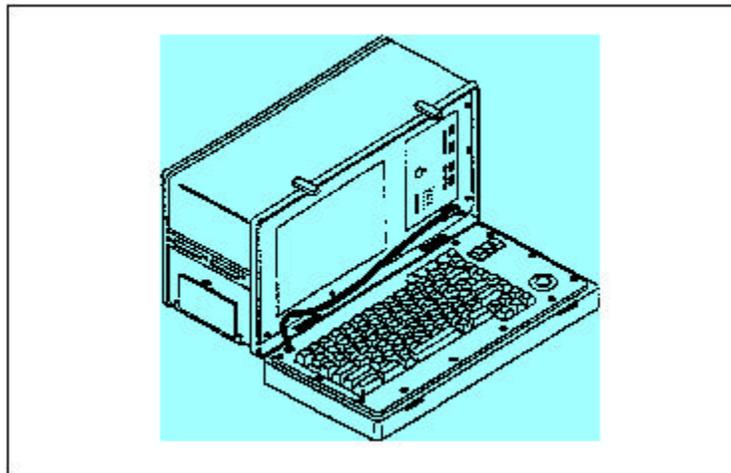


Figure 1: V2-LC Computer with Keyboard

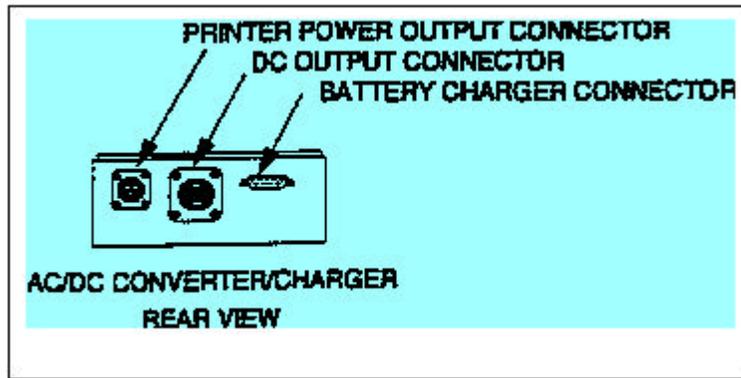


Figure 2: AC/DC Converter/Charger

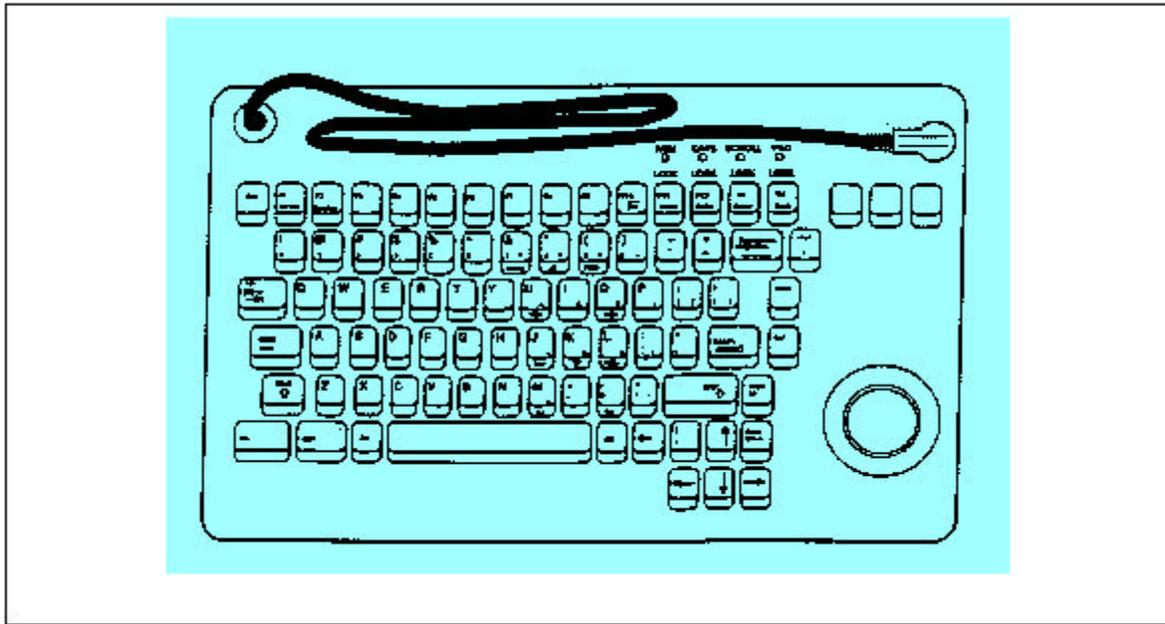


Figure 3: Keyboard with Mouse

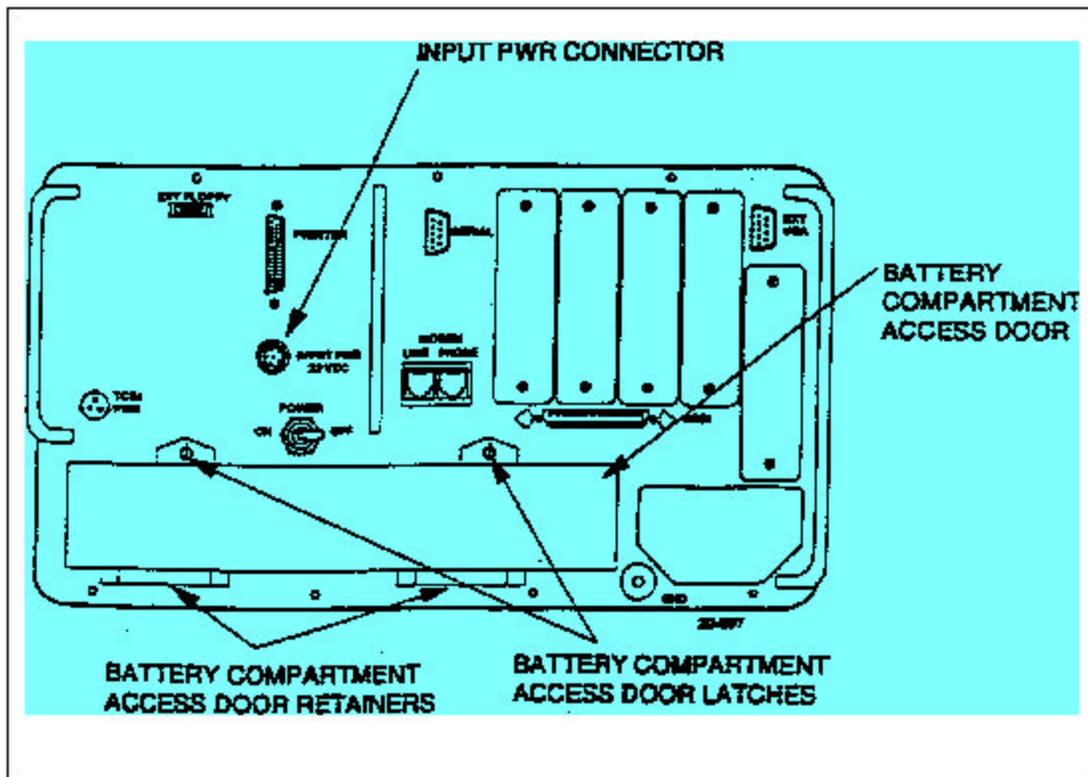


Figure 4: The Back Panel of the V2-LC

The basic hookup procedures are outlined below:

1. The male connector on the V2 LC input power cable is plugged in to the DC output connector on the AC/DC converter/charger. The female connector is plugged in to the Input PWR 32 VDC Connector on the rear of the V2 LC. Connect the female plug of the power cord into the male socket of the AC/DC converter/charger (See Fig 4.)
2. The ABOB is connected by plugging the female end of the 9 pin cable in to the male socket on the ABOB. Plug the male connector into the serial port on the V2 LC. The female end of the power cord into ABOB and the male end of the power cord into a 110/220 VAC supply outlet. If the indicator light is on, the ABOB is turned on. (further info on page 21).
3. For the optional printer, connect the printer cable to the printer power output connector on the AC/DC converter/charger and to printer serial port on the V2 LC computer.
4. An external VGA Monitor is available for use on this system. You must connect the cable for the monitor to the external VGA port on the V2 LC to the input VGA port on the monitor. The monitor **MUST** have this connection to be used.

The TED package consists of 4 main parts.

1. diagnostic software (TED).
2. repair parts and special tools list software (RPSTL).
3. special hardware inside the BOB (ABOB).
4. training software (DITS).

Brief Description of TED Modules

When you start your laptop you will see a screen like Figure 5 below, which contains 5 icons.

Double click on an icon to run it.

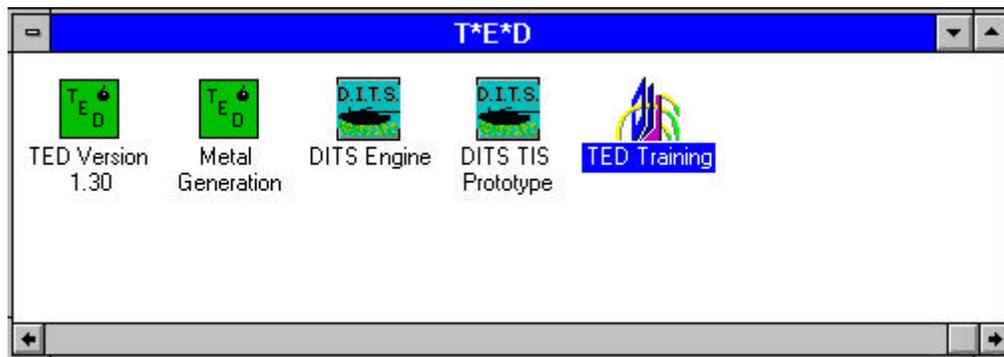


Figure 5: TED group in Program Manager

TED Version 1.30 This is the main TED program which contains the diagnostic, repair and RPSTL modules (Reference: TED Quick Access Menu).

Metal Generation This module which determines the extent and cause of metal contamination in the engine.

DITS Engine DITS (Diagnostic Intelligent Tutoring System) provides a self paced way to learn about the engine, and troubleshoot common faults through simulation, review modules and knowledge exercises. (See Appendix C. DITS Engine User Guide).

DITS TIS This version of DITS is for the Thermal Imaging System (TIS). (See Appendix D. DITS TIS User Guide).

TED Training This module explains how to hook up the Ground Hop Support Set (GHSS), the Breakout Box (BOB), the Automatic Breakout Box (ABOB), and how to use a multimeter.

TED Quick Access Menu

Double click the TED Version 1.30 Icon (shown in Figure 5) to get the TED Quick Access Menu shown in Figure 6 below.

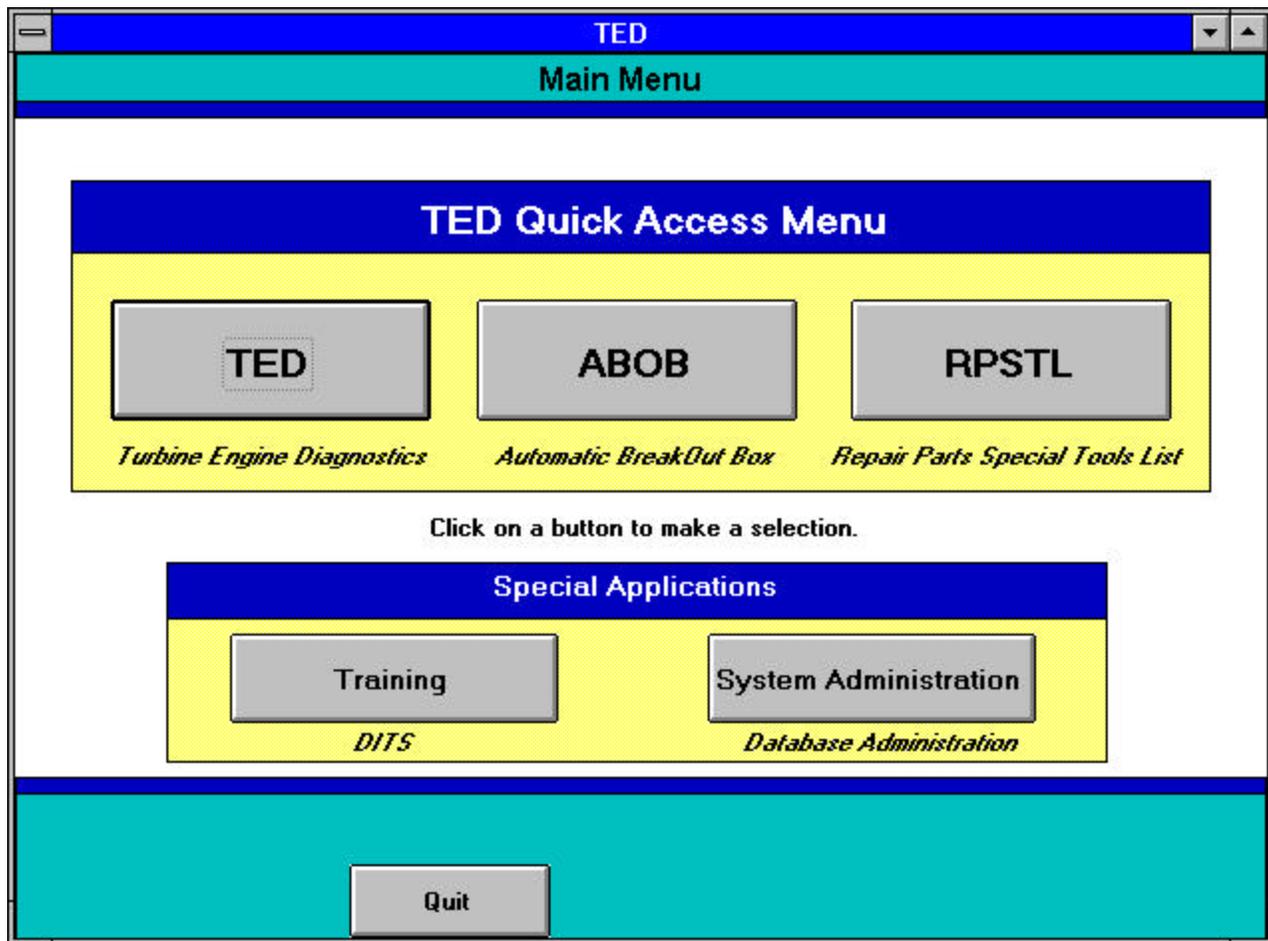


Figure 6: TED Quick Access Menu

TED This button starts the main TED program. See Figure 7 for the TED Main Menu.

Automatic Breakout Box (ABOB) This button opens the ABOB menu screen. See Appendix B for complete details.

Repair Parts Special Tools List (RPSTL) This button opens the RPSTL screen. See Appendix A for details.

TED Main Menu

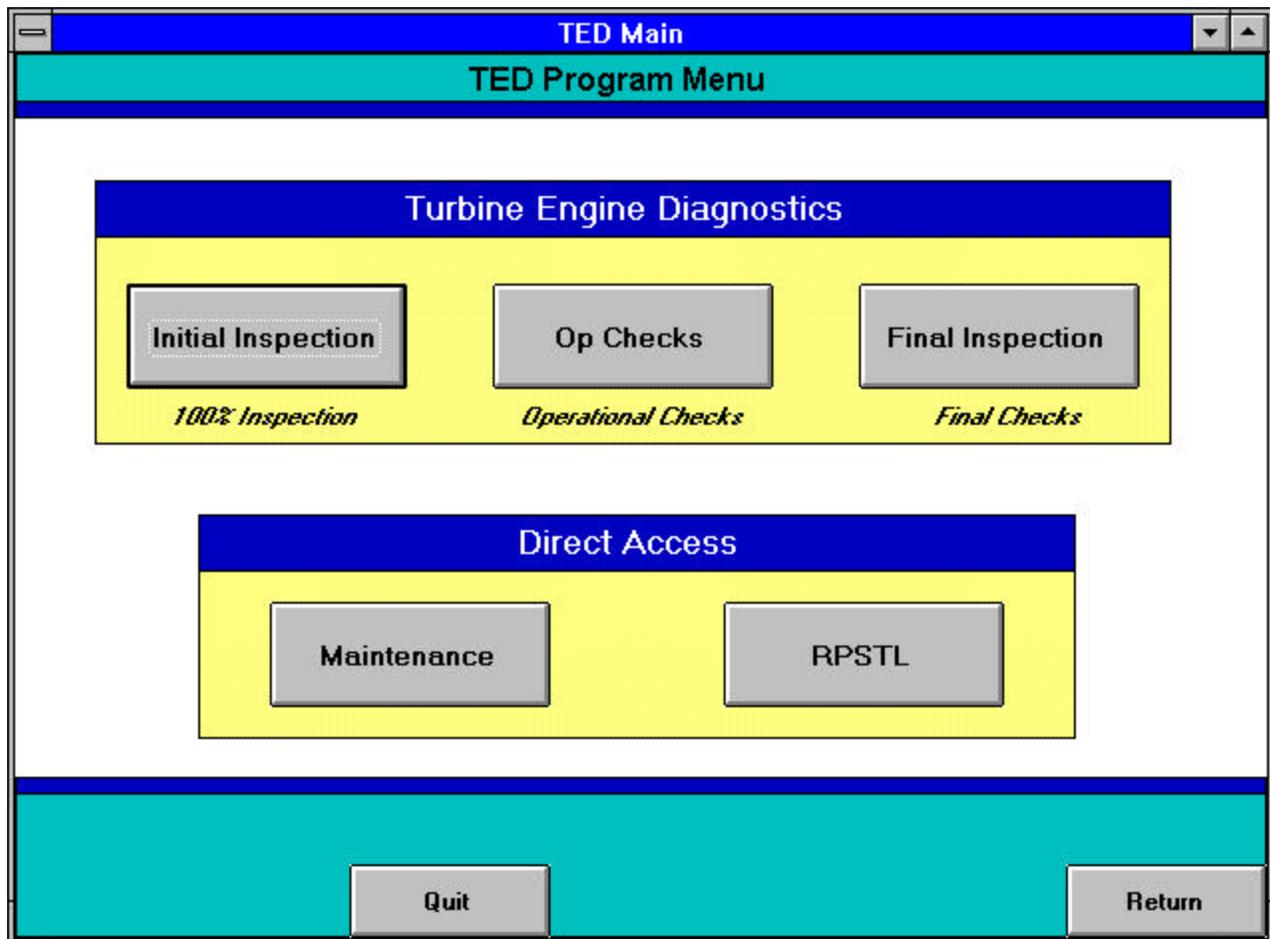


Figure 7: TED Main Menu Screen

Initial Inspection This button does a 100 % inspection of the power pack and prepares a DA 2404.

Op Checks This button leads to the menu choices shown in Figure 8.

Final Inspection This option not currently available.

TED Diagnostics Procedures

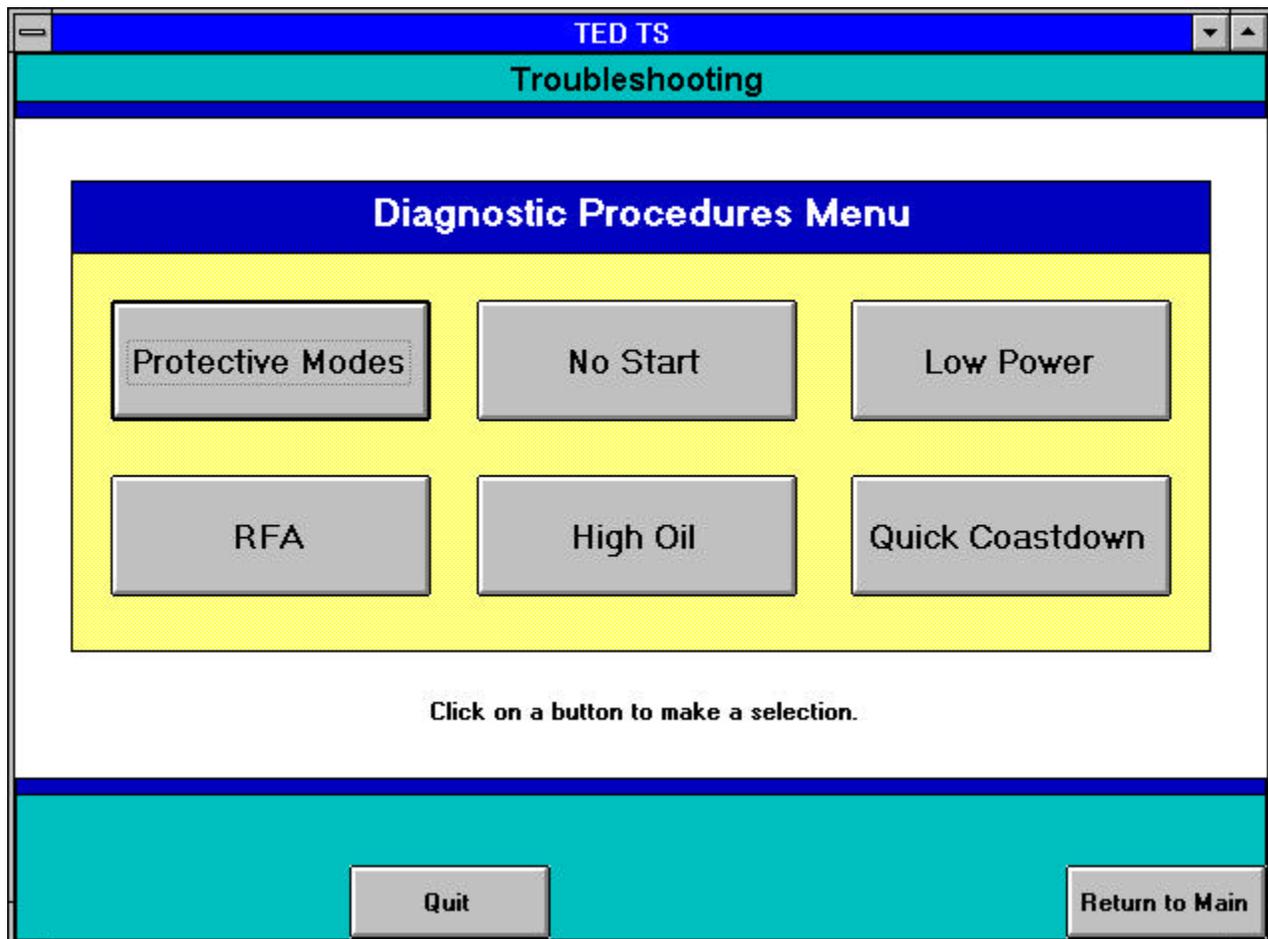


Figure 8: TED Diagnostic Procedures Menu

Protective Modes The ECU can initiate one of 4 protective modes to avoid damage to the engine. The ECU constantly monitors all sensor inputs, and compares them with established parameters. When certain inputs are out of tolerance, the ECU initiates one of the protective modes. This module will identify the protective mode and fault isolate the cause of the problem.

No Start Using a few basic questions as to why the engine will not start, this module quickly and accurately determines the most probable cause of a No Start condition.

Low Power This module is designed to fault isolate and repair a low power condition found by the engine health check.

RFA (Rapid Functional Assessment) This procedure quickly determines whether it is safe to attempt to start the FUPP. A minimal number of inspections -- 3 rotational and 4 lubricational -- evaluate the mechanical integrity of the engine's internal rotating components. This is important to prevent personal injury or unnecessary damage. If any problems are found, RFA will either fault isolate the problem, or for more serious problems, recommend replacement of the engine.

High Oil & Quick Coastdown This module not currently available.