End To End Troubleshooting

Engenix, Inc.
475 Providence Main
Suite 302
Huntsville, AL 35806

Daniel Strauss:
Daniel.Strauss@engenixinc.com

Getting Started

The purpose of this document is too outline and explain the end to end troubleshooting process for the mechanics interaction with the IETM technical manual. We will be going through the full process step by step with an in depth explanations for each step in the process.

Note: It is highly recommended that anyone reading this document opens the IETM on screen and follows the full process of this document from start to finish directly in the IETM too ensure full understanding of the process and avoid any confusion.

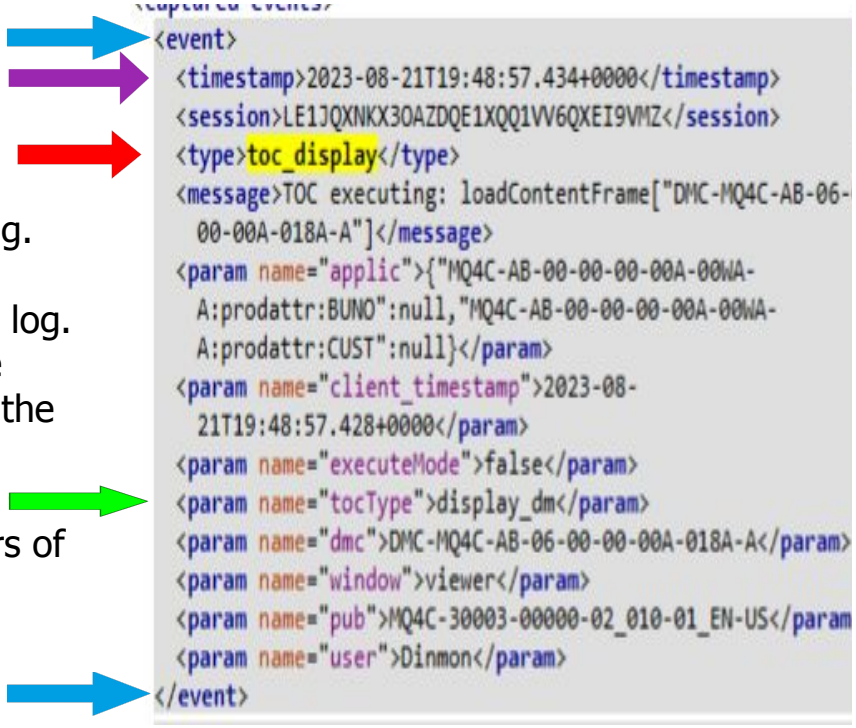
IETM: Overview

The IETM is an electronic technical manual that is used in the process of ensuring accurate maintenance is provide by the mechanic too the aircraft. When using the IETM the mechanics actions will be recorded at every step and will be entered into the audit log as part of an XML decision tree.

XML Decision Tree Overview

An XML decision tree can appear quite complex at first glance for someone who has never programmed before. But in essence this XMl decision tree acts as a log of all interactions with the electronic technical manual. Looking at the blue arrows you will see they both point at the word event. This indicates the start and end of the entry into the log. The purple arrow indicates the timestamp of the entry into the log. Year, month, day and time. The red arrow indicates the type of the interaction that the audit log is recording. The green arrow indicates the varying parameters of the entry into the log.

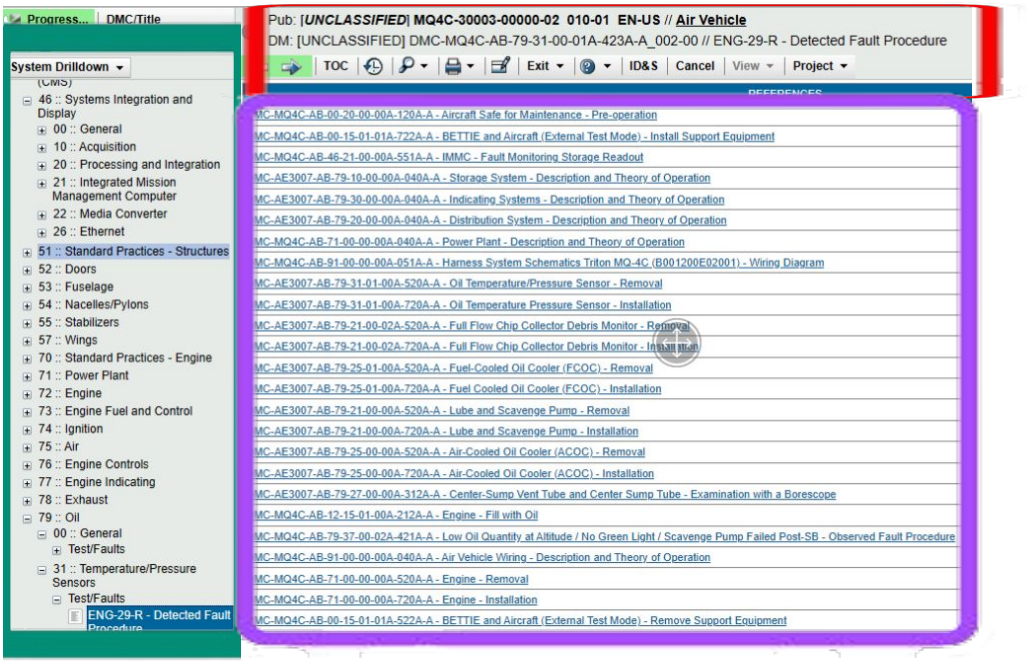
Note: This is a very simplified overview of the XML structure of the audit log.



IETM At A Glance

After gaining access to the the IETM. You will see a web page similar to the one bellow.

Note: There are several parts of the IETM that serve different functions.



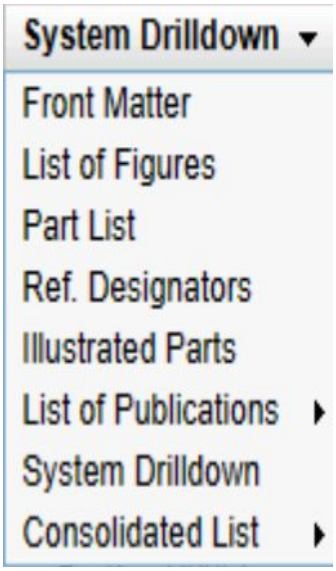
For ease of use we will break these down into three separate sections. The Scroll Down Menu, The Tool Bar and the Main Window.

The Scroll Down Menu

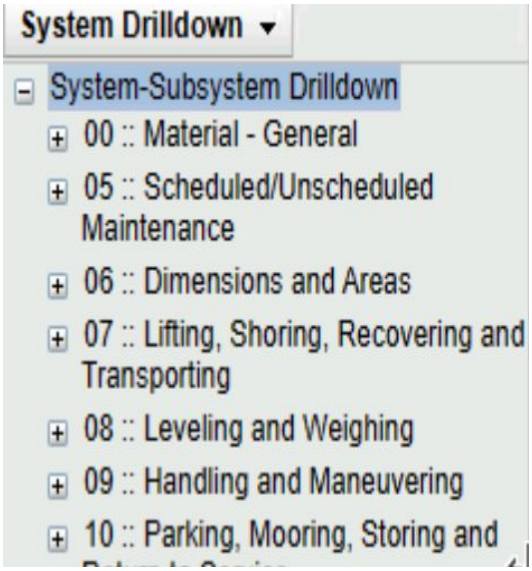
The Scroll Down Menu allows the mechanic to access all documents, Figures, Parts List, References, etc..

Through the Scroll Down Menu the user has access to the "System Drilldown" option which will be needed in the troubleshooting process.

Scroll Down Menu



System Drilldown



The Main Window

The Main Window is where most interactions will take place during the troubleshooting process. This is where the mechanic will proceed with Detect Fault Procedures, or review documents such as the Part List after selecting them on the Scroll Down Menu.

The Tool Bar

The tool bar is essential for the troubleshooting process. It is necessary for viewing the XML audit log, as well as executing and navigating Detect Fault Procedures.

Starting Point: Discrepancy Recorded

The mechanic may need to be involved should the operator of the aircraft or onboard software record a discrepancy.

IETM: Start Troubleshooting Process

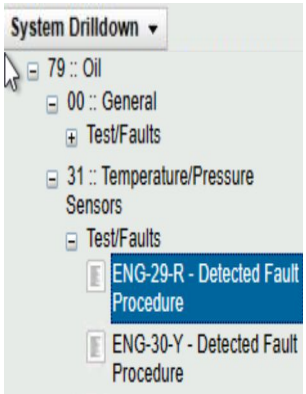
To start looking for a discrepancy it is best to be familiar with the aircraft in general and all relevant documentation. In the Scroll Down Menu the user may select among various options from a "List of figures", "Part List", or "System Drill down."

Step 1: The mechanic will need to select System Drill down" and select the part that has received a discrepancy report. For our example we will be assuming a reported "Oil" discrepancy in the temperature/pressure sensors.

Step 2: Select "Go Execute" above the Scroll Down Menu.

Step 3: You will see progress light in green indicating the detect fault procedure is active.

Step 1



Step 2

Step 3

Looking For Faults

Now that the detect fault procedure has been launched the mechanic will be directed to a list of procedures in the Main Window designed to help identify the defect. Walk through these procedure step by step.

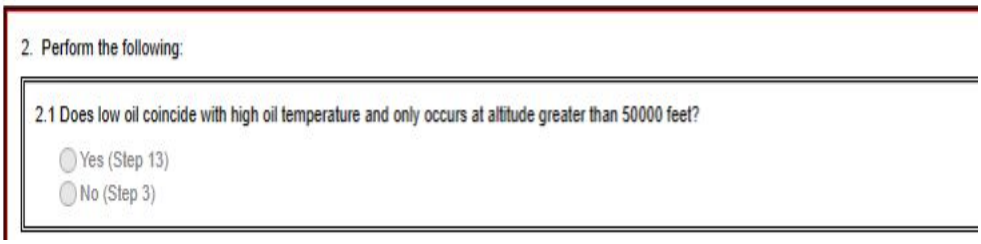
Note: There may be a list of reference material too review

Fault Isolation

Fault Code	Fault Description
ENG-29-R	This message occurs when oil temperature value measured by Oil Pressure and Temperature Transducer Sensor is above 260 °F (yellow) or 320 °F (red).

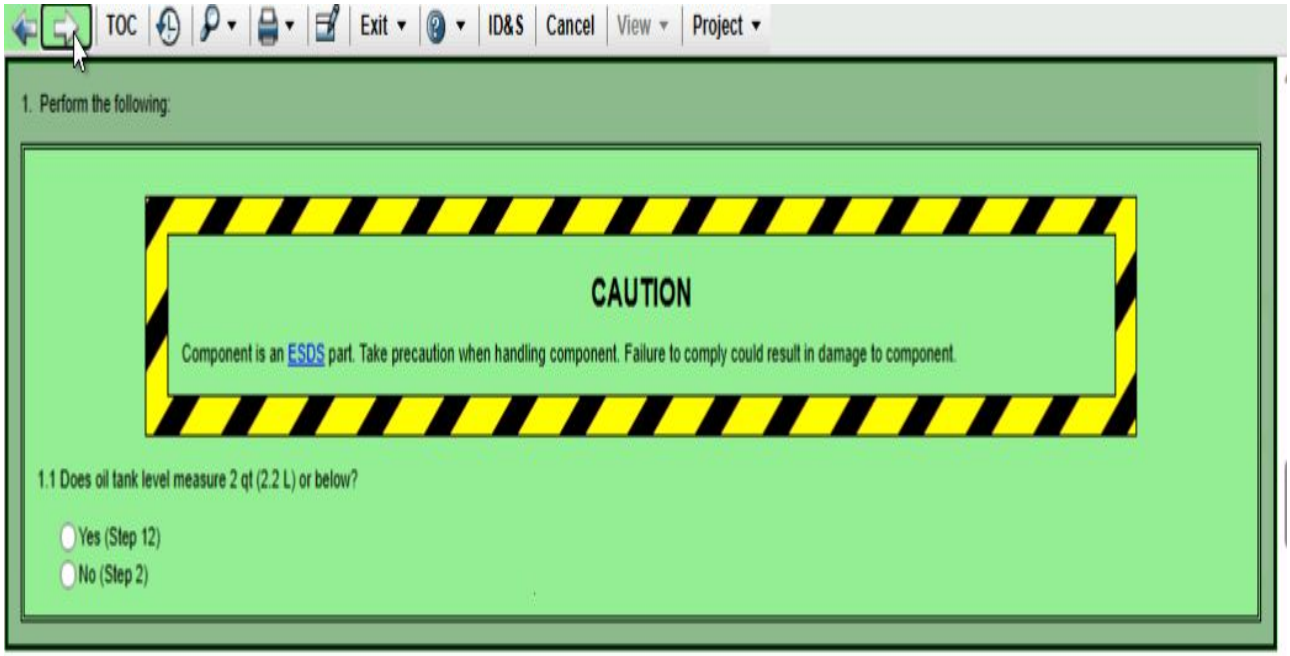
Overview Of Detect Fault Procedure

The detect fault procedure works by providing a list of required steps for the mechanic too follow. These steps may range from checking oil levels too replacing parts. The mechanic must work through these procedures in order and follow the instructions explicitly.



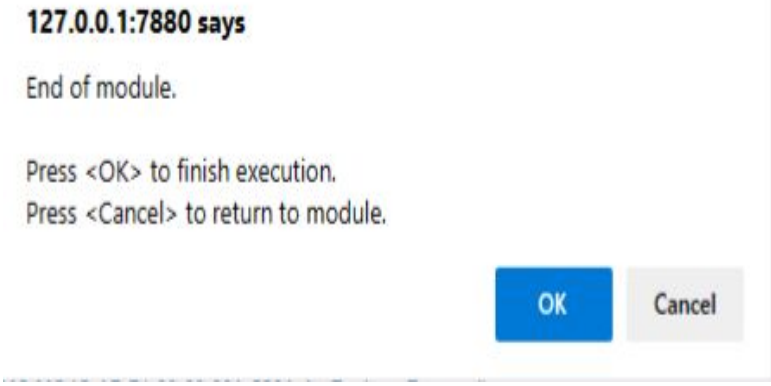
Performing Procedures - Step By Step

To begin the first step of the procedure and proceed to any further additional steps simply click the forward arrow  . Then complete the procedure.
Warning: Read all instruction and select the corresponding answer before clicking the forward arrow again  to proceed with the next part of the troubleshooting process.



Final Step Of Troubleshooting Process.

Question: How we know that the mechanic is done with the procedure and how does the Audit Log capture a successfully completed procedure.
Answer: Upon completion of the troubleshooting process the mechanic will be prompted by the "End of Module." After selecting "Ok." dm_completion will be added to the audit log.
Note: How to access and review the audit log will be covered in the next section.



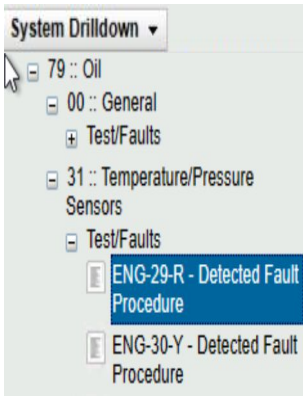

```
<event>
  <timestamp>2023-08-25T09:23:47.527+0000</timestamp>
  <session>LE1JQXNKX3OAZDQE1XQQ1VV6QXEI9VMZ</session>
  <type>dm_completion</type>
  <message>Completed Data Module:DMC-MQ4C-AB-79-31-00-01A-423A-A_002-
    00_EN-US.xml</message>
  <param name="applic">{"MQ4C-AB-00-00-00-00A-00WA-
    A:prodattr:BUNO":null,"MQ4C-AB-00-00-00-00A-00WA-
    A:prodattr:CUST":null}</param>
  <param name="client_timestamp">2023-08-25T09:23:47.524+0000</param>
  <param name="executeMode">true</param>
  <param name="dmc">DMC-MQ4C-AB-79-31-00-01A-423A-A_002-00_EN-
    US.xml</param>
  <param name="window">viewer</param>
  <param name="user">Dinmon</param>
</event>
```

Identify Data Captured At Each Step Of The Decision Tree - Part 1

Too identify what data is captured at each step of the decision tree one must first start first with initiating the IETM troubleshooting process. The below instructions are repeated for your convenience form page 3.

In the Scroll Down Menu the user may select among various options from a "List of figures", "Part List", or "System Drill down."
Step 1: The mechanic will need to select System Drill down" and select the part that has received a discrepancy report. For our example we will be assuming a reported "Oil" discrepancy in the temperature/pressure sensors.
Step 2: Select "Go Execute" above the Scroll Down Menu.
Step 3: You will see progress light in green indicating the detect fault procedure is active.

Step 1

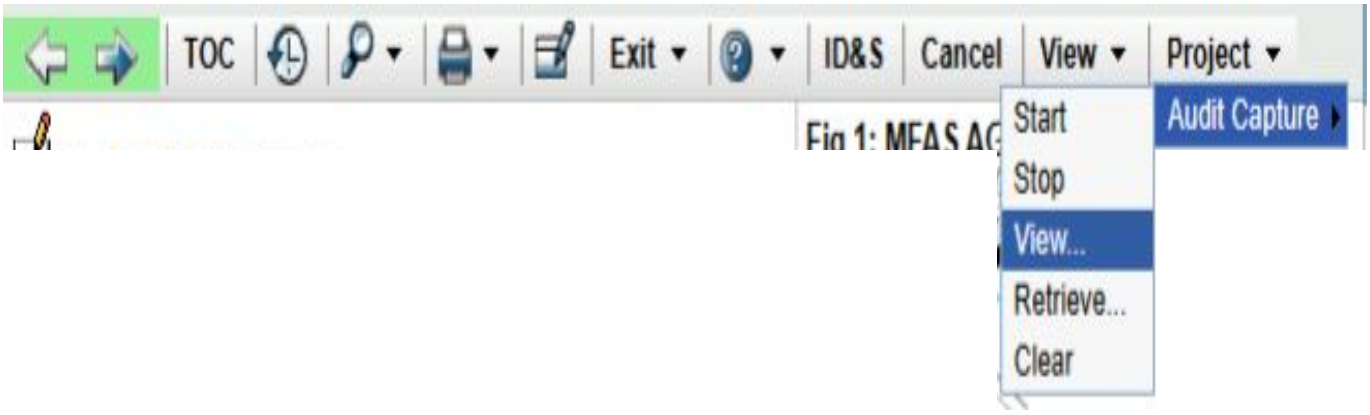


Step 2

Step 3

Identify Data Captured At Each Step Of The Decision Tree - Part 2

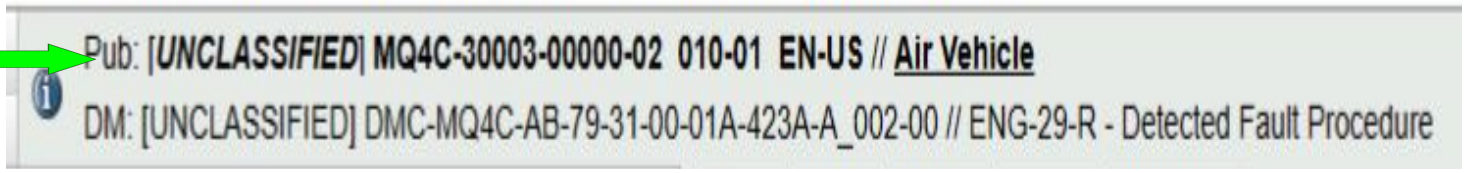
The audit log captures every interaction of anyone interacting with the IETM technical manual. To view an audit capture of an ongoing session select "Project" - "Audit Capture" - "View"



Note: The audit log capture what the mechanic does at every step. For example each interaction I have had with the IETM has been held in the audit log. Under the Name "Dinmon" as indicated by the blue arrow in the XML file below. Every action from selecting a file, link, or any other interaction is captured as part of the audit log as part of a single event in an XML format.

In the above XML Event we see that our initiation of the "Detect Fault Procedure" has been captured by the audit log. In the type section we see the type of dm_initiation indicating that the initiation of the detect fault procedure has been captured too the audit log as indicated by the purple arrow.

Another thing to note is that upon launching the detect fault procedure the mechanic will receive an indication that the fault procedure has launched successfully via the "Main Window" as indicated by the Green arrow below. This will be reflected in the XML file of the audit log as indicated by the green arrow above. Both codes will be identical.
MQ4C-AB-79-31-00-01A-423A-A 002-00



Note: The process of verifying if an action by the mechanic has been recorded as part of the audit log can be repeated on any step of the troubleshooting process. It does not need to be done on the the initiation of the detect fault procedure.

Estimated Time To Complete The Troubleshooting Process.

Determining our time to complete the troubleshooting can be done by simply viewing the audit log.

Our previous example for the dm_initiation had a timestamp for the initiation of the event on 2023-08-24. So August 24th 2023 at 21:05:18. So 9:05pm and 18 seconds.

The Time stamp for the completion of the event was on 2023-08-25. So August 25th 2023 at 09:23:47. So 9:23am and 47 seconds.

By comparing the two events dm_initiation and dm_completion we can see that the time between the two events represents the the full time for completion of the troubleshooting process.

Note: This was a test case and the time difference shown between the initiation and completion of the task is not reflective of a real world case.

Number Of Steps From Start to Finish

Determining the number of steps from start to finish can be done by simply viewing the audit log. dm_initiation can be viewed as the first step in any procedure. While dm_completion can be viewed as the end of any procedure.

- A full count of each XML event in the audit log between initiation and completion would give you the number of events in the log.
- While the number of <type> step_completion as indicated by the red arrow will give the corresponding Step numbers.

```
<event>
  <timestamp>2023-08-25T09:23:07.983+0000</timestamp>
  <session>LE1JQXNKX3OAZDQE1XQQ1VV6QXEI9VMZ</session>
  <type>step_completion</type>
  <message>Completed step Data Module:DMC-MQ4C-AB-79-31-00-01A-423A-A_002-
    00_EN-US.xml, step num:[step-number: 22. , stepID: S24]</message>
  <param name="applic">{"MQ4C-AB-00-00-00-00A-00WA-
    A:prodattr:BUNO":null,"MQ4C-AB-00-00-00-00A-00WA-A:prodattr:CUST":null}
    </param>
  <param name="client_timestamp">2023-08-25T09:23:07.975+0000</param>
  <param name="executeMode">true</param>
  <param name="step_number">step-number: 22. , stepID: S24</param>
  <param name="step_content">22. Remove Accessory Drive Gearbox from
    service.</param>
  <param name="dmc">DMC-MQ4C-AB-79-31-00-01A-423A-A_002-00_EN-US.xml</param>
  <param name="window">viewer</param>
  <param name="user">Dinmon</param>
</event>
```

Alert Code - Discrepancy Write Up

Upon receiving an alert code the mechanic will look up the corresponding detect fault procedure and follow the highlighted steps above to find and resolve the fault.

After competition of the end to end troubleshooting process the mechanic will be responsible for documenting the issue and the full processes used to resolve the fault.

Count Of Number Of Mechanics In Audit log

Determining the number of mechanics can be done by simply viewing the audit log. Retrieving a full count of each unique <param name="user"> (as indicated by the red arrow) and would give you the number of mechanics who logged into the IETM during the troubleshooting process.

XML - Decision Tree - Visualization

The decision tree for the Oil, Temperature and Pressure sensors is largely linear. However each entry is itself a Yes or No question. As such, almost every row is its own branch.