Prototype Aircraft Jet Engine Characterization and Test

Application Note 1270-3

Description
Jet engine prototypes must be tested on a number of performance parameters to refine design characteristics. This to improve fuel efficiency at various thrust levels, reduce noise output and vibration at various turbine rotational speeds and many other parameters, all to ensure reliability while optimizing the design.

Problem
Aircraft engines require rigorous testing, not only to ensure proper operation, but also to develop a baseline for future testing and refinement of test procedures. Development test systems for aircraft are unlike production test systems in that development tests are frequently designed on-the-fly, requiring frequent system reconfiguration and programming changes. Engineers might configure data channels one day to test engine pressure, temperature, or rotor speeds. Soon after, engine vibration testing may require a significant system reconfiguration and reprogramming.
Solution

A Hewlett Packard VXI Data Acquisition System offers the modularity and architectural flexibility for quick system reconfiguration by adding and/or substituting instrumentation modules into the base mainframes, reconnecting the various I/O devices and transducer components, and loading appropriate test programs into the embedded system controllers. The controllers transmit the acquired data to several workstations for interpretation and display, and to a file server system which maintains a data base. Dynamic Data Systems (DDS) digital tape recorders, controlled by a PC provide additional data recording and feed HP-UX Workstations for data analysis and broadcasting of test results over a network which allows test engineers to monitor test progress from terminals at their desks.

Key System Features

- Open System Architecture
- Quick configuration
- Ease of Programming
- Scalability
- Upgradeability

Typical System Configuration

<table>
<thead>
<tr>
<th>Data Acquisition System</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 Slot Mainframe</td>
<td>5</td>
</tr>
<tr>
<td>Integrating DVM</td>
<td>3</td>
</tr>
<tr>
<td>High-Speed DVM</td>
<td>2</td>
</tr>
<tr>
<td>Tachometer Module</td>
<td>1</td>
</tr>
<tr>
<td>Relay Multiplexer Channels</td>
<td>700</td>
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<tr>
<td>FET Multiplexer Channels</td>
<td>300</td>
</tr>
<tr>
<td>Voltage D/A Converter</td>
<td>80</td>
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</tbody>
</table>

Computer/Software

- PC Embedded Controller 5
- HP Series 700
- HP Vectra PC Workstation 1

X-Terminals

- Keyboards, Monitors and Mice
- Disc Drives and Printers

Software - Lynx real-time operating system
- LMS software
- Lab View
- HP-UX
- Oracle data base

Other Equipment

- Digital Tape Recorder