Custom Performance Test Systems Using Commercial Off The Shelf (COTS) Hardware and Software Platforms

David Johnston, TPS Group Manager
Racal Instruments

Test Systems Approach

The primary goal of any Automatic Test System (ATS) design is to provide the resources required to completely satisfy a targeted test requirement. Racal Instruments has taken this approach, and expanded it, to allow our test systems to continue to grow and adapt to the reality of ever-changing test requirements, without sacrificing performance. Racal integrates our own industry leading test and measurement instruments and chassis, along with those from many other vendors, to provide flexible and scalable automatic test solutions. Innovative software techniques, such as the Racal Instrument Software Layer for Automatic Test Equipment (isolATE™), are implemented to allow our systems to adapt to new requirements without impacting legacy Test Program Software.

Racal Instruments has provided numerous test solutions for a wide range of applications including Flap/Slat Actuators, Engine Control Units, In-flight Entertainment Systems, Automotive Electronics, CPU Manufacturing, and many others. One ongoing project that exemplifies the Racal commitment to innovative and high-performance systems is the U.S Navy Jet Engine Test Instrumentation (JETI) system. The JETI effort melds both existing technologies and cutting edge software implementations to produce a highly effective test solution, which maximizes the use of available industry-standard architectures for both hardware and software.

JETI System Configuration

Two Racal Instruments 1261B VXI chassis with the Enhanced Monitoring System (EMS) house the heart of the system's data acquisition hardware, while a unique, forward-looking software architecture empowers two Pentium III-based computer systems to accomplish instrument control, data retrieval/manipulation, user interface, and report generation. The JETI system was designed to provide maximum flexibility and maintainability. The host computer systems are both external to the VXI chassis. This allows maximum utilization of VXI real estate. A high-speed MXI-2 interface is used to allow one JETI computer to communicate with the VXI instrumentation. The two computers are linked together via a 100B-T network switch. This approach isolates the second computer system from the primary VXI data acquisition hardware. This eliminates the possibility of a single point failure in the data acquisition system disabling both computer systems. Redundant data acquisition capability is located in the second computer system to allow for emergency shutdown in the event of primary data acquisition failure. Figure 1 represents a typical JETI system configuration.

JETI System Capabilities

The JETI provides functional testing and troubleshooting for jet aircraft engines. It has the capability to measure analog, discrete, frequency, synchro, phase difference, pulse-encoded signals, vibration and Mil-Std-1553 data. It provides current and voltage sources as well as digital I/O and networking capability.

The JETI system provides a test solution which directs the system operator through each test step required by the engine Technical Order (T.O.) for each engine. Test requirements are embedded in the Test Program Software (TPS) for each engine

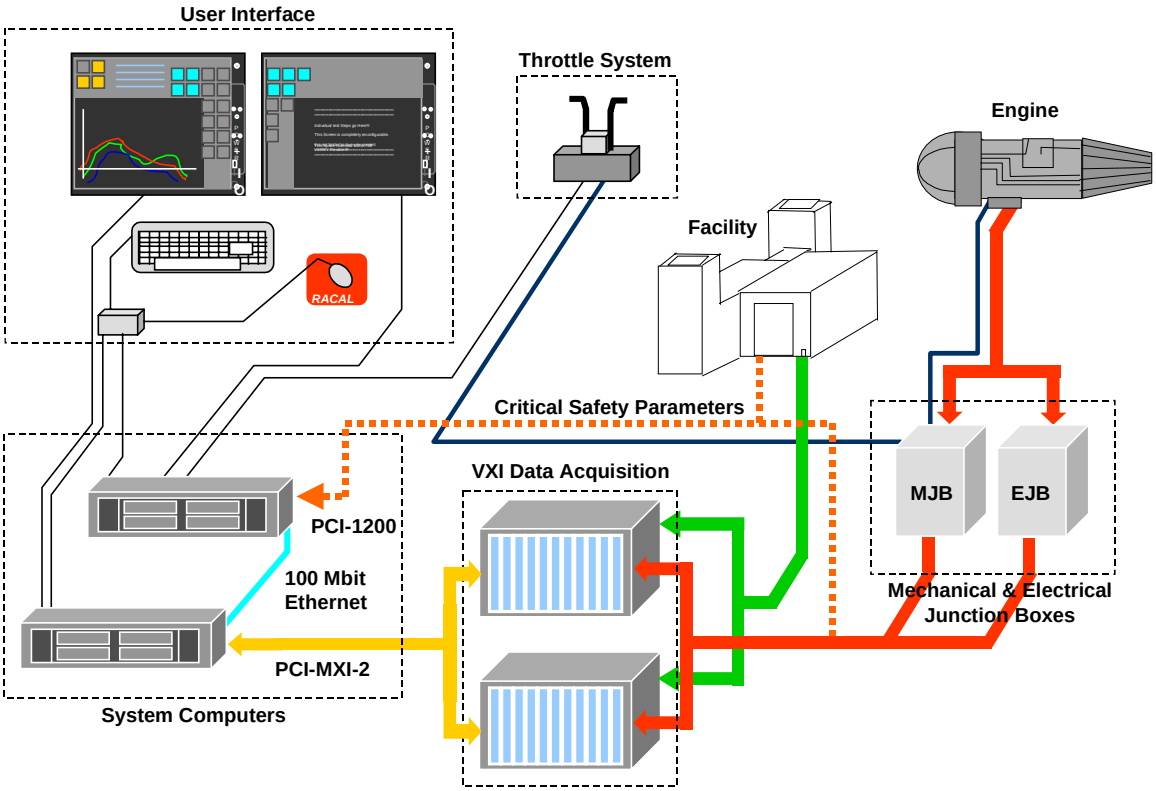
tested. The JETI system keeps the operator informed with visual alarms and text-based information that guides the user through the appropriate troubleshooting or repair procedure.

In addition to providing engine test and diagnostics capability, the JETI system completes the test solution by providing full control of the test facility and engine throttle functions.

JETI Software

Racal Instruments provides a full turnkey software solution. The two JETI host computers maintain a segmented approach to system software and TPS software. System software and Facility Interface software reside on the primary data acquisition computer. The TPS software, and engine control and monitoring software are located on the secondary computer.

Because of the segmented software approach, fast, reliable data transfer between the JETI computer systems is critical. Communication is handled over a 100B-T network connection. While this method provides slightly less performance than other methods of data transfer, such as using shared memory, it does have other advantages. The JETI system uses the LabVIEW® software development platform and takes full advantage of its powerful software capability. VI Server® and Distributed VI Server® are used to provide a seamless communications link between software modules on both computers. This allows not only fluid data transfer between the two computers, but allows the touch screen interface of each computer to control functionality of the other computer when required. This interaction is transparent to the operator, and system performance remains steady and responsive while continuously acquiring and processing over 900 parameters of analog, digital and 1553 data.

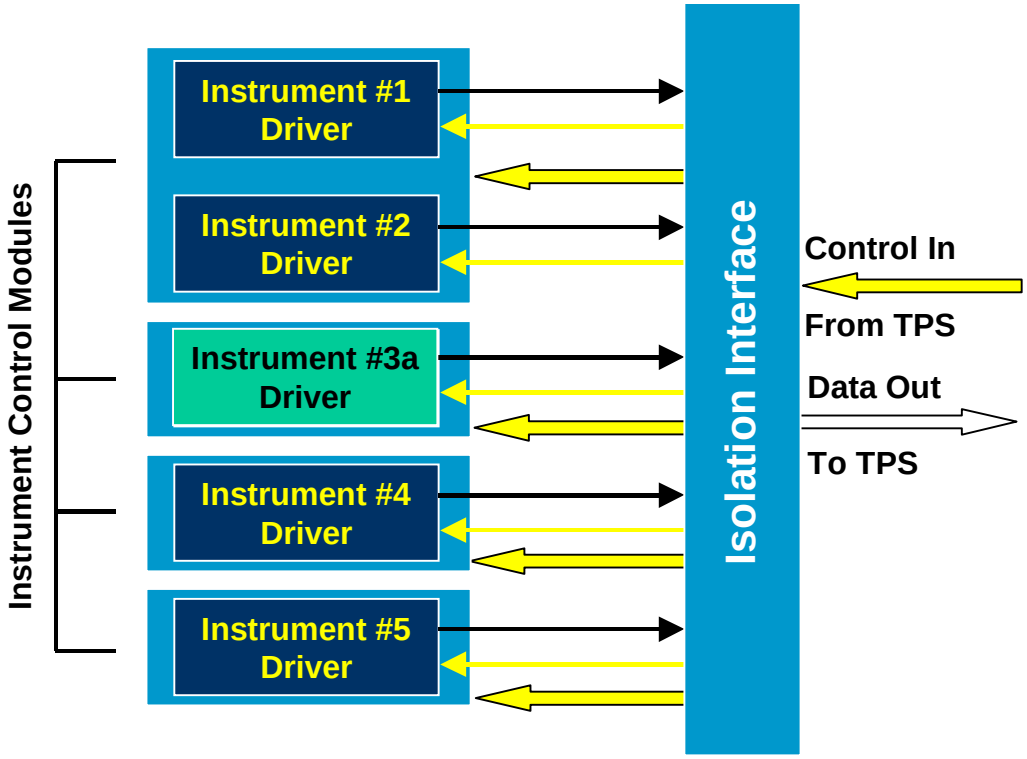


Typical JETI Configuration
FIGURE 1.

Instrument Software Layer for ATE (isolATE™)

The extensive capability of the JETI system is further enhanced by the implementation of Racal Instruments' isolATE™ interface. The isolATE™ interface was developed to maximize the supportability and maintainability of our test systems. By allowing instrumentation to be upgraded or replaced without impacting TPS software. Although most functional automatic test systems use only one computer system, the flexibility of the isolATE™ approach allows it to be implemented on single or multiple computer systems while maintaining the same efficient and streamlined structure. The isolATE™ approach provides a modular software interface which segregates code functionality. This allows TPS software to operate based solely on data presented by the isolATE™ interface, regardless of the specific instrument that is providing the data. Figure 2. Illustrates the typical JETI isolATE™ interface.

The efficient software architecture of the JETI system and the isolATE™ interface allow the JETI system to remain a "soft-real-time" system even though it is asked to provide a higher level of performance than previous generation engine test systems.



JETI isolATE™ Interface
FIGURE 2.

Performance and Flexibility Without Sacrifice

Throughout a test system life cycle, the system will often be required to perform tasks for which it was not originally intended. If the system lacks the flexibility to adapt, the added requirement could become quite costly. Since it is probable that not all future test requirements can be fully defined at the time of original system specification and purchase, architecture flexibility can become a significant issue.

Hardware and software architectures implemented by Racal Instruments allow the development of extremely flexible Test Solutions without sacrificing the high performance required of a custom test solution. Not only is the hardware architecture scalable, but the system software architecture can be adapted to changing requirements to optimize the performance of the system for each test program that is developed.

Although the JETI system is somewhat unique among ATE, it exemplifies the ingenuity and customer focus of Racal Instruments. The open architecture hardware and software platforms provide unparalleled supportability and maintainability, while Racal Instruments-developed software techniques such as isolATE™ further enhance the capabilities of already robust and powerful test platforms.

David Johnston
TPS Group Manager
Racal Instruments
12758 Cimarron Path, Suite 126
San Antonio, Texas 78249
(210) 699-6799
djohnston@racalate.com
www.racalinstruments.com