Keeping Abreast of Emerging Test Technologies

DoD Maintenance Symposium - October 2005

Bill Ross
NAVAIR PMA260
Test Technology - Scope

• Electronics/avionics on-system and off-system automatic maintenance test

• I will use the Navy CASS Automatic Test Equipment and Test Programs as the examples, but most of the test technology discussed are:
  – Leveraged Joint Services initiatives
  – Cooperative initiatives with Industry
    • 90% commercial solutions

• Terms:
  – Automatic Test Equipment (ATE) = The Test System
  – Test Program (TP) = the diagnostics S/W and the H/W to interface weapon system components to the ATE
Two Reasons:

1. To add capability to our test systems to meet emerging weapon system test requirements
   - Four times as accurate as the weapon system component being tested

2. To replace existing test capability to:
   - Address obsolescence
   - Improve quality of test
   - Improve through-put
   - Satisfy new operational need – scalable/mobile/smaller
   - etc
The CASS Story

30 Legacy Testers → One tester Family

$3.8B Reduced Total Ownership Costs
Test Technology Roadmap

- **CASS**
  - Multi Analog Capability (80% solution)
  - Programmable Serial Bus Capability
  - Measurement Synthetic Instruments
  - ATML

- **RTCASS**
  - Common Tester Interface
  - Stimulus & Measurement SI
  - Next Gen Digital Instrument (Parallel)
  - Power Supply Packaging
  - Smart Diagnostics

- **ARGCS**
  - Advanced Synthetic Instruments

- **ACTD**

- **Test Technology Demonstrations**

- **eCASS**
  - Multi Analog Capability (100% solution)
  - Next Gen Serial Bus
Current Test Technology Investments

- Advanced E-O test system
- Inertial Test Reference System
- Fast Serial Digital Test
- Link 16 Test Technology
- Advanced Synthetic Instruments
- Programmable Serial Bus
- Improved ATE and TP Software
- Common Tester Interface (CTI)
- Multiple Analog Stimulus and Measurement
- High Density Analog Instrument
- Next Generation Test System-level Demonstration
  - Agile Rapid Global Combat Support (ARGCS) ACTD
Advanced Synthetic Instruments

- Think of Synthetic Instruments as “software instruments”
  - Eliminates redundant ATE overhead hardware
  - Eliminates redundant ATE functionality
  - Creates needed instrument/function via software

- Modernized Mainframe CASS could replace at least 12 existing separate stimulus & measurement instruments with a small SI package
  - Demonstration programs underway

- Benefit: at least 65% decrease in hardware (and, therefore, support costs) and footprint
Bus Test Emulator provides:
- Bus communication – standard serial bus and custom bus protocols (MS 1553, ARINC 429, RS 422, RS 232, MS 1773, RS 485, etc)
- 4 channels per card
- Parametric variation for bus performance verifications

Benefit:
- Footprint reduction (5 cards replaced by 1 card)
- Higher quality tests with increased capability
Reusing Diagnostics Data

• ATML (XML for Automatic Test and diagnostics)
  – Industry/Gov’t Working Group & IEEE SCC20 standard
  – Integrated Diagnostics Interfaces
  – Knowledge Based Systems
  – Test Requirements Modeling

• “Smart” concepts for improved test program diagnostics (a CASS plug-in)
  – Use platform BIT data to “direct” a start point in a test program – 25% runtime savings
  – Historical maintenance data reuse to improve diagnostics decisions
  – Demonstrating on F/A-18 APG73 Radar Receiver and Super Hornet Flight Control Computer
Multiple Analog Stimulus and Measurement

- **Multiple Analog Instrument**
  - Each test pin has 6 instruments, all useable at same time
  - 1 VXI card has 32 pins, all useable at same time
  - CASS currently has 64 different instruments – the 3 Ai7 cards that CASS will use add 576 instruments – all useable at the same time

- **Benefit:**
  - Significant reduction in some TP runtimes
  - Real-time functional test - higher quality diagnostics
High Density Analog Instrument

- High Density Analog Instrument
  - Eight single-ended system-per-pin channels, including up to sixteen 200 MHz universal timers, 50 MSa/s 12-bit digitizers and 50 MHz 12-bit arbitrary waveform generators.
  - Includes a 6.5-digit digital multimeter and a 2-channel 1 Gsps digital sampling oscilloscope.

- Parallel source and measure capability for high-speed functional and operational analog testing

- More accurately emulates complete system-level operation

- Benefit: significantly reduce test times and increase fault coverage while reducing footprint
Common Tester Interface

- Industry/Gov’t Working Group developing a common standard pin map for the physical mating of the interface device to the automatic tester
  - IEEE standard in process

- Specification requirements include scalability, frequency coverage from DC to light, cost, reliability, etc

- Benefit:
  - Enable interoperability across DoD testers
  - Reduce costs associated with test program rehost
  - Ease insertion of new instrument technology
  - Facilitate modification and upgrade to existing testers
Agile Rapid Global Combat Support System (ARGCS)

FY04 Advanced Concept Technology Demonstration

Diagram showing various components and technologies related to the ARGCS system.
Our eCASS Vision

• Much smaller footprint with more test capability
• Faster run times
• Multi-lingual test environments
  – Facilitate factory-to-field
• Interoperable with other Services’ ATE
• More scalable to needs
• Reduced acquisition and support costs
• “Smarter” diagnostics concepts
  – Faster and better diagnostics
  – Reduced A-799 rate