Aircraft Diagnostics from Avionics Support Equipment Perspective 07 December 2010

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Topics for Discussion

- Diagnostics Requirements
- System Synthesis Model
- Smart Connector Development

Current Diagnostics Requirements

- Current status quo uses boilerplate requirements statement.
- Unachievable
  - COTS / NDI
  - Cost Overrun / Schedule Slippage
  - Specification Changes
- Solution Centered
  - BIT
  - Test Equipment
  - Manual Procedures
  - Diagnostics Reasoners
  - Iterative R&R

"The aircraft Built-In Test (BIT) shall demonstrate a Fault Detection (FD) rate of 95% or greater for all avionics and mission communications equipment. The aircraft BIT shall demonstrate a Fault Isolation (FI) rate to one Weapons Replaceable Assembly (WRA) of 95% or greater for all avionics and mission communications equipment."

- Incomplete
  - Avionics / Mission Communications Equip.
- Ambiguous
  - "Avionics" vs. "Non-Avionics" Failure Modes

Concepts for Future Diagnostics Requirements

- Specify Mean Time to Fault Detection (MTTFD) with respect to FMECA Severity Levels.
- Loosely specify (if at all) the FD/FI techniques that the systems developer shall use to implement effective diagnostics within the Mean Time to Repair (MTTR), as required.
- Specify Fault Isolation (FI) Rate solely in accordance with the set of detectable faults (if any) that are acceptable to be left unrepaired indefinitely.
- Specify an allowable CND rate for replaceable items sent to next level of maintenance for repair.

Figures of Merit for Future Diagnostics Requirements

- The mean and maximum operational times to detection of Category I and Category II failures
- The percentage of Category III and Category IV failures that may be left undetected
- The mean operational time to detection of Category III and Category IV failures
- The MTTR
- The frequency of CNDs

System Synthesis Model

Current

- NAVAIR PMA-260 System Synthesis Model Web Tool
  - Tester-based
    - Data entered aligns to CASS stimulus / response test capabilities.
  - Single purpose
    - Provides report of compatibilities / incompatibilities between CASS family and WRA.
  - Non-standard data format
- Suppliers ICDs
  - No standard format

Concept

- Standardized interface control database
  - Flows from systems engineering model
    - System
    - Subsystem
    - WRA
    - SRA
    - Component
  - Connector / signal based data at WRA-level
  - Multi-purpose
    - Reliability Analysis
    - Diagnostics Modeling
    - Test & Repair Equipment Selection
  - Standard Data Format
    - IEEE 1641, etc…

MIDS Smart Connector

Current

- MIDS Tactical Information System
  - Thousands of terminals fielded.
- MIDS-LVT Terminal Diagnostics Ambiguity
  - Receiver/Transmitter
  - Remote Power Supply
  - Cable Set
  - Host Power
- Currently, ~60% CND rate for RPS.
  - $7.5K for every return
- Receiver/Transmitter A799 rates between 30%-40%.
- Total loss from CNDs over system lifetime >$3M to date.

Smart Connector Diagnostics

- IDATS at NAVAIR Lakehurst currently developing MIDS Smart Connector Tester.
- Detects/isolates faults within MIDS Power Supply System
  - RPS
  - Cable Set
  - Host Power
- Currently executing $500K from ONR to bring tester to TRL-6 level.
  - Full capability
  - Hand-held form factor
  - Demonstration at SIL
    - Mid-March 2011

Thanks!

Questions?