Excelling in Electronic Test Solutions

DiagnoSYS

Changing the Current Electronic Test Methodology Using Functional Board Testers AND In-Circuit, Functional Component Testers

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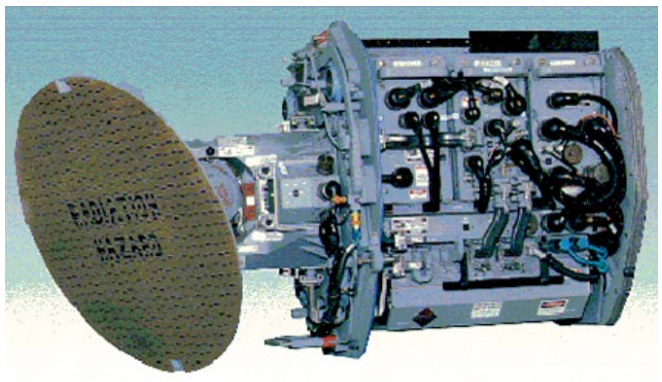
Definitions:

LRU – Line Replaceable Unit

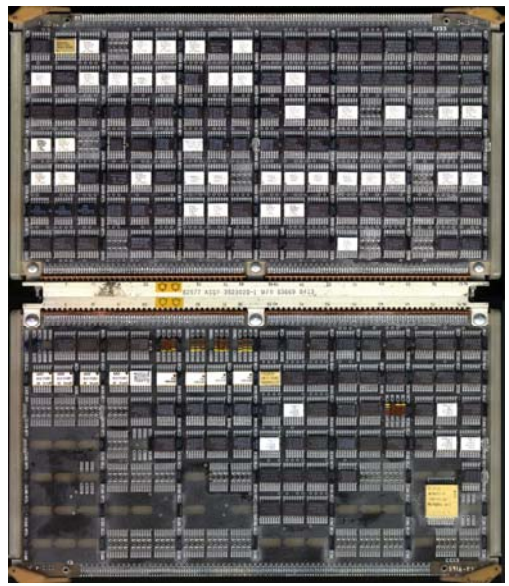
WRA – Weapons Replaceable Assembly



SRU – Shop Replaceable Unit

SRA – Shop Replaceable Assembly

CCA – Circuit Card Assembly



FCT – Functional Tester

Cause:

Electronic equipment fails in the field and must be sent back to identify the fault and repair the unit.

Current Solution:

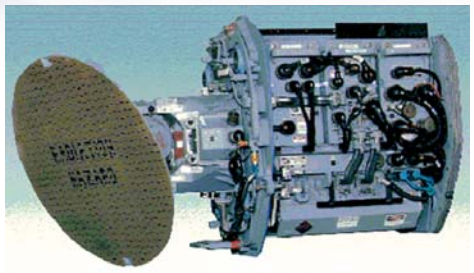
Functional Test System

Current Solution:

Testing a potentially failed electronic unit to find the fault requires:

1. A large scale functional tester.
2. A Test Program Set (TPS) is written (System test)
   - to determine if the LRU is faulty;
   - to determine which SRU inside the LRU is faulty.
3. Another TPS is written (System test)
   - to determine if the SRU is faulty;
   - to determine which component is causing the fault.

Current test process:



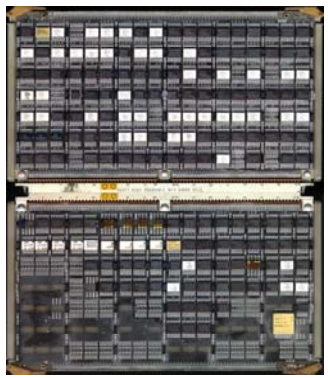
TPS

FAULTY

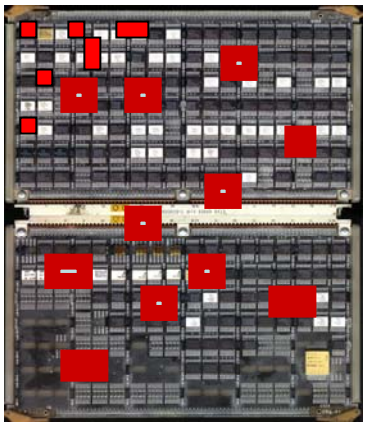
GOOD

FAULTY

TPS



FAULTY



Current Solution:

"…the in-circuit (component level) test is the most stringent because it isolates faults down to the failing component or node on a specific circuit card. Where the system test is the least stringent, because it will only isolate a failing system function, which will point to a number of subassemblies, or at best to a single subassembly as the failing component.
These two levels of test are completely different in scope, utilize different test methods, and different test equipment, sort of like comparing "apples to oranges,…"

Problems:

- While large Functional Testers are good for testing LRU / WRA / Box / CCA's
  - They will only work if a TPS has been written for that circuit card.
  - The TPS can cost a minimum of **$150k and take months to complete**.
    (EX: One program – 82 TPS' - $12M)
  - The TPS will only locate those faults that it has been told to find.

- Large Functional Test Systems are not designed to go down to the component level but $M's are spent each year trying to do just that.

Ultimate Goal:

Find the faulty component and repair the board and get the equipment and the Warfighter back in business!

Suggestion:

The 2-Tier Concept

a 2-tier test solution – Two separate tests

(1) System Test Set

primarily go-no go test on LRU or SRU using the Functional test system

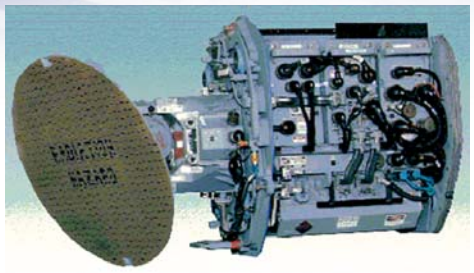
(2) In-Circuit Test Set

for diagnostics on the SRU using the PinPoint II

Why only PinPoint II – The Software.

14 Slot PinPoint II:

Current test process:



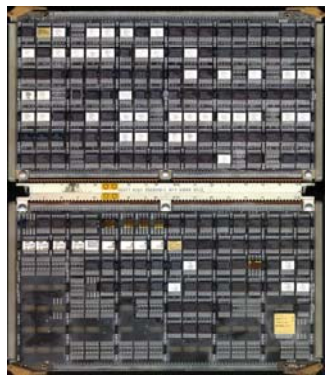
TPS

FAULTY

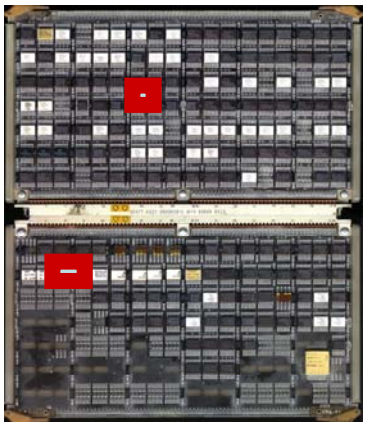
GOOD

FAULTY

In-Circuit Test



FAULTY



Why use PinPoint II:

- PinPoint II was specifically designed to do component level testing.

Bottom up testing instead of Top down.

-The Programming is much shorter.

Approximately **16,000** component programs already completed.
Generally, programmer "states" what to test but doesn't actually write the test.
Turn 6 months of programming into 3 weeks.

-Test is much more accurate.

FCT's cannot perform certain tests. Ex: Cannot find common faults such as Opens failures. Will flag a "failed device".

-No test fixtures needed.

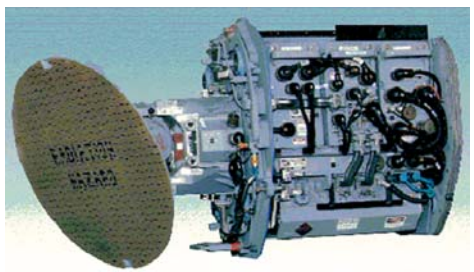
Keep in mind…

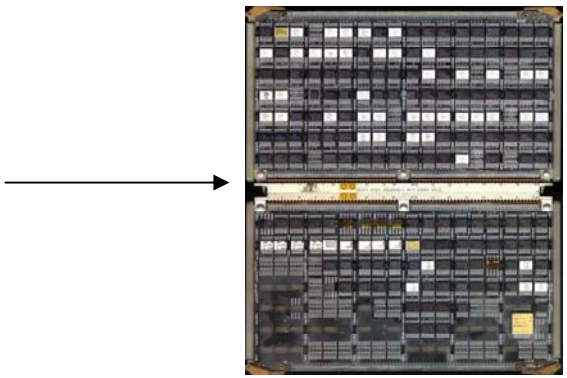
No matter what Functional Test system is used, the process is always the same…

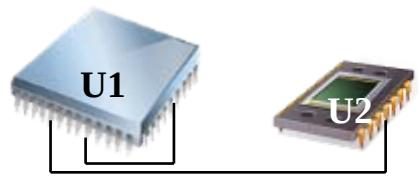
run the test through the LRU to find faults and then

run the test through the SRU to find faults and then

run the test through the components to find faults.







Where Does It Fit ?

Two-Tiered Test Approach

LRU's

EADS/Aerospatiale

ATEC

SRU's

Any Functional Test Set

Air Force

Navy

Bombardier

When to use PinPoint:

1, As a supplement to the Functional test system.
LRU Test Program on the FCT; Component Test Program on PinPoint

2. Where it is not economically feasible to write a test program.
Board costs $3000 to replace; functional TPS costs $150k. Good Fit??.

Board costs $3000 to replace; in-circuit TPS costs $9k. Good Fit??.

3. Where there is no available test program written.

4. Where the test program is too difficult to write on the larger Functional test system. (ACTUAL EXAMPLE from Lockheed)

CCA (1) – State of the Art Technology – Budget: $400 - $500k

OEM – No Bid

Outside Vendors – Average of over $1M for test equipment and TPS

DiagnoSYS – (2) full PinPoints, 35 handmade Interface adapters; TPS - **$386k**

Case History # 1:

GSM-285 Tester Replacement Effort for AWACS

Traditional ATE

- FCT Tester Cost = 2 @ $400K = $800K
- TPS Cost = $150K ea @ 100 TPSs = $15M
- Generation Time = 9 Months/TPS
- Support Cost @ 10 Years = $115K
- Estimate for total effort = **$15,915,000**

Pin Point II

- PinPoint II Tester Cost = 2 @ $145K ea = $290K
- TPS Cost = $13.4K ea @ 100 TPS = $1.34M
- Generation Time = 1 Month/TPS
- Support Cost @ 10 years = $10K
- Estimate for total effort = **$1,630,000**

Case History # 1:

GSM-285 Tester Replacement Effort for AWACS

ROI Calculated as: 8.7 or 870% return on the R-TOC funding

$$\frac{\text{Savings (Avoidance)}}{\text{Actual Investment}} = \frac{\$7.867M}{\$0.9M} = 8.7$$ (51 TPS')

Potential for additional savings. Additional TPS changes could show a ROI of 10.4 or 1040% (107 TPS')

•"Using the PinPoint, the Digital portion of the GSM-285 workload could be migrated within 2 1/2 years, compared to more than 20 years if conventional ATE was used, greatly reducing the risk that the E-3 repair capability will be interrupted."

Mr. Dennis Robichaud
AWACS SE Program Mgr.

Case History # 2:

Delta Airlines ROI = 90 days by Reducing External Costs ($85k system)

Outside Repair Cost vs. Pinpoint Repair Costs

FCC701 Flight Control Computer

Outside Repair Costs
Average ORP = **$ 2,479.55**
Total ORP = **$ 104,141.10**

PINPOINT II Tester:
Average = **$ 73.13**
Total = **$ 3,071.25**

AP703 Engine Alert Process

ORP COSTS
Average ORP = **$ 3,730.33**
Sum ORP = **$ 85,797.52**

PINPOINT II Tester:
Average IR = **$ 95.64**
Sum IR = **$ 2,199.72**

Conclusion:

When writing ***any*** TPS program (new or offload), serious consideration has to be given to using a separate, In-Circuit component level tester for circuit card diagnostics because it's:

-Takes much less time to program.

- Much more accurate.

- Cost avoidance is enormous.

QUESTIONS ??

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