The Detection and Prevention of Counterfeit/Defective Electronic Integrated Circuits using the NOKOMIS ADEC Sensor System

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- Aviation Maintenance Repair Overhaul (MRO) facility
- F/A-18, E-2, C-2, AV-8, H-53, H-60 etc.
- Over 4000 civilian/military personnel
- In-Service Support Center (ISSC) provides Research, Engineering & Logistical support for the Navy and Marine Corps
AAT Integrated Product Team (IPT) comprised of Subject Matter Experts to bring innovation to FRCSW

Leverages FRCSW Navy Federal Lab Designation with Office of Research and Technology Applications (ORTA) for Cooperative Research and Development Agreements (CRADA)

Avionics & Radar: currently exploring technologies to prevent Counterfeit/ Defective ICs at FRCSW IAW DoD Policy

DoD Instruction 4140.67
Counterfeit IC Background

- Most ICs Manufactured Overseas
- e-waste is “recycled”
- DoD is Relatively Small Consumer of ICs
  - Does not have “trusted” manufacturers
  - Can’t regulate industry
- Big risk that ICs acquired will not meet specifications for performance and reliability
- Counterfeit ICs cost DoD $100s Millions per year
Counterfeit Issues at FRCSW

• Obsolescence DMSMS Issues
  • Increases Risk of Counterfeit/Defective ICs for aging equipment

• Defects Not Discovered Until Soldered into PCB
  • Requires Costly Rework
  • Estimated $30,000 per incident
  • Estimated 228 incidents per year
  • Estimated cost $6.84 Million per year!

• Old ICs sold to Navy as new only work for a short time
  • Causes Early Life Failure (ELF) of WRAs

• Increased Lifecycle Costs in Tight DoD Budget
Counterfeits and IC Lifecycle

Electronic Component Lifecycle

Most likely to be targeted by counterfeiters
Current FRCSW Counterfeit Detection Methods

1) Pedigree Inspection (MilSpec)
   - Primary method used at FRCSW/Military Supply System
   - PROS: Qualified Product, Manufacturer, Supplier, Distributor
   - CONS: Pedigree does not guarantee authenticity; Open market purchases bypasses this method; DoD cannot regulate IC manufacturing industry

2) Visual External Inspection
   - Secondary method used at FRCSW and DoD
   - PROS: Cheap, easy, widely used
   - CONS: Only as good as the person inspecting; Does not catch substandard/defective ICs; Mostly shown to be ineffective

3) Electrical Testing
   - FRCSW Tests PCBs/WRAs after Repairs Completed
   - PROS: Widely Used; Relatively Effective
   - CONS: Costly, Time Consuming; Not Easy; Can’t detect substandard/defective ICs or Old chips sold as New
4) Microscopic Inspection

5) X-Ray Inspection

6) X-RF Inspection

7) De-capsulation Inspection

8) SAM Inspection

9) DNA Markings (not available for obsolete ICs)

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- **Pros:** Aggregate effectiveness only 86%
- **Cons:** Require huge investment; Expensive; Time Consuming; Require Advanced Training and Personnel; Cost/Benefit Ratio too Large; Impractical to use at FRCSW
FRCSW Technology Gap

- Pedigree & Visual methods Ineffective
- Electrical testing works but increases repair costs
- Legacy Counterfeit Detection Methods impractical at FRCSW
- FRCSW needs is a fast, affordable, automated, practical, user-friendly, fool-proof technology to identify Counterfeit and Defective ICs
- AAT IPT learned of a new Counterfeit & Defective IC Detection technology developed from over $16 M in DoD SBIR funding: NOKOMIS ADEC System. It is 99% Effective!
- AAT undertook initial pilot in FY2014 with NAVSEA and Nokomis related to counterfeits for parts used at FRCSW (Presented at DMSMS 2014)
ADEC Historical Timeline

2006
SBIR Success Story

2012
$15 Million in Phase I, II, & III to Develop Core Sensor

2013
NAVSEA Completes 3 Successful Blind Pilots

2014
Initial Air Force Pilot (Hill AFB)

2015
AFSC Wide Pilot (Hill, Robins, Tinker AFB)

2016
FRCSW Pilot & Integration Activities

NAVSEA/NAVAIR Pilot at FRCSW (Navy Evaluates FRCSW Stock Intended for System Installation)

NAVSEA IWS Repurposes Core Sensor (For Advanced Detection of Electronic Counterfeits)
• LTG Patrick O’Reilly, Former Director of MDA, estimated the cost per counterfeit incident for the THAAD missile system at $2.78 Million (Testimony to Senate Armed Services Committee, November 2011)

• Bruce Mahone, Director of SAE, estimated the cost per counterfeit incident at $2.8 Million (SAE G-19A meeting, December 2013)
  • Note: The following estimates are based on Bruce Mahone’s estimates.

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• FRCSW AAT Estimated Costs/Savings/ROI:
  • Cost of NOKOMIS ADEC System ~ $3 Million
  • Cost per unscheduled maintenance repair incident ~ $30,000
  • Number unscheduled maintenance repair incidents per year ~ 228
  • Savings per year ~ $6.84 Million
  • ROI over 10 years ~ 2000%
The Path Forward…

- Capitalize on over $16 Million in DoD SBIR Investment

- Consider LP-CRADA for further system evaluation
  - AAT is a Federal Lab

- Consider SBIR Phase II.5 project for additional R&D as determined after evaluation

- Eventually introduce this technology into all DoD Depot Repair Facilities as the standard Counterfeit IC Detection technology
Play Video Here (length 1:50)