

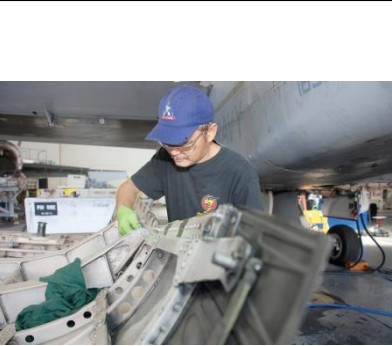
The Detection and Prevention of Counterfeit/Defective Electronic Integrated Circuits using the NOKOMIS ADEC Sensor System



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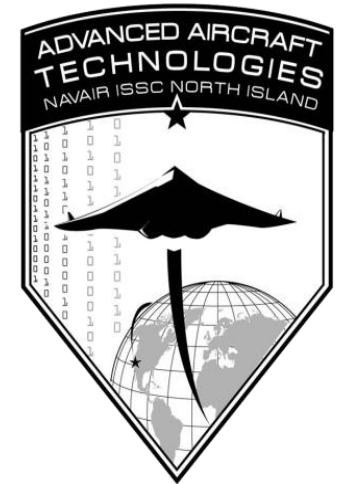
Fleet Readiness Center Southwest



- **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**



Advanced Aircraft Technologies IPT



- **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



DAVID BUTOW/FREDUX

Counterfeit Part



Authentic Parts



Example Device: Motorola MCU
Part #: MC6809CP

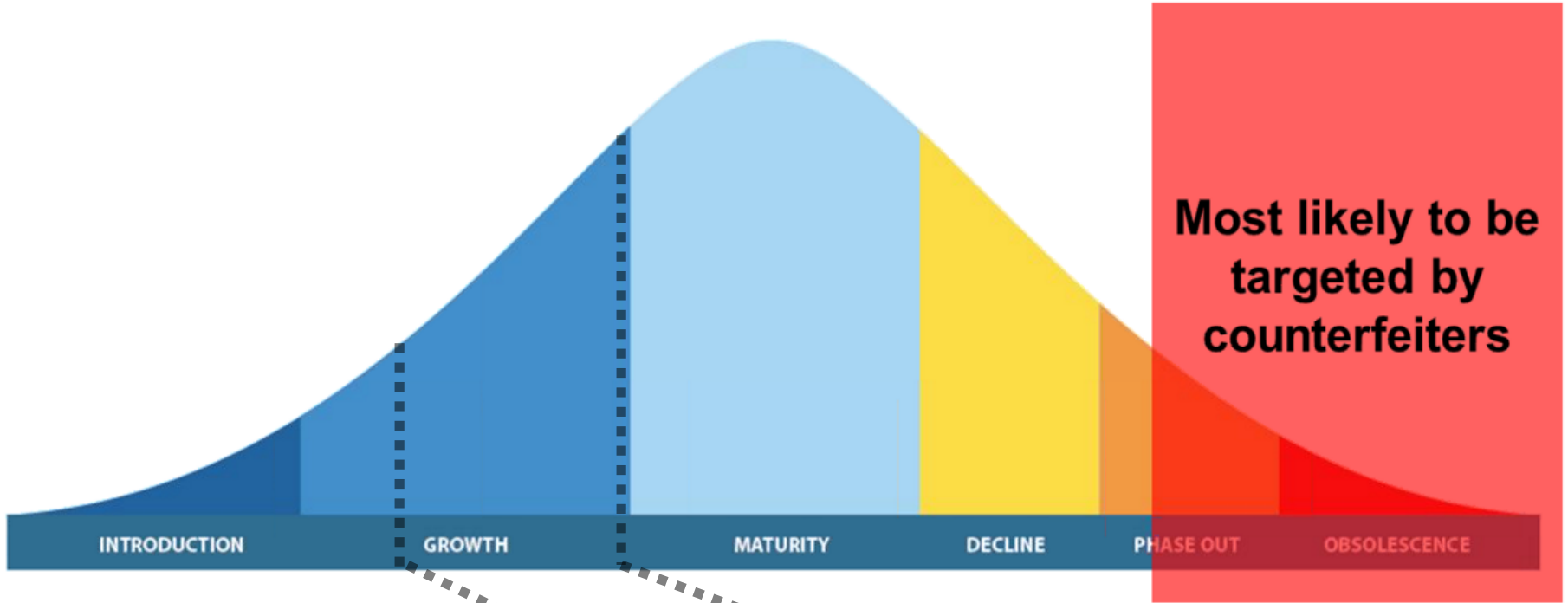
Counterfeit Issues at FRC SW



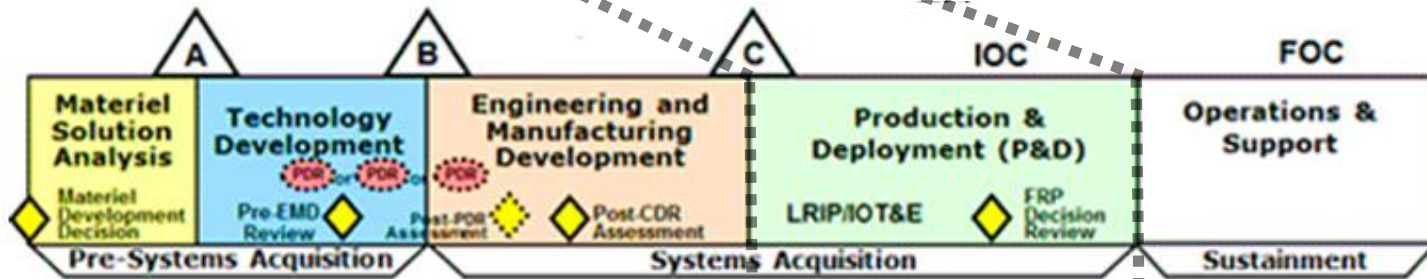
- **Obsolescence DMSMS Issues**
 - Increases Risk of Counterfeit/ Defective ICs for aging equipment
- **Defects Not Discovered Until Soldered into PCB**
 - Requires Costly Rework
 - Estimated \$30,000 per incident
 - Estimated 228 incidents per year
 - **Estimated cost \$6.84 Million per year!**
- **Old 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



Current FRCSW Counterfeit Detection Methods



1) Pedigree Inspection (MilSpec)

- Primary method used at FRCSW/Military Supply System
- PROS: Qualified Product, Manufacturer, Suppler, 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

Other Legacy Counterfeit Detection Methods



- 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)

-
- 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

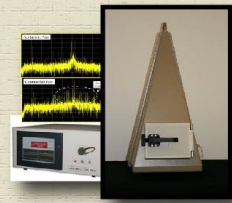
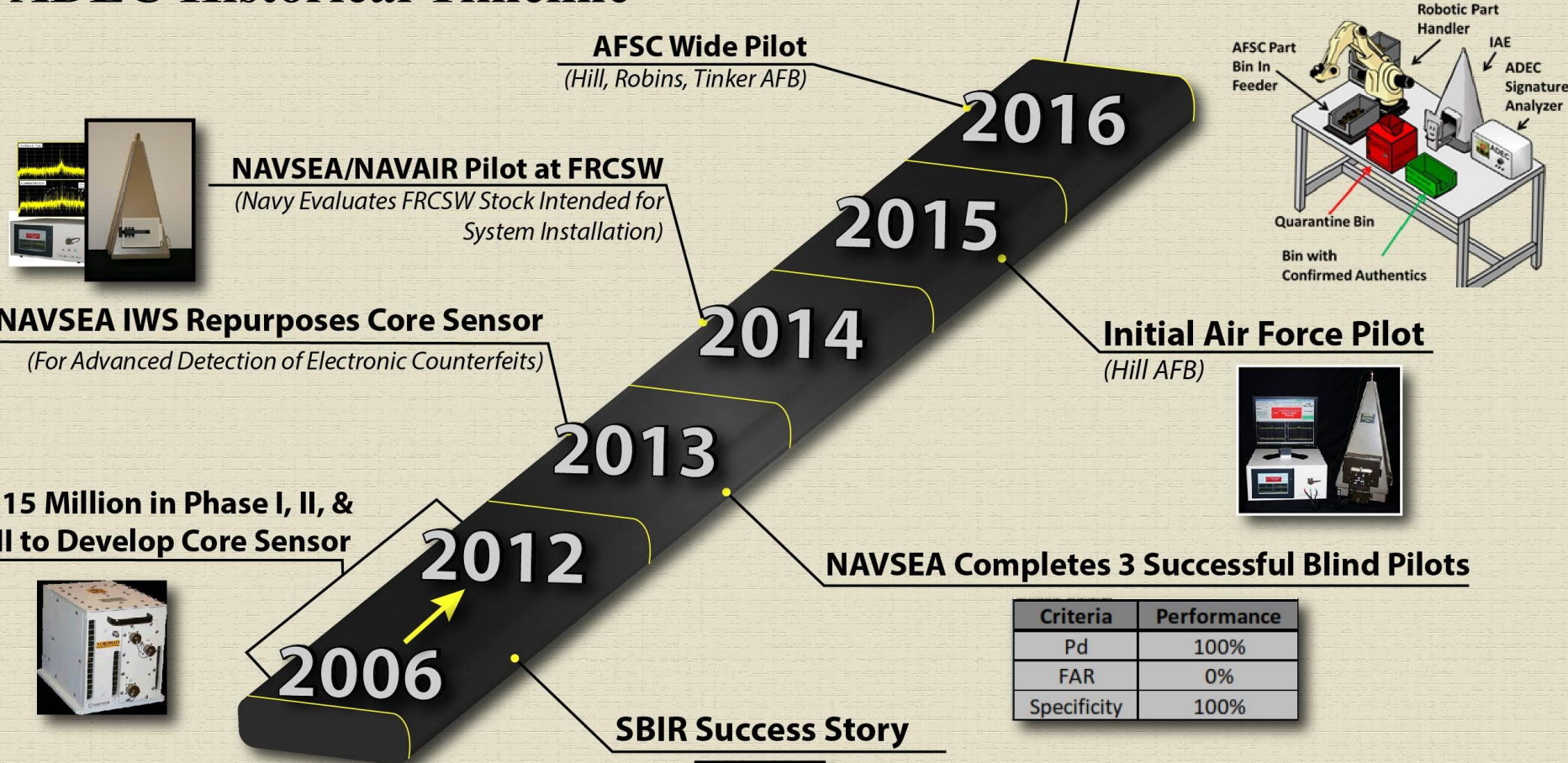


- **Pedigree & Visual methods Ineffective**
- **Electrical testing works but increases repair costs**
- **Legacy Counterfeit Detection Methods impractical at FRCSW**
- **FRCSW needs is a fast, affordable, automated, practical, user-friendly, fool-proof technology to identify Counterfeit and Defective 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)**



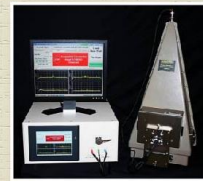
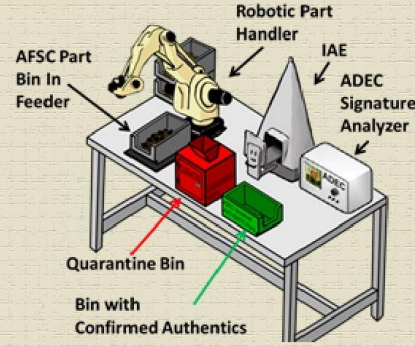
ADEC Historical Timeline

FRCSW Pilot & Integration Activities



NAVSEA IWS Repurposes Core Sensor
(For Advanced Detection of Electronic Counterfeits)

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



Criteria	Performance
Pd	100%
FAR	0%
Specificity	100%



Costs, Benefits, ROI



- **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**

2015 DoD
Maintenance
Innovation
Challenge

NOKOMIS

ADEC

Supporting America's Advanced Technology

Advanced Detection of Electronic
Counterfeits



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