

10:45 – 11:30 AM



Sultan Ali Lilani

Technical Business Development
Integra Technologies LLC

Current Status of Various Industry Standards for Mitigating Counterfeits and Challenges Ahead for Both Obsolete and Current Technology Products

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Sultan Ali Lilani
Technical Business Development
Integra Technologies LLC
3450 N Rock Road Building 100
Wichita, Kansas 67226

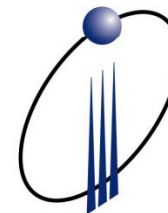
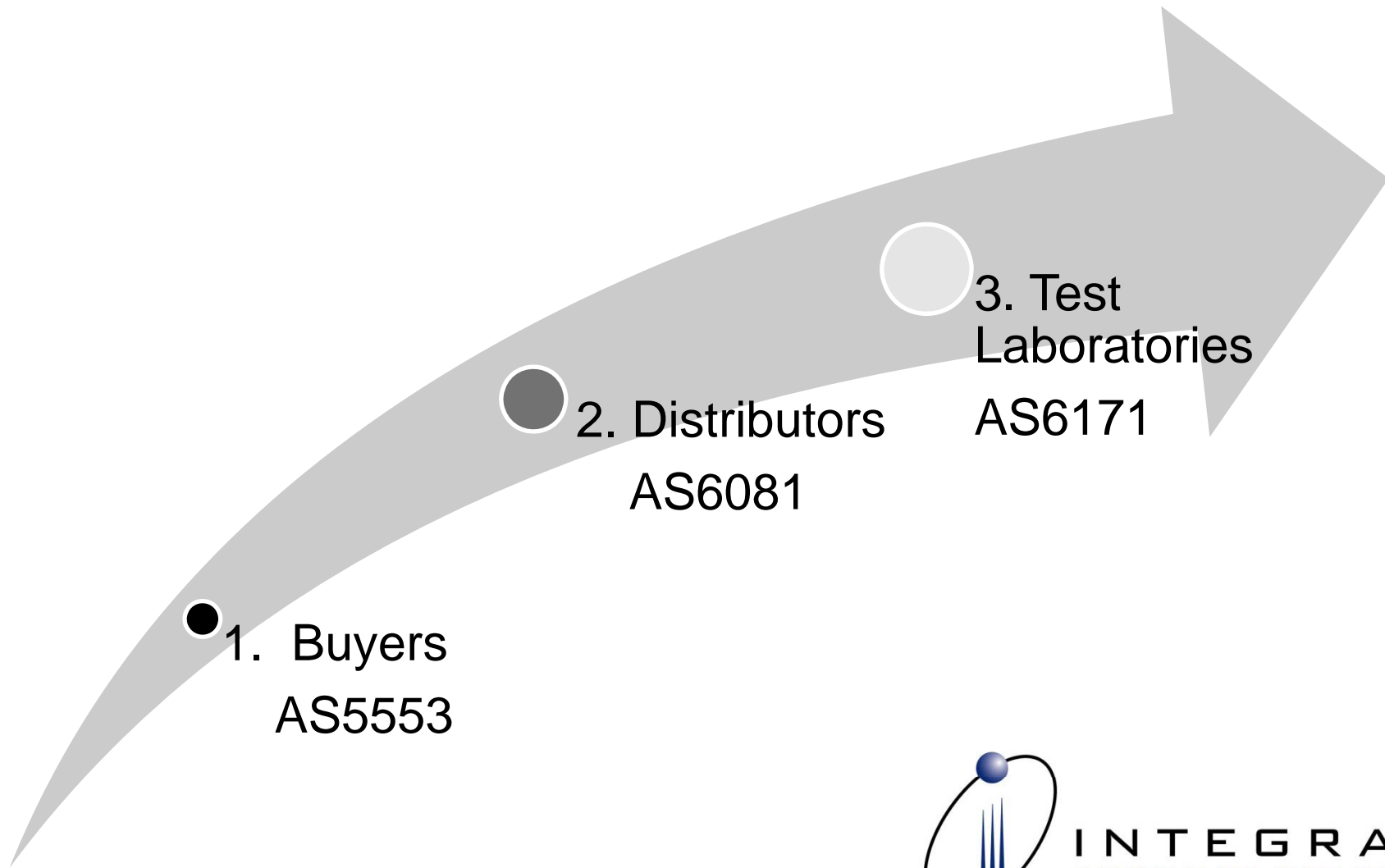
Ph 316-630-6857

Email: sultan.lilani@Integra-tech.com

Web: www.integra-tech.com



SAE G-19 Supplier Certification Standards



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Summary of SAE G-19 Aerospace Standards

Standard	Title	Status
SAE AS5553 Rev A	Counterfeit Electronic Parts; Avoidance, Detection, Mitigation, and Disposition	Issued and available at www.sae.org
SAE AS6081	Counterfeit Electronic Parts Avoidance – Distributors	Released in Nov. 2012
SAE AS6171	Test Methods Standard; Counterfeit Electronic Parts	Release expected in 2013
SAE ARP6178	Counterfeit Electronic Parts; Tool for Risk Assessment of Distributors	Published in Dec 2011
SAE AS6462	AS5553 Verification Criteria	In the Works
AIR6273	Terms and Definitions – Fraudulent/Counterfeit Electronic Parts	http://standards.sae.org/wip/air6273/ - Work continues into 2013

Summary of Other Counterfeit Mitigation Documents & Standards

Item	Title	Status
IDEA-1010	Methods to detect counterfeit devices - Great color photos and guidance In a major update (Rev B out 6-2011)	Issued and available at http://www.idofea.org/products
IEC/TS 62668-1:2012(E)	<ul style="list-style-type: none"> Requirements for avoiding the use of counterfeit, recycled and fraudulent components used in the aerospace, Defense and high performance (ADHP) industries 	<ul style="list-style-type: none"> Available at http://webstore.iec.ch/webstore/webstore.nsf/Artnum_PK/46350 Group is working on TS62668-2 designed for non-franchised distributors
G-11 and G-12 Counterfeit Mitigation Committee	Working on developing possible standard for EEE counterfeit mitigation – May be merged with SAE activities	Meets every three months
TechAmerica/ANSI STD-0016	Defines the requirements for developing a DMSMS Management Plan for minimizing the cost and impact of obsolete parts and material	Published in Dec 2011
AIA	Various Initiatives to promote AS5553, AS6081, TechAmerica STD-0016	Promotion On-Going
CCAP-101	Methods to detect counterfeit devices Great color photos and guidance In a major update (Rev B out 6-2011)	http://www.cti-us.com/pdf/CCAP101Certification.pdf
UK MoD Counterfeit Avoidance Working Group	Developing policy and guidance for counterfeit mitigation	At working group level with Industry and UK Defense suppliers participating

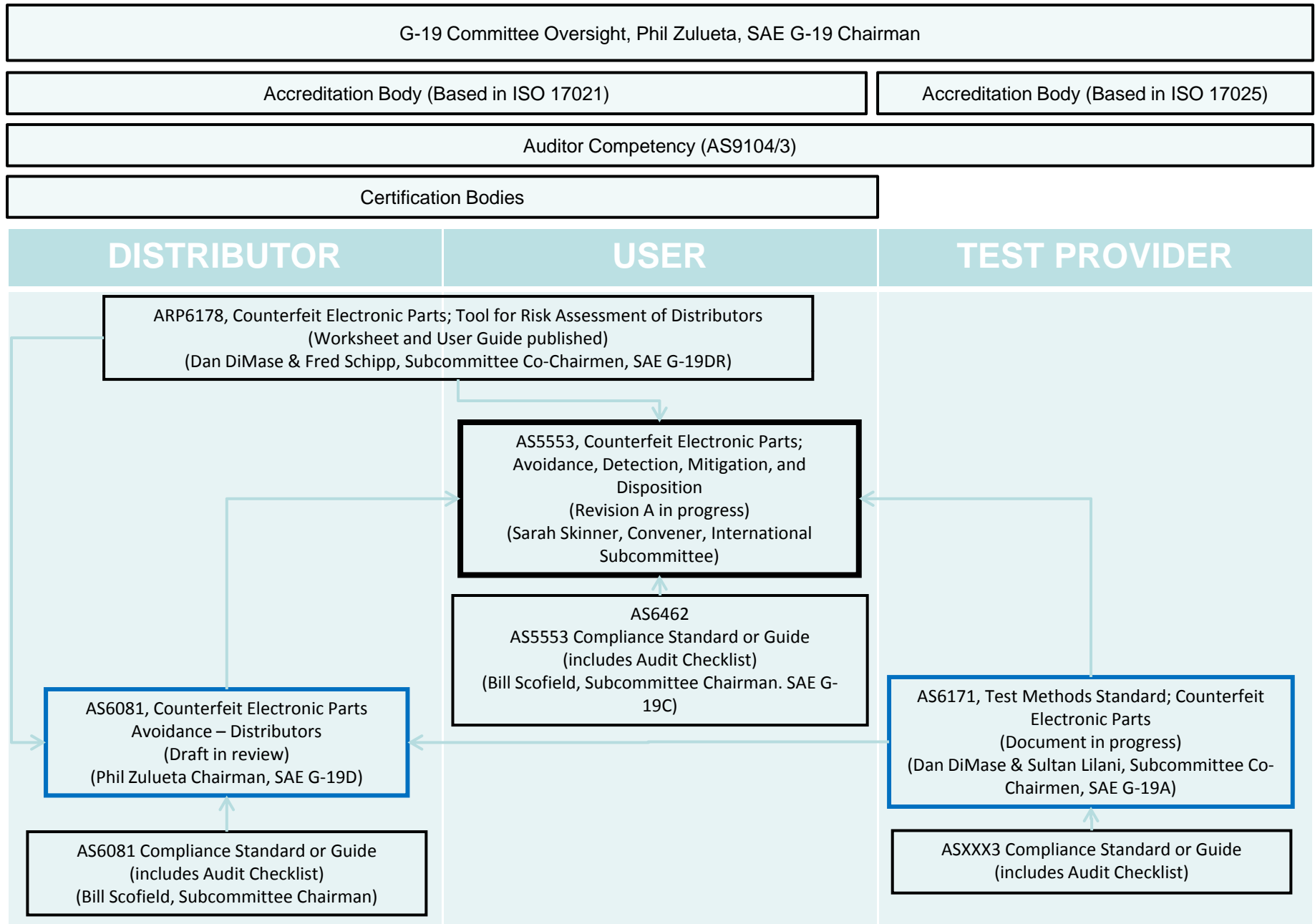


G-19 Makeup

- OEMs
- Regulators, Government & Military Agencies
- Legal Experts
- Industry Associations
- Distributors
- Research Laboratories
- Suppliers
- Independent Experts, Consultants



SAE G-19 Document Roadmap, March 2012



SAE G-19 Members

from Government, Defense and Industry Sectors

Government Members ...

- Defense Logistics Agency (DLA)
- Defense Contract Management Agency (DCMA)
- DOE - National Nuclear Security Administration (NNSA)
- Federal Aviation Administration (FAA)
- Intelligence Advanced Research Projects Activity (IARPA)
- Ministry of Defense, UK
- National Aeronautics and Space Administration (NASA)
- USAF/NRO (The Aerospace Corporation)
- USAF Wright Patterson AFB
- US Army - AMCCC Business Operations HQAMC
- US Army Aviation & Missile Command
- US Army Redstone Arsenal
- US Missile Defense Agency (MDA)
- US Navy - Naval Air Warfare Center
- US Navy - Naval Surface Warfare Center (NSWC)Crane
- US Navy - NAVSEA Crane
- US Navy, Submarine Maintenance Engineering, Planning and Procurement (SUBMEPP) Activity
- US Department of Transportation

Note: Members function as individuals intending to represent the best interests of the industry, and not as agents or representatives of any organization with which they may be associated

SAE G-19 Members

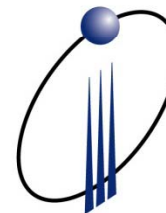
from Government, Defense and Industry Sectors

Industry Members ...

Adaptive Management Solutions
Aero Engine Controls
American Electronic Resource
Analytical Alternatives
Analytical Solutions
Applied DNA Sciences
Arcadia Components
Ares Corp
Arrow Electronics
Astute Electronics
BAE Systems (Operations)
BAE Systems
Ball Aerospace & Technologies
Boeing
Boeing Advanced Systems
Business Quality Process Management
Bechtel Plant Machinery
CALCE University Of Maryland
Celestica Corp. Technology & Engineering
China Aero-Polytechnology Establishment
Creative Electron
Crestwood Technology Group
DA-Tech
Derf Electronics
Det NortskeVeritas (DNV)
DPA Components International
Electronic Supply Chain Solutions
Eltek Semiconductors
General Dynamics
General Dynamics UK
GE Aviation
Glenbrook Technologies

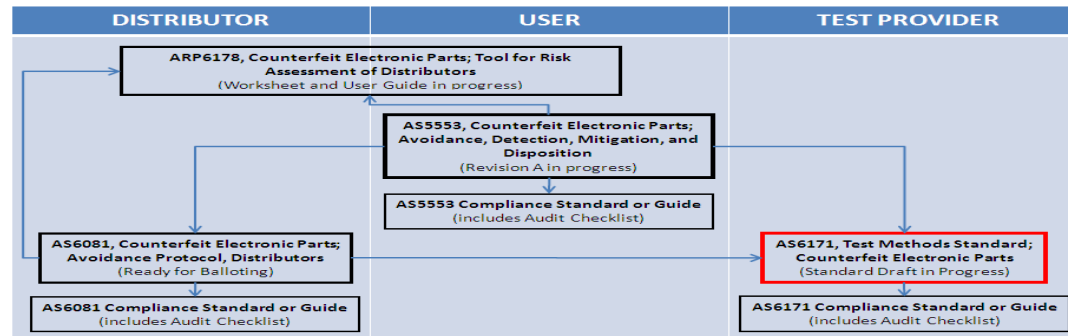
Goodrich Control Systems
Greenberg & Bass
Harris
Hi-Reliability Microelectronics
Hi-Rel Laboratories
Honeywell Aerospace Electronic Systems
Honeywell Int'l
Honeywell Technology Solutions
Infineon Technologies AG
Integra Technologies
Jabil Circuits
Jacobs Engineering
Jet Propulsion Laboratory
L-3 Communications - CSW
Left Coast Technical Solutions
Lockheed Martin Aeronautics
Lockheed Martin Missiles & Fire Control
3M
Microram Electronics
Motronics Circuits International
Mouser Electronics
Nisene Technology Group
Northrop Grumman Electronic Systems
N.F.Smith & Associates
NQA
Northrop Grumman
Orbital Sciences
Plexus
Premier Semiconductor Services
Process Sciences
Raytheon
Rochester Electronics
Sandia National Laboratories

Schlumberger HPS
Selex Galileo
Silicon Cert Laboratories
SMT Corp
SolTec Electronics
Sonix
Sonoscan
SRI International Sarnoff
Star Associates International
Trace Laboratories
TTI
Underwriters Laboratories, UL DQS
Westland Helicopters
White Horse Laboratories
World Data Products
World Micro
Wyle Laboratories



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T E C H N O L O G I E S

AS 6171 - Aerospace Standard

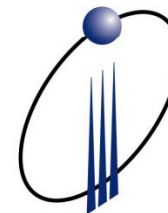


Test Methods Standard; Counterfeit Electronic Parts

Purpose	Standardize practices to detect suspect counterfeit electronic parts and to ensure consistency of test techniques and requirements across the supply-chain
Target Audience	Independent Testing Facilities Distributors (in-house testing capability)
Uses	<ul style="list-style-type: none"> • Definition of Test Methods for counterfeit detection • Level of testing is risk-based and includes sampling plans • Accreditation • Intended to be used for accreditation of Independent Test Laboratories or Distributors (ILAC, through ACLASS, A2LA,etc.)
Status	<ul style="list-style-type: none"> • In Draft, expected publication Q3/Q4-2013

AS6171 - Test Methods Standard; Counterfeit Electronic Parts

- Test Methods
 - External visual inspection
 - Radiological inspection,
 - X-ray fluorescence,
 - Remarking and resurfacing,
 - De-lid/ Decapsulation or destructive physical analysis,
 - Electrical tests,
 - Acoustic microscopy,
 - Optical/SEM inspection,
 - FTIR/DSC/TMA testing and miscellaneous testing
- Risk criteria and sampling plans
- Personnel certification requirements



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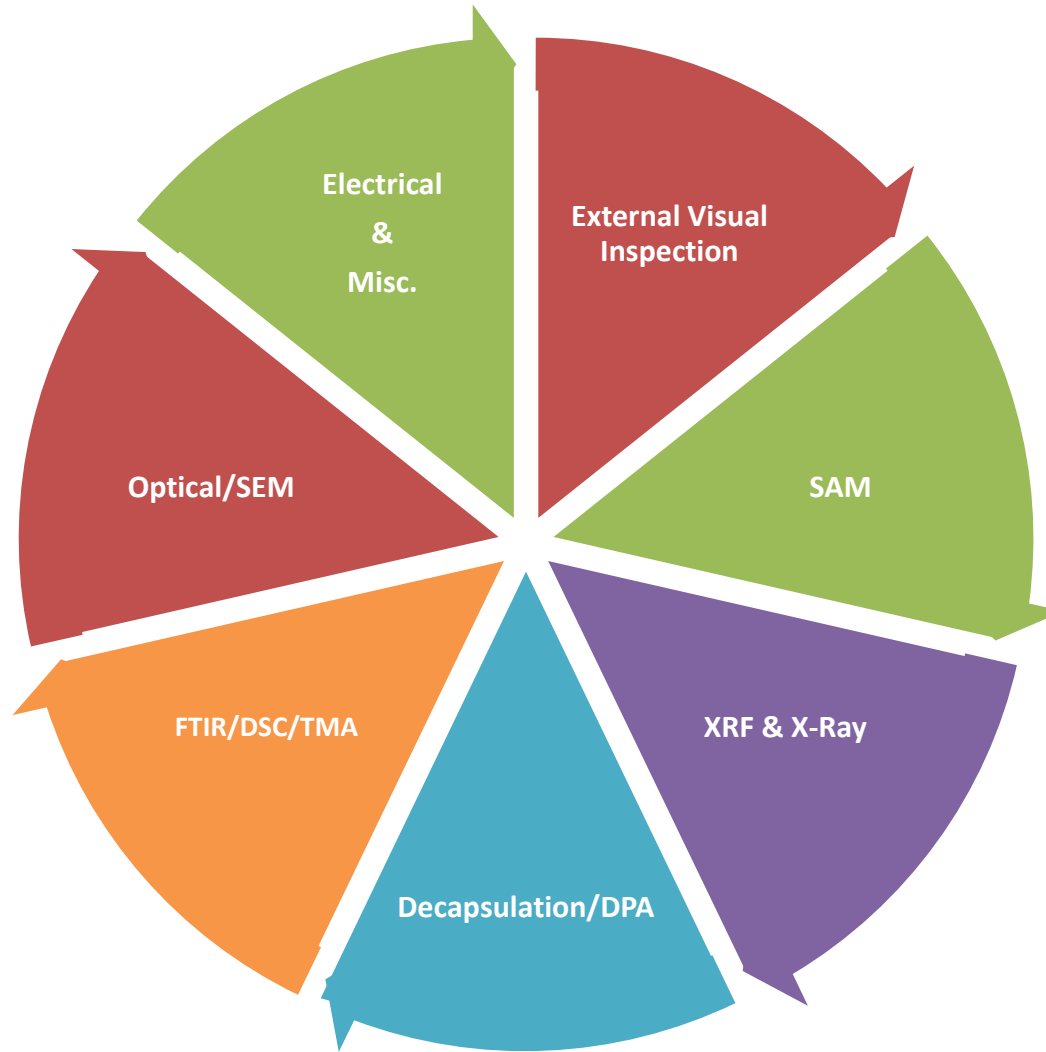
AS6171 - Test Methods Standard; Counterfeit Electronic Parts

Each Test Method section will include:

- Processes and a description of procedures,
- Apparatus needed for the test technique,
- Required qualification and certification of processes and personnel,
- Guidelines and requirements for reporting.



Test Laboratory Sub-Group Activity/Test Methods



Many Additional SME's Participate in Sub-Groups

Latest Status of AS6171

- Contents for First Round is Complete
- In Ballot As Individual Test Method Already – 28 Day Ballot
 - External Visual Inspection
 - Electrical
 - Acoustic Microscopy
 - Decap
- Rest in about 2 weeks
- Next Step: Mitigation of Comments
- Entire Document Ballot: 3Q 2013

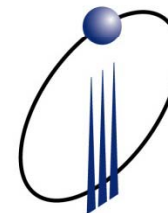


Challenges Ahead for Both Obsolete and Current Technology Products



Non-Functional Counterfeits

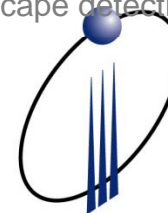
- Marking Quality can be excellent even better than the original
 - Generally done with ink mark
 - Can use the same ink as the manufacturer
 - Include: logos date codes and lot codes
 - Vendor part marking information available on the WEB
- What's inside
 - Derived from scrap parts or be made from scratch
 - Wrong DIE
 - Counterfeiter finds the package
 - Removes the marking
 - Re-marks to the device in demand
 - No DIE inside
 - Counterfeiter acquires blank packages from an assembler
 - Marks to the desired device
- Removing the Marking
 - Blacktopping is too easy to spot
 - Laser marking is very shallow (shave, sand or polish off a layer)
 - Chemically wash off or etch the ink
- Re-Marking
 - Simulated laser mark is impact-printed with laser colored epoxy ink
 - Some have true laser marking
 - Ink mark can be easily duplicated (many manufacturers use ink on some of their products)
- These parts are usually easily detected



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Functional Counterfeits

- Co-Marking
 - Processor or memory speed markings are stepped up to add premium value
 - Similar function changed to high spec parts (standard op-Amp to high performance)
 - Transform standard parts to more valuable industrial, military or space rated parts
 - These parts function correctly but may fail at temperature extremes
 - Testing may be the only way to know
- Date Code update
 - Old parts remarked with a current date codes
- Lead-free remarking
 - Pb-free parts marked as the Pb types
- Knock-off Parts
 - True counterfeit devices
 - Functional and carry the labels of well known component manufacturers
 - "Third rate makers" built product and label with a reputable manufacturer
 - Some devices can't possibly work at the rated power levels
 - Parts are flawed and may fail immediately or in the field
 - Can be functional, but will have quality and reliability issues
- Failed Real Parts
 - Parts are already marked by the manufacturer
 - Parts that failed manufacturer testing, were rejected and scrapped
 - Retrieved from dumpster, smuggled by employees, etc
 - Destruction of rejects in ASIA test houses is hard to guarantee
 - Show up on market may be sold as new
 - Often high percentages of failed parts may appear to work in applications
 - Leakage failures, elevated power supply currents, speed failures, single bit/gate failures, etc
 - Difficult to detect without full testing and pose a major quality and reliability risk
- Salvaged Parts
 - These are the most dangerous type of counterfeits since they may escape detection even in the system



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Newer Counterfeit Techniques Are Far More Sophisticated Than These Conventional Techniques Obsolete

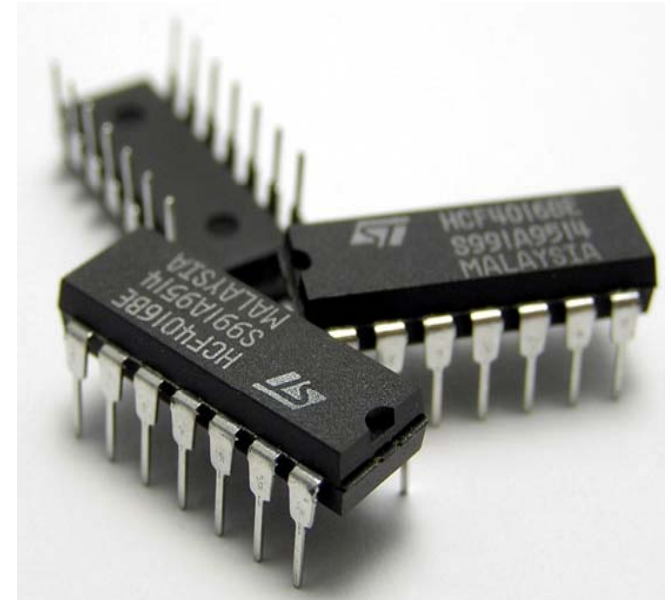
Short Term

- **New Counterfeit Threats**
 - What Are They?
 - Implications on Conventional Visual Techniques
 - Implications on Conventional Electrical Techniques
 - Implications on Latency and Long Tern Reliability
 - User Level DMSMS Solutions



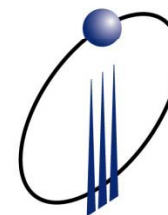
What Are We Facing

- Difficult to detect changes
 - Parts look new and have the correct die
 - Electrically would typically pass
 - Nominal electrical testing not adequate
 - Temperature screening needed
 - May be out of spec under load condition
- Latency Problem Has Not Been Addressed
 - Latency and Reliability problems
 - Damage during the die recovery process
 - Bond pad degradation
 - Possible heating issues due to package integrity
 - Potentially high rate of field failures



Finished Product

Photos courtesy of ERIA



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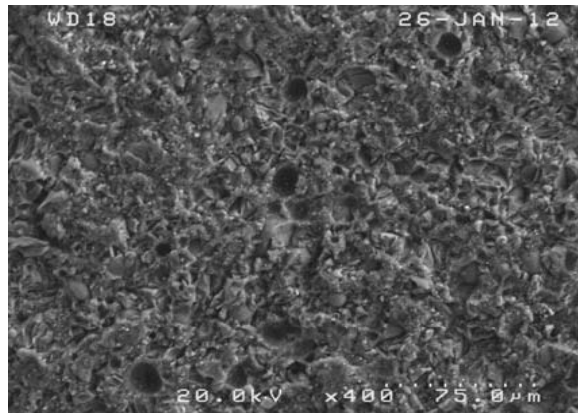
Short Term

Conventional Visual Techniques Not Adequate for Newer Threats

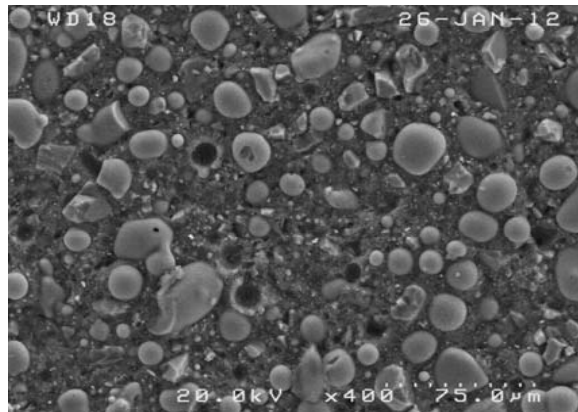
- New Counterfeit Threats That Are Non-Recognizable By Conventional Detection Techniques
 - Almost Perfected Micro-Blast Process
 - Top Back-Lapping
- What Do We See
 - Creation of a Completely Different P/N
 - Remark Change from RoHS or non-RoHS
 - Remarking from Commercial to Industrial
 - Remarking from Commercial to Mil-spec
 - Remarking from Industrial to Mil-spec
 - Remarking with Speed Upgrades
 - Remarking of Die Rev
 - Etc, etc
- Conventional Visual Techniques May Not Work
 - Conventional Optical Inspection
 - Typically Not Detectable But Detectable with Golden Samples to Detect Top Surface Variation
 - However, SEM Shows Finer Details



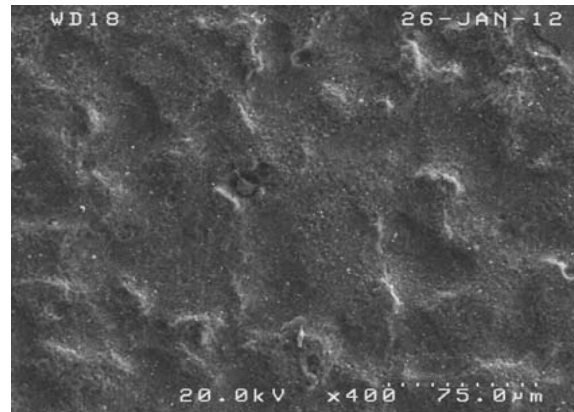
SEM Analysis PLCC Micro-blasted Device



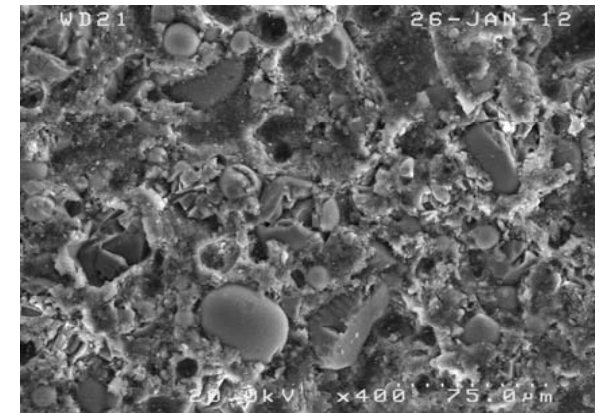
D1



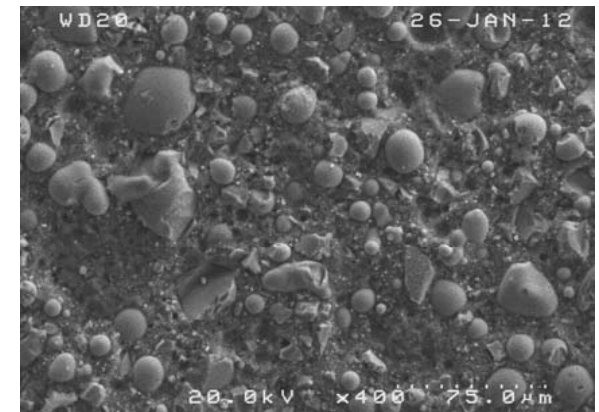
D2



Ref

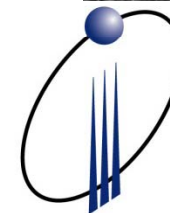


D3



D4

Photos taken by MU Analysis



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Short Term

- New Counterfeit Threats That Are Non-Recognizable By Conventional Detection Techniques
 - Almost Perfected Micro-Blast Process
 - Top Back-Lapping
 - Etc.
- Costly Electrical Testing is Inevitable to Detect Latest Counterfeit Techniques
- Latency and Long Term Reliability Needs to a Concern
- Costly DMSMS Solutions Are Being Implemented



Short Term

Conventional Electrical Testing Not Adequate for Newer Threats – Low Level Electrical Testing Will Not Catch The Newer Counterfeit Treats (Example: How Do You Verify Changes Speed Grade for a Processor Using Non-Detectable Micro-Blast Process)

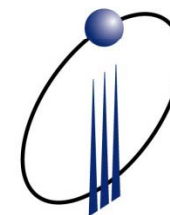
- Following Tests Cannot Adequately Detect Sub-Par Data Sheet Compliance
 - Curve Tracer Check
 - Gross Functional Check
 - Fully Testing Just One Portion of the Device
- At Minimum; Need to Test
 - Key DC and AC Parameters
 - Functional Testing
 - Testing All Blocks of the Device
- Costly Proposition But Cost Can Be Minimized By
 - Use of Smart Test Plan – Don't Need to Test What is not Being Used in Application
 - Use Emulators, Simulators, Reference Boards Instead of Developing All New Functional Vectors



Short Term

Counterfeit Detection Techniques Are Moving to the Right of Matrix

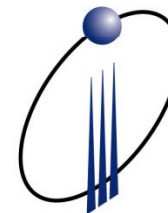
		Detection Methods								
		External Visual & Phys Dim	XRF Analysis	Mark Perm	Internal Visual	Basic DC Test	Min Func Test 25C	Full Spec Extended Temps	Test & Qual	
Counterfeit Type	Non Functioning Devices	No Die	Possible	No	Possible	Yes	Yes	Yes	Yes	Yes
		Wrong Die Re-Marked	Possible	No	Possible	Likely	Yes	Yes	Yes	Yes
		Board Pulls	Possible	No	No	No	Possible	Likely	Yes	Yes
	Functioning Devices	Failed Real Parts	No	No	No	No	Possible	Likely	Yes	Yes
		Speed up-marking	Possible	No	Possible	No	No	Possible	Yes	Yes
		Spec up-marking	Possible	No	Possible	No	No	Possible	Yes	Yes
		Temp up-range	Possible	No	Possible	No	No	No	Yes	Yes
		Pb Free Re-marked	Possible	Yes	Possible	No	No	No	No	No
		Lesser part (knock-off)	Possible	No	Possible	Possible	Possible	Possible	Likely	Yes



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Recommended Test Methodology

- Test the Device as it is Used
 - Functional at-speed
 - Application speed not max spec
 - Test frequency is a major tester cost driver
 - Comprehensive Functional Testing
 - Test all device functionality
 - Fault grading is not possible since only the manufacturer has device modeling capability
 - Test key AC Parameters
 - Key parameters are usually referenced to device clocks
 - Propagation delay
 - Setup and hold times
 - Extra parameters are often listed for designer reference
 - Use go-no-go testing to cover most AC parameters
 - Tested over the entire functional pattern
 - Selected AC characterization measurements can be made
 - DC Measurements to the Full Specified Limits
 - Attempt to test 25C parameters at extended temperatures
 - Limit adjustments may be required after testing
 - Select the Appropriate Tester
 - No one tester can effectively test all technologies



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Short Term

Latency and Reliability Concerns Have Not Been Addressed

- Fully Functional Part Meeting Datasheet Limits May Still Have Following Issues
 - Burn-In / Infant Mortality Screening May Have Not be Performed
 - Hard to Judge if Any of the Required Up-Screening Has Been Performed Because of no Traceability
 - Parts May Fail in Application Due to Inadequate Load Testing
 - Latent Handling Failures – ESD
 - Gross Functional Check
- Potential Solutions
 - Some Upscreening Taking into Consideration Application
 - Cost can be Minimized Considering System or Box Build Flows Stresses Applied



Short Term

Costly DMSMS Solutions Are Being Introduced

- Board Re-Designs by OEM Are Increasing
 - Replacement of Obsolete Products with Equivalent Currently Offered Products
- PEMs Introductions Are Increasing
 - Non-availability of Ceramic Version
- After Market Equivalent Product Usage on the Rise
 - Manufacture from Die Bank – Costly Upscreening
 - Re-Engineering
- Board Interposers for Equivalent Product in Different Form Factor (least costly)
 - Requires Extensive On-Board Functionality Verification



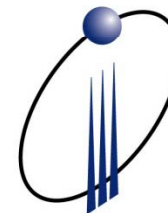
Mid and Long Term

- DNA Marking
 - Stop-Gap Fix With Risks
- “Usage Transistor” on the Silicon
 - Addresses Limited Counterfeit Scenario (mostly used or re-work parts)
- Trojan Counterfeit Transistor
 - Addresses High Risk National Security Devices for Newer Designs
- Unique Embedded or OTP Codes on The Device
 - Newer Devices – Potential Data Management Issues for Billions of Devices
- Planning for Obsolescence
 - Needs OCM, OEMs and After-Market Supplier Collaboration
- Long Term After Market Manufacturing Strategy
 - Needs OCM, OEMs and After-Market Supplier Collaboration
- Robust Supply Chain Solution Consisting of Trusted Non-Franchise Distributors
 - Requires a Different Breed of Non-Franchised Distributors



Integra Test Engineering Summary

- Test Facilities in Kansas and California
 - 41k sq. ft. (KS), 3k sq. ft. (CA)
- 27 Year History as a Testing Lab
- 24 Hours/Day x 7 Days/Week Operations
- 170 Employees, 26 Test Engineers & 38 Testers
- Broad tester and test technology capabilities
 - Memory, Digital, Linear, Mixed Signal, RF, FPGA
- Engineering expertise in every technology
 - Greater than 10,000 test programs developed locally
- >200 Active Customers Mil/Space & Semi-manufacturer
- Operations are ISO-9001, AS9100, ITAR, DSCC and Trusted
- On-Time Delivery Performance of 96%
- Customer Satisfaction Rating of 98%



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