Packaging Engineering: A First Line of Defense For Suspect Component Detection

Bob Vermillion, CPP/Fellow
RMV Technology Group, LLC
NASA-Ames Research Center
Moffett Field, CA 94035

The days of purchasing U.S. based products from one's local distributor can be compromised by outsourcing efforts lacking traceability in the supply chain. In contrast to aerospace & defense, the pharmaceutical sector is actively engaged in utilizing a sound packaging engineering approach enabling non-conforming or suspect counterfeit products to be differentiated, tracked, identified, inspected and placed into quarantine.

Scope of the Problem: Supplier Non-conformance and Suspect counterfeit packaging represents a hazard to electrostatic discharge (ESD) sensitive devices or components through cross contamination (Figure 1) during transport and storage while generating high voltage discharges in the parts inspection and manufacturing process. Several aerospace related issues involve long-term storage supplier non-conformance with antistatic foams, antistatic bubble wrap, vacuum formed antistatic polymers and Type 1 moisture barrier bags. The late John Kolyer, Ph.D. (Boeing, Ret.) and Ray Gompf, P.E., Ph.D. (NASA-KSC, Ret.) were advocates in the utilization of a formalized physical testing material qualification process. Today, however, prime contractors and CMs rely heavily upon a visual inspection process for ESD packaging materials. Over the past 10 years, however, suspect counterfeit ESD packaging materials have compromised the supply chain.

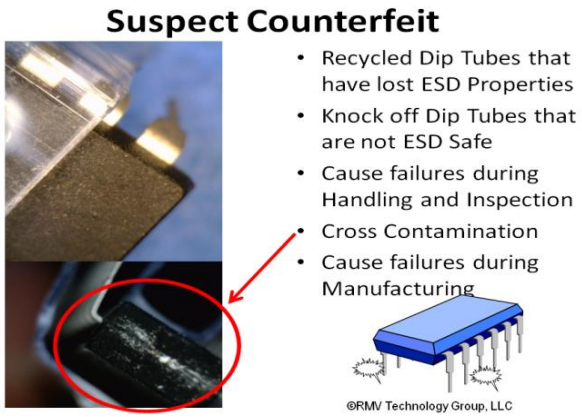

Figure 1

Most recently, despite visual inspection of an outer package label and bar code scanning by an electronic components distributor, suspect counterfeit re-topped electrostatic discharge (ESD) sensitive components were still purchased in error. To compound the matter, a new and very inexpensive method of removing a component's lettering is now being utilized by the counterfeiters that does not show evidence of tampering as illustrated in Figure 2.

Original: Left **Tampered**: Right

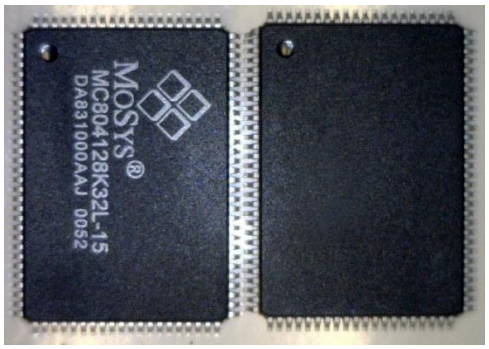

Figure 2

One countermeasure for detection is the use of RFID in packaging for incoming inspection and inventory tracking. Another measure constitutes "hands on" training for Incoming Shipping & Receiving personnel in the use of advanced inspection techniques of packaging materials. For example, ESD sensitive components are typically protected by packaging that industry identifies by " color": i.e., Pink for antistatic bubble, Black for carbon loaded polymer JEDEC trays and Tape & Reel. Color is not an indicator of static control packaging performance, however, this identification marker is widely accepted by the aerospace & defense and space sectors. A simple and cost effective electrical resistance test can very easily determine if the packaging is compliant beyond misidentification by color. If the package fails this initial test, then it should be flagged for components that could be compromised. A simple rule to remember is "*A counterfeiter will not be motivated to package fraudulent ESD sensitive components in compliant static control packaging that could add up to 40% or more in material costs alone.*"

PACKAGING ENGINEERING continued from Page 8

The author's groundbreaking presentation at the NASA-Quality Leadership Forum (March 2010) first identified that suspect counterfeit packaging materials are being used extensively in the supply chain. As a result of this white paper, two articles were published titled Dip Tube and JEDEC Trays and Tape & Reel that provide greater detail as a result of the conference. Both articles can be found at:http://www.esdrmv.com/content/suspect-counterfeit-training. The RMV presentation and referenced articles describe issues related to antistatic packaging as a long-term storage hazard. Even though NASA may not use dip tubes in manufacturing, many prime contractors, CMs and electronic distributors continue to source legacy products housed in antistatic IC carriers.

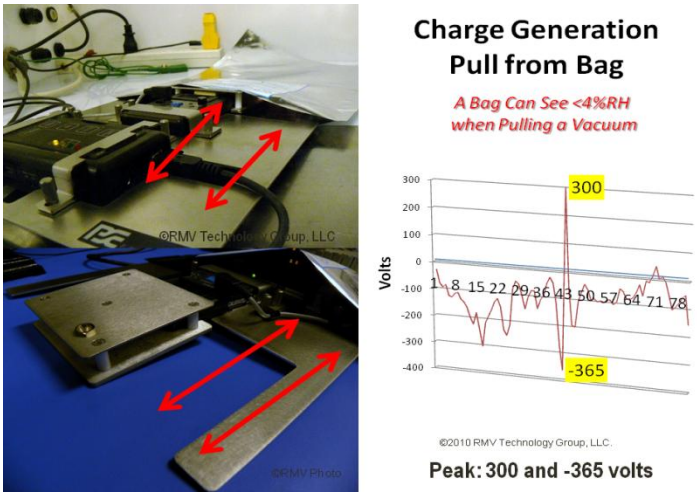

Figure 3

A first line of defense strategy to mitigation of counterfeits in the supply chain is a proactive approach in effective packaging design *know how* instead of reliance upon suppliers to do the right thing. Since 1997, RMV has tested static control products and packaging for the end user, OEMs, CMs and distributors. Despite favorable supplier in-house test reports or technical data sheets, we have found that the majority of ESD materials and packaging from the Pacific Rim fail standardized ESD testing. For example, the Type I & III bag required by the DOD is to provide a charge free shielding environment for ESD sensitive components (see Figure 3, Tape & Reel Type I bag). The utilization of ever changing pallet patterns in combination with specialized packaging (see Figure 4) is a simple change that can thwart

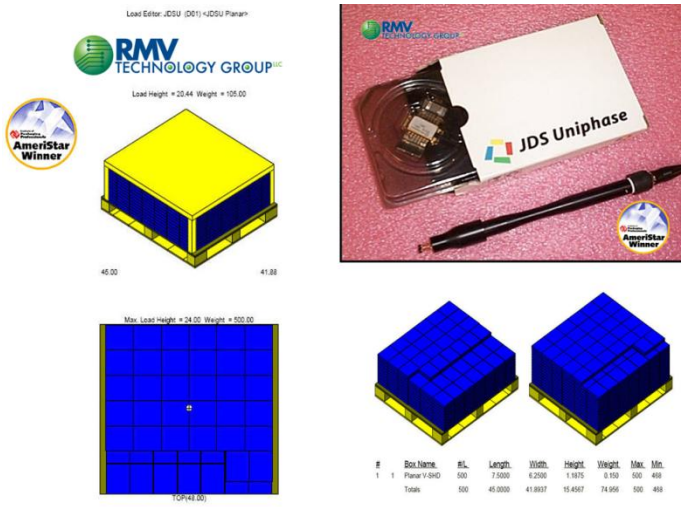

Figure 4

suspect counterfeiting and make tampering much more difficult. Thus, both supplier and customer are aware of the ever changing pallet patterns through the use of a Change Notification.

In March 2012, RMV in collaboration with the US Defense Ammunition Center (DAC) presented a white paper at NIPHLE, Washington, D.C. RMV demonstrated that despite accurate initial qualification efforts for ESD materials utilized in the DOD supply chain, four of the five packaging products (pulled from new inventory) yielded failing results:

1. Fast Packs (Failed)
2. Antistatic Bubble wrapping (Passed)
3. Antistatic Pink Poly Film (Failed)
4. Type 1 Aluminum ESD Moisture Barrier Film and Bags (Failed)
5. Type 3 Metalized ESD Shielding Film and Bags (Failed)

Once a package is qualified, these results indicate that periodic verification though physical testing is either not being required or that materials are subjected to long term storage conditions beyond a material's shelf life. Due to supplier nonconformance or suspect counterfeiting, protective packaging and materials for ESD sensitive devices must be revalidated on a periodic basis during the product life cycle. Taking a proactive approach by pulling the static control material or packaging from inventory to conduct ESD testing protects the warfighter and prevents equipment failure in theatre.

Bob Vermillion can be reached at bob@esdrmv.com