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<th>1. REPORT DATE</th>
<th>30 AUG 2011</th>
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<tbody>
<tr>
<td>2. REPORT TYPE</td>
<td></td>
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<tr>
<td>3. DATES COVERED</td>
<td>00-00-2011 to 00-00-2011</td>
</tr>
<tr>
<td>4. TITLE AND SUBTITLE</td>
<td>PMP Lessons Learned</td>
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<tr>
<td>5a. CONTRACT NUMBER</td>
<td></td>
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<td>5b. GRANT NUMBER</td>
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<td>5c. PROGRAM ELEMENT NUMBER</td>
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<td>5d. PROJECT NUMBER</td>
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<td>5e. TASK NUMBER</td>
<td></td>
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<td>5f. WORK UNIT NUMBER</td>
<td></td>
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<tr>
<td>6. AUTHOR(S)</td>
<td></td>
</tr>
<tr>
<td>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</td>
<td>National Defense University Press, 260 Fifth Ave., Bldg. 64, FT McNair, Washington, DC, 20319</td>
</tr>
<tr>
<td>8. PERFORMING ORGANIZATION REPORT NUMBER</td>
<td></td>
</tr>
<tr>
<td>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</td>
<td></td>
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<tr>
<td>10. SPONSOR/MONITOR’S ACRONYM(S)</td>
<td></td>
</tr>
<tr>
<td>11. SPONSOR/MONITOR’S REPORT NUMBER(S)</td>
<td></td>
</tr>
<tr>
<td>12. DISTRIBUTION/AVAILABILITY STATEMENT</td>
<td>Approved for public release; distribution unlimited</td>
</tr>
<tr>
<td>13. SUPPLEMENTARY NOTES</td>
<td>Published in the Journal PRISM vol 3, no. 2, 2012</td>
</tr>
<tr>
<td>14. ABSTRACT</td>
<td></td>
</tr>
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<td>15. SUBJECT TERMS</td>
<td></td>
</tr>
<tr>
<td>16. SECURITY CLASSIFICATION OF:</td>
<td></td>
</tr>
<tr>
<td>a. REPORT unclassified</td>
<td>b. ABSTRACT unclassified</td>
</tr>
<tr>
<td>17. LIMITATION OF ABSTRACT Same as Report (SAR)</td>
<td></td>
</tr>
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<td>18. NUMBER OF PAGES 17</td>
<td></td>
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<td>19a. NAME OF RESPONSIBLE PERSON</td>
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*Standard Form 298 (Rev. 8-98)*

Prepared by ANSI Std Z39-18
PMP LESSONS LEARNED

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30 AUGUST 2011

Contact:
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PMP Advisories

- Produced whenever a part, material, or process experiences an unusual failure or problem that can be shared with the community to help avoid future issues and improve system reliability, quality and safety

- Around 10-15 advisories per year covering a wide variety of PMP problems
  - Counterfeit parts
  - Ground Support Equipment issues
  - Safety issues
  - Process problems
Counterfeits

- Counterfeit parts found in several programs, and has implemented an agency-wide process (e.g. MDA Policy Memo #50) to combat the problem
- Not just Integrated Circuits, but diodes, transistors, chip capacitors, and COTS hardware items have been found to be counterfeit
- Most practical first step is to beef up procurement practices to avoid likely sources and increase awareness to detect them at incoming inspection
Watch where you buy!

DO NOT PROCURE FROM NON-APPROVED SOURCES!!

World of Component Sources

OEM Authorized Franchised Distributors

PREFERRED PROCUREMENT

Prime Approved Sources
Reality of Independent Distributors

Both distributors sell (sold) to defense contractors. Both advertise availability to thousands of components. Both are residential businesses.
Part Failures

• No matter how hard you try, part failures happen, often because of seemingly innocuous reasons
  • Chip capacitor failures because the sintering oven experienced a power glitch at the factory (process control)
  • Power supply failure due to a tiny transformer breaking loose inside a hybrid. The epoxy pre-form used to glue it down was found to be contaminated by mishandling with silicone
  • SMA jacks with intermittent signal loss found caused by a bad batch of poorly formed center contact barrels making it into finished product
• As Integrated Circuits shrink to ever-smaller geometries, sensitivity to Electrostatic Discharge (ESD) is a continuing problem

• Pink Poly is not that good

• Moisture sensitivity on small parts forces tighter humidity controls – too low and ESD becomes catastrophic, too high and sensitive devices pick up too much moisture prior to assembly on boards

• Worker awareness and training, MSD tracking processes more important than ever
• Sensitive parts that must be assembled in clean areas demand a robust Foreign Object Damage (FOD) program

• Shop cleanliness:
  – condition of floors, ceilings
    • We have found crumbling ceilings, broken floor tiles, falling insulation in FOD-sensitive assembly areas
  – clutter, wire clippings, solder splashes
  – tool condition
    • Flaking chrome plate, rust, tape residue on scissors
  – hand lotion (silicone contamination)
    • Sorry ladies, but most hand lotion has various silicones (often Dimethicone) in it
Defective Titanium

- Critical materials are occasionally a tempting thing to take shortcuts to save money or increase profit
- Titanium billet supplier was skipping a couple process steps to reduce cost on billet (an intermediate form of metal)
  - Was not rolling it to spec size, was cutting it
  - Was not performing spec heat treatment
- Resulted in potentially reduced material strength of titanium going into making aerospace parts
Design Flubs

• A lanyard pull connector failed due to the way the lanyard was oriented and the length of the lanyard
  – Resulted in pulling a connector off the hardware
• Shut-off switches poorly positioned, too close to where operators were resting their hands
  – Equipment accidentally shut off during test
• Need to carefully review design choices to make sure designs perform as intended
Materials Issues
that won’t just go away...

- Tin Whiskers
  - Pure tin plating, plus Zinc and Cadmium plating, will whisker given enough time – awareness and mitigation

- Red Plague
  - Silver plated wire will be destroyed by red plague (copper galvanic corrosion) given time, moisture, and plating damage

- Silicone and Loctite Migration
  - Silicone lubricants never cure, and creep and migrate to virtually any surface – avoid use where it can cause issues
  - Loctite (thread lock compound) does not cure, and creeps to unwanted areas – wipe off excess

- Gold Embrittlement – solder will become brittle if mixed with gold from gold plated pads
  - Remove 95% of gold from pads prior to soldering by tin/remove process
Embedded Software

- Embedded operating systems and firmware often has bugs and glitches that even the originating supplier doesn’t know about until users discover them
- Real-time OS vendor patches for a popular OS product number into the dozens
  - Make sure you implement all appropriate patches and thoroughly test the deployable code in the product
- A GPS vendor had a glitch in firmware that caused the time code to skip – once every few days
Quality is Deceiving

- Watch for references to MIL-SPEC quality, where vendor is only performing some of the steps for QPL, skipping others
Processes

• Bonding involves several steps besides applying the glue and putting pieces together
  – Need proper cleaning, surface prep, and testing to assure success
• Soldering still a major source of problems
  – Watch for hidden solder joints and implement proper inspection techniques (x ray, etc)
  – Proper hole fill, tip temperatures, wave exposure time, solder composition, gold removal (gold embrittlement), .....the list goes on.....
• Carefully design, execute, and monitor all critical processes
Summary

• Carefully select, implement, execute, and test all processes

• Be wary of where and from whom you procure – there is an ocean of unscrupulous operators out there
  – Cultivate a deeper relationship with suppliers, and share company concerns, provide oversight and flow-down of knowledge and requirements

• Spend the extra time and money to sample test and check critical items. It pays dividends by avoiding costly issues later