



Lead-free Thermal Cycle Testing Effort



**Thermal Cycle Testing Effort For JCAA/JGPP
Lead-free Solder Project S-01-EM-026**

http://www.jgpp.com/projects/projects_index.html

**Dave Hillman
Advanced Operations Engineering
Rockwell Collins Inc.
Cedar Rapids Iowa**



Lead-free Thermal Cycle Testing Effort



Agenda

- **Why Thermal Cycling?**
- **Thermal Cycle Parameter & Setup Descriptions**
- **What We Are Looking For?**



Why Thermal Cycling?

- Properly wetted solder joints do not fail in vibration due to solder joint characteristics – they fail due to improper vibration design.
 - This is an **avoidable** issue!! (Most of the time!)
- The solder joint stress induced by thermal excursions is due to Coefficient of Thermal Expansion (CTE) mismatch.
 - This is an **unavoidable** issue!! (Most of the time!)



Lead-Free Printed Wiring Assembly



PWB

- 14.5"X 9"X 0.09"
- Immersion Silver Finish
- SnPb HASL (rework)
- 12 layers

PWA

- Surface mount and through hole components
- Total Quantity: 205 (119/86)

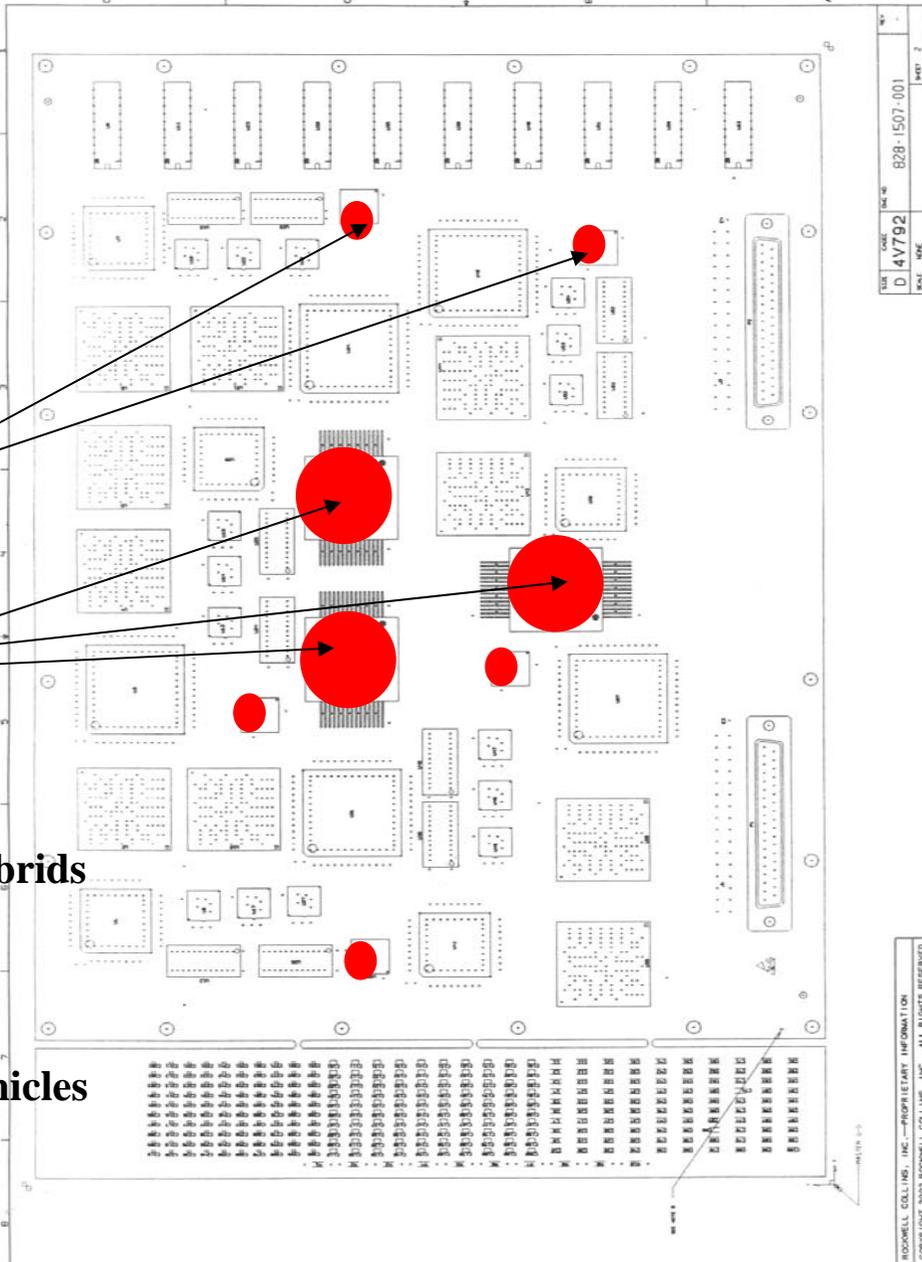
Lead-Free Solder Alloys

- Sn3.9Ag0.6Cu
- Sn3.4Ag1.0Cu3.3Bi
- Sn0.7Cu (stabilized)

CSPs

Hybrids

Due to design oversight, the CSP and Hybrids components were removed current Test Vehicles



Test Vehicle Design Layout from Draft Joint Test Protocol J-01-EM-026-P1



Parameter & Setup Description

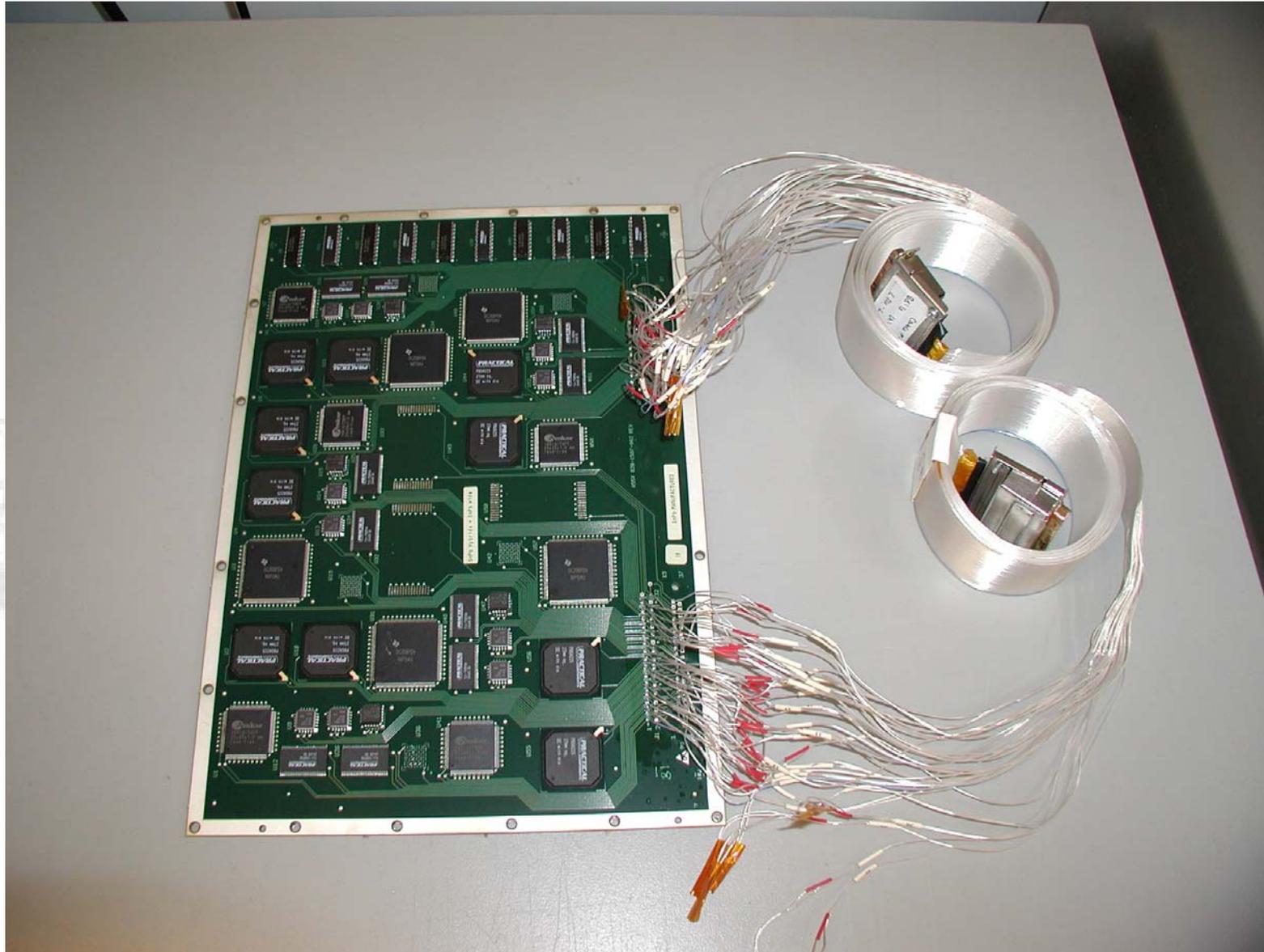


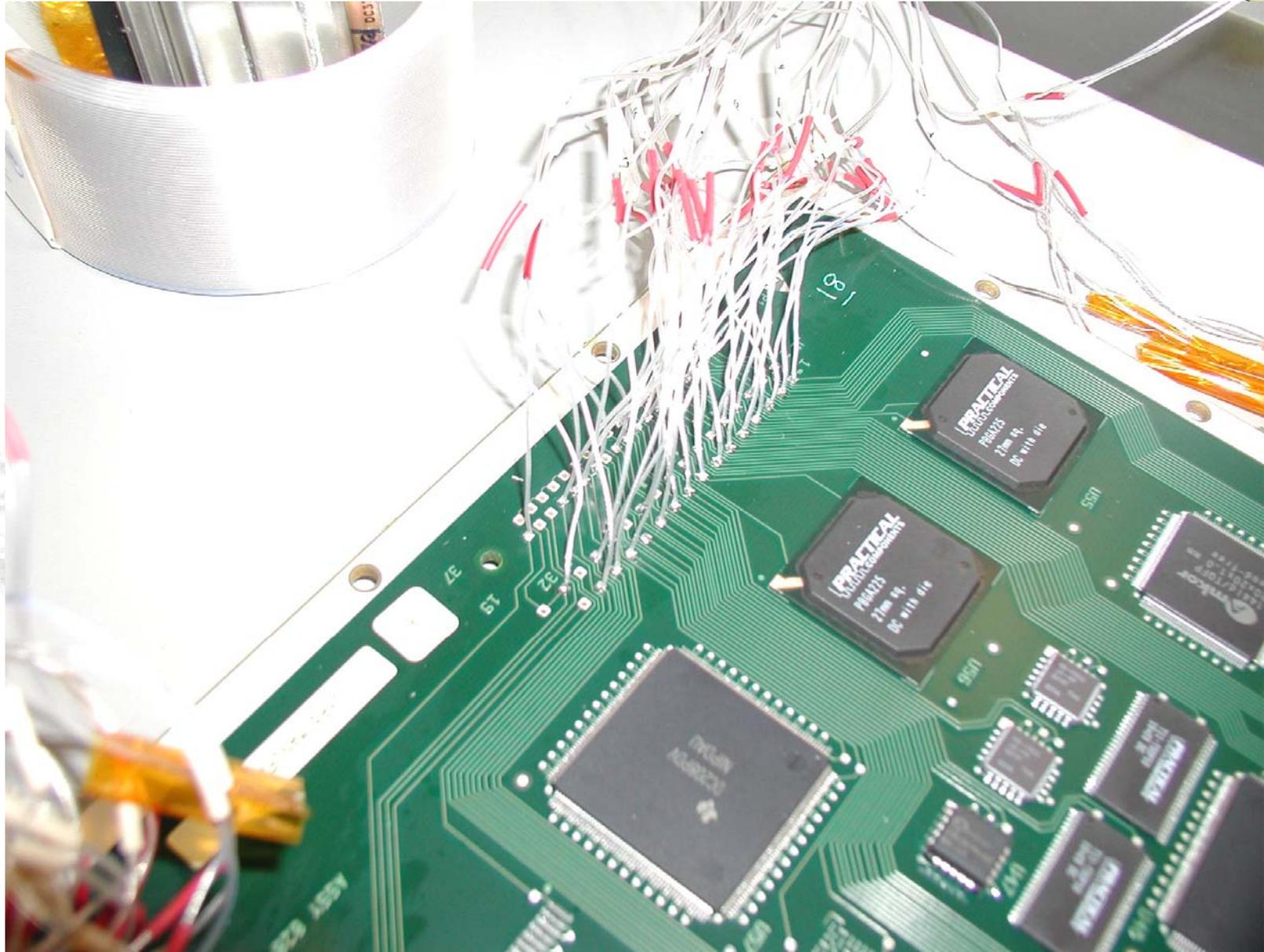
Rockwell Collins Testing = -55°C to +125°C Range

- **+125°C Dwell = 30 minutes -55°C Dwell = 10 minutes**
- **Thermal excursion ramp rates = 5°C-10°C/minute**
- **Temperature PWB-to-PWB tolerances = +/- 3°C**
- **In Accordance with IPC-9701 Guidelines**
 - **Constant Electrical Monitoring**
 - **Electrical interruption > 0.2µsec**
 - **Continuity interruption >300 ohms**
 - **Data recorded every 30 seconds**



Parameter & Setup Description







Parameter & Setup Description





Parameter & Setup Description





What Are We Looking For?



- 1. Surface Mount Versus Plated Thru Hole Technology**
- 2. Plastic LCC Versus Ceramic LCC**
- 3. PBGA Performance Versus QFP Performance**
- 4. TSOP Nonperformance (Alloy 42 lead material)**
- 5. Lead Contamination - Solder Joint Impact**
- 6. PWB Tg 170°C Versus PWB Tg 135°C**
(New Production Versus Legacy Production)
- 7. Impact of Rework (PBGA, TSOP, QFP, PDIP)**

Questions???

