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Joint Council on Aging Aircraft
Joint Group on Pollution Prevention

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Lead-Free Solder Project Meeting Minutes
24 February 2004
Anaheim, CA

Comments:

Attached please find the minutes for the February 24, 2004 Lead-Free Solder Working Group - meeting in Anaheim, CA. Please further distribute as necessary.

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Joint Council on Aging Aircraft
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MEMORANDUM FOR RECORD

Subject: –Face-to-face meeting, Anaheim, CA., Summary and Minutes – February 24, 2004

Next Teleconference: Tentatively scheduled for March 2, 2004

Next Meeting:

1. Board building/kickoff at Boeing Irving; Tentatively week of March 18

Minutes:

Decisions arrived at by this meeting's participants → Recommendations for group-at-large. Meeting led by Brian Greene, Project Integrator.

1. **Opening:** Brian Greene opened the meeting by welcoming everyone and thanking them for their participation. Mr. Greene then stated that the goal of this meeting was to attempt to answer some questions raised after the last teleconference.

2. **Discussion:**

   a. **Mechanical Shock Test:** It was determined that Mr. Dave Locker was the first to suggest the mechanical shock testing. The Navy has not commented on the mechanical shock tests. All efforts to contact the Navy POC (John Nelson) have been unsuccessful. Mr. Lee Whiteman informed the group that British Aerospace (BAE) is unable to measure the deflection of the board. BAE does have the ability to form a sinusoidal wave of the boards deflection and thus measure the deflection through the sinusoidal wave. BAE will be invited to the March 2 telecon to discuss the testing requirements with the group. Mr. Thomas Woodrow reiterated the need to know how much the boards bend. As the discussion continued, the topic turned to revising the Joint Test Protocol (JTP). Mr. Woodrow pointed out that any change to reduce the spectrum of the JTP would require approval from the group as a whole. Mr. Greene commented that changes have been made in the past when necessary, but solid justification would be required for any changes at this point. **See following paragraph and questions for background information.**

      Mr. Locker stated that mechanical shock testing is not a very controlled test. Mechanical shock testing is performed in order to collect data on the effect that shock environments have on lead-free solder joints. With the current mechanical shock testing scenario, it is important to understand what kind of stresses are on the solder joints. In order to fully understand these stresses, the displacement of the board during an actual shock needs to be measured, measuring the curvature of the board in order to understand the stress on the solder joint. Based on board displacement during shock, it can be determined if the

dynamic shaker table meets the specifications required. If BAE can measure displacement, a pathfinder board will be used.

In an attempt to bring resolution to issues associated with mechanical shock testing the following questions and subsequent answers have been provided:

Question: What are the capabilities/ tolerances of the dynamic shaker table being used for the mechanical shock testing procedure?

Answer: Lee Whiteman, ACI: The tolerance for the lower end of the profile is + 12 db under 80 Hz. However, this would be dependent upon several factors, such as the board's natural frequency, its orientation, and the construction.

In addition, there has been some comment on the board's calculated natural frequency would be around 80 Hz from the JG-PP team. BAE Systems indicates that it could be much higher than that. To accurately determine the natural frequency of the board, we would have to place the fully assembled board on a vibration table to find it. We could use the pathfinder board for this activity since it is not a destructive test.

Question: Can BAE measure displacement of the test vehicle while under testing?

Answer: Lee Whiteman, ACI: BAE Systems indicates that they can calculate and measure the amount of deflection of the board.

Question: Who provided the original mechanical shock test write-up, what is it that they wanted to see and if we deviate from the original plan will our testing provide sufficient data?

Answer: Mr. Kurt Kessel found the original document from the Department of the Navy, Naval Air Warfare Center Weapons Division (COMNAVAIRWARCENWPNDIV), dated August 22, 2001, which provided the original profiles for mechanical shock and vibration testing. The document also includes references to test methods outlined in MIL-STD-810F referenced in the JTP. The document does not include the original mechanical shock test procedure write-up that appears in the JTP. Currently Mr. Kessel is trying to contact Mr. John Nelson of COMNAVAIRWARCENWPNDIV to determine if Mr. Nelson was the original author of the mechanical shock test procedure write-up.

Question: Under the current proposed testing procedure, is sufficient stress being put on the board to categorize this test as mechanical shock testing?

Answer: To be determined by the group after further analysis of testing to be performed on the pathfinder board, including deflection measurements.

b. Hybrid Components

The issue of staking the hybrids was raised. Some of the group said the hybrids should not be staked and others said they should. Ms. Lety Campuzano-Contreras said her plan was to follow standard avionics procedures and stake the hybrids at each corner. Mr. Greene suggested Ms. Campuzano-Contreras contact Mr. Mark Stibitz to ensure the planned staking process was acceptable to his needs. **Action Item: Ms. Campuzano-Contreras.** The group wanted to get Mr. Stibitz's input as to the proposed resolution due to the delayed delivery of the hybrids. Mr. Greene reported that Mr. Stibitz was in agreement with the proposed resolution. Ms. Campuzano-Contreras commented it would be beneficial to have a scrap hybrid for assembly testing. **Action Item: Mr. Greene to contact Mr. Stibitz.**

See the following paragraph and questions for background information.

Mr. Dave Hillman estimates that he will receive 300 hybrids by February 24, 2004. The initial shipment of 300 hybrids and all of the LCC components will be sent off for tinning and should be ready for assembly by the third week of March. The second shipment of hybrid components, 315 hybrids, currently has a delivery date sometime around the end of March. The hybrids then must go to Corfin Industries for tinning and will need to be placed on the boards by hand.

Question: What is the best plan of action for placing the hybrid components of the boards? Do we place the initial shipment of 300 hybrid components on the manufactured boards or on the rework boards?

Proposed Resolution: The following decision was agreed upon at the February 17, 2004 Lead-Free Solder telecon. The group would still like to get input from Mr. Mark Stibitz.

Place the initial shipment of 300 hybrids, after tinning, onto the manufacturing boards during the automated part placement and solder procedures. This would provide reliability on hybrids with all three solder pastes. The second shipment of hybrid components, after tinning, then would be hand placed on the rework boards.

Initially, the hybrid components were to be placed onto the manufacturing and rework boards during automated part placement and soldering procedures. The hybrid components were not going to be reworked, they would only be on the board during rework procedures. Placing the second shipment of hybrid components on the rework boards by hand would allow for the use of different solders in conjunction with the hybrids thus simulating actual rework procedures performed at depots.

If the hybrids are put onto the rework boards by hand using solder wire, we could use any solder wire we want and get all three lead-free solders on the board. If we do not use solder wire the hybrid components will be soldered with tin-lead paste only.

Mr. Woodrow gave the following example; if we hand place a hybrid component on a rework board using SnAgCu solder wire, you end up with a SnAgCu solder joint contaminated with Pb from the HASL finish on the board. This will simulate the same type of solder joints that will be produced during the rework procedures being carried out on the TSOP-50, TQFP-208, PBGA-225 and PDIP-20 components. In conclusion, you end up with a no lead solder joint contaminated with lead which is what all the rework components will end up with.

Mr. Stibitz was contacted for his opinion on this issue, please see the following:
Mr. Stibitz has been out of the office and unable to provide comment. Comments from Mr. Stibitz on the proposed resolutions will be presented at the March 02, 2004 lead-free solder telecom.

Question: Since we are only receiving 300 hybrid components initially, and we need 357 to satisfy the component requirements for all manufacturing boards, how do we handle the component shortage?

Proposed Resolution: The following decision was agreed upon at the February 17, 2004 Lead-Free Solder telecon. The group would still like to get input from Mr. Mark Stibitz.

The group decided that since testing data from salt fog and humidity tests are not dependent on component type and the fact that there will be numerous other solder joints to show corrosion or lack there of, boards undergoing salt fog and humidity testing will not contain hybrid components. Hybrid components can also be left off of three or four of the extra test vehicles being built for pre-test characterization and assembly set up.

Mr. Stibitz was contacted for his opinion on this issue, please see the following:
Mr. Stibitz has been out of the office and unable to provide comment. Comments from Mr. Stibitz on the proposed resolutions will be presented at the March 02, 2004 lead-free solder telecom.

c. Component Procurement

The TSOP 50 components were shipped from Practical this week and are expected to arrive Monday, 1 March 2004.

See the following paragraph for background information.

Mr. Dave Hillman gave the current status on component procurement activities. Mr. Hillman stated that all components have been received from Practical except for the TSOP-50. All Practical components and a 1,150 foot roll of wire have been shipped to Ms. Campuzano-Contreras, Boeing Irving.

Currently the only component missing from Practical is the TSOP-50. This particular component needs to have wire bonds repaired on each side of the part located directly in the center of the part, this will not affect reliability. There has been no word of when those parts will be shipped to Rockwell Collins. Mr. Hillman expects the parts to arrive before March 1, but does not have confirmation.

2. Other Topics for Discussion

Ms. Campuzano-Contreras reported that her drop dead date to start the board assembly is 18 March 2004. Due to the use of three different solders and in an effort to minimize confusion, she plans to assembly the boards on three different days. The group pledged full support to Ms. Campuzano-Contreras. **Action Item: All stakeholders send any lessons learned to Ms. Campuzano-Contreras.** Mr Greene suggested to Ms. Campuzano-Contreras that during the 18 March meeting she brief the build process to the group.

Richard Hricko reported that the contract should be let within 1 ½ weeks.

Mr. Greene reported that BAE, United Kingdom, was interested in supporting the project with $50,000. Mr. Greene asked the group to think about how best to use the money.

Mr. Reza Ghaffarian brought up the issue of increasing the dwell time of the thermal cycle testing from 15 minutes to 30 minutes. After a lengthy and lively discussion the topic was tabled.

Attachment 1: Action Item Status

New Action Items (from 02/24/2004 meeting)

LFS.04.02.11
Date Due: **3/02/04**
Responsibility: All Stakeholders
Required Action: Send any lessons learned regarding board assembly to Lety Campuzano-Contreras
Comments:

LFS.04.02.10
Date Due: **3/02/04**
Responsibility: Brian Greene
Required Action: Contact Mark Stibitz to see if he can send a scrap hybrid to Lety Campuzano-Contreras for assembly testing
Comments:

LFS.04.02.09
Date Due: **3/02/04**
Responsibility: Lety Campuzano-Contreras
Required Action: Contact Mark Stibitz to confirm hybrid staking process
Comments:

Open Action Items

LFS.04.02.02
Date Due: **2/17/04**
Responsibility: Dave Hillman
Required Action: Send one empty board and one fully assembled board to Lee Whiteman for setup and test purposes.
Comments: 02/17/2004: Mr. Hillman sent the board to Mr Whiteman the week of February 09. Mr. Whiteman will check shipping to see if the board has arrived.

LFS.04.02.06
Date Due: **2/24/04**
Responsibility: ITB, Inc.
Required Action: Kurt Kessel to contact the author of the mechanical shock test procedure
Comments: In-Progress: Mr. Kurt Kessel found the original document from the Department of the Navy, Naval Air Warfare Center Weapons Division (COMNAVAIRWARCENWPNDIV), dated August 22, 2001, which provided the original profiles for mechanical shock and vibration testing, Currently Mr. Kessel is trying to contact Mr. John Nelson of

COMNAVAIRWARCENWPNDIV to determine if Mr. Nelson was the original author of the mechanical shock test procedure write-up

LFS.04.02.07
Date Due: **2/24/04**
Responsibility: ITB, Inc.
Required Action: Kurt Kessel to contact Mr. Mark Stibitz to bring resolution to the Hybrid placement and usage issue
Comments: In-Progress: Mr. Kessel drafted an email summarizing the discussion from the February 17, 2004 lead-free solder telecon; Comments from Mr. Stibitz on the proposed resolutions will be presented at the March 02, 2004 lead-free solder telecom.

LFS.04.02.08
Date Due: **2/24/04**
Responsibility: Dave Hillman
Required Action: Make sure the appropriate Gerber files were provided to Lety for the IPC Electrochemical migration test coupons
Comments:

LFS.04.02.01
Date Due: ***Date Changed from*** **2/20/04 to 03/10/2004**
Responsibility: Brian Greene
Required Action: Distribute article on lead contamination written by John Paul Clech
Comments: This article will be presented at the upcoming APEX conference. Tom Woodrow will send a copy of the article to Brian Greene once the article has been presented. Brian will distribute the article to the rest of the group.

LFS.04.01.08
Date Due: **2/5/2004**
Responsibility: Dave Hillman
Required Action: Contact Practical on the on the wire bonding issue with regard to daisy chained components
Comments: **Closed:** Practical offered to bond from 12 to 14 and from 37 to 39. The group accepted the work around at the 02/09/2004 Small-Group Telecon.
ISSUE STILL OPEN: Mr. Hillman is still working to determine the date when the components will arrive at Rockwell Collins.

LFS.04.01.07
Date Due: **2/5/2004**
Responsibility: Brian Greene
Required Action: Contact CALCE for support
Comments: 02/17/2004: Currently in progress

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LFS.04.01.02

Date Due:	**1/23/2004**
Responsibility:	Dave Hillman
Required Action:	Determine additional cost associated with two tinning assemblies.
Comments:	02/17/2004 – In-progress