

Lead-Free Solder Project E-mail

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Lead-Free Solder Project

October 16, 2003 Teleconference Minutes

Govt. Project Manager: MSgt Richard Hricko, ASC/AAA

Comments:

Following are the minutes from the October 16, 2003 Lead-Free Solder teleconference

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MEMORANDUM FOR RECORD

Subject: Teleconference Summary and Minutes – October 16, 2003

Next Teleconference: December 04, 2003, 11:00 AM EST

Minutes:

1. Mr. Brian Greene (ITB, Inc.) opened the teleconference by reviewing the August 21, 2003 Lead-Free Solder project meeting minutes. No comments were made to the minutes.
2. Recent Technical Topics and Recommendations. The following technical topics and recommendations were discussed and approved (with some modification, where noted) by the stakeholders on the teleconference.
 - a. Test Board Design
 - i. Issue - Components. A placement option (Option 5) (*Attachment 6*) has been identified that will yield useful information for all tests. Mr. Woodrow explained option 5 in full detail, pointing out that the goal was to have optimal component placement for data result comparison for vibration testing. The following additional comments were noted:
 1. Mark Stibitz, F-15, stated that he thought Option 5 was good and will provide the kind of data to address the lead rework issue that depots are particularly concerned with.
 2. Dave Hillman, Rockwell Collins, explained that there will be four component types reworked, TSOP, TQFP, BGA and PDIP. These component types will allow the group to see a mix of new and older technology undergo rework conditions.
 3. Dr. Reza Ghaffarian, NASA Jet Propulsion Laboratory, stated that he thought Option 5 represented a good, detailed plan. But he inquired of the difficulty in assembling the boards correctly without error.
 - a. Mr. Hillman explained that there would be specific component placement programs to address the leaded circuit boards, no-lead circuit boards and rework circuit boards. Very detailed documentation will be used to ensure that the rework boards are built correctly.
 - b. All agreed with Dr. Ghaffarian's suggestion of using a traveler document to accompany every board throughout its assembly, testing and evaluation. Mr. Hillman suggested that board drawings could be modified to be used as travel documentation. Ms. Campuzano-Contreras stated that she was planning to use labeled board photographs as travelers, she will send the purposed travel to Mr. Greene to that the group can provide review and comment.

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- ii. Issue - Board Size. Mr. Greene quickly reviewed this issue and explained that Mr. Hillman modified the board slightly to provide adequate free space along two edges of the board to accommodate the wedgelocks needed for vibration testing. There was no further discussion of this item.

 - iii. Issue - Hole Diameter for Connector. Mr. Greene reviewed that the diameter of the plated through holes (PTHs) will be 0.036 and after plating should be at the very worst case diameter 0.031, sufficient to accept a 22-gauge wire in support of the vibration testing. Mr. Woodrow stated that he may go with a 24 gauge wire to be on the safe side.

 - iv. Issue - Traces to Pads. Mr. Greene stated that Mr. Hillman was unable to accommodate the addition of pads for solder attachment instead of using the existing plated thru holes is a major design change and would add increased cost. Traces will *not* be run from the PTHs to pads on the edge of the board. This would have added an additional cost that was not budgeted for. No other comments were offered.

 - v. Labeled Plated Through Holes (PTHs). Mr. Greene stated that markers will be placed on the end and middle PTHs (i.e., every 1st, 11th, and 19th PTHs) so the entire length of the holes does not have to be counted. This will help in counting wire connections and reduce operator error.

 - vi. Components to be reworked. Mr. Hillman explained that for components that will be reworked, he will need more than 1,000 of certain component types to accommodate all the assembly and rework for Option 5. Because he only ordered 1,000 of certain component types (they come in lots of 1,000), this presents a shortage from what Mr. Hillman previously quoted to NASA/ITB. Mr. Hillman will work with the vendors and in-kind component suppliers to try to resolve the matter. A revised component cost quote may be required for the change in component numbers. See *Attachment 3* for the latest table of reworked components.
- b. Testing Materials
- i. Solder Fluxes. Mr. Greene explained that a continuing effort has been made by Lety Campuzano-Contreras, Boeing-Irving, to confirm the exact solders and fluxes that will be provided by the various vendors. See *Attachment 2* for the most up-to-date information. Ms. Campuzano-Contreras reviewed her changes and updates which appear in highlight (in yellow) on *Attachment 2*. Ms. Campuzano-Contreras stated that she is still trying to identify from the vendor the appropriate flux for the tin-silver-copper wave solder alloy still needs to be determined.

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3. Business and Other Topics

- a. JTP Approval. Mr. Greene stated that one or two more approvals have been received since the last (August 21) teleconference. Approximately 35 JTP approvals were received. Warren Assink, AFMC, stated that he did not believe that any more approvals would be received.
- b. Funding. Mr. Greene noted that NASA money is now available for component, board and material procurement. The Rockwell Collins purchase order is still awaiting finalization; new figures may be submitted based on a need for increased components numbers. Mr. Greene will work to determine the status of Air Force funding with regards to when the money will be made available from Air Force Aging Aircraft.
- c. Schedule. Mr. Greene stated that slight delays may be encountered due to the likely need to requote component costs. Presently, he projects that testing will begin late February or possibly March, depending on the length of the current delay. Either way, some testing results should be available by mid-2004.

4. Review of Open Action Items

LFS.03.10.05. Dr. Tom Woodrow, Boeing-Phantom Works, stated that he is currently testing a cleanable no-clean flux and test results indicate that you cannot clean it off the board. Mr. Woodrow expressed concern that this issue may arise during the lead-free solder study. Some of the inspection could be made more difficult due to residue left on the boards. Currently, there are no solutions to the problem, other than to continue to use vendor supplied flux which; this approach was recommended and was agreed to by the lead-free solder consortium.

LFS.03.07.12. Dave Locker, AMCOM, stated that it would be helpful to future modeling efforts if other technical representatives could send in any applicable accelerated thermal cycle data (e.g., IPC) for LCCs they are aware of.

5. Site Visit, Assembly of Boards at Boeing-Irving Facility. Anyone planning to attend the Boeing-Irving Facility to view the building of the test vehicles will have to undergo or show proof that you have Electro-Static Discharge (ESD) training. ITB will collect this information (AI **LFS.03.10.07**).

SIGNED (Approved by R. Hricko 10/27/03)

Rich Hricko
Govt. Project Manager, WPAFB

Attachment 1. Action Item Status

New Action Items

LFS.03.10.07

Date Due: 11/07/2003

Responsibility: ITB

Required Action: Solicit stakeholder interest in attending a tour of Boeing-Irving's assembly of the test vehicles, and who has ESD training.

Comments:

Open Action Items

LFS.03.10.05

Date Due: 10/16/2003

Responsibility: Lety Campuzano-Contreras

Required Action: Report of results of Kaizen no-clean flux cleaning study

Comments: 10/3/03 - An e-mail was sent to Kaizen to request an ECD for the results on the flux cleaning study.

LFS.03.10.03

Date Due: 10/16/2003

Responsibility: Dave Hillman

Required Action: Recalculate required number of components using Jeff Bradford's latest (10/3/03) component placement worksheets and suggest alternatives, if necessary (e.g., use tinned CLCCs for controls and lead-free finished CLCCs for LF PWAs; or buy CLCCs that are tinned)

Comments: 10/16/2003: Still under review

LFS.03.07.12

Date Due: 08/13/2003

Responsibility: Brian Greene (NASA AP2/ITB)

Required Action: (a) Contact Dave Locker, AMCOM, to ask if he could do some simple Coffin-Manson modeling, perhaps for just one component type (e.g., 44-pin or 20-pin LCCs) for inclusion in the project's Joint Test Report, and then (b) Contact Paul Vianco, Sandia Labs, to look for synergy with Sandia's prior LCC data

Comments: 08/05/03 - Dave Locker indicated that he could do some simple Coffin-Manson modeling for inclusion in the project's Joint Test Report

LFS.03.07.03

Date Due: 07/31/2003

Responsibility: Dave Hillman (Rockwell Collins)

Required Action: Look into saving his engineering drawings of the test vehicle into an electronic format suitable for Boeing-Irving to read.

Comments: 08/21/03 – Dave reported as in progress.

Action Items Closed on 10/16/03

LFS.03.10.01

Date Due: 10/16/2003

Responsibility: Brian Greene

Required Action: Distribute required number of PWAs for testing to Dave Hillman, Tom Woodrow, Joe Felty, Jeff Bradford, let Campuzano

Comments: **Closed 10/16/2003.** 10/3/03 – Completed. Total 205 PWAs: Minimum 109 manufacturing PWAs, 76 rework PWAs, and 20 PWAs for characterization.

LFS.03.10.02

Date Due: 10/16/2003

Responsibility: Dave Hillman, Tom Woodrow, Joe Felty, Jeff Bradford

Required Action: Review and be ready to comment on Jeff Bradford's 10/3/03 worksheets of component placement options yield desired results

Comments: **Closed 10/16/2003**– Reviewed at 10/15/03 small-group teleconference.

LFS.03.10.04

Date Due: 10/16/2003

Responsibility: Lety Campuzano-Contreras

Required Action: Verify that Vitronics-Soltec is comfortable with doing the quantity of PWAs in the new time frame suggested (Jan-Feb 2004)

Comments: **Closed 10/16/2003**- Lety talked to Denis Barbini [dbarbini@us.vitronics-soltec.com] from Vitronics-Soltec about the new suggested time frame. He said that Feb 2004 would be fine to wave solder the 39 test vehicles with Sn.7Cu (stabilized) and 39 test vehicles with Sn3.9Ag.6Cu. He also stated interest in participating in the JCAA/JG-PP group.

LFS.03.10.06

Date Due: 10/16/2003

Responsibility: Lety Campuzano-Contreras

Required Action: Confirm if Florida CirTech is to mask the PTHs and what material they would use

Comments: **Closed 10/16/2003**- Boeing-Irving will be masking the PTHs with Lonco WR (water soluble).

LFS.03.07.11

Date Due: 09/13/2003

Responsibility: Lety Campuzano-Contreras (Boeing-Irving)

Required Action: Propose which components (by board location) will be reworked from a worst-case perspective.

Comments: **Closed 10/16/2003**– Completed 10/3/03.

Attachment 2. Solder Summary Table

	Wave Soldering	Reflow Soldering	Manual Soldering	Dipping of LCCC20s
		3x500 grams of each alloy	2-3 rolls (1 lb each) of wire	Corfin Industries needs 300 lbs. of each alloy
Sn0.7Cu (stabilized)	SN100C Vitronics-Soltec will do at no charge	N/A	SN100C (011) Florida CirTech, Inc will provide @ no charge	N/A
Flux	NC160 (NoClean) Halide Free ROLO	N/A	RMA (NoClean) 0-.04% Halide Content 3-4% flux content Florida CirTech, Inc will provide @ no charge	N/A
Sn3.9Ag0.6Cu	Vitronics-Soltec will do at no charge	ECO Solder 7100-GRN360K Senju will provide @ no charge	ECO Solder RMA02 Senju	Florida CirTech, Inc will provide @ no charge
Flux	TBD by Vitronics-Soltec	ROL1	279C(5) Senju	N/A
Sn3.4Ag1Cu3.3Bi	N/A	CL30-7780 Heraeus will provide @ no charge	Indium Corp. \$290/roll	Florida Cirtech, Inc will provide @ no charge
Flux	N/A	No Clean (RMA)	No Clean (RMA)	
Sn37Pb	Kester Ultra-Pure Boeing	Kester R244 Boeing	Senju RMA98Super/ Aeromild10 Boeing	N/A
Flux	Alpha NR310 TypeORM0 Boeing	ROLO Boeing	Senju ZR102F (ORL0) Boeing	N/A

Solder Points Contact:

<p>Vitronics-Soltec: Denis Barbini, (603)772-7778 ext 207 2 Marin Way, Stratham, NH 03885 dbarbini@us.vitronics-soltec.com Bob Silveri, Ext. 205 bsilveri@us.vitronics-soltec.com</p>	<p>Senju Solder: Derek Daily 12980 Saratoga Ave., Ste. B Saratoga, CA 95070 (408) 446-7866 ddaily@sjmcb.mitsui.com</p>
<p>Florida Cirtech: Bob Gilbert 1309 North 17th Ave Greeley, CO 80631 (970)346-8002 bgilbert@floridacirtech.com</p>	<p>Corfin Industries: Joe Zaccari 78 Raymond Ave. Salem, NH 03079 (603) 893-9900 jzaccari@corfin.com</p>
<p>Indium Corp.: Tom Pearson 34 Robinson Rd. Clinton, NY 13323 (315) 8534900, Ext. 7564</p>	

Attachment 3.

Components to Rework

One component of each type will be reworked for a maximum of 4 components per board.

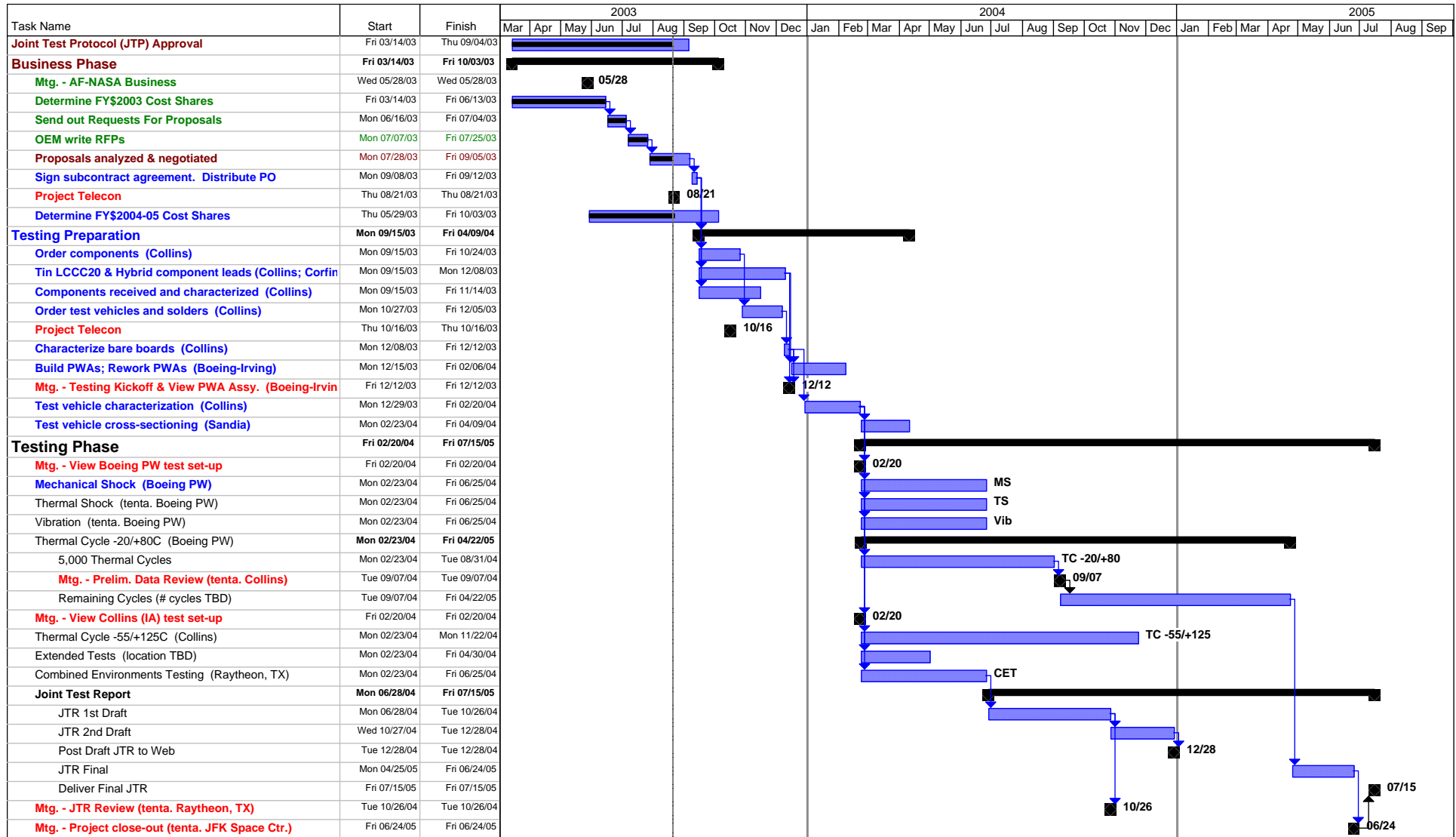
Rework *Control* Boards (Sn/Pb solder initially; reworked with Sn/Pb solder)

Location	Part Number	Qty Per Board	Part Finish Before Rework	Part Finish After Rework
U25	TSOP-50	1	Sn/Pb	Sn/Pb
U57	TQFP-208	1	Au/Pd/Ni	Au/Pd/Ni
U18	PBGA-225	1	Sn/Pb	Sn/Pb
U59	PDIP-20	1	Au/Pd/Ni	Au/Pd/Ni

Rework Boards (Sn/Pb solder initially; reworked with Sn/Ag/Cu or Sn/Ag/Cu/Bi solder)

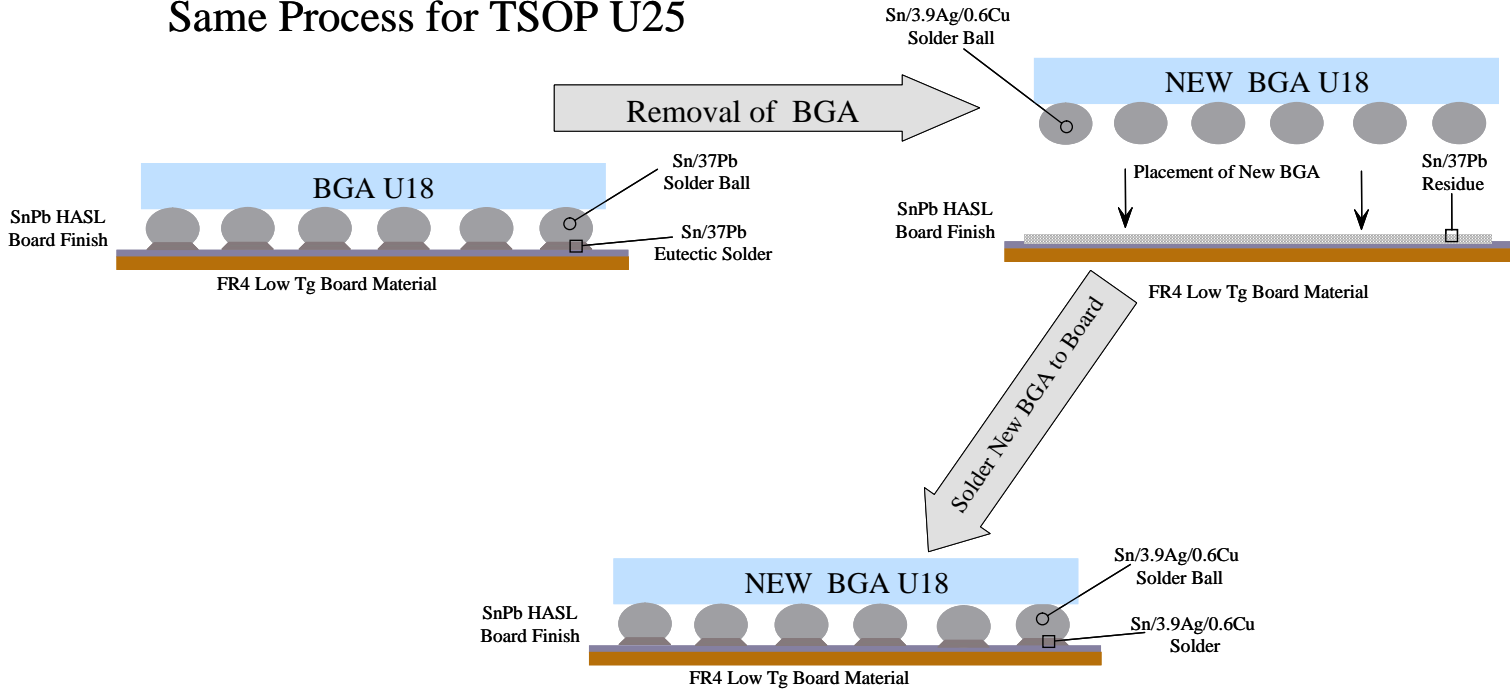
Location	Part Number	Qty Per Board	Part Finish Before Rework	Part Finish After Rework
U25	TSOP-50	1	Sn/Pb	Sn/Cu
U57	TQFP-208	1	Au/Pd/Ni	Au/Pd/Ni
U18	PBGA-225	1	Sn/Pb	Sn/Ag/Cu
U59	PDIP-20	1	Au/Pd/Ni	Au/Pd/Ni

Attachment 4. Project Schedule, as of 8/20/03



Attachment 5. BGA Rework Pictorial

Rework of BGA U18 on SnPb Board
Options 5
Same Process for TSOP U25



Attachment 6. Recommended Component Termination Finish-Solder Alloy Combinations and Placement Options (“Option 5”)

Option 5. Part Placement Strategy for Vibration Test (BGAs,TSOPs,CLCCs)								
	Only These Parts Are Actually Reworked BGAs: U18 TSOPs: U25			BGAs: U4,U6,U43,U55 TSOPs: U12,U29,U39,U61 CLCCs: U10,U14,U17,U45,U52 CSPs, Hybrids: TBD			BGAs: U2,U5,U21,U44,U56 TSOPs: U16,U24,U26,U40,U62 CLCCs: U9,U13,U22,U46,U53 CSPs, Hybrids: TBD	
Option 5. Placement	Paste	Parts		Paste	Parts		Paste	Parts
1. Manufactured (<i>Control</i> -SnPb Solder)	SnPb	SnPb		SnPb	SnPb		SnPb	SnPb
2. Manufactured (Lead-Free Solder)	Lead-Free	Lead-Free		Lead-Free	Lead-Free		Lead-Free	SnPb
3. Rework (<i>Control</i> -SnPb Solder)	SnPb	SnPb		SnPb	SnPb		SnPb	SnPb
4. Rework (SnPb Solder Initially)								
Before rework	SnPb	SnPb		SnPb	Lead-Free		SnPb	Lead-Free
After rework	Lead-Free	Lead-Free						

Useful combinations

Attachment 7. Parts List for Component Placement Option 5

Parts List (for Option 5)						
Parts Needed Per Board						
	Manufactured Boards (<i>Control-SnPb Solder</i>) (41 boards)	Manufactured Boards (<i>Lead-Free Solder</i>) (78 boards)	Rework Boards (<i>Control-SnPb Solder</i>) (30 boards)	Rework Boards (<i>Lead-Free Solder</i>) (56 boards)	Extra Parts for Rework	Total Parts Needed (Parts Per Board x Number of Boards + Extra Parts for Rework)
BGA225						
SnPb	10	5	10	1	30	1186
SAC	0	5	0	9	56	950
TSOP50						
SnPb	10	5	10	1	30	1186
SnCu	0	5	0	9	56	950
CLCC20						
SnPb	10	5	10	1	0	1156
Pb-Free (half SAC, half SACB)	0	5	0	9	0	894
TQFP144						
Sn	5	5	5	5	0	1025
TQFP208						
Au/Pd	5	5	5	5	86	1111
CSP100						
SAC	5	5	5	5	0	1025
PLCC20						
SAC	5	5	5	5	0	1025
PDIP20						
Sn	5	5	5	5	0	1025
Au/Pd	5	5	5	5	86	1111
HYBRID						
Sn?	3	3	3	3	0	615