



# JG-PP Email

Joint Group on Pollution  
Prevention

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## *Lead-Free Solder Technical Meeting Minutes*

**Comments:**

Attached please find the minutes from the June 20, 2001, Lead-Free Solder technical meeting. Please further distribute as necessary.



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**MEMORANDUM FOR RECORD**

**July 3, 2001**

**Subject: Meeting Summary and Minutes – June 20, 2001**

**Material(s) Identified:** Lead

**Process Identified:** Electronics soldering

**Methodology Phase:** I-Identification, II - Technical

**Summary:**

On June 20, 2001, technical representatives from Headquarters Air Force Material Command, American Competitiveness Institute, Boeing Company, Lockheed Martin, National Aeronautics and Space Administration-Kennedy Space Center, National Center for Manufacturing Sciences, Naval Air Warfare Center Weapons Division-China Lake, Ogden Air Logistics Center (F-16 Program), Oklahoma City Air Logistics Center (B-2 Program), Raytheon Company, Rockwell-Collins, U.S. Army Communications & Electronics Command, and Warner Robins Air Logistics Center participated in a meeting with representatives from the Joint Acquisition Sustainment Pollution Prevention Activity and National Defense Center for Environmental Excellence/ Concurrent Technologies Corporation. The objective of the one-day meeting was to define the scope of the project and the requirements of the technical phase. Action items were taken to collect system performance requirements from the system managers and identify candidate lead-free solders. See Attachment 1.

**To access the minutes and slide presentations from the June 20, 2001 Lead-Free Electronics Soldering technical meeting, follow these steps.**

1. Using your Web browser, go to the JG-PP home page at <http://www.jgpp.com>
2. On the home page, click on the "What's New" tab on the top menu bar to go to the What's New Web page ([http://www.jgpp.com/whats\\_new/whatsnew\\_index.html](http://www.jgpp.com/whats_new/whatsnew_index.html))
3. On the What's New page, click on the underlined 'click here' hypertext immediately following the announcement of the new Lead-Free Electronics Soldering project in the middle of the page. This will take you to the Solder project's Web page.
4. On the Solder project's Web page, note the "Related Topics" task bar on the right side. Click on the appropriate labeled item (either "Meeting and Teleconference Summaries" or "Presentations") to view the June 20, 2001 technical meeting minutes and presentations. For the minutes, you have the option to view just the meeting summary paragraph as it appears on the screen, or view the entire minutes by clicking on the 'click here' link where indicated. For the presentations, you will automatically be shown a listing of the eight presentations by title and presenter. You can click on each presentation individually to view it, and then hit your browser's 'BACK' button to go back and view the next presentation.
5. Just hit your Web browser's "BACK" button to return to a previous screen.



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**Next Teleconference:** August 8, 2001, 2:00 P.M. Eastern time

**Next Meeting:** TBD

### Minutes

1. The meeting began at 0830 on June 20, 2001 with a welcome and discussion of housekeeping points by Mr. Joe Felty, Raytheon. Introduction of attendees followed. Mr. Felty stated that the goal of the meeting was to define the scope of the project and the requirements of the technical phase.
2. Welcoming remarks were made by Mr. Jim Marischen, Director, ES Texas Engineering, Raytheon Company. Mr. Marischen reviewed Raytheon's business sectors, which would be affected by any changes in lead solder use. Raytheon is a prime contractor or subcontractor on numerous Electronic Systems platforms across the Air Force, Army, Navy, and Marine Corps. Raytheon builds subsystems and everything that goes into the subsystems. These include some very specialized, high-density components. Raytheon hopes to expand its Electronic Systems business segment internationally, which makes this JG-PP lead-free solder project of such interest to Raytheon. In addition, Raytheon seeks to maintain an environmentally conscious culture.

Mr. Tom Woodrow, Boeing Phantom Works, asked Mr. Marischen if, given that there are currently no U.S. regulations banning tin/lead solder and aerospace applications may be exempt from any European bans, would Raytheon require anything more than validation of a viable alternative to implement. Mr. Marischen replied that, yes, there would additionally need to be legislation, a cost advantage, or customer direction to switch to lead-free solder. However, Mr. Mike Leake, Raytheon, reminded everyone that some of these drivers have already begun to occur: Toxic Release Inventory threshold levels for lead are now lower; the commercial world is proceeding with lead-free solders; lead-free components from suppliers will soon be the norm; and there is already an international emphasis to compete with lead-free solders.

3. Mr. Doug Romm, Semiconductor Group, Texas Instruments, presented technical information on the efforts and views of TI's internal lead-free strategy team. The goal of this TI team is to identify a viable a lead-free solution for all TI (commercial) packages by the end of 2001. TI has a commercial, Ni/Pd, lead-free line. TI first implemented lead-free finishes based on economic considerations, they now feel it provides competitive advantage especially in the Asian market. Mr. Romm discussed the TI strategy team's selection criteria for a lead-free component finish. An essential criterion was that the lead-free solder must be compatible with lead and lead-free surface finishes.



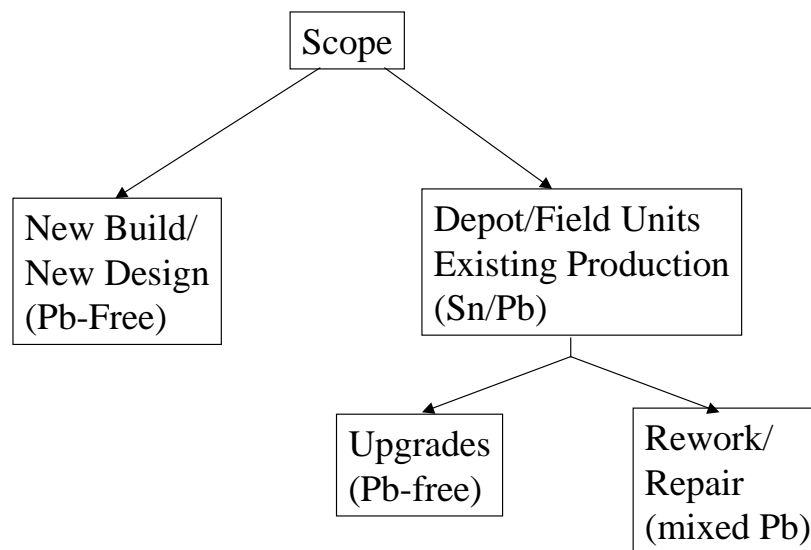
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A major issue for component suppliers is potential component performance degradation due to the higher application temperatures required for many lead-free solders.

4. Mr. Brian Greene, NDCEE/CTC, facilitated a group discussion of the scope of the lead-free solder project. The consensus was that the following variables were important for defining the project scope:
- Alloy application temperature — low, medium, or high
  - Process application technology — wave, reflow, or manual
  - Soldering environment: manufacturing or rework
  - Component configurations: surface mount technology (SMT), through-hole (TH), mixed, and/or interconnections
  - Surface finish: lead or lead-free
  - Systems: new or old designs
  - Performance environment: controlled or harsh
  - Circuit card laminate type
  - Flux type
  - Baseline materials: solder, laminate, etc.

The consensus was that, of the above variables, the type of system (new or old), would be a main determinant of the scope and the structure of a Joint Test Protocol, where:



5. The group agreed it was too early to determine whether there would be any significant difference in performance requirements between the new and old systems. The consensus of the group was that both manufacturing and rework were equally important based on production volume. Although economics will have a greater impact on new builds, the greatest near-term operational risk may be to rework, since they will need to



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accommodate both lead and lead-free systems in the future. If the requirements of existing vs. new systems were different, the JTP would likely need to be divided into two sections—for new systems and for old systems.

6. Several military and commercial standards were identified by the group as being potentially applicable to lead-free solder testing— MIL-C-28809, MIL-PRF-55110, MIL-STD-810 and SAE J1211 (automotive-commercial). The group acknowledged that each military/space system might have additional requirements that go beyond these MIL SPECS, but that these standards would be a good place to start. All agreed that a good first step would be to survey the Services and NASA to obtain their performance requirements for inclusion in the JTP.
7. The attendees were divided into two groups to further define the project scope (beyond new vs. old systems). Differences between existing and new systems are underlined in the following table.

<b>Variable</b>	<b>Existing Systems/ Depot Maintenance Requirements</b>	<b>New Build (OEM) Requirements</b>
Baseline solder	Eutectic (63/37) (medium temperature) solder alloy	Eutectic (63/37) (medium temperature) solder alloy
Alloy application temperature	<u>Need to determine if processing equipment can accommodate higher temperatures</u>	<u>High-temperature alloys</u>
Board finish	Sn/Pb and Hot Air Level Soldering (HASL)	Sn/Pb and Hot Air Level Soldering (HASL)
Board (laminates) type	FR-4 (but we should find out the percentage use)	FR-4
Components	Mix of finish leads	Mix of finish leads, <u>but also newer components</u>
Component configurations	Mixed, TH & SMT board components, & connectors (with and without different [gold] finishes)	Mixed, TH & SMT board components, & connectors (with and without different [gold] finishes)
Surface finish	<u>Sn/Pb</u> and lead-free	<u>All lead-free</u>
Process application technology	Wave, reflow, manual, and heat shrink	Wave, reflow, manual, and heat shrink
End-item performance environment	Wide range: controlled to harsh	Wide range: controlled to harsh
Flux type	As recommended by solder manufacturers (get data to	As recommended by solder manufacturers (get



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Variable	Existing Systems/ Depot Maintenance Requirements	New Build (OEM) Requirements
	narrow down)	data to narrow down)

8. Several technical issues were raised in the meeting that are being noted here for future discussion by the group-at-large:
- Desire to have an independent, third-party laboratory, perform the validation testing
  - The Joint Industry Standard for soldering, J-STD-001, allows for lead-free solders with testing data available for review
  - Focus on compatibility of existing technologies with lead-free components and lead-free alloy application at rework/repair
  - Interconnect performance with mixed lead-free alloy constituents and intermetallics
  - Alloy/flux interactions vs. elevated temperature application
  - Define the lead-based baseline — tentatively FR-4 or polyimide with tin-lead (reflow, HASL, manual) surface finish; tin/lead solder alloy; component types (SMT/TH) with Sn, SnPb, NiPdAu surface finishes.
  - JTP requirements can generally be categorized as follows: mechanical, electrical, corrosion, and process-related (i.e., how will the process be affected)
9. The consensus of the group was that the following would be the next major steps in the lead-free solder project:
1. Survey the weapon/space systems for their critical performance requirements using a standard survey form
  2. Downselect solder alloys based on the survey responses
  3. Identify types of test vehicles and select the best one or two
  4. Select and define the tests to run with pass/fail criteria.
10. It was assumed that the OEMs would have similar, but no more stringent, critical performance requirements than the services/NASA, and therefore it make sense to survey this community first. CTC and Raytheon took an action item to develop an initial requirements matrix/ survey form that would be sent by JASPPA to the affected weapon/space system managers for completion (Action item **LFS.01.06.01**). The survey form will include some basic requirements from MIL SPECS (in a matrix format) and provide space for system managers to enter additional requirements. In addition, the form should ask the following questions:
- Is the baseline identified on the form adequate for testing?
  - What is the highest temperature that your existing hardware to be soldered can withstand?
- The survey forms will be distributed by JASPPA within their service and NASA. JASPPA members should first identify the affected managers (in airframe electronics/avionics, Army land-based electronics, space based, commercial aircraft,



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- Navy avionics, etc.) who will receive the survey form (Action item **LFS.01.06.02**). The system managers will return the completed forms directly to Mr. Brian Greene, CTC, for incorporation into a draft JTP to be distributed before the next project meeting.
11. An action item was assigned to John Nelson, Joe Felty, and Dave Hillman to identify (e.g., through a literature search) any lead-free and tin-lead solder interactions and report the findings at the next project meeting (Action item **LFS.01.06.03**).
  12. A technical teleconference was tentatively scheduled for August 8, 2001 at 2:00 P.M. Eastern time. CTC will set up the teleconference and distribute an agenda to the group at large (Action item **LFS.01.06.04**). If the service survey responses are received in time, CTC will incorporate the survey findings into a strawman JTP and distribute it before the next teleconference (Action item **LFS.01.06.05**). An action items was assigned to all the service and NASA technical representatives to identify their top lead-free solder candidates to Mr. Felty (Action item **LFS.01.06.06**). Mr. Felty will consolidate the responses and provide them to CTC for inclusion in a draft JG-PP Potential Alternatives Report (PAR) (Action item **LFS.01.06.07**).
  13. Mr. Felty closed the meeting by again thanking everyone for attending. The meeting was adjourned.

*SIGNED (Approved by R. Hill 07/XX/01)*

Robert P. Hill  
JASPPA Chairman, NASA KSC

Attachments:

1. Action Items



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### New Action Items

#### **LFS.01.06.01**

**Date Due:** 07/03/01

**Responsibility:** CTC (Brian Greene), Raytheon (Joe Felty, Jeff Bradford)

**Required Action:** Develop a JTP requirements matrix/ survey form that would be sent by JASPPA to the affected weapon/space system managers for completion. The survey form will include some basic requirements from MIL SPECs (in a matrix format) and provide space for system managers to enter additional requirements.

*Comments:*

#### **LFS.01.06.02**

**Date Due:** 07/12/01

**Responsibility:** All JASPPA members

**Required Action:** Distribute to the affected managers (in airframe electronics/avionics, Army land-based electronics, space based, commercial aircraft, Navy avionics, etc.) the JTP requirements survey form developed under Action item LFS.01.06.01. The system managers will return the completed forms directly to CTC.

*Comments:*

#### **LFS.01.06.03**

**Date Due:** 07/30/01

**Responsibility:** NAWCWD (John Nelson), Raytheon (Joe Felty), Rockwell-Collins (Dave Hillman)

**Required Action:** Identify (e.g., through a literature search) any lead-free and tin-lead solder interaction and report the findings at the next project meeting

*Comments:*

#### **LFS.01.06.04**

**Date Due:** 08/01/01

**Responsibility:** CTC (Brian Greene)

**Required Action:** Schedule the next project technical teleconference, tentatively for August 8, 2001 at 2:00 P.M. Eastern time, and distribute an agenda.



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### **LFS.01.06.05**

**Date Due:** 08/03/01 (approx. one week after survey responses received)  
**Responsibility:** CTC (Brian Greene)  
**Required Action:** Incorporate the survey findings into a strawman JTP and distribute it before the next teleconference.  
**Comments:**

### **LFS.01.06.06**

**Date Due:** 07/30/01  
**Responsibility:** All Technical Representatives  
**Required Action:** Identify their top lead-free solder candidates to Joe Felty, Raytheon  
**Comments:**

### **LFS.01.06.07**

**Date Due:** 08/03/01  
**Responsibility:** All Technical Representatives  
**Required Action:** Consolidate the candidate lead-free solders and provide them to CTC for inclusion in a draft JG-PP Potential Alternatives Report (PAR)  
**Comments:**

### **Open Action Items**

#### **LFS.01.05.02**

**Date Due:** 05/23/01  
**Responsibility:** All Technical Representatives  
**Required Action:** Provide to Brian Greene, CTC, the name and organization of anyone within their Service, organization, or outside organization who should be involved in the JG-PP Lead-Free Solder project  
**Comments:** 06/20/01 - Names continue to be received

### **Closed Action Items**

#### **LFS.01.05.01**

**Date Due:** 05/23/01  
**Responsibility:** All Technical Representatives  
**Required Action:** Provide to Brian Greene, CTC, the names and organization of anyone who would like to participate in a Lead-Free Solder subcommittee meeting to be hosted by Raytheon. Brian Greene will forward the names to Mike Leake, Raytheon.  
**Comments:** Closed 06/18/01. Individuals identified before the June 20 meeting were extended a formal invitation to the subcommittee meeting.