



# JG-PP Email

Joint Group on Pollution  
Prevention

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## *1st European Union/United States Lead-Free Solder Interface Meeting Minutes March 27, 2002*

**MEMORANDUM FOR RECORD**

**April 5, 2002**

**Subject: Meeting Summary and Minutes – March 27, 2002**

**Material(s) Identified:** Lead

**Process Identified:** Electronic soldering

### **Meeting Summary:**

On March 27, 2002, representatives from various business and industry associations, government and academic organizations in Europe met with representatives from the U.S. Joint Group on Pollution Prevention/Industry Lead Free Solder project. Presenters from EU and US interests discussed issues and concerns facing all who use lead solder and are considering lead-free alternatives to meet market and environmental forces in manufacturing and electronic component suppliers. The objectives of the meeting were to 1) provide information exchange regarding EU and US efforts in lead-free solder technology development and 2) identify potential partnerships for determining shared lead-free solder technical needs and solutions. The meeting attendees asked questions of the U.S. JG-PP presenters and discussed the next steps to forming a working partnership to qualify lead-free solder. Many in the audience seemed to agree that European companies will have to switch to lead-free solders in a few years. The EU may wish to first focus on a particular application, such as a general purpose lead-free solder. Mention was also made of the benefits of pulling in European trade unions into the partnership. Such meetings were identified as forthcoming in Munich, Germany and in Valencia, Spain, on April 18-19, 2002 respectively. Additionally, many in attendance stated that funding for the partnership would likely come from a government entity (e.g., possibly British Ministry of Defence and the EU in Brussels) or, as in the U.S., from in-kind contributions from the stakeholders. In the conclusion of the meeting, an action item was assigned to the meeting's attendees to speak with the respective organizations' managers and identify to Mr. Hill and Mr. Brian Greene, ITB, in 3 weeks their interest in further developing a Lead-Free Solder project partnership.



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### Minutes

1. On March 27, 2002, representatives from various business and industry associations, government, and academic organizations in Europe met with representatives from the U.S. Joint Group on Pollution Prevention/Industry Lead Free Solder project. The objectives of the meeting were to 1) provide information exchange regarding EU and US efforts in lead-free solder technology development and 2) identify potential partnerships for determining shared lead-free solder technical needs and solutions. Copies of all presenters' slides will be made available on the JG-PP web site per an action assigned to Mr. Brian Green, ITB. Action items are summarized as Attachment 1.
2. The meeting began with a welcome from General Pelágio Castelo Branco, President, DANOTEC and Mr. Mike Pestorius, Technical Director, Office of Naval Research International Field Office. Both gentlemen encouraged the open dialog by participants regarding the meeting's topic concerning lead versus lead-free solder.
3. Opening remarks were made by Mr. Barry Braden, Deputy Associate Director for Spaceport Technology Project Management Office at the National Aeronautics and Space Administration (NASA), Kennedy Space Center (KSC), and representing the Chairperson of the U.S. Joint Group on Pollution Prevention (JG-PP). The JG-PP is a partnership between various government and industry organizations to assist in validating and implementing materials and processes that are less hazardous than those currently used in military and industrial facilities. The JG-PP mission is to coordinate pollution prevention projects among NASA, military services, and their contractors. In past JG-PP projects, participants have realized benefits such as lowered implementation and testing costs, decreased demonstration/validation costs, sharing of solutions, and accelerated implementation of alternatives. One of JG-PP's newest projects is to qualify lead-free solders. Mr. Braden stated that the objective of the meeting was to provide information exchange between the European Union and the United States in the area of lead-free solders, and to identify potential partnerships for determining shared lead-free technical needs and solutions.
4. Mr. Robert Hill, Vice President ITB, Inc. and Program Integrator, delivered an overview of the lead-free solder opportunity on behalf of Mr. Joe Felty, Senior Engineer, Raytheon, who could not attend the meeting. The briefing began by noting that Raytheon is a current partner in the JG-PP Lead-Free solder project. Mr. Hill discussed Raytheon's past experience with the other JG-PP projects and the success that Raytheon believes that the joint partnership will bring to all who participate in this lead-free solder project. Mr. Hill stated from the briefing that this project's goal is Demonstration/Validation of alternatives leading to implementation involving customer inputs/consensus in building the Joint Test Protocol (JTP) that include rework challenges. This JTP will include performance requirements for plated-through-hole (PTH), surface mount technology (SMT), and mixed technology circuit card assemblies technologies that investigate impact to new manufacturing and rework/repair of lead contamination of lead-free assemblies and lead-free contamination of lead assemblies. The briefing further highlighted that this effort would minimize duplication of other industry projects currently in progress while incorporating participating customers' and stakeholders' key performance parameters.



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Mr. Felty's briefing concluded by identifying that the days of tin-lead solder are numbered and that the Raytheon Company is interested in active participation to find solutions through the JG-PP Process which provide benefits. His briefing further stated that while the JG-PP Lead-Free Solder Project is in the Technical Phase, the JTP performance requirements, test vehicle design and test solder alloy selection are not finalized and that there is still ample time to join and participate in this effort.

5. Mr. Lee Whiteman, Principle Investigator, American Competitiveness Institute (ACI) presented ACI's experience with lead-free solders and a proposed timetable for lead legislation's impact on users. Mr. Whiteman is an active participant and technical advisor on the JG-PP Lead-Free Solder project and has worked as Principle Investigator on U.S. Navy contract studies concerning the lead-free solder issues and concerns. He emphasized that there is no drop-in replacement for eutectic tin-lead solder, and that there will be some potential difficulties with implementing lead-free solders in existing lead solder circuits. Mr. Whiteman illustrated the domino effect that is occurring in both commercial and military electronic regarding lead-free solder. His bottom-line is that all will see lead-free impacts to current and future production, lead-free impacts to commercial off the shelf (COTS) procurements, implementation, and support, and lead-free impacts to sustainment of existing programs. Mr. Whiteman offered to make available to the meeting attendees a copy of a white paper of lead-free solder from a colleague at ACI.
6. Dr. Richard E. Pinckert, Director of Design Integration and Environmental Assurance, The Boeing Company, presented on Boeing's partnerships with JG-PP, emphasizing prior work on qualifying nonchromate primers for aircraft exterior surfaces and the current Lead-Free solder project. Dr. Pinckert noted that one of the big benefits of JG-PP is its ability to bring together diverse partners. Dr. Pinckert presented the results of Boeing's lead-free solder investigations to-date. At present, Boeing plans to proceed in determining the reliability of six lead-free solders for reflow operations. The solders will also be contaminated with lead to determine the effect of the lead upon reliability. This simulates the condition where lead-containing boards are reworked with lead-free solders. To accomplish this process, Dr. Pinckert stated that Boeing will continue to support and participate in the activities of the JG-PP Lead-Free Solder project and noted that Boeing is willing to move forward in this project's partnership to solve the shared problem of qualifying lead-free solder. Meeting attendees were encouraged to view the JG-PP Web site (<http://www.jgpp.com>) for other success stories and potential project partnering initiatives.
7. Ms. Kay Nimmo, Research Director, Soldertec at Tin Technology, presented an overview of Soldertec's lead-free solder roadmap and EU lead legislation. Soldertec predicts all components will be lead free by 2004. Ms. Nimmo noted that the Improved Design life and Environmentally Aware manufacture of electronic assemblies by Lead-free Soldering identified Sn-3.8Ag-0.7Cu is a viable option, with peak temperature increase by 10-20°C. She also stated that the IDEALS European project concluded that lead-free soldering is technically and industrially viable, environmentally attractive, can offer an extended service life, and is in various stages of production implementation by industrial partners. Ms. Nimmo identified the European Lead-free Network ELFNET Technology research organisation consisting of representatives from Austria (Vienna University), Belgium (IMEC), Denmark (Technoconsult), France (LETI), Germany



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(Fraunhofer-IZM), Ireland (NMRC), Italy (Politecnico Milano), Netherlands (TNO), Portugal/Spain (UNINOVA), Sweden (IVF) and Nordic states, Switzerland (EMPA) EUREKA, and UK (Soldertec and others) are concerned with the RHS Directive expected phase out of lead solder by 2006. She further stated that from guideline timescales available among US, EU, and Japan; EU is at least 2 years behind Japan. To work this time lag, she discussed that much research and activity remain for the following issues; solder composition agreement, lead level definition, component development, process thermal profiling, mechanical, reliability, solderability, whisker test methods, environmental aspects, life cycle, and small company progress, implementation, supply networks.

8. Mr. Ruben Bergman, Chairman, Global Environment Coordination Initiative (GECI) Advisory Board, presented information on GECI's mission, and the HDP User Group's efforts to identify a general purpose lead-free assembly. Mr. Bergman stated that the resolution of technical and logistics issues involved in conversion of over 200,000 electronic products to become lead-free is a complex and massive undertaking. He noted that several of the world's leading electronics associations and consortia have therefore been participating in an effort to develop standardized alloys, processes, tools, etc. The mission of the "Global Environmental Coordination Initiative", GECI, as stated by Mr. Bergman, is to agree on a process for the orderly transition of the electronics industry to comply with the market driven and legislative environmental requirements with respect to product materials content and design; and to facilitate global cooperation to make the transition as smooth and cost efficient as possible while preserving the quality, reliability and safety of the electronics industry's products. Mr. Bergman believes resolving the Lead-free issue has the first priority due to the impact on the electronics infrastructure and halogen-free issues are next in line. However, "Environmental Load Analysis" of potential technologies, "Design for the Environment" and "End of Life Treatment" issues could also be addressed at a later stage. Mr. Bergman commented that he is extremely interested in solidifying working relationships with the JG-PP on this project.
9. General Pelágio Castelo Branco discussed the need and drivers for joint EU cooperation to address high priority environmental technology needs, with an emphasis on lead-free soldering. He noted that 30% of European Defence Industry as a whole has major companies conducting the bulk of the business with the remaining 70% conducted by small and medium sized enterprises. General Branco stated, "When big is beautiful small is put aside and forgotten." This is why an integrating effort to address both large and small company concerns is important relative to a projects of this nature. To this point, General Branco indicated that he saw this day's meeting as a first step in contributing to such international cooperation.
10. Mr. Eduardo Dias Lopes, Principal Engineer, ISQ, presented on ISQ's experience with bonding, welding and soldering technologies. They have worked with developing alternative lead-free soldering technology. ISQ identified the following capabilities to support a lead-free solder project: Chemical and Physical Characterization Modelling of Soldering, Soldering Tests (wave, laser assisted), Analysis of Soldering Solutions (eg. materials tests, X Ray, SEM, TEM, EDX, EDS, AES, XPS), Product Safety (Electrical Equipment and Component Testing, eg. humidity, temperature, radiation) Electromagnetic compatibility, Cleaning Technologies (cryogenic surface



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cleaning), NDT (e.g. X Ray microfocus). One material process alternative identified to provide clean soldering with lead free and low VOC identified was conductive adhesives as solder alternative for adhesive joining technology in electronics manufacturing (Adhesives in Electronics). Findings conclude use of conductive adhesives are applied at RT result in more adequate to accommodate stresses and strains and that there is no need for cleaning after the joining process. ISQ has a CD containing some of the lead-free solder test results that Mr. Lopes offered to share if participants would give him their business card at the end of the meeting. Information from this CD can be made available by contacting Eduardo Lopes at EDLopes@isq.pt.

11. Mr. Norman Stockham, TWI, presented on TWI's experience with lead-free soldering. TWI is the world center for materials joining technology. Dr. Stockham indicated that he has found a surprising number of companies that have yet to begin preparing for conversion to lead-free solder. Specifically he stated that a few 'large' companies have/are investing heavily and have a good understanding of the situation; that a large number of small and medium enterprises are still unaware of the effect of legislation; that a significant number of small/medium and some large companies have not yet conducted in-house work on their products; and that many of those who are aware have not established the full ramifications of the change to new solder/board technologies. Mr. Stockham's belief is that there is Confusion and uncertainty with respect to the technical and financial impact of environmental legislation on product and process reliability.
12. Mr. Clive Simmonds, BAE Systems, presented information on BAE's investigation of the impact of lead-free solder on their operations. Mr. Simmonds noted many manufacturing operational issues, process and implementation concerns for lead-free solder as follows: Controlling which line uses which solder and thermal profiles; Contamination of lead-free assemblies to include identification of lead and lead-free solders and identification of lead and lead-free components; prevention of incorrect hand rework and controlling in-service rework; phasing out of lead manufacturing lines; full lead-free process cut-off dates and new equipment purchase and operator training. To address these issues and concerns, Mr. Simmonds stated that BAE will complete a risk and opportunity assessment; look at component availability and transition timescales; assess level of all time buys across the Business sectors; agree on a BAE policy to assess impact to design standards and process capabilities. Mr. Simmonds commented that the BAE approach to address these factors is to develop a Working Group network and communications and maintain links and support external group activities such as the JG-PP, SMART, SolderTec, Suppliers and Contractors activities. Mr. Simmonds noted his intent to fully participate in the JG-PP Lead-Free Solder Project
13. Mr. Hill, Vice President ITB, Inc. and Program Integrator, provided an overview of the JG-PP program and project methodology. He discussed the following outline regarding Who is JG-PP?; What has JG-PP achieved?; What can JG-PP do for you? Where is JG-PP going? He further discussed the integrating activity and project methodology with meeting attendees. Mr. Hill noted that each phase of the JG-PP methodology has exit criteria that provides for a fully documented project process. Mr. Hill stated to the group that proactive participation in this project partnership can lead to increased technical confidence in qualified alternatives, reduced alternative



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qualification costs, reduced hazardous material logistics impact, and through this enhanced communication process.

14. Dr. Rick Ciocci, CALCE Electronic Products and Systems, University of Maryland, discussed the efforts of CALCE to provide a knowledge and resource base to support the development of competitive electronic products and systems in a timely manner by investigating the enablers for and the consequences of replacing eutectic tin-lead solder in electronics with the ternary Sn-Ag-Cu lead-free solder. He began by noting that U.S. manufacturers need to be globally competitive and well positioned for compliance with upcoming international and US environmental legislations because the Japanese electronics manufacturers are creating a market differentiation based on “green” products. Part of the reason for the change to lead-free is that a large number of companies have indicated that lead-free assembly is easier to control than eutectic solder. The result, component manufacturers are addressing reliability under new reflow conditions for conversion to lead-free solder technology. In fact, Dr. Ciocci identified that Lead-free Products are Already in the Market, citing two examples - Sony MiniDisc Player: MZ-E909 (Introduced August 2001) and the Panasonic MiniDisc Player: SJ-MJ-90-A (Introduced September 2001). As in previous briefings, Dr. Ciocci agreed that •Market and legislative forces will directly effect availability & affordability of feasible alternate materials; environmental impact & recyclability; manufacturability and reworkability; to include reflow temperatures, compatibility with other parts (PWBs, components, platings) compatibility with legacy materials (Pb contamination), process equipment, inspection standards; performance, durability and reliability involving interconnect failures: solder fatigue and intermetallic failure in permanent interconnects, fretting corrosion in plated connectors, and Pb contamination in mixed technologies; failure in components and PWBs: creeping corrosion & leakage currents in platings leading to leakage currents, other high-temperature failures; response of the Supply Chain and soldering standardization. Dr. Ciocci then discussed CALCE Consortium has developed methodologies that have been successfully used to benchmark risk management programs across the supply chain, for many CALCE member companies. This methodology is being applied to assess the risks in reducing and eliminating lead from existing and future electronic products and systems. His presentation concluded with discussion of Characterization of Constitutive Properties of Lead-free Solders and Experimentation for Constitutive Properties
15. The meeting attendees asked questions of the U.S. JG-PP presenters and discussed the next steps to forming a working partnership to qualify lead-free solder. Many in the audience seemed to agree that European companies will have to switch to lead-free solders in a few years. The EU may wish to first focus on a particular application, such as a general purpose lead-free solder. The benefits of pulling in European trade unions into the partnership was also mentioned. One such meeting is in Valencia, Spain, on April 18-19, 2002. Funding for the partnership would likely come from a government entity (e.g., possibly British Ministry of Defence and the EU in Brussels) or, as in the U.S., from in-kind contributions from the stakeholders. An action item was assigned to the meeting’s attendees to speak with the respective organization’s managers and identify to Mr. Hill and Mr. Brian Greene, ITB, in 3 weeks their interest in further developing a Lead-Free Solder partnership.
16. Mr. Braden thanked the attendees for their constructive participation at the meeting. He summarized the meeting by stating that “the train has left” and that there is urgency in identifying



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viable lead-free solders. The NASA Environmental Manager and JG-PP Chairperson supports the international partnership and is currently working a Memorandum of Understanding to formalize this interest. Mr. Brian Greene, ITB, Inc., was identified as the technical point of contact for the Lead-Free Solder project. Mr. Braden stated that the U.S. Joint Logistics Commanders are very interested in this project. At Mr. Braden's request for a show of hands for those interesting in continuing meeting, nearly every hand was raised. Finally, Mr. Braden thanked several individuals—Richard Hess, Robert Hill, General Branco, and Tess Flynn—who were very instrumental in coordinating this meeting. The meeting was adjourned at approximately 5:00 p.m.

*SIGNED (Approved by B. Braden 4/05/02)*

Barry M. Braden  
NASA/KSC Deputy Associate Director For Spaceport  
Technology Project Management Office

Attachments:

1. Action Items

**Action Items****LFS.02.03.01**

***Date Due:*** 04/17/02

*Responsibility:* All attendees to the 1<sup>st</sup> EU/US Interface Meeting

*Required Action:* Speak with the respective organization's managers and identify to Brian Greene, ([GreenBE@kscems.ksc.nasa.gov](mailto:GreenBE@kscems.ksc.nasa.gov)) in 3 weeks their interest in further developing a Lead-Free Solder partnership

*Comments:*

*Responsibility:* Brian Greene and Robert Hill

*Required Action:* To prepare meeting minutes and inform meeting invitees of the Web site address that will host the minutes, meeting proceedings, and related technical information.

*Comments:*