NASA Electronic Parts and Packaging Program (NEPP)

Title: Reworkable Underfill Characterization

☐ New Proposal **X** Continuing NEPP Work

Total $ Requirement for FY 01: $ 325

Technology Type: **X** Newly Available (COTS) ☐Emerging/Advanced

Project Area: ☐Parts **X** Packaging ☐Radiation

Proposing Center: Jet Propulsion Laboratory

Participating Centers: **21**% GSFC **0**% GRC **21**% LaRC
55% JPL **3**%MSFC **0**%JSC

Points of Contact: Reza Ghaffarian Code: SM
818-354-2059
818-393-5245(FAX)
reza.ghaffarian@jpl.nasa.gov

Investigator: Reza Ghaffarian

Objectives:

- Demonstrate a reworkable organic underfill using a high I/O package and die with low rigidity meeting the harsh dynamic requirements for space. This task will define, characterize, and validate techniques for rework and repair of devices following an underfill process. Evaluation will include development of validation, assessment and test methods/tools, advanced adhesion technology evaluation, process characterization and interconnect reliability guidelines as they relate reworkable underfill materials systems. The current standard non-reworkable materials will be used as control.
- Disseminate guidelines for quality assurance and reliability to NASA projects for hardware and processes as well as industry.

NASA Customers: NASA-wide advocacy including X-2000, SIM, HEDS, Mars Exploration Programs at JPL, PICASSO, GAMS, STS, at LARC, Next Generation Telescope at GSFC, JPL-led consortia (see below), Virginia power through LARC, Ames/MSFC/JSC through COTS support.

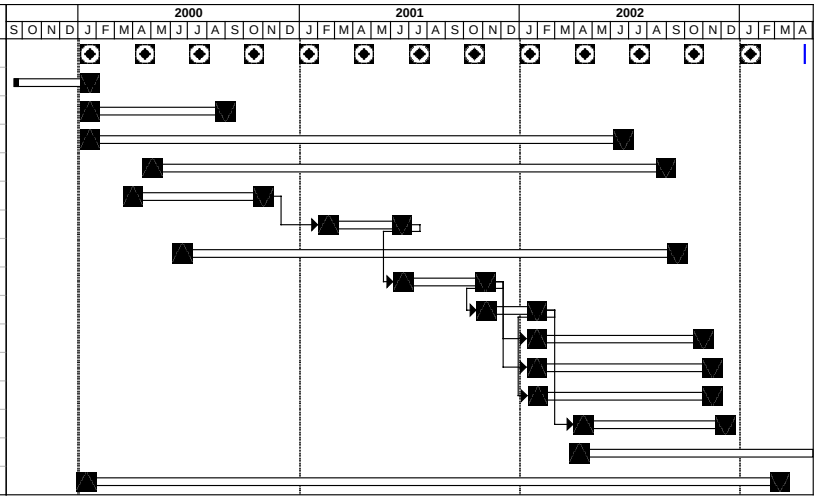
Deliverables:

- Test matrix design of experiments for different underfill materials
- Inspection criteria and quantifiable assembly data for acceptable adhesion and flow
- Quality Assurance guidelines
- Training course and technical papers in NASA EEE Links, industry-wide conferences and trade magazines

Schedule:

NASA Electronic Parts and Packaging Program (NEPP)

ID	Task Name
1	**Quarterly Report**
16	Search for current underfill tech.
17	**Form Rworkable Underfill Consortium**
18	Telecons with consortium team
19	**Workshops**
20	Design SMT Test Vehicle
21	Fabricat PCBs
22	Release Workshop Documents
23	**Assemble underfilled SMT TV**
24	Underfill
25	Perform Limited Testing
26	Develop Inspection for underfill
27	Characterize underfill Failure Modes
28	**Underfill mfg defect to Reliability**
29	**Guidelines on underfill**
30	**Publications, NASA EEE Links, etc.**



Task Approach to meeting NEPP Objectives

This task will characteristics key properties of underfill including bonding by mechanical and thermal test methods. Dies will be assembled on board with conventional and reworkable underfills and will be subjected to environmental testing to establish damage progress and failure. In addition based on results of no-destructive evaluation (NDE) and destructive physical analyses, defect correlation and to reliability will be established for reworkable underfill applications. These results will be used to bound critical parameters and to provide standards/inspection criteria guidelines for the optimum underfill condition for best reliability performance. Will provide guidelines document and will use knowledge and experience gained to effectively support the projects in these areas. This task meets the four objectives of NEPP.

Leveraging

JPL: Organize NASA/industry-wide consortia activities to meet the objectives of the program at the NASA centers as well as industry partners. Perform the majority of mechanical, thermal, and failure analyses to establish behavior of underfill and coordinate release of information gathered at centers and guidelines document
GSFC: Assemble test vehicle at GSFC with known variables and correlation to manufacturing parameters and establish quality assurance controls.
LARC: Modify LARC-SI to determine its applicability for underfill use. Test materials as one reworkable option.
MSFC: Attend workshops to better define infusion into missions
Industry Consortia: Solicit collaboration from a large number of companies which have been involved within the last four years in packaging projects under three consortia (BGA, micro BGA, and CSP) and other industry consortia including ITRI, Sematech, and NCMS. The consortia team members include: Boeing, Raytheon, TRW, ITT, Litton, USAF, Harris, Sandia National Labs., Micron, Sun Microsystems, StorageTek, Siemens, Hughes Network Systems, Amkor, Kyocera, Abpac, AMD, Sony, GE, Mitsubishi, EPIC, Irvine Sensors, LG Semicon, Flip Chip. Contacted other industry including APL, Aerospace, Aerojet, and Honeywell for additional resources. Expand and include additional consortia team with a unique experience as needed, e.g., Dexter, Loctite, etc. and underfill dispensing suppliers, e.g. Asymtek, will make the wafer COTS more attractive for space flight applications.

Information Management and Dissemination Project: Collaborate on the project information needs.
NASA Training course. Collaborate with the JPL and GSFC training centers to develop a training course for effective NASA-wide training and another vehicle for information dissemination.

Description and Technical Approach

Association Connecting Electronics Industries (IPC) : Collaborate to release NASA/IPC guidelines for this technology

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