Consensus opinion on issues in manufacturing implementation

- Surface preparation 90 VOTES
  - Environmental cleanliness and control, contamination
- Cure control 40 VOTES
  - Local variations in temperature and pressure, porosity
- Dimensional control (adhesive layer thickness) and Bonding Fixtures 39 VOTES
  - Dimensional control of substrates, verification of fit
  - Application of preloads, bondline thickness control, defects
- NDI/quality control 32 VOTES
  - Cured bondline evaluation, tracking outcome and bond process variables
- Scaling of processes to larger/smaller structures 26 VOTES
  - Scaling of a developed process to a larger (smaller) structure
- General (Human Factors) 25 VOTES
  - Equipment maintenance, training of personnel, documentation of process, handling/storage/disposal of materials
- Handling of the adhesive 13 VOTES
  - Storage, aging
- Dispensing adhesive 4 VOTES
  - Sequence and timing of bonding process steps, gap filling

MANY WERE UNCOMFORTABLE WITH THE CONCEPT OF RANKING
Consensus opinion on issues in manufacturing implementation

- Surface preparation 90 VOTES
  - Environmental cleanliness and control, contamination
    - TRAINING
    - Controlled environment
    - NDI does not answer everything
Consensus opinion on issues in manufacturing implementation

- **Cure control** 40 VOTES
  - Local variations in temperature and pressure, porosity
    - Does equipment work?
    - Scaling
- **Dimensional control (adhesive layer thickness) and Bonding Fixtures** 39 VOTES
  - Dimensional control of substrates, verification of fit
  - Application of preloads, bondline thickness control, defects
    - Tooling Design
    - Use Verifilm appropriately – useful for gross evaluation only
Consensus opinion on issues in manufacturing implementation

• NDI/quality control 32 VOTES
  – Cured bondline evaluation, tracking outcome and bond process variables
    • Necessary but not sufficient
    • Difficulty/costs in getting standards
    • New developments such as power ultrasonics, sonic IR
    • Visual inspection is valuable, but needs standards
    • Process data not being fully utilized when gathered

• Scaling of processes to larger/smaller structures 26 VOTES
  – Scaling of a developed process to a larger structure
    • Size, complexity, and number of steps increase dramatically
    • Formal procedure of Manufacturing Risk Articles to minimize risk
Consensus opinion on issues in manufacturing implementation

- **General (Human Factors) 25 VOTES**
  - Equipment maintenance, training of personnel, documentation of process, handling/storage/disposal of materials
    - TRAINING
      - Even when done well, sometimes not absorbed/obeyed
    - Automation
    - Documentation of Processes
- **Handling of the adhesive 13 VOTES**
  - Storage, aging
    - Shipping vs Manufacturing Date/ Out-time / Requalification
- **Dispensing adhesive 4 VOTES**
  - Sequence and timing of bonding process steps, gap filling
    - Mixing
Summary

• Everybody knows what the big issues are, and there is even rough consensus on prioritization
  – Many were uncomfortable with the concept of ranking
  – People have techniques to cope with the current situation, but nobody is fully comfortable

• Two topics where the comfort level is lowest
  – TRAINING
    • Not done well enough consistently enough often enough
  – SURFACE PREPARATION
    • Most in need of good practical solution(s)