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)