Photovoltaic Array – Topics for Discussion

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Introduction:

This document is intended to inform you about some of the issues involved in properly specifying or manufacturing a photovoltaic array for solar vehicle challenges. It is not intended, of course, to be an all-inclusive how-to manual. There is no doubt that in order to be successful, those team members responsible for the array must have a working knowledge of most, if not all of the topics listed here. There is also no doubt that questions will arise because of this list and that is precisely its purpose. Please feel free to introduce yourself and speak up.

Design Consideration

- Specification vs. actual
  - "Space" vs. terrestrial
  - General performance variables
    - Cell temperature (Not Ambient)
    - Spectral issues
    - Insolation
- System vs. component optimization
- Maximum power point trackers
  - Boost
  - Buck
  - Open vs. closed loop systems
  - Tracking time
- Diodes
  - Blocking
    - Reverse current limiting
  - Bypass
    - Reverse voltage limiting
  - Active
- Aerodynamic issues
  - Curves
  - Surface finish
- Anti-reflection treatments

Manufacturing Considerations

- Cutting
  - Edge passivation
  - Rejects

- Testing/Matching
  - Light source
  - Temperature

- Interconnection
  - Soldering
  - Conductive bonding
  - Strain relief

- Encapsulation
  - Usually multiple layers above and below cells
  - "Common" configurations
    - Tefzel/EVA/Cell/EVA/Tedlar
    - Same as above but replace EVA with Urethane, Polyolefin, Ionomer
  - Likely many, many materials and techniques but test small and scale up upon success

- Bonding / "Lay down"

Miscellaneous

- Testing
  - Current v. voltage curves
    - Open circuit voltage (Voc)
    - Short Circuit current (Isc)
    - Maximum power (Pmax)
      - Voltage at Pmax (Vmp)
      - Current at Pmax (Imp)
    - Fill Factor (FF)
      - Pmax/(Voc x Isc)
      - Interpretation
  - Reference cells
  - Cell temperature

- Safety
  - Generally high voltage even at low light
  - Unintentional current paths

- Cooling (or rain)
  - Unintentional current paths (the hair dryer "legend")
  - Use water without dissolved solids

- Shadows

- Touchy-Feely Public