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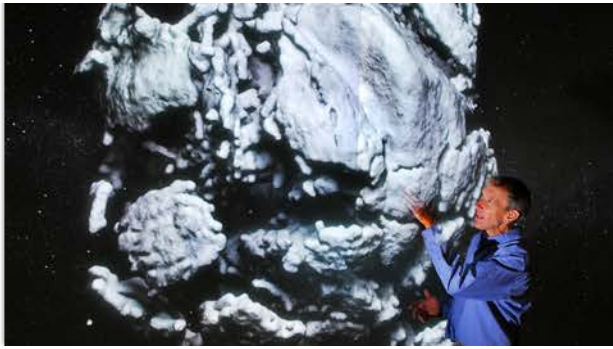

2013 Inverter Reliability Workshop
Breakout Session B: Component Level Reliability
Breakout Session D: Module-Scale Conversion

Moderators: Bob Kaplar, Jack Flicker, Chris Deline

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Component-Level Reliability

- Software should be considered a component
  - It is the most complex component
  - Can cause more damage than hardware degradation
  - Does not degrade, but a complex interplay exists between hardware degradation and software
- Components cannot be treated individually
  - Degradation of one can affect another in real-world environment
  - Design rules should be implemented
  - System design should be tolerant of component variation
  - Need physics-of-failure based models of components
- Cost is a major pressure
  - Good reliability can be achieved, but cost is prohibitive
  - PV industry is more cost-sensitive than other industries requiring good reliability for complex systems
  - Emphasis is placed on up-front costs, with a tendency to not worry about long-term costs such as reliability

Module-Scale Conversion

- Protection from moisture intrusion
  - Water can get in but not out (vapor condenses inside)
  - Potting / coating solves some problems but causes others (e.g. due to CTE mismatch, sealing to prevent leaks)
  - Problems with cable entry
- General environment is harsher than for centralized inverters
  - Intimate contact to solar module (this can affect module)
  - Module and MLPE are expected to have same reliability
  - On roof, not easily accessible, harsh thermal environment
- Lack of standards is a big issue
  - Residential, commercial, utility applications should have different requirements
  - Standards should be physics-based and relevant to real world (no “universal” acceleration factor)
  - Qualification can be costly; could be optional or self-certified
  - Difficult to get different manufacturers to agree on standards