NASA GRC Airframe Icing Meeting

An Ice Protection and Detection Systems
Manufacturer’s Perspective

June 9, 2009

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Sensors and Integrated Systems:

- De-icing & Specialty Systems
- Fuel & Utility Systems
- Hoist & Winch
- Sensor Systems
- Digital Data Systems

- 3,000 employees worldwide

Worldwide Locations:
- United States
- Canada
- Mexico
- France
- England
- Germany
- Italy
- Singapore
- China
- UAE
- India

June 9, 2009
• Accomplishments – NASA GRC
  – World Class Aircraft Icing Research Center and Facility
  – Primary Sponsor / Partner - Aircraft Icing Consortia / Meetings
  – Icing Research Tunnel
  – Icing Test Aircraft
  – Icing Codes – LEWICE / Scaling, et al
    • Example: Look Ahead Ice Detection
  – Pilot Training Materials
  – Full Cooperation with Academia, Government and Industry
• Recommendations - Codes
  – User Friendly - 3D LEWICE
    • Incorporation of Runback / Evaporation Module
    • Coupled Aero / Thermal / Runback / Ice Shapes
      – Aero with Enhanced Near Field Effects
    • Temperatures / Conditions at which Ice will not Accrete
    • Include SLD and Ice Crystals (Mixed Phase)
      – Splash / Loss of Large Droplets
  • LEWICE Verification
  • Suggestions:
    – Form LEWICE Consortium (User Community Team)
    – Regular User Community Updates through SAE / AIAA, et al
    – Conduct Training Sessions
• Recommendations - Codes
  – Model Icing Wind Tunnels
    • UIUC Proposal – Model IRT – Extend for other tunnels
    • Explain Differences between Facilities
    • Explain Differences between IWT and Flight
  – Develop Thermal Scaling Laws
    • Critical for Next Generation Electrothermal IPS
  – Engine Icing – Internal
  – Rotating Components – Propeller / Propfan / Rotorblade
    • Wind Turbine
  – Ice Shed Trajectory Model
    • How Shed Ice Breaks-Up in the Air Stream
    • Where Shed Ice Strikes the Aircraft
• **Other Recommendations**

  – IRT / Test Facilities
    - Develop SLD / Mixed Phase / Ice Crystal Test Capabilities
    - Engine Test Facility
      - Nacelle Inlets to Fan
      - Internal to Engine
    - Cost
  
  – Basic Icing Research
    - Impact Ice Formation
    - Ice Adhesion
    - Impact Ice Physical Properties