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To: Sam Taylor

From: Dragan Curcija

Re: Update on Umass Research Work and Priorities

Date: August 20, 2001

Cc:

Current Umass Research Priorities and Milestones Update:

1. NATURAL CONVECTION IN GLAZING CAVITIES

- **Summary:** Laminar and turbulent natural convection in entire range of glazing cavity configurations at vertical and sloped angles.
- **Significance:** Provide better models for wide and sloped cavities, typical of commercial systems and retrofit measures for windows. Provide additional algorithms for condensation resistance of systems with wide glazing cavities and sloped cavities.
- **Current Status:** CFD modeling of the remaining range of glazing cavities (prior research has completed most of typical glazing cavities) and entire range for sloped cavities. Currently dealing with difficulties when modeling low (near horizontal) angles.
- **Mid Term Goals:** Develop improved all-inclusive CI model for use in THERM and WINDOW

2. LOCAL CONVECTION HEAT TRANSFER ON INDOOR SIDE OF FLAT AND PROJECTING FENESTRATION PRODUCTS

- **Summary:** CFD modeling of laminar and turbulent natural convection on indoor side of "flat" and projecting fenestration products.
- **Significance:** Provide better algorithms for condensation resistance calculations for all products and U-factors for projecting products, including commercial products, which often have projecting frames. Use new algorithms in THERM and WINDOW for increased accuracy of simulation programs.
- **Current Status:** CFD modeling of foam garden window as installed in LBL's IR box is nearly completed. Currently validation of results and reduction of data into suitable correlation.
- **Mid Term Goals:** Additional CFD modeling of windows as installed in research class hot-box and refinement of heat transfer correlations.

3. 3-D HEAT TRANSFER

- **Summary:** Conduction, convection and radiation modeling in 3-D.

- **Significance:** Development of a model to account for 3-D heat transfer effects in fenestration systems. Also, to validate assumptions when using 2-D detailed radiation model and other 2-D simplifications in the current simulation tools. Additional benefit is to develop expertise in the transfer of information from CAD files to simulation tools, which could be of great importance to window manufacturers
- **Current Status:** Completed development of 3-D geometry using CAD package (Pro-E) of two sample Marvin windows and transferred geometry model to FIDAP. Simulations in FIDAP are underway and validation with other numerical results.
- **Mid Term Goals:** Develop additional 3-D models of other typical windows (i.e., Al slider, commercial window, etc.) and also develop knowledge base of model transfer from CAD to analysis for potential future use by window manufacturers.

4. NFRC/ASHRAE SUPPORT AND INTERNATIONAL HARMONIZATION AND TECHNICAL ASSISTANCE

- **NFRC Support:**
  - NFRC 500
  - NFRC 101
  - NFRC glossary
  - Tubular skylight procedure
  - NFRC 100 and 100 Test Procedure, including coordination with ASTM
- **ASHRAE Support:**
  - Handbook of Fundamentals (Chapter 30)
  - Participation at various TC4.5 subcommittees, main technical committee, and SPC142
- **International Harmonization and Technical Assistance:**
  - ISO TC163/WG2 and WG14
  - IEA Task 27, Co-leader in Subtask A1
  - Universal Hot Box work
  - Collaboration with Russian side (A. Fomichev 6 month visit)
  - Brazil/South America technical assistance
  - Translation into Russian, Chinese, Spanish
  - Other on-going/as needed support

5. POTENTIAL NEW AREAS

- **Shading Devices:** Night time heat transfer and solar heat gain. Development of new algorithms for shading devices. This area is also important for retrofit and commercial windows.

- **Durability:** Thermally induced stresses. Development of a finite element model and guidelines how to implement in THERM and WINDOW. Investigate effects of partially shaded windows and modeling implications.
- **Window/Wall Interface:** Investigate interaction and effects of windows being installed in realistic wall systems. Develop models that account for these effects and provide guidelines on how to implement them in THERM and WINDOW.