ASHRAE Research

PROGRAM OVERVIEW

November 8, 2011

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What we will cover

- Introduction to ASHRAE Research
- ASHRAE's Strategic Plan for Research
- Research and Objectives related to Heat Pumps
- GSHP System at ASHRAE HQ – Denny Meyer, ClimateMaster Dir. Of Commercial Sales
- Building Tour

Introduction to ASHRAE Research

History:

- 1912 - ASRE commissioned first project to define the heat of fusion of ice with the U.S. Bureau of Standards.
- 1919 to 1961 - ASHVE operated independent research lab
- 1959 - ASRE and ASHVE merged to form ASHRAE
- 1961 - ASHRAE research lab closed. Research work contracted to other facilities.
- 1961 to Present - Over 800 projects completed and approximately $60 million spent on HVAC&R related research projects and student research grants.

Introduction to ASHRAE Research

Areas of Past Research Successes:

- Indoor Environmental Quality (IEQ)
- Sustainability: Solar, Geothermal, Heat Pumps, Fuel Cells, CHP, etc.
- Property Data
- Energy & Load Calculation Procedures
- Refrigeration & Cryogenics
- System and Component Performance
- Fire & Smoke Control
- Weather Data

ASHRAE Research

68

projects

$12.2

million

15

Co-Funded

ASHRAE Research Outside North America

6 active projects

$750,000

2 completed this year

$200,000

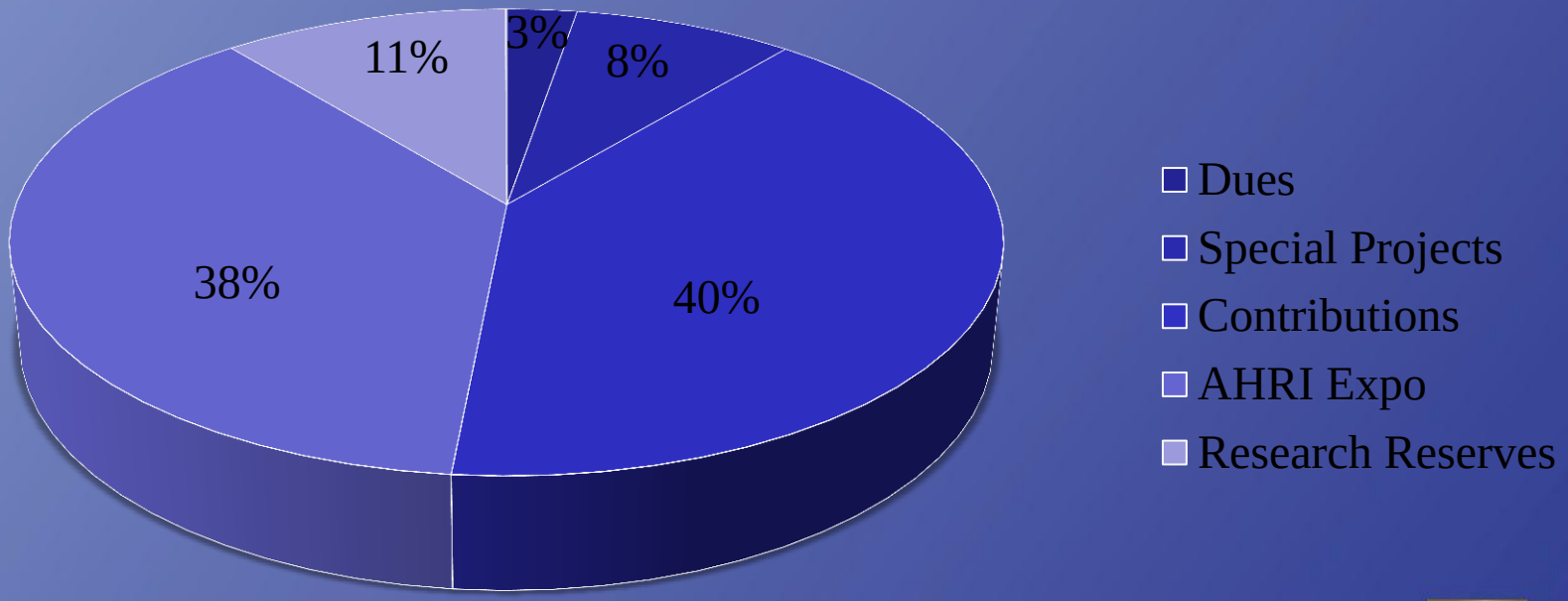
Total $950,000

ASHRAE Research Process

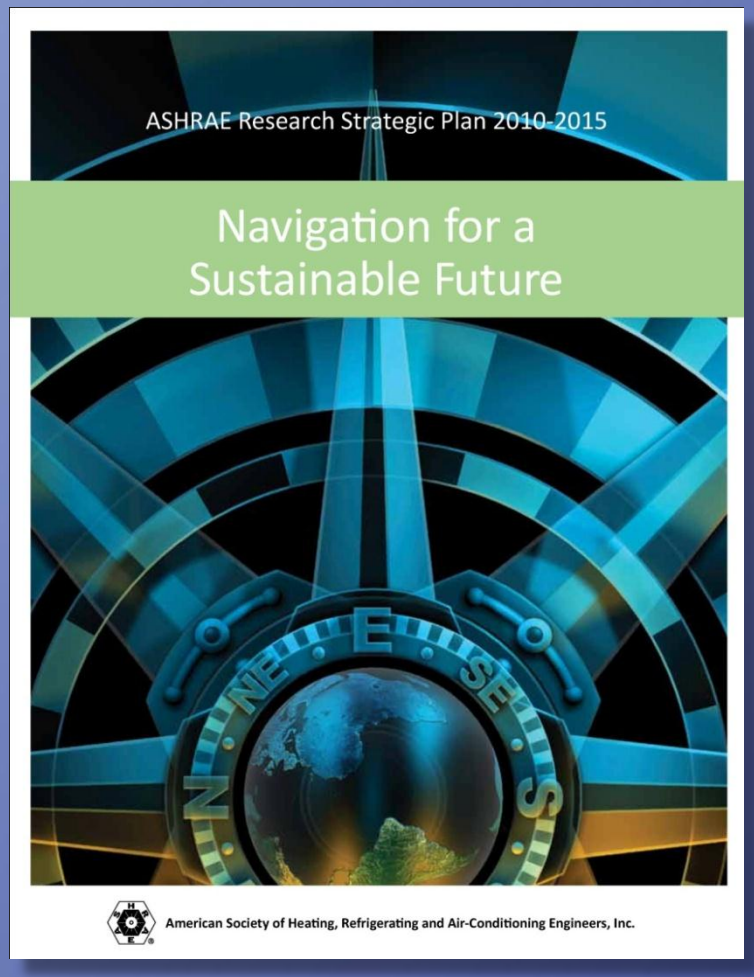
All research sponsored & supervised by a Technical Committee

Research Funding

$5,047,300 This Year



Research Strategic Plan



- 11 Strategic Goals
- Objectives
- Technical Challenges
- Needed Research

Strategic Plan – Provides Direction or Ideas! for Projects

Goals

1. Maximize the actual energy performance of buildings
2. Cost-effective net-zero-energy buildings
3. Reduce energy consumption in homes
4. Better understand the impact of IEQ on occupant performance, and health
5. Develop ASHRAE energy standards that require less end-user effort to demonstrate compliance
6. Integrate Building Information Modeling (BIM) into Society technical activities
7. Develop better design tools, procedures, and methods for low-energy buildings
8. Promote the use of natural and low GWP refrigerants and methods to reduce their charge
9. Improve performance of HVAC&R components
10. Improve training, collaboration, and understanding between engineers and architects.
11. Better understand infectious disease transmission and control in public spaces

Goal #3 – Reduce energy consumption in homes

Technology Challenges

1. Perfect new types of appliances , such as heat pump water heaters
2. Our equipment rating methods are (at best) obsolete. For example, we are not able to meaningfully compare energy use of a ground source heat pump (COP, EER) with a split system (HSPF, SEER), much less a mini-split. ASHRAE must collaboratively with others to remedy this problem.

Goal #9 – Improve performance of HVAC&R components

Technology Challenge

1. Applications where commercial size heat pumps could provide efficient and economical advantages have not been fully investigated.

Heat Pump Research

- RP-247, A Solar Heat Pump Heating System with Latent Heat Storage for Cold Climate – 1982
- RP-379, ARI/ASHRAE Heat Pump Test Program – 1983
- RP-479, Determination of the Transient Response Characteristics of the Air Source Heat Pump during Reverse Cycle Defrost – 1989
- RP-483, Development of Improved Ice-Making Techniques for Storage Heat Pumps – 1987
- RP-656, Heat Pump/Heat Recovery Operating Experience – 1993
- RP-780, Relevance of Electric Heat Pump Testing and Rating Methods to Engine –Driven Heat Pumps - 1996
- RP-790, Emission Characterization of Unitary Combustion Engine – Driven Heat Pumps – 2000
- RP-807, On-Site, Non-Refrigerant Resource Implications of Heat Recovery Heat Pump Systems - 1999

Heat Pump Research

- RP-863, Energy and Demand Savings of Commercial Ground-Source Heat Pumps – 1995
- RP-908, Assessment of Anti-Freeze Solutions for Ground-Source Heat Pump Systems– 1997
- RP-1016, Investigation of Methods to Optimize the Environmental Benefits of Ground–Coupled Heat Pumps– 2002
- RP-1217, Development of Guidelines for Selection and Design of the Pumping/Piping Subsystem for Ground-Coupled Heat Pump Systems – 2004
- RP-1384, Development of Design Guidelines for Hybrid Ground Source heat Pump Systems – 2008
- RP-1385, Development of Design Tools for Surface Water Heat Pump Systems (SHWP) - Active project

RP-1385

Development of Design Tools for Surface Water Heat Pump Systems (SWHP)

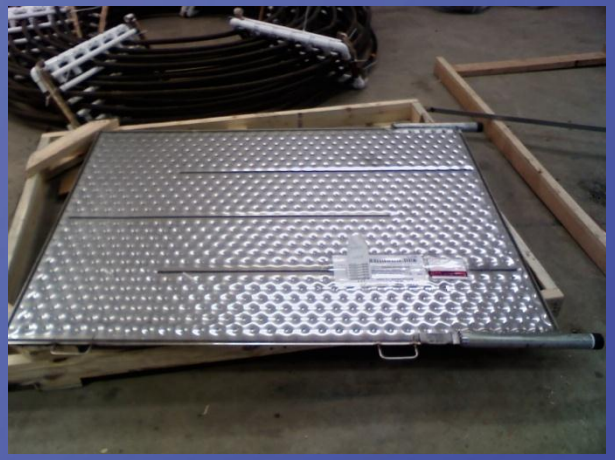
Sponsoring TC: TC 6.8 Geothermal Heat Pump & Energy Recovery Applications

Principal Investigator: Jeff Spitler, PhD.

- Range of activities supporting development:
  - Experimental measurements (Exterior convection correlations are the key "missing" information.)
  - Simulation model
  - Field surveys
  - Literature review, etc.

Experimental Measurements

Spiral-Helical Coils



Flat Plates

Flat Spirals

Slinkies

Status

- Exterior convection correlations developed for: spiral-helical coils, slinkies, flat spirals and flat plate heat exchangers.
- Design nomograms produced for spiral-helical coils.
- Additional testing may refine correlations.
- Development of apparatus for ice-on-coil experiments this winter is underway.

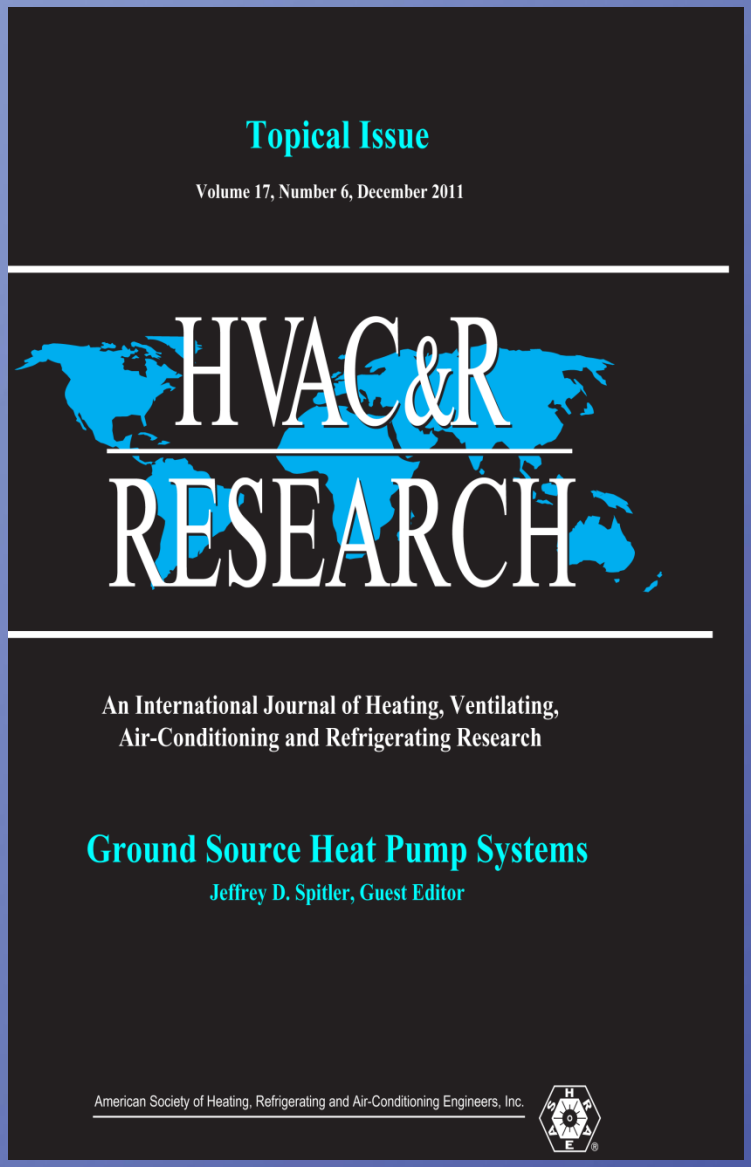

OSU

RTAR 1642

Improved Compressor Performance Modeling Methodology for use in System Simulation Programs

Sponsoring TC: TC 8.11 Unitary and Room Conditioners and Heat Pumps

- 10-coefficient polynomial used now in States to model mass flow rate, input power, etc per AHRI Standard.
- Issues identified with using polynomial include: 1. Number of lab data points required for accurate measurements and 2. extrapolation for conditions not tested.
- These issues are more significant for heat pumps, which expand the application envelope significantly.



- 16 papers
- Available Dec. 2011

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QUESTIONS?