

**AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS, INC.
1791 Tullie Circle, N.E./Atlanta, GA 30329
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TC/TG/MTG/TRG MINUTES COVER SHEET

(Minutes of all Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/MTG/TRG No. 6.1 DATE March 24, 2014

TC/TG/MTG/TRG TITLE Hydronic and Steam Equipment and Systems

DATE OF MEETING January 21, 2014 LOCATION New York, NY

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Ramez Afify	2011	Ken Luther	2011	
Jason Atkisson	2011	Frank Myers	2013	
Tricia Bruenn	2009			
Michael McDermott	2011			
Don Prather	2013			
Rex Scare	2011			
Greg Towsley	2013			
Edward Tsui (non-quorum)	2011			

DISTRIBUTION

All Members of TC/TG/MTG/TRG plus the following:

TAC Section Head:	Mark C. Hegberg
TAC Chair:	Walter T. Grondzik
All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters:	ALI/PDC – Hugh D. McMillan Chapter Tech. Transfer – Maggie Moninski Research - Stephen S. Hancock Special Pubs - Standard – Cyrus H. Nasser 2016 HB Systems - Forrest S. Yount 2017 HB Fundamentals – Van D. Baxter
Manager Of Standards Manager Of Research & Technical Services	Stephanie Reiniche Mike Vaughn

1. Call to Order:

Chair Bruenn called the meeting to order at 1pm. The Chair welcomed all in attendance, and self-introductions were made. An attendance sheet was passed and signed by those in attendance. A quorum was present with attendance by 6 of 11 voting members at the start of the meeting. 2 additional voting members (1 non-quorum voting member) joined while the meeting was in progress.

Technical Committee 6.1 is concerned with all aspects of hydronic and steam systems. This includes the application of boilers, chillers, terminal units, and all accessories and controls making up the total system as well as the design of the integrated system. In addition to comfort applications of both heating and cooling, snow melting systems are included. Cooperation with other TCs is recognized in areas such as control, noise and vibration, refrigeration, pumps and hydronic and service water piping.

2. Setting of the Agenda:

The Chair passed out an updated Agenda. Motion by Greg Towsley, seconded by Jason Atkisson to approve the past meeting minutes. Motion passed 6-0-0 (with the Chair voting).

3. Approval of Denver Meeting Minutes:

Motion by Greg Towsley, seconded by Jason Atkisson to approve the past meeting minutespast meeting minutes. Motion passed 6-0-0 (with the Chair voting).

4. Recognition of Liaisons:

Mark Hegberg, Section Head, was present for the meeting.

5. Chair's Report

Chair Bruenn summarized the key items from the Section 6 Breakfast.

- (a) Updates on the Hightower Award recipient.
- (b) ASHRAE discussion board is now on line, www.ashraexchange.com.
- (c) A new presentation template for TAC use at local ASHRAE chapters is available.
- (d) All members are asked to verify and update, if needed, their ASHRAE bio, especially the field of interest of each member.

6. Sub-Committee Reports

- A. Research: Tom Cappellin (Chair). Subcommittee meeting minutes of January 20, 2014; notes from the TC 6.1 are attached.

Mehdi Shahrestani presented on his submitted RTAR, "Developing a New Model for Dynamic Simulation of Hydronic Systems.

Motion by Greg Towsley, seconded by Mike McDermott, to further develop this into an RTAR. The motion passed 6-0-1, with the chair not voting. Greg also suggests the 90.1 Committee be advised of this proposed RTAR.

- B. Programs: Mike McDermott (Chair). Subcommittee meeting minutes of January 20, 2014, are attached.

There was one approved conference paper in New York.

Chair McDermott reviewed the tracks for programs in Seattle, Orlando and Atlanta. (Orlando and Atlanta Program Look Ahead is attached.)

Ideas for future programs are always welcome to Chair McDermott.

- C. Handbook: Jason Atkisson (Chair). Subcommittee meeting minutes of January 19, 2014, are attached.

Chair Atkisson reported TC 6.1 wanted to take over the editing responsibility for the Medium and High Temperature Water Chapter of the Handbook. Previous decision was to keep the chapter for historical purposes with no editing.

Motion by Rex Scare, seconded by Mike McDermott to accept the edits for Chapter 13 – Hydronic Heating and Cooling System Design. There was no discussion. Motion passed 5-0-2.

Motion by Rex Scare seconded by Mike McDermott to accept the edits for Chapter 48 – Heat Exchangers. There was no discussion. Motion passed 5-0-2.

- D. Chilled Water Sub Committee : Steve Tredinnick (Chair). Chair Tredinnick presented several cooling load profiles for offices and hospitals from over a dozen U.S. cities. A hospital in Miami was selected for the sample profile to use. Also, Chair Tredinnick has set up a Google document account to share and edit files and uploaded a sample chapter outline that was started.

- E. Membership: John Glunt (Chair). Chair Glunt was absent from the meeting.

Chair Bruenn reported 5 members have been moved to Provisional Status on the roster.

- F. Standards: Mike O'Rourke (Chair).

Standard 55-2013: Chair O'Rourke reported this standard has now been reissued and is in continuous maintenance status. A user's guide is being developed with Robert Bean leading this effort.

Standard 90.1-2013: Greg Towsley reported the following updates.

- Working on updates to the User's Manual
- 90.1 found a Handbook Chapter 13 error – recommended changes communicated at Handbook committee meeting

- New amendment for Hotel setback controls
 - expand setback requirements with occupancy sensor or card key
 - add ventilation control requirement – shutoff when vacant
 - Networked controls
- Addendum AK was not published in 90.1-2013.
- 90.1 progress indicator by PNNL
 - 110 addenda
 - 58 (69%) have energy impacts
 - 33 captured in progress indicator
 - Some key addenda not captured – pipe size, fan efficiency, small motor efficiency as examples
 - Goals
 - Regulated loads – 50% from 2004 baseline
 - Whole building – 40%
 - Calculated final savings estimated
 - Regulated loads – 37.8%
 - Whole building – 29% (Picked up another 7% points over gain of 2010 over 2004)
- 2016 Work Plan
 - Finalization of Scalar Factors for the 2016 Work Plan
 - Energy cost savings target for the 2016 Standard with the baseline of the ANSI ASHRAE/IES 90.1-2004 Standard: Whole building- 35-40% target which includes all energy end uses.

Mark Hegberg questioned why individual comments to 90.1 were not responded to or addressed?

Hydronics Working Group. Report from Greg Towsley.

- Heat Recovery WG
 - Rename from Service Water Heating to “Condenser Heat Recovery”
 - Specific facility requirements – focus on large hotels and hospitals
 - Need research and data to determine pat
- AEG Chilled Water Plant WG
 - Looking at analysis tools – do existing tools provide same output with same input?
 - Trying to get hands around the whole “system” energy
 - Develop a flow chart of the steps to complete an optimization that could be used to determine a near-optimum “standard” chilled water plant for the 90.1 Large Office model.
 - Suggesting of adding additional prescriptive requirements not yet covered
 - Long radius elbow – determine if long radius welded steel elbows meet the 90.1 economic criteria in chilled and condenser water systems; Basically, determine the straight-line payback for using LR instead of SR elbows. Analyze 2.5”, 8”, and 24”, and if all of them beat the required scalar, a requirement could be made for LR welded steel chilled water piping systems.
 - 6.1 WG for prescriptive requirements?

G. Professional Development (ALI). Chair Towlsey reported the following updates.

SDL 7 – Water Systems Design (Mark Hegberg) – Missing Q&As for all I-P chapters. No work received on the SI version. ASHRAE Special Pubs is beginning to prepare existing materials for publication.

SDL 12 – Heating Systems (Mark Hegberg) . No work received.

H. Web: Jason Atkisson (Chair). Chair Atkisson reports the website is up-to-date as of today's meeting.

He is still looking for someone to volunteer to take over the duties of the webmaster. Hooman Daneshmand indicated he would be willing to assist the new webmaster.

7. Liaison Reports from other TC's and Organizations.

Don Prather, representing the Air Conditioning Contractors Association, reported ACCA held their regular meeting.

8. Old Business:

- (a) IAPMO (International Association of Plumbing and Mechanical Officials) proposal to make major revisions to the hydronic requirements in the UMC (Uniform Mechanical Code). Chair Bruenn reports Ken Luther collected the comments from the committee members and submitted them for consideration.
- (b) Chair Bruenn reports Chapter 15 (S) – Medium and High Temperature Water heating system will be assigned to TC 6.2. Jason Atkisson will follow up with TC 6.2.
- (c) Chair Bruenn reports Chapter 28 (S) – Unit Ventilators, Unit Heaters and Makeup Air Units will now be assigned to TC 5.8. Jason Atkisson will coordinate this transition with TC 5.8.
- (d) Committee report on the split of TC 6.1 into two TCs. Committee is still discussing the potential of forming
- (e) The change of title of TC 6.1 from 'Hydronic and Steam Heating Equipment and Systems' to 'Hydronic and Steam Equipment and Systems' was submitted but not acted upon. This will be resubmitted by Chair Bruenn.

8. New Business:

- (a) Paul Lebbin from the National Research Council Canada updated the TC on the research being done regarding high performance buildings. A handout is attached to these meeting notes. A website updated for the life of the project can be found at: <http://www.nrc-cnrc.gc.ca/eng/solutions/collaborative/hpb.html>
- (b) Standard 125. Comments will be collected with a decision planning to be made in Seattle.

9. Meeting Adjournment:

Motion by Jason Atkisson, seconded by Mike McDermott, to adjourn the meeting. Meeting adjourned at 3:25pm.

Submitted by,
Bob Walker.
TC 6.1 Secretary

1

Date: 1-21-14

Not sure
...

TC Sign-in Sheet

Meeting Info: TC 6.1

Date: 1-21-14

[illegible]

[illegible]

RESEARCH SUBCOMMITTEE REPORT
ASHRAE TC 6.1 "Hydronic & Steam Heating Equipment & Systems"
ASHRAE WINTER CONFERENCE – New York City, NY
Monday, January 20, 2014
Thomas E. Cappellin – Chair

NOTES FROM RESEARCH SUBCOMMITTEE CHAIR'S BREAKFAST:

1. ASHRAE's CURRENT PROJECTS:
 - a. 62 active RPs having total value >\$ 10.8 million.
 - b. Since June, 2013:
 - i. 6 projects were completed.
 - ii. 10 new projects were started.
 - iii. 8 Tentative Research Projects (TRPs) were released for bid. No projects were on-hold this year waiting to bid due to a shortage of funding.
2. WS, RTAR, AND URP STATUS AS OF NEW YORK CITY MEETING:
 - a. RAC evaluated 6 RTARs (1650, 1715, 1716, 1722, 1725, and 1727).
 - b. RAC evaluated 4 WSs (1627, 1669, 1705, and 1724).
 - c. There are 11 potential TRPs ready for bid in spring 2014.
 - d. There are 5 URPs currently under review by RAC and TCs.
3. Why do RTARS get returned?
 - a. Most common reasons
 - i. Not appropriate for ASHRAE funding
 - ii. Inadequate references to past work or existing literature
 - iii. Project description not clear; how it will "advance" the state-of-the-art
 - iv. Budget does not seem in line with work to be completed
4. GRANTS-IN-AID (\$10k each)
 - a. A letter announcing the availability of ASHRAE Grants-In-Aid for Graduate Students was sent to over 300 colleges in October 2013
 - b. 64 candidates applied for a grant and 23 were selected by the RPS (last year, ASHRAE had 63 applicants and selected 23)
5. HOMER ADAMS AWARD
 - a. Meant for deserving graduate students who participated in an ASHRAE sponsored RP
 - b. There were 2 applicants, with 1 selected for the award
6. NEW INVESTIGATOR AWARD
 - a. 13 researchers were nominated for the award (7 nominations were made last year)
 - b. Applications were reviewed by ASHRAE on January 18
7. ANNOUNCEMENTS
 - a. Service to ASHRAE Research Award: no qualifying nomination were received this year
 - b. New (shorter, more concise) RTAR submittal form to be used; can be found on the ASHRAE Research website
 - c. It is important to obtain full TC vote accounting on approvals of submitted RTARs and WSs
 - d. Work Statement submittals based on conditionally approved RTARs must include descriptions of how approval conditions were met

NOTES FROM TC 6.1 RESEARCH SUBCOMMITTEE MEETING:

1. Scott Fisher RTAR:

RAC has rejected this RTAR (No. 1695). This subcommittee chair spoke with Section 6 Research Liaison during the Research Subcommittee Breakfast meeting and expressed disappointment that RAC appeared to be very arbitrary when conducting a series of reviews of TC 6.1s RTAR submittals over a period of several years.

- a. The Liaison suggested that this RTAR be re-submitted to RAC with qualifying statements as to the merit of the RTAR. This will be done by this subcommittee chair.

2. Mehdi Shahrestani (University of Reading in the U.K.) has submitted an RTAR titled "Developing a New Model for Dynamic Simulation of Hydronic Systems." Mehdi's research project deals with developing a computational method of comparing simulations of constant flow hydronic systems to variable flow systems, including all components (pumps, control valves, balancing valves, heating/cooling coils, pipes and fittings). The research project is intended to provide an accurate modeling and precise performance evaluation of Hydronic systems.

- a. This Research Subcommittee approved this RTAR for presentation to TC 6.1 Committee for their acceptance.
- b. Mehdi will prepare a "power point" presentation to explain the purpose and scope of the RTAR.

3. Justin Westmorland has volunteered to author a proposed RTAR titled "Steam System versus Heating Hot Water Efficiency Comparison." This research project would include site energy and power plant source energy together to produce a total energy and CO₂ comparison. The resulting comparison may be helpful with new "Green" design standards and Federal MACT requirements.

- a. This subcommittee chair will contact Justin to verify if he intends to move this topic into an RTAR format.

4. Stan Sveen has volunteered to author a proposed RTAR titled "Empirical Testing to Determine the Limitations of Various Hydronic and Chilled Water Distribution Piping Systems". The results of this research project may be suitable for entry into ASHRAE's Handbooks "Fundamentals" and "HVAC Systems and Equipment".

- a. Justification and Value to ASHRAE: Piping design practices regarding velocity are based on historical rules of thumb. Therefore this proposal is to better understand and validate the information ASHRAE has published in its handbooks regarding velocity restrictions in piping design practices. Specifically to make the design parameters explicit to the piping materials specified in engineering design. Additionally, to understand how velocity relates to degradation of system components. System components to be tested will be a defined and most likely be a function of pressure loss per component. Testing would be completed to provide information regarding initial design decisions and life expectancy of distribution piping systems by material.
- b. This proposed RTAR idea grew out of a precious research project projected to establish good practice design for minimum and maximum copper tube fluid velocity utilized in open and closed hydronic systems. The intent is to establish values for designers to consider in order to prevent oversizing the piping (too low velocity) or advancing wear of the internal pipe surfaces (too high velocity).

5. Bob Walker has volunteered to author a propose RTAR that would test the operation of various fluid flow control valves purported to have flow limiting and flow regulating characteristics. The purpose is to verify if they perform as advertised, or are they an expensive disappointment.

6. Scott Fisher has volunteered to author a proposed RTAR that would explore establishing credible allowance factors for accommodating aging in steel and iron pipes installed in open hydronic piping systems.
7. Review of additional topics for development into RTAR submittals:
 - a. Copper Tube Fitting Flow Factors and the Hydronic Coil Characteristic Modeling (Mark Hegberg).
 - b. Performance of ECM motors when applied to pumps – do they provided speed control and energy savings as advertised (Hans B. Hansen)?
8. Motion was tendered to adjourn (and unanimously accepted) the TC 6.1 Research Subcommittee meeting.

END OF MINUTES

Attachments: Attendance Sign-in sheets – two pages.
Current RTAR example forms – five pages

ATTENDANCE LIST

ASHRAE TC 6.1 HYDRONIC & STEAM HEATING EQUIPMENT & SYSTEMS - "RESEARCH" SUBCOMMITTEE

3:15 - 4:15pm - Monday, January 20, 2014 - Madison 6 (S5)

Name	Company and Address	Committee Position	Preferred Phone or E-mail Address
Thomas E. Cappellin	E.L. Pruitt Company Inc. 3090 Colt Road Springfield, IL 62707	Subcommittee Chair	tcappellin@msn.com
Scott Fisher	State Farm Mutual 112 E. Washington ST Bloomington IL 61710	CM	Scott.Fisher.agt@statefarm.com
Mehdi Shohrestani	University of Reading Berkshire, UK	Guest	m.shohrestani@reading.ac.uk
DAVID UZE	AKUSTRON & Fluid Technology 23 BERTHAUD AVE. TORONTO, CANADA	CM	dlee@akustronfluidtechnology.com
MIKE MCDERMOTT	GRUUMAN/BUTKUS 800 DAVIS EVANSTON, IL	Program's Chair	m.mcdermott@gruumanbutkus.com
ULF JOHANSSON	5925 148th St W Apple Valley, MN 55124	Guest	ulf.johansson@uponor.com

ATTENDANCE LIST

ASHRAE TC 6.1 HYDRONIC & STEAM HEATING EQUIPMENT & SYSTEMS - "RESEARCH" SUBCOMMITTEE

3:15 - 4:15pm - Monday, January 20, 2014 - Madison 6 (S5)

Name	Company and Address	Committee Position	Preferred Phone or E-mail Address
JOHN E. BADE	JOHNSON CONTROLS 631 S. RICHLAND AVE York, PA 17101	Chair	JOHN.E.BADE@JCI.COM
Jason Adkisson	Affiliated Engineers, Inc. Madison, WI	Chair Hartbrook Subcom	jadkisson@aereng.com
Bob Walker	BEIMO 1475 ST LAWRENCE CT FENTON MI 48430	Secretary	robert.walker@us.beimo.com
Tricia M. Bruenn	Belimo Belimo Danbury, CT	Chair	tricia@msn.com
STAN SVEEN	Upover 5925 198th St W. Apple Valley, MN 55124	Guest Pending C.M. Guest	Stan.sveen@upover.com
Aaron Stotko	Upover 5925 198th St W Apple Valley, MN 55124	Guest Pending C.M.	aaron.stotko@upover.com
Xu Wang	AHR1 2111 Wilson Blvd. Suite 500 Arlington, VA	Guest	XuWang@adninet.org

Research Topic Acceptance Request Cover Sheet

Date: February 16, 2012

(Please Check to Insure the Following Information is in the Work Statement)

- A. Title ☒
- B. Applicability to ASHRAE Research Strategic Plan ☒
- C. Application of the Results ☒
- D. State-of-the-Art (background) ☒
- E. Advancement to State-of-the-Art ☒
- F. Justification and Value to ASHRAE ☒
- G. Objective ☒
- H. Estimated Duration ☒
- I. References ☒

Title:

Experimental Evaluation of the Thermal and Ventilation
Performance of Stratified Air Distribution Systems Coupled
with Passive Chilled Beams

RTAR# 1666

(To be assigned by MORTS)

Results of this Project will affect the following Handbook Chapters,
Special Publications, etc.:

Underfloor Design Guild, DV Design Guide (RP-949),
Standard 62.1 Table 6-2, Fundamentals, Applications,

Responsible TC/TG: TC 5.3

Date of Vote: January 24, 2012

For		12
Against	*	0
Abstaining	*	1
Absent or not returning Ballot	*	5
Total Voting Members		18

Co-sponsoring TC/TG/MTG/SSPCs (give vote and date):

TC 4.7 (7-0-0-0-CNV) January 25, 2012

RTAR Lead Author: Fred Bauman, Ian Nelson

Expected Work Statement Lead Author: Fred Bauman, Ian Nelson

Potential Co-funders (organization, contact person information):

Chilled Beam Manufacturers, AHRI

Research Classification:

- ☒ Basic/Applied Research
- ☐ Advanced Concepts
- ☐ Technology Transfer

Has an electronic copy been furnished to the MORTS?

Has the Research Liaison reviewed the RTAR?

* Reasons for negative vote(s) and abstentions

Chair abstained

Yes

<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>

No

<input type="checkbox"/>
<input type="checkbox"/>

DRAFT RTAR Template

Experimental Evaluation of the Thermal and Ventilation Performance of Stratified Air

Title: Distribution Systems Coupled with Passive Chilled Beams.

Summary

Describe in summary form the proposed research topic, including what is proposed, why this research is important, how it will be conducted, and why ASHRAE should fund it (50 words maximum)

The project deliverable will be a research report presenting the following: (1) updated literature review of passive beams and combined stratified with passive beams (SPB) systems, (2) detailed description of experimental methods and results, (3) detailed description of CFD model, validation, and simulation results, (4) new guidelines for design and operation of SPB systems to achieve good energy and comfort performance, and (4) analysis of results and development of new calculation methods, energy simulation algorithms, and design tools, if applicable. A full set of all experimental data collected and CFD simulation results will accompany the final report. Upon completion of the project, a technical paper will be prepared to summarize the results of the research, including new guidelines and design tools for SPB systems.

Background

Provide the state of the art with key references (at the end of this document) substantiating it (300 words maximum)

Stratified air distribution systems are known to offer improvement in indoor air quality [1, 2, 3, 4, 5]. These systems are also known to offer some reduction in HVAC energy use [7, 8]. Guidelines for their application have been published by ASHRAE [6]. Building energy modeling of stratified systems has proven to be more challenging, but capabilities have been developed and are now available [7]. Although active chilled beams always result in a well mixed room, ceiling-mounted radiant cooling panels or passive chilled beams can provide additional sensible cooling for stratified air distribution systems.

Although, many studies have reported on displacement ventilation systems combined with chilled ceilings [8] including the impact of these systems on thermal comfort, air quality and energy efficiency [9, 16], none have reported on the interaction of passive chilled beams and stratified air distribution systems. Limited research on passive beams reported airflow patterns for an isolated passive beam in an environmental chamber with a uniform floor heat load. However the emphasis of these studies was on the velocity profiles of the generated thermal plume [17] and the interaction of a single heat load representing a person at a workstation positioned beneath the passive beam and the beam [18]. Neither study considered the interaction of the passive chilled beam with a stratified air distribution system.

Experimental data collected in environmental chambers has characterized the effect on airflow parameters of combined displacement ventilation and radiant panel systems. Ceiling temperatures lower than 16°C were shown to cause increased local air velocities near the floor, disrupting the displacement airflow pattern [10]. The ceiling temperatures must also be controlled to maintain a temperature stratification that does not exceed the limits for thermal comfort [11]. Heat source thermal plumes were shown to reduce the local velocity of the cooler air induced by the ceilings [14, 15]. Many studies have shown that even with high capacity cooling loads (62 W/m²) the combined systems do not generate velocities that cause draft [10, 11, 12]. The relationship between stratification and the ceiling cooling load was studied and reported that as the fraction of ceiling cooling capacity to the total cooling capacity increased, the room air stratification decreased [16]. Additionally, CFD was used in many studies to model the airflow characteristics and predict the thermal comfort of occupants [14, 15].

All of the research publications reviewed above used radiant panels as the equipment type in the chilled ceiling studies. The characteristics of heat transfer and the resultant airflow pattern for radiant panels is significantly different from passive chilled beams. The conclusions from the combined chilled ceiling plus displacement ventilation (CC/DV) systems do not necessarily apply to stratified systems using passive chilled beams.

Recently, the design, construction, and operation of a new call center with UFAD and passive beams was described [21]. Although the building is performing well from an energy and comfort point of view, one of the lessons learned was the finding that the passive beams disrupted (reduced) stratification more than expected. This result occurred despite CFD simulations during the design phase that predicted otherwise, indicating that the combination of a stratified system with passive beams is still not well understood.

Research Need

Use the state of the art described above as a basis to specify the need for the proposed effort (250 words maximum)

Passive chilled beams combined with stratified air distribution systems perform differently than combined systems using radiant panels, primarily due to the downward convective flow produced by the passive beams. Presently, no studies report the resultant airflow characteristics. Many of the current guidelines for combined systems are only applicable to radiant panel designs, namely the ceiling surface temperature specifications. The experimental data obtained in this project will be used to prepare design guidelines for combined systems that are applicable to passive chilled beams and specify the operating parameters necessary to achieve thermal comfort.

The analysis of the test results will enable designers to predict the significant environmental parameters based on the passive beam design and operational specifications. New algorithms will also enable the development of new and improved energy modeling capabilities for SPB systems.

Project Objectives

Based on the identified research need(s), specify the objectives of the solicited effort that will address all or part of these needs (150 words maximum)

The objectives of this project will be to:

Perform review of literature and selected passive beam projects (if available) to confirm the state of the art and consider opportunities for advancement in parallel with the deliverables identified above.

Conduct full-scale tests with a representative selection of passive chilled beams in combination with stratified air distribution systems (DV and UFAD) for specified test conditions and covering a full range of beam capacity values from zero to the maximum needed to disrupt the stratified performance of the room.

Develop a CFD model of a prototype SPB system and validate against experimental results. Using the validated CFD model, conduct supporting simulations to guide the selection of critical experimental test configurations and enlarge, where appropriate, the database generated by this project.

Analyze the test results to determine new guidelines, calculation methods, or design tools for purposes of predicting the temperature stratification and ventilation performance of the stratified environment.

Develop algorithms or regression equations to predict SPB system performance suitable for implementation in building energy simulation programs.

Expected Approach

Describe in a manner that may be used for assessment of project viability, cost, and duration, the approach that is expected to achieve the proposed objectives (200 words maximum).

Check all that apply: Lab testing ☒, Computations ☐, Surveys ☐, Field tests ☒, Analyses and modeling ☒ Validation efforts ☐ Other (specify) ()

Conduct full-scale tests with a representative selection of passive chilled beams in combination with stratified air distribution systems (DV and UFAD) for specified test conditions and covering a full range of beam capacity values from zero to the maximum needed to disrupt the stratified performance of the room.

Develop a CFD model of a prototype SPB system and validate against experimental results. Using the validated CFD model, conduct supporting simulations to guide the selection of critical experimental test configurations and enlarge, where appropriate, the database generated by this project.

Analyze the test results to determine new guidelines, calculation methods, or design tools for purposes of predicting the temperature stratification and ventilation performance of the stratified environment.

Develop algorithms or regression equations to predict SPB system performance suitable for implementation in building energy simulation programs.

Relevance and Benefits to ASHRAE

Describe why this effort is of specific interest to ASHRAE, its impact, and how it will benefit ASHRAE and the society. How does it align with ASHRAE Strategic Plans and Initiatives? How does it advance the state of the art in this area in general? Are there other stakeholders that should be approached to obtain relevant information or co-funding? (350 words maximum)

The experimental results and recommendations will result in previously unavailable new design and operating guidelines for combined stratified with passive beams (SPB) systems. New tools and models will improve the ability of designers to evaluate and predict the energy and comfort performance of SPB systems. The improved understanding achieved from this project will allow this promising integrated technology to be considered more confidently by system designers. This will reinforce the value of ASHRAE guidelines to building system designers and help to ensure mechanical system design and installation provides comfort while supporting ASHRAE's net-zero energy design strategies.

Anticipated Funding Level and Duration

Funding Amount Range: \$ 150,000 to 200,000

Duration in Months: 18 to 24

References

List the key references cited in this RTAR

- [1] Lee, K.S., Z. Jiang, and Q. Chen. 2009. Air distribution effectiveness with stratified air distribution systems. *ASHRAE Transactions*, 115(2).
- [2] Zhang P. 2007. Ventilation Considerations for Indoor Environmental Quality for a Control Center. *Proceedings of Clima 2007*.
- [3] Rimmer J., B. Tully and M. Buck. 2010 Displacement Ventilation as a Viable Solution for Patient Rooms. *Proceedings of Clima 2010*.
- [4] Seppänen, O. 2007. Ventilation Strategies for good indoor air quality and energy efficiency, *Proceedings of 2nd PALENC Conference and 28th AIVC Conference on Building Low Energy Cooling and Advanced Ventilation Technologies in the 21st Century*, pp. 929 – 35.
- [5] Bolster, D. T. and P. F. Linden. 2007. Contaminants in ventilated filing boxes. *J. Fluid Mech.* (2007), vol. 591, pp. 97–116.
- [6] Chen, Q. and L. Glicksman. 2003. System performance evaluation and design guidelines for displacement ventilation. Atlanta, GA: ASHRAE 2003.
- [7] Webster, T., F. Bauman, F. Buhl and A. Daly. 2008. Modeling of Underfloor Air Distribution (UFAD) Systems, *Proceedings from the Third National Conference of IBPSA-USA, Berkeley, USA*
- [8] S.B. Riffat, X. Zhao, P.S. Doherty (2004). "Review of research into and application of chilled ceilings and displacement ventilation systems in Europe." *International Journal of Energy Research* 28: 257-286.
- [9] Novoselac A. and Srebric J. 2002. A critical review on the performance and design of combined cooled ceiling and displacement ventilation systems. *Energy and Buildings*, 34 (5), 497-509.
- [10] D.L. Loveday, K. C. P., A.H. Take, S.Hodder, L.D. Jeal (1998). "Designing for Thermal Comfort in Combined Chilled Displacement Ventilation Environments." *ASHRAE Transactions* 104: 901-911.
- [11] Behne M. 1999. Indoor air quality in rooms with cooled ceilings. Mixing ventilation or rather displacement ventilation. *Energy and Buildings*, 30, 155-166.
- [12] K. Fitzner, Displacement ventilation and cooled ceilings, results of laboratory tests and practical installations, *Proceedings of Indoor Air '96* 1 (1996) 41-50.
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NYC MEETING MINUTES
PROGRAMS SUBCOMMITTEE

ASHRAE TC 6.1 "HYDRONICS AND STEAM HEATING EQUIPMENT AND SYSTEMS"

- A. Meeting was called to order at 2:15 pm, 20 January 2014 at NYC by Mike McDermott
- B. Members and Visitors projected attendance

Name - Position

Mike McDermott – Prog Chair

Tricia Bruenn - Chair

Scott Fisher - CM

Bob Walker - Secretary

Nels Bidstrup - CM

Jason Atkisson - Handbook

Edward Tsui - VM

Hans Brink Hanson - CM

John Bade - Guest

Mehdi Shahreslani - Guest

Aaron Stotfo - Guest

Ulf Johansson - Guest

Stan Sveen - Guest

David Lee - CM

Xudang Wang -Guest

- C. Current and future programs will be discussed.
 - 1. We have no programs in NYC.
 - 2. Feedback from CEC on rejected programs – Lower Rank.
 - 3. See attachment 1 look ahead spread sheet for future programs.
 - 4. For detailed information on how the above programs as to be assembled and submitted visit ASHRAE's web site for information and direction.
- D. Adjournment of subcommittee at 4:15 pm.

TC-6.1 Programs Look Ahead - Seattle 2014 Meeting

Year		2015		2016	
Date		June 28-July 2		Jan 24-28	
City		Atlanta		Orlando	
Tracks		www.ashare.org/atlanta/		www.ashare.org/orlando/	
1	HVAC & R Systems and Equipment			HVAC & R Systems and Equipment	
2	HVAC & R Fundamentals and Applications			HVAC & R Fundamentals and Applications	
3	Research Summit				
4					
5					
6					
7					
8					
9					
Technical Paper		Paper: September 23		Paper: April 14	
Conference Paper		Abstract: Sept. 23; Paper: Jan. 9		Abstract: March 24; Paper: July 9	
Seminar		Proposal: January 6 to February 14		Proposal: June 1 to August 13	
Forum		Proposal: January 6		Proposal: June 1 to August 13	

TC 6.1 Handbook Subcommittee Minutes

January 19, 2014

2014 Winter Meeting – New York

Attendees:

Jason Atkisson	Mick Schwedler	Tricia Bruenn
Bob Walker	Scott Fisher	Steve Tredinnick
David Lee	David McDaniel	Stan Sveen
Ulf Johnson	Eqils Dzelzitts	Niels Bidstrup
Hans Brink Hansen	Ramez Afify	Greg Towsley
Thomas Neill	Alison Williams	Sarah Widder
Steve Severini	Mehdi Shahrestani	

1. Introductions of Attendees
2. Reviewed Committee Assigned Handbook Chapters & Status

2016 Systems and Equipment

Chapter	Title	Lead Author	Status
11	Steam Systems	Ramez Afify	To Be Reviewed in Seattle
13	Hydronic Heating & Cooling System Design	Mick Schwedler	Final Edits Completed /Ready for Approval by TC
14	Condenser Water Systems	Steve Tredinnick	Final Edits Not Yet Completed /To Be Voted in Seattle
15	Medium and High Temperature Water Heating Systems		TC 6.2 is considering taking over this Chapter
28	Unit Ventilators, Unit Heaters and Makeup Air Units	Scott Fisher	To Be Reviewed in Seattle / Attempting to Move to TC 5.3 for 2020 version
32	Boilers	Evans Lizardos	In Need of Updating
36	Hydronic Heat Distribution Units and Radiators		In Need of Updating
44	Centrifugal Pumps	Neils Bidstrup	Cursory Review during Subcommittee / Awaiting Final Review by Volunteer Reviewers
46	Pipes, Tubes, & Fittings	N/A	Not Being Edited this Cycle / Being Combined with Ch. 22 (F – 2021)
47	Valves	Bob Walker	In Progress / Seeking Additional Reviewers
48	Heat Exchangers	Scott Fisher	Final Edits Completed /Ready for Approval by TC

2017 Fundamentals

Chapter	Title	Lead Author	Status
22	Pipe Sizing	Scott Fisher	In Need of Updating

3. Greg Towsley noted that there was an interpretation by 90.1 that would require modifications to Chapter 13 - Hydronic Heating & Cooling System Design. Mick Schwedler to provide the minor update and resend to Handbook Subcommittee Chair.
4. Niels Bidstrup reviewed his edits/comments to Chapter 44. Additional review still required by reviewers. Jason recommended that the Chapter, as currently edited, be sent to additional reviewers immediately following the meeting with a requested response date. If no response provided, Jason is to be notified so that additional reviewers can be requested. The intent is to have this chapter reviewed and ready for a vote by Seattle.
5. Bob Walker provided an update regarding the status of Chapter 47 – Valves. Bob specifically requested additional reviewers for check valves, balancing valves, and pressure reducing valves, as well as someone to review the SI units.
6. A representative from TC 1.4 – Control Theory & Applications was in attendance. Bob has shared Chapter 47 – Valves with TC 1.4 for comments regarding control valves.
7. A request for additional lead authors for chapter that do not yet have one assigned was made.
8. Adjourn