

**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.	<u>TC 2.6</u>	DATE	<u>March 17, 2014</u>
TC/TG/MTG/TRG TITLE	<u>Sound and Vibration</u>		
DATE OF MEETING	<u>January 20th, 2014</u>	LOCATION	<u>New York, NY</u>

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
<b>Voting Members:</b> John Dunlap Curt Eichelberger Dan LaForgia Jerry Lilly Dustin Meredith Erik Miller-Klein Kim Osborn Karl Peterman Raj Prime Douglas Reynolds Kenneth Roy Michael Schwob Terence Tyson Randal Zimmerman  <b>Corresponding Members:</b> David Carroll Zvirimumwoyo Chinoda Nicole Cuff Ronald Eligator Mark Fly Radha Ganesh Robert Hassler Joseph Horesco Reginald Keith Jim Kline Will Kowald Patrick Marks Paul Meisel Matthew Murello		<b>Voting Members:</b> Francis Babineau Eddie Lau Richard Peppin Matthew Stead  <b>Corresponding Members:</b> Danny Abbate Rami Alkhalil Jeffrey Babich Mark Bastasch Joseph Bridger Norm Broner Todd Busch Erroll Eaton Michael Froehlich Kevin Gaghan Jason George John Gierzak Lewis Goodfriend Brian Guenther Ali Kemal Guney Art Hallstrom Ali Herfat Michael Keating Manoj Khati Marvin Kloostra Kevin Lai Brian Landsberger Joshua Leasure Geoff Leventhall		<b>Visitors:</b> Victor Clemente Sami Elkhazin Tim Kuski Tim Mathson Joe Brooks David Herin John Murphy Franco Cincotti Matthew Hooti Gregory Miller Curtis Peters Tiberio Spulber Zach Minear Scott Campbell Dave Meredith Andrew Jenkins Eric Benoit Charles Dorgan Lawrence Copley Tao Xie Jack Zybura Emanuel Mouratidis Miles Possing Jane Miller Peter Bushnell Kenny Hightower

ASHRAE TC 2.6 Sound and Vibration Control

Meeting Minutes & Reports

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New York NY

MEMBERS PRESENT	YEAR APPTD	MEMBERS ABSENT	YEAR APPTD	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
Patrick Oliver Brian Reynolds Lauren Ronsse Mark Schaffer Robert Simmons Jason Swan Jack Wang Lily Wang Zhiping Wang Steve Wise Umberto Berardi Martin Deveci		Robert Lilkendey Charles Mattocks Greg Meeuwsen Alexander Michaud Andrew Mitchell Ralph Muehleisen Jose Nepomuceno Chris Papadimos John Pappas James Pooler Michael Resetar William Rockwood Erica Ryherd Benjamin Sachwald Ken Shook Tim Simcoe John Sofra Michael Spencer William Stewart Nicholas Sylvestre-Williams Vijay Tripathi Jonathan Weinstein Roman Wowk		

**DISTRIBUTION**

<b>All Members of TC/TG/MTG/TRG plus the following:</b>	
TAC Section Head:	Thomas Sobieski
TAC Chair:	Walter Grondzik
All Committee Liaisons As Shown On TC/TG/MTG/TRG Rosters:	Sheila Hayter Hugh McMillan Cyrus Nasser Harvey Sachs Michael Vaughn Chris Fudge
Manager Of Standards:	Stephanie Reiniche
Manager Of Research & Technical Services:	Mike Vaughn

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## Main Committee Meeting Attendance List

### Voting Members:

John Dunlap	Dunlap & Partners	<a href="mailto:jdunlap@dunlappartners.com">jdunlap@dunlappartners.com</a>
Curt Eichelberger	Johnson Controls	<a href="mailto:curtis.eichelberger@jci.com">curtis.eichelberger@jci.com</a>
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### Corresponding Members:

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**Main Committee Meeting Attendance List Continued**

**Guests Present**

Victor Clemente	IAC Acoustics	<a href="mailto:victor.clemente@iac-acoustics.com">victor.clemente@iac-acoustics.com</a>
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Tim Kuski	Greenheck	<a href="mailto:tim.kuski@greenheck.com">tim.kuski@greenheck.com</a>
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**ASHRAE TC 2.6 Sound and Vibration Control  
Main Committee Meeting Agenda**

**2:15-4:15 PM Monday, January 20, 2014**

**New York – Hilton 4<sup>th</sup> Floor – New York, NY**

**NOTE: All Task Group Chairs and Subcommittee Chairs are asked to submit written report to the Secretary (Dan LaForgia) before February 3.**

1. **Call to order** (Meredith) [3 minutes]
  - 1.1. Read scope of TC 2.6 – Read by Dustin Meredith
  - 1.2. Read ASHRAE Code of Ethics statement –Reviewed by Dustin on Website
  - 1.3. Additions and/or modifications to the agenda? - No
2. **Introduction of those present** (All) [5 minutes]
  - 2.1. Welcome new members and visitors
3. **Confirmation of current voting members** (Schwob) [3 minutes] – Reviewed by Mike Schwob – Quorum established – list voting members
4. **Review and approval of the minutes** (Meredith) [3 minutes] – Reviewed by Mike Schwob – Approved by Eichelberger – 2nd Mike S.
5. **Secretary's report** (LaForgia) [3 minutes]
6. **ICC A117 Review ( International Code Council) – Mark Shaffer & Ken Roy – Calculating reverb time and chart for absorption recommendations based on NRC– TC to support language as presented in attached document – Language is included in appendix Doug Reynolds– Approve – Second Jerry Lilly – Motion Passes**
7. **TC Chair's meeting report** (Meredith) [5 minutes]
8. **Chair's announcements and correspondence** (Meredith) [3 minutes]
  - 8.1. Call for conference paper reviewers
9. **Subcommittee reports (written reports to be provided to Secretary)**
  - 9.1. **Research Subcommittee** (Eichelberger) [20 minutes]
    - 9.1.1. Research Chair's meeting report
    - 9.1.2. Ongoing research projects
      - 9.1.2.1. RP-1408 Attenuation of Lined Ducts with PI Reynolds/UNLV (Lilly)
        - 9.1.2.1.1. 6 month extension no cost add – Motion by (Eichelberger) Second (Lilly) – Motion Passes
      - 9.1.2.2. RP-1529 Numerical Modeling of Lined Ducts (Marks)
        - 9.1.2.2.1. 6 month extension no cost add – Motion by (Eichelberger) Second (Lilly) – Motion Passes
    - 9.1.3. Work Statements/RTAR's/URP's
      - 9.1.3.1. RTAR-1560 Installed Performance of Vibration Isolators (Simmons)
      - 9.1.3.2. RTAR-\*\*\* Effect of HVAC Noise in Hospitals (Babineau/Roy)
      - 9.1.3.3. RTAR-1707 Annoyance Thresholds of Tones in Noise (Wang)
    - 9.1.4. Topics for future research
      - 9.1.4.1. Fluctuation Criteria
      - 9.1.4.2. Non-Fibrous Duct Liners
      - 9.1.4.3. Flow noise generation in ducts

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- 9.1.4.4. Flex Ducts
- 9.1.4.5. IL in terminal units
- 9.1.4.6. ASHRAE rebrand – RTAR on speech privacy / noise from outside
- 9.2. **Programs Subcommittee** (Miller-Klein) [15 minutes]
  - 9.2.1. Program Chair's meeting report
  - 9.2.2. Programs this meeting
    - 9.2.2.1. Seminar 12- Hydronic System Acoustics – Jack / Pat Marks / Patrick Oliver
  - 9.2.3. Potential programs next meeting – Seattle, June 2014
    - 9.2.3.1. Basics of HVAC Noise Control / Green Building Acoustics / Track 1 - Indoor
- 9.3. **Publications Subcommittee** (Wise) [10 minutes]
  - 9.3.1. Handbook chapters
    - 9.3.1.1. Handbook Applications 2015 (Wise/Peppin)
      - 9.3.1.1.1. Vibration table in chapter 48 to be reviewed at later date – Motion (Reynolds) – second (Osborn) Vote – 10,1,0 CNV
      - 9.3.1.1.2. Approve handbook - Motion (Dunlop) Seconded Vote 12,0,0, CNV
    - 9.3.1.2. Handbook Fundamentals 2017 (Weinstein/Wise)
  - 9.3.2. Other publications
  - 9.3.3. Web page (Schwob)
    - 9.3.3.1. Updated Research page (reports available online)
    - 9.3.3.2. Publications
    - 9.3.3.3. meetings locations updated
- 9.4. **Standards Subcommittee** (Ronsse) [20 minutes]
  - 9.4.1. SPC 79 – Method of Test for Fan Coil Units (Oliver) –
    - 9.4.1.1. Met Saturday – Defining sounds testing in SPC 79 standard
  - 9.4.2. SPC 130 – Method of Test for Rating Ducted Air Terminal Units (Zimmerman)
    - 9.4.2.1. – Met Sunday – no mention in AHRI – New test procedures for sound and pressure drop testing – vote soon
  - 9.4.3. SPC 189 – Design for High Performance Green Buildings (Bridger/Schaffer)
    - 9.4.3.1. Subcommittee formed -
  - 9.4.4. SPC 197 – Method of Test for Passive Vibration Isolators (Peterman)
    - 9.4.4.1. RTAR being done for testing
  - 9.4.5. SPC 200 – Method of Test for Chilled Beams (Zimmerman)
    - 9.4.5.1. Standard out for review – Web meeting in a few weeks
  - 9.4.6. GPC 10 – Interactions Affecting the Achievement of Acceptable Indoor Environments (Wang)
    - 9.4.6.1. In continuous review – modifications on humidity – not much change on acoustics
  - 9.4.7. Updates from Other Standards Organizations
    - 9.4.7.1. AHRI (Abbate)
      - 9.4.7.1.1. New standard 230 – Sound intensity – under review – AHRI 270 and 350 – Working with Pool Heater – 1280 for chillers – filing a research project with University of Nebraska. Patrick Marks filled in for Dan - AHRI 885 – Duct liner specified
    - 9.4.7.2. AMCA (Brooks) -

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- 9.4.7.3. ANSI (Ali Herfat) - None
  - 9.4.7.3.1. Working Group on Sound Measurement in Rooms (Lilly)
    - 9.4.7.3.1.1. Get out to ballot
- 9.4.7.4. ASTM (Peppin); E33 (Lilly) – NONE
- 9.4.7.5. ASTM E477 – New 13 standard coming out – round robin test.
- 9.4.7.6. ISO (Reynolds); ISO TC205/TC43.2 (Roy)
  - 9.4.7.6.1. Meeting is tomorrow – 10 panels – Indoor acoustic environment.
- 9.5. **Standing Subcommittees** [10 minutes]
  - 9.5.1. Sound Criteria (Wang)
    - 9.5.1.1. Draft work statement in Seattle
  - 9.5.2. Vibration Isolation (Peterman)
    - 9.5.2.1. RTAR for determining a testing method and apparatus for testing.
- 9.6. **Operations Subcommittee** (Schwob) [15 minutes]
  - 9.6.1. Bylaws (Meredith) – On website
  - 9.6.2. Honors and awards (Wang) – Distinguished service awards – nominate members for fellowship / lecturer – looks at webpage.
  - 9.6.3. Long range planning (Meredith) –
    - 9.6.3.1. Changes in leadership – new team – vice chair available for subcommittees.
  - 9.6.4. Membership (Schwob)
  - 9.6.5. Liaisons (Schwob)
    - 9.6.5.1. International Green Construction Code update( None)
    - 9.6.5.2. ASHRAE TC 2.1 Physiology and Human Environment (Wang)
      - 9.6.5.2.1. Meet tomorrow afternoon – No change
    - 9.6.5.3. ASHRAE TC 2.7 Seismic and Wind Restraint Design (Meissel)
      - 9.6.5.3.1. SPC 171 – revising testing standard / handbook work being completed.
    - 9.6.5.4. ASHRAE TC 5.1 Fan Design and Application (Osborne/Brooks)
      - 9.6.5.4.1. Overseeing AMCA 210 revision / Plenum fan inlet effects (1420 and 1216)
    - 9.6.5.5. ASHRAE TC 5.2 Duct Design (Gierzak) – No update
      - 9.6.5.5.1. Duct Design Guide
    - 9.6.5.6. ASHRAE TC 5.3 Room Air Distribution (Oliver/Zimmerman) – No update
    - 9.6.5.7. ASHRAE TC 6.10 Fuels and Combustion (Herrin) –
      - 9.6.5.7.1. Final report available on commercial boilers
    - 9.6.5.8. ASA (Wang)
      - 9.6.5.8.1. Meeting in Providence RI in May – Health care facilities / green building acoustics / room acoustics / wind turbine noise / construction noise / loud speakers in rooms
    - 9.6.5.9. VISCMA (Peterman)
      - 9.6.5.9.1. Code Changes
    - 9.6.5.10. Others: CTI, INCE, NCAC, CIBSE etc.
      - 9.6.5.10.1. INCE Special session @ NoiseCon on HVAC noise control Mark Schaffer to speak Steve Lind doing refrigeration noise.
      - 9.6.5.10.2. NCAC – More members to come – supporting efforts of TC 2.6
- 10. **New business/Old business** [5 minutes]



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- 10.1. **Hot topic – SCOPE change** – Hot topic session held in NY and subcommittee will propose language change that will be voted on in the upcoming summer meeting (Seattle WA)
- 10.2. Review Scope of Committee
- 11. Next meeting date and location – Seattle, WA; June 30, 2014**
- 12. Adjournment – Motion passed**

Curt Eichelberger ([curtis.eichelberger@jci.com](mailto:curtis.eichelberger@jci.com))

### Highlights of Research Chair's meeting:

- Harvey Sachs ([RL2@ashrae.net](mailto:RL2@ashrae.net)) is our new liaison. Reminder that our Research Liaison, should review all RTARs, WS and should participate in all PMS meetings. Please copy Curt Eichelberger on all correspondence with the Research Liaison.
- A new RTAR form is posted on the web site.
- There are no projects on hold for funding.
- RTARs due May 15, August 15 and December 15.

### Ongoing Research Projects:

RP-1408 The effect of lining length on the insertion loss of acoustical duct liner. Jerry Lilly PMS chair. Dr. Doug Reynolds, UNLV, principle investigator. The objective of this research is to show how the sound attenuation of lined ducts depends on duct length. This project is operating under a no-cost extension which has been granted to June 2014. The UNLV Lab has finished testing all the round ducts. Rectangular ducts being fabricated at E. H. Price and UNLV will start these ducts in March. E. H. Price will also be testing the sound absorption coefficients of the duct liner, in accordance with ASTM C423, for inclusion in the final report. Target completion date for this project is August 2014.

RP-1408 Extension. An extension to the 1408 Work Statement was approved January 2010. The purpose is to collect vibration and sound intensity test data on a small subset of duct configurations. This test data will then be used to validate the analytical models of breakout noise that will be developed in RP-1529. UNLV have done some preliminary sound intensity testing to validate their test apparatus. In March Curt Eichelberger will visit UNLV to will collaborate on sound intensity on 24" round duct. Target completion date of August 2014. TC 2.6 voted to recommend a no-cost extension to January 1, 2015,

RP-1529 Full frequency numerical modeling of sound transmission in and radiation from lined ducts – Pat Marks, PMS Chair. Dr. David Herrin, University of Kentucky, principle investigator. This project will develop and validate full-frequency numerical modeling techniques for sound transmission through, and radiation from, HVAC ductwork. So far the preliminary analysis models look very promising. All duct configurations will be run by July 2014. Target completion date is mid 2014, but this will likely be delayed until completion of RP-1408 testing. TC 2.6 voted to recommend a no-cost extension to January 1, 2015.

### RTARs:

RTAR-1707 Annoyance Thresholds of Tones in Noise as Related to Building Services Equipment. Lily Wang championed this RTAR, along with contributions from Mark Schaffer, Steve Wise and Patrick Oliver. RAC conditionally approved the RTAR in their June 2013 meeting and instructed the TC to proceed with preparing the WS.

Vibration Isolation Dynamics Test for HVAC Equipment. Jack Wang prepared a new draft of an RTAR (formerly 1560). The draft was reviewed and edited at the Vibration Subcommittee and SPC 197 meetings. Jack and other contributors will be revising further and submitting to TC 2.6 for letter ballot.

### **Topics discussed and prioritized for future research:**

The top topics discussed during the research subcommittee meetings are listed below in order of priority.

1. **Effect of HVAC noise in hospitals** – Ken Roy agreed to champion this topic and prepare an RTAR on speech privacy in health care facilities.
2. **Room effect** (include effect of single pass ceiling systems) – Joe Bridger agreed to champion this topic and prepare an RTAR, along with Ken Roy and Erik Miller-Klein. This task will start with a good literature review.
3. **Fluctuation criteria** – Objective would be to develop a metric for Criteria section of Handbook. Criteria subcommittee decided to work on tone criteria first.
4. **Non-fibrous” duct liners** – Application related, not product ratings.
5. **Flow noise generation in ducts** – No champion for this topic at this time.

Added topics that were discussed, but not prioritized, include:

- **Flex duct** – Where does the sound go? Where should the duct end correction be applied?
- **IL in terminal units** – Why isn't this accounted for and is it important?
- **With ASHRAE rebranding itself and promoting a broader scope to include the built environment, we may want to consider added topics such as:**
  - Speech privacy, and the opposite, speech communication.
  - Noise intrusion from outside or adjacent interior spaces.
  - Background noise consideration that extends beyond HVAC system noise, such as sound masking.

**ASHRAE TC 2.6 Programs Subcommittee Report**

Submitted by: Erik Miller-Klein

Program Topics –NYC, Seattle, and Chicago

Status	Subject	Type	Champion
New York 2014 (Sunday 1/19 @ 1:30 PM)	<b>On-going Equipment Series (TRACK 7: Hydronic System Design)</b> <ul style="list-style-type: none"> <li>Chillers (Jack Wang)</li> <li>New Standards for Chiller Sound Ratings (Pat Marks)</li> <li>Chilled Beam (Patrick Oliver)</li> </ul>	Seminar <b>12</b>	Pat Marks
Resubmit - Seattle 2014	<b>Basics of HVAC Noise Control or Workshop (Seattle - Track 5: Applications or Track 6: Standards, Guidelines, Codes)</b> <ul style="list-style-type: none"> <li>Environmental Noise Codes: Current and Future (Miller-Klein)</li> <li>Objectionable: Tones &amp; Fluctuations (Jennifer Francis)</li> <li>Outdoor Equipment Noise Control (Dan Laforgia/Sami Elkhazin)</li> </ul>	Seminar	Erik Miller-Klein
Resubmit - Seattle 2014	<b>Green Building Acoustic Performance – LEED, IGCC, PMP Best Practices (Seattle - Track 6: Standards, Guidelines, Codes)</b> <ul style="list-style-type: none"> <li>Kenneth Roy</li> <li>Lily Wang</li> <li>Curt Eichelberger</li> </ul>	Seminar	Lily Wang
Seattle 2014	<b>Track 1: Indoor Environment – Health, Comfort and Productivity</b>  <b>Track 7: Refrigeration</b>  <b>Track 8: Installation, Commissioning, Operation, Maintenance of Existing Buildings</b>		
Seattle 2014	<b>Workshop? – Select Track</b>		
Chicago 2015	<b>Track 1: Systems and Equipment</b> TC 5.3 - Air Distribution (co-sponsor): Randy Zimmerman Practical Seminar on Quieting Air Distribution Systems <ul style="list-style-type: none"> <li>Duct Velocities</li> <li>Insulation of VAVs</li> </ul>		

	<ul style="list-style-type: none"> <li>• Radiated/Inlet Noise for Fan Powered Boxes</li> <li>• Pressure drop across the valve</li> </ul>		
Chicago 2015	<b>Track 2: Fundamentals and Applications</b>		
Chicago 2015	<b>Track 3: Industrial Facilities</b>		
Chicago 2015	<b>Track 4: Large Buildings: Mission Critical Facilities and Applications</b> <ul style="list-style-type: none"> <li>• Generator Noise Control</li> <li>• Transformer &amp; Generator Vibration Noise Control for upper level installations</li> <li>• Manufacturer Perspective (Robert Simmons)</li> </ul>		Mark Schaffer Jerry Lilly Reggie Keith Robert Simmons
Chicago 2015	<b>Track 6: Life Safety</b>		
Chicago 2015	<b>Track 8: Hospital Design and Codes</b> <ul style="list-style-type: none"> <li>* Speech Privacy</li> <li>* HCAPHS</li> <li>* 2014 FGI Guidelines (Jeff Boldt)</li> </ul>		
	<b>Workshop? – Select Track</b>		
Future	<b>Basics of HVAC Noise Control (New Sub-Topics)</b> <ul style="list-style-type: none"> <li>• Duct Liner, Breakout &amp; Flanking (Doug Reynolds)</li> <li>• Updated algorithms for insertion loss, break-out, an</li> </ul>	Seminar	Jerry Lilly?
Future	<b>Advanced Topics, Conference Papers...</b> <ul style="list-style-type: none"> <li>• Speech Privacy and Interior Noise with Low Noise Open Offices</li> <li>•</li> </ul>	Seminar	Champion?

Seattle 2014 (Summer Conference)

Upcoming Deadlines:

**February 13, 2014** – Seminar and Forum Program Proposals Due

Chicago 2015 (Winter Conference)

Upcoming Deadlines:

**March 24, 2014** – Conference Paper Abstracts Due

**April 24, 2014** – Technical Paper Abstracts Due

**June 1, 2014** – Seminar and Forum Program Proposals Due

ASHRAE TC 2.6 Sound and Vibration Control

Meeting Minutes & Reports

January 20 2014

New York NY

<b><u>TC2.6</u></b>	<b><u>Programs Meeting</u></b>
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## **ASHRAE TC 2.6 Publications Subcommittee Report**

### **Meeting Minutes**

March 19 2014

Submitted by: Steve Wise

### Applications Handbook, 2015 revision

By a 12-0 vote of members in attendance, the TC approved the composite revisions to Ch48 for submittal to ASHRAE in the usual 4-year print version rev cycle. Many thanks to the many volunteers for various reviews/comments/updates.

In general, we are satisfied that the chapter is accurate and up to date, though such things as new duct attenuation data from our ongoing research projects could not be incorporated at this time.

Four issues were discussed that may factor into future revisions in this chapter:

1. The chapter is now accessible via ASHRAE HANDBOOK ON-LINE, for people wishing to pay an extra \$49/yr. Right now, there are format issues: it is difficult to scroll through the text on a small mobile device, and certain graphics may be hard to view. We may also want to establish some keyword links so that readers can jump to particular issue of interest.

Any volunteers to help in that endeavor are welcome.

2. We need to decide if the Applications chapter should do a more thorough job referencing other pubs available at the bookstore like:

\*ASHRAE STD 189 "Green Buildings"

\*"Performance Measurement Protocol"

One of the motivations is that ASHRAE has expanded their scope beyond what might historically have been called "noise control for HVAC equipment" to include "guidelines for room acoustics", which gets into things like reverb time and room-to-room transmission of voices and other non-HVAC. .

3. Suggestion and examples of a revised master table in the VIBRATION section was presented by Reggie Keith. Reggie, Curt, Rich, Steve, Don have agreed to start coordinating on an update for that – tentatively scheduled to be presented in Seattle.

4. Post meeting, it was pointed out that the breakin/breakout section had confusing references to tables with regard to TL data apparently based on 20-ft lengths, and no clear and precise methods for dealing with other lengths. This is a good topic for Seattle to possibly address for the on-line version.

### Fundamentals Handbook, 2017 revision

Rich Peppin and Eric Sturm have volunteer to take the first look at it to start the rev cycle.

## ASHRAE TC 2.6 Sound and Vibration Control

### Meeting Minutes & Reports

January 20 2014

New York NY

#### Other pubs -

1. Mftr Guide - Curt, Pat, Dustin have agreed to look at that to decide if we want to do an update
2. Algorithms – Pat M, Pat O, Doug R, Andrew, Dustin, Joe B, Mike S are going to look at the old algorithms and decide if we want to do an update.

#### **ASHRAE TC 2.6 Webmaster Report**

Submitted by: Michael Schwob

- The following pages have been updated:
  - Research
  - Publications
  - Meetings (with Denver meeting minutes)

The following pages have been added:

- Winter Meeting Schedule
- Winter Meeting Agenda
- Past Research

We will be creating a LinkedIn group to increase communication and interaction of the TC members between meetings. LinkedIn is a social networking website for people in professional occupations. Invitations will be sent via email to invite members and corresponding members once the group has been setup.



## TC 2.6 Criteria Subcommittee

### Meeting Minutes - NYC

June 19, 2014 (4-5 PM)

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*Attendees: U. Berardi, J. Bridger, V. Clemente, C. Eichelberger, R. Eligator, M.Fly, R. Keith, R. Hassler, J.*

*Horesco, A. Jenkins, D. LaForgia, J. Lilly, P. Marks, D. Meredith, G. Miller, E. Miller-Klein, A. Mitchell,*

*R. Muehleisen, P. Oliver, M. Passing, K. Peterman, D. Reynolds, L. Ronsse, K. Roy, M. Schaffer, M.*

*Schwob, J. Swan, L. Vargas, J. Wang, L. Wang, S. Wise*

I. Scope/purpose of the criteria committee: "To define and promote measurement protocols and benchmarks/guidelines/criteria to evaluate building acoustics, as related to building mechanical systems"

II. Update on RTAR on Tones

A. RAC voted in Denver (June 2013) to conditionally accept our RTAR 1707 for further development into a work statement (WS), provided that the RAC approval condition(s) below are addressed to the satisfaction of your Research Liaison in a revision to the RTAR first.

1. "Justify estimated cost & duration. Compared to similarly scoped projects, the budget and time allotted seems excessive by 50% or more."

2. "The following additional issues should be addressed in the work statement draft:

- a. Clearly describe the project's technical approach.
- b. Define in greater detail the project's scope of work.
- c. Seek out co-funding sources for the project"

III. Development of Work Statement on Tones:

A. Summary of Denver (+prior) Discussion

1. Definition of the research question: "At what point is a tone in noise rated as 'annoying' by certain percentages (10%, 20%, 50%, etc) of the general population?" = dose-response relationship

2. WHO: Definition of 'general population'... Normal hearing adults, ages 19 to 65; investigators should consider subjects' noise sensitivities and compare against any published normal distributions

3. WHAT (Signals): **Suggestion is made to include a 'table of signals' within the Work Statement.**

a. Tones: 7 fundamental (29.5, 60, 120, 240, 500, 750, 1000 Hz), alone and also all of the above with harmonics (e.g. 29.5 Hz + 177 Hz, etc.) = 14 tonal signals

i. Signals with harmonics: investigator should consider probable harmonic structure of building services equipment

b. Level of the tones: varying levels, from below detectability to above annoyance levels

## TC 2.6 Criteria Subcommittee

### Meeting Minutes - NYC

June 19, 2014 (4-5 PM)

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c. Bandwidth of tones: Mechanical/electrical tones tend to be narrow in bandwidth, while aerodynamic tones tend to be wider in bandwidth.

Work Statement can state: "Bandwidth of tones should match typical building systems equipment."

d. Generation: Consensus is to digitally synthesize, tones on top of a common spectra produced by equipment.

e. Background noise spectrum: Consensus is to start with recording of HVAC noise (i.e. measured at inlet of large 30" FC fan) and then shape to match an RC contour

f. Metrics: consensus is that it's best to use narrow band data and apply the psychoacoustically developed metrics of PR and TNR (already used in standard ANSI S1.13)

i. FFT - Researcher must use high quality equipment and specify what FFT procedures will be applied (window, number of lines, etc), and also perhaps determine what the variability of metrics would be based on FFT settings.

g. Multiple (non-harmonic) tones and fluctuating tones will not be covered in this RTAR, but may be a topic for future research

h. Background level and/or spectrum:

i. Base absolute level of the background noise does impact the perceived annoyance of a tone ... 18 dB PR above a 50 dBA noise IS more annoying than 18 dB PR above 30 dBA noise.

ii. Recent pilot data from a lab study conducted at University of Nebraska was presented by L. Wang. (This work has been submitted for Conference Paper presentation in upcoming Seattle meeting.) Results seem to support that base level of background noise does impact perceived annoyance. Also, results from two methodologies (direct assessment with task and magnitude estimation) seemed to produce similar annoyance thresholds, although magnitude estimation took much less time. Other findings are:

- 125 Hz tone generally more annoying than 500 Hz tone
- Thresholds of annoyance found to be *above* thresholds of prominence when tones are in *lower* BNL, and *below* thresholds of prominence when in *higher* BNL

4. HOW (Methodology):

a. Test a 'worst case' scenario where participants do not have control over the tone

B. Questions that remain ...

TC 2.6 Criteria Subcommittee

## Meeting Minutes - NYC

June 19, 2014 (4-5 PM)

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1. HOW (Methodology): ... can impact COSTS... need to justify \$180k

a. Field studies: "Performing experiments in the field, in a series of welldefined and very different contexts at work and at home, will produce findings that are more then be relevant and useful." (feedback from TC 2.1)

i. Consensus of meeting participants is that we are still not comfortable with the number of variables that could be uncontrollable in the field, so that a field study should be done as a second separate study to validate findings from a lab study first.

b. There are a number of methodologies that could be used in a lab study (see previous minutes/agendas for further details: direct assessment, paired comparison, magnitude estimation, cognitive load assessment, working memory tests, etc.)

c. Some participants expressed the thought that doing a task while being surveyed on annoyance of tones in noise would be more compelling.

d. If magnitude estimation techniques are used (which appeared to be much quicker with similar results compared to direct assessment in the Nebraska study), investigators should test both from above and from below the expected threshold.

2. In the end, research results should be related back to HVAC equipment to be most helpful.

### IV. Ongoing Tasks

A. L. Wang to liaison further with RAC representative, as we develop Work Statement

B. Subcommittee (L. Wang, P. Oliver, M. Schaffer, S. Wise, +?) continue to work on details of Work Statement draft to discuss or possibly vote upon at next meeting in Seattle (request 1.5 hours)