



1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

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. TC 9.9 DATE February 2, 2020

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

DATE OF MEETING February 2, 2020 LOCATION Orlando, Florida

Note: These minutes have been approved by the TC.

MEMBERS PRESENT	MEMBERS ABSENT	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
VOTING MEMBERS	Lex Coors	Tim Halsor
Gerardo Alfonso	David L Moss	Mark Pugh
John H Bean, Jr	Christopher O Muller	Hazyu Li
Donald L Beaty	Roger R Schmidt	Sama Aghniaey
Dustin Demetriou		Steven Dobson
Ecton English		Galen Gerig
John M Gross, III		Hooman Parhizkar
David F Kelley		Kevin Connor
Matt Koukl		Kourosh Niemati
Terry L Rodgers		Douglas Sick
Vali Sorell		
Dave Meadows		
CORRESPONDING MEMBERS		
Henry Amistadi	Ahmed Abdel Salam	
Matthew Archibald	Raymond Abraham	
Paul Artman	Antonio Aguayo	
Benjamin Coe	Robert Akkerman	
Michael Collarin	Stuart Aldridge	
Thomas Davidson	Husam Alissa	
Benedict Dolcich	Serpil Ari	
Paul R Finch	Rangarajan Arulselvan	
Mark Fisher	Sean Ashburn	
Jon Fitch	Robert Bader	
Nick Gangemi	William Bahnfleth	
David Grant	Andrew Baxter	
Steve Greenberg	William Beck	

John Groenewold	Chad Beery	
Hugh Hudson	Adenilson Belizario	
Gary Johnson	Paul Bemis	
Rajendera Kapoor	Satyam Bendapudi	
Mukesh Khattar	Ng Kai Beng	
Allan Lee	James Betts	
Jason Matteson	Michael Bishop	
Robert McFarlane	Byron Blackmore	
Michael Miller	Alonzo Blalock	
Shlomo Novotny	James Bogart	
John O'Brien	Sébastien Brasseur	
Richard Pavlak	Holly Brink	
John Peterson	Douglas Brown	
Joel Rutledge	Jerrod Buterbaugh	
Justin Seter	Tahir Cader	
Mark Seymour	Andrew Calder	
Timothy Shedd	Aldo Calvi	
Jeffrey Stein	Nicholas Casale	
Mark Steinke	Noe Casalino	
	John Castelvevchi	
	Neil Chauhan	
	David Chialastri	
	Sruti Chigullapalli	
	Dale Cibene	
	Alan Claassen	
	Fabio Clavijo	
	Brad Cochran	
	Dan Comperchio	
	Howard Cooper	
	Bryce Cox	
	James Coyle	
	Bryan Coyne	
	Craig Crader	
	Matthew Cronmiller	
	Greg Crumpton	
	Bob Culver	
	Christopher Daniel	
	Steve David	
	George Degroft	
	Cuong Dinh	
	Bob Doherty	
	Daniel Donahoe	
	Robert Druga	
	Aaron Duda	
	John Dumler	
	Andrew Dunn	
	Dan Dyer	
	Jacqueline Eaton	
	David Edenburn	
	Michael Edie	

	Dennis Eisenbarth	
	Michael Ellsworth	
	Frank Erceg	
	Hamza Erden	
	Maxwell Evans	
	Jeffrey Ewin	
	Huang Feng	
	Gregory Fennewald	
	Philip Flinn	
	Sophia Flucker	
	Clayton Foster	
	Kamran Fouladi	
	David Franczak	
	Michael Frank	
	Terry Frantzis	
	Charles Freda	
	F French	
	Paul Galloway	
	Hongwen Gao	
	Kevin Gebke	
	Rajat Ghosh	
	John Gideon	
	Arthur Giesler	
	Robin Gilbert	
	Kenneth Gill	
	Jack Glass	
	Troy Goldschmidt	
	Scott Graf	
	Shaun Green	
	Charles Gullledge	
	Edward Gutowski	
	Kamel Haddad	
	Stephen Halsted	
	John Haney	
	Andrew Harrison	
	Kyle Hasenkox	
	Scot Heath	
	Dennis Hellmer	
	Magnus Herrlin	
	Robert Hewitt	
	Ted Hight	
	Elly Hiu	
	Chris Hsieh	
	Kevin Hughes	
	Steven Hyde	
	Mark Hydeman	
	J C Ierschot	
	Hifumi Iguchi	
	Julian Iosifescu	
	Gwenn Ivester	

	Madhusudan Iyengar	
	Charles Johnson	
	Rhonda Johnson	
	Alex Juncker	
	Alekhya Kaianathbhatta	
	George Kaler	
	Kailash Karki	
	Vijay Kasibhatla	
	Kanchan Kelkar	
	Daniel Kennedy	
	Michael Kester	
	Rehan Khalid	
	Kishor Khankari	
	Richard Killian	
	William Kingrey	
	Marvin Kirshenbaum	
	Timothy Kittila	
	Erhard Klotz	
	Paul Knight	
	Srinivas Kodea	
	Michael Koerner	
	Devdatta Kulkarni	
	Pardeep Kumar	
	Sushil Kumar	
	Yuichi Kurihashi	
	Christopher Kurkjian	
	Osmo Kuusisto	
	Yiu Wa Kwan	
	Stephen Lahti	
	Yuk Kuen Lam	
	David Landsberg	
	John Lane	
	Federico Lang	
	Elizabeth Langer	
	John Lanni	
	Jon Larry	
	Geoff Lawler	
	Matt Lawrence	
	Stuart Lawrence	
	Christian Le	
	Sang Lee	
	Bret Lehman	
	Frank Lembo	
	Guillermo Leon Orellana	
	Hsing-Sheng Liang	
	Mike Licitra	
	Nemat Lotfi	
	Francis Allen Lumabas	
	Lu Luna	
	William Mak	

	Mark Malkin	
	William Maltz	
	Alessandro Mandelli	
	Lawrence Markel	
	Ted Marwitz	
	Caroline Mason	
	Carl Massey	
	Guillermo Massucco	
	James McAleer	
	Timothy McCann	
	Christopher McDermott	
	Jaakko McEvoy	
	Michael McKenna	
	Douglas McLellan	
	Godwyn Mendes	
	Francis Mills	
	Richie Mittal	
	Michael Monahan	
	Mark Monroe	
	Chad Moore	
	Stephen Mowrer	
	John Murgida	
	Ram Narayanamurthy	
	Philip Naughton	
	C.D Nayak	
	Ian Nelson	
	David Nesheiwat	
	John Neubauer	
	Michael Nicolai	
	Zuokui Ning	
	Budy Notohardjono	
	Mark Ogilvie	
	Michael Ohadi	
	Sean OHern	
	Lawrence Ollice	
	Shelley Ophir	
	Leslye Paniagua	
	Farid Parsaei	
	Chandrakant Patel	
	Mark Pavol	
	Andrew Pearson	
	Thomas Peddle	
	Tim Persoons	
	Craig Petersen	
	FLORIN POPA	
	Joseph Prisco	
	Justin Prosser	
	Honore'du Puy	
	Suhasini Pyarasani	
	David Quirk	

	Prakash Rapolu	
	David Redford	
	Stuart Redshaw	
	Mark Reed	
	Gamal Refai-Ahmed	
	Charles Rego	
	William Reynolds	
	Steven Rosenstock	
	Jeffrey Rutt	
	Hitoshi Sakamoto	
	Nestor Salinas	
	Michael Salvatore	
	Peter Samain	
	Angela Sampaio	
	Michael Schwarz	
	Michael Schwedler	
	Clifford Scofield	
	Ian Seaton	
	Darshit Shah	
	Anthony Sharp	
	Saurabh Shrivastava	
	Matt Shumway	
	Ruben Sidranski	
	Thursten Simonsen	
	Mark Simpson	
	Shelby Sims	
	Satwinder Singh	
	Annie Smith	
	Grant Smith	
	Stuart Smith	
	John Song	
	Marc Soucy	
	Ronald Spangler	
	Jonathan Spreeman	
	Mark Sprenger	
	Robin Steinbrecher	
	Morgan Stevens	
	Charles Stewart	
	Robert Sullivan	
	Kaiyu Sun	
	David Sundin	
	Jacob Svenkeson	
	Inn Tang	
	Edwin Teoh	
	Jeff Tepler	
	Ronald Thomas	
	Russell Tipton	
	David Tootle	
	Sengul Topuz	
	Robert Tozer	

	Adam Fleming	
	Nigel Gore	
	Dinesh Gupta	
	Xu Han	
	Michael Hathorne	
	Mohamed Hegazy	
	Mathias Hery	
	Ming-Ren I	
	Roger Jones	
	Md Masud Karim	
	Gordon Keogh	
	Steve Krupka	
	Jayavant Kumar	
	Colin Laisure-Pool	
	Guy Majestic	
	Christopher Malone	
	Noreshvarman Manisagar	
	Michael McRee	
	Pooya Navid	
	Salah Nezar	
	Balakrishnan P Panicker	
	Mani Prakash	
	Anders Saksager	
	Carine Saliba	
	Jimil Shah	
	Mohit Shrivastava	
	Thomas Sin	
	Ameya Soparkar	
	Michael Streich	
	Micah Sweeney	
	SOON TATT	
	William Ung	
	Kazuyuki Wakita	
	Darrin Watson	
	Malcolm White	
	Christopher Wilson	

Published Agenda

Topic		Time	Presenter
Introduction	Welcome and Introductions	10	Dustin Demetriou
Programs	Orlando and Austin Conferences	15	Nick Gangemi
Handbook	Chapter 20	5	Bob McFarlane
Research	1675-RP: Guidance for CFD Modeling of Data Centers	15	C. Lin / M. Seymour
	1755-RP: Impact of Gaseous Contamination	5	Dustin Demetriou
	Energy Modeling	5	Mark Seymour
	Future Research Topics	5	Mark Seymour

Total Time 65 minutes

Call to Order: 2/2/20 5:00 PM Dustin Demetriou

- Introductions and Welcome
 - Dustin Demetriou Current Chair, John Groenewold- Vice Chair
 - Agenda for Sunday and Monday meetings is posted on TC 9.9 website.
 - Sign-in sheet being passed
 - Overview of Meeting Agenda
 - New to Orlando Conference TC Collaboration space
 - Open Sunday Monday Tuesday: 7:30-4:00
 - Wednesday 7:30-1PM
 - Encouraged to use space
 - Focus on reducing the number of subcommittees and space can be use for those that may not have space.
 - Formal Introduction to happen at Sunday Meeting
 - 2:15 to 7:00PM Monday meeting agenda announced.
- Programs – Nick Gangemi
 - No handouts but the presentation is available on the TC 9.9 website at
 - Upcoming Summer Conference
 - Austin TX | June 27- July 1, 2020, JW Marriott Austin
 - Next winter conference is in Chicago January 23–27, 2021
 - Different Types of Presentations at ASHRAE
 - Each Track has a Chair
 - If no data center track, Conference Chair will help make decisions on where the presentation will occur when no data center track.
 - Eight (8) Tracks for Orlando
 - HVAC&R Fundamentals and Applications
 - Systems and Equipment

- Refrigeration and Refrigerants
- Cutting Edge Applications
- High Efficiency Design and Operation
- Big Data and Smart Controls
- Ventilation, IAQ, and Air Distribution Systems
- Standards, Guidelines and Codes
- TC 9.9 Meetings at this conference
 - Conference Paper Session 8: Utilizing Waste Heat and Thermal Management
 - Seminar 55: The Future of Data Center Infrastructure Management Tools
 - Seminar 63: Ventilation Effectiveness Metrics, Part 2: Equipment
 - Seminar 70: Leveraging Computational Models to Make Smart Controls
 - Presentation is located at:
- TC members are encouraged to work through Nick when working on ASHRAE presentation activities to help with acceptance success rate.
- Contact Nick Gangemi, Program Chair | 585-721-8795 | ngangemi@primaryintegration.com
 - Presentation Options
 - Technical Papers
 - Option based upon technical paper
 - Research paper
 - Major Industry updates
 - Conference Papers
 - Updates on research on going
 - Panels, Debates, Forums
 - General can be a bit more freeform
 - Seminar
 - Generally, most common for the TC9.9 group
 - Workshops
 - Seminar and Conference paper will have title, abstract and presentation. Abstract is important to the submission to get it accepted and into the correct track.
 - Nick will communicate with the different conference chairs to coordinate paper/ seminar approval process.

- Deadlines:
 - Austin Conference papers and dates are past. Option for Chicago but generally will take a year later.
 - Monday Feb 10th everything is due for extended abstract paper or program. (Title and abstract Due)
 - Monday, March 2, 2020 Extended Abstracts Accept/Reject Notifications
 - Friday, March 20, 2020 Debate, Panel, Seminar, Forum, Workshop Accept/Reject Notifications
 - Friday, May 1, 2020 Upload of presentation open for review
 - Monday, June 1, 2020 Presentation submissions due
 - Eight (8) Tracks for Austin
 - Fundamentals and Applications
 - HVAC&R Systems and Equipment:
 - Research Summit
 - Professional Development:
 - Grid-Interactive Efficient Built Environment:
 - Multifamily and Residential Buildings:
 - Resilient Buildings and Communities:
 - Zero Energy Buildings and Communities: Opportunities and Challenges
 - Building Myths
 - Systems and Equipment
- 123 seminars and 75 got accepted, all technical papers were accepted. Sometimes difficult to get Seminar accepted
- Handbook Revision Update – Bob McFarlane
 - (4) volumes published (1) each year and comes with
 - Chapters are written by TC's
 - TC 9.9 is included in the Applications Handbook
 - We are in chapter 20, in 2019 it was moved from 19 to 20
 - 2015 was totally re-written by 20 people.
 - Heavily revised in 2019 publication
 - Designed to parallel datacom book series.
 - 2017 Out of Sequence Update (OSU) and added multiple new items including:
 - Completed research topics
 - Refrigerant Economizer information

- Computational Fluid Dynamic (CFD) Information.
 - Green grid PI metric
 - AHRI Standards
 - Reference for Standard 90.4
- 2019 revisions included updates in 2017
 - Reflected only online
 - Printed versions every 4 years
- 1st year after publication handbook wants to have topics for new updates for the 2023 update.
- Could do an Out of Sequence Update in 2020 for publication online in 2021
- Suggestions were provided from two people. (see slides for the suggestions)
 - Industry trends and international
 - 2019 updates for 90.4
 - Update to green grid papers
 - Reference book 14 for DCIM
 - Handbook is clamping down on figures to minimize the number of pages
 - Including international standards
 - Air cooling solutions.
 - Energy efficiency standards
 - Clarifying economizer system for a more international standardization
- Chapter review form to be submitted outlining updates for handbook
 - Pages, number of figures, etc.
 - Located on the authoring portal of ASHRAE website.
 - Form due by end of Feb. 2020
 - Topics only to outline what might be changed/ updated/ added
 - Does not need to be provided by "approved" by committee vote
 - Send suggestions to Bob prior to the information going to ASHRAE.
- Program charts to go on website located at:
 - <http://tc0909.ashraetcs.org/documents/presentations/2020%20Orlando%20Programs%20Update.pdf>
- Research Subcommittee – Mark Seymour
 - ASHARE released a new Strategic Plan. More to come on Sunday.
 - Most Current Research Strategic Plan was through 2018

- ASHARE is looking at developing a new research strategic plan.
- Questionnaire provided to ASHRAE members to comment on where ASHARE member would like to have money allocated for research. (Likely located in junk email)
- R-1675 Guidance for CFD Modeling
 - Not much to report
 - Research is starting
 - FIU is performing the work, subcontracted to Ga Tech
 - Lab is set-up
 - Instrumentation has been set-up
 - Test data has been configured
 - CFD Work
 - Work is being done in Fluent
 - Object models verified and improved
 - Perf tiles, CRACH units Raised floor, floor mounted PDU's.
 - Numerical simulations ongoing
 - Project management
 - GA Tech Subcontract extended to 3/31/2020
 - 1675-RP requires no cost extension
 - Discussed the various modeling details and developing the confidence of the model.
 - Discussed floor tile model and the simulation development and the different model characteristics.
 - Discussed next steps for the modeling and analysis and reporting
 - Looking at a 1-year extension due to the additional amount of simulation.
 - Question about what the original intent on research project.
 - Intent is to show and provide guidance on how to set-up CFD model for Data Centers.
 - Intent is to provide guidance to provide information and guidance like what is needed for the development of models.
 - Original proposal was rejected by RAC due to the size of the project. The resultant of the rejection was to take smaller project.
 - Intent is to provide guidance for a general purpose CFD tool and not for a tool that's already specialized.
 - Question about servers in the racks

- Intent was to use server simulator to better equal and represent server airflow and heat generation
- Intent is to represent the server simulator as close as possible in the model.
- kW/ cabinet- (4) 3- KW load banks per rack, up to 12 KW/ rack
- Question about what your trying to achieve with a legacy type design.
 - Guidance is all about how to simulate a data center in CFD. Not how to design a data center.
 - Intent is to use the same similar components for any size room or any type of data center.
 - Likely a future topic will discuss control and location of sensors as a future research project.
 - Research project is only looking at how to model a data center and not control.
- 1867-RTAR Developing and Validation of a model for accessing corrosion risk for datacom equipment (See slides)
 - Was approved by TC9.9 and co-sponsored by TC 2.3
 - Was rejected last conference (Summer 2019)
 - Go feedback from RAC
 - Likely more work would be needed to refine for resubmission
 - Needs to better align with ASHRAE Strategic Plan.
 - Need to define and clarify as to how it is different than 1755.
 - 1755 was a research project done on gaseous contamination at high humidity.
 - Testing has been done already for similar situation and how it differs from existing research.
 - 1755 would need to be completed.
 - Authors need to look at 1755 and show how it will be different.
 - Identify risks and if there's nothing that comes from the research.
 - \$250K anticipated for research project.
 - Because it doesn't align directly with Strategic plan, why doesn't the data center fund this research.
 - Seems more like fundamental research and might look at someone like NSF to fund the research.

- RP-1755 Impact of Gaseous Contamination
 - Approved PMS, TC 9.9 voted on the research and approved the research.
 - Final report is now available on ASHRAE portal through ASHRAE member log-in.
- Study of Sea Salt level of Filtration Required to Maintain High Reliability of Electronic Equipment
 - Proposed by Roger Schmidt
 - Doesn't have an RTAR yet
 - Likely May 2020 to have document and RTAR put together.
 - Is a MERV 11/ 13 acceptable for outside air to protect against sea salt.
 - Chloride compounds act as a rapid accelerator for corrosion.
 - Potentially some existing research performed on this topic.
 - Need to understand what NaCl concentration levels were acceptable, what the airborne solubility levels of NaCl are depending on humidity levels, and whether or not particulate filtration is viable for this.
 - Discussed research objectives.
 - Determine cost effective filtration for outside air
 - Determine characteristic of particulate size and distribution
 - Evaluate pressure drop, and efficiency
 - Evaluate upstream temperature and relative humidity in the costal locations.
 - why and what type applications would be and the specific areas of the research.
 - Forward comments to Dustin and or Roger.
- Energy Modeling Update- Henry Amistadi
 - 90.4 tells you the major requirements but doesn't speak to how to perform the calculations.
 - Should there be better guidance for how to perform data center energy calculations. Being led by Vali Sorrel
 - Possible outcomes
 - Informative annex in 90.4 to discuss how this should be performed.
 - TC 9.9 could develop/ published a book on energy modeling.
 - Should be a 90.4 User guide (similar to 90.1)

- ASHRAE previously hired consultants to produce user guides.
 - New funding available from ASHRAE to develop the guide.
- Mathcad has been used and developed. Likely white papers might come from this workgroup activity.
- See Henry if you would like to get more info or to get involved.
- Questions is the wholistic or just the environment being looked at by 90.4.
 - Looking at the whole data center.
 - 90.4 hasn't accounted for energy reuse and is still being evaluated.
- Future modeling will look at energy reuse but will need further guidance from the standards bodies on how to model
- Next meeting at 2:15PM on Monday

6:20 PM Meeting Concluded

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TC/TG/MTG/TRG No. TC 9.9 DATE February 3, 2020

TC/TG/MTG/TRG TITLE Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

DATE OF MEETING February 3, 2020 LOCATION Orlando, Florida

MEMBERS PRESENT	MEMBERS ABSENT	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
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Gerardo Alfonso	Christopher Muller	Mark Pugh
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Matt Koukl		Douglas Sick
Terry Rodgers		Ramander Singh
Vali Sorell		Terry Fletcher
David Meadows		Sama Zastrow
David Moss		Nathan Flood
		Marc Sorge
		Michelle Etherton
		Alex Kozinets
		Lance Brown
		Julio Pulido
		Hannah Hoffman
		Sean Faltermeier
		Ramanathan Arymugasamy
		Christian Pastrana
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Sang Lee	Brad Cochran	
Lawrence Ollice	Dan Comperchio	
Mark Pavol	Howard Cooper	
Joseph Prisco	Bryce Cox	
Stuart Smith	James Coyle	
Mark Sprenger	Bryan Coyne	
David Tootle	Craig Crader	
Marianna Vallejo	Matthew Cronmiller	
	Greg Crumpton	
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	Marvin Kirshenbaum	
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	Erhard Klotz	
	Paul Knight	
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	Michael Koerner	
	Devdatta Kulkarni	
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	Bret Lehman	
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	Hsing-Sheng Liang	
	Mike Licitra	
	Nemat Lotfi	
	Francis Allen Lumabas	
	Lu Luna	
	William Mak	
	Mark Malkin	
	William Maltz	
	Alessandro Mandelli	

	Lawrence Markel	
	Ted Marwitz	
	Caroline Mason	
	Carl Massey	
	Guillermo Massucco	
	James McAleer	
	Timothy McCann	
	Christopher McDermott	
	Jaakko McEvoy	
	Michael McKenna	
	Douglas McLellan	
	Godwyn Mendes	
	Francis Mills	
	Richie Mittal	
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	Michael Nicolai	
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	Mark Ogilvie	
	Michael Ohadi	
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	Shelley Ophir	
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	Farid Parsaei	
	Chandrakant Patel	
	Andrew Pearson	
	Thomas Peddle	
	Tim Persoons	
	Craig Petersen	
	FLORIN POPA	
	Justin Prosser	
	Honore'du Puy	
	Suhasini Pyarasani	
	David Quirk	
	Prakash Rapolu	
	David Redford	
	Stuart Redshaw	
	Mark Reed	
	Gamal Refai-Ahmed	
	Charles Rego	

	William Reynolds	
	Steven Rosenstock	
	Jeffrey Rutt	
	Hitoshi Sakamoto	
	Nestor Salinas	
	Michael Salvatore	
	Peter Samain	
	Angela Sampaio	
	Michael Schwarz	
	Michael Schwedler	
	Clifford Scofield	
	Ian Seaton	
	Darshit Shah	
	Anthony Sharp	
	Saurabh Shrivastava	
	Matt Shumway	
	Ruben Sidranski	
	Thursten Simonsen	
	Mark Simpson	
	Shelby Sims	
	Satwinder Singh	
	Annie Smith	
	Grant Smith	
	John Song	
	Marc Soucy	
	Ronald Spangler	
	Jonathan Spreeman	
	Robin Steinbrecher	
	Morgan Stevens	
	Charles Stewart	
	Robert Sullivan	
	Kaiyu Sun	
	David Sundin	
	Jacob Svenkeson	
	Inn Tang	
	Edwin Teoh	
	Jeff Tepler	
	Ronald Thomas	
	Russell Tipton	
	Sengul Topuz	
	Robert Tozer	
	Chad Tramonte	
	Jeff Trower	
	William Tschudi	
	Edward Tsui	
	Saahil Tumber	
	James Vallort	
	James VanGilder	
	Richard Velten	
	Herb Villa	

	Ming-Ren I	
	Md Masud Karim	
	Gordon Keogh	
	Steve Krupka	
	Jayavant Kumar	
	Colin Laisure-Pool	
	Guy Majestic	
	Christopher Malone	
	Noreshvarman Manisagar	
	Michael McRee	
	Pooya Navid	
	Salah Nezar	
	Balakrishnan P Panicker	
	Mani Prakash	
	Anders Saksager	
	Carine Saliba	
	Jimil Shah	
	Mohit Shrivastava	
	Thomas Sin	
	Ameya Soparkar	
	Michael Streich	
	SOON TATT	
	William Ung	
	Kazuyuki Wakita	
	Darrin Watson	
	Malcolm White	
	Christopher Wilson	

Published Agenda

Topic		Time	Presenter
Introduction	Welcome and Introductions	10	Dustin Demetriou
	ASHRAE Strategic Plan	5	
	What is TC 9.9 Presentation	10	
	TC 9.9 Officers and Membership	10	
Webmaster		5	Ecton English
Liaison Reports	Standard 90.1	10	Rick Pavlak
	Standard 90.4	10	Dave Kelley
	SPC-127	5	John Bean
	AHRI 1360	5	Dave Kelley
	SSPC 300, Guideline 1.6	5	Terry Rodgers
Marketing		5	Paul Finch
International	Lisbon Data Center Course	10	M. Seymour / P. Finch
	International Update	10	Don Beaty
Industry Engagement	LBNL / DOE	10	Steve Greenberg
	OCP Liquid Cooling Workgroup	10	Jason Matteson
Publications	Datacom Book 3: Design Considerations	5	Larry Ollice
	Hot Aisle Considerations for Human Health	5	John Gross
	Small Data Center (Edge) Considerations	5	Jon Fitch
	Water Cooled Servers White Paper Errata	5	Roger Schmidt
	Cold Weather Shipping White Paper	10	Joe Prisco
IT Subcommittee	Water Cooling Hurdles White Paper	20	Dave Moss
	Thermal Guidelines 5 th Editon	10	Roger Schmidt
Voting Members	Closed Session	20	Dustin Demetriou

Total Time 3 hours 20 minutes

Call to Order: 02/03/2020 2:21 PM Dustin Demetriou

1. Introduction – Dustin Demetriou

- a. Introduction
 - i. Thanks to those that attended Sunday Research and Handbook meeting.
 - ii. Comments to ASHRAE by End of Feb. 2020. Complete form and send back to Bob.
- b. Reviewed ASHRAE Code of Ethics Review.
- c. Introductions of Attendees and around the room Introductions.
- d. Reviewed meeting agenda.
- e. Reviewed ASHRAE background slides
 - i. Non-Profit Technical Society Formed in 1894
 - ii. 56,000 members from 132 Nations
 - iii. 100 Technical Committees
 - iv. Focused on unbiased information

- a. Reviewed TC 9.9 Overview deck is on the TC 9.9 website at
 - i. Website Link to TC9.9 Overview:
 - ii. 399 members
 - iii. Representatives from all areas within and outside the data center environment
 - iv. Volunteer organization
 - v. Areas of Influence
- b. Discussed books that we've published and been involved with executing.
 - i. Handbook Chapter 20 overview
 - ii. Discussion on new Datacom books
 - 1. Available in ASHRAE bookstore.
 - 2. No new books since last meeting (Book 14)
 - iii. IT equipment information and books review and discussion.
 - 1. Looking at an upcoming 5th edition to the Thermal Guidelines book.
- c. Reviewed ASHRAE background slides
- d. TC 9.9 Overview deck is on the TC 9.9 website at:
 - http://tc0909.ashraetcs.org/documents/presentations/ASHRAE_TC0909_About_Us_Orlando_2020.pdf
 - i. Officer and Membership
 - ii. Voting and nonvoting
 - iii. Review of Officers (as of Feb 2, 2020)

Position	Name
Chair	Dustin Demetriou
Vice Chair	John Groenewold
Secretary	Matt Koukl
Program Subcommittee Chair	Nick Gangemi
IT Subcommittee Chair	Roger Schmidt
Handbook Subcommittee Chair	Robert McFarlane
Standards Subcommittee Chair	Richard Pavlak
Membership Subcommittee Chair	Jack Glass
Research Subcommittee Chair	Mark Seymour
Webmaster	Ecton English

- e. Membership Update
 - i. 398 members as of January 27, 2020.
 - ii. You can join through the TC 9.9 website using the “Join” button.

- iii. 2-year term for provisional corresponding members and then the chair will convert you to full corresponding members if you are active in the committee. If not promoted to corresponding member you are opted from the roster.
 - iv. 58 of the 398 members are provisional corresponding members.
 - v. 315 of the 398 members are full corresponding members.
 - vi. Encourage members to use my profile to update e-mail addresses especially if your job changes.
 - vii. E-mail blast was sent out prior to the meeting. If e-mail bounced back, then the person was removed from the roster.
 - viii. If you were removed and it was due to an out-of-date email, please contact the Chair.
- f. Voting Members
- i. Must be made up of corresponding members and have been an active corresponding member for at least one year.
 - ii. 15 are full voting members.
 - iii. Consists of an average of 12, minimum of 6 and a maximum of 18.
 - iv. Shall be appointed annually by the chair for not more than 4 consecutive one-year terms.
 - v. Number of voting members required to be present to conduct business or a quorum is at least four or more than half of the number of voting members.
 - vi. Currently 15 voting members
 - 1. Dustin Demetriou
 - 2. Matt Koukl
 - 3. Ecton English
 - 4. Gerardo Alfonso
 - 5. John Bean
 - 6. Donald Beaty
 - 7. Lex Coors
 - 8. John Gross
 - 9. David Kelley
 - 10. David Meadows
 - 11. David Moss
 - 12. Christopher Muller
 - 13. Terry Rodgers
 - 14. Roger Schmidt

15. Vali Sorell
- vii. Since Summer 2019 Meeting there have been 2 activities that the voting members have voted on.
 1. Recommendations for 1755 Research: Approved Research Project
 2. KC Meeting Minutes
- g. Discussed how the Technical Committee is organized and the reorganization of committees.
 1. (Include slide info...)
 2. Committee membership is down
 3. Looking to confirm that the TC is producing work.
 4. Reorg committee formed and recommendations have been provided to ASHRAE.
 - a. Some technical committees are going to merge or disband.
 5. ASHRAE is formally tracking TC recommendation of disbanding or merging.
- h. Saturday Award Ceremony
 1. Paul Finch KAO data won award
- i. ASHRAE Strategic Plan
 - i. Unveiled at 2019 Summer Conference.
 - ii. Encouraged members to visit the website to review the strategic plan to understand where ASHRAE is heading
 - iii. New Mission statement
 1. To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.
 - iv. Vision Statement
 1. A healthy and sustainable built environment for all.
 - v. Revised core values
 1. Excellence
 2. Commitment
 3. Integrity
 4. Collaboration
 5. Volunteerism
 6. Diversity
 - vi. (3) goals have been defined.
 1. Position ASHRAE as an Essential Knowledge Resource for a Sustainable, High-Performance Built Environment.

2. Maximize Member Value and Engagement
3. Optimize ASHRAE's Organizational Structure to Maximize Performance

vii. Link to new Strategic Plan: [Link](#)

2. Website – Ecton English

- a. Post info from meeting to website.
- b. Email Dustin for approval to post info to the website.
 - i. Cannot post seminars.
- c. Can Post relative info to TC
- d. Website: <http://tc0909.ashraetcs.org/index.php>
- e. Section 9 is very complementary about the TC 9.9 website:

3. Liaison Reports

- a. Standard 90.1- Rick Pavlak
 - i. Discussed adoption of various ASHARE 90.1 revisions.
 - ii. Between 2007 to 2010 changed TPS and brought in computer rooms into the standard.
 - iii. 2010 Orlando addendums that discussed specific expectations for air side economizer
 - iv. PUE metric was adopted to get away from metric. 2010, 2013, 2016.
 - v. In 2019 PUE metric has now been replaced with 90.4 -2016 standard.
 - vi. Basically 90.4-2016 is one cycle behind 90.1
 - vii. 2019-90.1 includes 90.4 in section 8 and section 6 for mechanical.
 - viii. 90.4 can be used separately or combined.
 - ix. In 90.1-2019 it will not have a perspective requirement for photovoltaic requirements. Likely will occur in 90.1-2022
 - x. ICC 2018 includes prescriptive items from ASHRAE 90.1-2019 and the associated addendums.
- b. Standard 90.4 & AHRI 1360- Dave Kelley
 - i. 90.4
 1. 90.4-2019 was just published just after 90.1-2019 was published.
 2. An addendum will be published to get 2019 90.4 into 90.1-2019.
 3. Will work to have 90.4 and 90.1 2022 in sync. 90.4 will be published in fall for 90.1 to reference when published in the fall of 2022.

4. (3) addendums are going to be published for public review in the coming months. Looking for any comments from the committee.
 - a. Heat recovery credit
 - b. Onsite renewable credit. No 3rd party source
 - c. Corrections to section 11 of calculations. And adding rotary UPS systems and Diesel Rotary UPS (DRUPS). Revised Uninterruptible spelling.
5. Discussed how to perform calculations. 90.4 will take ownership of the calculations and developing a user guide.
6. Looking at a revision to ELC due to use of MV. Would like to have input from members about MV calculations.
7. Would like to have input from anyone to make the standard better and provide feedback on items that should be included and or revised.
8. Performance standard and not a prescriptive Standard.
- ii. AHRI-1360 Standard that addresses Data Center Cooling Equipment.
 1. DOE has proposed a number of changes that are being evaluated
 2. Gov't has been slow on new update
 3. Target for updating metrics again
 4. Looking for a year of data based upon a metric for systems rather than components.
 5. Challenges is the cost to do all the testing. Looking for the potential interpolation.
 6. DOE Looking at updating standard to include other equipment.
 7. DOE Looking to regulate other equipment that's not a CRAC or CRAH to regulate to the data center equipment. In general, all equipment that could be sold into the data center environment would be held to the same standards including comfort cooling equipment.
- c. ASHRAE-127 - John Bean
 - i. Went through two rounds of voting, didn't have quorum for previous votes, 3rd vote had a much better turnout and unanimous vote.
 - ii. Good response this week and has been sent forward to SPLS

- for public review.
- iii. Looking to get out very quickly
 1. SPLS needs to understand that there's lots of interest
 2. New Equipment for testing to standard
 3. There's some equipment that needs to be brought into the standard.
 4. New ratings that might require new methods of test.
 5. Hoping to become a standing committee
 - a. Want to become more strategic in activity and scope of information development.
 6. Looking to control scope to get quicker adoptions
- d. SSPC 300 Guideline - subcommittee GPC1.6 – Terry Rodgers
 - i. 1.5 years ago, was developed for Data Center Commissioning.
 - ii. TC 7.6 Building Commissioning-> SSPC 300-> Cx Standard 202, Cx Guidelines 0.
 - iii. Approved TPC.
 - iv. Significant progress made since June 2019
 - v. Intent is a guideline / best practice standard / minimum standard.
 - vi. Will cover new buildings and existing construction, might break into two guidelines in the future.
 - vii. One committee is working on BOD/OPR CFC.
 1. Intent to follow the process.
 2. Significant progress has been made.
 3. OPR and BOD has been developed and out for review.
 - viii. New groups to help with development of text include
 1. Commissioning specs
 2. Factory witness testing
 3. Load Bank Plans
 4. Training
 - ix. Looking for volunteers to help with the guideline development.
 - x. To get added to GPC 1.6 must join SSPC 300.
- e. TC 1.5 cybersecurity subcommittee. – Ecton English
 - i. Under computer applications
 - ii. MTG (Multidisciplinary Task Group).
 - iii. Going to ASHRAE vote to break off from TC 1.5
 - iv. Made up of different people from other TC's.
 1. Would likely include the following TC's: 1.4, 7.5, 9.9, and

a few other TC's.

4. Marketing Subcommittee, International, Publications

a. General Overview

- i. TC 9.9 is at a pivotal time due to regrouping TC committees.
- ii. Since 2004 always had a quorum.
- iii. Speed to market kept us in the limelight with ASHRAE.
- iv. Need to have more research and money.
 1. Research needs to fund TC9.9 research
 2. Could likely result in increased energy use due to the reduction in economizers due to the possibility of increasing the contamination.
- v. Statistics show very well for the group.
- vi. Committee has done a great job on producing material
- vii. At RAC had only 2 new research proposals. Look at something that has a very important topic that has better alignment with ASHRAE goals and Strategic perspective.

b. Marketing – Paul Finch

- i. Intent is to show and promote ASHRAE internationally
- ii. Provide access to information for others around the world
- iii. 450 followers from around the world on LinkedIn since 2018 launch.
- iv. Follow and share LinkedIn data when it becomes available. LinkedIn site is tied to TC9.9 website and associated books and white papers.
 1. Water Cooled white paper- over 2000 views
 2. DCIM paper– 1400 views
 3. Hard disc performance paper- over 1600 views
- v. What can get more people to follow:
 1. Share, like, and follow the information when it becomes available.
- vi. Ecton to add details about how to follow LinkedIn on the website.
- vii. Why can't ASHRAE provide reduced cost to those that have bought books in the past and provide a reduced rate.
 1. ASHRAE doesn't have a method to track those that download to provide the reduced rate.
 2. Steve Comstock is now in charge of EMEA and is a large promoter of TC 9.9
- viii. Get a canned presentation out for local chapters.

1. Existing presentation about what is TC 9.9 posted on website.
- ix. At RAC had only 2 new research proposals. Look at something that has a very important topic that has better alignment with ASHRAE goals and Strategic Plan perspective. Not enough research proposals at the moment and might have a better chance at getting acceptance.
 1. Jan 13th survey has been sent out. Look for others to participate.
 2. Send comments/ thoughts to Mark.
- c. International – Don Beatty
 - i. Steve Comstock has moved to EMEA
 1. Steve wanted to get the data center course out into EMEA
 2. First course was presented in Lisbon, Portugal
 3. Looking at middle east and others in EMEA to provide presentation.
 4. Looking for people to provide the presentation in other areas in EMEA and Middle East.
 - a. Contact Steve Comstock or Dustin to provide names of people that might provide the presentation/ course.
- d. Publications – Larry Ollice
 - i. Book 3 Status
 1. Turned over to committee (Don Beatty)
 2. Bob McFarlane reviewed and added comments.
 3. Revised structural issues and has been reviewed for content.
 4. Need one person to read book through for content. Make changes in book with tracked changes. Decision can then be made. Questions are not needed, just revisions.
 5. See Larry Ollice for help to read book 3 for final comments.
 6. Document is on basecamp.

5. Industry Engagement

- a. OCP Liquid cooling – Jason Matteson
 - i. In KC discussed need to identify an informal liaison with OCP.
 - ii. Nigel Gore left ASHRAE and role and Jason is taking over.

- iii. Discussed definition and founding (founded in 2011 mainly by Facebook). Important because it is driving standardization.
 - 1. Mostly around rack level infrastructure
 - 2. Also aligning with the room level.
- iv. Important to get regular updates from OCP to feed into ASHRAE and have alignment and correct messaging is in alignment with the group.
- v. Collaboration, communication, etc.
 - 1. Develop Specification
 - 2. Whitepapers, workshops, summits, etc.
 - 3. Product recognition for acceptance and have compliance with OCP.
- vi. Highlight on Rack & Power Project group
 - 1. Scope
 - a. ACS Immersion cooling sub-project
 - 1. Requirements document published; updates anticipated to be published every 6 months.
 - 2. Developing guidance on IT equipment design guidance for immersion 1-2nd qtr. 2020
 - b. ACS Coldplate sub-project
 - 1. New group developed QDC- quick disconnect
 - 2. V2, V3 update 2nd evaluate this year
 - 3. Ready for open rack V3
 - c. ACS heat exchanger sub-project
 - 1. Focus on rack and rear door heat exchanger
 - 2. Open rack V2,V3
 - 3. Update 2nd quarter 2020
 - 2. Data Center Facility Group
 - a. Scope
 - 1. Facility Power
 - 2. Facility Cooling
 - 3. IT Space layout and Design
 - 4. Datacenter facility monitoring and control
 - 5. Data center facility operations
 - b. Modular data center Sub-project
 - 1. Optimized for OCP hardware
 - 2. Speed of DC deployment

- 3. Improve efficiency in power and cooling
 - 4. Improve DC deployment efficiency
 - 3. ACS Cold-plate development had alignment and usage of the TC 9.9 datacom series books.
- b. Center of Expertise for Energy Efficiency in Data Centers LBNL—Steve Greenberg
 - i. See website: <https://datacenters.lbl.gov/>
 - ii. Activities
 - 1. Webinars provided for federal agencies to update all govt agencies
 - 2. Data Center Optimization
 - 3. DCEP off shoot from DOE training
 - 4. Address underserved markets
 - iii. Discussed new and updated resources.
 - 1. Newsletter for DCEP individuals and others.
 - 2. More info and contacts
 - a. Can contact Steve Greenberg with questions or comments.
 - 3. Report to congress is part of this groups practice.
 - a. Hope that it will be updated and depends on federal government.
 - 4. Tools and resources are free on the website

6. Publications

- a. Hot Aisle Considerations for Human Health – John Gross
 - i. Hot Aisle containment for white paper with TC 2.1 about physiology
 - ii. Thermal guidelines are in alignment with OSHA guidelines.
 - iii. Requesting for individuals to work on white paper
 - iv. Looking for end user input and driving decision on going to higher temperatures... risk, workplace safety, etc.
 - v. Look at PPE?
 - vi. Energy side vs. industry initiatives to reconcile the differences
 - vii. Not really guidance on the issues but starting the conversation.
 - 1. Looking for all industry perspectives, COLO and Hyperscale
 - viii. John will be attending the TC 2.1 Meeting

- b. Edge Computing environments. – Jon Fitch
 - i. What is edge computing thoughts on role for ASHRAE in edge computing
 - ii. Edge is driven for low latency
 - iii. Edge datacenters
 - 1. Might be a small enclosure,
 - 2. Distributed in remote areas
 - iv. What happens to ITE when a door is opened.
 - v. TIA organization and has worked to define the edge.
 - 1. Collaboration with TIA has been going on since 2006
 - vi. Look to issue white paper on challenges with Edge
 - 1. Excursions
 - 2. Energy efficiency
 - 3. Reliability
 - 4. How do you handle multiple efficiency and reliability?
 - vii. Look to address applications and edge. (Chicken or Egg first...)
 - viii. Explosive growth on edge through 2020/3
 - ix. Edge generally can be small but can also be quite large.
 - x. Industry wants the ability to be nimble.
 - xi. Likely an educational white paper is needed

7. IT subcommittee

- a. Cold weather shipping – Joe Prisco
 - i. Currently in a white paper status and started after KC meeting
 - ii. 14 pages of content.
 - iii. Tried to do a research project but didn't get traction
 - iv. Most of the work led by IBM.
 - v. Looking to have complete in April may of 2020
 - vi. Looks a finalized in September/ October
- b. Liquid Cooling Considerations – Dave Moss
 - i. Driver of chip density
 - ii. Obstacles to adoption
 - 1. Large groups...
 - iii. Benefits
 - iv. Looking at defining a new metric
 - 1. Thermal Challenge =w/ degreeC
 - 2. Thermal resistance (Typical IT benchmark)
 - v. Chart presented is agnostic of ASIC
 - vi. Need to define a discernable metric to bring to a broader

- audience
- vii. Air cooling is breaking down and is going to need to transition to liquid cooling. What is the range that would make sense to go to water cooling?
 - viii. Most of the considerations and the curves are for HPC
- c. Thermal guideline book 5 (see slides) – Dave moss Presented
- i. Liquid cooled white paper and an errata published.

Meeting Ended 5:30PM

Executive Session – Dustin Demetriou

- Not Held