



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 January 30, 2022

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

DATE OF MEETING January 30, 2022 LOCATION Hybrid: Las Vegas, NV & Virtual

Note: These minutes have not been approved and not the official, approved record until approved by the TC.

MEMBERS PRESENT	MEMBERS ABSENT	EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE
<b>VOTING MEMBERS</b>		
Gerardo Alfonso	Lex Coors	
Terry L Rodgers	Donald L Beaty	
Dustin Demetriou	Dave Meadows	
Ecton English	John M Gross, III	
Matt Koukl	John H Bean, Jr	
David L Moss		
John Groenewold		
Roger R Schmidt		
David F Kelley		
Vali Sorell		
<b>CORRESPONDING MEMBERS</b>		
Jimil Shah	Raymond Abraham	
Ramesh Navaratnam	Antonio Aguayo	
Daniel Donahoe	Robert Akkerman	
Michael Strouboulis	Stuart Aldridge	
Mukul Anand	Sajad Alimohammadi	
Jeff Trower	Husam Alissa	
Mark Seymour	Mohammad Alkiswani	
Christopher Muller	Shawn Andrews	
Jainish Gandhi	Serpil Ari	
Bob McFarlane	Benjamin Petschke	
Thomas A Davidson	Sang Lee	

Jason Matteson	Sean Ashburn	
Melissa Olson	George Augustini	
Rick Pavlak	Robert Bader	
Mark Steinke	William Bahnfleth	
Jim VanGilder	Andrew Baxter	
Nick Gangemi	William Beck	
Nicholas Casale	Chad Beery	
Shlomo Novotny	Adenilson Belizario	
Steve Greenberg	Paul Bemis	
Benjamin Coe	Satyam Bendapudi	
Henry Amistadi	James Benville	
Paul Artman	James Betts	
Michael Hathorne	Rakesh Bhatia	
Benedict Dolcich	Erich Binder	
Sushil Kumar	Michael Bishop	
kamal mostafavi	Byron Blackmore	
Matt Archibald	Alonzo Blalock	
	James Bogart	
	Holly Brink	
	Rolf Brink	
	Douglas Brown	
	Jerrod Buterbaugh	
	Wim Buters	
	Aldo Calvi	
	Ameya Soparkar	
	Noe Casalino	
	John Castelvechi	
	Neil Chauhan	
	David Chialastri	
	Vijayakumar Chithambaram	
	Dale Cibene	
	Alan Claassen	
	Fabio Clavijo	
	Brad Cochran	
	Paul Finch	
	Michael Collarin	
	Dan Comperchio	
	Howard Cooper	
	Florin Corcoz	
	Bryce Cox	
	James Coyle	
	Bryan Coyne	
	Craig Crader	
	Greg Crumpton	
	Bob Culver	
	Christopher Daniel	
	Steve David	
	George Degroft	
	Robert Tozer	
	Charuchandra Dewasthale	

	Cuong Dinh	
	Bob Doherty	
	Alexandre Kontoyanis	
	Robert Hewitt	
	DAVID DONGES	
	Robert Druga	
	Aaron Duda	
	John Dumler	
	Dan Dyer	
	Jacqueline Eaton	
	David Edenburn	
	Michael Edie	
	Dennis Eisenbarth	
	Frank Erceg	
	Hamza Erden	
	Maxwell Evans	
	Huang Feng	
	Mark Fisher	
	Jon Fitch	
	Adam Fleming	
	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	
	Troy Goldschmidt	
	Nigel Gore	
	Scott Graf	
	David Grant	
	Shaun Green	
	Charles Gullede	
	Dinesh Gupta	
	Edward Gutowski	
	Kamel Haddad	
	Stephen Halsted	
	Xu Han	
	John Haney	
	Andrew Harrison	
	Kyle Hasenkox	

	Casey Winkel	
	Scot Heath	
	Mohamed Hegazy	
	Dennis Hellmer	
	Magnus Herrlin	
	Mathias Hery	
	Ali Heydari	
	Ted Hight	
	Elly Hiu	
	Chris Hsieh	
	Hugh Hudson	
	Kevin Hughes	
	Steven Hyde	
	Ming-Ren I	
	J C Ierschot	
	Hifumi Iguchi	
	Gwenn Ivester	
	Madhusudan Iyengar	
	Charles Johnson	
	Rhonda Johnson	
	Gary Johnson, Jr	
	Roger Jones	
	Alex Juncker	
	Alekhy Kaianathbhatta	
	George Kaler	
	Rajendera Kapoor	
	Md Masud Karim	
	Kailash Karki	
	Kanchan Kelkar	
	Daniel Kennedy	
	Gordon Keogh	
	Michael Kester	
	Rehan Khalid	
	Kishor Khankari	
	Richard Killian	
	William Kingrey	
	Marvin Kirshenbaum	
	Timothy Kittila	
	Erhard Klotz	
	Paul Knight	
	Srinivas Kodea	
	Michael Koerner	
	Jayavant Kumar	
	Pardeep Kumar	
	Ahmed Abdel Salam	
	Yuichi Kurihashi	
	Christopher Kurkjian	
	Osmo Kuusisto	
	Yiu Wa Kwan	
	Stephen Lahti	

	Colin Laisure-Pool	
	Yuk Kuen Lam	
	David Landsberg	
	Federico Lang	
	Elizabeth Langer	
	John Lanni	
	Jon Larry	
	Geoff Lawler	
	Matt Lawrence	
	Christian Le	
	Allan Lee	
	Bret Lehman	
	Frank Lembo	
	Guillermo Leon Orellana	
	Hsing-Sheng Liang	
	Mike Licitra	
	Nemat Lotfi	
	Francis Allen Lumabas	
	William Mak	
	Mark Malkin	
	William Maltz	
	Alessandro Mandelli	
	Noreshvarman Manisagar	
	Eugene Maritz	
	Lawrence Markel	
	Ted Marwitz	
	Caroline Mason	
	Carl Massey	
	Guillermo Massucco	
	James McAleer	
	Timothy McCann	
	Christopher McDermott	
	Jaakko McEvoy	
	Michael McKenna	
	Douglas McLellan	
	Michael McRee	
	Godwyn Mendes	
	Michael Miller	
	Francis Mills	
	DONALD Mitchell	
	Richie Mittal	
	Michael Monahan	
	Mark Monroe	
	Chad Moore	
	John Murgida	
	Ram Narayanamurthy	
	Philip Naughton	
	Pooya Navid	
	C.D Nayak	
	Ian Nelson	

	David Nesheiwat	
	John Neubauer	
	Salah Nezar	
	Michael Nicolai	
	Zuokui Ning	
	Budy Notohardjono	
	John O'Brien	
	Mark Ogilvie	
	Michael Ohadi	
	Sean OHern	
	Lawrence Ollice	
	Shelley Ophir	
	Leslye Paniagua	
	Balakrishnan P Panicker	
	Farid Parsaei	
	Chandrakant Patel	
	Mark Pavol	
	Andrew Pearson	
	Tim Persoons	
	Craig Petersen	
	John Peterson	
	FLORIN POPA	
	Mani Prakash	
	Justin Prosser	
	Suhasini Pyarasani	
	David Quirk	
	Prakash Rapolu	
	David Redford	
	Stuart Redshaw	
	Charles Rego	
	William Reynolds	
	Steven Rosenstock	
	Joel Rutledge	
	Jeffrey Rutt	
	Hitoshi Sakamoto	
	Anders Saksager	
	Carine Saliba	
	Nestor Salinas	
	Michael Salvatore	
	Angela Sampaio	
	Michael Schwarz	
	Michael Schwedler	
	Clifford Scofield	
	Justin Seter	
	Darshit Shah	
	Gaurav Soni	
	Anthony Sharp	
	Timothy Shedd	
	Mohit Shrivastava	
	Saurabh Shrivastava	

	Matt Shumway	
	Ruben Sidranski	
	Thursten Simonsen	
	Mark Simpson	
	Thomas Sin	
	Satwinder Singh	
	Annelise Smith	
	Grant Smith	
	Stuart Smith	
	John Song	
	Marc Soucy	
	Ronald Spangler	
	Jonathan Spreeman	
	Mark Sprenger	
	Jeffrey Stein	
	Robin Steinbrecher	
	Morgan Stevens	
	Charles Stewart	
	Michael Streich	
	Robert Sullivan	
	Kaiyu Sun	
	David Sundin	
	Jacob Svenkeson	
	Micah Sweeney	
	Inn Tang	
	SOON TATT	
	Edwin Teoh	
	Russell Tipton	
	David Tootle	
	Sengul Topuz	
	Chad Tramonte	
	Devdatta Kulkarni	
	William Tschudi	
	Edward Tsui	
	Saahil Tumber	
	William Ung	
	Marianna Vallejo	
	James Vallort	
	Richard Velten	
	Herb Villa	
	David Vranish	
	Darrin Watson	
	Ralph Webb	
	Aaron Wemhoff	
	Andrew Wengerd	
	Kurt Wetzel	
	Malcolm White	
	Katherine Whitenack	
	Robert Wichert	
	Christopher Wilson	

	Stephen Woollard	
	Stephen Wren	
	Lixia Wu	
	Eric Yang	
	Yang Zou	
	Wangda Zuo	
<b>PROVISIONAL CORRESPONDING MEMBERS</b>		
Girish Anant Kini	Mina Abiedallah	
David McGlocklin	Sama Aghniaey	
Jonell Watson	Rafael Aharoni	
Timothy Startt	Hassan Ali Younes	
Ashwin Siddarth	Ramanathan Arumugasamy	
	Adenilson Belizario	
	Matthew Brazil	
	Dustin Bremner	
	Glenn Brenneke	
	Cillian Brown	
	Julia Call	
	Chris Campbell	
	Byron Coetser	
	Kevin Connor	
	Anthony Cosenze	
	Brian Courtright	
	Biswajit De	
	Shivraj Dhaka	
	Terry Fletcher	
	Yangyang Fu	
	PIETRO FUMAGALLI	
	Leo Gabrek	
	Michael Geraghty	
	Michael Geraghty	
	Michael Gibbons	
	Mike Gilkerson	
	Kenneth Goodman	
	Rohit Gupta	
	Michael Hallstrom	
	John Han	
	Ariel Iantosca	
	Dennis Julian	
	Ali Akber Kazmi	
	Sadegh Khalili	
	Peter Koneck-Wilwerding	
	Steve Krupka	
	Cheng-Xian Lin	
	Bernie Malouin	
	Kapil Mehrotra	
	Giuliano Molon	
	Lucas Moreira	
	Mark R Mannex	



	Cibi Chakravarthy N	
	Bjorn Oberg	
	Robert Curtis	
	RYAN REIMER	
	Oscar Rueda	
	Francisco Sanchez	
	Jeremy Smith	
	Antonio Tan III	
	Russell Taylor	
	Sharon Thomas	
	Greg Towsley	
	Alfred Uzokwe	
	Bruno Winge	
	David Yancosky	
	Philip Yu	
	Samual Zastrow	
	Jon Zubiaurre	
	Kyle Bergeron	
	Norman Bourassa	
	Tozer Bandorawalla	
	Ken Beach	
	ERIC TUNKS	
	Jian Wen Chan	
<b>Guest</b>		
Mustafa Kadhim		
Tim Halsor		
Bernard Poton		
Thiago Vidal Valente		
Mohammed		
Moises Levy		
Daniel Jankus		
Scott Schanken		
Marcus Hassen		

## PUBLISHED AGENDA

Sunday, January 30, 2022  
TC 9.9 Programs, Handbook and Research  
5:00 PM – 7:00 PM PST  
Location: Caesars Palace, Emperors I (E)

Microsoft Teams Meeting

[Link](#)

Attendance

<https://forms.gle/uR4n7Scq5G6TWar7A>

Topic		Time	Presenter	In-Person or Virtual
Introduction	Welcome and Introductions	10	John Groenewold	IP
Programs	2022 Winter Las Vegas and 2022 Summer Toronto	15	Nick Gangemi	V
Handbook	Chapter 20	10	Bob McFarlane	V
Research	1675-RP: Guidance for CFD Modeling of Data Centers	15	Mark Seymour	V
	Sea Salt Filtration RTAR and WS	15	Roger Schmidt	V
	Wetted Materials Research	10	Mark Steinke	IP
	Open Discussion on Research Topics	15	All	
Total Time:		90	Minutes	

**CALL TO ORDER:** 01/30/22 5:02 pm PST - John Groenewold

### INTRODUCTION – John Groenewold

- Welcome to the first “Hybrid” meeting
  - Attendees are both in person and joining virtually
  - Introductions of new officers
    - John Groenewold – new TC 9.9 Chair
    - Matt Koukl – new TC 9.9 Vice-Chair
    - Mark Steinke – new TC 9.9 Secretary
- Virtual meetings will be in two platforms
  - Teams for Sunday meeting
  - Webex for Monday meeting
- Procedures to conduct hybrid meeting
  - Virtual attendees to stay muted. Unmute to ask a question
  - In person attendees to unmute table microphones to be heard by virtual attendees
- Attendance form
  - Link: <https://forms.gle/uR4n7Scq5G6TWar7A>
  - Both in person and virtual attendees to click and fill out the attendance form
  - Must fill out for each meeting (Sunday/Monday)
- Overview of today’s meeting

## PROGRAMS - Nick Gangemi

- Reviewed ASHRAE 2022 Winter Conference Las Vegas, NV
  - No data center specific track.
  - Currently no programs at present conference
  - Turn focus to annual conference in Toronto
  - Pointed out following tracks
    - Research summit
    - IAQ, energy use, comfort & health
  - Any interest in submission, please inform Nick and he will assist
  - Question on 90.4 awareness
    - Short session on data center design
- Reviewed ASHRAE 2022 Summer Conference Toronto, ON Canada
  - Important dates for Toronto
  - Question on Education track.
    - Need more academic support teaching students and causing awareness
  - Winter 2023 date not yet published
  - Program date is Feb 17 as deadline. Nick confirmed
  - Question. Might be able to make submission for the educational track
    - Can resubmit
    - Mark S. had rejection due to not being in person
  - Nick reviewed descriptions of the submission types
    - Program Types
      - Technical Papers
        - Submitted for review and be technically accurate and clearly written.
        - Undergo a double-blind review and must be approved by three-reviewers
        - Can be up to 30 double-spaced manuscript pages in length and include tables, charts, and a max. of 12 figures.
        - Accepted papers are available as hard-copy reprints at the book store during the conference.
        - Must be presented at the conference in order to be published in *ASHRAE Transactions*
        - Typically will include major industry updates
      - Conference Papers
        - Updates on research on going
        - Shorter than Technical Papers, undergo a less stringent review and can be prepared closer to a conference.
        - Abstracts are submitted first for review
        - Once the abstract is accepted, they undergo a single-blind review and must be approved by two reviewers.
        - Once approved, papers are presented at the conference.
        - No more than 8 single-spaced pages in total length including text, tables, figures, etc.
      - Workshops
        - ASHRAE Technical Committee provides a series of short presentations on a topic requiring specific expertise.

- Goal is to engage the audience for active participation and training in a specific set of skills.
- Seminars
  - Presentation on a subject of current interest
  - Papers are not available
- Panels, Debates, Forums
  - Broad range of subjects and explore different perspectives
  - No papers
  - Promote a free exchange of ideas
  - Can be about a “hot-button” issue
- 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.
- TC members are encouraged to work through Nick when working on ASHRAE presentation activities to help with acceptance success rate.
- Email Nick Gangemi for interest (Nick.Gangemi@vanir.com)
- 

## **HANDBOOK – Bob McFarlane**

- Chapter 20
- Draft revisions April 1, 2022
- All topics now reviewed
- No works on multiple platforms
- Need writers
- Need secondary reviewers
- Review plan is on the website
- Changes
  - Air distribution
- New categories
- Need authors for
  - HRI std 1360-2017
    - Is this the latest version for inclusion. Yes
  - Printing & tape..
    - Table 3 – Workload type
- Request for additional reviewers
- Reviewed Update method
  - Now Browser independent
  - Select review topics by Spreadsheet line number and send to Bob

## **RESEARCH – Mark Seymour**

- 1675-RP update – Mark Seymour
  - Almost complete
  - Pare down to focus on modelling guidance
  - Reviewed project objectives
  - First edition of final report draft finished and submitted to PMS 9/21

- Revisions made based upon feedback. Back to PMS 10/21 for review and voting
- Summarize experimental work
- Summarized CFD validations
- Updated general guidelines based upon DC specifics
- Presented models and results from the study
- CRAH airflow distributions
- Blower angle important
- Even an approximation is better starting point
- Plenum representation
- Floor tile flow resistance is important and not all vendor data can not always be trusted
- Next steps
  - Finalize report & guidelines
  - Questions
    - Report size
    - Intended users? Intended for practitioners
    - Lots of lessons learned to get fluent to effective
  - Question
    - Guidelines refer to report
    - Publish the guidelines independently and on TC9.9 website
    - Guideline + instructions – maybe a technical bulletin?
    - Include a reference to the handbook?
- Link to obtain the final research report, once published:  
<https://www.ashrae.org/technical-resources/technology-portal>
- Tropical Data Centers – Roger Schmidt
  - IMDA + NTU doing a project
  - Request TC9.9 for guidance
  - Investigate if TDC should use different environmental
  - Is it safer to increase operation temp 25 -> 37 C
  - Planning on collab with the sea salt filtration data center work
  - Question: Is there a defined workload?
    - Need to get back to you
  - Question: what defines server reliability?
    - Failures in performance
- Sea Salt filtration – Roger Schmidt
  - Roger presented work
  - RTAR - Presented background
  - Collaboration with other TC (need reference)
  - Proposal rejected. Adjusted based upon feedback
  - Adjusted test apparatus
  - Literature search
  - Hyperscaler helped with coupons and data collection
  - Added a dry cloth for salinity measurements
  - Update RTAR and resubmit
  - March 15th or June 15th or Sept 15th for RAC

- Question: No data or research from US navy??
  - Any input military specs or marine electronics
  - Military coating probably proprietary
- Question: Energy impact from filter clogging?
  - Needs investigation
- Proposed RTAR Wetted Materials – Mark Steinke
  - Background
    - Liquid cooling Guidelines book contains a listing of wetted materials for the Facility Water Supply (FWS) and Technology Cooling System (TCS) loops.
    - Latest water-cooling white paper “Water-Cooled Servers – Common Designs, components, and processes” identified the growing list of wetted materials being used by ITE manufacturers.
      - Just an acknowledgement that the list is growing.
      - More liquid cooled solutions coming to the market
      - Heavily debated topic of the white paper.
    - Every ITE manufacturer should be investigating.
    - Every customer should be asking
  - Purpose
    - Every ITE manufacturer should be performing own studies and results are typically proprietary to that company.
    - Begin work on an RTAR to study wetted materials in liquid cooled systems.
    - Provide validation of a basic set of wetted materials for use.
    - Develop testing roadmap to validate other or emerging wetted materials.
    - Provide a common set of recommended wetted materials that can be expanded over time using this process.
  - Action
    - Form small group interested in research topic
    - Begin RTAR work statement
    - Goal of having RTAR work statement ready by summer meeting
    - Contact if interested in participating
      - Mark Steinke (Mark.Steinke@amd.com)
      - Mark Seymour

**CALL TO CLOSE:** 01/30/22 7:06 pm PST - John Groenewold

**DRAFT**

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	Gaurav Soni	
	Kamel Haddad	
	Stephen Halsted	
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	John Haney	
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	Kyle Hasenkox	
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	Rhonda Johnson	
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	Alekhya Kaianathbhatta	
	George Kaler	
	Rick Pavlak	
	Md Masud Karim	
	Kailash Karki	
	Kanchan Kelkar	
	Daniel Kennedy	
	Gordon Keogh	
	Michael Kester	
	Rehan Khalid	
	Kishor Khankari	
	Richard Killian	
	William Kingrey	
	Marvin Kirshenbaum	
	Timothy Kittila	
	Erhard Klotz	
	Paul Knight	
	Srinivas Kodea	
	Michael Koerner	
	Jayavant Kumar	
	Pardeep Kumar	
	Sushil Kumar	
	Yuichi Kurihashi	
	Christopher Kurkjian	
	Osmo Kuusisto	
	Yiu Wa Kwan	
	Stephen Lahti	
	Colin Laisure-Pool	
	Yuk Kuen Lam	
	David Landsberg	
	Federico Lang	
	Elizabeth Langer	
	John Lanni	
	Jon Larry	
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	Matt Lawrence	
	Christian Le	
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	Hsing-Sheng Liang	
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	Francis Allen Lumabas	
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	Caroline Mason	
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	Guillermo Massucco	
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	Christopher McDermott	
	Jaakko McEvoy	
	Michael McKenna	
	Douglas McLellan	
	Michael McRee	
	Godwyn Mendes	
	Michael Miller	
	Francis Mills	
	DONALD Mitchell	
	Richie Mittal	
	Michael Monahan	
	Mark Monroe	
	Chad Moore	
	John Murgida	
	Ram Narayanamurthy	
	Philip Naughton	
	Pooya Navid	
	C.D Nayak	
	Ian Nelson	
	David Nesheiwat	
	John Neubauer	
	Salah Nezar	
	Michael Nicolai	
	Zuokui Ning	
	Budy Notohardjono	
	John O'Brien	
	Mark Ogilvie	
	Michael Ohadi	
	Sean OHern	
	Lawrence Ollice	
	Shelley Ophir	
	Leslye Paniagua	
	Balakrishnan P Panicker	
	Farid Parsaei	

	Chandrakant Patel	
	Andrew Pearson	
	Tim Persoons	
	Craig Petersen	
	Micah Sweeney	
	FLORIN POPA	
	Mani Prakash	
	Justin Prosser	
	Suhasini Pyarasani	
	David Quirk	
	Prakash Rapolu	
	David Redford	
	Stuart Redshaw	
	Charles Rego	
	William Reynolds	
	Steven Rosenstock	
	Joel Rutledge	
	Jeffrey Rutt	
	Hitoshi Sakamoto	
	Anders Saksager	
	Carine Saliba	
	Nestor Salinas	
	Michael Salvatore	
	Angela Sampaio	
	Michael Schwarz	
	Michael Schwedler	
	Clifford Scofield	
	Justin Seter	
	Darshit Shah	
	Jimil Shah	
	Anthony Sharp	
	Timothy Shedd	
	Mohit Shrivastava	
	Robert Tozer	
	Matt Shumway	
	Ruben Sidranski	
	Thursten Simonsen	
	Mark Simpson	
	Thomas Sin	
	Satwinder Singh	
	Annelise Smith	
	Grant Smith	
	Stuart Smith	
	John Song	
	Marc Soucy	
	Ronald Spangler	
	Jonathan Spreeman	
	Mark Sprenger	
	Jeffrey Stein	
	Robin Steinbrecher	

	Morgan Stevens	
	Charles Stewart	
	Michael Streich	
	Robert Sullivan	
	Kaiyu Sun	
	David Sundin	
	Jacob Svenkeson	
	Inn Tang	
	SOON TATT	
	Edwin Teoh	
	Russell Tipton	
	Robert Hewitt	
	Sengul Topuz	
	Chad Tramonte	
	Jeff Trower	
	William Tschudi	
	Edward Tsui	
	Saahil Tumber	
	William Ung	
	Marianna Vallejo	
	James Vallort	
	Richard Velten	
	Herb Villa	
	David Vranish	
	Darrin Watson	
	Ralph Webb	
	Andrew Wengerd	
	Kurt Wetzel	
	Malcolm White	
	Katherine Whitenack	
	Robert Wichert	
	Christopher Wilson	
	Stephen Woollard	
	Stephen Wren	
	Benedict Dolcich	
	Yang Zou	
	Wangda Zuo	
	Alexandre Kontoyanis	
	Mark Seymour	
	Devdatta Kulkarni	
<b>PROVISIONAL CORRESPONDING MEMBERS</b>		
Tony Yu	Mina Abiedallah	
Don Mitchell	Sama Aghniaey	
Matt Shumway	Rafael Aharoni	
Jonell Watson	Hassan Ali Younes	
Mukul Anand	Ramanathan Arumugasamy	
Mark R. Mannex	Adenilson Belizario	
Michael McKenna	Matthew Brazil	

David McGlocklin	Dustin Bremner	
Girish Kini	Cillian Brown	
Mustafa Kadhim	Julia Call	
Kourosh Nemati	Chris Campbell	
Ashwin Siddarth	Byron Coetser	
Norman Bourassa	Kevin Connor	
Jeff Ewin	Anthony Cosenze	
Timothy Startt	Brian Courtright	
Michael Strouboulis	Biswajit De	
Robert B Curtis	Shivraj Dhaka	
Philip Yu	Terry Fletcher	
Chris Campbell	Yangyang Fu	
Glenn Brenneke	PIETRO FUMAGALLI	
	Leo Gabrek	
	Michael Geraghty	
	Michael Geraghty	
	Michael Gibbons	
	Cibi Chakravarthy N	
	Kenneth Goodman	
	Rohit Gupta	
	Michael Hallstrom	
	John Han	
	Ariel Iantosca	
	Dennis Julian	
	Sadegh Khalili	
	Peter Koneck-Wilwerding	
	Steve Krupka	
	Cheng-Xian Lin	
	Bernie Malouin	
	Kapil Mehrotra	
	Giuliano Molon	
	Lucas Moreira	
	Kyle Bergeron	
	Ramesh Navaratnam	
	Bjorn Oberg	
	Melissa Olson	
	RYAN REIMER	
	Oscar Rueda	
	Francisco Sanchez	
	Jeremy Smith	
	Antonio Tan III	
	Russell Taylor	
	Sharon Thomas	
	Greg Towsley	
	Alfred Uzokwe	
	Bruno Winge	
	David Yancosky	
	Philip Yu	
	Samual Zastrow	
	Jon Zubiaurre	

	Jian Wen Chan	
	Ken Beach	
	Timothy Startt	
	Tozer Bandorawalla	
	ERIC TUNKS	
	Ali Akber Kazmi	
<b>Guest</b>		
Oumou Sidibe		
Ron Spangler		
Long Phan		
Liz Balke		
Jerry Yeh		
Damien Rodowski		
Scott Schanken		
Anthony A Lott		
Aaron Hatlevoll		
Galen Gerig		
Angel Randall		
Damien Rodowski		
Rhonda Johnson		
Ignacio Gómez-Cornejo		
Rani Doughty		
Hifumi Iguchi		
Marcus Hassen		
Farid Parsaei		

## PUBLISHED AGENDA

Monday, January 31, 2022  
 TC 9.9 Main Meeting  
 2:30 PM – 7:15 PM PST  
 Location: Caesars Palace, Emperors I (E)

Webex Meeting

<https://ashrae.webex.com/ashrae/j.php?MTID=m9a1172e64d78bc80a68f425d6def3c2b>

Attendance

<https://forms.gle/uR4n7Scq5G6TWar7A>

Topic		Time	Presenter	In-Person or Virtual
Introduction	Welcome and Introductions	5		
	What is TC 9.9 Presentation	15	John Groenewold	IP
	TC 9.9 Officers and Membership	10		
Program		5	Nick Gangemi	V
Webmaster		5	Ecton English	V
Liaison Reports	Standard 90.1	10	Rick Pavlak	IP
	Standard 90.4	10	Rick Pavlak	IP
	SPC-127	10	John Bean	V
	AHRI 1360	10	David McGlocklin	IP
	SSPC 300, Guideline 1.6	10	Terry Rodgers	IP
	MTG.CYB	10	Ecton English	V
	SSPC15 WG15 ASHRAE Std. 15	10	John Groenewold	IP
Break		15		
International	International Update	10	Don Beaty	V
Industry Engagement	LBNL / DOE	10	Steve Greenberg	V
	Advanced Cooling Facilities	10	John Gross	V
	OCP Liquid Cooling Workgroup	10	Nigel Gore	V
Publications	Datacom Book 3 - Design Considerations for Datacom Equipment Centers	10	Dustin Demetriou	IP
	Cold Weather Shipping White Paper	5	Joe Prisco	IP
	Thermal Guidelines 5 <sup>th</sup> Edition	15	Roger Schmidt	V
IT Subcommittee	Hot Aisle Considerations for Human Health	5	John Gross	V
	Liquid Cooling Book Revision	15	Dustin Demetriou & Mark Steinke	IP
Total Time:		215	Minutes	



**CALL TO ORDER:** 01/31/22 2:40 pm PST - John Groenewold

**INTRODUCTION** – John Groenewold

- Welcome to the first “Hybrid” meeting
  - Attendees are both in person and joining virtually
- Thank you and presentation to outgoing TC 9.9 Chair – Dustin Demetriou
- Virtual meetings will be in two platforms
  - Teams for Sunday meeting
  - Webex for Monday meeting
- Procedures to conduct hybrid meeting
  - Virtual attendees to stay muted. Unmute to ask a question
  - In person attendees to unmute table microphones to be heard by virtual attendees
- Attendance form
  - Link: <https://forms.gle/uR4n7Scq5G6TWar7A>
  - Both in person and virtual attendees to click and fill out the attendance form
  - Must fill out for each meeting (Sunday/Monday)
- AHRAEE Code of Ethics presented
- Introduction to the TC 9.9 website
  - <https://tc0909.ashraetcs.org>
- Present TC 9.9 purpose and scope
- Introductions of new officers
  - John Groenewold – new TC 9.9 Chair
  - Matt Koukl – new TC 9.9 Vice-Chair
  - Mark Steinke – new TC 9.9 Secretary
- TC 9.9 Liaisons
  - Standard 90.1: Rick Pavlak
  - Standard 90.4: Dave Kelley
  - Standard 127: John Bean
  - Standard 300, Guideline 1.6: Terry Rodgers
  - International: Don Beaty
  - MTG.CYB: Ecton English
- Reviewed membership data
  - Provisional 86
  - Corresponding 336
- Reminder to keep ASHRAE account email up to date and through job changes
  - Email bounce backs are used to purge the roster
- Overview of today’s meeting

**PROGRAMS** - Nick Gangemi

- Reviewed ASHRAE 2022 Winter Conference Las Vegas, NV
  - Currently no programs at present conference
  - Turn focus to annual conference in Toronto
  - Pointed out following tracks
    - Research summit
    - IAQ, energy use, comfort & health

- Any interest in submission, please inform Nick and he will assist
- Question on 90.4 awareness
  - Short session on data center design
- Reviewed ASHRAE 2022 Summer Conference Toronto, ON Canada
- Email Nick Gangemi for assistance (Nick.Gangemi@vanir.com)

## WEBMASTER – Ecton English

- TC 9.9 website <https://tc0909.ashraetcs.org>
- TC 9.9 website analytics presented
- Invites and other documents are stored on the website.
- Meeting minutes are provided on the website.
- Document section has current white papers and old presentations
- Question: Does ASHRAE have a preference to print or digital
  - No known preference
  - Digital media is searchable

## LIAISON REPORTS

- Standard 90.1 – Rick Pavlak
  - Add summary
- Standard 90.4 – Dave Kelley
  - UPS segment updated
  - Efficiencies added for 25 & 75%
  - 1st addendum
  - 2nd addendum - Mechanical
    - Updates and changes to definitions no longer use
    - Clarifications made
  - 3rd addendum
    - Relative to mech component to load calculations
  - Changes better align mech & elec
    - Question. Where does heat reclaim come into play?
      - We do not use it
    - Question: UPS efficiencies?
      - We took everything into account that was reported from mfg
      - ELC or MLC must perform better than standard
- SPC-127 – Dave Meadows
  - Speed of delivery of info important
  - Several comments from DOE and spent time presenting more complete and thorough answers
  - ASHRE 37 liaison applied for
  - New tech need ratings and validation effort
- AHRI 1360
  - Reviewed purpose
  - New items
    - Wall mount roof mount units
    - Additions from DOE to ease DOE acceptance
  - Release expected in 2022
- SSPC 300, Guideline 1.6
  - Poll the room about guideline 0
  - Reviewed std for new construction and adding one for existing

- Best practices. Gold standard is guideline 0
  - Most generic and can be
  - Sister docs 1.6p commish process for data centers. Used with std 202 or guideline 0
  - GIL1.3
  - GL 1.4
  - GL 1.5
- MTG.CYB – Ecton English
  - Cyber security
  - Focused on getting awareness.
  - Call for participants
- Global Warming Potential GWP - Ben Dolcich
  - Effort to reduce impact
  - DC is lumped into comfort cooling. So impacts DC
- SSPC15 WG15 ASHRAE Std. 15
  - Began work
  - Federal act impacts in 2025
  - Q: Are current refrigerants not good for DCs?
    - A: It is more a fire safety issue and not performance
  - Q: Call DC not computer room?
    - A: Ref std classify toxicity and flammability. Current used ref are A1. GWP fluids are A2Ls are no toxic and low flammability
  - Q: Are these standards based on total refrigerant or per circuit like Std 15?
    - A: Per circuit
  - Q: Any charging or change out procedure?
    - A: Majority used in comfort and DC is common. Focus is on compatibility with comfort first and DC trails

## BREAK

### Discussion with TC 9 Section Head

- TC9 section head, Brad Cockrine (SP???) joined the meeting
- TAC. Roster in place at end of this meeting deadline for 2/15.
- Send email for voting member consideration
- Recommending virtual meetings in between conference meetings
- TAC is supporting hybrid.
  - Maybe assign an AV tech and better equipment
- 3 new functions
  - MTG.res
  - TFBF Taskforce on building decarbonizations
  - RAST reactive air an
- TC 9.8 name change. Specialized building applications
- ASKTAC@ashrae.net for direct emails to Chair

### INDUSTRIAL ENGAGEMENT

- LBNL / DOE - Steve Greenberg
  - Upcoming webinars
  - New & updated resources
  - Contact Steve for details and info
  - Q: 2016 energy report. Report to be refresh?
    - A: Yes. However, there needs to be interest from the present

- administration to update
- Advanced Cooling Facilities - Nigel Gore
  - OCP - Overview
    - Structures
    - Most interest
      - DC facility
      - Rack Power
      - Server
    - Advanced cooling solutions charter
    - Standardization
    - Don Mitchell calls for participation
- OCP Liquid Cooling Workgroup
  - Skipped. Nigel covered

## PUBLICATIONS

- Datacom Book 3 - Design Considerations for Datacom Equipment Centers – Dustin Demetriou
  - Reviewed new release
  - Key updates
    - Chapter page numbers vary widely. Re-organization is needed
    - Summary sections need to be added to each chapter
    - Introduction section need to be added to each chapter
    - Appendix and references need to be revised
    - Need to address all track changes and comments
    - Need to update based on 5th Edition of Thermal Guidelines
    - Alignment to liquid cooling book updates
    - Need to update Chapter 5 Liquid Cooling
    - Move general content from Liquid Cooling book into Book 3
- Cold Weather Shipping White Paper – Joe Prisco
  - White paper is now available on the TC9.9 website
- Thermal Guidelines 5th Edition – Roger Schmidt
  - List of major changes.
  - Need to review again
  - Q: With higher recommended RH, does it eliminate evaporative cooling?
    - A: Yes, should be able to still utilize
  - Gerardo: TRANSLATION COMPLETE!
  - Q: Any idea if the reduced corrosion at the server rear is due to decreasing RH through the server as the DB temp goes up?
    - A: Yes correct.
  - Q: If you are under 300 Ang of corrosion, no issue?
    - A: correct
  - Q: Impact of humidity
    - A: Sea salt might impact but not fully known

## ITE SUBCOMMITTEE

- Hot Aisle Considerations for Human Health
  - Skipped
- Liquid Cooling Book Revision – Roger Schmidt
  - Showed recent pubs that expand this topic.

- Broke into 3 sections
  - Facilities
  - Emerging technology
  - Secondary side
- Call for participation
- Facilities – Dustin Demetriou
  - Sections reviewed
  - Integration parts into book 3
  - Need help on Electrical considerations. Reach out to Dustin
  - Bob M can review and also look for 90.4
  - Raj to look as well
- New sections around
  - Framework / classifications of liquid cooling
  - Controls
  - Fire protection
  - How to design for transitions to liquid cooling
- Call for participation
- Work effort ~year
- Q: OCP interaction and sync with us
  - A: we need alignment

**CALL TO CLOSE:** 01/31/22 6:24 pm PST - John Groenewold